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Գիտագործնական հանդես

Հատոր 19, թիվ 2

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REVIEW ARTICLE

TRENDING TOPICS IN PLATELET CONCENTRATES: PLATELET-RICH FIBRIN AND PLATELET-RICH PLASMA BIBLIOMETRIC ANALYSIS

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Abstract

Objectives: This paper aims to provide a bibliometric analysis on publication trends and a list of the top 100 most cited articles on platelet concentrates over the past 20 years.

Methods: A bibliographic search was performed on Microsoft Academic using the following strategy "(platelet-rich)". The number of citations related to specific use, favorable outcomes, and disciplines were analyzed using Microsoft Excel and XLSTAT. A second table with the number of citations, the altmetric attention score (AAS) and the year of publication was created. A ranking was sorted according to the number of citations with the 100 most frequently cited articles and variables being discussed. A graphical visualization of keywords was created with VOSviewer. Statistical analyzes have taken into account a 95% confidence interval.

Results: A helpful list of the top 100 articles has been developed to help professionals in a wide variety of ways. Platelet concentrates trends are valuable for researchers to visualize what interests' readers and editors more. Surgical use of platelet concentrates and some results are in the uptrend of publications ($p < .05$).

Conclusions: Bibliometrics and altmetrics are valuable tools to be updated in any healthcare profession. Both tools save those interested in the topic a lot of effort and time. Having a suitable keyword is critical to article dissemination.

Keywords: *Blood platelet; Fibrin; Growth Factors; PRP; Platelet-rich plasma*

Introduction

Over 4 million scientific articles were published in 2020 and updating them becomes an arduous task. Scientometrics is the measurement and analysis of scientific literature, and bibliometrics and altmetrics are, among others. Here it is one and perhaps a major function of any bibliometric analysis, a high-quality bibliographic search. Bibliometric analysis produces a list of highly effective articles that is so important that

many other articles have cited it. Another form of scientific evaluation is on the rise, the altmetric study. This name is the combination of alternative + metrics, alternative forms of evaluating scientific work through web citations.[1]

Bibliometrics seeks to identify the most influential articles on a given topic and to examine the characteristics of those articles.[2] The ranking created relates to the scientific interest of another researcher (bibliometric), or an internet user (altmetric). Of course, a much cited and commented article has a higher probability of being a pivotal contribution to science, with an excellent methodological grade that provides a scientific foundation with high impact.

Citations refer to another scientific work; an author reads exciting work and uses it as a reference in his article. An altmetric citation refers to any type of internet quote, primarily social media, when a person writes about a specific article on social media or other web source such as Wikipedia.There is no graduation between these two analyzes,they complement each other.[3] This retrospective study provides a list of the most cited articles on platelet-rich plasma and platelet-rich fibrin. The author hypothesizes that bibliometric analysis could be supported at any research or professional level, saving time to get a high-quality bibliographic search.

The aim of this study was to do a bibliometric analysis, with some statistical tests being performed to confirm more exciting topics and trends. This analysis could help any healthcare professional dealing with platelet-rich concentrates, especially researchers due to publications trends.

Material and methods

This bibliometric analysis is a retrospective study that followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.[4] This paper attempted to follow the principles of the Leiden Manifesto,[5] with particular attention to transparency, avoidance of false precision, and allowing data to be verified.

Search strategy

A literature search was done until April 29, 2021, using Microsoft Academic (MA) platform. An investigation was conducted using the term "(platelet-rich)". No language restrictions, publication year range, journal impact factor, or methodology selections were applied. As a review, this article is exempt from institutional review board approval.

Data extraction and Bibliometric Parameters

Articles were identified using the search at Microsoft Academic (MA). On the same day, a Pubmed search was done. The list of top 100 articles was ordered by number of citations and created using the following variables: citations per year, authors, and publication year. The investigator designed a table in Microsoft Office Excel, and each paper was retrospective hand-searched to identify the topic area, and year of publication. Another column was created with the Altmetric Attention Score (AAS) of each article, using the Dimensions app. Any missed data between MA and Dimensions were cross-matched to ensure the accuracy of collected information. To be included in this study sample, publications had to present platelet AND rich on the title and/or abstract, with no restriction about language or year of publication. Publications were excluded if articles are not related to platelet-rich plasma or fibrin.

Methodological design and data analysis

A list of 100 most-cited articles was created through the MA platform and ordered through citations. After this step, a table produced in Microsoft Excel was fulfilled manually with year of publication, authors reference, journals, institution, and country of origin. Another manual fill was performed using data from Dimensions, AAS. Finally, the citation density column was automatically calculated through Microsoft Excel, splitting the number of citations between years of publication.

A second analysis included all published articles about platelet concentrates. This second analysis aimed to evaluate publication trends through the last 20 years. This bibliometric analysis was conducted comparing specific use of concentrates (surgical or therapeutical), favorable outcomes (wound healing, bone regeneration, osteoarthritis and tendon injuries/tendinopathies) and main disciplines (orthopedics, oral and maxillofacial surgery, periodontics, implantology, and dermatology). In addition, correlation between open articles and number of citations, mentions were performed. Tables were created through Microsoft Excel. Statistical and

linear trend analysis performed through Microsoft Excel and XLSTAT. VOS-Viewer free software (Leiden University, The Netherlands) was used to create a graphical illustration of some critical elements, a visual form of bibliometric analysis. Pearson correlation test, Mann-Kendall test and Kruskal-Wallis test were performed in Microsoft Excel and XLSTAT ($p < .05$).

Results

There are 7,576 articles published in journals concerning platelet concentrates. An excellent manner to evaluate publishing trends is to assess MeSH (Medical Subject Headings) descriptors, relevant words used by own author to describe the subject of the article better. Therefore, a retrospective list of the top 100 most-cited articles was generated (table 1) with variables number of citations in two different platforms, AAS, year of publication, authors reference, and citation density (average number of citations per year).[6]

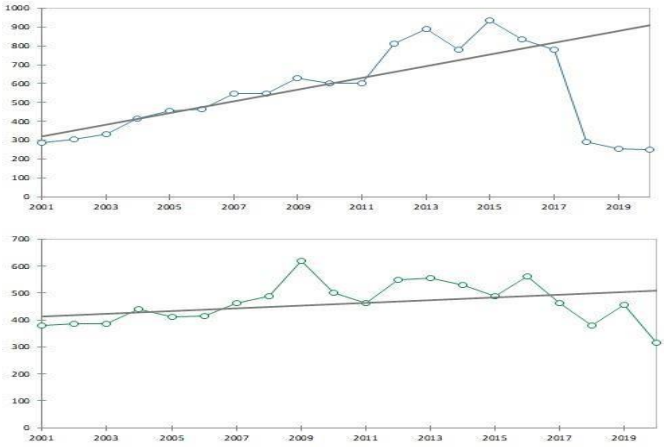
Table 1. List of top 100 most cited articles sorted by number of Microsoft citations

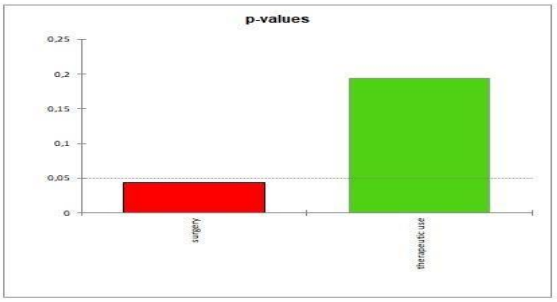
MA	Dimensions	AAS	citation density	reference	year
3440	1983	13	149,57	Marx et al [10]	1998
2007	1335	4	118,06	Marx [11]	2004
1677	834	14	111,80	Dohan et al [12]	2006
1539	901	31	128,25	Ehrenfest et al [31]	2009
1494	928	6	74,70	Marx [32]	2001
1265	797	17	105,42	Foster et al [33]	2009
1261	755	26	74,18	Eppley et al [34]	2004
1170	533	10	78,00	Choukroun et al [35]	2006
1127	592	10	75,13	Dohan et al [36]	2006
1111	632	37	74,07	Mishra, Pavelko [23]	2006
950	592	77	86,36	de Vos et al [21]	2010
866	438	0	57,73	Dohan et al [37]	2006
818	381	13	54,53	Choukroun et al [38]	2006
813	518	14	73,91	Peerbooms et al [39]	2010
774	452	3	40,74	Weibrich et al [40]	2002
770	459	11	55,00	Sánchez et al [41]	2007
742	412	3	43,65	Weibrich et al [42]	2004
720	398	0	40,00	Sánchez et al [43]	2003
692	413	11	57,67	Alsousou et al [44]	2009
667	423	53	83,38	Patel et al [19]	2013
654	329	6	32,70	Man et al [45]	2001
652	359	10	43,47	Anitua et al [46]	2006
644	394	29	58,55	Kon et al [22]	2010
599	364	36	46,08	Sampson et al [20]	2008
592	374	36	59,20	Kon et al [28]	2011
550	387	25	55,00	Gosens et al [26]	2011
548	395	8	36,53	Eppley et al [47]	2006
518	299	10	47,09	Lacci, Dardik [48]	2010
511	296	9	42,58	Mishra et al [49]	2009
511	288	3	24,33	Landesberg et al [50]	2000
504	307	3	38,77	de Mos et al [51]	2008
500	297	3	35,71	Schnabel et al [52]	2007
490	364	0	49,00	Castricini et al [53]	2011

484	324	0	34,57	El-Sharkawy et al [54]	2007
479	279	13	47,90	Filardo et al [55]	2011
479	26	0	47,90	Dhillon et al [56]	2011
476	291	9	31,73	Akeda et al [57]	2006
476	283	9	26,44	Okuda et al [58]	2003
474	264	8	22,57	Kassolis et al [59]	2000
472	195	0	24,84	Froum et al [60]	2002
471	334	13	47,10	Castillo et al [61]	2011
462	313	4	46,20	Sundman et al [62]	2011
456	293	20	57,00	Amable et al [63]	2013
439	290	0	36,58	Ehrenfest et al [64]	2009
431	291	11	35,92	Mishra et al [65]	2009
428	331	3	42,80	Randelli et al [66]	2011
427	293	0	47,44	Mazzocca et al [67]	2012
427	299	10	47,44	Boswell et al [68]	2012
427	295	10	47,44	DeLong et al [69]	2012
416	242	3	27,73	Driver et al [70]	2006
410	183	8	34,17	Mazor et al [71]	2009
409	269	0	34,08	Hall et al [72]	2009
407	191	72	58,14	Moraes et al [30]	2014
405	244	0	21,32	Aghaloo et al [73]	2002
404	255	3	25,25	Fréchette et al [74]	2005
402	255	3	33,50	McCarrel, Fortier [75]	2009
395	242	20	23,24	Yamada et al [76]	2004
391	254	6	27,93	Ishida et al [77]	2007
390	320	0	26,00	Everts et al [78]	2006
390	223	3	20,53	Camargo et al [79]	2002
388	105	5	48,50	Martinez-Zapata et al [80]	2013
385	269	27	42,78	Cerza et al [25]	2012
385	288	7	32,08	He et al [81]	2009
385	231	3	32,08	Sánchez et al [82]	2009
385	264	6	35,00	Bendinelli et al [83]	2010
383	237	9	34,82	Filardo et al [84]	2010
380	310	13	54,29	Dhurat, Sukesh [85]	2014
378	238	5	42,00	Filardo et al [86]	2012
378	241	6	31,50	Kon et al [87]	2009
378	249	35	37,80	de Jonge et al [24]	2011
377	204	2	53,86	Ghanaati et al [88]	2014
376	254	12	37,60	Thanasas et al [89]	2011
375	225	1	23,44	Pietrzak, Eppley [90]	2005
375	232	13	34,09	Niemeyer et al [91]	2010
375	236	4	34,09	Haleem et al [92]	2010
374	269	6	28,77	Kakudo et al [93]	2008
370	229	0	52,86	Ehrenfest et al [94]	2014
367	233	3	33,36	Ehrenfest et al [95]	2010
367	213	0	21,59	Wiltfang et al [96]	2004
357	245	17	39,67	Filardo et al [97]	2012

354	215	4	27,23	Kajikawa et al [98]	2008
347	205	15	38,56	Li et al [99]	2012
346	229	15	16,48	Hemker et al [100]	2000
342	173	0	19,00	Tözüm, Demiralp [101]	2003
341	231	13	34,10	van Buul et al [102]	2011
338	247	3	24,14	Murray et al [103]	2007
338	206	3	22,53	Van Den Dolder et al [104]	2006
337	255	10	37,44	Rodeo et al [105]	2012
335	220	16	27,92	Hammond et al [106]	2009
338	248	3	24,14	Murray et al [107]	2007
335	206	6	19,71	Kitoh et al [108]	2004
333	233	62	41,63	Krogh et al [18]	2013
331	223	2	36,78	Mishra et al [109]	2012
330	192	9	18,33	Carter et al [110]	2003
326	237	0	36,22	McCarrel et al [111]	2012
316	227	11	35,11	Sheth et al [112]	2012
314	205	30	28,55	Engebretsen et al [29]	2010
310	226	14	38,75	Zhu et al [113]	2013
307	206	8	27,91	Sampson et al [114]	2010
306	213	61	61,20	Meheux et al [27]	2016

Platelet concentrate related to surgical procedures (54,33%) have a little higher articles number than therapeutical procedures (45,66%). A Mann-Kendal test performed returned a Sen´s slope value of 30,885 and Kendall´s tau of 0,332 to surgical while a Sen´s slope of 5,031 and Kendall´s tau of 0,216 to therapeutical. This shows us, both procedures have an increasing number of publications, but surgical procedures have the most robust trend (figure 1).





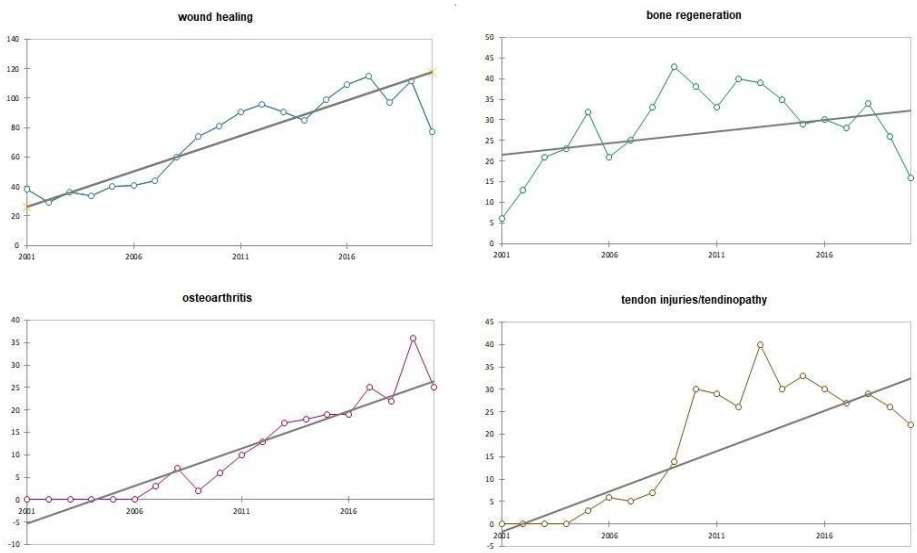
Furthermore, a p-value of surgical use of platelet concentrates is 0,044, statistically significant, but therapeutical use has a p-value of 0,194.

Favorable outcomes analysed included wound healing, bone regeneration, osteoarthritis and tendon injuries/tendinopathy. A resume of Kendall´stau, p-value and Sen´s slope is on table 2.

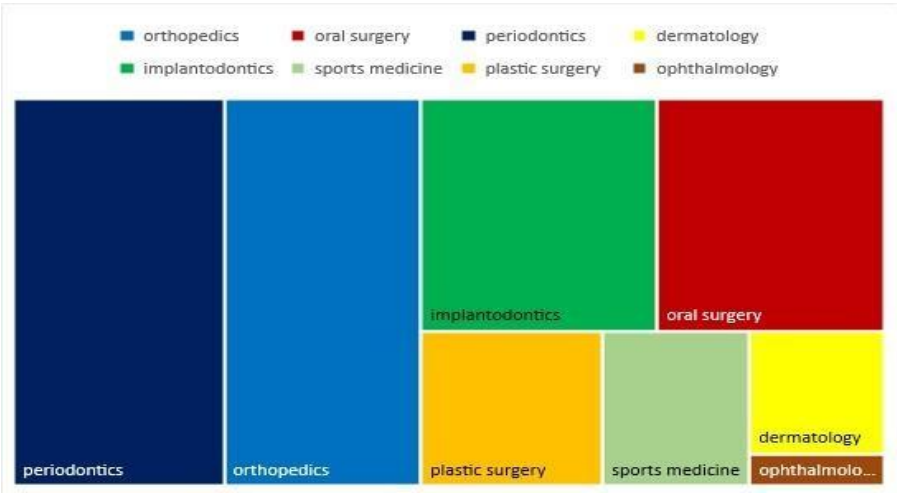
Table 2. Favorable outcomes Mann-Kendal test results

Series\Test	Kendall's tau	p-value	Sen's slope
wound healing	0,765	<0,0001	4,806
bone regeneration	0,222	0,183	0,569
osteoarthritis	0,899	<0,0001	1,667
tendon injuries/tendinopathy	0,569	0,001	1,806

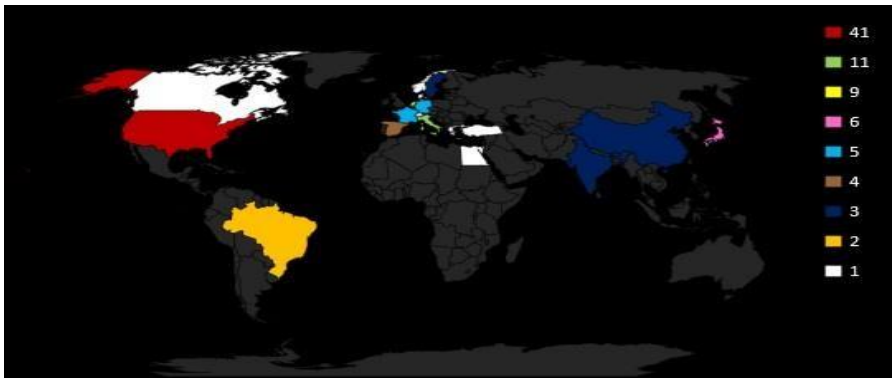
There is a clear uptrend in all outcomes, most notably on wound healing. Three results have statistically significant p-values while bone regeneration returns a p-value not statistically significant (p = 0,183). A graphic visualization of trends can be seen on figure 2.



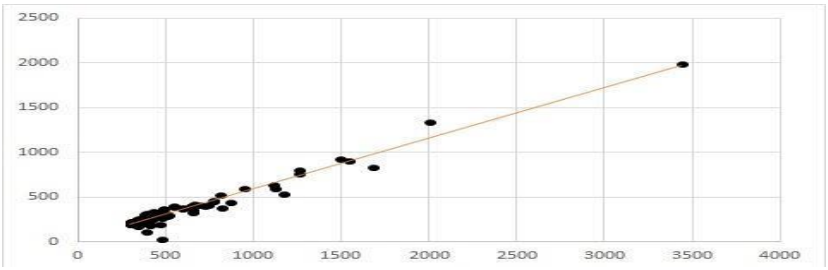
Platelet concentrates can be used in many indications, spread in some disciplines. For example, the medicine disciplines that most routinely use platelet concentrates are orthopedics, sports medicine, plastic surgery, dermatology, and ophthalmology while in dentistry, it is possible to cite oral surgery, implantodontics, and periodontics.[7] An area graphic demonstrates a visual comparison between number of articles in each discipline (figure 3).



In figure 4 is possible to see a map of the countries that are producing these papers.

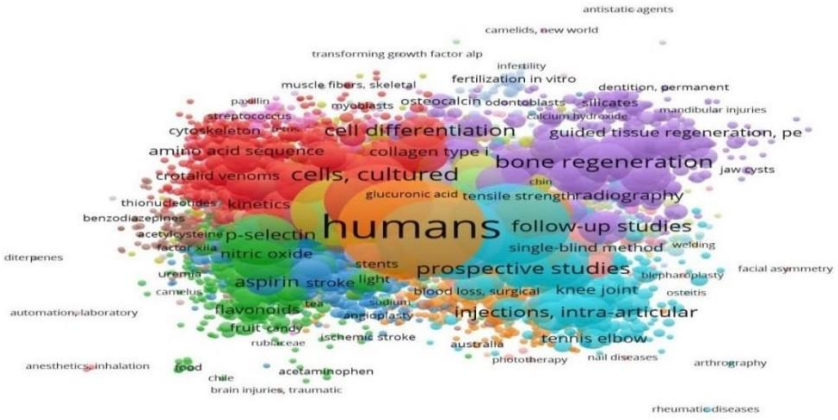


A Pearson´s correlation test was performed on the top 100 list, between two bibliographic search platforms, MA and Dimensions and between each platform and AAS. Pearson´s correlation coefficient between MA and Dimensions was 0.977 (figure 5), considered very high. MA and AAS have a coefficient of 0.1096 (poor) and between Dimensions and AAS, 0.36699 (moderate).



A Fisher exact test was performed to assess if an open-access article has more chances to be mentioned. Test statistic returned a statistically significant value of 0.0182 ($p < .05$). A Kruskal-Wallis test was performed to examine the relation between citation density and year of publication, returning a H statistic of 209.3354 (1, N=315, $p < .00001$).

The most frequent MeSH keyword were “humans”, “male”, “platelet-rich plasma”, “female”, and “animals”. In figure 6 is possible to see a graphical representation of keywords in a network visualization made through free software VOSviewer (Leiden University, Netherlands). The size of the circles is related to the number of citations using the determined keyword.[8]



Discussion

This paper aims to perform a bibliometric analysis of platelet concentrates and assess publications trends over time. Graphic data visualization through bibliometric software and statistical tests were performed to make information more assimilable ($p < .05$). Bibliometric analysis enables researchers and readers to identify research evolution in a specific area over time and to get a superior comprehension as well as some possible failures.[9]

Interest in surgical use of platelet concentrates has an uptrend. As a result, handling platelet concentrates with surgical purposes has a higher chance of publication and dissemination (p = 0,044), contrary to therapeutical use, in a downtrend. However, this trend is not statistically significant (p = 0,194).

Same statistically significant uptrend can be found on wound healing (p < .0001), osteoarthritis (p < .0001) and tendon injuries/tendinopathy (p = 0.001), what indicates these outcomes has a high chance of increase in number of publications. And although bone regeneration is in uptrend, this is not statistically significant (p = 0,183).

Number of publications about platelet concentrates on periodontics and orthopedics is higher than in other disciplines. This difference could get bigger over time due to constant interest in these two disciplines. However, the three more cited articles are related to oral surgery.[10–12] Thus, the list of top 100 most cited articles has an heterogeneous distribution on disciplines and journals. The only question with a higher predominance on the top 100 list is USA as country of origin, with 36 articles.

Keyword choose is critical on article dissemination,[13] specially in cases of some topic areas like platelet concentrates, used in various disciplines. A graphical analysis through a bibliometric software can be instrumental in choosing an appropriate keyword, increasing precision, sensitivity and efficiency on a bibliographic search.[14]

There is no surgical precision in bibliometrics analysis.[5] However, there is a high correlation between Microsoft Academic and Dimensions, which delineates these two platforms are equivalent. The same correlation is not found on AAS. These two search platforms lead us to conclude that altmetrics is complementary to bibliometrics, two utterly different manners to assess scientific articles. An open-access article has more chances to be mentioned (AAS) than a paid articled (p < .05), same conclusion of another paper [15] and contrary to a second one.[16]

Citation density is the number of citations per year of publication and is an essential manner for understanding the scientific strength and impact of a determined paper. A strong correlation was found (p < .05) between year of publication and citation density. An older article has a higher chance of increasing citations than a more recently published article.[6,17]

According to Altmetrics, a score that could be considered good is about.[20] Seventeen articles on this top 100 list are equal or higher than,[20] of these,[13] are related to orthopedics or sports medicine.[18–31] There is a growing interest on the web about platelet concentrates use on orthopedics and sports medicine.

Conclusions

Bibliometric and altmetric analysis are very useful for researchers, academics, and students since both can facilitate any study, research or publishing an article. Open articles have a higher chance to be mentioned than paid articles. Surgical use of platelet concentrates as wound healing, osteoarthritis and tendon injuries/tendinopathy are uptrend, with more opportunities to achieve publication. An appropriate keyword is crucial in article dissemination. Futures studies are necessary since science is very dynamic, and this list needs updating from times to times.

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Ethical approval: Not required

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Patient consentment: Not required

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ԹՐՈՄԲՈՑԻՏՆԵՐԻ ԽՏԱՆՅՈՒԹԵՐԻ ԱՐԴԻԱԿԱՆ ԹԵՄԱՆԵՐ. ԹՐՈՄԲՈՑԻՏՆԵՐՈՎ ՀԱՐՈՒՏ ՖԻԲՐԻՆ և ԹՐՈՄԲՈՑԻՏՆԵՐՈՎ ՀԱՐՈՒՏ ՊԼԱԶՄԱՅԻ ՄԱՏԵՆԱԳԻՏԱԿԱՆ ՎԵՐԼՈՒԾՈՒԹՅՈՒՆ

Ռիկարդո Գրիլլո,[1,2] Մարիանա Ապարեսիդա Բրոզոսկի,[1] Մարիա դա Գրասա Նակլերիո-Հոմեմ [1]

[1] Դիմածնոտային վիրաբուժության, վնասվածքաբանության և պրոթեզավորման ամբիոն,Ստոմատոլոգիայի ֆակուլտետ, Սան Պաուլոյի համալսարան, Բրազիլիա:

[2] Դիմածնոտային վիրաբուժության բաժանմունք, Faculdade Planalto Central, Բրազիլիա, Բրազիլիա:

Ամփոփում

Նպատակներ. Այս հոդվածի նպատակն է տրամադրել հրապարակումների միտումների մատենագիտական վերլուծություն և թրոմբոցիտների խտանյութերի վերաբերյալ 100 ամենաշատ մեջբերված հոդվածների ցանկը վերջին 20 տարիների ընթացքում:

Մեթոդներ. Մայքրոսոֆթ Ակադեմիկում իրականացվել է մատենագիտական որոնում՝ օգտագործելով հետևյալ ռազմավարությունը «(Platelet Rich)»: Հատուկ օգտագործման, բարենպաստ արդյունքների և առարկաների հետ կապված մեջբերումների քանակը վերլուծվել է Microsoft Excel-ի և XLSTAT-ի միջոցով: Ստեղծվել է երկրորդ աղյուսակը՝ հղումների քանակով, Altmetric Attention Score (AAS) և հրապարակման տարեթիվով: Վարկանիշը դասակարգվել է ըստ մեջբերումների քանակի՝ 100 ամենահաճախ մեջբերվող փաստաթղթերի և քննարկված փոփոխականների հետ միասին: Հիմնաբառերի գրաֆիկական վիզուալիզացիան ստեղծվել է VOSviewer-ի միջոցով: Վիճակագրական վերլուծությունը հաշվի է առել 95% վստահության միջակայքը:

Արդյունքներ. Լավագույն 100 հոդվածների օգտակար ցուցակը կազմվել է տարբեր ձևերով մասնագետներին օգնելու համար: Թրոմբոցիտների կոնցենտրացիայի միտումները արժեքավոր են հետազոտողների համար, քանի որ դրանք թույլ են տալիս պատկերացնել այն, ինչը ավելի շատ հետաքրքրում է ընթերցողներին և խմբագիրներին: Թրոմբոցիտների կոնցենտրատների վիրաբուժական օգտագործումը նորոշ արդյունքներ հրապարակումների աճի միտում ունեն ($p < 0.05$):

Եզրակացություններ. Bibliometrics-ը և altmetrics-ը արժեքավոր գործիքներ են, որոնք պետք է թարմացվենցանկացած առողջապահական մասնագիտության մեջ: Երկու գործիքներն էլ մեծ ջանք ու ժամանակ են խնայում նրանց համար, ովքեր հետաքրքրված են թեմայով: Ճիշտ բանալի բառ ունենալը կարևոր է հոդվածիտարածման համար:

АКТУАЛЬНЫЕ ТЕМЫ КОНЦЕНТРАТАХ ТРОМБОЦИТОВ: БОГАТЫЙ ТРОМБОЦИТАМИ ФИБРИН И БИБЛИОМЕТРИЧЕСКИЙ АНАЛИЗ БОГАТОЙ ТРОМБОЦИТАМИ ПЛАЗМЫ

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Резюме

Цели: Целью этой статьи является предоставление библиометрического анализа тенденций публикаций и списка 100 наиболее цитируемых статей о концентратах тромбоцитов за последние 20 лет.

Методы: Был проведен библиографический поиск в Microsoft Academic с использованием следующей

стратегии «(обогащенные тромбоцитами)». Количество цитирований, связанных с конкретным использованием, благоприятными исходами и дисциплинами, было проанализировано с использованием Microsoft Excel и XLSTAT. Была создана вторая таблица с количеством цитирований, альтметрической оценкой внимания (AAS) и годом публикации. Рейтинг был отсортирован по количеству цитирований со 100 наиболее часто цитируемыми статьями и обсуждаемыми переменными. Графическая визуализация ключевых слов была создана с помощью VOSviewer. Статистический анализ принял во внимание 95% доверительный интервал.

Результаты: Был составлен полезный список из 100 лучших статей, чтобы помочь профессионалам самыми разными способами. Тенденции концентратов тромбоцитов ценны для исследователей, поскольку позволяют визуализировать то, что больше интересует читателей и редакторов. Хирургическое использование концентратов тромбоцитов и некоторые результаты находятся в восходящем тренде публикаций ($p < 0,05$).

Выводы: Библиометрия и альтметрика являются ценными инструментами, которые необходимо обновлять в любой профессии здравоохранения. Оба инструмента экономят много сил и времени тем, кто интересуется темой. Наличие подходящего ключевого слова имеет решающее значение для распространения статьи.

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REVIEW ARTICLE

PREVENTION AND MANAGEMENT OF INTRA-OPERATIVE COMPLICATIONS IN MAXILLARY SINUS AUGMENTATION USING THE LATERAL APPROACH? A REVIEW

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Abstract

The lateral approach for maxillary sinus grafting has become a routine technique with an implant survival rate over 96% in the maxillary posterior region. However, this technique may be associated with some complications that may occur at different time points and influence short and long-term implant survivalrate. This article is dedicated to intra operative complications which are mainly due to anatomical variations such as the shape of the sinus, the presence of septa and other particularities such as the intraosseous passage of the antral alveolar artery which may interfere with the position of the vestibular window.

In order to identify the risk and prevent the complications, a perfect knowledge of the anatomy is therefore essential. If a complication does occur, it must be treated in an efficient manner to prevent the postoperative complications that may follow, in the form of chronic or acute sinusitis. The prevalence of intra operative complications is conversely proportional to the surgeon's skill and experience without an influence on implant survival if they are properly managed.

Keywords: *Bone graft, complications, management, maxillary sinus augmentation, prévention*

Introduction

Maxillary sinus augmentation via the lateral approach technique, has been recognized for many years as a reliable, effective and well documented technique for bone augmentation in the posterior maxilla.[1,2,3] This technique is reported to induce more complications being more invasive than the crestal approach.[4,5]

In medecine, as in everyday life, each time a complication occurs, two questions must be asked: why did I get this complication, and how could I have avoided it? According to Pjetursson et al,[6] there is a learning curve in implant dentistry, represented in higher survival rates and lower complication rates reported in more recent clinical studies. This is particularly true for maxillary sinus augmentation using the lateral approach. Comparing studies from the early 2000s[7,8] with those published 20 years[9,10] later the 5y implant survival rate is 92% and 95% respectively. the purpose of this article is to identify, through the literature and the author's experience, the ways to achieve this by preventing and treating complications in the most predictable way.

Intra operative complications:

In order to prevent and to anticipate them a pre-operative CBCT is absolutely mandatory.[11,12.]

Neurosensory disturbance:

This complication is rarely mentioned. Sometimes after the surgery the patient can feel some numbness on the same side the graft has been performed. This is

due to the presence of terminal branches of the infra orbital nerve which are cut at the moment the anterior vertical releasing incision is made.[13] The prevention of this complication consists of making a partial incision, instead a full thickness one, in the alveolar mucosa and spreading the edges with Metzenbaum scissors, which stretches the nerve fibers rather than cutting them (Figure 1).

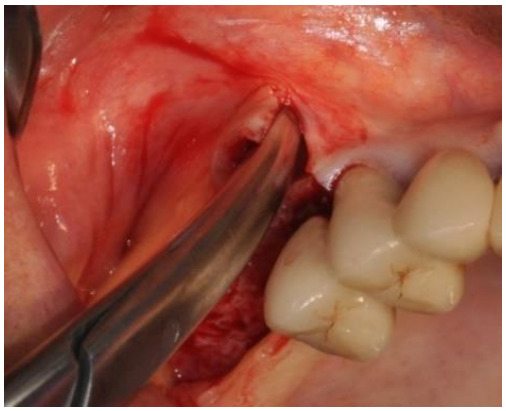

Figure 1. Metzenbaum scissors are inserted under the split thickness incision and opened to stretch the nerve branches without cutting them

Vascular damage

This complication is only observed if the lateral approach is used. A significant bleeding may complicate the procedure. It is due to a damage of the alveolar antral artery when making the vestibular osteotomy when its passage is intra osseous within the buccal wall. This artery is an anastomosis between the infraorbital artery and the postero-superior alveolar artery, its passage being extraosseous in 44% of cases.[14] Its course can be very variable so it should be checked systematically on cross sectional cuts witha pre op CBCT. The likelihood for an intraoperative bleeding with a vessel of 0.5-1mm in diameter will be 10% and 57% for a diameter of 1-2 mm.[15] The higher risk corresponds with a diameter more than 2mm.[16]

Intra operative bleeding can be managed with various methods. By crushing the bleeding point with a hemostat,[17] applying pressure with a gauze impregnated with tranexamic acid 13 or bone wax.[17] The risk is the recurrence of bleeding post operatively.[13] Electro coagulation with a bipolar device can also be employed with the risk of sinus membrane damage.

The absence of a suture at the distal releasing incision may favour the drainage of the clot.[18]

Avoiding bleeding remains the best approach. To do this, it will be necessary to proceed with the isolation of the alveolo antral artery using piezo surgery (Figure 2).[13,19] Another option, if technically possible, is to make the window as small as possible and to move it lower.[17]

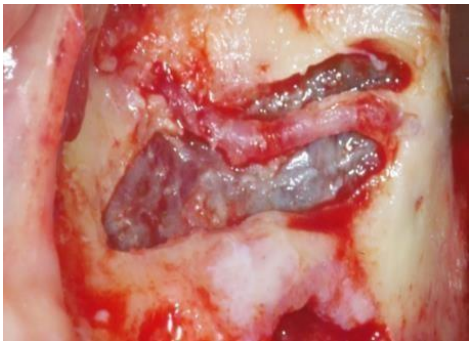

Figure 2. The alveolo antral artery has been isolated using piezo surgery

Membrane perforation:

It is the most common complication with a prevalence between 0 and 58% and an average of 19.5%.[20] This complication is not considered as a negative factor for bone formation and implant survival[21,22] evencontrary opinions on the quality of new-bone formation [23] and survival have been expressed.[24,25]

Risk factors and prevention:

The prevention of this type of complication is essential and for that it is necessary to be able to detect the risk factors of tearing in the most comprehensive manner.[26]

Considering the membrane thickness, there is a controversy. According to Aimetti et al [27] the sinus membrane in patients with a thick gingival phenotype is thicker. Lum et al [28] in their retrospective study, concluded that patients who experienced membrane perforation had a thinner membrane compared with patients without membrane perforation. But Insua et al,[29] after testing mechanically sinus membranes harvested from fresh cadavers, found that a thick membrane is not prevented to tear, as its resistance under elastic forces is not higher than a thinner one. Similarly, Lin et al [30] showed that membranes with a thickness of 1 to 1.5 mm were the most resistant while those that are thinner or thicker are more prone to tearing.

It is therefore impossible to appreciate the real thickness relying solely on radiographic examination, especially since it is over-evaluated on the CBCT.[31]

Another risk factor that must be considered is the presence of septa. In case of complex internal anatomy, a 3D reconstruction is essential [32] to have an exact idea of the number of septa, their orientation, and their size.

The prevalence of perforation is less with medio lateral septa compared with antero-posterior [26] and an appropriate surgical approach must be implemented according to these criteria.[33] For instance, when the sinus is divided in [3] cavities because of the presence of 2 medio-lateral septa it is preferable to consider 3

different sinuses [34] to be grafted or by removing surgically the septa when it is antero-posterior.[13]
The width of the sinus cavity is also a risk factor.[35] This parameter is appreciated by measuring the angle between the buccal wall and the palatal component of the nasal wall. When this angle is acute the perforation rate is more than 60% [36] and it decreases moving in a more posterior direction, making the anterior region the most dangerous regarding the risk of perforation, especially in the presence of a particularly narrow anterior recess (Figure 3). Consequently, the window should be placed as close as possible to the anterior wall in order to dissect the membrane under direct vision, which will allow the detection and treatment of any tears.

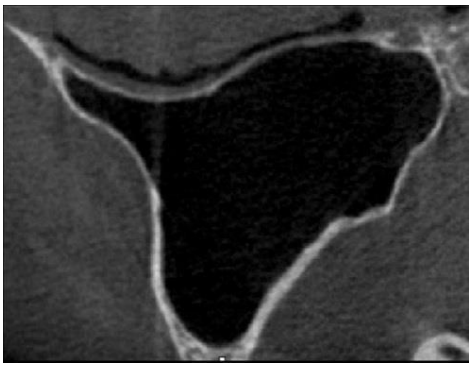

Figure 3. The anterior part of the sinus is very narrow (axial cut)

The thickness of the lateral wall is also mentioned as a risk factor.[37] If the buccal wall is thin, it is recommended to erode it until the membrane is visible in order to lift it.[19] When the buccal wall is thick the lateral osteotomy by erosion using the piezo surgery would be time consuming and therefore it is recommended to cut the window and to lift it out. The risk of perforation being very high, in some cases, because of its strong adhesion to the bone. This degree of adhesion can't be detectable on the CBCT. To prevent this drawback, it is recommended to split the thick window in small pieces in order to detach each of them with a lower pulling force (Figure 4. a, b).[13]
Regarding the grafting technique, when the implants are placed simultaneously if the sinus is entirely filled with the grafting material, the risk is to tear the membrane apically while inserting the implants is very high by creating an increased pressure internally.

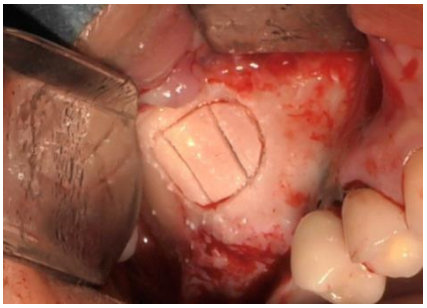

Figure 4a. The window is divided in 3 small pieces

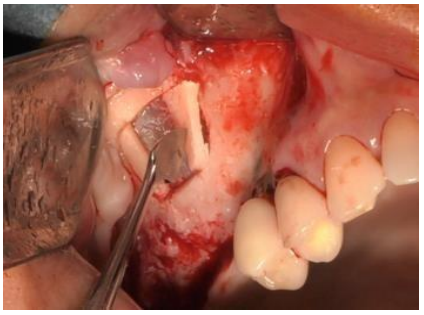

Figure 4b. All pieces are removed successively

To avoid this undetectable perforation, it is preferable to fill the sinus cavity two-thirds of the way and then place the implants before completing the graft. Smoking has been recently identified as a risk factor.[38]

How to detect the perforation?

The Vaslava maneuver might have certain limitations,[39] thus, a more preferable approach would be to detect perforation and to manage it more efficiently by direct view. An alternative way is to inject saline into the sinus cavity and to ask the patient if he/she feels liquid flowing into the nose.

Management of perforations

According to Nolan et al,[24] the use of antibiotics to treat post-operative sinusitis and graft failure was higher in sinuses with perforation. This means that the size of the perforation must be as small as possible and that perfect hermeticity must be ensured to grafting material penetration in the sinus. Among the treatments reported, the most widely used technique in the studies reviewed was collagen membrane repair although this was managed in different ways.[40]
Often the perforation occurs when the window is made and is tangent to the osteotomy line (Figure 5a), so that it is not completely visible. In this case, the shape of the window must be modified so that it can be seen in its entirety (Figure 5b). The next step is to initiate the detachment on the opposite side (Figure 5c) of the perforation to take advantage of the membrane's own elasticity, which will lead to a reduction of its size and to its partial closure (Figure 5d).

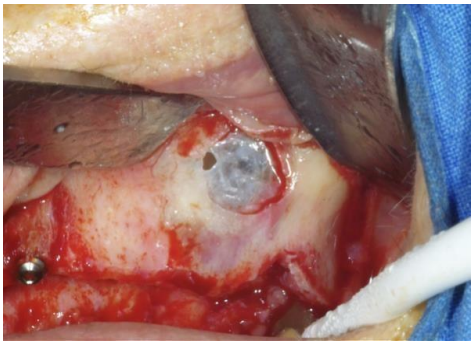

Figure 5a. The perforation is tangent to the osteotomy line

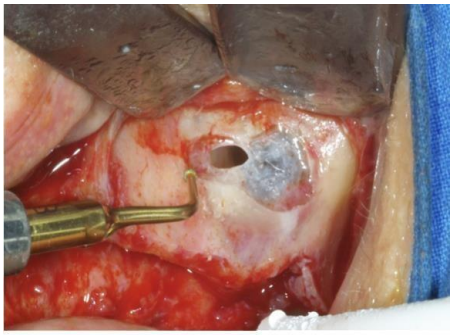

Figure 5b. The shape of the window is modified to see the perforation in its entirety

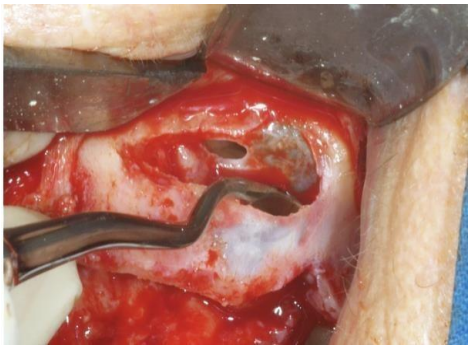

Figure 5c. The detachment is initiated opposite to the perforation

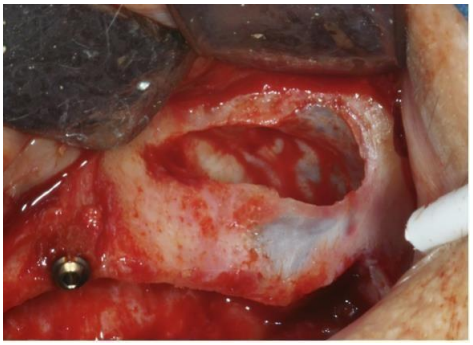

Figure 5d. The perforation size is reduced

Then, it will be necessary to seal it with a collagen membrane to ensure its hermeticity.[41] But, despite the use of a collagen, membrane perforation and repair of the Schneiderian membrane can compromise new bone formation and implant survival rate.[42] They explain this by saying that during the condensation of the graft the surgeon cannot know if the membrane resists the pressure or not. To prevent this, it is preferable to pack the grafting material always against a bony wall and not upwards or backwards because of the risk of an undetected perforation.

In the same way it was reported [43] a higher prevalence for sinusitis in cases of membrane perforation (31.4%) despite intraoperative closure with resorbable membranes. In this report, as the way in which the collagen membrane was used was not specified, it can be assumed that the stability of this membrane above the perforation was not ensured and that it shifted during the placement of the graft.[44] It is therefore necessary to ensure its stability at the time of grafting. For this purpose, the Pouch Technique has been advocated.[45]

The disadvantage of this technique is that there may be a gap between the medial wall and the graft which may alter the quality of the newly formed bone. The way to prevent this could be the use of the Tattone Technique [46], which consists of stabilizing part of the collagen membrane with titanium pins on the medial wall, allowing this type of perforation to be hermetically sealed (Figure 6. a, b).

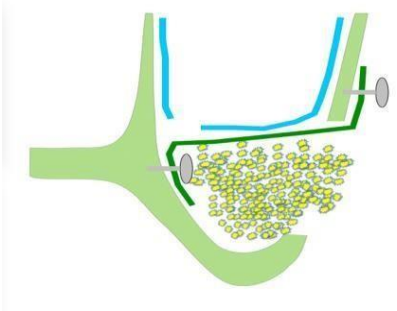

Figure 6a. The membrane is pinned in the medial wall and the buccal wall

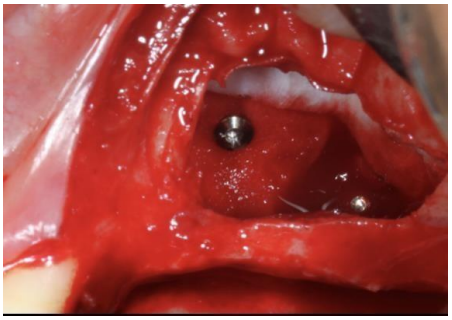

Figure 6b. Clinical view: the titanium tacks in the medial wall

This technique is particularly indicated in case of presence of a para-nasal recess of less than 30° which can result in a tear adjacent to the medial wall.[24,47]
De Oliveira et al [48] assert that the resorbable membrane influences the intensity of inflammatory responses producing a reduction in bone formation. Another option is to use a resorbable suture [49] with the risk with of enlarging the perforation or PRF membranes.[47] This last possibility needs to be further documented.
According to other authors [39,49] the implant failure rate increases as the perforation size. In only two studies[50,51] the treatment of both small and large defects has been described. Small defects have been managed with resorbable collagen membrane in both studies.
Large defects with resorbable sutures and adsorbable membranes [49] with no differences for the implant failure, conversely to Hernandez-Alfaro et al [52] who treated large defects with lamellar bone and a lower implant success compared to small defects.
The impact of membrane perforation on graft quality and implant survival remains controversial. Moreno Vazquez et al [53] and Sakkas et al [54] assert there is no impact of membrane perforation on the graft failure rate conversely to others.[42] In a recent systematic review,[40] it was concluded that a negative impact on the bone graft itself or on remodeling processes could not have been shown. Another option to avoid the complications related to granules loss trough the perforation could be the use of PRF [55,56] alone as grafting material or without any grafting material [57] with an implant survival of 100% and 98.7% respectively, but evidence is still lacking.

Delamination

At the time of the osteotomy or during its dissection, the schneiderian membrane may be partially damaged due to the tearing of its periosteal part (Figure 7). Although not perforated because the pseudostratified respiratory epithelium will remain, it will be very fragile. This type of lesion should be treated in the same way as a perforation.

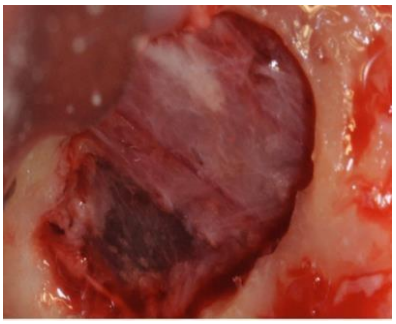

Figure 7. The delamination (dark area) in the lower left

For large perforations, a better option would be to abort the surgery and to insert a collagen sponge in the sinus cavity and to wait 3-6 weeks.[58] This time frame allows the membrane to heal, making the re-entry much easier using a split thickness approach.

Implant migration

When the implant placement is performed simultaneously to the graft it is necessary to achieve a perfect implant stability to prevent the implant from falling into the sinus and its migration in sensitive areas (Figure 8).[59] The implant can migrate for two reasons: If the sinus floor is not dense, the osseodensification technique can be used.[60]
The second reason is when the bone height under the sinus is reduced and there is an indication to place implants at the same time as the graft, it will be necessary to undersize the drilling and to use a tapered implant which may cause a fracture of the vestibular wall when the implant is inserted using a high torque.

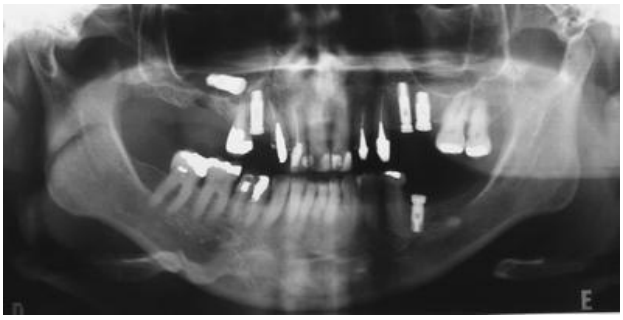

Figure 8. The Implant migration in the sinus

The solution is to shift the window apically 8-10 mm[13].

Conclusion

In addition to the risk factors mentioned above the frequency of intra operative complications is also inversely proportional to the surgeon's skill and experience. They can be considered to have no influence on graft and implant postoperative survival, if they are properly managed thanks to a perfect knowledge of the anatomy and its variations. If not, they may cause acute or chronic infectious post- operative complications.

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ԿՈՂԱՅԻՆ ՄՈՏԵՑՄԱՄԲ ՎԵՐԾՆՈՏԱՅԻՆ ԾՈՑԵՐԻ ՄԵԾԱՑՄԱՆ ՆԵՐՎԻՐԱՀԱՏԱԿԱՆ ԲԱՐԴՈՒԹՅՈՒՆՆԵՐԻ ԿԱՆԽԱՐԳԵԼՈՒՄ ԵՎ ԿԱՌԱՎԱՐՈՒՄ: ԱԿՆԱՐԿ

Պասկալ Վալենտինի*

* Կորսիկայի համալսարան Պասկուալ Պաոլի, Առողջապահության ինստիտուտ, իմպլանտների վիրաբուժության բաժին, Տատտոնե հիվանդանոց, 20250 Կորտե, Ֆրանսիա

Ամփոփում

Վերծնոտային ծոցերի մեծացման կողային մեթոդը դարձել է սովորական տեխնիկա, իմպլանտների գոյատևման մակարդակը գերազանցում է 96%-ը վերծնոտային ծոցերի հատվածում: Այնուամենայնիվ, այստեխնիկան կարող է կապված լինել որոշ բարդությունների հետ, որոնք կարող են առաջանալ տարբեր ժամանակներում և ազդել իմպլանտների կարճաժամկետ և երկարաժամկետ գոյատևման մակարդակի վրա:Այս հոդվածը նվիրված է ներվիրահատական բարդություններին, որոնք հիմնականում պայմանավորված են անատոմիական փոփոխություններով, ինչպիսիք են վերծնոտային ծոցերի ձևը, միջնապատերի առկայությունը և այլ առանձնահատկություններ, ինչպիսիք են անտրալ ալվեոլային զարկերակի ներոսկրային անցումը, որը կարող է խանգարել վեստիբուլյարի պատուհանի դիրքին:

Ռիսկը բացահայտելու և բարդությունները կանխելու համար անհրաժեշտ է անատոմիայի կատարյալ իմացությունը: Եթե բարդություն առաջանա, այն պետք է արդյունավետ կերպով բուժել՝ կանխելու հետվիրահատական բարդությունները, որոնք կարող են հետևել՝ քրոնիկ կամ սուր սինուսիտի տեսքով: Ներվիրահատական բարդությունների տարածվածությունը հակառակը համեմատական է վիրաբույժի հմտությանը և փորձին՝ առանց իմպլանտների գոյատևման վրա ազդեցության, եթե դրանք պատշաճ կերպով կառավարվեն:

ПРОФИЛАКТИКА И ЛЕЧЕНИЕ ИНТРАОПЕРАЦИОННЫХ ОСЛОЖНЕНИЙ ПРИ УВЕЛИЧЕНИИ ВЕРХНЕЧЕЛЮСТНОЙ ПАЗУХИ ЛАТЕРАЛЬНЫМ ДОСТУПОМ. ОБЗОР

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Абстракт

Латеральный доступ при увеличении верхнечелюстной пазухи стал рутинной техникой с коэффициентом приживаемости имплантата более 96% в задней области верхней челюсти. Однако этот метод может быть связан с некоторыми осложнениями, которые могут возникать в разные моменты времени и влиять на краткосрочную и долгосрочную приживаемость имплантатов. Эта статья посвящена интраоперационным осложнениям, которые в основном связаны с анатомическими вариациями, такими как форма пазухи, наличие перегородок и другими особенностями, такими как внутрикостное прохождение антральной альвеолярной артерии, которое может мешать положению вестибулярного окна.

Поэтому для выявления риска и предотвращения осложнений необходимо идеальное знание анатомии. Если возникнет осложнение, его необходимо лечить эффективным образом, чтобы предотвратить возможные послеоперационные осложнения в виде хронического или острого синусита. Распространенность интраоперационных осложнений обратно пропорциональна навыкам и опыту хирурга и не влияет на приживаемость имплантата при правильном лечении.

Valentini P. Prevention and management of intra-operative complications in maxillary sinus augmentation using the lateral approach? A review. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):16-26. doi: 10.58240/1829006X-2023.19.2-16

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CLINICAL ARTICLE

EVALUATION OF THE EFFECTIVENESS OF DIFFERENT METHODS SINUS FLOOR ELEVATION THE LATERAL APPROACH

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Abstract

Background: The posterior maxillary area sometimes has insufficient bone mass for dental implants. The augmentation of the sinus floor allows the implant to be placed in the posterior of the upper jaw.

Purpose: The aim of this study was to compare the effectiveness antral balloon- assisted maxillary sinus elevation and traditional sinus floor elevation followed by bone graft and delayed implant placement the posterior maxillary area.

Material and methods: A total of 68 patients, (aged 27 to 56 years, 32 women and 36 men), without any systemic diseases with unilateral/bilateral missing teeth and atrophy of the posterior maxillary area, who required an enlargement of the sinus prior to implant placement, whom the location of the sinus floor from the crest was 3-5mm, width ≥5 mm were included in the study between 2018 and 2021. Patients underwent a thorough clinical examination according to the generally accepted scheme. All patients were selected after meticulous evaluation of their medical histories and dental examinations, including OPG and dental Computed Tomography (CT) scans.

Results: The sinus lift using balloon technique was performed successfully in patients 1 group, with no complications. In 9 patients 2 group, perforation of the sinus membrane occurred during the operation, sinusitis in 4 patients, graft failure in 3 patients. Regardless of the approach used, both approaches showed significant increases in bone mass gain. Though not statistically significant difference, balloon-assisted procedure showed more mean bone gain (8.4 mm) compared to osteotome -assisted procedure (8.1 mm). The mean amount of Marginal Bone Loss (MBL) in patients 1 group 3 years follow-up was 0.86 mm in patients 2 group showed significantly less marginal bone loss 1,16mm. The implant survival rate 3 years follow-up was in patients 1 group was 97.62%, in patients 2 groups was 95.2%.

Conclusions: Research has shown that the balloon sinus lifting offers predictable, safe and effective results, and eliminates the complications associated with traditional side window techniques. However, further controlled clinical trials are needed to evaluate the efficacy and safety of these technique for their appropriate implementation in the field of oral implanotology.

Keywords: *Sinus Floor Elevation, osteotome -assisted procedure, balloon- assisted maxillary sinus elevation*

Intaduction

Dental implants will resolve the problems associated with conventional dentures. Sufficient alveolar bone to for placement 10 mm long and a diameter of 3.5-4 mm implants has traditionally been considered the minimum requirement to allow bone placement of the implant. Due to the extraction of teeth into the segment molar and pneumatization of the maxillary sinus, the vertical height of the bone in the posterior edentulous upper jaw decreases thus limiting the installation of dental implants.[1] Bone density greatly affects primary implant stability and success, since implants in areas of lower bone quality are associated with a high failure rate.[2] It is important to place implants in locations with good primary stability, which cannot be acquired in regions with low bone density. Posterior maxilla often presents type III or type IV bone quality according to Lekholm and Zarb's classification.[3] Increased pneumatization of the maxillary sinus and the quality of the III or IV types of bone in the posterior part of the upper jaw-all this emphasizes the need for additional procedures that increase the quality and quantity of bone.[4,5] One solution in these clinical cases is to use shorter implants, which sometimes leads to an unfavorable crown-to-root ratio. Maxillary sinus augmentation has become the most common surgical procedure that involves detaching the Schneider membrane from the floor of the maxillary sinus, creating a space filled with a bone graft to facilitate vertical bone augmentation in the maxillary sinus cavity, allowing future dental implants to be restored.[6] Boyne and James in 1980 proposed a conventional sinus augmentation procedure that involves direct visualization and manipulation of the Schneider membrane through a lateral window osteotomy (modified Caldwell-Luc approach).[7] Although these procedures often ensured high implant survival and stability of bone tissue levels over time.[8] However they were not always well accepted by patients due to their high cost, increased postoperative morbidity, high risk of infection (fistula with pus or abscess, often caused by infection of the graft material) and a long healing time. In addition to being an invasive surgical procedure, it also presents with post-operative conditions such as bleeding, edema, and membrane perforation.[9-11] H. Tatum in 1986 Transcrestal Sinus Floor Elevation (TSFE) was performed by lifting the sinus floor via sequential crestal bone preparations.[12] Later, in 1994, summers introduced the osteotomy sinus floor elevation, which is a minimally invasive technique to localize the elevation of the maxillary sinus through the alveolar ridge.[13] This approach is supposed to offer more patient comfort, more primary stability, and less morbidity. However, this method has been shown to be effective only when the crest height exceeds 6 mm. Perforation of the sinus membrane will result in deposition or interruption of the sinus lift procedure. Various modifications have been proposed to prevent complications associated with the summer's sinus floor elevation method.[14]

Over the past decade, many authors have developed minimally invasive sinus lift techniques to overcome the postoperative complications associated with traditional sinus lift procedures. Muronoi et al. for the first time it was proposed to enlarge the maxillary sinus floor using a balloon.[15] The technique of balloon lift of the antral membrane was introduced through the lateral approach.[16] Thereafter, a technique was described for minimally invasive balloon elevation of the antral membrane using a transcrestal approach, which included the use of a balloon device through a 3 mm osteotomy.[17-19] Approach to the antrum through the lateral window and elevation of the Shneidar membrane with an antral balloon is the method that has shown the lowest of membrane perforation. It elevates the membrane easily and makes the antral floor accessible for augmentation with grafting materials. The development of minimally invasive sinus lift surgery includes progress in endoscopy, development of intraoperative navigation for maxillofacial surgery. Decision making includes diagnostic and therapeutic indications, patient preferences and values, and cost considerations. After the sinus membrane lifting a variety of bone grafting materials can be used.[20-22] Since different techniques sinus lifting were evaluated in different trials, for implant failures and complications. Based on relevance question in focus in this study is the antral membrane balloon elevation technique effective in the terms of sinus augmentation success rate, survival rate of dental implants, bone gain, and complication rate compared with the traditional sinus floor elevation technique. The aim of this study was to compare the effectiveness antral balloon-assisted maxillary sinus elevation and traditional sinus floor elevation followed by bone graft and delayed implant placement the posterior maxillary area.

Material and methods

A total of 68 patients, (aged 27 to 56 years, 32 women and 36 men), without any systemic diseases, with unilateral/bilateral missing teeth and atrophy of the posterior maxillary area, who required an enlargement of the sinus prior to implant placement, were included in the study between 2018 and 2021. All patients presented functional and esthetic complaints. Written informed consent was obtained from all patients explaining the possible side effects of the procedure.

Indications of the technique in the study

The study included patients in whom the location of the sinus floor from the crest was 3–5 mm, width ≥5 mm (from the floor of the sinus to the crest of the bone, as determined radio graphically), a minimum follow-up period of 1-year loading.

Contraindications of the technique in the study

Contraindications included any systemic condition that could interfere with physiological wound healing, orofacial cancer, radiation / chemotherapy to the head and neck area, Advanced medical conditions, patients who consumed oral bisphosphonates for more than three years, excessive smoking, alcohol or substance consumption, psychological problems. Local contraindications of sinus lift surgery included untreated active periodontal disease, maxillary sinus infections and pathological lesions, chronic sinusitis, alveolar scar possibility, odontogenic infections, allergic rhinitis. Patients underwent a thorough clinical examination according to the generally accepted scheme. All patients were selected after meticulous evaluation of their medical histories and dental examinations, including OPG and dental Computed Tomography (CT) scans (Figure 1).

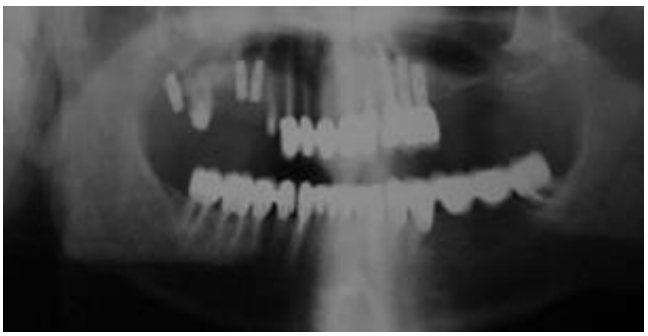

Figure 1. Preoperative radiograph

Initial height of the bone from the alveolar ridge to the sinus floor, the width of the ridge and the mesiodistal diameter of the edentulous area were measured using CT. To assess the volume of new bone and to monitor maxillary sinus re-pneumatization, CT scans were taken. These tests were conducted after the functional loading of implants and repeated after 1, 2, 3 years. Patients were divided into 2 groups; group distribution was performed randomly. In 36 patients of 1 group, implantation was performed after lateral approach antral balloon technique for sinus elevation followed by bone graft and delayed implant placement the posterior

maxillary area. In 32 patients of 2 group, implantation was performed after traditional sinus augmentation procedure (Boyne and James method) a that involves direct visualization and manipulation of the Schneider membrane through a lateral window osteotomy followed by bone graft and delayed implant placement the posterior maxillary segment. Patients were started on prophylactic antibiotic treatment 24 hours before surgery.

In patients 1 group after local anesthesia was injected into the edentulous ridge, after reflecting a mucoperiosteal flap bone scraper is used to collect autogenous bone from site of the operation (Figure 2). Opening a window on lateral wall of the maxillary sinus by round diamond bur and separating the Shneider membrane from the bony walls of maxillary sinus (Figure 3). Balloon-assisted maxillary sinus floor elevation was carried out using a Zimmer balloon (Zimmer, USA) (Figure 4).

Insertion of Zimmer balloon (Zimmer, USA) in between the sinus membrane and the bony walls to detach the remaining part of the sinus membrane from its bony walls (Figure 5). The balloon was then slowly inflated with saline (1 cm3 of saline corresponds to 6 mm membrane elevation) until the desired elevation

(usually ≥11 mm) was achieved. The balloon was then slowly deflated and removed.

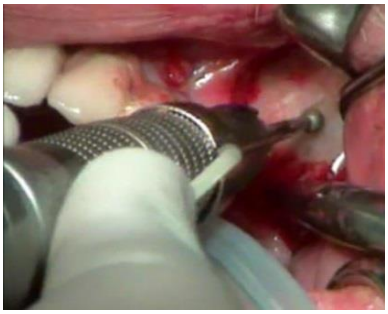

Figure 2. Bone scraper is used to collect autogenous bone from site of the operaration

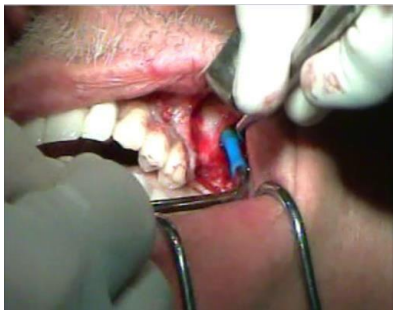

Figure 3. Opening a window on lateral wall of the maxillary sinus by round diamond bur

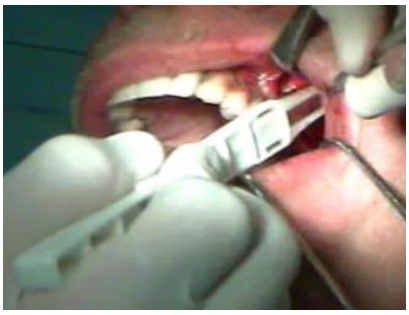

Figure 4. Insertion of Zimmer balloon in between the sinus membrane and the bony walls and inflating it with saline solution to detach the membrane from its bony walls

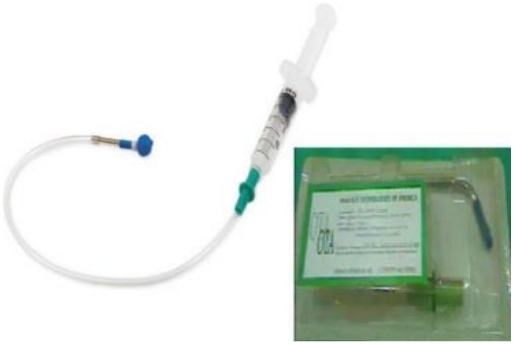

Figure 5: Zimmer balloon

Mixing the autogeneos bone which is collected from the site of the operation by a scraper with Cerasorb® (Curasan, German) cristals along with the patient's blood Platelet-Rich fibrin (Figure 6).

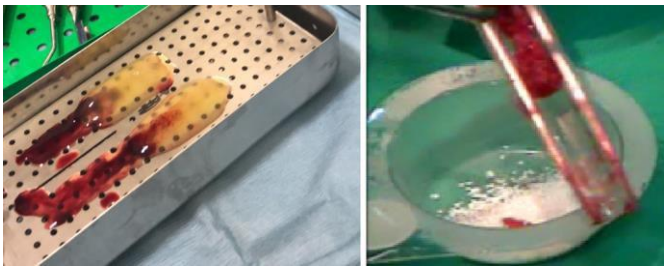

Figure 6. Autogeneos with Cerasorb® (Curasan, German) cristals along with the patient's blood Platelet- Rich fibrin

Bone graft material and Platelet-Rich fibrin were inserted into the sinus under the antral membrane, placement of Resodont® (Resorba Wundversorgung GmbH & Co. KG, Germany), resorpable membrane to cover the lateral wall of the sinus and separate it from the mucuperiosteal flap after which the flap was repositioned and sutured using 3-0 silk sutures (Figure 7,8,9). Radiographs were taken to assess the degree of sinus floor elevation in the surgical site after the procedure (Figure 10). The augmentation evaluated by CT scans. Patients were advised to strictly follow the postoperative instructions. Post-operative patient reactions including swelling, discoloration, discomfort, hematomas.

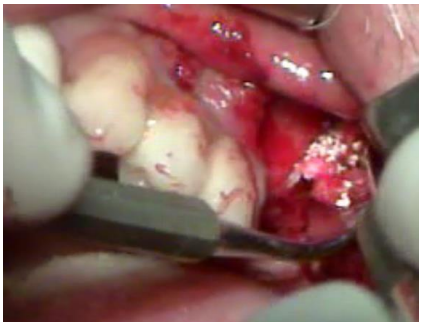

Figure 7. Augmentation of the sinus with bone graft and Platelet- Rich fibrin

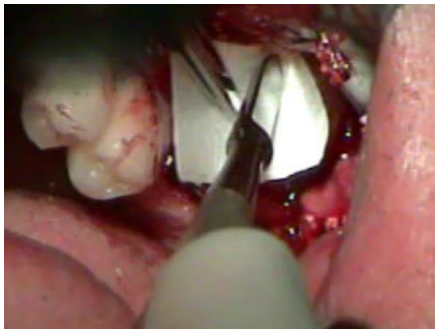

Figure 8. Resorpable Resodont® membrane to cover the lateral wall of the sinus and separate it from the mucuperiosteal flap

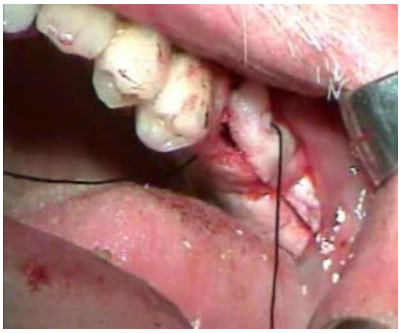

Figure 9. Suturing of the flap

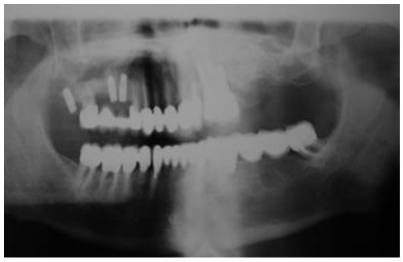

Figure 10. Postoperative radiograph after sinus lift

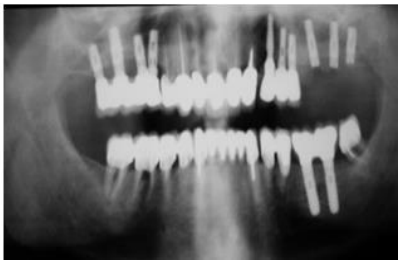

Figure 11. Radiograph after implant placement

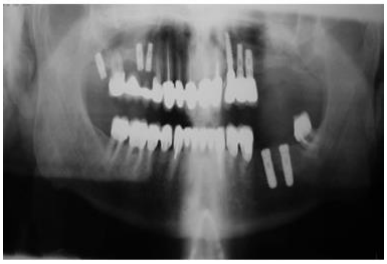

Figure 12. Final postoperative radiograph with restorations

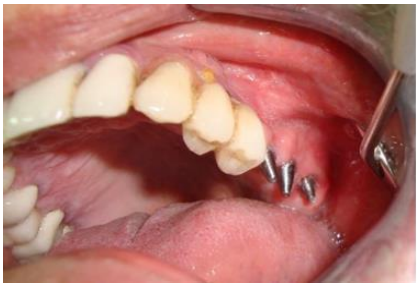

Figure 13. Intraoral view with abutments before fixation of the prosthetic construction

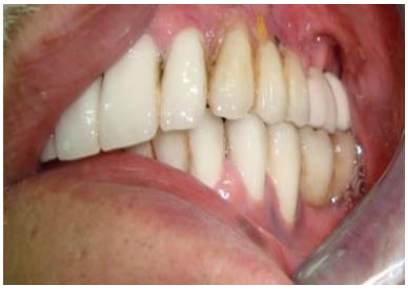

Figure 14. Final restoration with metal ceramic bridge

Implant placement was initiated 6 months post-operatively and reviewed at frequent intervals. Loading of the implants was carried out after 6 months. After removing the cover screw, healing plugs were installed and after 10 days the prosthetic stage of treatment was started (Figure 13, 14). All patients were evaluated radio- graphically after prosthetics (Figure 12) and 6th month, 1, 2, 3 years after prosthetics. The crestal bone height was maintained and verified by subsequent radiographs. In 32 patients of group 2 sinus lift procedure was performed using the traditional lateral approach method using bone graft material Resodont® and Platelet-Rich fibrin.

Midcrestal incision is made in the mesiodistal direction along the length of the alveolar crest and anterior- and posterior-releasing incisions are made. A full-thickness mucoperiosteal flap with a trapezoid base is elevated while maintaining periosteal integrity. The superoior inferior and anteroposterior

borders of the lateral window are determined by the sinus volume, which is preoperatively examined by CT The shape of the osteotomy window rectangular or oval and outlined with a size of 10×20 mm. The size of the window can increase or decrease, according to the size of the planned augmentation for implant placement. The inferior border of the bony window should be 2-5 mm superior to the sinus floor.

The elevation sinus membrane performed using broad-based freers or curettes. The prepared graft material Resodont® and Platelet-Rich fibrin is placed by pieces into the drilled hole, followed by a 6-month wait. After the bone is placed in the sinus, Resorpable Resodont® membrane to cover the lateral wall of the sinus and the mucoperiosteal flap is positioned and primary closure is achieved. Patients instructed about sinus precautions, which are avoiding anything that can cause sudden pressure changes in the sinus, such as nose blowing with nostrils pinched closed and sneezing with a closed mouth. A total of 118 implants were installed in patients 1 group and 96 implants were installed in patients 2 group. An implant was considered to have failed (clinical or absolute failure) if it had any of the following conditions: pain on function, mobility, radiographic bone loss > 1/2 the length of the implant, uncontrolled exudate, or was no longer in the mouth. Postsurgical change in Marginal Bone Loss (MBL) was assess by digital x-ray were taken immediately (base line for comparison), 1, 2, 3 years after prosthesis loading. Statistics were used to calculate and analyze the mean marginal bone loss of implants

Statistical analyses

Statistical analyses were performed using SPSS software ver. 22.0 (IBM, Armonk, NY, USA), and MedCalc program for Windows. To test the significance of variations in the BOP, PPD, MBL, the t-test was used. The minimum level of statistical significance was set at a value of less than 0.05.

Results

The sinus lift using balloon technique was performed successfully in patients 1group, with no complications. In 9 patients 2 group, perforation of the sinus membrane occurred during the operation, sinusitis in 4 patients, graft failure in 3 patients.

Table 1: The sinus lift complications in 1 and 2 groups

Complications	1 group	2 group
perforation of the sinus membrane	0	9
sinusitis	0	4
graft failure	0	3

Regardless of the approach used, both approaches showed significant increases in bone mass gain. Though not statistically significant difference, balloon-assisted procedure showed more mean bone gain (8.4 mm) compared to osteotome-assisted procedure (8.1 mm) table 2.

Table 2: Bone mass gain after sinus lift procedures in 1 and 2 groups

Bone mass gain	mm
1 group	8,4 mm
2 group	8,1 mm

The mean amount of Marginal Bone Loss (MBL) in patients 1 group 3 years follow-up was 0.86 mm in patients 2 group showed significantly less marginal bone loss 1,16mm table 3.

Table 3: Mean of marginal bone loss (MBL) in patients 1 and 2 groups 3 years follow-up

Mean marginal bone loss (MBL)	mm
1 group	0,86 mm
2 group	1,16 mm

In our study, delayed implant placement was performed due to insufficient initial bone height, as well as to ensure sufficient graft maturation. The implant survival rate 3 years follow-up was in patients 1 group was 97.62%, in patients 2 groups was 95.2%.

Discussions

Alveolar bone quantity and quality are the most important parameters primarily affecting the success of implant treatment. The choice of the method of rehabilitation with an implant for upper jaw atrophy is of decisive importance. Sinus lift procedures increase bone volume by augmenting the sinus cavity with autogenous bone and/or biomaterials.[13,23,24] However, sinus floor elevation surgery is generally associated with higher costs, more complex surgical procedures,

and a high prevalence of complications such as infection, sinus membrane perforation and graft failure.[25,26] Various techniques have been proposed to overcome this complication. Outcomes of this procedure may be affected by simultaneous versus delayed implant placement, selection of graft material, and the surface characteristics of the implants. Numerous articles have been published in this field regarding different grafting materials and modification to the classic technique. Minimally invasive balloon antral membrane lift is a surgical technique developed as a less invasive alternative to a lateral window approach that includes sinus lift using the sinus balloon followed by standard implant placement.[27,28.]

To further simplify sinus lifting procedures and enhance their predictability and success, additional modifications technique, have been introduced during the past 10 years.[29] Numerous articles have been published in this field regarding different modification to the classic technique as transcrestal approach, lateral window approach, piezosurgery, hydrodynamic ultrasonic approach, balloon elevation technique, osteotomy technique and nasal suction technique with their success rate. Which method to give preference when choosing the method of sinus lifting is important for the prevention of complications of surgery and is actual topic for research in the field of oral implantology.[13,30-33] The present study was undertaken to comparison the safety and efficacy of a balloon sinus lift technique and traditional sinus lift. To compare the efficacy of balloon sinus, lift and traditional sinus lift technique, two groups of patients were formed. In patients of 1 group, lateral approach antral balloon technique for sinus elevation followed, in of 2 group traditional sinus lift procedure followed. The study used anorganic mineral and autogenous bone for the bone augmentation technique, a collagen membrane to protect the sinus window, and a staged approach for implant placement. Bone scraper was used to collect autogenous bone from the side of the operation before opening of the window and mixed with bone graft material Resodont® with along with patient's blood Platelet-Rich fibrin and covered by resorpable membrane Resodont®. In our study, delayed implant placement was performed due to insufficient initial bone height and to ensure sufficient graft maturation. Compared to traditional sinus lift and balloon antral sinus lift have the advantage of being a high survival solution, they are less expensive, require less surgical time compared to traditional sinus lift surgery, and thus increase patient satisfaction. By incorporating efficient and efficacious materials such as anorganic bone grafting material and PRP, the balloon sinus lift technique offers an effective approach for minimally invasive sinus lifts, preventing sinus membrane perforation, reducing patient trauma, and improving implant osseointegration into grafted alveolar bone. Balloon antral sinus lift present an alternative traditional sinus lift with high survival rate and fewer complications and improving implant osseointegration into grafted alveolar bone. The process should be refined in order to reduce the percentage of mucosa perforation.

Conclusion

Research has shown that the balloon sinus lifting offers predictable, safe and effective results, and eliminates the complications associated with traditional side window techniques. Further controlled clinical trials are needed to evaluate the efficacy and safety of these techniques for their appropriate implementation in the field of oral implanotology.

Conflict of interest and financial disclosure

The author declares that he has no conflict of interest and there was no external source of funding for the present study. None of the authors have any relevant financial relationship(s) with a commercial interest.

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Consent statement

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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randomized trial. *J Clin Periodontol.* 2018;45:1128-1139. https://doi.org/10.1111/jcpe.12985

ԿՈՂՄՆԱՅԻՆ ՄՈՒՏՔՈՎ ՎԵՐԾՆՈՏԱՅԻՆ ԾՈՑԻ ՀԱՏԱԿԻ ԲԱՐՁՐԱՑՄԱՆ ՏԱՐԲԵՐ ՄԵԹՈԴՆԵՐԻ ԱՐԴՅՈՒՆԱՎԵՏՈՒԹՅԱՆ ԳՆԱՀԱՏՈՒՄ

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Ամփոփում

Նախապատմություն. Հետին վերծնոտային հատվածը երբեմն անբավարար ոսկրային զանգված ունի իմպլանտների տեղադման համար: Վերծնոտային ծոցի հատակի բարձրացում թույլ է տալիս իմպլանտը տեղադրել վերին ծնոտի հետին մասում:

Նպատակ. Այս հետազոտության նպատակն էր համեմատել անտրալ փուչիկի օգնությամբ վերծնոտային ծոցի հատակի բարձրացումը և վերծնոտային ծոցի հատակի բարձրացման ավանդական մեթոդները, որին հաջորդում է ոսկրային փոխպատվաստումը և իմպլանտների հետաձգված տեղադրումը:

Նյութ և մեթոդներ. 2018-ից 2022թ. հետազոտության մեջ ներառվել են ընդհանուր 68 հիվանդ (27-ից 56 տարեկան, 32 կին և 36 տղամարդ), առանց որևէ համակարգային հիվանդությունների,միակողմանի/երկկողմանի բացակայող ատամներով և հետին վերծնոտային հատվածի ատրոֆիայով, որոնց ծոցի հատակի տակ բարձրությունը 3-5 մմ էր, լայնությունը ≥5 մմ և նախքան իմպլանտների տեղադրումը պահանջվում էր վերծնոտային ծոցի հատակի բարձրացում: Հիվանդները ենթարկվել են մանրակրկիտ կլինիկական հետազոտության՝ ընդհանուր ընդունված սխեմայի համաձայն: Բոլոր հիվանդներն ընտրվել են իրենց բժշկական պատմության մանրակրկիտ գնահատումից և ատամնաբուժական զննումներից հետո, ներառյալ OPG և ատամնաբուժական համակարգչային տոմոգրաֆիա (CT) սկանավորումները:

Արդյունքներ. Վերծնոտային ծոցի հատակի բարձրացումը անտրալ փուչիկի տեխնիկայի միջոցով հաջողությամբ իրականացվել է 1-ին խմբի հիվանդների մոտ՝ առանց բարդությունների: 9 հիվանդի 2 խմբի մոտ վիրահատության ժամանակ առաջացել է ծոցի թաղանթի պերֆորացիա, 4 հիվանդի մոտ՝ սինուսիտ, 3 հիվանդի մոտ պատվաստման ձախողում: Անկախ օգտագործված մոտեցումից, երկու մոտեցումներն էլ ցույց տվեցին ոսկրային զանգվածի ավելացման զգալի աճ: Թեև վիճակագրորեն նշանակալի տարբերություն չկա, անտրալ փուչիկի օգնությամբ պրոցեդուրան ցույց է տվել ավելի միջին ոսկրային բարձրացում (8,4 մմ)՝ համեմատած օստեոտոմի օգնությամբ (8,1 մմ): 3-ամյա հսկողության ընթացքում սահմանային ոսկրային կորստի (MBL) միջին չափը հիվանդների 1-ին խմբի եղել է 0,86 մմ, հիվանդների 2-րդ խումբը ցույց է տվել զգալիորեն ավելի քիչ սահմանային ոսկրային կորուստ՝ 1,16 մմ: Իմպլանտների գոյատևման մակարդակը 3 տարի շարունակ եղել է հիվանդների 1-ին խմբի մոտ 97,62%, հիվանդների 2 խմբի մոտ՝ 95,2%:

Եզրակացություն. Հետազոտությունը ցույց է տվել, որ անտրալ փուչիկով ծոցի հատակի բարձրացումը առաջարկում է կանխատեսելի, անվտանգ և արդյունավետ արդյունքներ և վերացնում է ավանդական կողային պատուհանների տեխնիկայի հետ կապված բարդությունները: Այնուամենայնիվ, անհրաժեշտ են հետագա վերահսկվող կլինիկական փորձարկումներ՝ գնահատելու այս տեխնիկայի արդյունավետությունն ու անվտանգությունը՝ բերանի խոռոչի իմպլանտոլոգիայի ոլորտում դրանց համապատասխան իրականացման համար:

ОЦЕНКА ЭФФЕКТИВНОСТИ РАЗЛИЧНЫХ МЕТОДОВ СИНУС-ЛИФТИНГА БОКОВЫМ ДОСТУПОМ

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Абстракт

Актуальность: В задней части верхней челюсти иногда недостаточно костной массы для установки зубных имплантатов. Увеличение дна пазухи позволяет разместить имплантат в задней части верхней челюсти.

Цель: целью данного исследования было сравнить эффективность поднятия верхнечелюстной пазухи с помощью антрального баллона и традиционного поднятия дна верхнечелюстной пазухи с последующей костной трансплантацией и отсроченной установкой имплантата в задней области верхней челюсти.

Материал и методы: Обследовано 68 пациентов (в возрасте от 27 до 56 лет, 32 женщины и 36 мужчин), без каких-либо системных заболеваний, с одно-/двусторонним отсутствием зубов и атрофией задней верхнечелюстной области, которым потребовалось расширение пазухи. до установки имплантата, у которых расстояние дна пазухи от гребня составляло 3-5 мм, ширина ≥5 мм, были включены в исследование в период с 2018 по 2021 год. Пациенты прошли тщательное клиническое обследование по общепринятой схеме. Все пациенты были отобраны после тщательной оценки их истории болезни и стоматологических обследований, включая ОПГ и стоматологическую компьютерную томографию (КТ).

Результаты: Синус-лифтинг баллонной техникой успешно выполнен пациентам 1 группы, без осложнений. У 9 больных 2 группы во время операции возникла перфорация оболочки пазухи, синусит у 4 больных, несостоятельность трансплантата у 3 больных. Независимо от используемого подхода, оба подхода показали значительное увеличение прироста костной массы. Хотя статистически значимой разницы нет, процедура с использованием баллона показала больший средний прирост кости (8,4 мм) по сравнению с процедурой с помощью остеотома (8,1 мм). Средняя величина потери маргинальной кости (MBL) у пациентов 1 группы через 3 года наблюдения составила 0,86 мм, у пациентов 2 группы потеря маргинальной кости была достоверно меньше 1,16 мм. Приживаемость имплантатов через 3 года наблюдения составила у пациентов 1 группы 97,62%, у пациентов 2 группы 95,2%.

Выводы: исследования показали, что баллонный синус-лифтинг дает предсказуемые, безопасные и эффективные результаты и устраняет осложнения, связанные с традиционными методами бокового окна. Однако необходимы дальнейшие контролируемые клинические испытания для оценки эффективности и безопасности этих методов для их надлежащего применения в области оральной имплантологии.

Boyadjian A, Boyadjian M, Gevorgyan A, Gevorgyan V. Evaluation of the effectiveness of different methods sinus floor elevation the lateral approach. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):27-37. doi: 10.58240/1829006X-2023.19.2-27

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CLINICAL ARTICLES

THE APPLICATION OF AN ENAMEL MATRIX PROTEIN (EMDOGAIN) IN REGENERATIVE PERIODONTAL THERAPY. CLINICAL SERIES

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Abstract

Objectives: The purpose of this clinical series is to present indications for regenerative therapy with EMD.

Materials and Methods: The study included 53 patients with osseous defects from 7-15mm's in depth. Each patient understood that the procedures were not within the normal treatment due to the severity of the defects but opted to accept treatment. Along with EMD each defect also had freeze fried demineralized bone placed in the defect as well.

Results: Reentry of the original defects was undertaken at approximately 1 year after surgery. It was noted that for the most part significant improvement was noted in almost all defects. Exact improvement of defects was not calculated.

In several cases 10-year reentry was undertaken and in fact further reduction in defects were noted. It could not be determined at any time over the 10-year period that the reduction in pocket depth was in fact bone as no histology was ever taken to verify what the defects were filled with.

Conclusions: Clinical studies have indicated that treatment with EMD with freeze dried demineralized bone positively influences regenerative periodontal therapy.

Keywords: *Periodontit, Treatment of periodontitis, Enamel matrix derivative; Periodontal regeneration*

Introduction

Periodontal (gum) disease is one of the most common oral diseases, half of adults aged 30 and over have some degree of gum disease, and the percentage increases with age because the symptoms of periodontitis can be very subtle, many don't realize they have gum disease until it's severe, which can lead to tooth loss.[1-4]

Elimination of pathological processes in the periodontal pocket, and elimination of the pathological pocket is one of the main goals of periodontal surgery, which is why this process is also called pocket treatment (pocket therapy). Periodontal therapy is aimed at preventing the disease, slowing down or stopping the progression of the disease, restoring the lost periodontium and maintaining the achieved therapeutic goals. Treatment of chronic periodontitis can be done by non-surgical or surgical approach. Various treatments have been used, including subgingival curettage, gingivectomy, modified Widmann flap, full thickness or split flaps with or without bone recontouring.[5-8]

The best surgical approach remains controversial, although the results of longitudinal clinical trials have highlighted the advantages and disadvantages of each method. Since every periodontal pocket is different, specific treatment recommendations will depend on the depth and shape of the pocket, and whether the inflammation is restricted to the gum tissue, or if it has spread to the bone that lies beneath. Getting rid of plaque bacteria (also called biofilm) and tartar is the first step in keeping gum disease from getting worse. In the case of inflamed gums with no bone loss, even a pocket depth of 4 mm or 5 mm may be treated with professional cleanings to remove the causes of the inflammation, along with an enhanced at-home oral care regimen.[9-12]

Stage of surgical treatment of periodontal diseases logical sequence of complex treatment of periodontal diseases. The indications for surgical periodontal treatment are: pockets with a depth of 5 mm or more, the presence of bone pockets.[13-16]

Flap operations are one of the main methods of treatment of periodontal pockets. They are carried out only after the initial stage of periodontal treatment, with high oral hygiene. River operations are aimed at treating the affected surfaces of the roots in an open way, as well as reducing or eliminating pathological pockets.

Some methods have evolved over time. Each method has its own indications for use and features of the obtained results. The choice of method depends on the clinical situation and aesthetic requirements of the patient, as well as the doctor's preferences, experience and financial capabilities of the patient. In the presence of an active inflammatory process in the periodontium, stimulation of bone regeneration is not appropriate. In the presence of an acute purulent process, rag surgery is not only not advisable, but also dangerous due to the risk of spread of the purulent process.

The goal of regenerative periodontal therapy is to restore lost periodontal structures (i.e., new formation of root cementum, periodontal ligament, and alveolar bone). However, complete and predictable regeneration is still an elusive goal.[17-19]

Periodontal surgery has evolved with the use of new methods and materials. Several surgical techniques have been developed for periodontal tissue regeneration, including guided tissue regeneration (GTR), bone grafting (BG), and enamel matrix derivatives (EMD).[20,21] Application of the technique guided tissue regeneration (GTR) - in some cases, it is possible to recreate previously lost tissue, depending on the nature of the tissue / bone destruction that has occurred.[22,23] Biocompatible materials are used alone or in combination, which can help the body to produce new bone and gum tissue.

A biocompatible membrane, applied during the procedure, isolates the area of bone damage around the tooth, creating an environment for the formation of new bone, prevents the migration of the faster moving epithelium and connective tissue of the gums into the wound space; allowing time for cement to migrate into the wound space; periodontal ligament and bone to refill the area.[24,25]

The guided tissue regeneration technique consists of placing a non-resorbable or resorbable membrane between the recession defect and exposed bone on one side and a coronally advanced flap on the other, in order to allow selective repopulation of the root surface by periodontal ligament cells that can form a new connective tissue junction between the root surface and alveolar bone.[26,27]

Grafting materials used during regenerative procedures may be allogeneic, xenografts they function as biocompatible space fillers and the use of these materials can stimulate bone growth and serve as a scaffold for new bone deposition. The resulting bone filling may also be accompanied by the development of a long junctional epithelium and/or increased attachment of connective tissue.

To date, enamel matrix derivative (EMD) is considered one of the few biomaterials for clinical use capable of demonstrating true periodontal regeneration.[28-30]

Amelogenins are a family of highly conserved extracellular matrix proteins derived from a single gene and play a role in biomineralization and hard tissue formation. Amelogenins can have a positive effect on wound healing, bone formation. Amelogenin (a derivative of the basic enamel matrix protein) has been shown to be effective in stimulating gingival tissue growth).

When applied Amelogenin to tooth root surfaces, amelogenins precipitate to form a stable extracellular matrix with a hydrophobic surface capable of maintaining interaction with cells in adjacent tissues.[31]

The major (>95%) component of Emdogain® is Amelogenins (Amel). Emdogain® (Straumann AG,

Basel, Switzerland) is well established as a topical adjunct to periodontal surgery to stimulate the regeneration of periodontal tissue lost due to periodontal disease.

Emdogain® stimulates local growth factor secretion and cytokine expression in treated tissues, inducing a regenerative process that mimics odontogenesis. Emdogain is applied during surgery and forms a coating on the roots of the teeth. The gel itself dissolves after 2 days, leaving the active substance.[32]

Many case reports have now been published showing that EMD significantly improves the level of periodontal attachment and reduces probing pocket depth compared to open flap debridement. The use of EMD in periodontal regeneration procedures demonstrates stable periodontal regeneration after 5 years of follow-up. EMD is adsorbed both on hydroxyapatite and collagen, and on bare tooth roots.[33]

EMD treatment likely mimics odontogenesis and works to restore lost periodontal tissues by recruiting cementoblasts to the root surface and hence stimulating their formation of root cementum, which will then regenerate periodontal fibers and alveolar bone.[34,35]

A review of the literature indicates that the use of EMD may result in more bone formation when applied to supporting defects compared to non-supporting defects.[36-38]

EMD promotes the proliferation of PDL cells, cementoblasts and osteoblasts, allowing the restoration of normal periodontal architecture within a short intervention time.[39]

In a meta-analysis by Matarasso et al. that the combination of EMD and bone grafting materials increased CAL and reduced PD compared with EMD alone, the authors did not provide information on the comparative assessment of radiological bone level.[40]

This opens up possibilities for EMD applications as discussed below. The purpose of this clinical series is to present indications for regenerative therapy with Emdogain®.

Materials and methods

The study included 53 patients (mean age 51.7 years, 28 men and 25 women) with chronic periodontitis, after initial periodontal therapy with intraosseous defects ≥3 mm in depth in one or more teeth. Bone material and EMD were applied upaccent.

Inclusion criteria were the presence of interproximal areas with a probing depth (PD) ≥6 mm, at least one intraosseous defect ≥3 mm deep in the area of the teeth, and an adequate level of plaque control (mean plaque index ≤1). Participants were required to undergo initial periodontal therapy.

Exclusion criteria were the presence of uncontrolled systemic diseases, smoking, concomitant or previous use of such as bisphosphonates or other drug therapy, current pregnancy, contraindications to dental and / or surgical interventions.

Conservative treatment was carried out according to the FMDP. All teeth were scaled and root polished with an ultrasonic scaler. The patient was instructed in proper oral hygiene and rinsing with chlorhexidine solution (0.2% 3 times a day for 2 weeks).

The sulcular incisions with a 15c scalpel and a thin elevator were used to raise the mucoperiosteal flaps in various places. Then careful degranulation of intraosseous defects and scaling of the root surface were applied. The operating field was flushed with saline. EDTA was applied to the roots surfaces for 45 seconds removing the smear layers. EMD was then placed in the defects. At this point the filling material was saturated with EMD and then placed in the defect. The flap was tightly closed with sutures using the with 5-0 Chromic gut absorbable suture. Oral hygiene measures were restricted to local rinses with chlorhexidine 0.2% three times a day for 3 weeks. After suture removal or absorption no brushing was allowed for two full weeks. The first postoperative evaluation underwent at 6 months, which was followed by a strict maintenance protocol.

The mean increase in clinical attachment level (CAL) at 2 years was Smm from baseline. the average decrease in the decrease in probing depth (PD) after 3 years was 3.2 mm, respectively, the average percentage of bone filling after 3 years was up to 31%-75%. The use of EMD in patients with intraosseous defects showed effectiveness in terms of clinical periodontal and radiographic parameters for 3 years.

In the presented clinical cases reported patients with periodontitis with intraosseous defects 3 years after regenerative periodontal therapy with enamel matrix derivative (EmdogainR; Straumann ^{TM}), it can be stated that the condition of the teeth has changed for the better. Many studies show

significant improvement of periodontally affected teeth with the use of an enamel matrix.

Case report 1

The patient presented with the presence of pronounced defects in the lateral incisors and canine teeth of the lower jaw, after clinical and radiological examinations, a treatment plan was drawn up, which included initial conservative periodontal therapy, then bone plastic in the intraosseous defects. After local anesthesia, buccal gingival tissue was incised mesial and distal to the defect site to provide access for visualization and instrumentation of the defect. After flap reflection, granulation tissue was removed from the defect. Scaling and root planing were performed with hand and the defect was rinsed with water. Area debrided and root surfaces cleaned. Phosphoric acid 38% was applied to the surfaces for 25 seconds to remove the smear layer.

After site preparation, the EMD gel was applied on the root surfaces and into the intrabony defect. A mixture of EMD and freeze-dried demineralized bone was then placed into the defect. Flaps were repositioned at the preoperative level or slightly coronal without tension. Sutures were placed using 5-0 Chromic gut absorbable sutures. Pain control was obtained by 400 mg Ibuprofen 3 times per day for the first 72 h and subsequent doses were indicated only if needed. Patient was advised to rinse three times per day with a 0.2% chlorhexidine gluconate solution for 6 weeks and mechanical tooth cleaning was not allowed in the surgical area during this period. However if the soft tissue was sufficiently healed after 3 weeks the patient was instructed to use a Braun circular head toothbrush twice a day.

Professional oral hygiene/maintenance procedures and reinforcement of oral hygiene instructions were performed during follow-up visits.

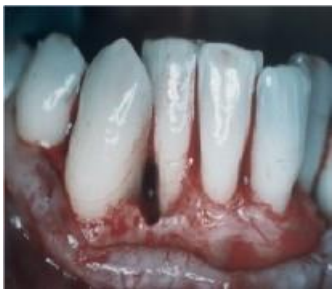

Figure 1. Day of surgery, intraosseous defect 7-8mm's with bone only present ob the buccal and lingual

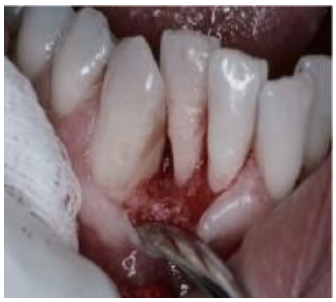

Figure 2. 1 year evaluation with a small incision to evaluate material present. 95% of the defect was filled with a material that resembled bone

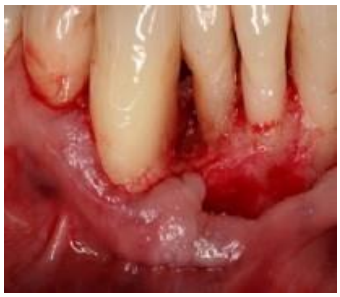

Figure 3. 10-year reentry shoed virtually no changes from 1-year photos

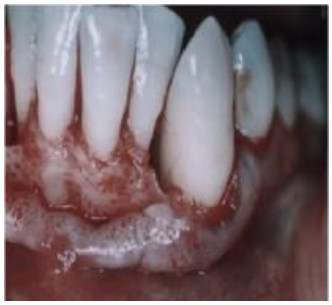

Figure 4. Day of surgery, intraosseous 6-8mm's with bone only present on the buccal and lingual of the defect

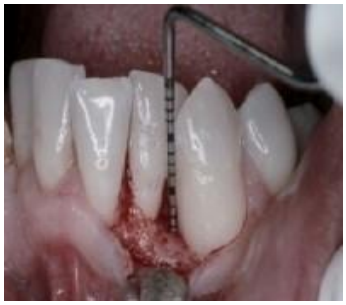

Figure 5. 1-year post surgery showed a material that appeared to be similar to bone. Fill appearedto be 95%

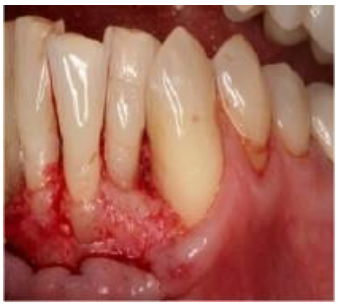

Figure 6. 10-year post surgery 0 changes occurred

Case report 2

The patient applied for the presence of pronounced the intraosseous defects surrounding the apex on the mandibular right canine tooth. The patient had no money for any treatment and it was determined that an effort would remake to keep the tooth for free along with endodontics. After clinical and radiological examinations, a treatment plan was drawn up, which included initial conservative periodontal therapy, then bone graft in intraosseous defects. It was decided to splint the right canine so it would not fall out at surgery. The periodontal treatment protocol was the same as in the clinical case 1 patient: After site preparation, the EMD gel was applied on the root surfaces and into the intrabony defect. A mixture of EMD and freeze-dried demineralized bone was then placed into the defect. The treatment undertaken was simply to try to buy time for the patient to position herself financially for future treatment of a more permanent nature.

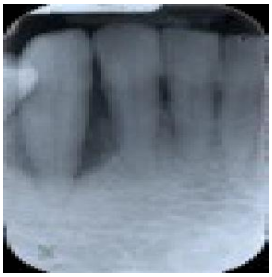

Figure 7. Intraoral periapical baseline radiographic view, bone loss as seen in the right cuspid tooth

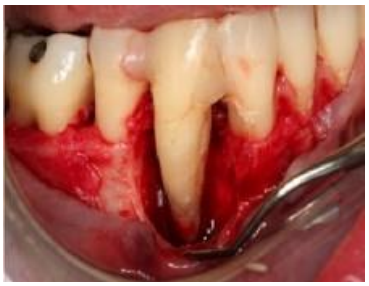

Figure 8. Application of standard protocol for treatment with EMD was undertaken. Endodontic treatment followed 6 weeks later

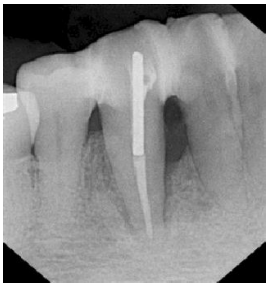

Figure 9. 24-months follow-up lntraoral periapical radiographic view

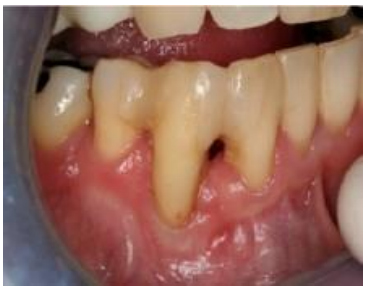

Figure 10. 24-month follow-up clinical view with no bleeding upon probing

Case report 3

The patient presented with the presence of pronounced the intraosseous defects surrounding the mandibular right premolar. After clinical and radiological examinations, a treatment plan was drawn up, which included initial conservative periodontal therapy, then bone graft in intraosseous defects. The periodontal treatment protocol was the same as in all previous cases. After site preparation, the EMD gel was applied on the root surfaces and into the intrabony defect. A mixture of EMD and freeze-dried demineralized bone was then placed into the defect.

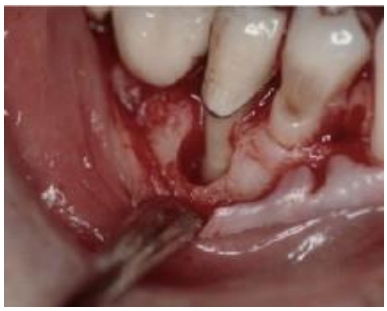

Figure 11. Intraoral periapical baseline radiographic view, bone loss as seen in right bicuspid tooth

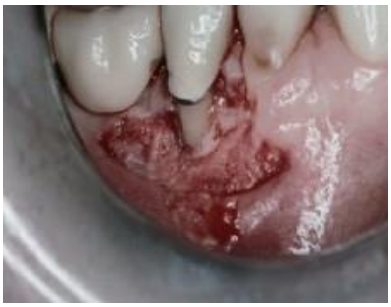

Figure 12. Reentry at 1 year show the original defect gone and a material that appears to be of the consistency of bone present. 95% of the defect was filled

Case report 4

The patient presented with an intraosseous defects surrounding the upper right central incisor. The patient had limited finances not even in a position to replace the central incisor with a partial denture. Since this was in the early use of EMD it was determined to splint the tooth and make an effort to keep it. After clinical and radiological examinations, a treatment plan was drawn up, which included initial conservative periodontal therapy, then bone plastic in the intraosseous defects. It was decided to splint the anterior teeth. The periodontal treatment protocol was the same as in the clinical case 1 patient: After site preparation, the EMD gel was applied on the root surfaces and into the intrabony defect. A mixture of EMD and freeze-dried demineralized bone was then placed into the defect.

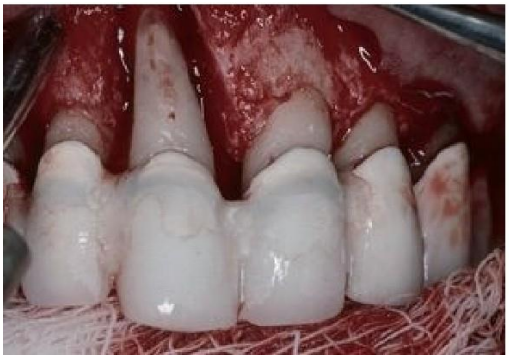

Figure 13. Intraosseous defects surrounding the apex 11 incisor tooth

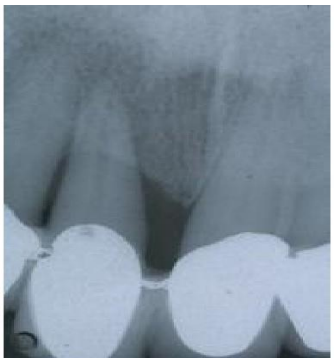

Figure 14. lntraoral periapical radiographic view 1 year later

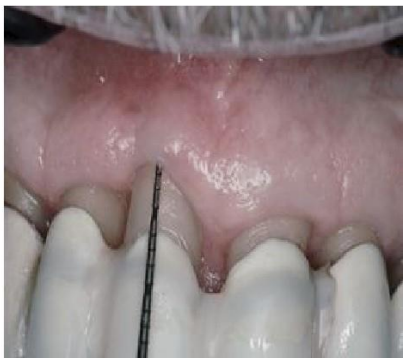

Figure 15. Probing at 1 year showed 1mm at best with adequate pressure placed. The patient continued with no real probings up to 8 years when he left the practice to return up north

Case report 5

The patient presented with an intraosseous defects surrounding the lower left cuspid.
Reflection of flaps on the buccal and lingual for ideal visibility. Close attention to removal of all granulation was undertaken in the flap itself. Meticulous removal of calculus and altered cementum ensured using curettes as well as diamond burs where possible Prefgel (EDTA) was used to remove the smear layer. Prefgel was part of the Emdogain protocol. I also used 38% Phosphoric acid for 15 seconds as an alternative to Prefgel. Emdogain was then placed in the defect. Highly important is that Emdogain be placed where no blood was present as the proteins in the blood would bind the Emdogain.
Whatever filling material was also used was soaked in Emdogain prior to placing in the defect.
In the case below a small CT graft was added to the buccal bone which really had no bearing on the regenerative procedure. Primary closure with 5-0 Chromic absorbable suture was used.

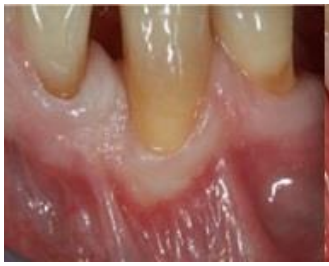

Figure 16. Lower left cuspid photo prior to entry for an attempt to eliminate deep pocket

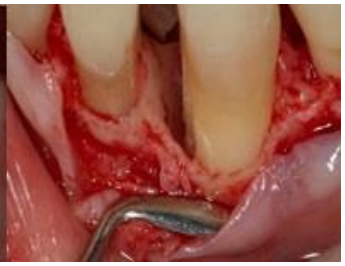

Figure 17. Reflection of flaps on the buccal and lingual for ideal visibility. Close attention to removal of all granulation was undertaken in the flap itself

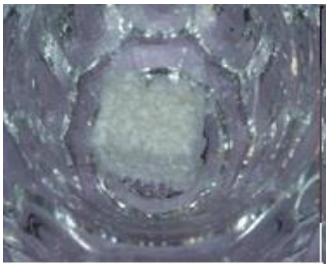

Figure 18. Bio-Oss Collagen placed in dampen dish

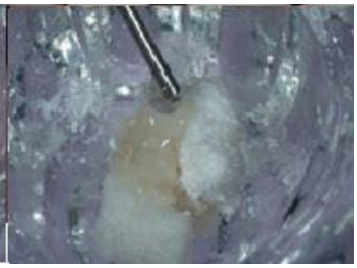

Figure 19. Bio-Oss collagen is impregnated with Emdogain and mixed thoroughly so all the material has EMD present

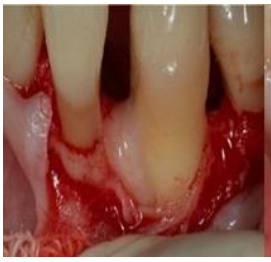

Figure 20. Prefgel (EDTA) was used to remove the smear layer. Prefgel was part of the Emdogain protocol. I also used 38% Phosphoric acid for 15 seconds as an alternative to Prefgel

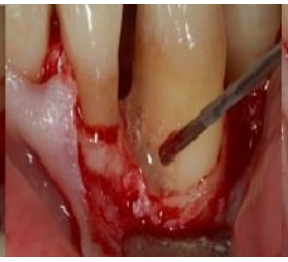

Figure 21. Emdogain was then placed in the defect. Highly important is that Emdogain be placed where no blood was present as the proteins in the blood would bind the Emdogain

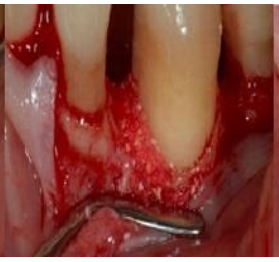

Figure 22. Whatever filling material was also used was soaked in Emdogain prior to placing in the defect

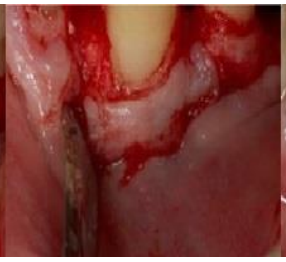

Figure 23. In the case below a small CT graft was added to the buccal bone which really had no bearing on the regenerative procedure

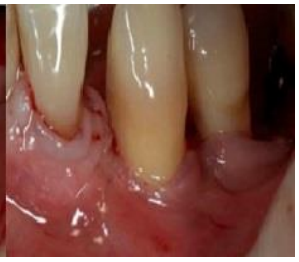

Figure 24. Primary closure with 5-0 Chromic absorbable suture was used

Case report 6

The patient presented with an intraosseous defects surrounding right lower second bicuspid.

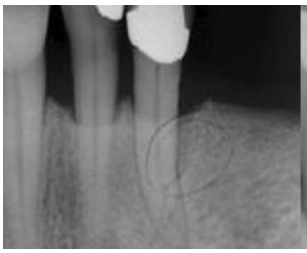

Figure 25. Distal defect of lower right second bicuspid to be treated

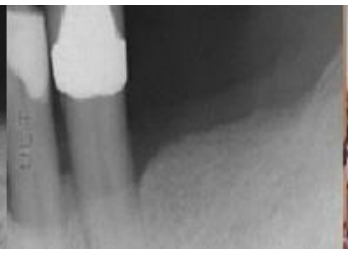

Figure 26. 1-year post surgery radiographically appears to have a material that looks like bone having filled the defect

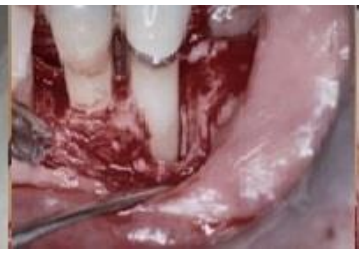

Figure 27. Entry prior to placement of EMD and filling material

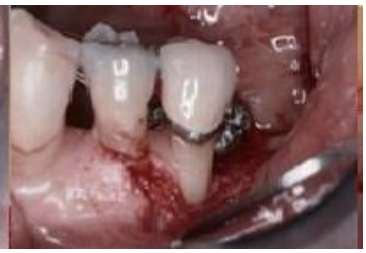

Figure 28. Reentry at 1 year shows nice fill with a material that resembles bone

Case report 7

The patient presented with an intraosseous defects surrounding between maxillary molar and bicuspid.

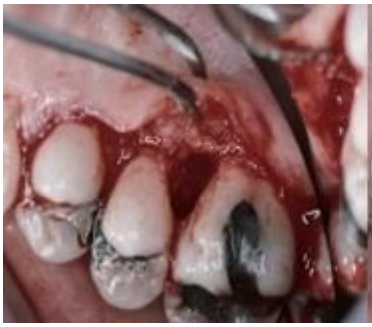

Figure 29. Deep defect between maxillary bicuspid and molar. EMD and freeze-dried demineralized bone placed in defect

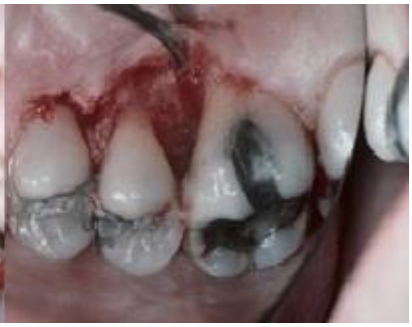

Figure 30. 1-year reentry shows excellent fill with a material that resembles bone

Discussion

In the 1990's Emdogain came to market as a method of bone regeneration. It was however FDA approved for use only by itself. As the practitioner I was uncomfortable using it by itself. So initially all procedures had freeze dried demineralized bone placed along with Emdogain. A huge advantage of Emdogain was its ability to prevent epithelial down growth which eliminated the need for a barrier. Years later the use of Bio-Oss collagen was instituted with Emdogain as a substitute for FDDMB.

Restoration of lost periodontal structures (i.e., new formation of root cementum, periodontal ligament and alveolar bone) is the goal of regenerative periodontal therapy.

Enamel matrix protein derivatives (EMD) play an important role in periodontal wound healing. There is a large body of clinical and experimental evidence that demonstrates that enamel matrix proteins (EMPs) mediate periodontal regeneration.

EMRs have been used therapeutically with EMD, which is clinically available as Emdogain. There are histological data in animals and humans showing the restoration of true periodontal regeneration with new bone, new PDF, new cementum and functional fibers.[42,43]

Surgical periodontal treatment of deep intraosseous defects with EMD can lead to a significant improvement in clinical parameters than open flap debridement alone.[35]

Clinical trials have been conducted for the assessment of the effectiveness of EMD regarding its ability to improve periodontal health. One of the first human studies was a split-mouth randomized multicenter trial undertaken to compare the longterm effect of EMD treatment as an adjunct to modified Widman flap (MWF) surgery vs. MWF plus a placebo (PGA).[44]

Thirty-three patients with 34 paired test and control sites (one- or two-wall bony defects > 4 mm deep) were enrolled in the study and monitored for 36 months. The results in the EMD group were better, as shown by a gain in the clinical attachment level, probing depth reduction, and restoration of bone radiographically.

The superiority of surgically treating intrabony defects with EMD compared with open-flap debridement has also been shown with re-entry 12 months post-surgery, where the average defect fill was 2.4 mm greater with EMD (Froum et al., 2001).[45]

Keila et al investigated the effects of EMD on rat bone marrow stromal cells and on gingival fibroblasts.[46] EMD increased the osteogenic capacity of bone marrow and mineralized nodule formation. The presence of EMD in the initial stages (first 48 hours) of the culture was crucial for this effect. In contrast, EMD did not induce osteoblastic differentiation of gingival fibroblasts but increased both cell numbers and amount of matrix produced by up to two-fold.

The use of EMD indicated a positive effect on both surgical and non-surgical therapy. However, the

available literature is scarce, with low evidence in non-surgical approach and modest evidence in surgical approach using EMD. More RCTs with standardize protocols are necessary to evaluate the efficacy of using EMD in both therapies.[46,7]

Regenerative surgery with a combination of enamel matrix derivative (EMD) and natural bone mineral (NBM) can result in bone formation and clinical results can be maintained for up to 5 years.[48,49]

A study by Alessandro Crea et al showed that the treatment of intraosseous defects in patients with chronic advanced periodontitis with NTR or EMD led to a significant improvement in clinical parameters. Significance tests showed better results with EMD, although absolute differences between treatments were small.[50]

This cases series demonstrates that of intraosseous defects with Emdogain can be successfully treated and preserved. The combination of EMD and bone substitutes may result in some improvement in soft and hard tissue parameters compared to EMD treatment alone.

Clinical studies have indicated that treatment with EMD positively influences regenerative periodontal therapy. EMD contributes to the replenishment of bone tissue of intraosseous defects, as well as the regeneration of the destroyed periodontal apparatus.

Conclusions

Clinical studies have indicated that treatment with EMD with freeze dried demineralized bone positively influences regenerative periodontal therapy.

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ԷՄԱԼԱՅԻՆ ՄԱՏՐԻՑԱՅԻՆ ՍՊԻՏԱԿՈՒՑԻ (EMDOGAIN) ԿԻՐԱՌՈՒՄԸ ՎԵՐԱԿԱՆԳՆՈՂԱԿԱՆ ՊԱՐՕԴՈՆՏԱԼ ԹԵՐԱՊԻԱՅՈՒՄ: ԿԼԻՆԻԿԱԿԱՆ ԴԵՊՔԵՐԻ ՇԱՐՔ

Դանիել Մելկեր

պարօդոնտոլոգ, Clearwater, Ֆլորիդա, ԱՄՆ

Ամփոփում

Այս կլինիկական շարքի նպատակն է ներկայացնել EMD-ով վերականգնողական պարօդոնտալ թերապիայի ցուցումներ:

Նյութեր և մեթոդներ. Ուսումնասիրությունը ներառում էր 7-15 մմ խորության ոսկրային արատներով 53 հիվանդ: Յուրաքանչյուր հիվանդ նախիկն բուժական միջամտությունները արդյունավետ չեն եղել՝ թերությունների լրջության պատճառով և ընդունել են առաջարկված բուժումը: EMD-ի հետ մեկտեղ կիրառվել է նաև ալոգեն ապահանքայնացված ոսկր:

Արդյունքները. Բուժման արդյունքների գնահատվել է վիրահատությունից 1 տարի հետո: Արձանագրվել է կլինիկական վիճակի զգալի բարելավում գրեթե բոլոր արատներում: Մի քանի կլինիկական դեպքերում դիտարկվել է բուժման արդյունքները 10 տարի անց, փաստացի արձանագրվել է թերությունների հետագա կրճատում:

Եզրակացություններ. Կլինիկական ուսումնասիրությունները ցույց են տվել, որ ալոգեն դեմինալիզացված ոսկորի հետ համակցված EMD-ով բուժումը դրականորեն ազդում է պարօդոնտալ վերականգնող թերապիայի վրա:

ПРИМЕНЕНИЕ ПРОТЕИНА ЭМАЛЕВОГО МАТРИКСА (ЭМДОГЕЙН) В РЕГЕНЕРАТИВНОЙ ТЕРАПИИ ПАРОДОНТА. СЕРИЯ КЛИНИЧЕСКИХ СЛУЧАЕВ

Дэниел Мелькер

пародонтолог, Clearwater, Флорида, США

Абстракт

Цели: Целью данной серии клинических исследований является представление показаний к регенеративной терапии при ЭМД.

Материалы и методы: В исследование включены 53 пациента с костными дефектами глубиной от 7 до 15 мм. Каждый пациент ранее имел неудачные пародонтологические терапевтические вмешательства и согласился на рекомендованное лечение. Наряду с EMD также использовалась аллогенная деминерализованная кость.

Результаты: Результаты лечения оценивали через 1 год после операции: достоверное улучшение клинического состояния было зафиксировано практически по всем дефектам. В нескольких клинических случаях результаты лечения наблюдались через 10 лет, было зафиксировано дальнейшее уменьшение дефектов.

Выводы: Клинические исследования показали, что лечение ЭМД в сочетании с аллогенной деминерализованной костью оказывает положительное влияние на восстановительную терапию пародонта.

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CLINICAL REVIEW

USE OF PIEZOSURGERY IN IMPLANT DENTISTRY

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Abstract

Piezosurgery is a new and modern innovative method of bone surgery in implantology.

The purpose of this review was to present, through a literature review, the clinical applications of piezosurgery in implant dentistry and outline their advantages and disadvantages compared to conventional surgical systems.

The main advantages of this technique are precise cuts, absence of thermal damage and preservation of soft tissue structures. Thanks to the use of piezoelectric surgery, increased efficiency the preparation of the site for the implant, bone grafting, elevation of the sinus floor, splitting of the edentulous crest, lateralization of the inferior alveolar nerve. The reduced blood loss the risk of complications is minimized.

Keywords: *implantology, piezoelectric device, piezosurgery, maxillary sinus elevation, bone grafting, osteotomy, edentulous ridge splitting*

Introduction

Treatment success in implant dentistry, periodontology and oral surgery must take into account more precise biologic criteria. These criteria include: using atraumatic surgical procedures; limiting risks to surrounding tissues; an improving visibility, haemostasis and postoperative conditions.

Most instruments available today have not met all above criteria in helping the clinician during treatment process. Manual mechanical instruments like saws, burs, and/mallets and chisels available today in many ways are modifications of old technology.

Currently, piezosurgery is widely used in oral surgery and implantology, various devices are available.[1]

Piezoelectric bone surgery, also simply known as piezosurgery, is a new technique for osteotomy and osteoplasty utilizing an innovative ultrasonic surgical apparatus.

In today's dentistry, it is desirable to have in one's disposal a surgical precision instrument tailored in every aspect of periodontal and implant surgery of hard tissues.[2]

Furthermore, an instrument that helps to create a visual acuity during surgery, minimise the trauma to the bone and surrounding tissues and help in reduced postoperative complications and optimal healing process.[3] The Piezosurgery device has been developed to overcome the limits of precision and intra-operatory

safety existing in traditional bone cutting instruments. Piezosurgery allows the clinician to obtain high predictability and low morbidity in bone surgery. The technique of working with a piezoelectric device is based on the use of microvibrations at a certain ultrasonic frequency modulated by sound waves.[4]

The joint work of sound and ultrasonic frequencies (25–30 kHz) creates a mechanical shock wave, which oscillates in a linear way, with vibration amplitude (horizontal 20–200 μm, vertical 20–60 μm).

Since cutting soft tissues requires frequencies of more than 50 kHz, only mineralized tissues are cut with the vibration amplitude of the tip of the piezoelectric device. This reduces damage to the nerves and membranes of the sinus, and the reduction in the risk of overheating is due to the occurrence of a cavitation effect in the irrigation solution due to mechanical micro-movements with a frequency of approximately 25–30 kHz.

Due to their characteristics, the microvibrations allow a selective cut of only mineralized structures without damaging soft tissues, which remain undamaged even in case of accidental contact. The micrometric vibration ensures precise cutting action and at the same time maintains a blood-free site because of the physical phenomenon of cavitation. The micrometric vibration makes the instrument manageable and permits major intra-operative control with a consequent increase in safety especially in anatomically difficult areas.

In 2001, Piezosurgery® was introduced, an instrument that combines ultrasound and piezoelectric effect.[5]

Piezosurgery approach to hard tissue surgery was developed in the 1980's. It is derived from basic principles of "piezoelectricity" discovered by Jacques and Pierre Curie in the late 19th century. The idea of bone cutting was also assessed by Horton et al 1975, 1981 using ultrasonic modulated frequency.[6]

Further advances were made by Torella et al (1998) and Vercellotti et al (2001) that have perfected and adapted to clinical needs.[7-9]

Cavitation effect is a result of vibrations at the tip of the instrument (2-3mm from the tip). The air bubbles formed vibrate with their source, increase in size and explode. This phenomenon, which has antibacterial properties, is called cavitation. It depends on the frequency not the amplitude of the ultrasonic vibration.

These three key factors above surpass any instrument available today as a one tool that is inseparable in my practice in areas of implant dentistry, as well as periodontal surgical procedures and minor oral surgery.

Applications Implant surgeries [10,11]

1. Implant site preparation
2. Extraction for immediate implant placement
3. Bone graft harvesting
4. Alveolar ridge expansion
5. Sinus lift procedures
6. Nerve mobilization for implant prosthetic issues
7. Removal of implants

The controlled three-dimensional ultrasound microvibrations, the piezosurgery technique opens up a new age for osteotomy and osteoplasty in Implantology, Periodontology, Endodontics, and surgical Orthodontics.[12]

- Micrometric Cut: Precise cutting actions with an excellent surgical tactile control
- Selective Cut: Minimizing of the risk of adjacent soft tissue damage
- Cavitation Effect: Maximum intra-operative visibility

Piezoelectric bone surgery, also simply known as piezosurgery, is a new technique for osteotomy and osteoplasty utilizing an innovative ultrasonic surgical apparatus.[13]

The precise nature of the instrument allows exact, clean, and smooth cut geometries during surgery. Postoperatively, excellent wound healing is observed. It is apparent that the range of application of piezosurgery is not limited to minor operations. Because of its highly selective and accurate nature, with its cutting effect exclusively targeting hard tissue, its use may be extended to more complex oral surgery cases, as well as to other interdisciplinary problems.

Piezosurgery technique was created and developed in response to the need to reach major levels of precision and safety in bone surgery, as compared to that available by the usual manual and motorized instruments.[14,15]

The absence of macro-vibrations makes the instrument more manageable and allows greater intra-

operative control with a significant increase in the cutting safety in the more difficult anatomical cutting zones. The oscillation at the tip with saline jet created an effect of cavitations effect giving the operator maximum visibility, even in most difficult excess area encountered during surgical procedures. This creates a visual acuity, combined with micrometric precision cuts, offers safety, comfort to both the patient and the operator in delicate surgical scenarios.

This precise and atraumatic technique however requires a learning curve and training to understand the perfect balance using hand pressure and vibrating tip of the instrument.

The piezosurgery technique differs considerably from a drill orientadet clinician, where considerable force is required to "mechanically cut the bone" piezosurgery is more closely resemble in laser surgery from user angle rather than from handpiece pressure concept of bone cutting.

The difference in time requirement for surgical procedures using the piezosurgery instrument in comparison with the conventional drill is negligible. Naturally there are always imitations, however adjunct clinical tool, it definitely sets new standard in most aspects of surgical dentistry. The clinical examples provided will help the clinician to perhaps look at a different angle of clinical applications and indications of piezosurgery.

Contraindications

Electrical implants such as pacemakers, in either the patient or the clinician.

Preparing implant osteotomies in fresh extraction sockets using piezosurgery

Although literature states that tooth extraction must be atraumatic during implant placement, the accepted protocol for method of atraumatic extraction in contemporary implant dentistry especially where immediate implant placement is indicated, needs to be addressed in detail.[16]

Vigorous tearing of the periodontal membrane using conventional tooth extraction measures can lead to alteration of the delicate bundle bone and blood supply disruption, created by twisting and apical movement during forceps extraction. This procedure is even more applicable where the roots are brittle and deeper positioned in the alveolar socket.[16]

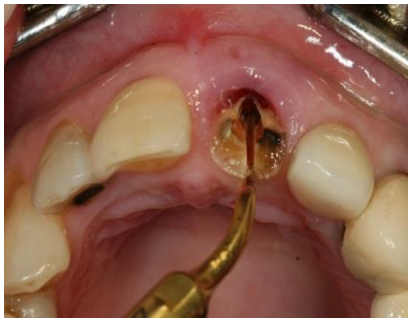


Figure 1. Sectioning of the tooth (intra-alveolar in-fracture): no disruption to the socket

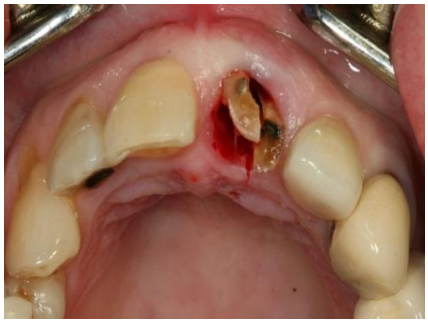


Figure 2. Ultrasonic tip gently cuts the PDL fibres surrounding the root and the socket: the tooth is easily mobilised, can easily continue apically 7-10mm to mobilise the roots using periotomes

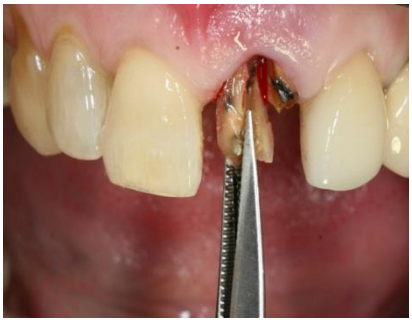


Figure 3. Tooth is removed in sections to preserve the delicate labial cortical bone and it' vascular supply: preserving the regional anatomy. Gingival margin has remained intact. Note limited bleeding during extraction

Preparing implant osteotomies in fresh extraction sockets using piezosurgery has the following advantages[3,17];

1. Notching the apical third of the wall at exactly correct 3D position, which is very simple compared to drill-orientadet. Surgeon, as there is no sslipping of the bur along the incliding palatal bone.
2. This also leads to no damage to delicate buccal cortical plate that we are trying to preserve.[18]
3. Cavitation effect gives an excellent visual acuity.

4. Osteotomy bed can be prepared and reshaped by almost splitting and forming the palatal bone (provided it is 3-4mm) into newly fully formed osteotomy site. This procedure also condenses bone improving the primary stability.[19]
5. This is a fast, if not faster procedure than conventional drill osteotomy.

Sinus lift transcrestal approach using piezosurgery

Prosthetic rehabilitation is based on accurate diagnosis and treatment planning. Systemic and local conditions compatible with implant placement and sinus floor elevation procedures must be assessed; the absence of signs and symptoms of sinus diseases, as confirmed by clinical examination and radiographic assessment prior to the maxillary sinus floor augmentation.

The sinus lift was initially introduced as a lateral approach by Tatum in 1976[20] and subsequently published by Boyne in 1980.[21] Surgical techniques for sinus floor elevations using the transcrestal approach where fundamentally rely on the fracture or perforation of the sinus floor by means of osteotomes.[22-27]

However, both bur-driven and osteotome procedures present advantages and limitations. Osteotomes may increase the density of the soft maxillary bone while tenting the Schneiderian membrane by the hydraulic pressure of the bone graft pulled into the sinus. Where the implant site preparation is realized by the use of a trephine drill this trephined core of autogenous bone in many cases helps the vertical bone augmentation during the elevation of the sinus floor. Controlling the pressure of osteotomes is difficult that can result in penetration of sinus, membrane perforation and graft entry into the sinus. The problem is when a thick layer cortical bone remains at the sinus floor; the osteotome technique may require vigorous traumatic malleting during sinus floor elevation. Benign paroxysmal positional vertigo (BPPV) has been as post-surgery complication.[4]

The use of burs with different working lengths provides a controlled perforation of the sinus floor, restraining the action of the cutting edge to the native bone and limiting the risk for perforation of the sinus membrane. However, the tactile sensitivity of piezosurgical tips and visual acuity provided by cavitation effect gives that added confidence during clinical procedures, creating 90% of osteotomy; bone spreading and elevating sinus floor, reducing sinus floor perforation. In edentulous patients with insufficient bone volume and therefore reduced ridge height, sinus floor elevation is often the most appropriate solution for implant placement. Although the lateral window is probably the most commonly used technique, other techniques have been described, including crestal access. If there is 4mm or more vertical height of existing bone, a simultaneous placement of the implant is usually performed, as there is adequate bone to stabilize the implant while the bone graft matures. Where there is a perforation of the membrane, the procedure is delayed 2-3 months, in most cases. Sinus floor carefully dissected using piezosurgery tips as well as preparing the osteotomy site simultaneously. Internal sinus lift crestal approach-Hydro pneumatic pressure using saline subjected to piezoelectric cavitation.[28]

Using piezosurgery simultaneous osteotomy, sinus lifts and implant placement in prosthetically optimal position residual bone height (i.e., the distance from the bone crest to the sinus floor) ≥4 mm. A 3-4mm diameter osteotomy is performed in crestal bone at the site of implant placement to stop inferior to the Schneiderian membrane to avoid perforation. This is probably requiring a considerable learning curve and is the most technique sensitive aspect of the entire procedure. Graft material of choice is then placed in the osteotomy. Blunt Instruments are used to gently place graft material in the sinus, using the membrane to maintain the graft. Piezosurgery provides easy access and maximum tactile sensitivty to the operator contemplating any sinus lift procedures. This is especially important in delicate, difficult acess area in the posterior regions of maxilla.

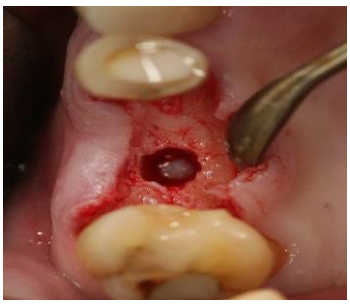


Figure 4. Sinus floor carefully dissected using piezosurgery tips as well as preparing the osteotomy site simultaneously

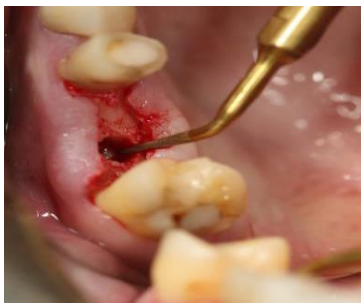


Figure 5. Internal sinus lift crests al approach-hydro pneumatic pressure using saline subjected to piezoelectric cavitation

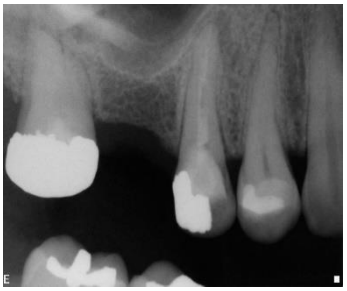


Figure 6. X-rays before implant placement

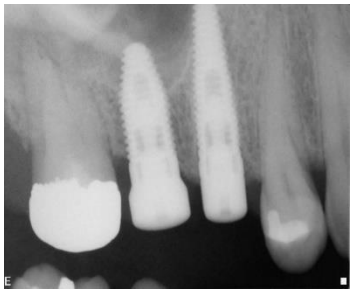


Figure 7. X-ray after implant placement

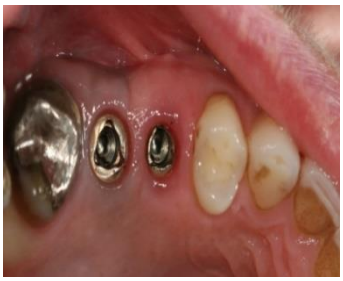


Figure 8. Optimal prosthetic platform for individual implant supported PFM crowns

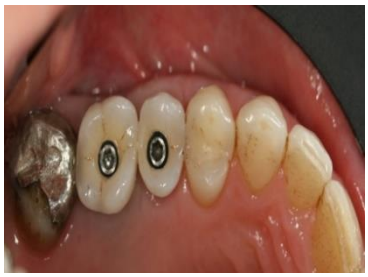


Figure 9. PFM crowns with implant support after fixing

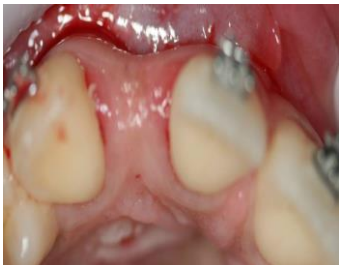
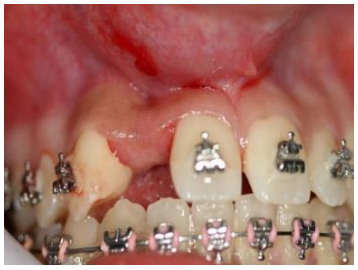
Sinus Lift-Latreal window approach using piezosurgery

The lateral window surgical procedure involves the removal of the bony window of the anterior wall of the maxillary sinus. Perforation of the Schneiderian membrane can occur both during the removal of the bone window and during the elevation itself.[29,30]
If perforation occurs and bone grafting is completed, there is a risk of an inflammatory complication that may require further surgical interventions, including revision of the maxillary sinus. Therefore, it is very important to avoid any perforation. A precise cutting device that does not perforate the Schneiderian membrane is preferred over conventional methods. The hydropneumatic pressure of the applied elements, through a cooling solution, helps in dissection of the maxillary sinus membrane. More articles have been published on the use of a piezoelectric device for sinus augmentation with a lateral window.[31-36] The use of a piezoelectric device reduces the incidence of membrane perforation in surgeons with limited experience. Piezosurgery provides easy access and maximum6tactile sensitivty to the operator contemplating any sinus lift procedures " you can feel the bone at the tip of your instrument".

Split alveolar ridge using piezosurgery for narrow ridge

Edentulous site enhancement (ESE)[6] is a systemic regenerative approach that improves the anatomy of

the edentulous site en mass, independent on any specific implant system and applicable in most clinical situations, irrespective of aesthetic requirements.[16,37] ESE approach helps uses implant and prosthetic components to restore ideal bone and mucosal contours, since ideal bone scaffolding and mucosal dimensions are provided optimal outcome.

Figures 10; 11. 2.5mm width narrow ridge

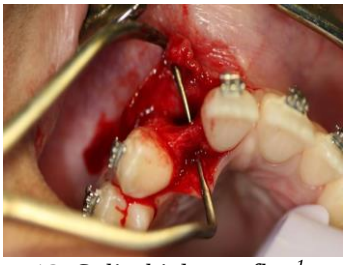


Figure 12. Split thickness flap[1] to maintain periosteal blood supply to the ridge crest ridge width 2.5mm

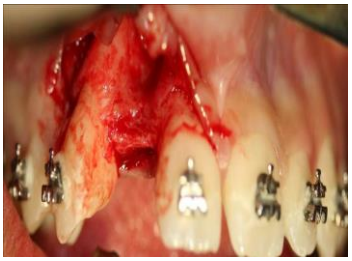


Figure 13. No bone flap-vertical bony incision

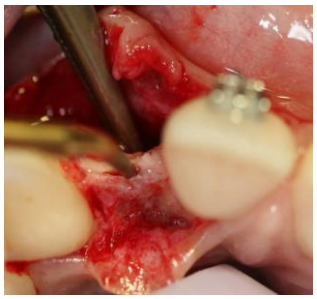


Figure 14. Careful piezosurgery assisted osteotomy splitting and expanding the ridge from 2.5mm to 4.2mm to house 3,5mm diameter implant

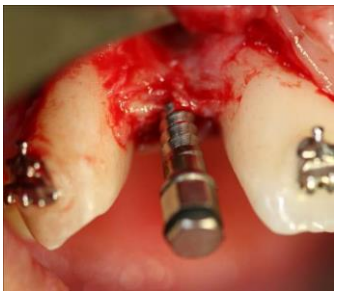


Figure 15. Meisinger rotary osteotomes shaping the implant osteotomy

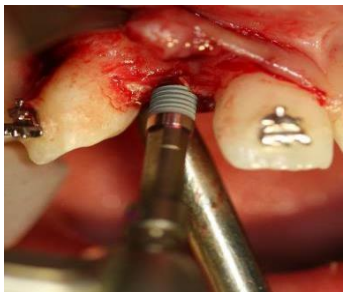


Figure 16. Implant placement at 32 Ncm: good primary stability obtained

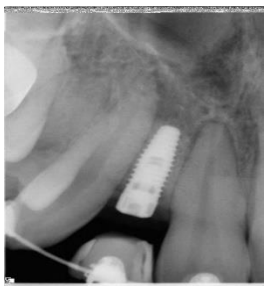


Figure 19. X-rays after implant placement

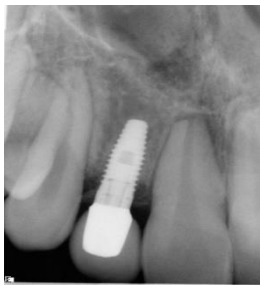


Figure 20. X-ray after provisional crown fixin

Figure 21. Long-term provisional crown 18 months post op

Split alveolar ridge is a recognized surgical technique that allows the implant to be inserted into a narrow and atrophic alveolar ridge. With insufficient width of the alveolar ridge, the technique of splitting the edentulous ridge can be applied. For this procedure, the lingual plate is separated from the buccal plate of the edentulous ridge. Alveolar ridge splitting is possible with piezosurgical approach. Case reports and studies demonstrate the successful use of a piezosurgical device.[38-40]

Bone separation with a piezoelectric device is possible even in difficult bone situations thanks to precise and well-defined cutting abilities without macro vibrations. Narrow 2.2- 2.5mm ridge expansion using combination of piezosurgery assisted osteotomy and Meisinger rotary osteotomes: ridge expansion and shaping the implant osteotomy is solution. Crestal split augmentation technique involved a surgical osteotomy that was followed by alveolar crest split and augmentation after buccolingual bony plate expansion, prior to implantation. A minimally invasive approach allows toreduce the surgical trauma and postsurgical discomfort. The complete vascular supply is maintained, the bone resorption is reduced, and the connective epithelium does not undergo postsurgical retraction, achieving the full maintenance of the residual keratinized gingiva.

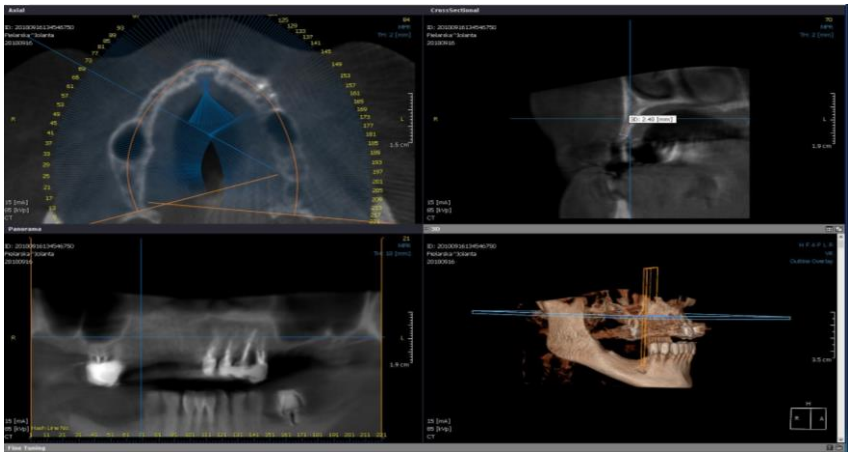


Figure 22. CT Narrow ridge 2.1mm site 15 Class IV (Cawood & Howell 1988)

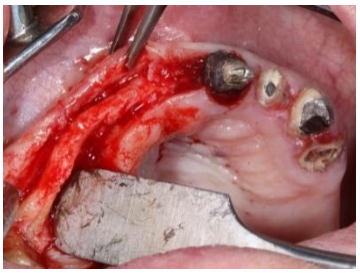


Figure 23. Mid-crestal incision: note the narrow ridge 2.5mm -3.00mm

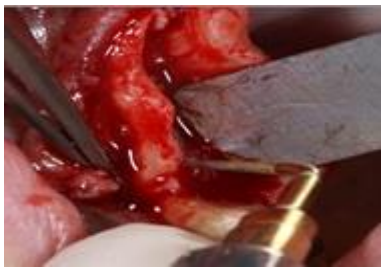
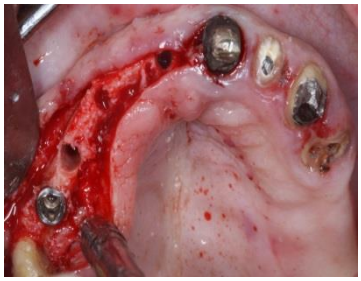
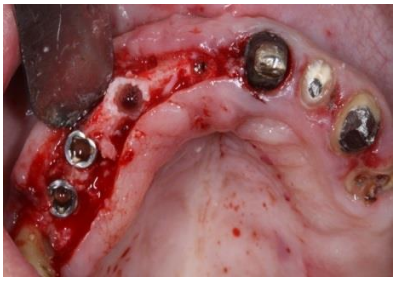


Figure 24. Osteotomy by piezosurgery. The Piezosurgery OP5 insert at initial site of the proposed osteotomy

Figure 25. IM2A 2mm Osteotomy Inserts





Figures 26, 27, 28. Maxillary Implant placement & Provisionalisation

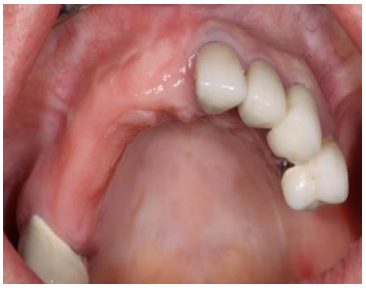


Figure 29. Intraoral condition before crestal ridge expansion piezosurgery split augmentation technique

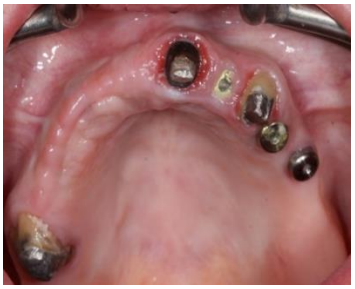


Figure 30. 14 days Post Op: Ridge expansion and placement of 7 fixtures

Disscusion

Healing of the implant within the biologic envelope is a natural tissue engineering that helps to generate native bone to the implant surface. Enhancing implant survival as it is within the native bone. The main advantages of using piezoelectric devices are precise and selective cuts, no thermal damage and preservation of soft tissue structures. This highly predictable surgical procedure is the result of precise and conservative use of piezosurgery assisted osteotomy and bone spreaders that allows the implants to be placed at the same time: reducing treatment time, overall cost and number of surgical procedures, especially in the maxillary atrophic ridge.[41-43]

Through the use of piezoelectric surgery, implant site preparation, bone grafting, sinus floor elevation, edentulous ridge splitting, or inferior alveolar nerve lateralization are technically feasible.[44]

The use of piezosurgery in areas with very dense cortical bone may have limited cutting capacity and may not work as efficiently as burs and thus may not be suitable for all types of implant site preparation.

Samples of cortical bone particles were collected using ultrasound or conventional drills. Bone particles were compared using histomorphometric analysis. The study concluded that autogenous bone particles harvested by ultrasound contain vital cells that differentiate into osteoblasts compared to conventional osteotomies.[45]

Postoperative recovery and wound healing after piezosurgery are favorable for achieving optimal bone regeneration. The use of piezosurgery can also benefit the patient by reducing postoperative swelling and trismus, as well as speeding up the healing process. In addition, the absence of piezosurgery-induced osteonecrosis and the positive effects on bone healing and osteogenesis mean that piezosurgery is a valuable tool to have in your dental implant arsenal.

A few histomorphometrical, immunohistochemical, and molecular analysis comparing piezosurgery with conventional drills and oscillating saws observed similar rate of bone healing but slightly more bone formation following piezosurgery.[46] Bone harvested using PS device was found to contain more osteoblast like cells.[47]

Stubinger et al. observed better periosteal microcirculation while using PS device for subperiosteal preparation which could be an incentive for enhanced bone metabolism.[4]

One of the key disadvantages of piezosurgery is time: the piezoelectric scalpel requires repeated application to the bone to gradually deepen the incision and complete the osteotomy. This increase in preparation time inevitably entails financial implications, so slightly higher costs may be required.[48]

This clinical review provides a brief overview of the current literature and describes the advantages and disadvantages of piezoelectric bone surgery in implant dentistry.

The outlook for the use of piezosurgery promises to revolutionize implantology, with most studies agreeing that the piezoelectric device is extremely efficient and accurate and recommend its use. In the near future, piezoelectric instruments will become an integral part of any procedure in maxillofacial surgery and implantology.

With the advent of technological advances, piezosurgical devices will become a promising technique with numerous applications in various disciplines of dentistry.

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ՊԻԵԶՈՎԻՐԱԲՈՒԺՈՒԹՅԱՆ ՕԳՏԱԳՈՐԾՈՒՄԸ ՍՏՈՄԱՏՈԼՈԳԻԱՅՈՒՄ

Սարգիս Նալբանդյան

Օրթոպեդ, իմպլանտոլոգ, այցելու պրոֆեսոր ԵՊԲՀ, ICODP (Ավստրալիա)

Ամփոփում

Պիեզովիրաբուժությունը իմպլանտոլոգիայում ոսկրային վիրահատության նոր և ժամանակակից նորարարական մեթոդ է: Այս գրականության վերլուծության նպատակն է ներկայացնել պիեզովիրաբուժության կլինիկական կիրառությունները ստոմատոլոգիական իմպլանտոլոգիայում և ուրվագծեր դրանց առավելություններն ու թերությունները՝ համեմատած սովորական վիրաբուժական համակարգերի հետ:

Այս տեխնիկայի հիմնական առավելություններն են ճշգրիտ կտրվածքները, ջերմային վնասվածքների բացակայությունը և փափուկ հյուսվածքների կառուցվածքների պահպանումը: Պիեզոէլեկտրական վիրաբուժության կիրառման շնորհիվ իմպլանտի համար տեղանքի պատրաստումը, ոսկրային փոխպատվաստումը, սինուսի հատակի բարձրացումը, անատամ գագաթի ճեղքումը, ստորին ալվեոլային նյարդի կողայինացումը, արդյունավետությունը բարձրացնում է: Արյան կորստի նվազեցման դեպքում բարդությունների ռիսկը նվազագույնի է հասցվում:

ИСПОЛЬЗОВАНИЕ ПЬЕЗОХИРУРГИИ В ИМПЛАНТОЛОГИИ

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Абстракт

Пьезохирургия – это новый и современный инновационный метод костной хирургии в имплантологии.

Цель обзора состояла в том, чтобы представить посредством обзора литературы клинические применения пьезохирургии в имплантационной стоматологии и обозначить их преимущества и недостатки по сравнению с обычными хирургическими системами.

Основными преимуществами данной методики являются точные разрезы, отсутствие термических повреждений и сохранение структур мягких тканей. Благодаря применению пьезоэлектрической хирургии повысилась эффективность подготовки места для имплантации, костной пластики, поднятия дна пазухи, расщепления беззубого гребня, латерализации нижнеальвеолярного нерва. Уменьшается кровопотеря, риск осложнений сводится к минимуму.

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PROSTHETIC REHABILITATION OF A RESORBED MAXILLA WITH AN INDIVIDUAL TITANIUM IMPLANT USING SELECTIVE LASER MELTING (SLM) TECHNOLOGIES. CASE REPORT

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Abstract

The purpose of presented case report was to show the outcome of prosthetic rehabilitation of a resorbed maxilla with an individual titanium maxillary implant using virtual 3D surgical planning and fabrication using Selective Laser Melting (SLM) technology. Oral rehabilitation in patients with severe atrophy using a custom titanium subperiosteal implant could be a solution with great potential to solve the well-known problems of traditional implantology.

It is also very important to have enough experience with implants in general to reach the skill level to perform custom subperiosteal titanium implants using SLM laser growth technology.

Keywords: atrophic maxilla three-dimensional (3D) models of, individual implant, Digital additive manufacturing technologies

Introduction

Rehabilitation of patients using dental implantats has shown long-term results with success rates up to 97%, in the presence of a sufficient amount of jaw bone. However, physiological atrophy of the jaws, post-extraction resorption, defect of the alveolar ridge different etiology, the installation of standard dental implants becomes more complicated.[1,2]

For the implant rehabilitation of such patients, traditional augmentation procedures such as bone augmentation techniques, guided bone regeneration, maxillary sinus elevation techniques with or without transplantation provide effective long-term solutions in the treatment of atrophy.[3-9]

Various types of grafts have been available for alveolar ridge augmentation, Autografts (autogenous grafts), Allografts (allogenic, homologous,

homografts), Allografts (allogenic, homologous, homografts), Alloplasts (alloplastic grafts, synthetic grafts), Platelet-rich plasma (PRP), Platelet-derived growth factors (PDGF). Resorbed ridge reconstruction using Autografts is considered the gold standard in rehabilitation.[10,11]

Effective implantation of bone grafts depends on the following factors: surgical asepsis, soft tissue coverage, secure fixation of the graft, presence of a bone blood vessel, and optimization of growth factors.[12] However, the obtained data suggest that the success of bone grafts also depends on the volume (size) of the restoration and the number of missing bones walls.[13]

Bone grafting may not always lead to a positive result, which dictates the search for alternative methods of implantation without bone grafting, which can reduce the risk of surgical complications and treatment time.[14-16]

Modern treatment options such as zygomatic implant, pterygoid implant, tilted implant, short implants, for posterior atrophic areas where aesthetics are not of paramount importance, may be the treatment of choice given that they may lead to an orthopedic and functional compromise.[17-20]

The use of individual implants opens up new perspectives for the rehabilitation of patients with significant resorption of the jaw bones. Digital additive manufacturing technologies and methods have made it possible to create individual implants based on cone beam computed tomography (CBCT) data for each individual clinical case.[21]

In recent years, digital technologies, such as computer-aided design/computer-aided manufacture (CAD/CAM), digital intraoral scanners, and additive manufacturing (AM) technologies, have been successfully applied in implant dentistry.[22,23]

Today, Selective Laser Melting (SLM) technology opens up promising possibilities for customized titanium dental and maxillofacial implants.

For the manufacture of individual implants, the obtained CT scans (DICOM files) are required; have a number of tools for virtual modeling of individual implants; convert virtual models of individual implants using Digital additive manufacturing technologies.[24]

In this clinical case, the presented use of a 3D-modeled custom implant produced using Selective Laser Melting (SLM) technology for the rehabilitation of a patient with significant resorption in the edentulous upper jaw will be presented.

Case reporta

52 years female patient, presented to clinic with edentulous significant atrophic maxilla.

Objectively

Edentulous atrophic maxilla. After the clinical-radial examination, a treatment plan was defined that included: installation an individual implant implant. 3 months after implant placement non-removable metal-ceramic prosthetic restoration was fabricated and adjusted. The patient has been followed up for 1 years. So far, no further problem has occurred and the restoration has remained functional.

Preoperative Planning

Virtual surgery was planned using high-resolution computed tomography. The CBCT-derived DICOM files were imported into software to create three-dimensional (3D) models of the patient's bone anatomy. The next step was to design and determine the shape and extent of the subperiosteal structure, taking into account the position of the prosthetic abutments and the remaining bone, as well as its length in a particular position. Based on the CT images of the patient's bone anatomy, a CAD model an individual implant was digitally constructed figure 1-2.

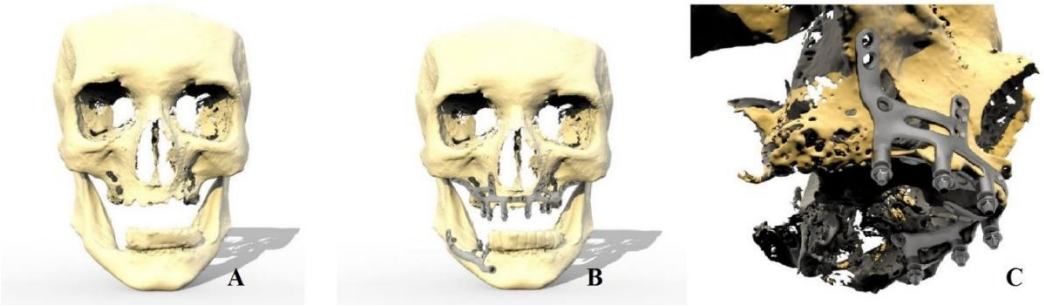

Figure 1. A, B, C. 3D CT images of the patient's bone anatomy, a CAD model an individual implant was digitally constructed

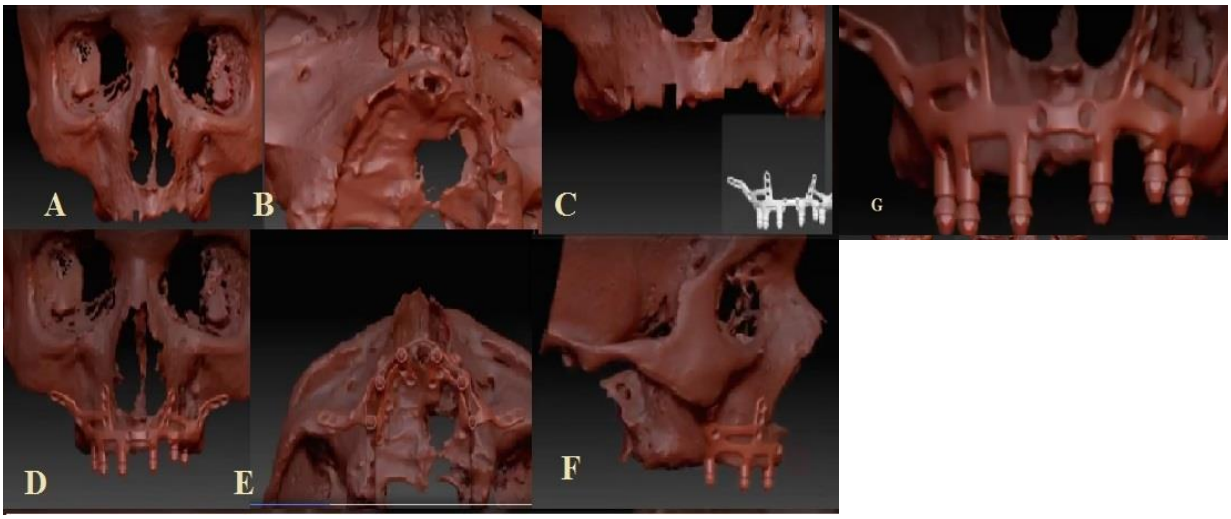

Figure 2 A, B, C, D, E, F, G. The planned position of the implant on the overview image in the frontal, axial and sagittal directions. The extreme planned position of the implant was located taking into account the position of the prosthetic abutments and the remaining bone

The biomodel was then physically built individual implant using Digital SLM manufacturing technologies.

Surgical Procedure

Crestal incisions were made to elevate the mucoperiosteal flap to ensure adequate soft tissue coverage of the titanium implant. After a thorough dissection with a periostotomy and complete exposure of the maxillary defect, a maxillary implant was placed, which provides a passive fit to the bone surface. Implant was fixed to the bone with screws 1.5 and 2 mm in diameter of different lengths according to a preliminary virtual plan. The ends of the prosthetic connections came out through small incisions in the flap. Finally, periosteal relaxation incisions were made in the periosteum to facilitate proper mobilization of the flap, and the wound was closed hermetically with absorbable sutures figure 3.

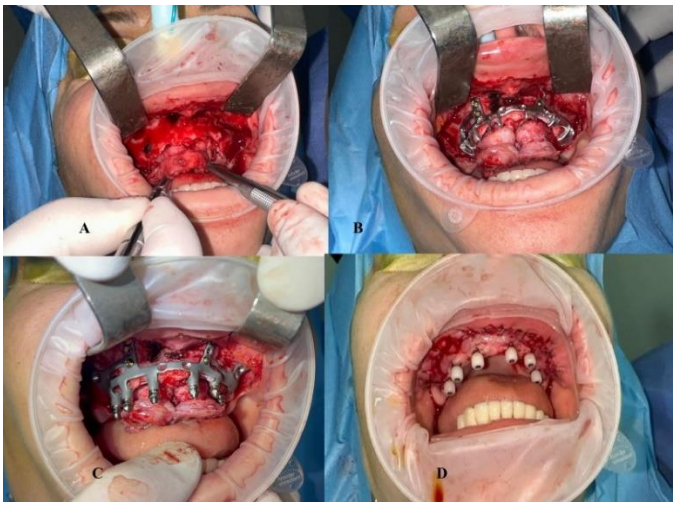

Figure 3 A, B, C, D. A patient with a total maxillary edentation treated with a subperiosteal implant (implant aspect and surgical stage)

In the postoperative period, oral antibiotic therapy (amoxicillin/clavulanic acid 1 g/8 h) was prescribed

for the first 7 days, analgesics, anti-inflammatory drugs, and 0.12% chlorhexidine solution for mouthwash 2–3 times a day, during the first week. Two weeks after the intervention, removes the sutures and installs a temporary prosthesis, turning the edges to avoid friction and trauma to the mucous membrane. 3 months after the operation, after the gums have completely healed, impressions are taken and a fixed prosthesis is made from metal-ceramic according to the CAD/CAM project fig.4,5. Prostheses were made in the clinic according to the generally accepted protocol. The patients were rehabilitated with a fixed prosthesis on subperiosteal implants with good aesthetic and functional results figure 6, 7.

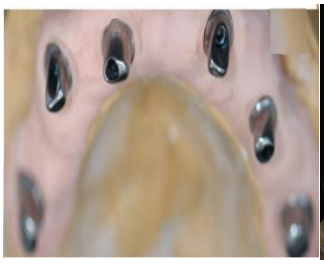

Figure 4. The position of the abutments in the working laboratory plaster model

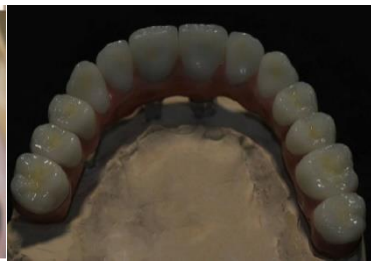

Figure 5. Finished metal-ceramic prosthes according to the CAD/CAM project on a working lab plaste

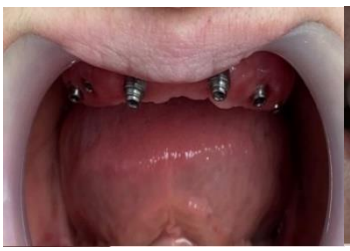

Figure 6. The position of the abutments in the cavity makes the final fixation of the prosthesis

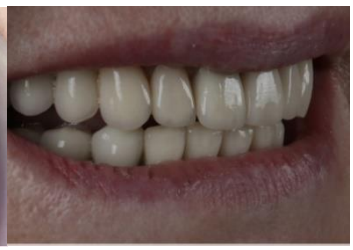

Figure 7. Finished metal-ceramic prostheses fixed in the oral cavity

A follow-up CT scan was performed to assess the accuracy and placement of the implant.

Disscusion

Treatment of severely atrophied posterior jaws with standard length root implants is a challenge. Bone reconstructive surgery is the treatment of choice; however, some patients may not take it for economic reasons or due to higher morbidity. For severe bone resorption in the jaw where the patient does not want to undergo bone regeneration, modern digital technologies may represent a viable solution with the possibility of fabricating customized implants ideally adapted to their local morphology and anatomy.[25] Computer-aided design / computer-aided manufacturing (CAD/CAM) technologies have recently opened up new frontiers in biomedical applications. Selective laser melting (SLM), is a CAD/CAM technique that allows the creation of complex three-dimensional (3D) structures created using image-based computer-aided design techniques. With Selective laser melting (SLM) technology, individual implants can be made for individual patients. SLM technology allows the creation of porous implant structures, which help provide attachment points to the bone tissue and promote accelerated osseointegration.[26] Therefore, implants made using SLM technology can adequately transfer loads between the implant and the bone, thereby increasing the life of the implant and the implant-supported restoration. In terms of materials, titanium is a widely used material in implants and other biomedical applications due to its high strength-to-weight ratio, corrosion resistance, low density, and non-magnetic properties.[27-29] Due to its high biocompatibility, Ti-6Al-4V is considered one of the most suitable biomaterials for dental and maxillofacial implants, manufactured using selective laser melting (SLM) technology. The highly porous surface of laser-sintered titanium implants clearly demonstrated a high level of bone contact and osseointegration with bone inclusion in the pores in the posterior maxilla 2 months after placement.[30-33]

Purpose

The purpose of this case report is to present a protocol for the fabrication and clinical use of custom-made SLM implants with a titanium subperiosteal implant as an alternative prosthetic treatment for orthopedic rehabilitation of severely atrophied posterior jaws. The patient's CT scan datasets were transferred to dedicated reconstruction software where a 3D projection of the atrophied jaw was obtained and a customized implant was designed. A customized implant was fabricated using the SLS technique, placed in a severely atrophied posterior maxilla and restored with fixed restorations 3 months later,

demonstrating good aesthetic integration. The implants can be made on an individual basis as a custom designed device. This non-traditional approach may represent an option for reconstructing an atrophied posterior jaw in patients who do not wish to accept traditional bone graft protocols.

Dental rehabilitation in edentulous patients with severe maxillary resorption has traditionally been treated with bone grafting to restore the alveolar ridge. This complex technique has a number of problems, including unpredictable medium to long term success rates, associated morbidity, duration of treatment (due to waiting times for graft consolidation and implant osseointegration, among other reasons), and overall cost. Thanks to modern new technologies for designing and manufacturing individual implants in patients with severe jaw resorption, new opportunities for orthopedic rehabilitation open up. This method is simpler and faster as it does not require the use of grafts and thus significantly reduces the treatment time.

Individual subperiosteal titanium maxillary implants may be a safe alternative for maxillary defect reconstruction, our experience shows promising results in terms of functional and aesthetic restoration. Using the latest SLM laser growth technology, individual implants are made for orthopedic rehabilitation of patients with significant atrophy of the jaw bones. This is of particular interest to patients who are unwilling or unable to undergo complex regenerative surgery but require fixed prosthetics. However, prospective and randomized trials with long-term follow-up are needed to evaluate its long-term efficacy and safety.

Conclusions

Oral rehabilitation in patients with severe atrophy using an individual titanium subperiosteal implant could be a solution with great potential to solve the well-known problems of traditional implantology. It is also very important to have enough experience with implants in general to reach the skill level to perform individual subperiosteal titanium implants using SLM laser growth technology.

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Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

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ԱՐՏԱՀԱՅՏՎԱԾ ԱՏՐՈՖԻԱՅՈՎ ՎԵՐԻՆ ԾՆՈՏԻ ՊՐՈԹԵԶԱՅԻՆ ՎԵՐԱԿԱՆԳՆՈՒՄ ԱՆՀԱՏԱԿԱՆ ՏԻՏԱՆԻ ԻՄՊԼԱՆՏՈՎ՝ ՍԵԼԵԿՏԻՎ ԼԱԶԵՐԱՅԻՆ ՀԱԼՄԱՆ (SLM) ՏԵԽՆՈԼՈԳԻԱՆԵՐԻ ԿԻՐԱՌՄԱՄԲ. ԿԼԻՆԻԿԱԿԱՆ ԴԵՊՔԻ ՀԱՇՎԵՏՎՈՒԹՅՈՒՆ

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Ամփոփում

Ներկայացված կլինիկական դեպքի հաշվետվության նպատակն էր ցույց տալ արտահայտված ատրոֆիայով վերին ծնոտի պրոթեզային վերականգնման արդյունքը անհատական տիտանի իմպլանտով՝ սելեկտիվ լազերային հալման (SLM) տեխնոլոգիաների կիրառմամբ; Բերանի խոռոչի վերականգնումը ծանր ատրոֆիայով հիվանդների մոտ՝ օգտագործելով տիտանային ենթավերն ոսկրային իմպլանտը, կարող է մեծ ներուժ ունեցող լուծում լինել ավանդական իմպլանտոլոգիայի հայտնի խնդիրները լուծելու համար: Նաև շատ կարևոր է ավանդական իմպլանտների հետ կապված բավականաչափ փորձ ունենալ՝ հասնելու հմտությունների մակարդակի՝ սելեկտիվ լազերային հալման (SLM) տեխնոլոգիաների կիրառմամբ անհատական ենթավերն ոսկրային լ տիտանի իմպլանտներ օգտագործելու համար:

ПРОТЕЗИРОВАНИЕ РЕЗОРБИРОВАННОЙ ВЕРХНЕЙ ЧЕЛЮСТИ ИНДИВИДУАЛЬНЫМ ТИТАНОВЫМ ИМПЛАНТАТОМ С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИЙ СЕЛЕКТИВНОГО ЛАЗЕРНОГО ПЛАВЛЕНИЯ (SLM): КЛИНИЧЕСКОЕ СЛУЧАЯ

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Резюме

Целью представленного клинического случая было показать результат ортопедической реабилитации резорбированной верхней челюсти с применением индивидуального титанового поднадкостничного имплантата с использованием виртуального 3D-хирургического планирования и изготовления с использованием технологии селективного лазерного плавления (SLM). Оральная реабилитация у пациентов с тяжелой атрофией с применением индивидуального титанового поднадкостничного имплантата может стать решением с большим потенциалом известных проблем традиционной имплантологии. Также очень важно иметь достаточный опыт работы с имплантатами в целом, чтобы достичь уровня навыков для применение индивидуальных поднадкостничных титановых имплантатов с использованием технологии лазерного выращивания SLM.

Khachatryan L, Khachatryan G, Karapetyan E, Sahakyan V. Prosthetic rehabilitation of a resorbed maxilla with an individual titanium implant using selective laser melting (SLM) technologies. Case report. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):63-70. doi: 10.58240/1829006X-2023.19.2-63

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CLINICAL ARTICLES

MODERN METHODS OF DIAGNOSTICS AND TREATMENT OF CHRONIC MAXILLARY SINUSITIS

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Abstract

The objective of the present study was to compare the efficacy of traditional and endoscopic surgical treatments for maxillary sinusit.

Materials and methods: The present study is based on a comparison of the results of the radical maxillary sinusotomy and endoscopic endonasal approach sanation in 206 patients with sinusitis. The patients were divided into 2 comparable groups. The diagnosis was established on the basis of complaints, endoscopy of the nasal cavity and CT scan of the paranasal sinuses.

We have developed a scale for assessing clinical effectiveness of surgery the criteria of which were:

1) intraoperative and postoperative complications;
2) relapse diseases. Clinical efficacy was defined as "unsatisfactory" in the event of a relapse of the disease, the presence of complications in the early postoperative period. "Satisfactory" - if available complications and with an increase in the length of stay patients in the hospital by 6-30%, "good" – in absence of complications, recurrence of the disease and reducing the length of the patient's stay in hospital.

Results: Clinical efficacy in the 1nd group was higher in 62.4% - "good", in 23% - "satisfactory" and in 14.6% - "unsatisfactory" clinical efficacy. Clinical efficacy in the 2nd group was higher in 82.3% - "good", in 14,2% - "satisfactory" and in 4.5% - "unsatisfactory" clinical efficacy.

Conclusion: Endoscopic sinus surgery at allows to reduce complications in comparison with radical maxillary sinusotomy. The endoscopic sinus surgery technique is characterized by low trauma and the physiological principle of influencing the sinus, allows for constant visual control both during the intervention and in the postoperative period, and reduces the time of inpatient treatment compared to radical maxillary sinusectomy.

Keywords: *radical maxillary sinusotomy, endoscopic endonasal sinus surgery, maxillary sinusit*

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Introduction

The main sources of infection of the maxillary sinuses are periapical foci of inflammation, odontogenic cysts, foreign bodies, perforations of the sinus floor. Approximately 30% of cases of unilateral sinusitis may have a dental cause which usually leads to cases of recalcitrant sinusitis, often associated with serious complications.[1-3]

Dental materials used in endododntic therapy extrusion of into the maxillary sinus has also a high risk of producing sinusist.[4] Moreover, along with the bacterial microflora, mycotic infection plays a significant role in the development of inflammatory processes.[5]

In recent years, due to the rapid development of implantology, the number of patients with sinusitis after dental implantation and sinus lift has increased.[6] Sinusitis of rhinogenic, rather than odontogenic origin, originates from nasal inflammation followed by anterior ethmoid disease and secondary obstruction of the ostiomeatal unit.

The search for more gentle methods of surgical treatment of diseases of the nasal cavity and paranasal sinuses was aimed at the possibility of minimizing surgical trauma and maintaining the normal anatomy of the intranasal structures. Despite significant advances in diagnosis and treatment of chronic maxillary sinusitis.

In clinical practice, for the sanitation of maxillary sinuses, radical maxillary sinusotomy developed more than a century ago by the Caldwell-Luc method or its modification is still widely used.[7,8] This does not take into account pathological changes in the intranasal structures and mucous membrane, the state of the natural opening, i.e., the state of the anatomical formations that determine the functional activity of the mucociliary apparatus.

Meanwhile, over the past two decades, not only in otorhinolaryngology, but also in the practice of maxillofacial surgery, endoscopic technologies have been actively introduced.[9]

Endoscopic sinus surgery is one of the most used operations, which is performed mainly in the treatment of chronic inflammation of the paranasal sinuses, tumors of the paranasal sinuses, trauma to the anterior part of the base of the skull, damage to the eyeball associated with trauma, and compression of the optic nerve.[10]

Endoscopic sinus surgery (FESS-Functional Endoscopic Sinus Surgery) is by far the most optimal method of surgical treatment of chronic sinusitis. The performance of such operations requires not only a good knowledge of the endoscopic anatomy of intranasal structures, but also the ability to bimanually perform endoscopic manipulations.[10-12]

The following operations are carried out under endoscopic control:

- Ethmoidotomy - opening the cells of the ethmoidal labyrinth
- Sinusectomy - opening of the maxillary sinus
- Opening of the sphenoid sinus
- Revision of the fronto-nasal pocket
- Infundibulotomy
- Removal of a foreign body from the maxillary sinus
- Removal of a cyst-like formation from the maxillary sinus
- Removal of inflamed tissue/polyps
- Enlargement of the drainage channels that connect the sinuses to the nose
- Correction of anatomical problems such as "concha bullosa" (concha bullosa, bullous deformity of the middle turbinate), multiple openings of the excretory channels of the paranasal sinuses (accessory ostium) and abnormal areas of contact with the mucous membrane

Of great importance in the development of diseases of the paranasal sinuses are pathological changes in the region of the middle nasal passage, where their fistulas open.

The goal of surgical treatment for chronic maxillary sinusitis is to create an adequate communication between the sinus and the nasal cavity. Thus, the ventilation and drainage of the sinus is restored.

Through the expanded natural fistula, all pathological contents from the sinus can be removed - purulent discharge, foreign body, cyst, mucocele, polyps. When removing foreign bodies and cysts from the maxillary sinuses located in the region of the sinus floor, the approach through the lower nasal passage is often used. Visual control allows you to preserve unchanged structures as much as possible.

For the treatment of sinusitis, it is necessary to restore the ventilation of the frontal sinus through the natural

fronto-nasal canal. With regard to the ethmoid and sphenoid sinuses, the same principle is used: if necessary, the maximum number of affected cells of the ethmoid labyrinth is opened, but not necessarily all. The preservation of not only normal, but also pathologically altered mucosa is one of the concepts of endoscopic sinus surgery. Restoring normal sinus ventilation has been shown to promote mucosal regeneration. It is also necessary to take into account the fact that the development of chronic sinusitis may be associated with pathological changes in the nasal cavity: curvature of the nasal septum, hypertrophy of the middle or lower turbinate. In this regard, in order to achieve a good effect during operations on the paranasal sinuses, the nasal septum is corrected, the inferior turbinates are destroyed, and the middle turbinate is partially resected.

Using the ESS method allows not only to restore normal nasal breathing, but also to preserve the anatomy of the nasal cavity and paranasal sinuses as much as possible. Such operations are easily tolerated by patients and do not require a long stay in the hospital. After the intervention, the recovery period takes about a week.

Postoperative care of the nasal cavity is also important - the removal of clots and crusts, the appointment of anti-inflammatory, anti-edematous and antibacterial therapy. This prevents adhesions and promotes better healing.

Unsatisfactory results of treatment are primarily due to the lack of a unified approach to the treatment of this disease. Most surgeons believe that the necessary volume surgery is a wide opening the affected sinus. This method is traumatic, not physiological, and the frequency of development complications, including recurrent sinusitis, anesthesia of the upper lip, gums and teeth, neuralgia trigeminal nerve, cicatricial deformity of tissues infraorbital region and even osteomyelitis of the upper jaw and zygomatic bone, reaches 80%.

The resulting extensive bone defect in the anterior wall of the sinus, the formation of an unnatural messages with the lower nasal passage in the absence attention to the state of the natural fistula, frequent trauma to the nasolacrimal canal and infraorbital nerve — the main disadvantages of the classical Caldwell-Luc operation.

Broad prospects opened up with the advent of rhinological endoscopic techniques in clinical practice. Optics with 0° viewing angles, 30° and 70° made it possible to inspect all departments maxillary sinus, restore the patency of its natural anastomosis, remove polyps and cysts without resorting to to the opening of the sinus through the anterior wall, which opens up fundamentally new possibilities in the surgical treatment of sinusitis.[13,15]

The study of the effectiveness of this new method was the goal of this study.

The purpose of the study is to conduct a comparative assessment of traditional and endoscopic surgical treatments for maxillary sinusitis.

Material and methods

The study included 206 patients divided into 2 comparable groups. The diagnosis was established on the basis of complaints, endoscopy of the nasal cavity and CT of the paranasal sinuses.

At the first stage, CT of the paranasal sinuses was performed in axial and frontal projections with tomograph step 0.5 mm.

In 102 patients 1 groups according to CT the following results were obtained: in 23 patients in the cavity of the maxillary sinus, an accumulation of heterogeneous liquid content was detected, in 19 patients cysts in the cavity of the maxillary sinus, in 38 patients uneven parietal thickening of the mucosa membranes, in 18 patients filling material associated with the mycelium of the fungus, which was confirmed morphologically, in 4 patients fragments in the maxillary sinus (figures 1, 2, 3, 4, 5).

In 104 patients 2 groups according to CT the following results were obtained: in 24 patients in the cavity of the maxillary sinus, an accumulation of heterogeneous liquid content was detected, in 13 patient's cysts in the cavity of the maxillary sinus, in 43 - uneven parietal thickening of the mucosa membranes, in 16 - filling material associated with the mycelium of the fungus, which was confirmed morphologically, in 8 – fragments in the maxillary sinus.

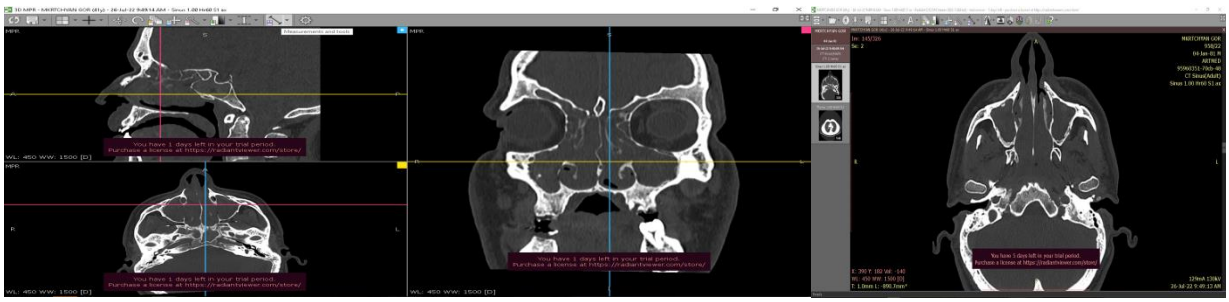

Figure 1. CT shows a liquid in the maxillary sinus

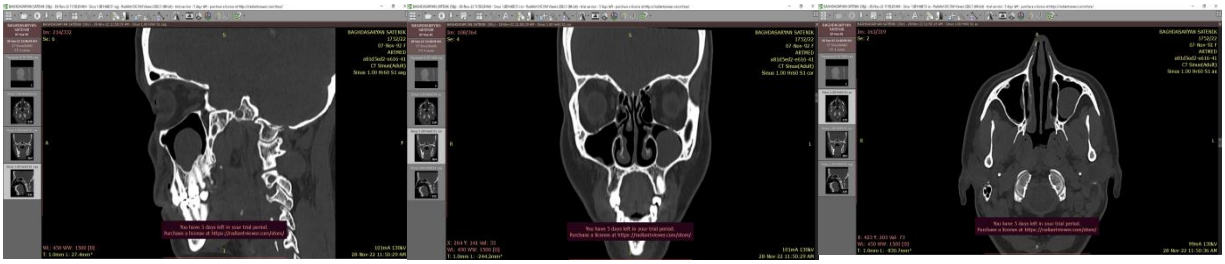

Figure 2. CT shows cysts in the cavity of the maxillary sinus

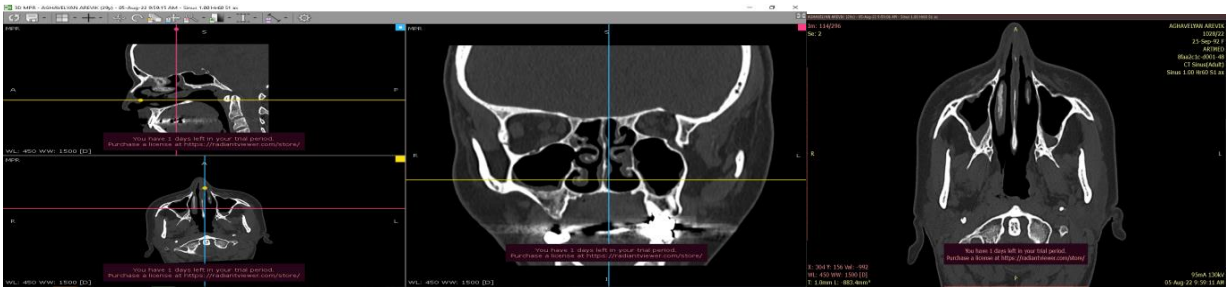

Figure 3. CT shows uneven parietal thickening of the mucosa membranes sinus

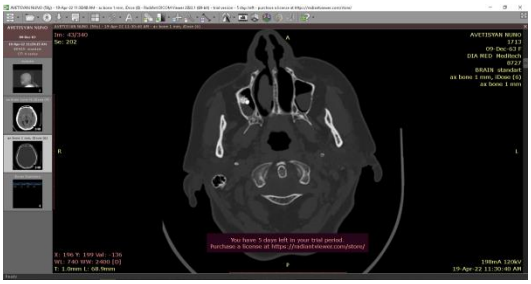

Figure 4. CT shows filling material associated with the mycelium of the fungus of the mucosa membranes sinus

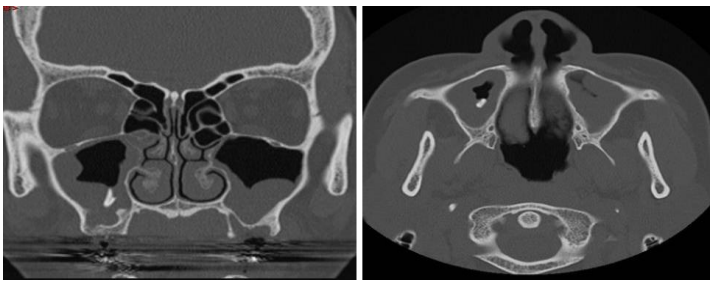

Figure 5. CT shows tooth root in the maxillary sinus

The size and shape of foreign bodies from filling materials were different, from small areas to significant ones, up to 1.7 cm in diameter. Foreign bodies were located in 28.2% patients in the region of the sinus floor at the root apex of the causative tooth, in 71.8% in the sinus cavity.

Located in the maxillary sinus, the filling material has tendency to migrate, blocking the natural anastomosis, which often leads to an exacerbation of the inflammatory process. In radiodiagnosis, it is important to determine the localization filling material, assess the state of the odontogenic source of infection adjacent to the sinus.

102 patients1 groups underwent traditional radical maxillary sinusectomy according to the Caldwell-Luc method.

104 patients 2 groups underwent endoscopic sanitation with using equipment from Karl Storz, consisting of rigid 4-mm endoscopes with a viewing angle of 0°, 30° and 70°, video equipment and special tools.

Intervention began with an endoscopic revision of the natural opening of the maxillary sinus in the middle nasal passage. For of this, under the control of a 0° endoscope, gentle traction of the middle turbinate in medial direction, and then resection of the uncinate process, opened and removed the walls ethmoid bulla and visualized the natural sinus fistula, the latter was expanded backwards and downwards, after which endoscopes of 30° and 70° were examined sinus lumen. Pathological contents of the sinus removed with a suction tip, polyps, foreign body - with antral forceps (figure 6).

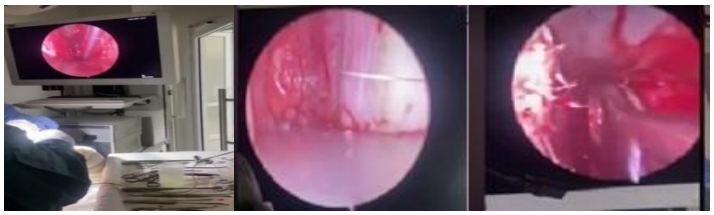

Figure 6. Endoscopic sanitation with using equipment from Karl Storz

It should be noted, that in all cases we managed to remove by endonasal access foreign bodies located in the lumen of the sinus - pieces of filling material and turundas.

Operations were performed under the endotracheal anesthesia. Antibacterial therapy was performed in the postoperative period. The average length of stay of patients in the hospital was 7±2 days.

We have developed a scale for assessing clinical effectiveness of surgery the criteria of which were:

1) the length of stay of patients in the hospital;
2) intraoperative and postoperative complications;
3) relapse diseases.

Clinical efficacy was defined as "unsatisfactory" in the event of a relapse of the disease, the presence of complications in the early postoperative period and increased length of stay of patients in the hospital than 30%. "Satisfactory" - if available complications and with an increase in the length of stay patients in the hospital by 6-30%, "good" – in absence of complications, recurrence of the disease and reducing the length of the patient's stay in hospital.

Results

The following postoperative complications in patients 1 groups were noted: recurrence – in 4 patients; postoperative hematoma of the soft tissues of the face – in 7, temporary disturbance of sensitivity on the operated side – in 6, in 8 cases, synechia was observed in the nasal cavity.

The following postoperative complications in patients 2 groups were noted: recurrence in 2 patients; postoperative hematoma of the soft tissues of the face – in 3, temporary disturbance of sensitivity on the operated side – in 2, in 3 cases, synechia was observed in the nasal cavity.

Clinical efficacy in the 1st group was higher in 62.4% - "good", in 23% - "satisfactory" and in 14.6% - "unsatisfactory" clinical efficacy.

Clinical efficacy in the 2nd group was higher in 82.3% - "good", in 13,2% - "satisfactory" and in 4.5% - "unsatisfactory" clinical efficacy.

Discussion

Chronic inflammation of the paranasal sinuses and nasal cavity, which is estimated to occur in more than 15% of adults and is known as chronic rhinosinusitis, is one of the main causes of pain in the face, paranasal sinuses, back of the eye, ear or forehead.[16] The treatments for these types of chronic inflammations

are varied and mainly include multidrug therapy (MLT) with corticosteroid steroid hormones, antibacterial agents, phenylpropanolamine (PPA), mucoactive agents, and nasal irrigation with saline. In situations where these therapies are ineffective, functional endoscopic sinus surgery (FESS) may be suggested to improve symptoms associated with the disease.[17]

Clinical observations show that otorhinolaryngologists often underestimate association of maxillary sinusitis with the disease teeth, and the odontogenic process is often considered as rhinogenic. As a result, he meets much more often than diagnosed. Availability foreign bodies, often filling material, roots and fragments of teeth that migrated into the cavity sinus after endodontic treatment.[18,19]

Second the reason is the pneumatic type of structure maxillary sinus (MS), occurring in about 40% of people, when the roots of the upper teeth the jaws are separated from the lumen of the sinus by a very thin bone wall or only mucous membrane.[20,21]

Over the past two decades, the surgical management of rhinosinusitis has entirely changed due to technical advances in endoscopic systems and the recognition of the importance of mucociliary flow and ventilation through the anatomical ostia for normal sinus function. Functional endoscopic sinus surgery (FESS) is a set of minimally invasive techniques in which sinus air cells and ostia are opened under direct visualisation. The goals of functional endoscopic sinus surgery (FESS) in the treatment of sinusitis are to enlarge sinus ostia, restore adequate aeration of sinuses, improve mucociliary transport, and provide a better route for topical therapies.[22]

Endoscopic endonasal maxillary sinusectomy allows you to perform revision of the maxillary sinus with minimal trauma, which creates conditions for a smoother course of the postoperative period, reduces length of stay of patients in the hospital. Satisfaction of patients after endoscopic endonasal maxillary sinusectomy is higher than in patients after radical surgery on the maxillary sinus according to Caldwell-Luc.[23,24]

The risks of sinus surgery have been the subject of controversy for years. Several large series have reported very low complication rates endoscopic sinus surgery, suggesting that this procedure can be performed safely.[25,27] Currently well established for the treatment of chronic rhinosinusitis, which is not amenable to medical treatment. However, there is an apparent lack of good scientific evidence of the comparative effectiveness of this intervention.

Endoscopic studies and observations have shown that the most common cause of paranasal sinus infections is rhinogenic in nature, spreading from the nose to the sinuses. A common focus of infection in sinusitis is stenotic areas of the anterior ethmoid bone, with infection recurring in the larger sinuses. Thus, the anterior part of the ethmoid bone, especially its infundibulum, is a key site for infection or treatment, and the maxillary as well as the frontal sinuses are completely dependent on the pathophysiological conditions in this area. Histological examination shows that massive changes in the nasal glands are the cause of persistent thickening of the mucous membrane. Retention cysts, highly viscous mucus, extravasation of mucus, and metaplastic changes in the epithelium complete the vicious cycle of ostium-meatus occlusion.

In the literature there are several studies on that address surgical method of choice for recurrent or chronic sinusitis.[28,29]

The current philosophy is to choose a surgical technique that is as conservative as possible and as radical as possible, depending on the individual case. The surgical method of choice for recurrent or chronic sinusitis is the radical Caldwell-Luc technique (maxillary sinus).

Endoscopic sinus surgery (ESS) is a modern method used to treat inflammatory diseases of the paranasal sinuses surgically. The complication rate associated with endoscopic sinus surgery is low, and improvements in surgical technology and experience can reduce its side effects.[30-32]

The idea behind ESS may seem simple, but the anatomical variability and the wide range and severity of diseases treated in each ESS remain challenges for the surgeon in every case. Preoperative sinus surgery planning is an important step to obtain optimal results and prevent all possible complications.

We present the technological advances that have enabled endoscopic intranasal techniques to expand and successfully treat other pathologies. The boundaries of ESS are constantly expanding with the development of technology.

ESS readings have surpassed the area of rhinosinusitis so far.

206 hundred cases of chronic/recurrent sinusitis were examined endoscopically using 0° (4 mm) rigid endoscopes in combination with conventional x-ray and computed tomography to reveal the exact nature of the pathology, which was sometimes not possible with conventional examination. Once the cause was established, functional endoscopic sinus surgery (FESS) was performed to treat and relieve symptoms. The Messerklinger technique was used with good results and minimal surgical trauma. Complications with possible treatment and long-term results were discussed. The use of endoscopic sinus surgery can give the most appropriate positive results.

In order to achieve the most suitable surgical outcome, the surgeon must be sufficiently skilled in diagnosis and face any possible complications during the operation, as well as complex and revision problems.

Conclusions

Endoscopic sinus surgery at allows to reduce complications in comparison with radical maxillary sinusotomy. The endoscopic sinus surgery technique is characterized by low trauma and the physiological principle of influencing the sinus, allows for constant visual control both during the intervention and in the postoperative period, and reduces the time of inpatient treatment compared to radical maxillary sinusectomy.

Conflicts of Interest

The authors declare no conflict of interest.

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Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

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ՔՐՈՆԻԿ ՎԵՐԾՆՈՏԱՅԻՆ ՍԻՆՈՒՍԻՏԻ ԱԽՏՈՐՈՇՄԱՆ և ԲՈՒԺՄԱՆ ԺԱՄԱՆԱԿԱԿԻՑ ՄԵԹՈԴՆԵՐ

Արայիկ Ղարիբյան,[1] Սոնա Գեւորգյան, Անժելա Չախոյան,[3] Կարեն Սեւտերտաերյան [4]

[1] Առողջապահության ազգային ինստիտուտի գլխի և պարանոցի էսթետիկ և վերականգնողական վիրաբուժության ամբիոնի դոցենտ, ARTMED բժշկական վերականգնողական կենտրոնի բժշկական տնօրենի տեղակալ, Հայաստան

[2] Երևանի Մ. Հերացու անվան պետական բժշկական համալսարանի վիրաբուժական ստոմատոլոգիայի և դիմածնոտային վիրաբուժության ամբիոնի դասախոս, Հայաստան

[3] Առողջապահության ազգային ինստիտուտի գլխի և պարանոցի էսթետիկ և վերականգնողական վիրաբուժության ամբիոնի քիթ-կոկորդ-ականջաբան-օրդինատոր, Հայաստան

[4] Երևանի Մ. Հերացու անվան պետական բժշկական համալսարանի բերանի խոռոչի և դիմածնոտային վիրաբուժության ամբիոնի դասախոս, Հայաստան, Դիմածնոտային վիրաբույժ, Կենտրոնական կլինիկական Հոսպիտալ, Հայաստան

Ամփոփում

Սույն հետազոտության նպատակն էր համեմատել վերծնոտային սինուսիտի ավանդական և էնդոսկոպիկ վիրաբուժական բուժման արդյունավետությունը:

Նյութեր և մեթոդներ. Ուսումնասիրությունը հիմնված է վերծնոտային սինուսիտով 206 հիվանդների ռադիկալ սինուսոտոմիայի և էնդոսկոպիկ էնդոնազալ մոտեցմամբ սանացիայի արդյունքների համեմատության վրա: Հիվանդներին բաժանել են 2 համեմատելի խմբի. Ախտորոշումը հաստատվել է գանգատների, քթի խոռոչի էնդոսկոպիայի և պարանազային սինուսների համակարգչային տոմոգրաֆիայի հիման վրա: Մշակվել է վիրահատության կլինիկական արդյունավետության գնահատման սանդղակ, որի չափանիշներն են.

1) ներվիրահատական և հետվիրահատական բարդություններ,
2) հիվանդության կրկնություն; Կլինիկական արդյունավետությունը սահմանվել է որպես «անբավարար» հիվանդության կրկնության, վաղ հետվիրահատական շրջանում բարդությունների առկայության դեպքում: «Բավարար»՝ առկա բարդությունների դեպքում և հիվանդների հիվանդանոցում գտնվելու տևողության 6-30%-ով ավելացմամբ, «լավ»՝ բարդությունների բացակայության, հիվանդության կրկնության և հիվանդի հիվանդանոցում մնալու տեւողության կրճատման դեպքում:

Արդյունքներ. Կլինիկական արդյունավետությունը 1-ին խմբում ավելի բարձր է եղել 62.4%-ի մոտ՝ «լավ», 23%-ի մոտ՝ «բավարար» և 14.6%-ի մոտ՝ «անբավարար» կլինիկական արդյունավետությամբ: 2-րդ խմբում կլինիկական արդյունավետությունն ավելի բարձր է եղել 82.3%-ում՝ «լավ», 13,2%-ի մոտ՝ «բավարար», իսկ 4,5%-ի մոտ՝ «անբավարար» կլինիկական արդյունավետությունը:

Եզրակացություն. Սինուսների էնդոսկոպիկ վիրահատությունը թույլ է տալիս նվազեցնել բարդությունները՝ համեմատած վերծնոտային սինուսիտի ավանդական սինուսոտոմիայի հետ: Սինուսների էնդոսկոպիկ վիրահատության տեխնիկան բնութագրվում է ցածր տրավմայով և սինուսի վրա ազդելու ֆիզիոլոգիական սկզբունքով, թույլ է տալիս մշտական տեսողական հսկողություն իրականացնել ինչպես միջամտության, այնպես էլ հետվիրահատական շրջանում և կրճատում է ստացիոնար բուժման ժամանակը՝ համեմատած արմատական սինուսէկտոմիայի հետ:

СОВРЕМЕННЫЕ МЕТОДЫ ДИАГНОСТИКИ И ЛЕЧЕНИЯ ХРОНИЧЕСКОГО ЧЕЛЮСТНОГО СИНУСИТА

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Абстракт

Целью настоящего исследования было сравнение эффективности традиционного и эндоскопического хирургического лечения гайморита.

Материалы и методы: Настоящее исследование основано на сравнении результатов радикальной гайморотомии и санации эндоскопическим эндоназальным доступом у 206 больных синуситами. Больные были разделены на 2 сопоставимые группы. Диагноз установлен на основании жалоб, эндоскопии полости носа и КТ придаточных пазух носа.

Нами была разработана шкала оценки клинической эффективности оперативного вмешательства, критериями которой были:

1)интраоперационные и послеоперационные осложнения;

2) рецидив заболевания. Клиническая эффективность определялась как «неудовлетворительная» при возникновении рецидива заболевания, наличии осложнений в раннем послеоперационном периоде. «Удовлетворительно» - при наличии осложнений и увеличении сроков пребывания больных в стационаре на 6-30%, «хорошо» - при отсутствии осложнений, рецидивах заболевания и сокращении сроков пребывания больных в стационаре.

Результаты: Клиническая эффективность в 1-й группе была выше у 62,4% - «хорошая», у 23% - «удовлетворительная» и у 14,6% - «неудовлетворительная». Клиническая эффективность во 2-й группе была выше у 82,3% - «хорошая», у 13,2% - "удовлетворительная" и у 4,5% - "неудовлетворительная" клиническая эффективность.

Заключение: Эндоскопическая хирургия околоносовых пазух позволяет уменьшить количество осложнений по сравнению с радикальной верхнечелюстной пазухой. Эндоскопическая методика хирургии носовых пазух характеризуется малотравматичностью и физиологическим принципом воздействия на пазуху, позволяет осуществлять постоянный визуальный контроль как во время вмешательства, так и в послеоперационном периоде, сокращает время стационарного лечения по сравнению с радикальной гайморэктомией.

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FEATURES OF CONTROLLED WOUND HEALING AND ORTHOPEDIC TREATMENT IN BILATERAL RESECTION OF THE UPPER JAW. CASE REPORT

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Abstract

Oral and maxillofacial prosthodontics is engaged in prosthetics of congenital and acquired defects of the maxillofacial region occurred from resections of the jaws in case of neoplasms and as a result of injuries as well.

In the presence of defects in the maxillofacial region, various methods of treatment are currently used, including removable prosthetics, reconstruction of the defect with a vascularized musculoskeletal autograft, and prosthetics with implants. This direction tends to be further developed and improved, which will contribute to the full integration of the patient into society.

In this article the method of prosthetic treatment of the defect occurring at maxillary resection (clinical case) followed by prosthetic rehabilitation is presented.

Keywords: *resection of the upper jaw, defect of the upper jaw, obturator, removable prosthesis*

Introduction

Cranio-maxillo-facial defects can be caused by various factors. One of the most common causes of acquired defects is surgical treatment of neoplasms in the area of the face. MF cancer treatment may require partial or total maxillectomy, which may cause functional, aesthetic defects and hygiene problems.[1-3] As a result of the defect caused by the resection of the upper jaw, the integrity of soft and hard tissues is violated, a communication between the nasal and oral cavities is created.[4] The following will be disturbed; aesthetics, phonetics, breathing, processes of chewing and swallowing. Depending on the volume of surgery, patients may experience asymmetry of the face, lips,lowering of the lower third of the face, lowering of the corners of the mouth and nose, maceration in the corners of the mouth, etc. e.

At the same time, the speech function is disturbed, the patient develops snoring (rhinolalia), the speech becomes unclear, especially when there is communication between the oral and nasal cavities. The last circumstance also leads to the occurrence of quite serious problems with food intake, since the absence of teeth makes chewing difficult, and communication with the nasal cavity leads to the passage of nutrients into the nasal cavity and adjacent cavities. As a result, the mucous membrane of the nasal cavity is irritated, sneezing and coughing occur, as a result of which the patient refuses to eat. These

problems cause psycho-emotional disorders and a feeling of inferiority in the patient. And if the patient's disease is cured, but he remains isolated because of his physiological, aesthetic and psychological defects, how valuable is the treatment for the patient?[3]

Taking into account a number of inconveniences caused by resections of the upper jaw, there is a need to restore them with the help of special obturator prostheses.[5-8] An obturator is a maxillofacial prosthesis used to preserve the integrity of the mouth and nose, closing and overlapping the communication between them caused by congenital or acquired defects.[9-10]

The prosthesis facilitates speech and swallowing due to the replacement of tissue lost during the development of the disease, and, as a result, can reduce nasal insufficiency and hypernasal speech, improve articulation, swallowing and chewing. Surgical, temporary and final obturators are sequentially used to eliminate the defect.[8,11]

The surgical obturator is placed immediately at the end of the operation. This is a simple device that is made according to the model obtained in the postoperative period and, thus, can reduce the frequency of local infection. Installation of a surgical obturator during surgery can minimize defects caused by maxillectomy and provide immediate restoration of facial contours, preventing their deformations, which can have important physical and psychological consequences for the patient.[10,12]The surgical obturator is replaced by a temporary obturator a few weeks after the operation. It is made according to a post-operative cast, has an artificial palate, a part that goes into the opening of the defect (abutment) and can initially contain teeth or be toothless with a tendency to add them later. The surgical obturator is replaced by a temporary obturator a few weeks after the intervention. It is made according to a post-operative cast, has an artificial palate, a part that goes into the hole of the defect and can initially artificial teeth or be toothless with a tendency to add them later. The temporary obturator is replaced by the final obturator, which completely replaces the missing tissues and fills the defects of the latter. The final prosthesis can be made 6 months after the operation. However, the terms may vary depending on the size of the defect, the progress of healing, the prognosis of tumor control, the effectiveness of the obturator, and the presence or absence of teeth.

The size and location of defects affect the course of prosthetics and the prognosis of successful treatment.

The choice of restoration method depends on the cause of the defect, its localization, size, degree of expression, age and willing of the patient, diseases, complications that occurred during the surgery, refusal of the patient from further restorative treatment[8,11]

The lack of tissue, which leads to a decrease in the support surface of the prosthesis, leads to a decrease in retention and stability. They are the main complications of orthopedic treatment of maxillofacial patients.[9] Therefore, at the stage of prosthetics planning, the available tissues and teeth should be used as much as possible, trying to minimize these problems as much as possible. A combination of surgical and orthopedic treatment of patients with resection of the upper jaw is mandatory.[12,13] It should be noted that scarring changes that occur in the post-traumatic or post-operative stage in the maxillo-facial region directly led to permanent changes in the contours of the face, the return of which to the aesthetic norm requires certain surgical interventions. It is possible to correct deformations with the help of certain surgical interventions.[14-18]

The purpose of this case report is to demonstrate the benefits and applicability of appropriate maxillofacial prosthetic rehabilitation following surgical resection cancer of the upper jaw.

Clinical case

A 52-year-old man was diagnosed with cancer of the upper jaw, and according to the patient's treatment plan, resection of the upper jaw was to be performed. For the manufacture of the surgical obturator, an impression was made with alginate impression material. In a well-planned extensive operation, which will be accompanied by the loss of soft tissues and bone support, a surgical obturator is applied, obtained as a result of joint work with the surgeon at the preparatory stage. The impression was sent to the laboratory, from which a plaster model was obtained. The areas to be resected were marked by the surgeon on the model (figure 1), immediate surgical obturator was made in the laboratory according to the instructions (figure 2 a, b). The latter was placed in the oral cavity during the operation itself. Correction of

the surgical obturator was performed during several post-operative appointments (Figure 3).

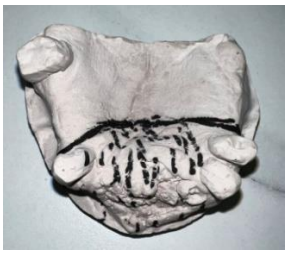
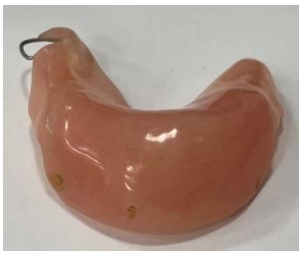
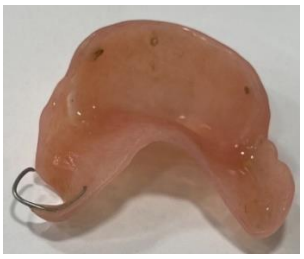


Figure1. The part to be removed is projected onto the initial model





Figures 2 a, b. Immediate surgical prosthesis

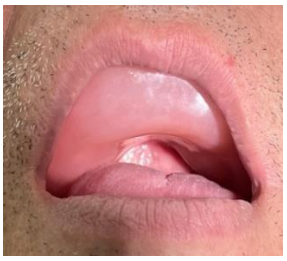


Figure 3. Immediate surgical prosthesis in the oral cavity

The long and painful edges were polished, the edges were enlarged in some areas with the help of acrylic material, and refixation with soft acrylic was also performed to control the directed regeneration of soft tissues (Figure 4).

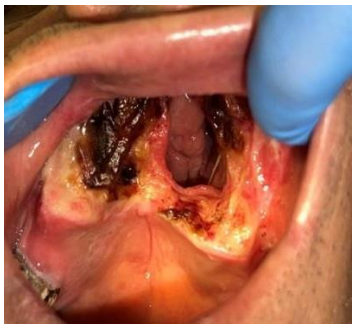


Figure 4. The appearance of the defect after surgery

Only after the final healing of the adjacent tissues is it possible to make the final prosthesis, which is carried out in five treatment visits. The first treatment visit, which is held a few hours after the surgical stage, after healing of tissues in the area of the defect, is a preliminary impression of an individual spoon. At this stage, they determined the class of the defect, evaluated the tissue of the wound area, the state of the existing teeth, the appearance, and then proceeded to take an impression. After resection of the upper jaw, the patient's aesthetic problem is combined with functional problems drooping of the upper lip and asymmetry of the face. According to Aramani, the defect formed belongs to the VI class of the classification of acquired defects of the upper jaw.[19] There are 27 teeth on the jaw, which were used during prosthetics as a support with the available tissues, maximally contributing to the stability and retention of the prosthesis.

Gauze soaked in Vaseline was placed in the holes opening into the nasal cavity and adjacent cavities in the area of the defect to avoid the penetration of the remnants of the stamp material into the alveolar cavities surrounding the defect (Figure 5). Then, with the help of a standard, modified beeswax spoon of the appropriate size and a modified syringe (for introducing the impression material into the area of the defect), an alginate impression (Figure 6) was made with the subsequent production of an individual spoon in the dental laboratory.

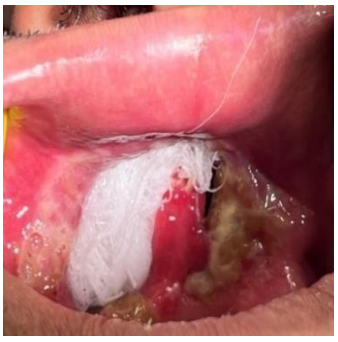


Figure 5. The opening to the nasal cavity is closed with vaseline-coated gauze

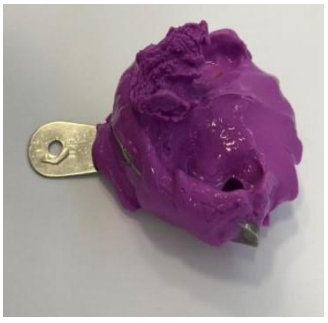


Figure 6. Initial alginate impression

During the second treatment visit, an individual evaluation of the spoon, oral testing, formation of the edges and areas of the defect with the help of thermoplastic impression material and obtaining the final impression with the help of silicone impression material were carried out.

First, we form the edge of an individual impression tray with a thermoplastic stamp, and then proceed to the part of the defect. The design of an individual impression tray, inserted into the area of the defect, is of great importance for the complete preparation of the occlusal part of the future prosthesis, the elimination of the defect, and is aimed at correcting the symmetry of the face and the appearance of the cleft lip. For this, we shape the surface of the obturator part of an individual impression tray, directed to the soft tissues of the lip and saliva, with a thermoplastic stamp, applying several layers.

Then we apply glue on the inner surface and edge of the impression tray and make a stamp with a silicone stamp, covering the throat cavities with a stamp lubricated with petroleum jelly.

After solidification of the impression material, it is extracted from the oral cavity, evaluated, sent to the laboratory, where the dental technician receives the plastic support of the prosthesis and sends it to the clinic for the next treatment appointment.

During the third visit first, we evaluate the plastic support in the oral cavity, then we move on to the confirmation of the back edge of the upper tooth row (A-line), which is performed in the same way as with ordinary prosthetics. Then they made a roller and installed it on the support of the prosthesis at the level of natural teeth. They noted the vertical height of the face, the intermaxillary central ratio, the contour of the smile and the midline of the face (Figure 7). They conduct buccal protocol and fix the model of the upper jaw to the articulator, after which the model of the lower jaw is also fixed to the articulator with a plaster bandage with the recording of the centric relation. At the end of the visit, as a result of the conversation with the patient, the color and shape of the teeth were determined. Preliminary alignment of the teeth was performed on the articulator in the laboratory (Figure 8).

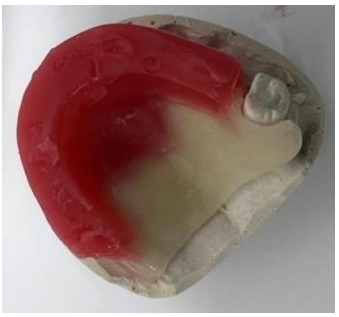


Figure 7. Wax roller after

Figure 8. Upper denture on hard abutment

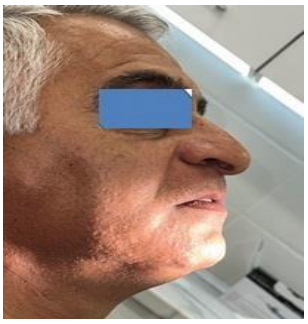


Figure 9. Esthetic assessment of dentures.Recording the intermaxillary relationship

During the fourth appointment, an initial alignment test is performed, vertical height and central ratio are checked, eccentric ratio is recorded, aesthetic assessment by the doctor and the patient (Fig. 9), registration of existing inaccuracies, transfer to the laboratory for correction and final preparation of prosthetics are completed.

And on the during the fifth appointment, a custom-made prosthesis (fig. 10 a, b, c, d) was placed in the oral cavity, the final aesthetic appearance of the patient was evaluated (figure 11), the final aesthetic appearance of the patient was evaluated (fig. 11), pronunciation, correspondence of the prosthesis to the tissues of the oral cavity.

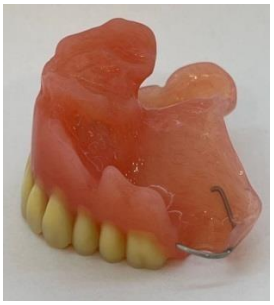


Figure 10 a. View of the final prosthesis from the left side

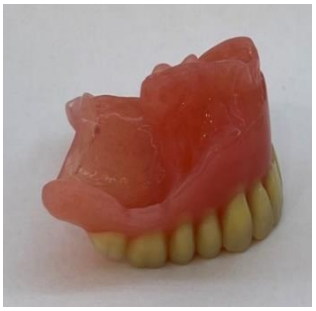
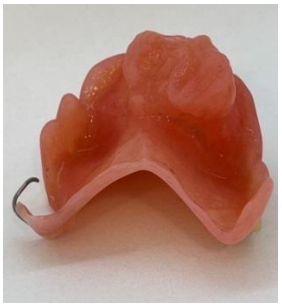
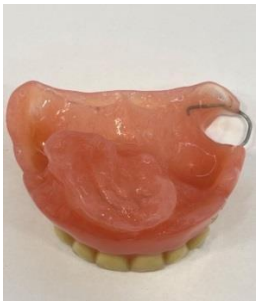


Figure 10 b. View of the final prosthesis from the right side





Figures 10 c, d. Final prosthesis on the windward side

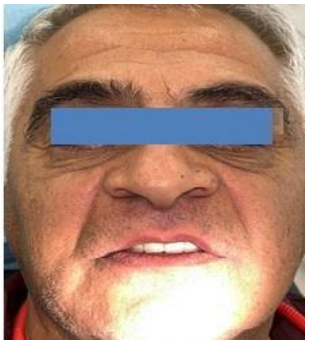


Figure 11. Esthetic assessment of dentures

Applying zinc oxide paste to the inner surface of the prosthesis, placing it in the oral cavity, we first found contact points, then long edges, thick areas and all asymmetries. Places of premature contact should be selectively grinded if necessary.

Since the healing of tissues is still ongoing, the tissues surrounding the defect are constantly changing. Added to this was the fact that our patient removed the obturator in the evening before going to bed (which is undesirable in all cases). And, finally, after all the corrections, the prosthesis was handed over to the patient and the necessary instructions for the care of the prosthesis were given. A final prosthesis was planned to be made 6 months after the surgery. In the future, the prosthesis will be relined regularly.

Discussion

Prosthetics of maxillofacial defects, which is the maximum possible restoration of missing tissues with the help of an obturator, minimizes both functional and mental problems of the patient, contributing to his integration into society.[20,23] Maxillary obturator is very important in the speech rehabilitation of patients with surgically acquired maxillary defects.[24]

Immediate surgical obturators have facilitated retention of the surgical bandage, promoting healing with minimal postoperative infection and scar contracture formation. This ensured the restoration of acceptable aesthetics and maintenance of oral function at an acceptable level in the initial postoperative period. The definitive obturators restored aesthetics, oral function, and fluid management to a satisfactory level. Satisfactory functional and aesthetic results are achieved in patient with extensive acquired defects of the upper jaw after surgical resection cancer using obturator prostheses.

Conclusion

The loss of any part of the maxillary region, in addition to physical problems, causes severe mental trauma to the patient. Prosthodontic treatment should be started before the operation, taking into account that the patient should be given the best rehabilitation assistance. Cooperation between the surgeon and the maxillofacial orthopedist during treatment is mandatory, as joint activity leads to full recovery.

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Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest**.**

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ՎԵՐԻՆ ԾՆՈՏԻ ԵՐԿԿՈՂՄԱՆԻ ՌԵԶԵԿՑԻԱՅԻ ԺԱՄԱՆԱԿ ՎԵՐԱՀՍԿՎՈՂ ՎԵՐՔԵՐԻ ԲՈՒԺՄԱՆ և ՕՐԹՈՊԵԴԻԿ ԲՈՒԺՄԱՆ ԱՌԱՆՁՆԱՀԱՏԿՈՒԹՅՈՒՆՆԵՐԸ. ԿԼԻՆԻԿԱԿԱՆ ԴԵՊՔ

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Ամփոփում

Դիմածնոտային օրթոպեդիան զբաղվում է դիմածնոտային շրջանի բնածին և ձեռքբերովի արատների պրոթեզավորումով, որոնք առաջանում են նորագոյացությունների ծնոտների ռեզեկցիայից, ինչպես նաև վնասվածքների հետևանքով:

Դիմածնոտային շրջանի արատների առկայության դեպքում ներկայումս օգտագործվում են բուժման տարբեր մեթոդներ, այդ թվում՝ շարժական պրոթեզավորում, թերության վերականգնում անոթային հենաշարժական ավտովոխպատվաստումով և պրոթեզավորում՝ իմպլանտների միջոցով: Այս ուղղությունը հակված է հետագա զարգացման և կատարելագործման, ինչը կնպաստի հիվանդի լիարժեք ինտեգրմանը հասարակությանը: Այս հոդվածը ներկայացնում է վերին ծնոտի ռեզեկցիոն արատի պրոթեզավորման կարգը (կլինիկական դեպք), որին հաջորդում է պրոթեզային վերականգնումը:

ОСОБЕННОСТИ УПРАВЛЯЕМОГО ЗАЖИВЛЕНИЯ РАН И ОРТОПЕДИЧЕСКОГО ЛЕЧЕНИЯ ПРИ БИЛАТЕРАЛЬНОЙ РЕЗЕКЦИИ ВЕРХНЕЙ ЧЕЛЮСТИ. КЛИНИЧЕСКИЙ СЛУЧАЙ

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Резюме

Стоматологическая и челюстно-лицевая ортопедия занимается протезированием врожденных и приобретенных дефектов челюстно-лицевой области, возникших в результате резекции новообразований челюстей, а также травм. При наличии дефектов челюстно-лицевой области в настоящее время применяют различные методы лечения, в том числе съемное протезирование, замещение дефекта васкуляризированными аутотрансплантатами, протезирование имплантатами. Данное направление имеет тенденцию к дальнейшему развитию и совершенствованию, что будет способствовать полной интеграции пациента в общество.
В статье представлено протезирование резекционного дефекта верхней челюсти (клинический случай) с последующим ортопедическим восстановлением.

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CRYSTALLINE OXIDE CERAMICS AT VARIOUS STAGES OF THE TECHNOLOGICAL PROCESS COMPARATIVE CHARACTERISTICS OF THE TECHNOLOGICAL PROCESS

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Abstract

The article discusses research about microstructure of crystalline oxide ceramics at stages of the technological process. It is proved that the introduction of stabilizing substances into the composition of oxide ceramics leads to homogenization of the basic substance and to smoothing between crystal contacts. This leads to hardening of the ceramic.

Keywords: *zirconium dioxide, crystalline oxide ceramics, technological stages of ceramics production, aluminium oxide*

Intraduction

Ceramic is a biocompatible and inert material and has a high degree of intraoral stability. Therefore, they can be safely used in the oral cavity. However, ceramics are brittle and break easily.[1]

Most high-performance ceramic products are based on oxides, nitrides, carbides and borides of high purity with a carefully controlled composition. High performance ceramics can be divided into two main categories; structural and functional ceramics. Typical structural ceramics - aluminum oxide (Al_2O_3), zirconia (ZrO_2), silicon nitride (Si_3N_4) and silicon carbide (SiC). However, Ceramics based on Al_2O_3, ZrO_2 and SiC also often used as functional ceramics. Other functional ceramics of technological interest are barium titanate ($BaTiO_3$) and lead zirconate titanate ($Pb(Ti,Zr)O_3$). To combat this weakness, ceramics are usually particle-reinforced, supported by metal, or made exclusively from polycrystalline material.

All-ceramic materials clearly have quality characteristics through biocompatibility, mechanical strength, low heat transfer and consistently high aesthetics.[2]

Ceramic materials exhibit creep deformation at temperatures above about half their melting point.

Non-contact 3D scanning and digital computer modeling with subsequent milling are not only adapted to friction surfacing, but also provide high accuracy of the edge section of the carcass material.

Various clinical studies prove the optical stability of all-ceramic systems, a high level of biological and functional indicators.[3]

Polycrystalline zirconium oxide, which does not contain glass, is a reliable and effective innovative system that allows obtaining clinically stable results with minimal complications. Improved material strength, improved aesthetics and high biocompatibility give zirconia ceramics great potential for use in a wide range of promising clinical applications.[4]

Microstructural changes of polycrystalline oxide porcelain occur at all stages of the technological process, be it chemical synthesis, grinding, cleaning from mixtures, introduction of stabilizing additives, pressing or firing.

Moreover, the physical-mechanical profile of these glasses (strength, resistance to bending) is determined not only by the crystal structure, but also by the phase transformation under loading.[5-9]

Electron microscopic studies will provide clinically important data on the microstructure of polycrystalline oxide porcelains, which will clarify the optimal limits of the technological process of material processing and will improve the clinical efficiency of all-ceramic structures.[10-16]

Objectives

To evaluate the microstructure of polycrystalline oxide glasses at different stages of the technological process.

Materials and methods

According to the chemical and structural composition, we have identified four types of materials under study: unrefined, without stabilizing additives, zirconium dioxide:

- pressed polycrystalline zirconium stabilized with yttrium
- alumina from a natural deposit
- extruded aluminum oxide (99.5% Al_2O_3)

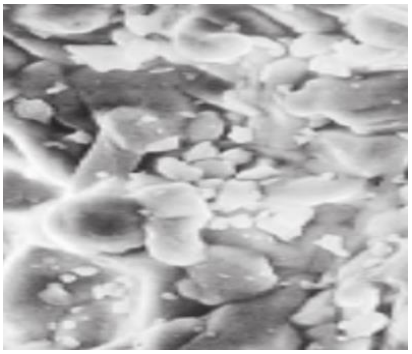
The study was carried out using a Pictoval microscope, the studied materials were magnified 3500 times.

Results and Discussion

The following criteria for the evaluation of the microstructure of polycrystalline oxide glasses are based on research:

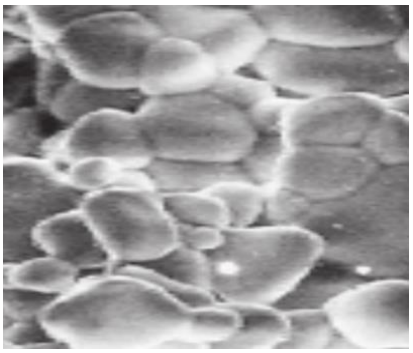
- phase homogeneity
- structural saturation with crystals
- placement of crystals
- type of crystal borders

This method allows not only to obtain a visual image of the microstructure, but also to determine the density of the investigated material.



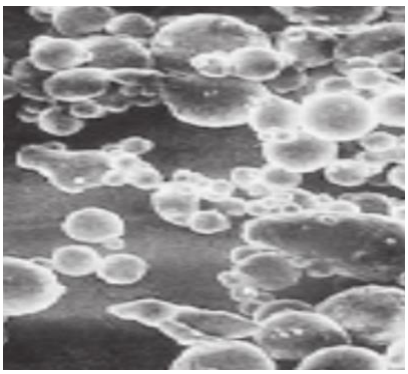
Picture 1. Dioxide of unrefined zirconium without stabilizing additives

Phase heterogeneity is observed. Multiple conglomerates are present.



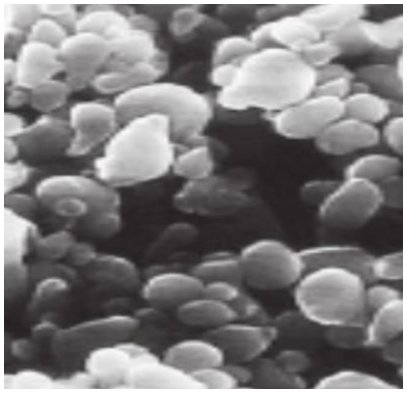
Picture 2. Pressed polycrystalline zirconium, yttrium stabilized

The homogeneity of the phases is obvious, the structure of the material is homogeneous, the crystals have a distinct ovoid shape.



Picture 3. Aluminum oxide from natural deposits

Phase inhomogeneity is present, the amount of aluminum oxide crystals is small, a disproportionate local clustering of crystals is observed. Crystals do not have a specific shape.



Picture 4. Pressed aluminum oxide (99.5% Al_2O_3)

A pronounced phase homogeneity, homogeneous microstructure is observed. Aluminum oxide crystals have an elongated shape. The boundaries of the crystals are smooth, without sharp touches.

It is obvious that the absence of stabilizing additives in the zirconium dioxide material will not contribute to the ordered crystal microstructure in case of firing and pressing.

Chemically synthesized aluminum oxide has the ability to undergo transformational changes at various stages of compression and firing, when oval crystals become elongated. In that process, internal energy is generated, which ensures the stability of the crystal structure.

Expressed homogeneity of phases, homogeneous microstructure is observed. Aluminum oxide crystals have an elongated shape. The edges of the crystals are even, without sharp strokes.

From the above, we conclude that the stabilizing additives regulate the arrangement of the crystals, excluding the pointed contacts of the crystals, thereby ensuring the evenness and phase homogeneity of the arrangement of the crystals.

Conflict of interest and financial disclosure

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Հակոբյան Աննա,[1] Վանյան Նվարդ,[2] Զուլումյան Աննա,[3] Երանյան Մերի,[4] Սաղաթելյան Լիլիթ [5]

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Ամփոփում

Հոդվածում քննարկվում է տեխնոլոգիական պրոցեսի տարբեր փուլերում օքսիդ կերամիկական զանգվածների միկրոկառուցվածքի ուսումնասիրությունը:Հաստատվում է, որ կայունացնող նյութերի ներմուծումը օքսիդ կերամիկայի բաղադրության մեջ հանգեցնում է բազային նյութի համասեռացման և միջբյուրեղային շփումների հարթեցման՝ դրանով իսկ դրականորեն ազդում է օքսիդային կերամիկայի ամրության բնութագրերի վրա:

СРАВНИРЕЛЬНАЯ ХАРАКТЕРИСТИКА КРИСТАЛЛИЧЕСКИХ ОКСИДНЫХ КЕРАМИК НА РАЗЛИЧНЫХ ЭТАПАХ ТЕХНОЛОГИЧЕСКОГО ПРОЦЕССА

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Резюме

В статье обсуждается исследование микроструктуры оксидных керамических масс на различных этапах технологического процесса.Обосновывается,что введение в состав оксидной керамики стабилизирующих веществ приводит к гомогенизации основного вещества и сглаживанию межкристаллических контактов, тем самым положительно сказываясь на прочностных характеристиках оксидных керамик.

Hakobyan A, Vanyan N, Zulumyan A, Eranyan M, Saghatelyan L. Comparative characteristics of crystalline oxide ceramics at various stages of the technological process. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):90-94. doi: 10.58240/1829006X-2023.19.2-90

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CLINICAL ARTICLES

RECONSTRUCTION OF POST-TRAUMATIC DEFECTS OF THE EXTERNAL EAR AND NOSE WITH AUTOLOGOUS COSTAL CARTILAGE

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Abstract

Traumatic ear amputation and post-traumatic nose defect are aesthetic deformities that can have negative consequences (lead to psychological trauma), leading to a change in the quality of life.

The presented clinical case describes a protocol for the reconstruction of a partially amputated defect of the external ear and nose, which required various surgical steps; including the removal of cartilage from the ribs, followed by the creation of a cartilaginous model of the ear, the introduction of its subcutaneous region behind the ear, taking into account the anatomy of the outer ear as much as possible. The second stage after 1.5 months is the restoration of the amputated ear area with a combined superficial temporal fascial flap, costal cartilage with suturing to the amputated part of the ear and dorsal rhinoplasty using modeling costal autocartilaginous flap. The postoperative result is satisfactory with the restoration of a good aesthetic appearance of the ear and nose.

Reconstruction of the external ear after partial traumatic amputation and post-traumatic nose defect with autocartilage from the ribs provides a stable aesthetic result and becomes the method of choice for such injuries.

Keywords: *post-traumatic defects, external ear, nose, autologous costal cartilage, reconstruction*

Introduction

Although traumatic subtotal ear amputation (EA) is relatively rare, it is a serious aesthetic deformity that can have a huge negative impact on the patient's psychological state.[1]

Various surgical methods for EA reconstruction have been described in the literature, ranging from simple reattachment to microsurgical reconstruction of the damaged ear.[2]

The problem of reconstruction of Acquired defective auricles (UR) is one of the most difficult tasks of reconstructive and plastic surgery. On the one hand, this is due to the complex relief design of its cartilaginous frame, covered with delicate and thin skin, which is very difficult to recreate due to the lack of an "ideal" donor material. On the other hand, the UR is a paired organ that makes up the appearance of a person, the reproduction of which requires maximum similarity with the healthy side both in

terms of geometric proportion and symmetry, and in terms of overall shape.

The causes of traumatic subtotal ear amputation of the external ear are different: car accidents, accidents related to sports or work, attacks, animal bites, benign or malignant tumors, burns.

Luo et al[3]. classified acquired deformities of the ear depending on the affected tissue components, the size of the defect and the condition of the surrounding soft tissues into 5 types, for each of which different methods of reconstruction are used.

- Type I: severely scarred ear without cartilage deficiency;
- Type II: partial full-layer defects;
- Type III: most or complete ear loss, periauricular skin intact;
- Type IV: Major or complete ear loss, periauricular skin involved;
- Type V: Major or complete loss of healthy surrounding skin and soft tissue due to inaccessibility of TPF unavailability.

The residual ear helps maintain an elevated ear position, but results in an abnormal-looking connection between the normal and reconstructed ear. The anatomical complexity of the ear makes reconstruction particularly challenging, and postoperative results are often disappointing.

Reconstruction of acquired ear deformity is a complex operation and requires individual reconstruction.[4-7] The gold standard for ear reconstruction after trauma is the reconstruction using autologous costal cartilage proposed by Tanzer[8] and soft tissue covering of postauricular skin flaps. This was later by Nagata and Firmin.[9-14] The method developed by Nagata can only correct the upper helical area of a constricted ear.

The extreme variety of post-traumatic defects and deformities does not allow us to offer universal methods of surgery. Moreover, with seemingly identical defects in size and shape, surgeons offer various options for plastic surgery. There is considerable controversy regarding the determination of the definitive method of recovery from subtotal ear amputation. Surgical intervention in such cases is often the patient's last chance to return to a full life in society.

Despite the variety of proposed methods of otoplasty, there is no single standard for the optimal solution of this problem.[15,16]

Among the defects of the nose, a saddle type of nose is often found, in which the aesthetics of the face are disturbed, which makes the patient turn to the rhinoplasty method.[17,18]

Autologous costal cartilage is widely used in plastic surgery procedures (such as rhinoplasty, ear microtia reconstruction, and skull reconstruction) because it does not lead to complications.[19-21]

Autogenous costal cartilage can be extracted in large quantities and poses few problems during healing.[22]

The technology of the entire cartilaginous sheath is evolving, reflecting an improvement in shape, each time including new framework elements.

Autologous cartilage is the preferred source of material for dorsal rhinoplasty as it ensures the quality of the cartilage.[23,24] During surgery for aesthetic reasons, an autologous rib often serves as a source of plastic material; it can be successfully used as a donor graft in patients with a dorsal nasal defect.

The current variety of methods for eliminating defects in UR and dorsal rhinoplasty indicates the absence of an optimal method, the results of which would suit surgeons and patients.[25-27]

To date, according to the literature, there is no system for choosing the optimal material for the reconstruction of the dorsal nasal defect, depending on the clinical situation.

All of the above indicates the relevance of this problem, which requires a detailed scientific study in order to develop optimal reconstruction methods depending on the type, location and size of the defect.

In the presented clinical case, the author describes a protocol for the reconstruction of a partially amputated external ear, and a post-traumatic deformity of the nose, which required various surgical steps.

Clinical case

The patient complains about the absence of the upper 1/3 of the ear, due to post-traumatic deformity of the nose (figure 1).

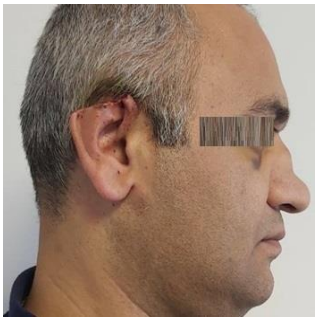

Figure 1. Lateral profile of the patient with absence of the upper 1/3 of the ear, post-traumatic deformity of the nose

Treatment plan

1. Reconstruction of the missing part of the upper 1/3 of the ear with own cartilage (autograft)
2. Recovery free flap
3. Nose reconstruction

The guiding principle is to create a template of the normal ear and transfer it to the affected ear in order to assess the extent of the defect and determine which ear contours are missing. For the reconstruction of the upper third, a mastoid skin flap was used with a cartilage graft selected taking into account the size of the defect and the need for a cartilage graft.

At the first stage, a model is made, printed from a mirror image of the scan of the other ear (figure 2).

After adjustment, the template is aligned symmetrically to the contralateral ear using the ear-to-nose ratio, lateral bevel angle, and lobe position.

Figure 2. Model printed from a mirror image of the scan of the other ear

Surgical procedures

Rib preparation and frame fabrication

First, the chest wall in the projection of the ribs, 8,9, the incision site is marked (figure 3). Incision was made through the 8 intercostal space to split the rectus abdominis and expose the ribs 8,9 and osteotomized ribs 8 with a piezotome (figure 4). A negative pressure drain was placed at the donor site, and the rectus abdominis, fascia, subcutaneous tissue, and skin were sutured using 3-0, 4-0 Vicryl, and 5-0. From the resulting rib graft, an ear skeleton was formed on the ear model (figure 5).

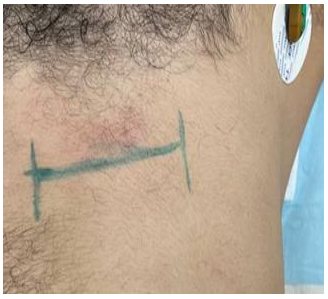

Figure 3. On the chest wall in the projection of the ribs 8.9, the incision site is marked

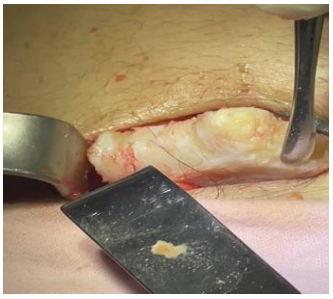

Figure 4. Expose the ribs 8 and osteotomized with piezotome

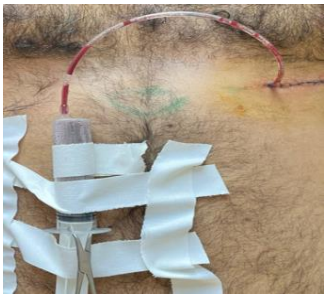

Figure 5. Drain was placed at the donor site, and skin were sutured using 3-0, 4-0 Vicryl, and 5-0

Received a block of the cartilage of the eighth rib, trying to avoid damage to the pleura (figure 6 a, b, c, figure 7). A curved incision is made along the hairline over the intended ear region in accordance with the previously marked superficial temporal artery. After making a pocket in the back of the ear region, the prepared auricle frame with the missing parts was implanted under the skin, after which the wound was sutured (figure 8). Part of the remaining rib was preserved in solution for use in rhinoplasty.

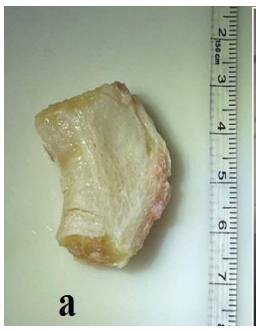

Figure 6 a. Obtained block of cartilage of the eighth rib

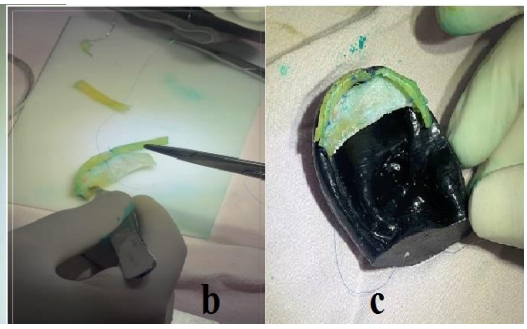

Figure 6 b, c. From the obtained rib graft, an ear skeleton was formed on the ear model

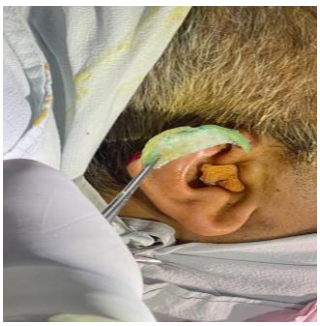

Figure 7. Formed ear frame tried on the ear

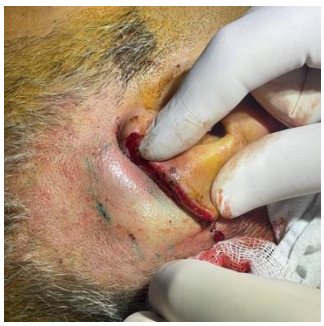

Figure 8. Prepared auricle frame with the missing parts was implanted under the skin

The second stage in 1.5 months

For exposing costal cartilage, the incision site is marked on the skin behind the ear region. After the incision, the formed costal cartilage of the formed missing part of the ear is exposed. Facial surface - with pedicle, Posterior surface - fascia + free flap combining superficial temporal fascial flap with costal cartilage graft removed. After refreshing the edges of the residual part of the ear, the superficial temporal fascial flap with a graft of costal cartilage was sutured on the amputated part of the ear, thereby restoring the anatomical shape of the injured ear. The pedicled flap was chosen to avoid severe congestion (figure 9 a, b, c, d). Drain was placed at the reception site, skin was sutured using 3-0, 4-0 Vicryl, and 5-0 (figure 10).

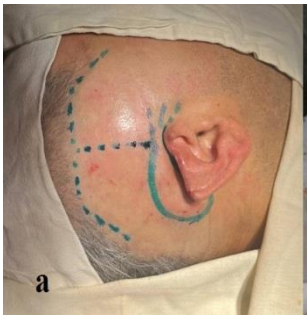

Figure 9a. Incision site is marked on the skin behind the ear region

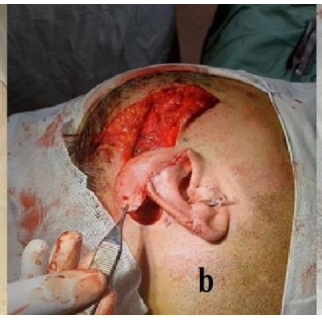

Figure 9b. After the incision, the formed costal cartilage of the formed missing part of the ear is exposed

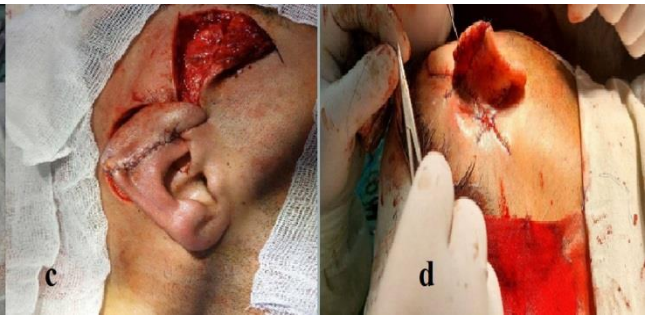

Figure 9 c, d. Combining superficial temporal fascial flap with costal cartilage graft removed and sutured on the amputated part of the ear

Figure 10. Drain in reception site, skin was sutured using 3-0, 4-0 Vicryl, and 5-0

Nose reconstruction

To design an implant for dorsal augmentation the cartilage is periodically soaked in saline for 10-20 min to carefully monitor signs of warping. Once warping is evident, the remaining peripheral concave portion of the cartilage is cut out keeping the central core figure (Figure 11). The final dorsal graft is a canoe-shaped graft when seen from above. When seen from the lateral view, it has a slightly concave side that comes into contact with the nasal dorsum, and the skin side is slightly convex (Figure 12).

Figure 11. A dorsal onlay graft carved from a rib cartila

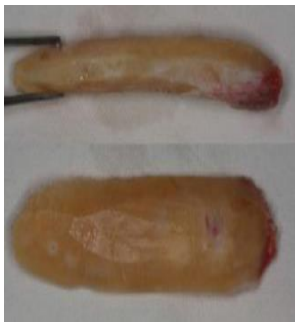

Figure 12. Modeled costal autocartilage final graft has a canoe-like shape from the frontal view and a slightly convexity in the dorsal side when seen from the lateral view

After an internal incision and exposure of the dorsal part of the deformed nose, the molded costal autocartilage graft was placed on the recipient site in the area of the defect (Figure 13,14).

Figure 13. Exposure of the dorsal part of the deformed nose

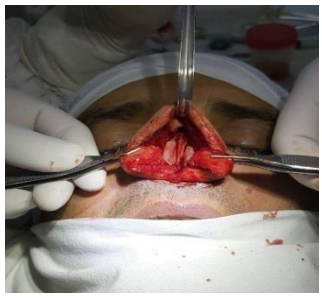

Figure 14. Insertion of the dorsal graft, the molded costal autocartilage graft was placed in the defect

At the end of the operation, the skin flap was returned to its normal anatomical position and closed with 5/0 nylon sutures. The final position of the graft was corrected by external manual manipulations (Figure 15).

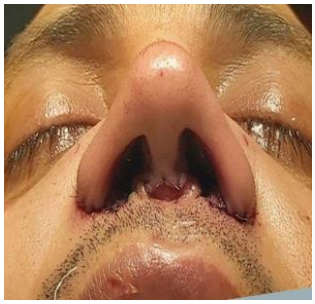

Figure 15. The skin flap was returned to its normal anatomical position and closed with 5/0 nylon sutures

To minimize soft tissue edema and graft displacement at the end of rhinoplasty, a Steri-Strip bandage was applied to the entire back of the nose for a week, the length of stay in the hospital was 2.4 days. Antibiotics of the third-generation cephalosporin series are used for prophylaxis; no other treatment is used to suppress the immune system. Patients were observed the next day after the operation, then every 2 days, then 2, 6 and 12 months after the operation. Aesthetic results of ottoplasty dorsal rhinoplasty were assessed by preoperative and postoperative photographs, as well as by visual examination (Figures 16, 17, 18). Reconstructed by our method showed good results without deformation during the first year after the operation.

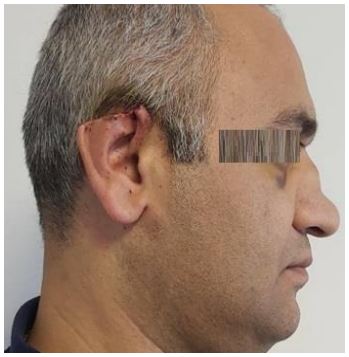

Figure 16. Preoperative photographs lateral profile of the patient

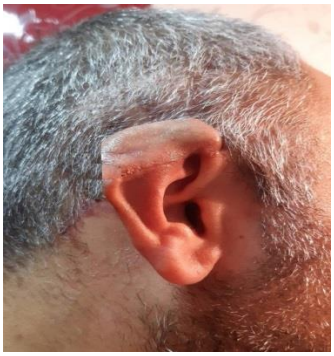

Figure 17. Photographs lateral profile of the patient, after ottoplasty

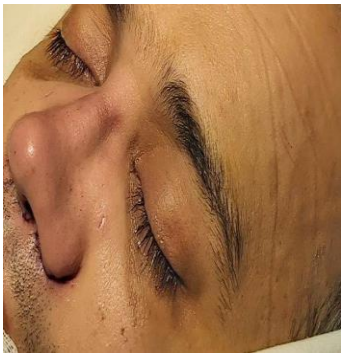

Figure 18. Lateral profile of the patient, after dorsal rhinoplasty

Disscussion

The presence of deformities and defects of the auricles, nose, in addition to a physical defect, leads to psychological trauma, the result of which is a change in the quality of life.[28,29] This is expressed in the limitation of social contacts, low self-esteem, anxiety, changes in personal attitudes and values.

Alloplastic scaffolds do not always take root in UR plastics, and the use of cartilage in the opposite UR does not allow for an adequate complete reconstruction.[30,31]

After injury, various ear defects are observed, partial, subtotal or total, which require complex contour reconstruction. The main principle is to create a template of the normal ear and transfer it to the affected ear. If the defect is less than a quarter and two planes of the ear are missing, then a fibrocartilage graft can be used to reconstruct the defect. If more than two planes or more than a quarter of an ear are missing, costal cartilage is required for reconstruction. In cases of subtotal and total amputation, costal cartilage is required for reconstruction. The presence and quality of local skin will determine if any fascia is required, indirect tissue expansion, and the number of steps to achieve the desired end result.

In the presented clinical case, the effectiveness of the reconstruction of the missing part of the upper 1/3 of the ear and the reconstruction of the bridge of the nose using an autocartilage graft is reported, presentes some principles and guidelines that will enable an accurate surgical treatment plan to be drawn up.

Evaluation of the results of operations performed using a cartilage graft showed a low antigenicity of cartilage tissue, the use of this material made it possible to achieve stable positive aesthetic and functional results. Cartilage graft selection criteria for esthetic rhinoplasty of the dorsal nose, such as microstructure, biochemistry and mechanics, contribute to good procedure results with the least graft resorption.

Our technique can provide good surgical results in traumatic cases where one third of the upper helix is lost. The operation is a safe and reliable technique in traumatic cases.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

The study was approved by the Institutional Review Board and performed in accordance with the principles of the Declaration of Helsinki. Written informed consents were obtained.

Patient consent

The patient provided written informed consent for the publication and the use of their images.

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ԱՐՏԱՔԻՆ ԱԿԱՆՋԻ և ՔԹԻ ՀԵՏՎՆԱՍՎԱԾՔԱՅԻՆ ԱՐԱՏՆԵՐԻ ՎԵՐԱԿԱՆԳՆՈՒՄ ԿՈՂԱՅԻՆ ԱՃԱՌՈՎ. ԿԼԻՆԻԿԱԿԱՆ ԴԵՊՔ

Ռաֆիկ Գ. Շահպարոնյան [1]

[1] պլաստիկ և դիմածնոտային վիրաբույժ, պլաստիկ և դիմածնոտային վիրաբուժության բաժանմունքի վարիչ, Սուրբ Գուրիգոր Լուսավորիչ բժշկական կենտրոն, Երևան, Հայաստան

Ամփոփում

Արտաքին ականջի վնասվածքային անդամահատումը և քթի հետվնասվածքային արատը էսթետիկ դեֆորմացիաներ են, որոնք կարող են ունենալ բացասական հետևանքներ՝ (հոգեբանական տրավմա) հանգեցնելով կյանքի որակի փոփոխության:

Ներկայացված կլինիկական դեպքը նկարագրում է մասամբ անդամահատված արտաքին ականջի և քթի արատի վերականգնման արձանագրություն, որը պահանջում էր տարբեր վիրաբուժական քայլեր՝ ներառյալ

կողերից աճառի ստացում, որին հաջորդում է ականջի աճառային մոդելի ստեղծումը՝ հնարավորինս հաշվի առնելով արտաքին ականջի անատոմիան, ականջի հետևում ականջի աճառային մոդելի ենթամաշկային շրջանի ներմուծում: Երկրորդ փուլում՝1,5 ամսից հետո, ամպուտացված ականջի վերականգնումն է համակցված մակերեսային ֆասցիալ և կողային աճառով և ռինոպլաստիկա՝ օգտագործելով մոդելավորված կողային աճառ: Հետվիրահատական արդյունքը գոհացուցիչ է ականջի և քթի լավ էսթետիկ տեսքի վերականգնմամբ:

Արտաքին ականջի վերականգնումը մասնակի վնասվածքային անդամահատումից և քթի հետվնասվածքային արատից հետո կողոսկրերից ավուտոճառով ապահովում է կայուն էսթետիկ արդյունք և դառնում ընտրության մեթոդ նման վնասվածքների դեպքում:

РЕКОНСТРУКЦИЯ ПОСТТРАВМАТИЧЕСКИХ ДЕФЕКТОВ НАРУЖНОГО УХА И НОСА АУТОЛОГИЧНЫМ РЕБЕРНЫМ ХРЯЩОМ

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Абстракт

Травматическая ампутация уха и посттравматический дефект носа являются эстетическими деформациями, которые могут иметь негативные последствия (приводить к психологической травме), приводящие к изменению качества жизни.

Представленный клинический случай описывает протокол реконструкции частично ампутированного дефекта наружного уха и носа, потребовавший различных хирургических этапов; включая получение хряща из ребер с последующим созданием хрящевой модели уха максимально учитывая анатомию наружного уха, внедрением его подкожной области за ухом,. Второй этап через 1,5 месяца восстановление области ампутированного уха комбинированным поверхностным височным фасциальным лоскутом с реберным хрящом с подшиванием на ампутированную часть уха и дорсальной ринопластикой с использованием L-моделированного реберного аутохрящевого лоскута. Послеоперационный результат удовлетворительный с восстановлением хорошего эстетического вида уха и носа.

Реконструкция наружного уха после частичной травматической ампутации и посттравматического дефекта носа аутохрящом из ребер обеспечивает стойкий эстетический результат и становится методом выбора при таких повреждениях.

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CLINICAL ARTICLES

OUR EXPERIENCE WITH THE CORRECTION OF PROTRUDING EARS: CLINICAL CASE SERIES

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Abstract

Many methods have been developed to correct protruding ears, but the best one should be simple, reliable, and reproducible.

Obectives: The purpose of our study is to evaluate the effectiveness of protruding ear correction.

Materials and Method: This is a 5-year retrospective study (2018–2023) of 103 patients with protruding ears. Patients were followed up for at least a year after surgery.

A modified Mustarde technique procedure was applied. Incision made high at the level of the retroauricular projection of the retroauricular fossa to make it more difficult to see. After that, the skin is carefully separates from the cartilage. The cartilage is trimmed followed by the formation and modeling of the cartilage configuratio so that the auricle acquires a normal and natural shape. We stabilize the newly reconstructed antihelix using two to three stitches of Vycryl 4/0. Elastic bandage is worn for seventh day. The sutures were removed at the consultation on the 7–10 postoperative day. Patients were followed up at 3, 6, and 12 months followed by yearly intervals for 3-5 years. Data on functional and aesthetic outcomes were documented. Preoperative and postoperative photographs were also taken of all patients. The result was assessed on a visual analogue scale by the patient. Patient satisfaction was assessed in accordance with the indicators of the questionnaire, in which their degree of satisfaction was assessed on a 4-point scale: 1 (poor), 2 (satisfactory), 3 (good) and 4 (Great). Parameters included: improvement in the natural contour of the ears, improvement in frontal vision, improvement in the asymmetry of the concho-mastoid angle.

Results: In study, hemorrhages, hematomas, keloid formations, suture extrusion, skin and cartilage infections, skin necrosis and recurrences were not observed in any patient.

The average score of the the patient's is 8.4. The average concho-mastoid distance before the operation is 2.2 cm, after the operation it decreases to 1.4 cm. Clinical evaluation showed excellent results (58.7%), good results (28.6%), satisfactory results (12.7%) and without poor results.

Conclusion: Correction of protruding ears using this technique is safe and simple. Serious complications were not observed, good aesthetic results were obtained. The applied technique is universal, gives good results and has a low level of complications.

Keywords: *prominent ears, cosmetic ear surgery, chongchet technique, otoplasty*

Intoduction

Severe ear deformity has a major impact on facial aesthetics and social acceptance. Many studies have demonstrated the negative impact of protruding ears on the social and psychological state of people with protruding ears and the positive impact of surgical treatment on their quality of life.[1-4]

The normal auricle protrudes 20 to 30 degrees from the skull. From the point of view of modern plastic surgery, the ears are considered normally located if:

- the angle between the auricle and the head does not exceed 30°;
- the lines of the ear and cheek are strictly parallel;
- the gap between the edge of the ear and the surface of the skull is about 2 cm.

Failure to meet these criteria is a sign of prominent ears.

Prominent ears are characterized by the following changes:

1. Deletion or absence of antihelix, with scapholunate-conchal angle of > 90º;
2. Excessively deep or hyperdeveloped shell with increased cephalo-auricular angle of > 40º;
3. Combination of the deformities of item 1 and 2, the most common finding;
4. Protrusion of the earlobe.

In about 60% of cases, the cause of the defect is a hereditary factor. In other situations, protruding ears are most likely due to disorders during fetal development. There is still controversy on this issue.

The laying of the ear cartilage occurs in the third month of fetal development, and the presence of a problem is already present at the time of the birth of the child. By the age of 6-7, the final formation of the ear occurs, and the defect can only become more or less pronounced.

There are two ways to get a prominent ear:

- functional weakness caused by improper muscle attachment;
- congenital, intrauterine deformity in which two cartilaginous lobes do not develop, which leads to deformation of the parts of the ear and their stretching and enlargement.

Surgical intervention prominent ears are performed from the age of 6, when the cartilage is completely formed and it is possible to perform otoplasty.

In the Caucasoid population, the incidence of protruding ear is about 5%, and it accounts for the most common congenital deformity of the head and neck.[5]

The protruding ear is characterized by an enlarged conchomastoid angle, deep shell cartilage, a developed antihelix fold, or a combination of both.[5]A protruding ear is characterized by pinna hypertrophy or abnormal attachment of the pinna to the head side, either alone or in combination.[6] Patients with protruding ears are usually exposed to psychological distress at the beginning of schooling,[7] so it is advisable to correct the deformity before the age of 6 years.

Over the past few decades, there have been various methods to address the problem of protruding ears with sutures or incisions in the cartilage.[8-10]

The ears began to rule hundreds of years ago, during which time many methods of performing operations have been developed. The first operation to remove a protruding ear date back to 1845 by Dieffenbach.[11] Dieffenbach described the correction protruding ear defects postauricular skin excision and conchomastoid suture fixation.

Folds, Luckett was the first to describe a caniling technique in which he excised the medial skin and cartilage along the entire length of the new antihelical fold.[12]

Numerous modifications based on these foundational techniques have since been described in otoplasty. After that, more than 200 different methods were implemented.[13,14]

In 1960, Chongchet proposed his technique using a posterior approach to incise the anterior cartilage of the lateral part of the scapula to create an anti-helix.[15]

In 1963, Mustardé used an otoplasty technique in children with soft or thin cartilage. In this technique, an incision with retroauricular skin is made 8-10 mm below and parallel to the helical surface, the skin over the cartilage is mobilized caudally to the mastoid process and cranially to the spiral edge. The mobilization should not extend beyond the spiral edge to avoid postoperative skin defects. The perichondrium, which provides adequate nutrition for the cartilage, and the ear cartilage itself remain intact.[16] Mustarde technique one of the most popular approaches to correcting the prominent ear. Simply using the Mustard technique is usually not sufficient for most otoplasties, and additional work is usually required to correct an overdeveloped shell.[17]

Indractions for may include: protrusion of one or both

auricles; asymmetry of one or both ear cartilages; large size of the auricle; torn holes after wearing "tunnels"; age-related changes in the earlobe.
Complications after correction of protruding ears can be classified into early and late stages, with the former occurring within 14 days of surgery and the latter after an initial 14-day period.[17]
Sadhra et al reported complications during the first 2 weeks as bleeding, hematoma and infection. They referred to this as insufficient hemostasis during surgery or other errors in surgical technique. In our study, we have 1 case (1.7%) of wound rupture.[18]
The purpose of study is to evaluate the effectiveness of protruding ear correction.

Materials and Method

This is a 5-year retrospective study (2018–2023) of 103 patients with protruding ears. Patients were followed up for at least a year after surgery. The Mustarde technique was adopted to create a new anti-spiral fold using a permanent mattress conchoscaphalal suture.

A modified procedure was applied. Incision made high at the level of the retroauricular projection to make it more difficult to see. After that, the skin is carefully separates from the cartilage. The cartilage is trimmed followed by the formation and modeling of the cartilage configuratio so that the auricle acquires a normal and natural shape. We stabilize the newly reconstructed antihelix using two to three stitches of Vycryl 4/0. Elastic bandage is worn for seventh day (figure 1-4).

The sutures were removed at the consultation on the 7–10 postoperative day. Patients were followed up at 3, 6, and 12 months followed by yearly intervals for 3-5 years.

Data on functional and aesthetic outcomes were documented. Preoperative and postoperative photographs were also taken of all patients (figures 5-8).

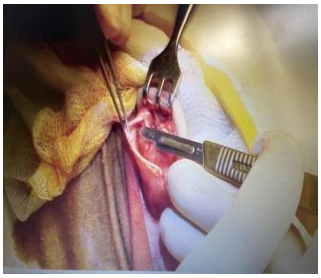

Figure 1. Incision made high at the level of the retroauricular projection.

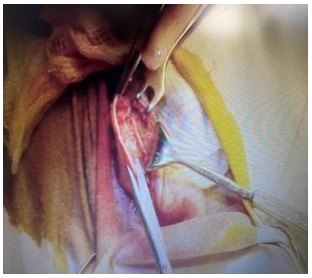

Figure 2. Skin is carefully separates from the cartilage

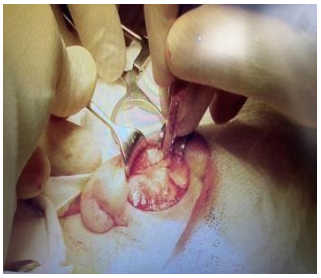

Figure 3. The cartilage is trimmed followed by the formation and modeling of the cartilage configuratio so that the auricle acquires a normal and natural shape

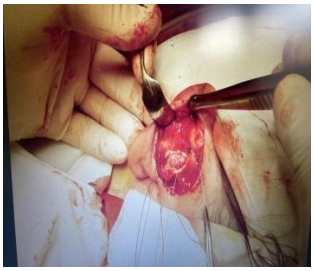

Figure 4. Stabilize the newly reconstructed antihelix using two to three stitches of Vycryl 4/0

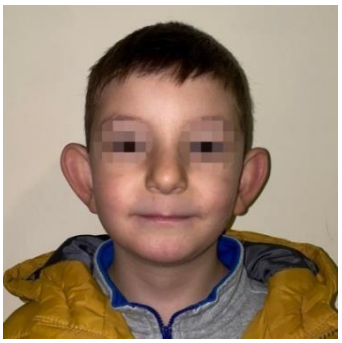

Figure 5. Patients A. Front view (preoperative)

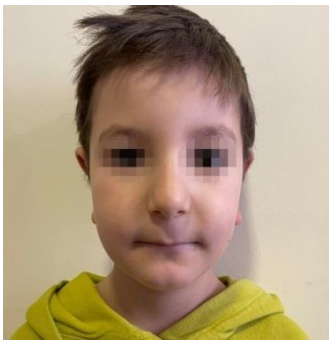

Figure 6. Patients A. Front view (postperative)

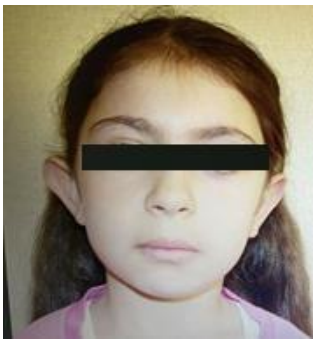

Figure 7. Patients B. Front view (preoperative)

Figure 8. Patients B. Front view (postperative)

The result was assessed on a visual analogue scale by the patient. Patient satisfaction was assessed in accordance with the indicators of the questionnaire, in which their degree of satisfaction was assessed on a 4-point scale: 1 (poor), 2 (satisfactory), 3 (good) and 4 (Great).

Parameters included: improvement in the natural contour of the ears, improvement in frontal vision, improvement in the asymmetry of the concho-mastoid angle.

Results

In study, hemorrhages, hematomas, keloid formations, suture extrusion, skin and cartilage infections, skin necrosis and recurrences were not observed in any patient.

The average score of the the patient's is 8.4. The average concho-mastoid distance before the operation is 2.2 cm, after the operation it decreases to 1.4 cm. Clinical evaluation showed excellent results (58.7%), good results (28.6%), satisfactory results (12.7%) and without poor results.

Discussion

The external ear is a complex structure with great variation between individuals and even between the two sides of the same individual. Protruding ears are the most common congenital deformity of the outer ear. The defect is usually bilateral and may be asymmetrical. The optimal age for the correction of protruding ears is 10-14 years. There are many methods of surgical treatment of patients with protruding ears.

Becker proposed a method of using cartilage dimensions and suturing techniques to reduce the contour of a corrected protruding ear.[19]

Chongchet,[15] Converse and Wood-Smith,[20] Criklair GF,[21] Stenström SJ[22] performed incomplete posterior cartilage incisions.

In combination with fixing sutures. the use of the conchomastoid suture was popularized by Furnas and later modified by Spira et al.

Otoplasty techniques are divided in

- cartilagesculpting (cutting)[22]
- cartilage-sparing (suturing)[16,23]
- composite techniques (combination of sutures and sculpting)[20,24]

One of the main difficulties associated with otoplasty techniques is related to achieving durable aesthetic results. This cartilage memory problem occurs especially in the case of notched cartilage reshaping procedures with protruding ears. auricular cartilage cartilage tends to warp away from an injured surface.[25]

Unsatisfactory long-term outcome otoplasty - residual deformity over time after surgery, even if with the correct implementation of the surgical technique with the resumption of protruding ears.[26-29]

Proper evaluation is therefore essential to the application of the corrective technique. The goals of performing otoplasty are well known and can be achieved through a thorough medical examination. This variety of options can make it difficult for a surgeon to choose the right procedure most appropriate for a particular patient.

This article presents our experience of more than 100 otoplasties using a range of previously described techniques, resulting in consistent, aesthetically pleasing results in both young and elderly patients. This study presents its own experience in the correction of protruding ears using a range of previously described techniques (combination of seams and cartilage cutting technique). Resulting in consistent, aesthetically pleasing results in both young and elderly patients. The proposed measures can be used as an accurate planning to improve the effectiveness of surgical treatment in order to eliminate defects and deformities of the auricles.

The surgeon will be able to use an arsenal of corrective measures that are most appropriate for each individual patient. With an objective algorithm of the surgeon in relation to the deformation of the auricle, you can get the maximum aesthetic result.

For best results when correcting protruding ears, the following should be observed:

Perform an ellipsoid resection of the skin in the postauricular region, where the final scar should be hidden in the postauricular sulcus.

Creation of an anti-spiral with rounded contours, avoiding borders with sharp edges.

Avoid overcorrecting the anti-helix, which causes helix wear.

Reducing the hypertrophy of the shell in some cases, when indicated.

Control the position of the earlobe, which often remains in front when the ear is positioned behind.

Attaching the shell to the mastoid fascia, if necessary.

Surgical treatment of ear correction according to thes method gives satisfactory aesthetic results, favorably affects the mental status of the patient. The long-term result in our series was completely satisfactory: the natural appearance, tactile sensations and plasticity of the ear are similar those of the ears that have not undergone surgery.

The reconstructed auricle shows reliable results in terms of stability, size and normal convolutions without recurrence in this study group. It does not lead to complications and gives good, reproducible esthetic results. None of the patients developed keloids. Suture extrusion did not occur in any of the patients during the follow-up period. No patient developed a recurrence or required a corrective secondary operation.

Conclusion

Correction of protruding ears using this technique is safe and simple. Serious complications were not observed, good aesthetic results were obtained. The applied technique is universal, gives good results and has a low level of complications.

Conflicts of Interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

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ԼՈՇՏԱԿՈՒԹՅԱՆ ՇՏԿՄԱՆ ՄԵՐ ՓՈՐՁԸ. ԿԼԻՆԻԿԱԿԱՆ ԴԵՊՔԵՐԻ ՇԱՐՔ

Հայկ Ենոքյան [1]

[1] բ.գ.թ., դոցենտ, Առողջապահության ազգային ինստիտուտի գլխի և պարանոցի էսթետիկ և վերականգնողական վիրաբուժության ամբիոնի վարիչ, «Էլիտ-Մեդ» ԲԿ պլաստիկ և դիմածնոտային վիրաբուժության ծառայության ղեկավար

Ամփոփում

Շատ մեթոդներ են մշակվել լոշտակության շտկման համար, բայց լավագույնը պետք է լինի պարզ, հուսալին վերարտադրելի:

Նպատակները. Մեր ուսումնասիրության նպատակն է գնահատել լոշտակության շտկման արդյունավետությունը:

Նյութեր եւ մեթոդներ. Սա 5-ամյա հետահայաց ուսումնասիրություն է (2018–2023) 103 հիվանդների լոշտակության շտկման վիրահատության արդյունավետություն գնահատման: Կիրառվել է փոփոխված Mustarde տեխնիկան։

Կտրվածքը կատրվել է ականջի հետին վերին պրոյեկցիայի մակարդակում՝ այն ավելի դժվար տեսնելուհամար: Դրանից հետո մաշկը խնամքով առանձնացվել է աճառից։ Աճառը կտրվել է, որին հաջորդել է աճառիկոնֆիգուրացիայի ձևավորումն ու մոդելավորումը, որպեսզի ականջը նորմալ և բնական տեսք ստանա,կայունացվել է նոր մոդելավորված ականջը, օգտագործելով Vycryl 4/0 երկու-երեք կար: Հիվանդը վիրակապըկրել են յոթ օր: Կարերը հանվել են կոնսուլտացիայի ժամանակ հետվիրահատական 7-10-րդ օրը:Հիվանդներին հետևել են 3, 6 և 12 ամիս, որին հաջորդել են տարեկան ընդմիջումներով 3-5 տարի: Փաստագրվել են ֆունկցիոնալ և էսթետիկ արդյունքների վերաբերյալ տվյալները: Բոլոր հիվանդներին արվելեն նաև նախավիրահատական և հետվիրահատական լուսանկարներ: Արդյունքը գնահատվել է հիվանդիկողմից տեսողական անալոգային սանդղակով: Հիվանդի բավարարվածությունը գնահատվել է հարցաշարիցուցանիշներին համապատասխան, որոնցում նրանց բավարարվածության աստիճանը գնահատվել է 4բալանոց սանդղակով՝ 1 (վատ), 2 (բավարար) , 3 (լավ) և 4 (գերազանց): Պարամետրերը ներառում են՝ ականջների բնական ուրվագծի բարելավում, դիմային տեսողության բարելավում, կոնխո-մաստոիդ անկյանանհամաչափության բարելավում:

Արդյունքները: Ուսումնասիրության ընթացքում արյունազեղումներ, հեմատոմաներ, կելոիդային գոյացություններ, կարի արտամղում, մաշկի և աճառի վարակներ, մաշկի նեկրոզ և ռեցիդիվներ չեն նկատվելոչ մի հիվանդի մոտ:

Հիվանդի գնահատման միջին միավորը 8,4 է: Միջին կոնխո-մաստոիդ հեռավորությունը մինչև վիրահատությունը 2,2 սմ է, վիրահատությունից հետո այն նվազել է մինչև 1,4 սմ: Կլինիկական գնահատումը ցույց է տվել գերազանց արդյունքներ (58.7%), լավ արդյունքներ (28.6%), բավարար արդյունքներ (12.7%) և առանց վատ արդյունքների:

Եզրակացություն. Լոշտակության շտկման կիրառված այս տեխնիկան անվտանգ և պարզ է, լավ էսթետիկ արդյունքներ են ստացվել: Կիրառվող տեխնիկան ունիվերսալ է, լավ արդյունք է տալիս և ունի բարդությունների ցածր մակարդակ;

НАШ ОПЫТ КОРРЕКЦИИ ЛОПОУХОСТИ УХА. СЕРИЯ КЛИНИЧЕСКИХ СЛУЧАЕВ

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Резюме

Для коррекции лопоухости уха разработано множество методов, но лучший из них должен быть простым, надежным и воспроизводимым.

Цели: Цель нашего исследования - оценить эффективность лопоухости уха.

Материалы и методы: Это 5-летнее ретроспективное исследование (2018–2023 гг.) 103 пациентов, оценивающее эффективность коррекции лопоухости уха. Использовалась модифицированная методика Mustarde.

Разрез был сделан на уровне задней верхней проекции уха, чтобы его было труднее увидеть. После этого кожу аккуратно отделяли от хрящей. Производился обрезка хряща с последующим формированием и

моделированием конфигурации хряща, чтобы ушная раковина приобрела нормальную и естественную форму и вновь смоделированное ухо было стабилизировано с помощью двух-трех швов Vycryl 4/0.
Пациент эластичный бинт носил семь дней. Швы были сняты во время консультации на 7-10 день после операции. Пациентов наблюдали в течение 3, 6 и 12 месяцев с ежегодными интервалами в течение 3–5 лет.
Функциональные и эстетические данные результатов были задокументированы. Все пациенты были также сфотографированы до и после операции. Результат оценивался пациентом по визуальной аналоговой шкале. Удовлетворенность пациентов оценивалась по показателям анкеты, в которой степень их удовлетворенности оценивалась по 4-балльной шкале: 1 (плохо), 2 (удовлетворительно), 3 (хорошо), 4 (отлично). Параметры включают: улучшение естественного контура ушей, улучшение фронтального зрения, улучшение асимметрии конхо-сосцевидного угла.
Результаты: Кровоизлияний, гематом, келоидных образований, экструзии швов, инфекций кожи и хрящей, некрозов кожи и рецидивов не наблюдалось ни у одного больного за время исследования.
Средняя оценка пациента 8,4. Среднее конхо-сосцевидное расстояние до операции составляло 2,2 см, после операции уменьшилось до 1,4 см. Клиническая оценка показала отличные результаты (58,7%), хорошие результаты (28,6%), удовлетворительные результаты (12,7%) и отсутствие плохих результатов.
Заключение: Этот метод коррекции деформации безопасен и прост, с хорошими эстетическими результатами. Применяемая методика универсальна, дает хороший результат и имеет низкий процент осложнений.

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REVIEW ARTICLES

RESIN INFILTRATION FOR MINIMALLY INVASIVE TREATMENT OF INITIAL CARIES AND NON-CARIOUS SPOT LESIONS: LITERATURE REVIEW

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Abstract

A concept of minimal intervention dentistry focuses on dental caries prevention, managing risk factors, detection of initial caries lesions and minimally invasive treatment. The article presents the possibilities, indications and advantages of Icon resin infiltration in the treatment of initial dental caries and non-carious spot lesions. Based on data from previous studies it is effective, painless and aesthetic method. After resin infiltration of enamel lesions the integrity of the tooth is preserved, the restoration of luster, transparency and color of the enamel is observed, the microhardness and surface roughness of the demineralized area increased to the values of intact dental tissues. Icon infiltration can be used for the treatment of initial non-cavitated dental caries on proximal and smooth surfaces of teeth as well as for the aesthetic treatment of non-carious spot lesions.

Keywords: *dental caries, non-carious lesions, minimally invasive treatment, Icon, caries infiltration*

Introduction

According to the World Health Organization dental caries is still a main public health problem worldwide. Dental caries affects all age groups in almost all countries, starting with the eruption of the first teeth (deciduous teeth/primary dentition) and, after eruption of the permanent teeth, increasing in prevalence until late adulthood (permanent teeth), then remaining at high levels until older age.[50]

The approach to dental caries treatment has changed dramatically in recent years, evolving from traditional restorative treatment to prevention and non-invasive or minimal intervention dentistry.[28] The increase of modern requirements for the diagnosis of initial dental caries entails the improvement of treatment methods. An innovative approach is focuses on dental caries prevention, managing risk factors, detection of initial caries lesions and their minimally invasive treatment with maximum preservation of intact tooth structures.[14,25]

The requirements for teeth preparation with the improvement of filling materials have gradually changed. The enhancement of the adhesive properties of composite materials made it possible to move away from the traditional preparation according to Black to the tooth preserving preparation approach, which is important in the treatment of proximal caries lesions.[49] Considering that any restorative treatment involves the tooth in a cyclical process of treatment and often subsequent retreatment, such invasive intervention is critical for the long-term preservation of the tooth.

It is also concluded that iatrogenic preparation damage is a frequent side-effect of operative intervention with proximal caries lesions, and represents a dental health problem, since the damage increases caries progression and the perceived need for restorative therapy of the adjacent teeth.[41]

Therefore, special attention should be paid to early diagnosis and subsequent non-invasive or minimally invasive treatment of non-cavitated caries lesions.[17]

In preventive strategies several methods for non-invasive treatment of non-cavitated caries lesions (from the first signs of enamel demineralization to non-cavitated dentine caries) have been proposed: enamel remineralization with fluoride- and calcium-containing agents, the application of silver diamine fluoride solution and the use of dental sealants.[7,9,19]

The enamel remineralization contributes to the prevention or non-invasive treatment of white spot lesions. This technique is effective because the protein matrix within the lesion is preserved that allows remineralization process. If this method is ineffective the use of additional methods of treatment is required.[25,39]

In recent decades silver diamine fluoride has been used for non-invasive treatment and arresting dental caries in primary teeth. This technique is recommended by international and national dental associations due to its high efficacy. However, it causes darkening of caries lesions, up to persistent black staining and does not restore the anatomical shape and function of decayed teeth. Therefore, parents often refuse to use this non-invasive caries treatment technique in primary teeth in children.[24]

White spot lesions are early signs of demineralization under an apparently intact enamel surface layer. These early enamel lesions show a whitish appearance as a result of an increased porosity within the lesion due to mineral loss. Plaque removal and topical fluoride application can result in arresting early carious lesions. Though the caries progression may be stopped the whitish appearance often remains as the remineralization is superficial and there is still a porous lesion body underneath. In addition to those stains can be incorporated into the lesion with the result of a brownish appearance of the lesion (brown spots) which often leads to even more esthetic deficiencies. Treating non-cavitated white spot lesions may include tooth bleaching, micro-abrasion, composite fillings or even prosthetic restorations like veneers. All these options are quite invasive implying tooth structure loss.[22]

Resin infiltration has made possible an innovative method of treating initial carious lesions that reflects perfectly with the concept of minimal intervention dentistry. Infiltration of carious lesions represents a new approach to the treatment of non-cavitated lesions of proximal and smooth surfaces of deciduous and permanent teeth. The major advantage of this method is that it is a non-invasive treatment, preserving tooth structure, masking the whitish appearance of the lesions and that it can be achieved in a single visit.[28]

The resin infiltration is an alternative non-invasive method of the initial dental caries treatment based on experiments conducted in the 70s.[42]

This concept has been modernized and a light-curing polymer of a low viscosity and a higher penetrating power began to be used for the treatment of non-cavitated caries lesions. The polymer fills all microspaces of demineralized tissues and arrests the progression of caries lesion. The affected tooth structures impregnated with infiltrant are comparable in aesthetic and mechanical properties to those of intact ones.[10]

In all cases of initial caries, both in active and stable forms, a large number of cariogenic bacteria producing lactic acid are detected in the zone of enamel lesion and often on its surface. The enamel infiltration method is based on arresting caries progression by closing the pores in the enamel, which are the pathways for the penetration of acids and the exit of dissolved minerals.[41,46]

First infiltration system was presented by a two-stage treatment technique. At the first dental appointment, an orthodontic rubber ring was inserted into the interdental space to separate the contact and provide

access to the proximal surface of the tooth. On the second appointment (after 1-2 days), the infiltration method was performed by etching the enamel surface with phosphoric acid and applying the GLUMA bonding system.

The need for repeated visits and discomfort from the presence of an orthodontic ring in the oral cavity, insufficient depth of etching with phosphoric acid and thus poor penetration of infiltrant deep into the lesion caused that many dentists and patients refused to use this treatment method.[27]

The modern resin infiltration technique was developed in the 2000s by Prof. H. Meyer-Lueckel and Dr. S. Paris. While doing research at the Charite Clinic (Charite Berlin) and the Kiel University (CAU, Germany), together with DMG. They significantly improved the infiltration method and developed not only the material itself, but also offered a kit of accessories that greatly facilitates the procedure for the dentist and the patient. Many clinical and laboratory studies have been carried out to improve every step of this technology.[31,32,35-38]

Currently the Icon resin infiltration (Infiltrant Concept) is successfully used for minimally invasive treatment of dental caries.

Icon Kariesinfiltrant *(DMG, Germany)* includes: *Icon-Etch* (contains 15% hydrochloric and pyrogenic silicic acid), *Icon-Dry* (99% ethanol), *Icon-Infiltrant* (methacrylate-based polymer).

DMG company produces two Icon systems for use on smooth and proximal surfaces (Figure 1).

Figure 1. Icon systems for smooth and proximal surfaces

Icon Kariesinfiltrant – vestibular includes: special vestibular applicator tips for use on smooth surfaces that will not be dissolved under the hydrochloric acid unlike microbrush fibers (Figure 2A).

Icon Kariesinfiltrant – approximal includes: proximal applicator tips with one-sided perforation for application of Icon-Etch and Icon-Infiltrant as well as plastic dental wedges, that allows the material to be applied to the treated surface without affecting the intact surface of the adjacent tooth (Figure 2B).

Figure 2. Applicator tips designed to apply Icon-Etch and Icon-Infiltrant on smooth (A) and proximal (B) surfaces

Steps of resin infiltration for treatment of proximal caries lesions:

1. Clean the affected tooth surface and adjacent teeth. Remove all cleaning residue with water spray. Apply rubber dam. Introduce one of the enclosed dental wedges into the interproximal space to obtain separation of the teeth.
2. Screw the proximal applicator tip onto the Icon-Etch syringe and insert into the proximal area. Apply Icon-Etch with a slight excess to the lesion site. Make sure that the green side of the proximal tip faces in the direction of the surface to be treated. Let Icon-Etch to act for 2 minutes.
3. Remove the applicator tip from the interproximal space. Aspirate off Icon-Etch and rinse with water at least 30 seconds. Dry thoroughly with air that is free of oil and water.
4. Screw the applicator tip onto the Icon-Dry syringe and introduce into the proximal area. Apply Icon-Dry onto the lesion and allow set for 30 seconds. Dry carefully with air that is free of oil and water. Carry out visual inspection within step 4. The whitish opaque lesion discolorations must

diminish significantly when applying Icon-Dry, otherwise repeat steps 2-4 (up to two times).
5. Turn off the direct operating light to prevent premature polymerization of Icon-Infiltrant. Screw the proximal applicator tip onto the Icon-Infiltrant syringe and insert into the interdental space. Make sure that the green side of the proximal tip faces in the direction of the surface to be treated. Apply Icon-Infiltrant with a slight excess to the lesion site. Allow Icon-Infiltrant to penetrate for 3 minutes.
6. Remove the applicator tip from the interproximal space. Remove excess material with dental floss. Light cure from all sides at least 40 seconds.
7. Screw a new proximal applicator tip onto the Icon-Infiltrant syringe. Repeat the application of Icon-Infiltrant and let set for 1 minute;
8. Remove the applicator tip from the interproximal space. Remove excess material with dental floss. Light cure from all sides at least 40 seconds. Remove the wedge and rubber dam. Use polishing strips for the surface finish.

The resin infiltration on smooth surfaces is carried out by a similar method. Icon-Etch and Icon-Infiltrant are applied using vestibular applicator tips for smooth surfaces.

To carry out the procedure, a completely dry field is required, the tooth surface is dried with oil-free air at the stages, since the liquid can change the composition and properties of the material[5]. The use of a rubber dam is mandatory, because it ensures the dryness of the working field, which affects the effectiveness of the procedure, and it also protects the gums and oral mucosa from hydrochloric acid and Icon-Infiltrant. The scarf for the rubber dam must be latex, since non-latex scarves can be dissolved during the infiltration procedure. If caries lesions on the vestibular surfaces are treated isolation with a liquid dental dam can be used in case of an allergy to latex or the inability to use a rubber dam.

The disappearance of white spots after surface drying and Icon-Dry processing is the criterion for sufficient etch depth. The etching process should be repeated if the pseudo-intact surface layer is too thick and whitish opaque lesion discolorations remains after ethanol application. It is allowed to etch the lesion area up to three times for 2 minutes. The application of the Icon-Infiltrant to the affected surface is possible only after a noticeable masking of the spots (at the Icon-Dry processing stage).

It is important to control the presence of excess infiltrate, as it can create micro-roughness, which will negatively affect the result of infiltration[37]. It is recommended to remove excess material with a cotton roll and/or dental floss from smooth surfaces and with a dental floss from proximal surfaces. To apply technique infiltration technique on vestibular surfaces, the use of matrices to prevent the leakage of infiltrant into interdental spaces might be useful. The treated surface should be polished with strips and polishing cups in order to create the smoothest surface after infiltration.

Dynamic monitoring with regular X-ray control (at least once a year) is necessary after Icon enamel infiltration. Since Icon is not a radiopaque material, it is mandatory to fill out a special form for each treated tooth to be recorded in the medical card, as well as to inform the patient. To carry out a photo protocol before and after treatment as well as at follow-up examinations are recommended. Thus, the process of communication with the patient will be optimized and the effectiveness of the infiltration procedure will be evaluated.

The use of an intraoral LED camera with the technology of quantitative light-induced fluorescence has permitted to determine that the fluorescence intensity after the Icon infiltration of initial caries lesion returns to the figures of intact tooth structures, which indicates the restoration of density in the area of caries lesion. This is very important for the aesthetic treatment result.[28]

Advantages of Icon infiltration for treatment of initial caries lesions[3,30,43,47]:

- removal of the pseudo-intact layer of enamel up to 50 microns in 2 minutes due to chemical treatment of caries lesion with hydrochloric acid that creates conditions for infiltrant penetration;
- high fluidity of infiltrant, which contributes to the penetration of infiltrant into the depth of the lesion;
- creation of a smooth surface, which significantly reduces the adhesion of plaque and promotes the natural remineralization of enamel;

- impact on the microflora due to the termination of oxygen access that results in stabilization of carious process;
- restoration of the structure, microhardness and density of dental structures, thus the enamel becomes more resistant to bacterial acids, which reduces the probability of caries progression;
- preservation of intact tooth structures;
- restoration of the natural color and luster of enamel in the area of caries lesion that allows to get an aesthetic result;
- painless procedure, i.e. anesthesia is not required;
- one visit treatment, possibility to treat several teeth at the same time;
- the duration of the procedure is 15-20 minutes, so it can be successfully used in children;
- convenience of the method through the use of specially designed applicator tips.

Dental examination using a monocular or binocular loupe, intraoral LED video camera, as well as laser fluorescence and transluminescence methods, significantly improve the quality of dental caries diagnosis. For successful diagnosis of proximal dental caries, it is necessary to use radiographic images where the presence of hidden carious cavities is clearly visualized. These diagnostic methods allow to determine the depth of the caries lesion and optimize the choice and tactics of non-invasive treatment.[18]
To determine the indications for Icon infiltration, the score system of proximal caries lesions radiographic classification by depth should be used *(Mejare I., 1999)*:

- E1 – radiolucency in the outer half of enamel;
- E2 – radiolucency in the inner half of enamel;
- D1 – radiolucency in the outer third of dentin;
- D2 – radiolucency in the middle third of dentin;
- D3 – radiolucency in the inner third of dentin.

Indications for Icon infiltration of caries lesions[25]:

- non-cavitated proximal caries lesions of enamel and the outer third of dentin (scores E1, E2 and D1 according to the radiological classification by depth);
- initial dental caries on smooth surfaces provided with preserved enamel surface layer (white spot carious lesions, post orthodontic white spot lesions).
- non-carious spot lesions (dental fluorosis, hypoplasia, amelogenesis imperfecta, molar-incisor hypomineralization).

Contraindications for Icon infiltration of caries lesions:

- allergic reaction on Icon components;
- progression of caries lesions to the middle and inner layers of dentin (scores D2-D3);
- impossibility of the working field isolation;
- cavitated enamel and dentin caries.

The effectiveness of the minimally invasive treatment with Icon of initial enamel caries has been proven by numerous studies.
Caries infiltration originally was developed to arrest non-cavitated caries lesions. One positive side-effect of the treatment is that the whitish color of enamel lesions disappears during and after infiltration as the infiltrated resin reduces the light scattering between the enamel crystals. In this way lesions can be camouflaged and an esthetic improvement can be achieved quite easily with only minimal substance loss. With the infiltrant the porosities in the lesion body are occluded. Therefore, this treatment may be used not only to arrest enamel lesions but also to improve the esthetic appearance of buccal white spots.[21]
Resin infiltration can be considered a safe and effective treatment to reduce progression of initial proximal caries. Thus, the progression of initial proximal caries within 1 year after Icon infiltration was detected radiographically only in 4.7% of teeth. A high quality of infiltration was found for the marginal adaptation. In contrast to the improvement of colour at the one-week recall, the infiltrated surfaces showed a statistically significant increase in the discoloration within the following year.[1]
Randomized controlled clinical trials revealed that the radiographic progression of E2-D1 scored proximal caries lesions was observed only in 7% of teeth in the test group after 18 months of Icon infiltration and in 37% of teeth in the control group with placebo treatment. After 3-years follow-up, 4% of test lesions and 42% of control lesions had progressed. The

authors concluded that resin infiltration of proximal caries lesions is efficacious in reducing lesion progression.[31,35]

Proximal infiltration is an effective preventive and minimal invasive method in adolescents. No dental plaque accumulation and gingival bleeding were observed after proximal infiltration in most cases. At annual recalls, plaque scores remained constant. The gingival status in adolescents remained steady and no differences in tooth shape and contour were detected. Discoloration was detected in 19% of treated teeth in 1st year recall and was constant at annual intervals. The radiographic evaluation of the bitewing radiographs showed no progression of lesions from baseline to the 4-year recall.[5]

A randomized controlled split-mouth study was performed to assess the efficacy of resin-infiltrated lesions covered by fluoride varnish (FV) versus FV treatment only on proximal lesions of deciduous molar teeth. After 1 year, 31% of the test lesions and 67% of the control lesions showed signs of progression according to the ICDAS scores. Radiographically, 23% of the test lesions and 62% of the control lesions had progressed. The clinical and radiographic therapeutic effect of both resin infiltration/FV over FV alone was >35% and significant. Thus, resin infiltration in conjunction with fluoride varnish seems promising for controlling proximal lesion progression on deciduous molar teeth.[11]

White spot lesions are non-cavitated caries lesions that are often observed in the esthetical visible area. During orthodontic treatment with fixed elements (brackets) plaque retention is increased resulting in a higher risk for new white spot lesions. Infiltration during orthodontic treatment leads to arrest lesions progressing at an earlier stage of treatment, significantly reduces the number of caries lesions and its progression during active long-term orthodontic treatment[23]. It has been shown that resin infiltration of demineralized enamel does not affect the bond strength of orthodontic brackets.[40]

Post-orthodontic white spot lesions are a significant aesthetic challenge. Slightly visible initial lesions often completely remineralize in saliva, since fixed elements have been removed. However, deeper lesions cannot be visually masked by saliva and fluoride alone. They remain visible for life. Thus, for severe lesions more invasive treatments are indicated.

Resin infiltration was proven to be an effective treatment for masking post-orthodontic white spot lesions after removal of braces. Immediately after Icon infiltration 22.9% of teeth were classified as completely masked, whereas 77.1% of teeth were classified as partially masked and no tooth unchanged. The area of enamel demineralization decreased immediately by an average of 61.8%, after 6 weeks – by 60.9%. The surface color of infiltrated lesions remained stable after 12 months.[13]

It's evident that Icon infiltration permitted the masking of white spot lesions and made initial caries lesions indistinguishable from intact enamel, with the greatest effect after 8 weeks of treatment. After a new acid challenge, the lesions infiltrated with low viscosity resin presented the lowest means of colour change.[48]

Discoloration on smooth surfaces of teeth can be associated not only with dental caries development. The cause of visual disturbances and white or brown spots appearance may be non-carious lesions of teeth not associated with the negative influence of plaque microorganisms. These lesions can occur before eruption (dental fluorosis, hypoplasia, amelogenesis or dentinogenesis imperfecta) and after eruption of teeth (abrasive teeth wear, wedge-shaped defect, dental erosion).[25]

Previously teeth whitening has been a method of choice for masking enamel spots in particular with fluorosis, but this alone is not enough to achieve a high-quality aesthetic result in most cases of natural tooth color change. Invasive methods of treatment such as composite restorations and ceramic veneers often require substantial preparation of dental tissue and also involve multiple patient visits.

A number of studies have been carried out shown that Icon infiltration can be recommended for aesthetic treatment of non-carious enamel spot lesions, such as dental fluorosis, hypoplasia (including traumatic hypomineralization), molar-incisor hypomineralization (MIH), amelogenesis imperfecta.[8,33,43,47]

In milder fluorosis, the shallower subsurface porosities are usually adequately infiltrated and the esthetic results commonly satisfying. In moderate or severe fluorosis, the aesthetic treatment should begin with a whitening procedure as well as an initial mechanical wear of the surface of the affected enamel

might be required before resin infiltration, that is followed by increments of composite resins.[20,51]

The histopathology of traumatic hypomineralization is similar to that of white spots and fluorosis. It involves also subsurface hypomineralization under a relatively well-mineralized surface layer. Either superficial or deep infiltration is effective in treatment of traumatic hypomineralisation. MIH is not indicated for the Icon infiltration treatment. Nevertheless, infiltration of MIH lesions often leads to significant improvements of aesthetics and has a positive impact of patient's quality of life.[21]

The data indicate stabilization of the wedge-shaped defect development after Icon infiltration of the affected area, which allows to consider this method as the preserving minimally invasive technique for treating the initial forms of the wedge-shaped defect.[15] However, additional clinical studies are required to determine the effectiveness of this procedure in the treatment of other non-carious lesions.

According to the results of a laboratory study, the mean hardness values for demineralized enamel treated with Icon was significantly higher than untreated lesions. SEM showed irregular, pitted and rough demineralized enamel surface with destruction of enamel rods and dissolution of enamel crystals. After Icon application, the surface showed complete blockage of enamel rods with resin infiltration.[12]

Enamel surface treated with the resin infiltrant showed approximately the same microhardness and surface roughness as sound enamel, indicating that this material might be suitable for the treatment of enamel subsurface lesions. After the resin infiltration with Icon the enamel microhardness and surface roughness of the demineralized area of teeth increased to the values of intact dental tissues.[45]

Due to pathological changes that affect the enamel refractive index, the light suffers deviation and reflection inside the lesion, creating an optical maze which is over-luminous and responsible for the whitish aspect on the affected areas. The refractive index of enamel impregnated with Icon-Infiltrant is comparable to intact enamel. Micropores are filled with infiltrant and the color of the affected area is brought into line with intact enamel, at the same time the material-tooth border is not observed. The color stability and microhardness of the infiltrant resin provided suitable material for treating white spot lesions.[4,6]

The infiltrant is transparent and colorless and white spots are masked due to a change in the refractive index, as a result the original color of the tooth is restored. In vitro studies have demonstrated that immediately after infiltration teeth appear lighter, but then acquire and retain their natural color for a long time.[34,44]

However, the use of Icon infiltration alone will not be effective enough in teeth with deep spot lesions. The deep infiltration protocol has been proposed in which the external lesion surface should be previously removed using mechanical abrasion with aluminum oxide sandblast or a rotary diamond bur. This procedure grants access to the lesion body, allowing penetration of the resinous monomers. In addition, the border area can be gently removed, preventing the halo effect after the infiltration. The area is then covered with a composite restoration if necessary.[2]

When introducing a new technology, it is important for researchers and practitioners to evaluate both the effectiveness of the technique and its convenience and the willingness of patients and dentists to use this treatment method.

Icon resin infiltration is not laborious to be carried out by a dentist of any qualification and is applicable in daily practice due to convenient full kit of materials and application system. Nevertheless, dentists at various steps of Icon application may claim their experienced difficulties in cleaning the proximal surfaces of teeth, applying rubber dam and wedging the teeth for inserting applicator tips.

A survey of patients showed positive feedback from Icon application. It has been particularly noted that this minimally invasive approach produces the desired aesthetic result.[16,29]

Questioning conducted by Preventive Dentistry Department in the Moscow State University of Medicine and Dentistry named after A.I. Evdokimov has showed that the majority of dentists evaluate the Icon resin infiltration as relatively simple method in comparison with the traditional filling. In questionnaire survey dentists mentioned that in all infiltration procedure the greatest difficulty was experience installing rubber dam, but not a technique itself. Only 7% surveyed patients found the procedure to be tiring and lengthy, while more than 60% found it

fast, pleasant or comfortable. Most dentists (93%) would like to apply this method in their practice.[26]

Conclusion

Based on previous clinical and laboratory studies, it can be concluded that resin infiltration is an effective minimally invasive method for the treatment of initial dental caries and non-carious spot lesions. After Icon application the integrity of the tooth is preserved, the restoration of luster, transparency and color of the enamel is noted, the microhardness and surface roughness of the demineralized area increased to the values of intact dental tissues. The inhibition of caries progression by resin infiltration is readily accepted by most dentists and patients and should now be considered as an alternative to invasive restorations in the treatment of initial dental caries on proximal and smooth surfaces of teeth as well as in the aesthetic treatment of non-carious spot lesions.

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ԻՆՖԻԼՏՐԱՑԻՈՆ ՄԵԹՈԴԻ ԿԻՐԱՌՈՒՄԸ ՍԿԶԲՆԱԿԱՆ ԿԱՐԻԵՍԻ ԵՎ ՈՉ ԿԱՐԻՈԶ ԱԽՏԱՀԱՐՈՒՄՆԵՐԻ ՆՎԱԶԱԳՈՒՅՆ ԻՆՎԱԶԻՎ ԲՈՒԺՄԱՆ ՀԱՄԱՐ

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Ամփոփում

Ստոմատոլոգիայի ներկայիս միտումները կենտրոնացած են կարիեսի կանխարգելման, կարիեսի ռիսկի գործոնների կառավարման, վաղ փուլերում կարիեսային ախտահարումների հայտնաբերման և դրանց նվազագույն ինվազիվ բուժման վրա: Այս հոդվածը ներկայացնում է Icon ինֆիլտրացիայի համակարգի օգտագործման հնարավորությունները, ցուցումները և առավելությունները կարիեսի վաղ փուլերի և ատամների ոչ կարիեսային ախտահարումների համար:

Կատարված ուսումնասիրությունների արդյունքների վերլուծությունը ցույց է տալիս, որ այս մեթոդը արդյունավետ է և ցավազուրկ, հանգեցնում է բուժման էսթետիկ արդյունքների:

Էմալի ախտահարումները Icon ինֆիլտրատով բուժելուց հետո պահպանվում է ատամի ամբողջականությունը, նշվում է էմալի փայլի, թափանցիկության և գույնի վերականգնումը, էմալի դեմինալիզացիայի ֆոկուսի միկրոկարծրության և կոշտության ցուցանիշները վերադառնում են ինտակ ատամիների հյուսվածքների արժեքներին:Icon ինֆիլտրացիայի մեթոդը կարող է օգտագործվել ատամների պրոկսիմալ և վեստիբուլյար մակերևույթների էմալում և դենտինում կարիեսի սկզբնական փուլերը բուժելու, ինչպես նաև ոչ կարիեսային ախտահարումների էսթետիկ բուժման համար:

Kuzmina IN, Said DS, Pazdnikova NK. Resin infiltration for minimally invasive treatment of initial caries and non-carious spot lesions: Literature review. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):112-123. doi: 10.58240/1829006X-2023.19.2-112

ПРИМЕНЕНИЕ МЕТОДА ИНФИЛЬТРАЦИИ ДЛЯ МИНИМАЛЬНО ИНВАЗИВНОГО ЛЕЧЕНИЯ НАЧАЛЬНЫХ ФОРМ КАРИЕСА И НЕКАРИОЗНЫХ ПОРАЖЕНИЙ ЗУБОВ: ОБЗОР ЛИТЕРАТУРЫ

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Резюме

Современные тенденции в стоматологии направлены на профилактику кариеса зубов, управление факторами риска развития кариеса, обнаружение кариозных поражений на ранних стадиях и их минимально инвазивное лечение. В данной статье представлены возможности, показания и преимущества применения системы инфильтрации Icon при лечении начальных стадий кариеса и некариозных поражений зубов. Анализ результатов проведенных исследований свидетельствует, что данный метод является эффективным и безболезненным, приводит к достижению эстетичных результатов лечения. После обработки очагов поражения эмали инфильтратом Icon сохраняется целостность зуба, отмечается восстановление блеска, прозрачности и цвета эмали, показатели микротвердости и шероховатости очага деминерализации эмали возвращаются к значениям интактных твердых тканей зуба. Метод инфильтрации Icon может использоваться для лечения начальных стадий кариеса эмали и дентина проксимальных и вестибулярных поверхностей зубов, а также для эстетического лечения некариозных поражений.

Kuzmina IN, Said DS, Pazdnikova NK. Resin infiltration for minimally invasive treatment of initial caries and non-carious spot lesions: Literature review. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):112-123. doi: 10.58240/1829006X-2023.19.2-112

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MANIFESTATIONS OF SEXUALLY TRANSMITTED INFECTIONS IN THE ORAL CAVITY

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Abstract

Sexually transmitted diseases are transmitted in the oral cavity through various forms of sexual activity. This article discusses the relevant clinical manifestations of several sexually transmitted viruses, including human papillomavirus, chlamydia trachomatis, and gonorrhea. Oral manifestations of these infections include ulcerative, inflammatory, or papillomatous lesions of the lips, tongue, mucous membranes, and throat, and may also present with oropharyngeal cancer. The literature review used the databases Google Scholar, PubMed, Scopus, Web of Science.

Keywords: *oral manifestations; sexually transmitted diseases*

Intraduction

Sexually transmitted diseases often affect the mucous membranes, causing characteristic lesions on the oral mucosa.[1]

Membranes of the oral cavity are vulnerable to direct inoculation of many of these infections. Oral contact with the genitals can create tiny microtraumas through which pathological microorganisms in body fluids can come into contact and be transmitted.[2]

Oral sex is one of the most common ways of transmitting sexually transmitted infections (STIs). STIs that can be contracted through oral sex:

- chlamydia
- gonorrhea
- herpes
- genital warts
- hepatitis (A, B and C)
- HIV
- Syphilis

Depending on the transferred pathogen, ulcerative, inflammatory or papillomatous lesions of the lips, tongue, mucous membranes and pharynx occur.

Today, the authors estimate that about 75% of women report having had oral sex. The authors attribute its growing popularity to a common misconception that oral sex is relatively safe compared to intercourse that requires a condom to protect against.[3] The authors emphasize that this sexual practice comes with other risks, such as potential female infertility.

Identification of sexually transmitted infections in oral cavity characteristic clinical signs allows for early diagnosis and treatment.

This article presents a literature review of Oral manifestations of sexually transmitted infections and the clinical picture of these diseases in the oral cavity.

We conducted a literature review of scientific papers, using the resources of the Google Scholar, PubMed, Scopus, Web of Science and embase search engines, for the above keywords. For this analysis, we used articles containing an evidence-based experimental and clinical base on the most recent issues related to

the epidemiology, etiology and pathogenesis of Sexually transmitted diseases (STDs.

Human papillomavirus (HPV) is the most common sexually transmitted disease.[4] HPV can affect the mouth and throat. Some high-risk strains, notably HPV-16, have been linked to head and neck cancers, which are four times more common in men than women. These cancers usually develop in the throat at the base of the tongue, in the folds of the tonsils, or at the back of the throat, making them difficult to detect. Although the oral transmission of HPV is not clear, various sexual habits such as early sexual initiation, increased number of partners, and orogenital sex have made HPV an endemic infection. It has been postulated that the incidence of HPV-associated tumors is related to changes in sexual practices. A significant proportion of squamous cell carcinoma of the mucous membranes of the head and neck, especially the oropharynx, is directly related to HPV. As a result, some studies have shown the role of viruses in the development of head and neck cancer.

HPV infections are often asymptomatic and unrecognized. Most sexually active people become infected with HPV at least once in their lives6, often unaware of it and without showing any symptoms. HPV infection prevalence, persistence, and infection correlate with sexual behavior, viral load, anatomical location, local immunity, and clearance.[5,6]

Despite evidence that HPV is an etiologic risk factor for head and neck cancers, especially HPV type 16, there are few population-based studies on the mechanisms of HPV transmission. Initial studies have shown that smoking, age, and HIV-positive serostatus are risk factors.[7]

The human papillomavirus (HPV) is responsible for a growing percentage of head and neck cancers (HNCs); primarily, a subset of oral squamous cell carcinoma, oropharyngeal squamous cell carcinoma, and laryngeal squamous cell carcinoma. Most HPV-associated head and neck cancers (HPV + HNC) are caused by HPV16; in addition, cofactors such as smoking and immunosuppression promote HPV+HNC progression by interfering with tumor suppressor siRNA and disrupting immune system mediators.[8]

Case-control studies of head and neck cancer have shown an association with the number of sexual partners, history of oral-genital contacts, history of genital warts, and age at first intercourse.[9-11]

Head and neck cancer, the sixth most common cancer in the world, accounts for approximately 1 in 20 malignancies. In recent years, there has been a decrease in the incidence of cervical cancer, but a concomitant significant increase in the incidence of HPV-mediated oropharyngeal cancer caused by orogenital transmission of HPV. Consequently, in rich countries, oropharyngeal squamous cell carcinoma (OPSCC) is currently the most common HPV-associated cancer, overtaking cervical cancer. Orogenital transmission of HPV has now overtaken smoking and excessive alcohol consumption as the main risk factor for oropharyngeal cancer.[12]

Human papillomavirus (HPV) accounts for the majority of sexually transmitted infections (STIs). Oral sexual behavior is an important factor contributing to HPV infection of the oral mucosa. HPV infection of the oral mucosa is believed to affect between 1% and 50% of the general population, depending on the method used for diagnosis. The immune system clears most HPVs naturally within 2 years (about 90%), but those that persist can cause serious illness. HPV is an important carcinogen that is increasingly causing cancers that occur in many places in the body.

Increased oral transmission of HPV eventually leads to increased head and neck infections; Thus, oral sex is associated with the majority of HPV infections in the head and neck region.

Head and neck cancer (HNC) accounts for ~4.8% of cancers, and 90 percent of HNCs arise from squamous cells lining the mouth, pharynx, larynx, or, less commonly, the nasal cavity.[13]

These include: (i) oral squamous cell carcinoma (OSCC), which is a cancer that occurs on the lips, tongue, floor of the mouth, oral cavity, etc.; (ii) oropharyngeal squamous cell carcinomas (OPSCCs), which are cancers arising from the base of the tongue, soft palate, tonsils, back of the throat; (iii) squamous cell carcinoma of the larynx (LSCC), which arises from the supraglottic, vocal, and subglottic regions; (iv) nasal squamous cell carcinoma (NSCC; to a lesser extent), which arises from squamous epithelial cells lining the nasal cavity and paranasal sinuses.[14,15]

Factors such as alcohol consumption, tobacco smoking and/or chewing increase the risk of HNC.[16,17] Alcohol consumption is associated with ~5% of HNC cases, tobacco use is associated with ~34%, and alcohol combined with tobacco use is associated with

36% of ~HNC cases [5,7,9]; thus ~75% of HNC (i.e. squamous cell carcinoma) is caused by alcohol and tobacco use.[18]

The remaining percentage (~25%; world average) of HNC cases are caused by human papillomaviruses (HPV).[19,20]

HPV also causes almost all cases of cervical cancer, a percentage of other anogenital cancers (vaginal, vulvar, anal, penile, etc.) and almost all cases of genital warts.[21]

HPV associated with HNC is transmitted orally, mainly through oral sex. Studies have shown that oral sexual activities, as well as an increase in the number of oral sexual partners, transmission of HPV.[22,23] A high number of HPV infections in the head and neck area have been reported in men compared with women.[24,25] This is likely due to the large number of men who have oral sex with partners infected with HPV. Thus, oral sex is associated with the majority of HPV infections in the head and neck region. Deep kissing (with open mouth) has also been reported to be associated with oral transmission of HPV. HPV has been found on the oral mucosa of men/women without a history of oral sex who have had ≥10 deep kisses in a lifetime or ≥5 deep kisses in a year.[23]

HPV can be transmitted by self-vaccination from the genital area to the mouth area through infected nails.[26,27]

The HPV + OCSCC Prevalence Worldwide

In addition, both low and high levels of HPV incidence have been reported in all geographical locations. The lowest prevalence of HPV+ OCSCC has been found in the Philippines, the United Kingdom (UK), India, the Republic of Korea and France. The highest prevalence is reported to be 37% in Jordan. A proportional meta-analysis was conducted, determining the total prevalence of HPV+ OCSCC to 6% (95% CI; 3–10%)[28]. There was a great heterogeneity in the prevalence as well, $I^2 > 75\%$, $p < 0.01$, shown in Figure 1.

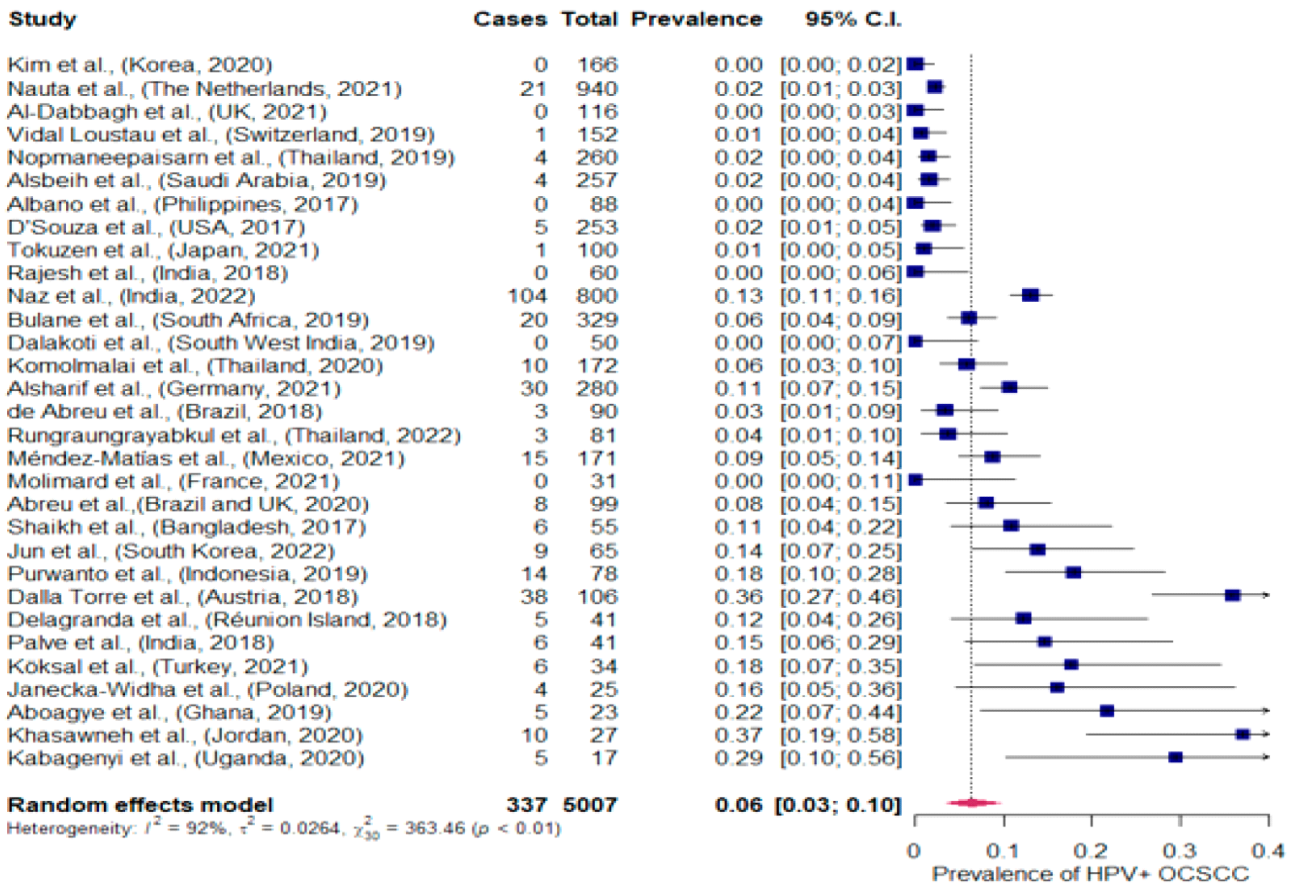

Figure 1. Meta-analysis of the HPV+ OCSCC prevalence in the included studies, representing the present HPV+ OCSCC prevalence worldwide HPV+: human papillomavirus positive
[OCSCC: oral cavity squamous cell carcinoma. 95% C.I: confidence interval]

Distribution of human papillomavirus-associated head and neck cancers (HPV + HNC) between anatomical sites

HPV status in tumors located at different anatomical subsites of the oral cavity was reported in studies. These cancers usually develop in the throat at the base of the tongue, in the folds of the tonsils, or at the back of the throat, making them difficult to detect.[29] Around 30% of oropharyngeal cancers (which mainly comprises the tonsils and base of tongue sites) are caused by HPV.

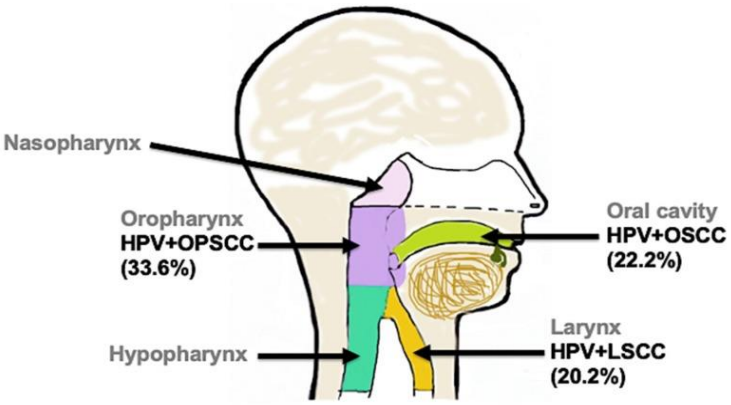

Figure 2. Distribution of human papillomavirus-associated head and neck cancers (HPV + HNC) between anatomical sites. HPV is associated with 33.6% of OPSCC (lavender), 22.2% of OSCC (bright green), and 20.2% of LSCC (gold) worldwide

Therefore, HPV in the head and neck is transmitted orally through oral sex, contributing to the majority of HPV transmission/infections associated with the head and neck.[30,31] While progress (in terms of treatment) has been made over the past few decades to improve overall survival for HPV+HNC patients, HPV+HNC screening and diagnosis has lagged behind cervical cancer. Future screening methods should focus on using HPV DNA as a marker in the diagnosis of HPV+HNC cases regardless of anatomical region; if HPV + OPSCC is suspected, p16INK4a expression levels should be assessed for protein in oropharyngeal cells, as well as seropositivity for E6/E7 antibodies in blood serum. E6 antibodies were detected in the blood serum, more than 10 years, before the diagnosis of HPV + OPSCC; seropositivity is a sensitive diagnostic tool for HPV + OPSCC.

Over the past decade, the number of cases of oropharyngeal cancer has increased at least four to five times. The oropharynx includes the tonsils and the base of the tongue. The increase in these cancers is the result of HPV infection. Almost all of these cancers are caused by HPV16, a subtype of the HPV virus. Studies show that approximately 70 percent of oropharyngeal cancers are caused by HPV16. These cancers have the HPV16 virus found in the tumor. The number of HPV-positive cancers of the tonsils and the base of the tongue (cancer of the oropharynx) is growing rapidly. Several studies evaluating the prevalence of active oral HPV infection have shown that three to five percent of adolescents and five to 10 percent of adults have active HPV infection. More than 3% of adult men and 1% of adult women have HPV16 in their saliva at any given time. In contrast to active infection, it is estimated that 90% of adults have been exposed to HPV16 and 70% have signs of infection.[32,33]

In the literature, studies of sexually transmitted viruses in oral lesions have generally been limited to the search for HPV, so little is known about the presence and co-infection with other infectious agents such as C. trachomatis and Neisseria gonorrhoeae.[34]

The frequency of Neisseria gonorrhoeae (NG) and C. trachomatis in the oral cavity varies widely among published studies.[35,36] Neisseria gonorrhoeae (NG) and Chlamydia trachomatis (CT) are the two most common causes of sexually transmitted infections (STIs) in the oropharynx. These pathogens can be transmitted by orogenital contact.

Current results confirm that our knowledge of the diversity of infectious agents in the oral cavity is only partial. Indeed, C. trachomatis infection can alter the normal pattern of epithelial cell junctions, increasing susceptibility to HPV infection in both the genital mucosa and the oral cavity[37].

Human Papillomavirus (HPV) and *Chlamydia trachomatis* (*C. trachomatis*) are the most frequent, viral and bacterial respectively, sexually transmitted infections (STIs) worldwide. Co-infection with chlamydia trachomatis is considered a possible cofactor that can lead from infection to oncogenesis. A positive association has been observed between C. trachomatis infection and cervical squamous cell carcinoma or its precursors in most epidemiological studies identifying HPV infection. Indeed, C. trachomatis infection can alter the normal pattern of epithelial cell junctions, increasing susceptibility to HPV infection in both the genital mucosa and the oral

cavity.[38-39] A possible biological explanation for the increased risk of coinfection is that Chlamydia causes local inflammation leading to damage to epithelial tissue, which in turn may become more susceptible to other infections. *Chlamydia trachomatis* infection: Possible cofactor for oropharyngeal cancer development.[40]

This study highlights the importance of diagnosing HPV and sexually transmitted pathogens such as C. trachomatis, which have been identified in many studies as possible cofactors of oncogenesis.[41]

Due to the increase in the practice of oral sex, researchers are urging scientists and clinicians to consider that when transmitted by the fecal-oral or genital-oral route, Chlamydia trachomatis (C. trachomatis) can colonize the gastrointestinal tract (GIT) and ultimately increase the risk of female infertility.

Chlamydia, one of the most common sexually transmitted diseases in the world, often goes unnoticed for many years because infected people often do not show symptoms. This increases the chance that infected people will not receive treatment to treat the infection; if left untreated, chlamydia can lead to urethritis, cervicitis, pelvic inflammatory disease, ectopic pregnancy and infertility. All members of the Chlamydiaceae have evolved primarily as commensals of the digestive tract of their host(s), with the fecal-oral route of transmission (FOT) as the main route of spread to new hosts. In communities where the PBF is reduced, the occurrence of chlamydia in the digestive tract is reduced. Oral chlamydia is a chlamydia infection that is found in the mouth or throat. C. trachomatis, a commensal microorganism of the human gastrointestinal tract, is an opportunistic pathogen in the genital and respiratory tracts, as well as on the conjunctiva. In conditions of reduced FOT, direct contact is the main mode of transmission. C. trachomatis is effectively transmitted into the gastrointestinal tract of new hosts through oral sex. The growing practice of oral sex is contributing to an increase in the prevalence of C. trachomatis in the human gastrointestinal tract in communities where FOT has previously been reduced.

The frequency of C. trachomatis in the oral cavity varies widely in published studies. This variability can be explained by the diversity of biological samples, the lack of global standardization methods, and the diversity of study populations.[42,43]

Although HPV-associated tumor information is clear, the prevalence of HPV and C. trachomatis oropharyngeal infection remains unclear.[44,45] Both organisms are important to public health because an existing chlamydial genital infection can increase the risk of contracting HPV and also contribute to the persistence of the virus, leading to complications such as cervical cancer.[46]

Indeed, C. trachomatis infection can alter the normal pattern of epithelial cell junctions, increasing susceptibility to HPV infection in both the genital mucosa and the oral cavity. A possible biological explanation for the increased risk of coinfection is that Chlamydia causes local inflammation leading to damage to epithelial tissue, which in turn may become more susceptible to other infections. The researchers urge other researchers and clinicians in the field to expand screening for chlamydia to include also sampling from rectal and pharyngeal sites when deemed appropriate to identify infection and patients receive treatment, thereby avoiding the potential long-term consequences of undiagnosed infection.[47]

In most cases, patients complain of symptoms of oral chlamydia, which include pain and tenderness in the mouth and throat.[48]

Oral chlamydia infections in the mouth or throat may cause the following symptoms: sore throat with a scratchy, dry feeling, mouth pain, redness in the throat or mouth with white spots, similar to strep throat, painless mouth sores, lesions around the mouth that look like cold sores, tonsillitis, redness with white spots resembling strep throat. However, in rare cases, patients may also experience chlamydial bumps on the tongue.

Gonococcal infection of the pharynx is usually transmitted through oral sex. Oropharyngeal gonorrhea is known to be rare because saliva is a hostile environment for N. gonorrhoeae. The disease can be transmitted through oral sex and kissing even in an asymptomatic infected person. Oropharyngeal infections with Neisseria gonorrhoeae or Chlamydia trachomatis (Serovar D-K) can cause pharyngitis and tonsillitis with sore throat, but in most cases are completely asymptomatic.[49-51]

Infection with gonorrhea in the mouth and throat occurs more often through oral-sexual contact than through oral-vaginal contact. Oral gonorrhea is often asymptomatic, but persistent sore throat is the most predominant symptom. Other possible signs include

acute ulceration, diffuse erythema of the oropharynx, swelling of tissues that bleed easily, the tonsils are invariably enlarged and infected, covering a whitish-yellow exudate and flu-like symptoms. Untreated oral gonorrhea can lead to disseminated gonococcal infection, causing fever, chills, skin sores, inflammation, and joint pain.[52,53]

Laboratory tests directly detect the gonococcal pathogen in urogenital, anorectal, or oropharyngeal swabs and should be considered in patients with symptoms and a history suggestive of gonorrhea. Nucleic acid amplification tests (NAATs) can detect N. gonorrhoeae in the genitals or extragenital specimens such as the pharynx. The development of multiplex NAATs now allows simultaneous screening of extensive sexually transmitted diseases.

Genital candidiasis can also be transmitted to the mouth. Depending on the transferred pathogen, ulcerative, inflammatory or papillomatous lesions of the lips, tongue, mucous membranes and pharynx occur. Asymptomatic infections are an important but often overlooked source of new infections. Systemic treatment for oral STIs is usually the same as for anogenital infections. May be accompanied by symptomatic local therapy. For infections of the tonsils and other hard-to-reach tissues, higher doses and an antibiotic with good tissue penetration are recommended.

Therefore, HPV in the head and neck is transmitted orally through oral sex, contributing to the majority of HPV transmission/infections associated with the head and neck.[54-59]

While progress (in terms of treatment) has been made over the past few decades to improve overall survival for HPV+HNC patients, HPV+HNC screening and diagnosis has lagged behind cervical cancer. Future screening methods should focus on using HPV DNA as a marker in diagnosing HPV+HNC cases regardless of anatomical region

We believe that our review allows us to draw the following conclusions. The orogenital route of transmission has been shown to be the most documented route of oral HPV infection.

To successfully control these infections, programs will need to use strategies such as frequent testing of the oropharyngeal reservoir in addition to promoting condom use. Moreover, it is important for the attending physician to be aware of these manifestations in order to make an early diagnosis and begin adequate treatment. Oral examination should be an integral part of the evaluation of any patient with suspected STI.

Declaration of Competing Interest

The author declare that they have no known competing financial interests or personal relationships that, could have appeared to influence the work reported in this paper.

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ՍԵՌԱԿԱՆ ՃԱՆԱՊԱՐՀՈՎ ՓՈԽԱՆՑՎՈՂ ՀԻՎԱՆԴՈՒԹՅՈՒՆՆԵՐԻ ԴՐՍԵՎՈՐՎՐՈՒՄՆԵՐԸ ԲԵՐԱՆԻ ԽՈՌՈՉՈՒՄ

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Ամփոփում

Սեռական ճանապարհով փոխանցվող հիվանդությունները բերանի խոռոչում փոխանցվում են սեռական հարաբերությունների ժամանակ: Այս հոդվածը քննարկում է բերանի խոռոչում սեռական ճանապարհով փոխանցվող մի քանի վիրուսների համապատասխան կլինիկական դրսևորումները, ներառյալ մարդու պապիլոմավիրուսը, Chlamydia trachomatis, Gonorrhea: Այդ վարակների դրսևորումները բերանի խոռոչում ներառում են շրթունքների, լեզվի, լորձաթաղանթների և կոկորդի խոցային, բորբոքային կամ պապիլոմատոզ ախտահարումներ, նաև կարող են արտահայվել առաջանում են բերան -ըմպանային շրջանի քաղցկեղով: Գրականության վերլուծության այս ակնարկում օգտագործվել է Google Scholar, PubMed, Scopus, Web of Science տվյալների բազաները:

ПРОЯВЛЕНИЯ ИФЕКЦИИ ПЕРЕДАЮЩИЕСЯ ПОЛОВИМ ПУТЕМ В РОТОВОЙ ПОЛОСТИ

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Резюме

Заболевания, передающиеся половым путем, передаются в ротовой полости во время полового акта. В этой статье обсуждаются соответствующие клинические проявления нескольких вирусов, передающихся половым путем, включая вирус папилломы человека, Chlamydia trachomatis и гонорею. Проявления этих инфекций в полости рта включают язвенные, воспалительные или папилломатозные поражения губ, языка, слизистых оболочек и горла, а также могут проявляться раком ротоглотки. В обзоре литературы использовались базы данных Google Scholar, PubMed, Scopus, Web of Science.

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ОБЗОРНАЯ СТАТЬЯ

РЕЗУЛЬТАТЫ КОСТНОЙ ПЛАСТИКИ ПРИ ПОДГОТОВКЕ К ДЕНТАЛЬНОЙ ИМПЛАНТАЦИИ: АНАЛИЗ РИСКОВ И ФАКТОРОВ УСПЕХА

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Резюме

Основным препятствием для долгосрочного успеха дентальной имплантации является дефицит костной ткани челюстей, которая встречается в 25-70% случаев отсутствия зубов. В связи с этим, проводятся предварительные реконструктивные костно-пластические оперативные вмешательства для восстановления объема костной ткани.

Цель исследования: Оценить результаты различных методик костной пластики у пациентов при подготовке к дентальной имплантации и выявить факторы успеха этих оперативных вмешательств.

Материалы и методы: Проанализированы результаты лечения 281 пациента с отсутствием зубов и значительной атрофией костной ткани челюстей. В зависимости от вида выполненной костно-пластической операции пациенты разделены на четыре группы: 1 - направленная костная регенерация (НКР); 2 - трансплантация костного блока (ТКБ); 3 - открытый синус-лифтинг (ОСЛ); 4 - локальная костная модификация (ЛКМ). Результаты оценивались при помощи клинико-рентгенологического обследования в сроки 6, 12, 24 месяца после оперативного лечения, использовалась собственная 4-х бальная система оценки и методы статистического анализа.

Результаты исследования: Анализ исходов костнопластических операций в полости рта говорят о значительном проценте неудачных исходов костнопластических операций НКР (76,59%) и ТКБ (57,14%). Статистический анализ говорит о том, что это связано с рядом факторов, основным из которых является количество имеющихся костных стенок дефекта (атрофии) и его объём. Предоперационная оценка этих факторов позволяет прогнозировать результат костно-пластических операций у пациентов при подготовке к дентальной имплантации.

***Ключевые слова:** дентальная имплантация, атрофия альвеолярного отростка, костная пластика, результат операции, факторы успеха костной пластики*

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Актуальность

Дефицит костной ткани альвеолярного отростка верхней челюсти и/или альвеолярной части нижней челюсти (АОВЧ/АЧНЧ) является основным препятствием для долгосрочного успеха дентальной имплантации и встречается в 25-70% случаев.[1-5]

Физиологическая атрофия, постэкстракционная резорбция, дефект альвеолярного гребня могут иметь различные этиологию и патогенез, более выражены в случаях длительного отсутствия зуба и/или травматичной операции его удаления и определяются индивидуальными анатомическими особенностями, однако, мы условно объединим их в термин «атрофия/дефект» для общего обзора методов и результатов лечения.[4-7]

В зависимости от объема, расположения и геометрии атрофии и/или дефекта, применяются различные методы костной пластики, предназначенные решить эту проблему.[8-15]

При этом, традиционно используемые термины "восстановительная хирургия», «пластическая хирургия», «реконструктивная хирургия» относятся к хирургии в целом, слишком широко и недостаточно специфично отражают особенности применяемых в нашей области методик.

Поэтому, мы считаем целесообразным и возможным использовать другую систематизацию, более точно и предметно отражающую механизм и особенности применяемых в челюстно-лицевой области хирургических техник и методик костнопластических операций, что не вступает в противоречие с традиционными и общепринятыми терминами (Рисунок 1).

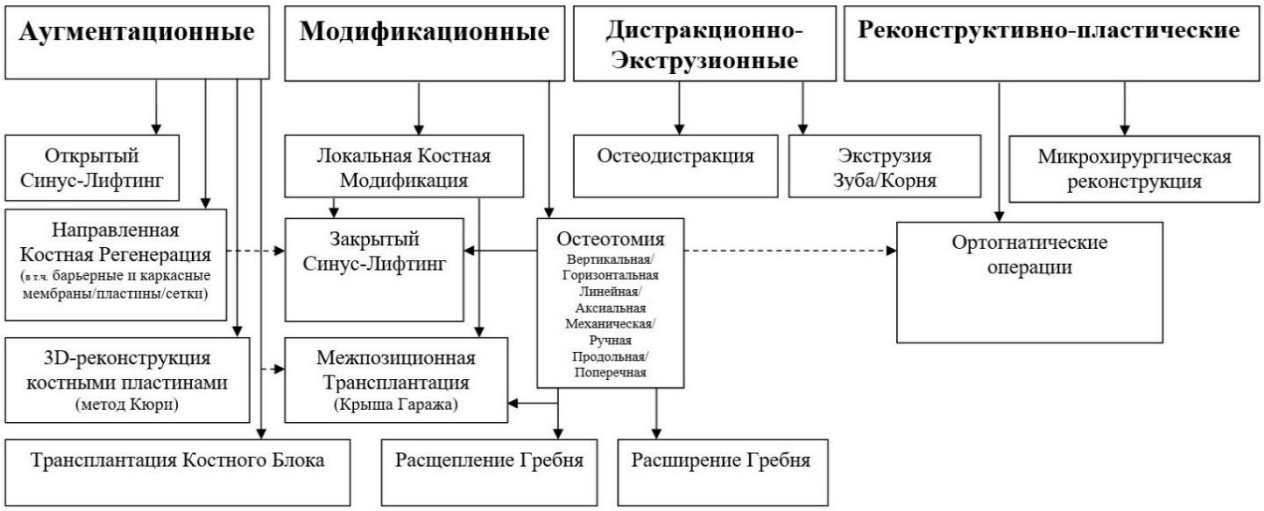

Рисунок 1. Основные современные методы костной пластики в полости рта

В амбулаторной практике чаще других используются две группы этих методов.

Аугментационные - наиболее распространенная группа методов (от лат. augmentare - увеличивать, усиливать).[9,13,14] Их суть заключается в увеличении объема с помощью «добавления» костнопластических материалов и/или собственной кости (трансплантата), при этом широко используются различные костнопластические материалы в виде блоков, пластин, стружки, порошка, гранул разной величины.[10,12,14-17] По данным различных авторов, при хирургических вмешательствах с использованием аугментационных методов костной пластики неудовлетворительные результаты и осложнения встречаются с частотой от 23% до 93%.[14,21-27] Такие результаты, заставляют задуматься о смене тактики лечения и целесообразности некоторых из этих операций, в связи с тем, что сложно прогнозировать их результат.

Модификационные методики локально изменяют форму и/или объём имеющейся кости. Можно сказать, что это пластика «местными костными тканями» в местах необходимой установки

дентальных имплантатов. К ним относятся различные виды остеотомии (рассечения кости) и изменение взаимного положения частей с целью изменения её архитектуры - вертикальную остеотомию (в т.ч. закрытый синус-лифтинг); горизонтальную остеотомию (в т.ч. расщепление альвеолярного гребня и технику «крыша гаража»); редукцию и реверсивное расширение костного ложа (в т.ч. конденсацию кости). Такая костная пластика чаще всего проводится без использования мембран и с минимальным использованием костнопластических материалов, а её успех обусловлен механизмами остеонеогенеза естественного заживления костной раны при механической травме (переломе).[18-21] Эти методики имеют потенциал для широкого клинического применения, поскольку более предсказуемы в исходе, чем аугментационные методы и менее травматичны, потому что используют местный костный ресурс. Все методы костной пластики связаны между собой и невозможно четко провести разделяющую их грань, однако для сравнительной оценки результатов, мы взяли для рассмотрения основные из них и объединили модификационные методики в отдельную группу локальной костной модификации (ЛКМ), сравнив с наиболее широко распространенными методиками костной пластики, применяемыми при подготовке к дентальной имплантации

Цель данной работы: оценить результаты (исходы) различных методик костной пластики у пациентов при подготовке к дентальной имплантации и выявить факторы успеха этих оперативных вмешательств.

Таблица 1. Половозрастная характеристика исследуемых групп

Characteristic	N = 281[1]
Возраст (лет) **(возрастная группа)**	53 (45, 62)
	66 (23%)
	120 (43%)
61+	95 (34%)
Пол	
Мужской	107 (38%)
Женский	174 (62%)

[1]Median (IQR); n (%)

Материал и методы

На базе отделения хирургической стоматологии ГАУЗ МО «Московская областная стоматологическая поликлиника» (ГАУЗ МО МОСП) и отделения челюстно-лицевой хирургии ГБУЗ МО «Московский областной научно-исследовательский клинический институт им. М.Ф. Владимирского» (ГБУЗ МО МОНИКИ им. М.Ф. Владимирского) с 2017 по 2021 годы нами проведена оценка результатов лечения 281 пациента с отсутствием зубов и значительной атрофией костной ткани АОВЧ/АЧНЧ различными методиками (таблица 1).

Проанализированы результаты 281 костнопластической операции у 107 мужчин (38%) и 174 женщин (62%) в возрасте от 23 до 74 лет с диагнозами (МКБ-10): К00.00 Частичная адентия; К00.01 Полная адентия; К08.1 потеря зубов вследствие несчастного случая, удаления зубов или локализованного пародонтита; К06.84 Атрофия гребня частичная.

Для оценки результатов (исходов), все проведенные костнопластические операции были распределены в 4 группы в зависимости от вида: направленная костная регенерация (НКР); трансплантация костного блока (ТКБ); открытый синус-лифтинг (ОСЛ); локальная костная модификация (ЛКМ).

При проведении рентгенологического и клинического исследований через 6, 12, 24 месяцев после оперативного лечения, оценивалось состояние и процесс восстановления костной ткани АОВЧ/АЧНЧ с целью анализа исходов (результатов) костнопластических операций и анализа эффективности применения различных методик операции (во внимание принималось минимальное значение).

Таблица 2. Распределение по возрастным группам в зависимости от исхода

		Возраст						p-value
		18 - 44		45 – 60		> 60		
		n	%	n	%	n	%	
Исход	Негативный	24	27,6%	38	21,0%	19	14,6%	0.064
	Позитивный	63	72,4%	143	79,0%	111	85,4%	

* - Хи-квадрата Пирсона

Оценивались:

- пол и возраст пациентов;
- объем замещения;
- локализацию дефекта / атрофии (верхняя / нижняя челюсть, правая / левая сторона, боковой/передний отдел);
- количество (от одной до пяти) и позиция (передняя / задняя / латеральная / медиальная) имеющихся костных стенок восстанавливаемого дефекта / атрофии (при условном переводе его формы в 6-стеночный куб);
- исходы (результаты) костнопластических операций (по 4-х балльной шкале в диапазоне от «Плохой» до «Хороший»).

Оценка исходов костнопластических операций проводилась по следующим критериям:

Плохим негативным исходом (1 балл) считалось: развитие острого (в т.ч. нагноение) или хронического воспаления (в т.ч. остеомиелит) в области хирургического вмешательства; отсутствие какой-либо видимой костной структуры в области костной пластики (в т.ч. резорбция костнопластического материала) и/или убыль имеющегося до операции собственного костного объема – локальный статус хуже, чем на дооперационном этапе.

Неудовлетворительным негативным исходом (2 балла) считалось: развитие хронического воспаления в области хирургического вмешательства, не поддающееся консервативному лечению; отсутствие достаточного костного объема в местах костной пластики; резорбция костнопластического материала без замещения костной тканью; прорастание мягких тканей в зону костной пластики; резорбция костного блока/трансплантата; невозможность достижения первичной стабильности дентального имплантата из-за низкого качества костной ткани; смещение или
подвижность смоделированного костного объема – локальный статус аналогичный дооперационному.

Удовлетворительным позитивным исходом (3 балла) считалось: недостаточное увеличение размеров альвеолярного гребня; наличие рентгенологических и клинических признаков нового костного объёма и/или структуры, качество которой позволяет достичь первичной стабильности при установке дентального имплантата.

Хорошим позитивным исходом (4 балла) считалось: планируемое увеличение размеров альвеолярного гребня; формирование клинически и рентгенологически достоверного нового костного объема, стабильного в отдаленные сроки, с наличием замкнутой поверхностной кортикальной пластинки, качество которого позволяет проводить установку дентального имплантата необходимого размера с достаточной первичной стабильностью.

Статистический анализ проводили в программах IBM SPSS Statistics v25 (IBM, USA), Excel 2016 (Microsoft, USA), Statistica 12 (StatSoft, USA). Для описания количественных переменных рассчитывали средние арифметические значения и стандартные отклонения (M ± SD), медианы и квартили (Me [LQ; UQ]). Анализ нормальности распределений количественных параметров проводили с помощью критерия Колмогорова-

Смирнова с коррекцией Лилиефорса. Анализ качественных параметров оценивался с помощью Хи-квадрата Пирсона.

Для сравнения количественных переменных с качественными в двух группах применяли критерий Манна-Уитни. Для сравнения количественных переменных с качественными более чем в двух группах применяли критерий Краскала-Уоллиса, а для попарных сравнений использовали поправку по Бонферрони. Для номинальных данных рассчитывали абсолютные (n) и относительные (%) частоты. Статистически значимым считали значение вероятности ошибки первого рода менее 0,05 (p<0,05).

Таблица 3. Распределение по видам операций в зависимости от исхода

		Операции								p-value
		ЛКМ		ОСЛ		НКР		ТКБ		
		n	%	n	%	n	%	n	%	
Исход (баллы)	1-2	3	1,8%	3	10,0%	57	86,4%	19	90,5%	**<0.001**
	3-4	161	98,2%	27	90,0%	9	13,6%	2	9,5%	

* - Хи-квадрата Пирсона

Результаты

Достоверных различий в результатах костнопластических операций не обнаруживалось в разных возрастных группах, т.е. результат операции в нашем исследовании не зависел от возраста (таблица 2). Однако статистически значимые отличия обнаруживались при сравнении различных видов проведенных операций. Так после оценки результатов костнопластических операций нами выявлено, что встречаемость исходов, оцениваемых нами как негативные (оценка 1 и 2 балла), составила 90,5% при проведении операций ТКБ, 86,4% НКР, 10,0% ОСЛ и 1,8% случаев ЛКМ. При этом как позитивные (оценка 3 и 4 балла) нами оценивались исходы в 98,2% ЛКМ, 90% ОСЛ, 13,6% НКР и 9,5% ТКБ (таблицы 2, 3, 4).

Плохой результат (1 балл) преобладал в общей структуре при операциях ТКБ (52,4%) и НКР (28,8%), в то время как их доля в структуре исходов ОСЛ составляет 3,3% и 0,6% при ЛКМ.

Как неудовлетворительные (2 балла), чаще других оценивались результаты при операциях НКР (57,6%), ТКБ (38,1%), в структуре ОСЛ и ЛКМ такие результаты наблюдались в 6,7% и 1,2% соответственно. Стоит отметить, что негативные результаты в этих группах коррелировали со значительным числом осложнений после этих операций.

Таблица 4. Сравнение исходов операций по группам

Параметр		**Вид операции**				**Значение p**	**Попарные сравнения**
		ЛКМ	**ОСЛ**	**НКР**	**ТКБ**		
Исход (балл)	1, n (%)	1 (0,6%)	1 (3,3%)	19 (28,8%)	11 (52,4%)	<0,001[b]	1-2: <0,001 1-3: <0,001 1-4: <0,001 2-3: <0,001 2-4: <0,001 3-4: 0,247
	2, n (%)	2 (1,2%)	2 (6,7%)	38 (57,6%)	8 (38,1%)		
	3, n (%)	28 (17,1%)	14 (46,7%)	7 (10,6%)	2 (9,5%)		
	4, n (%)	133 (81,1%)	13 (43,3%)	2 (3%)	0 (0%)		
Исход	позитивный, n (%)	161 (98,2%)	27 (90%)	9 (13,6%)	2 (9,5%)	<0,001[a]	1-2: 0,143 1-3: <0,001 1-4: <0,001 2-3: <0,001 2-4: <0,001 3-4: 0,907
	негативный, n (%)	3 (1,8%)	3 (10%)	57 (86,4%)	19 (90,5%)		

[a] - Критерий Хи-квадрат Пирсона
[b] - Точный критерий Фишера

Результаты, относившиеся нами к группе удовлетворительных (3 балла), наиболее часто отмечались при операциях ОСЛ (46,7%) и ЛКМ (17,1%), в то время как при операциях НКР они встречались в 10,6% и в 9,5% случаев при ТКБ.

Наилучшие оценки (4 балла) результата костнопластической операции отмечались в 81,1% случаев ЛКМ, 43,3% ОСЛ и в 3% НКР.

При операциях ОСЛ отрицательный (негативный) исход встречался в 10%, однако только в 3,3% случаев он относился нами к плохому (1 балл), а при проведении операций ТКБ и НКР 52,4% и 28,8% соответственно.

Операции НКР и ТКБ показали негативный результат в 86,4% и в 90,5% случаев соответственно, в то время как у операций ЛКМ такие исходы составили всего 1,8%. Наиболее успешными являлись результаты операций ОСЛ (наивысшая оценка в 43,3%) и ЛКМ (81,1%), в то время как 28,8% операций НКР и 52,4% ТКБ продемонстрировали плохой результат с уменьшением имеющегося костного объема.

При дальнейшем анализе результатов, была выявлена связь количества имеющихся стенок костного дефекта и объема костного восстановления с результатами оперативного лечения. Негативные исходы чаще соответствовали меньшему количеству имеющихся костных стенок и большему объёму костного восстановления. После статистической обработки результатов было выявлено, что у пациентов с негативным исходом операции, объём замещения в целом был выше, а количество имеющихся костных стенок меньше, чем у пациентов с позитивным

Обсуждение

Различные остеопластические материалы рассматриваются как потенциальный фактор успеха костной пластики, хотя их сравнительная эффективность является предметом дискуссии, но большинство учёных признает «золотым стандартом» аутокость, отдавая ей предпочтение в смеси с другими материалами [6,10,12,29-31]. Однако, полученные нами данные говорят о том, что успех костнопластических операций зависит от других факторов, первую очередь от объема (размера) восстановления и количества отсутствующих костных стенок.

Таблица 5. Анализ взаимосвязи различных факторов с негативным исходом

Параметр		**Исход**		**Значение p** p-value
		Позитивный (3-4 балла)	**Негативный** (1-2 балла)	
Вид операции	ЛКМ, n (%)	161 (80,9%)	3 (3,7%)	<0,001[a]
	ОСЛ, n (%)	27 (13,6%)	3 (3,7%)	
	НКР, n (%)	9 (4,5%)	57 (69,5%)	
	ТКБ, n (%)	2 (1%)	19 (23,2%)	
Возраст (лет), Me [LQ; UQ]		55 [46; 62]	52 [39,2; 57,8]	0,034[b]
Возрастная группа	18-44, n (%)	41 (20,6%)	25 (30,5%)	0,06[a]
	45-60, n (%)	83 (41,7%)	37 (45,1%)	
	61+, n (%)	75 (37,7%)	20 (24,4%)	
Пол	Мужской, n (%)	73 (36,7%)	34 (41,5%)	0,539[a]
	Женский, n (%)	126 (63,3%)	48 (58,5%)	
Сторона	Левая, n (%)	105 (52,8%)	40 (48,8%)	0,634[a]
	Правая, n (%)	94 (47,2%)	42 (51,2%)	
Группа	Боковая, n (%)	149 (74,9%)	59 (72%)	0,72[a]
	Передняя, n (%)	50 (25,1%)	23 (28%)	
Челюсть	Верхняя, n (%)	104 (52,3%)	33 (40,2%)	0,089[a]
	Нижняя, n (%)	95 (47,7%)	49 (59,8%)	
Объём замещения (мл), M±SD Me [LQ; UQ]		1.4±0.6 1 [1; 2]	1.8±0.8 2 [1; 2]	<0,001[b]
Количество имеющихся стенок (1-5), Me [LQ; UQ]		3 [3; 3]	2 [2; 3]	<0,001[b]
Передняя стенка	Нет, n (%)	171 (85,9%)	67 (81,7%)	0,477[a]
	Есть, n (%)	28 (14,1%)	15 (18,3%)	

Задняя стенка	Нет, n (%)	182 (91,5%)	65 (79,3%)	0,008[a]
	Есть, n (%)	17 (8,5%)	17 (20,7%)	
Латеральная стенка	Нет, n (%)	24 (12,1%)	70 (85,4%)	<0,001[a]
	Есть, n (%)	175 (87,9%)	12 (14,6%)	
Медиальная стенка	Нет, n (%)	13 (6,5%)	17 (21%)	<0,001[a]
	Есть, n (%)	186 (93,5%)	64 (79%)	
[a] - Критерий Хи-квадрат Пирсона [b] - Критерий Манна-Уитни				

Удачным исходам операций костной пластики способствует наличие 4-5 стенок дефекта (ящико-образная форма), что можно оценить при клиническом осмотре или изучив данные ортопанорамной и компьютерной томографии на этапе планирования оперативного лечения. Это подтверждается наблюдениями других авторов, которые установили, что встречаются дефекты различной формы и с разным количеством стенок, с различной частотой на верхней и нижней челюстях.[17] При этом наши результаты согласуются с приведенными данными других исследований и описанной моделью заживления костных лунок после удаления зубов, что говорит о схожести механизмов костного восстановления.[7,17]

Анализ результатов костнопластических операций в полости рта говорит о значительном количестве негативных исходов при выполнении операции НКР (86,4%) и ТКБ (90,5%), что можно объяснить меньшим количеством имеющихся костных стенок и возможном мышечным натяжением слизистых лоскутов при выполнении этих операций. Так, успех операций ОСЛ можно объяснить достаточным количеством костных стенок в геометрии дна верхнечелюстной пазухи, особенностями её сосудистого строения, изоляцией области аугментации от полости рта, отсутствием мышечного натяжения лоскутов, а также регенеративной способностью надкостницы. Известно также, что значительный вклад в процесс образования костного регенерата вносит её способность активировать морфогенетические белки, которые являются основными активаторами дифференциации остеобластов и остеогенеза.[32-36] Поэтому, её функциональное состояние также является одним из ключевых факторов успеха костной пластики.[21]

Заключение

Оценка результатов (исходов) различных методик костной пластики у пациентов при подготовке к дентальной имплантации показывает, что операции НКР и ТКБ показывали негативный результат чаще, чем позитивный, в то время как у операций ОСЛ и ЛКМ позитивные исходы преобладали над негативными.

Анализируя факторы, способствующие успеху костнопластических операций и его закономерностям, нами прослеживалась прямая зависимость отрицательных исходов операций с объёмом дефекта и количеством отсутствующих стенок, что является критически значимым критерием в прогнозе успеха. Это необходимо учитывать при разработке персонализированного подхода и планировании таких операций.

Конфликт интересов

Авторы декларируют отсутствие конфликта интересов.

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RESULTS OF BONE GRAFTING IN PREPARATION FOR DENTAL IMPLANTATION: ANALYSIS OF RISKS AND SUCCESS FACTORS

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Resume

The main obstacle to the long-term success of dental implantation is a deficiency of alveolar ridge bone, which occurs in 25-70% of cases of tooth absence. In this regard, preliminary reconstructive bone surgery is carried out to restore the volume of bone.

The Aim of the study was to evaluate the results of various bone plastic techniques in patients in preparation for dental implantation and to identify the success factors of these surgical procedures.

***Materials and methods*:** The results of surgery of 281 patients with missing teeth and significant bone atrophy of the jaws were analyzed. Depending on the type of surgery performed, patients are divided into four groups: 1 - guided bone regeneration (GBR); 2 - bone block transplantation (BBT); 3 - open sinus lifting (OSL); 4 - local bone modification (LBM). The results were evaluated using a clinical X-ray examination within 6, 12, 24 months after surgical treatment, using its own 4-point evaluation system and methods of statistical analysis.

Results: The analysis of the outcomes of oral bone surgery indicates a significant percentage of unsuccessful outcomes of the GBR bone surgery (76.59%) and BBT (57.14%). Statistical analysis suggests that this is due to a number of factors, the main of which is the number of available bone walls of the defect (atrophy) and its volume. Preoperative assessment of these factors allows predicting the result of bone plastic surgery in patients in preparation for dental implantation.

ՈՍԿՐԱՅԻՆ ՓՈԽՊԱՏՎԱՍՏՄԱՆ ԱՐԴՅՈՒՆՔՆԵՐԸ ԱՏԱՄՆԱՅԻՆ ԻՄՊԼԱՆՏԱՑԻԱՅԻ ՆԱԽԱՊԱՏՐԱՍՏՄԱՆ ԺԱՄԱՆԱԿ. ՌԻՍԿԵՐԻ և ՀԱՋՈՂՈՒԹՅԱՆ ԳՈՐԾՈՆՆԵՐԻ ՎԵՐԼՈՒԾՈՒԹՅՈՒՆ

Ալեքսանդր Սիպկին,[1] Պավել Պոլուպան,[2] Իրինա Կրյաժինովա,[3] Արտեմ Չումակով [4]

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[3] Դիմածնոտային վիրաբուժության բաժանմունքի գիտաշխատող, Մ.Ֆ. Վլադիմիրսկու անվ Մոսկվայի տարածաշրջանային գիտահետազոտական կլինիկական ինստիտուտ. Մոսկվա, ՌԴ

[4] Դոկտորանտ, Մ.Ֆ. Վլադիմիրսկու անվ Մոսկվայի տարածաշրջանային գիտահետազոտական կլինիկական ինստիտուտի Դիմածնոտային վիրաբուժության ամբիոն, Մոսկվա, ՌԴ, Պոդոլսկի Տարածաշրջանային կլինիկական հիվանդանոց, Պոդոլսկ, ՌԴ

Ամփոփում

Ատամների իմպլանտացիայի երկարաժամկետ հաջողության հիմնական խոչընդոտը ալվեոլային ոսկորի անբավարարությունն է, որը հանդիպում է ատամի բացակայության դեպքերի 25-70%-ում: Այս առումով կատարվում է ոսկրերի նախնական վերականգնողական վիրահատություն՝ ոսկորների ծավալը վերականգնելու համար:

Հետազոտության նպատակն էր գնահատել տարբեր ոսկրային պլաստիկայի արդյունքները հիվանդների մոտ իմպլանտացիայի նախապատրաստման ժամանակ և բացահայտել այս վիրաբուժական միջամտությունների հաջողության գործոնները:

Նյութեր եւ մեթոդներ. Վերլուծվել են բացակայող ատամներով և ծնոտների զգալի ոսկրային ատրոֆիայով 281 հիվանդի վիրահատության արդյունքները: Կախված կատարված վիրահատության տեսակից՝ հիվանդները բաժանվել են չորս խմբի՝ 1 - ուղղորդված ոսկրային ռեգեներացիա ; 2 - ոսկրային բլոկի փոխպատվաստում; 3 - բաց սինուս լիֆտ; 4 - տեղային ոսկրային փոփոխություն: Արդյունքները գնահատվել են կլինիկական ռենտգեն հետազոտության միջոցով վիրաբուժական բուժումից հետո 6, 12, 24 ամիսների ընթացքում՝ օգտագործելով սեփական 4 միավորանոց գնահատման համակարգը և վիճակագրական վերլուծության մեթոդները:

Արդյունքները. Բերանի խոռոչի ոսկորների վիրահատության արդյունքների վերլուծությունը ցույց է տալիս ուղղորդված ոսկրային ռեգեներացիա վիրահատության անհաջող արդյունքների զգալի տոկոս (76.59%) և ոսկրային բլոկի փոխպատվաստման (57.14%): Վիճակագրական վերլուծությունը ցույց է տալիս, որ դա պայմանավորված է մի շարք գործոններով, որոնցից հիմնականը արատի առկա ոսկրային պատերի քանակն է (ատրոֆիա) և դրա ծավալը: Այս գործոնների նախավիրահատական գնահատումը թույլ է տալիս կանխատեսել ոսկրավերականգնողական վիրահատության արդյունքները հիվանդների մոտ ատամների իմպլանտացիայի նախապատրաստման ժամանակ:

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FULL ARCH IMPLANT SUPPORTED FIXED PROSTHETIC REHABILITATION FOLLOWING MANDIBULAR RECONSTRUCTION WITH VASCULARIZED FIBULA BONE GRAFT

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Abstract

Dental rehabilitation with osseointegrated implants in reconstructed mandibles is a common procedure, lot of treatment and prosthetic options have been documented in literature. Full and complete rehabilitation of masticatory function may only be achieved by a final prosthetic restoration, leading to improvement of general well being. We herein report a case of full arch dental rehabilitation of vascularised fibula reconstructed mandible using 5 implants, multiunit abutment and an acrylic titanium hybrid screw retained denture. The hybrid denture helps in compensating the vertical and horizontal bone and soft tissue discrepancy and also allows easy retrievability for maintenance or repair and contributes to healthy peri-implant tissue.

***Keywords:** Dental implants, mandible reconstruction, fibula bone graft, full arch rehabilitation, hybrid denture*

Introduction

Treatment of orofacial tumors commonly requires partial resection of the mandibular bone, soft tissue and muscle tissue leading to facial asymmetry, mandibular deviation, masticatory dysfunction, speech disturbances and swallowing difficulties as well as considerable aesthetic impairment.[1]

Immediate reconstruction of maxilla, mandible and adjoining soft tissues has been performed using vascularized fibula tissue transfer from past 3 to 4 decades and has proved to be a reliable morphofunctional reconstruction technique. Fibula free flap was first described by Taylor and colleagues in 1975,[2] and then Hidalgo[3] introduced it for mandibular reconstruction in 1989.

The fibula free flap offers an ideal reconstruction because it is a long, straight, strong, highly cortical bone that is expendable and includes a lengthy vascular pedicle with adequate calibre for anastomosis to recipient vessels in the head and neck. The donor site morbidity is minimal and a two-team approach

can be employed for ablative and reconstructive procedures. Osteotomies can be performed safely with reliable periosteal blood supply. The septocutaneous component offers flexibility in resurfacing external skin or internal lining separate from the bony reconstruction.[4] In addition to the esthetic and functional benefits osteocutaneous free flaps are a suitable substrate for endosseous implants to restore the dentition removed as part of tumor ablation.[5]

Nocini et al stated many advantages such as sufficient length of the bony segment, good vascularization, better quality of the bone, and a long vascular pedicle, which have been discussed earlier, but it is also associated with some disadvantages with regard to prosthetic rehabilitation with dental implants because of the height discrepancy between the native mandible and the transplanted fibula. They used distraction osteogenesis to increase the height of fibula in order to improve quantitative of bone and vertical mandibular deficiency[6] and others have used use of a double-barrel fibula flap graft[7] to increase the vertical discrepancy.

In this case report the author is challenging these clams, Distraction requires an additional surgery to place the distractor and another one to remove the it and it has been reported that the bridging of mandibular defects of >9.0 cm in length is very challenging with the double-barrel technique due to the limited fibula length.[7]

In this case report left mandibular ameloblastoma was resected and reconstructed using a free fibula bone graft, to compensate for the vertical discrepancy author is using, multi-unit abutments and an acrylic hybrid titanium screw retained prosthesis to rehabilitate the entire mandibular arch.

Multi-unit abutments

Multi-unit abutments are intended to be connectors between the dental implants and multiple implant screw-retained restorations. They are designed with a range of angle correction and are available for virtually all implant platforms. Multi-unit abutments provide a passive draw and positive uniform seat for all abutment sites. There are usually 3-4 angle correction options to choose from, ranging from straight - 0º to 45º. And also come in different gingival heights from 1mm to 6mm. The use of multi-unit abutments can overcome restorative challenges and is highly recommended when creating a full arch screw-retained implant restoration.

Case Report

A 48 years old female was referred to the dept of oral and maxillofacial surgery at Fortis Memorial Research Institute, Gurugram, India, with a swelling on the left lower posterior region since the last few years, the swelling was progressively increasing and was not associated with pain. She previously got an OPG, GБCT scan which suggestive of a multi locular lesion in the left lower body of the mandible extended from the left angle of the mandible up to the right mandibular canine (Figure 1 A, B).

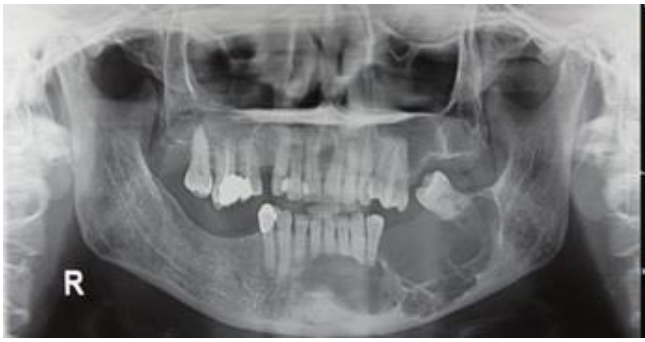

Figure 1A. Pre op OPG

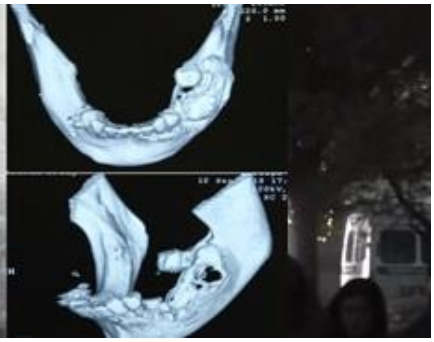

Figure 1B. GБCT scan

There was root resorption of the seen in 38, 34, 33, 32, 31, 41, 42. A incisional biopsy was performed, histopathological findings suggestive of a follicular Ameloblastoma.

The treatment plan was resection and reconstruction with free fibula bone graft followed by dental rehabilitation with dental implants.

Surgical procedure

Preoperative lower-leg Doppler ultrasonography was done evaluate the peroneal circulation before surgery. Under nasotracheal intubation, neck extended a left submandibular incision made, sub platysma dissection done, marginal mandibular vein identified and preserved the facial artery and vein ligated along with the external jugular vein, lower border of the mandible exposed, subperiosteal dissection done to expose the mandible body and the tumour (Figure 2A). A corticortomy of the buccal bone done in the angle and premolar region 1.5cm from the tumor margin. A 3.5mm reconstruction plate was adapted to the lower border of the mandible and secured with 3.5mm locking screws at the angle ramus and the right premolar region (Figure 2B).

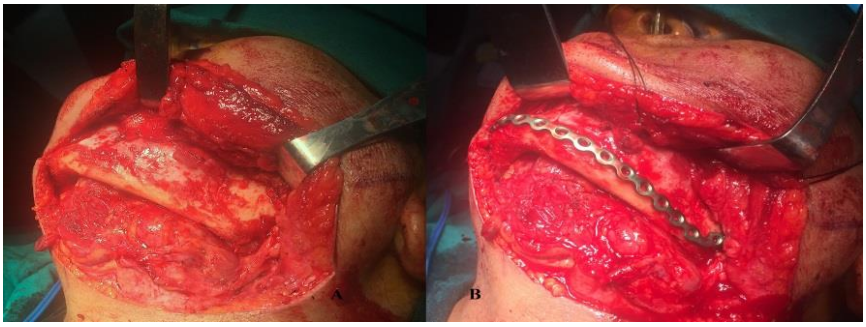

Figure 2A. Tumor exposed through sub mandibular incision

Figure 2B. Reconstruction plate adapted along the lower border of mandible before resection of tumor

Mandible osteotomy done and the tumor resected (Figure 3A, B, C).

The fibular flap was harvested at the same time as ablation of the diseased mandibular segment (Figure 4).

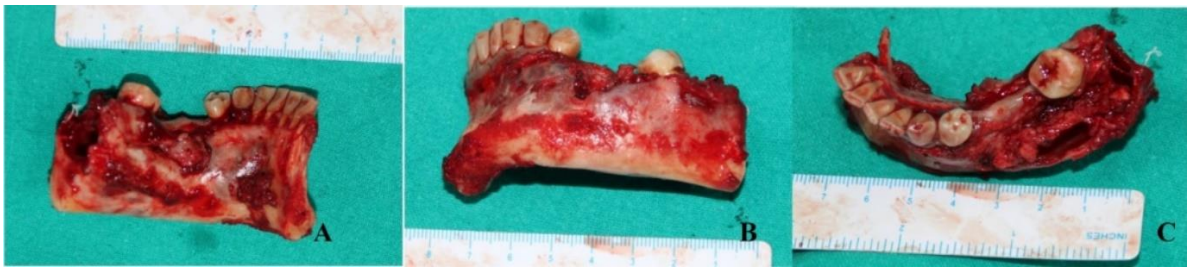

Figure 3A, B, C. Resected tumor specimen

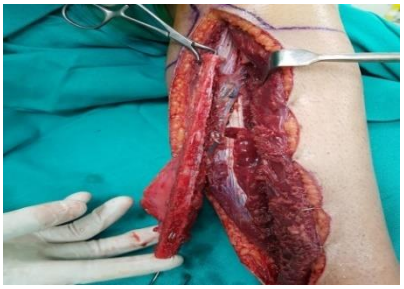

Figure 4. Fibula harvested from right leg

Once harvested, the fibula was osteotomized to fit the contour of the mandibular defect and fixed to the residual mandible with the previous contoured and secured reconstruction plate with screws to maintain the inferior border of the mandible (Figure 5 A, B).

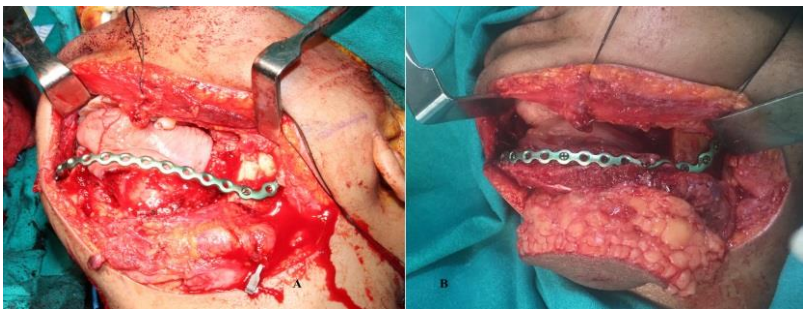

Figure 5A. Mandibular defect after tumor

Figure 5B. Resection fibula in situ

Microvascular anastomoses were performed of the peroneal vessels to the facial vessels using 9-0 ethilon. Skin paddles was placed along the submandibular incision to provide a sentinel monitor of bone viability.

Six months following reconstruction a crestal incision made right mandibular alveoloplasty done (Figure 6A, B), 4 implants were placed in the fibula and one tilted implant placed in the right 2nd premolar region of the mandible.

A 30-degree multi-unit abutment was placed on the tilted implant to correct the angulation and straight multi-unit abutments in the remaining implants were placed at the time of surgery (Figure 7A, B).

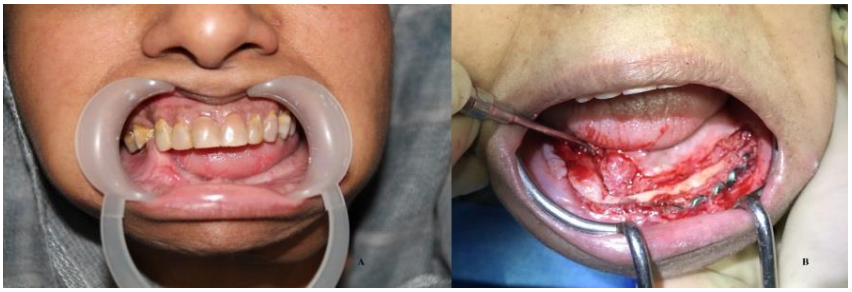

Figure 6A. Intraoral after 6 months of flap healing

Figure 6B. Crestal incision and exposed fibula

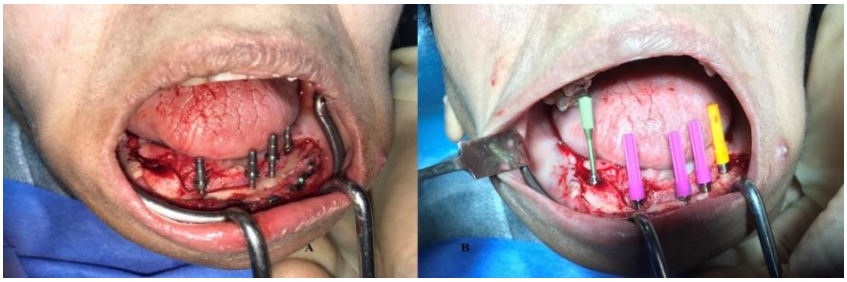

Figure 7A. Direction indicators placed to check the parallelism

Figure 7B. Multi-unit abutments placed (30-degree places in the right premolar tilted implant to maintain parallelism with the other straight implants)

Prosthetic procedure

Two months following soft tissue healing, impression made, (Figure 8 A, B, C), jaw relation, jig and teeth setting trial done and (Figure 9 A, B) a hybrid screw retained titanium acrylic denture delivered (Figure 9 C).

After the end of the prosthetic treatment, a GБCT scan showed good integration of the implants (Figure 10).

The denture improves both cosmetic and function (Figure 11 A, B).

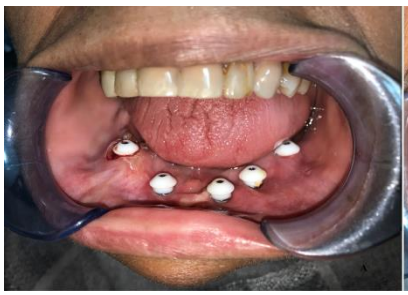

Figure 8A. 2 Months after mucosal healing

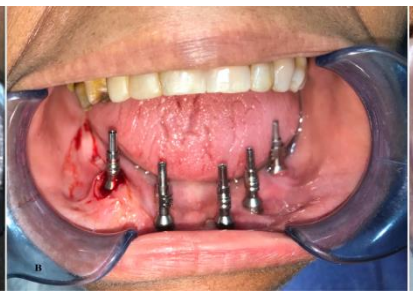

Figure 8B. Prosthetic phase open tray impression coping

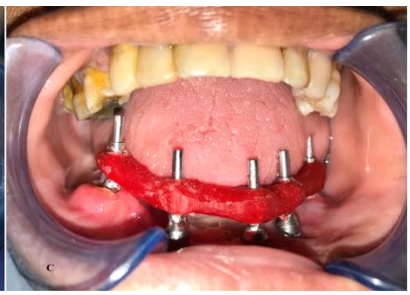

Figure 8C. Hybrid screw retained titanium acrylic denture delivered

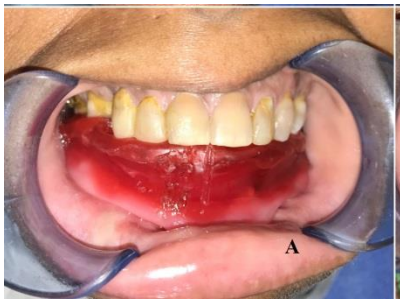

Figure 9A. Jig trial, bite registration

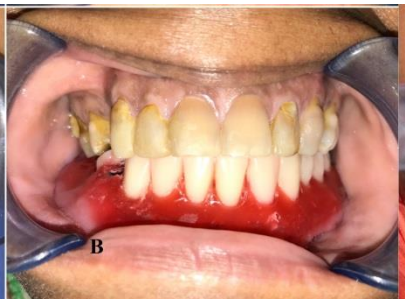

Figure 9B. Teeth setting trial done

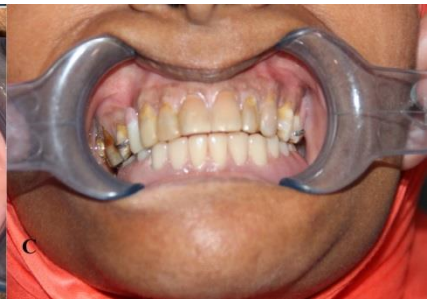

Figure 9C. Final prosthesis in situ

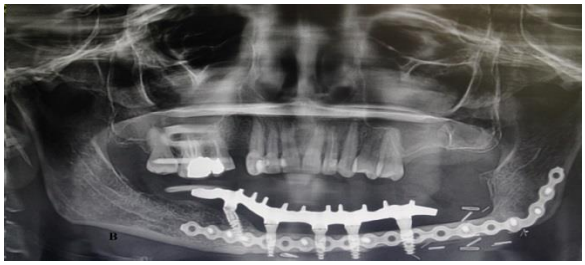

Figure 10. Post op OPG

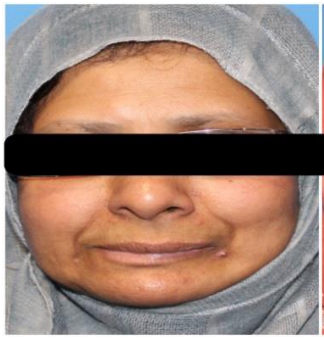

Figure 11A. Front profile view, lip fullness seen after placement of the hybrid denture

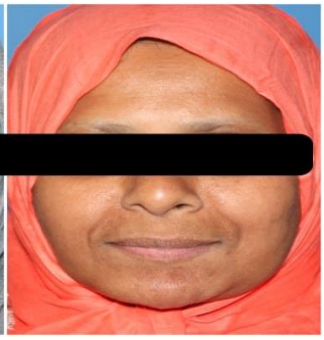

Figure 11B. The denture improves both cosmetic and function

Discussion

Various reviews have shown that only about 15–25 % of patients who have been reconstructed end up with dental rehabilitation, the remainder of patients staying functionally crippled.[8] Reconstruction of segmental maxillary or mandibular defects can be reliably accomplished using osteocutaneous free flaps, most commonly the fibula. The osteocutaneous fibula free flap provides only bony and soft tissue covering of the defect, but does not re-establish the function (such as mastication) of these structures.[9] There is a patient need and demand for dental rehabilitation following resection and reconstruction of orofacial tumors. Full and complete rehabilitation of masticatory function may only be achieved by a final prosthetic restoration, leading to improvement of quality of life.

The benefits of implant-retained prosthesis have been recognized since several years. Dental implants may improve denture retention and stability without unnecessary loading of the vulnerable mucosa. Function, comfort, aesthetics, and eventually the quality of life can be improved.[10]

A previous cadaveric study revealed that the fibula bone has adequate width, thickness, and bone volume for dental implant placement that can withstand the biomechanical loads of mastication forces experienced throughout a lifetime.[13] In fact, a recent

retrospective study reported that the success rate of implants placed in fibula flaps was 92% with an average follow-up of 30 months.[11]

In this case report a two-stage mandibular reconstruction and rehabilitation approach was used. A screw retained implant supported titanium hybrid acrylic full arch prosthesis was placed on 5 implants following reconstruction of the mandible using a free fibula bone graft, the prosthesis was screwed on muti-unit abutments which were placed at the time of implant placement so that soft tissue was allowed to heal around them.

Currently, a one-piece abutment, which can be straight or angled, is commonly used. These definitive multi-unit abutment enable better hemidesmosomal adherence between the soft tissue and titanium and therefore might reduce bone resorption around the implants This "one abutment at one time" concept is especially advantageous in immediately restored implants for partial and full edentulous cases, whereas non removal of the multi-unit abutments placed at the time of surgery results in a statistically significant reduction in crestal bone resorption around the implants.[14]

Multi-unit abutments also enable an adequate parallelization, facilitating common insertion path for multi-unit, long-span, cross-arch restorations. When connecting several implants with a screw-retained implant restoration, there is a need for an interim part, a multi-unit abutment, to correct the differences in implant angles and to create a common path of insertion.[15]

The advantage of Screw-retained design of implant-based restorations allows for easy and nondestructive retrievability of the restoration for maintenance or repair procedures and contribution towards healthy peri-implant tissues. The added advantage of an acrylic hybrid denture is it compensates for vertical and horizontal discrepancy of the bone and soft tissue. Acrylic can be added to increase the fullness of the soft tissue on the face without drastically increasing the weight of the prosthesis.

Other techniques have been advocated for rehabilitation following reconstruction in the literature. Rohner et al shared their experience with prefabricated free flaps, which helped pave the way for the fibula jaw-in-a-day procedure. In this technique, implants and skin graft are placed on the fibula in situ and left there for 3 months for osseointegration. In a second-stage surgery, the fibula is harvested with the osseointegrated implants and an immediate provisional prosthesis is inserted.[16]

Levine et al reported on 4 patients for whom fibula free flap reconstruction with immediate dental implants and full dental rehabilitation was performed in 1 surgery. They coined the term 'jaw in a day' for the procedure which is an occlusion-driven reconstruction.[17]

Although further studies are needed to validate these findings, immediately placed implants appear to be safe at this time and serve as the rationale for the jaw-in-a-day procedure. The greatest and most obvious disadvantage of this technique is the loss of the investment in dental implants and the prosthesis should a flap failure occur.[17]

There are various treatment strategies to achieve different types of implant anchored prosthesis, and the treatment planning must be based on a cost-benefit analysis of the prosthesis for each patient.

We performed a delayed implant surgery as Insertion of implants into a fibula flap during one-stage reconstruction can compromise bone viability. The patient was explained the entire treatment plan in detail before the start of the treatment and also the pro and cons of immediate and delayed implant placement. The patient was comfortable in waiting for 6 months for rehabilitation following reconstruction. it was decided to go with a two-stage procedure.

The success of delayed loading when compared to immediate loading has been documented in the past delayed loading procedure guarantees that the implant is well protected during its incorporation in bone when the osseous interface has not been established properly, as evidenced from experimental and clinical studies.[18]

The primary objected was to get the patient disease free once the tumor was removed and reconstructed. We essentially treated the fibula-reconstructed mandible the same way as an edentulous mandible and followed all prosthetic steps as in a normal mandible rehabilitation.

Conflict of interest

The authors declare no conflict of interest.

Funding

This research received no external funding.

Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

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ԻՄՊԼԱՆՏՆԵՐԻՆ ՖԻՔՍՎԱԾ ԱՄԲՈՂՋԱԿԱՆ ՕՐԹՈՊԵԴԻԿ ՌԵԱԲԻԼԻՏԱՑԻԱ ՍՏՈՐԻՆ ԾՆՈՏԻ ՎԵՐԱԿԱՆԳՆՈՒՄԻՑ ՀԵՏՈ՝ ՕԳՏԱԳՈՐԾԵԼՈՎ ԱՆՈԹԱՎՈՐՎԱԾ ՖԻԲՈՒԼԱՅԻ ՈՍԿՐԱՅԻՆ ՓՈԽՊԱՏՎԱՍՏ

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Ամփոփում

Վերականգնված ստորին ծնոտներում իմպլանտներով օրթոպեդիկ վերականգնումը սովորական պրոցեդուրա է, բուժման և պրոթեզավորման բազմաթիվ տարբերակներ փաստագրված են գրականության մեջ: Ծամող ֆունկցիայի ամբողջական վերականգնումը կարող է իրականացվել միայն վերջնական պրոթեզային վերականգնմամբ, ինչը կհանգեցնի ընդհանուր բարեկեցության բարելավմանը: Մենք ներկայացնում ենք 5 իմպլանտների և ակրիլային տիտանի հիբրիդային պտուտակով ամրացված պրոթեզի միջոցով անոթավորված ֆիբուլայի ոսկրային փոխպատվաստով վերականգնված ստորին ծնոտի ատամների ամբողջական վերականգնման դեպք: Հիբրիդային պրոթեզն օգնում է փոխհատուցել ոսկրերի և

փափուկ հյուսվածքների ուղղահայաց և հորիզոնական անհամապատասխանությունը, ինչպես նաև թույլ է տալիս հեշտ վերականգնում կատարել պահպանման կամ վերականգնման համար և նպաստում է առողջ պերիիմպլանտային հյուսվածքին:

Իմպլանտներին ֆիքսված ամբողջական օրթոպեդիկ պրոթեզը աջակցում է անոթային ոսկրային փոխպատվաստումով ստորին ծնոտի վերականգնմանը:

ОПИРАЮЩИЙ НА ИМПЛАНТОВ НЕСЪЕМНАЯ ПОЛНАЯ ОРТОПЕДИЧЕСКАЯ РЕАБИЛИТАЦИЯ ПОСЛЕ РЕКОНСТРУКЦИИ НИЖНЕЙ ЧЕЛЮСТИ С ИСПОЛЬЗОВАНИЕМ ВАСКУЛЯРИЗИРОВАННОГО КОСТНОГО ТРАНСПЛАНТАТА МАЛОБЕРЦОВОЙ КОСТИ

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Резюме

Стоматологическая реабилитация с помощью остеоинтегрированных имплантатов в реконструированных нижних челюстях является распространенной процедурой, в литературе описано множество вариантов лечения и протезирования. Полная реабилитация жевательной функции может быть достигнута только при окончательном протезировании, что приводит к улучшению общего самочувствия. Здесь мы сообщаем о случае полной стоматологической реабилитации реконструированной васкуляризированной малоберцовой кости нижней челюсти с использованием 5 имплантатов, мультиюнитного абатмента и протеза с гибридной акриловой титановой винтовой фиксацией. Гибридный протез помогает компенсировать вертикальное и горизонтальное несоответствие костей и мягких тканей, а также позволяет легко извлекаться для обслуживания или ремонта и способствует здоровой ткани вокруг имплантата.

Sabharwal G, Singh A, Taneja R, Batra RS, Chugh RK. Full arch implant supported fixed prosthetic rehabilitation following mandibular reconstruction with vascularized fibula bone graft. *Bulletin of Stomatology and Maxillofacial Surgery*. 2023;19(2):145-153. doi: 10.58240/1829006X-2023.19.2-145

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CLINICAL ARTICLE

MACULAR HOLE RECOVERY SURGERY USING AUTOLOGOUS PLATELET RICH PLASMA

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Abstract

The aim of this study was to evaluate the long-term outcomes of highly concentrated autologous platelet-rich plasma (PRP) used as an adjunct inmacular hole surgery.

Materials and methods: 11 patients (11 eyes) were selected for surgical treatment, of which 9 patients were female and 2 males. 10 patients (10 eyes) had primary macular tears, of which 8 eyes had grade 4 and 2 eyes had grade 3 macular tears and one patient had post-traumatic macular tear. The age of patients with primary macular tear was 59-75 years, and the patient with traumatic macular tear was 32 years old.

Visiometry, tonometry, ophthalmoscopy, biomicroscopy, echography of the eyeball, and optical coherence tomography of the retina were performed on all patients before the operation and in the postoperative period.

The patients were operated under local anesthesia (2% 2ml Lidocaine and 0.75% 2ml Bupivacacaine) in the following way: 25 Gauge standard pars plana vitrectomy with mandatory removal of the posterior hyaloid membrane, after which peeling of the internal limiting membrane of the retina was performed with a large volume. Platelet-rich plasma was separated under sterile conditions in the operating theatre. It was introduced into the macular hole region in the end of surgery and 8% octafluoropropane gas (C3F8) was introduced into the eye.

Results: There were no complications during surgery or in postoperative period. Optic coherence tomography of the macula was performed on the 7th day after surgery. In all 11 cases there was anatomical closure of the macular holes. Visual acuities were measured on days 14 and 3. On average there was an improvement in visual acuity by 2 lines according to Snellen chart, disappearance of metamorphopsia and image distortion.

During the follow up the patients during 6 month there was no development cataract, retinal tears or detachment, late endophthalmitis or any other complications.

Conclusion: During the surgical treatment of patients with primary and secondary macular holes the use of autologous platelet rich plasma promotes the anatomical closure of the holes, as a result of which metamorphopsias and central scotomas disappear and an increase in visual acuity is observed.

***Keywords:** macular hole, platelet rich plasma, vitrectomy*

Introduction

The inner layer of the eyeball is a layer of nerves, located between the choroid and the vitreous body and is called the retina. It includes the macula which is the central part of posterior pole and its responsible for our central vision. The retina lacks sensory innervation and this leaves its mark on the clinical picture of retinal diseases.

Macular hole is a full thikness round tear in the center of the fovea.[1] It is an acquired multifactorial diease that found in developed and developing countries, in people of all races and genders.

There is considerable controversy regarding the pathophysiology, natural history, and treatment of macular holes and antecedent lesions.

The pathogenesis of idiopathic age-related macular holes remains unclear despite many theories. Pseudo-macular holes can be mistaken for macular hole lesions despite careful clinical examination. Vitreous tangential traction may play a role. Cellular components surrounding the edges of the macular holes can also generate tangential traction forces and elevate the edge.

Historically, macular holes have been rare, have been associated with trauma, and have been seen in young adults. Macular hole was first described in ophthalmic literature in 1869 by Herman Knapp as a consequence of eyeball blunt trauma.[2]

Macular hole Due to the accompanying trauma-induced retinal pathologies, such as retinal concussion, vitreous hemorrhage, retinal hemorrhage, choroidal rupture, retinal pigment epithelium (RPE) injury, subretinal choroidal neovascularization, and fibrosis functional prognosis is often uncertain.[3,4]

This pathological condition causes central vision deterioration, metamorphopsia, distortion of images and central scotoma.

Macular hole can be primary or idiopathic and secondary.[5] In most cases it is primary as a result of abnormal vitreofoveal traction. The average prevalence of idiopathic macular hole is 3.3 per 1000: usually it is unilateral, only 10% in cases it is bilateral: the female to male ratio for idiopatic macular hole is 3:1.[6,7]

Risk factors macular hole can include older age, female sex, contraction of the premacular cortex of the vitreous, posterior hyaloid detachment, foveal cysts, myopia, eyeball injuries, intraocular inflammations, long term macular edema and etc.[8,9]

Currently optic coherence tomography of the macula is considered the main diagnosis method, which allows evalnating the diameter and hight of the macular hole edges.[10-12] The first surgical treatment of macular hole was performed by Neil E Kelly and Robert T. Wendel.[13]

Vitrectomy with gas tamponade is considered an effective treatment method for this pathology, which has been the gold standart of treatment since[14,15] with removal of the epiretinal tissue and internal limiting membrane). Previous studies have shown a decrease in the effectiveness of vitrectomy in LMWH, especially in the absence of additional traction epiretinal components. Thus, treatment recommendations are often delayed, leading to disease progression and possible worse outcome after late initiation of therapy. Therefore, we need safer and more effective therapeutic approaches for LMWH.

Despite continuous improvement in techniques and surgical tools, extremely large and refractory macular holes still have poor surgical outcomes with current treatment standards. PRP is an alternative therapeutic approach for surgical treatment of MH, even in those of difficult management, as with myopic origin.[16]

Since the 1990s, platelet-rich plasma (PRP) has been described as an adjunct to macular surgery for traumatic, persistent, and recurrent full-thickness macular holes or optic disc pit maculopathy.[17]

The surgery using autologous platelet rich plasma technique is one of several techniques that can be used to improve the efficiency of macular hole surgery in eyes in which a previous operation has failed, or which have characteristics that make the hole difficult to close. It facilitates macular hole closure by creating an interface.[18,19]

A prospective method of surgical treatment macular holes is the using of autologous platelet rich plasma during surgery.[20]

Using of autologous platelet rich plasma in treatment of macular holes will significantly improve anatomic and functional outcomes. Platelet rich plasma is believed to enhance glial proliferation, which ensure anatomic closure of macular holes.[21-23]

The main component of PRP are platelets, also called platelets. These cells are a natural reservoir of many growth factors that play an important role in wound healing, such as epidermal growth factor (EGF), nerve growth factor (NGF), platelet-derived growth factor (PDGF), transforming growth factor (TGF), basic

fibroblast growth factor (bFGF) or vascular endothelial growth factor (VEGF).[24]

Autologus platelet rich plasma is easy to obtainand use almost free. Its acts as an absorbent plug rather than a tissue glue. It does not cause inflammatory or toxic reactions. Platelet rich plasma acts as a slow-release fibrin matrix containing several growth factors and cytokins, as well as mesenchymal stem cells which promote the healing process.

Considering the prevalence of this disease, the reduction of central vision and the deteration of quality of life the aim of our reseach was to develop a surgical treatment system that would allows us to restore the anatomy pf the retina thereby improving central vision.

Materials and methods

11 patients (11 eyes) were selected for surgical treatment, of which 9 patients were female and 2 males. 10 patients (10 eyes) had primary macular tears, of which 8 eyes had grade 4 and 2 eyes had grade 3 macular tears and one patient had post-traumatic macular tear. The age of patients with primary macular tear was 59-75 years, and the patient with traumatic macular tear was 32 years old.

The patients were not taking anticoagulant drugs, nor were they suffering from anemia.

Visiometry, tonometry, ophthalmoscopy, biomicroscopy, echography of the eyeball, and optical coherence tomography of the retina were performed on all patients before the operation and in the postoperative period.

Clinical case

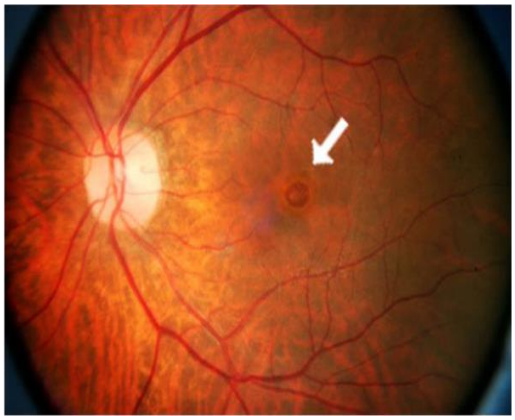

Figure 1. Optic coherence tomography (OCT) picture, posttraumatic macular hole three years old, female 32 years, visual acuity 0.1

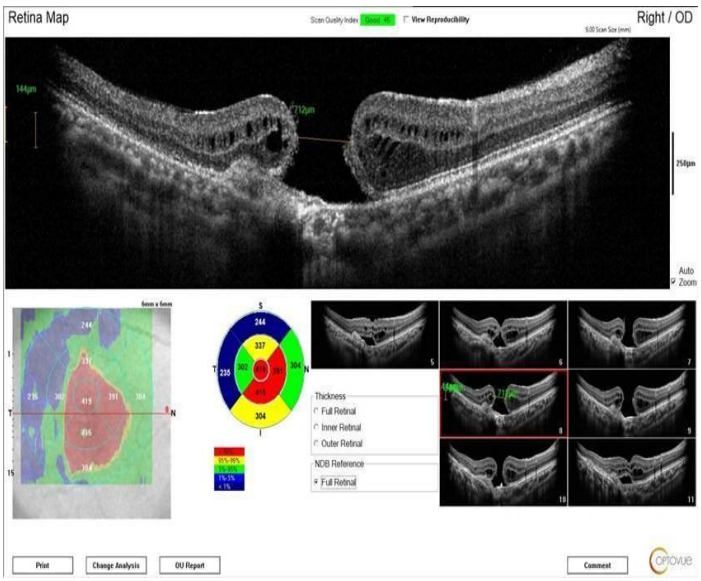

Figure 2. Photo of the retina with macular hole
Figure 3. Optic coherence tomography (OCT) picture after surgery of the same patient from figure 1, visual acuity 0.5

PRP preparation

The preparation of PRP followed the protocol described previously.[25] Whole-blood collected preoperatively (105ml) was anti-coagulated at a ratio of 1:7 and divided into its components by a special closed-circuit centrifugation procedure. In addition to platelet-poor plasma (PPP) and red blood cells (RBC), this method produced a highly concentrated PRP, which, because of the centrifugation mode, had a particularly low proportion of pro-inflammatory leukocytes compared with that obtained by the usual methods.

The patients were operated under local anesthesia (2% 2ml Lidocaine and 0.75% 2ml Bupivacacaine) in the following way: 25 Gauge standard pars plana vitrectomy with mandatory removal of the posterior hyaloid membrane, after which peeling of the internal limiting membrane of the retina was performed with a large volume. Platelet-rich plasma was separated under sterile conditions in the operating theatre. It was introduced into the macular hole region in the end of surgery and 8% octafluoropropane gas (C3F8) was introduced into the eye.

To ensure good visibility of the posterior hyaloid membrane and the internal limiting membrane of the retina as stains were used triamcinolone acetonide and 0.05% Brilliant Blue G.

After the operation the patients were left lying on his back for 2 hours, after which they take a face down position for the next 7 days.

Results

There were no complications during surgery or in postoperative period.

Optic coherence tomography of the macula was performed on the 7th day after surgery. In all 11 cases there was anatomical closure of the macular holes.

Visual acuities were measured on days 14 and 3. On average there was an improvement in visual acuity by 2 lines according to Snellen chart, disappearance of metamorphopsia and image distortion.

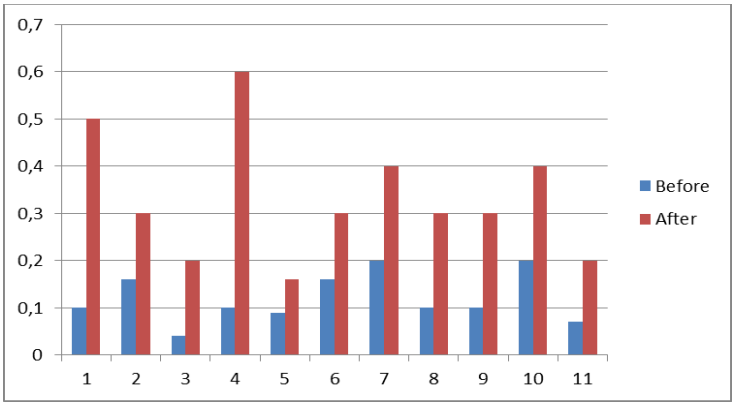

Figure 4. Visual acuity before and after surgery

During the follow up the patients during 6 month there was no development cataract, retinal tears or detachment, late endophthalmitis or any other complications.

Disscusion

The macular hole is one of the main vitreoretinal disorders causing metamorphopsia and impaired central vision in the elderly.[26] The overall incidence is approximately 3.3% per 1000 people. the prefoveal cortex of the vitreous.[27] It has been suggested that the main factors in spontaneous macular closure are the release of vitreofoveal traction or glia proliferation.[28] The treatment of macular holes has improved over the past 30 years, and improvements in technique allow closure of typical macular holes in more than 90% of cases. Visual acuity improves by at least 2 lines in over 70% of eyes. The challenge of the last decade has been to improve the treatment of eyes with macular holes, in which the prognosis for successful closure of the macular hole and improvement in visual acuity is less favorable. Although vitreous surgery was first described as a likely treatment for full-thickness macular holes (FTMH), it has become a common surgical procedure. With current surgical techniques, approximately 90% of FTMHs achieve anatomical closure at primary surgery, with nearly half of patients achieving visual acuity of 20/50 or better. The frequency of closure and visual outcome of FTMHs depends on their size and chronic nature.

Modern surgical interventions effectively treat macular holes (MR) in more than 90%.[29-30] The current surgical treatment for MH is epiretinal squamous vitrectomy, internal limiting membrane peeling (ILM). However, a small subset of MH creates problems for surgeons and is frustrating for patients. Several surgical techniques are developed and tried for the management of refractory macular holes. These include relaxing retinotomy, free and inverted ILM flaps, posterior lens capsular flap, autologous neurosensorial retinal flap, and foveal hydrodissection.

Two new alternative methods for closing atypical macular holes have been described, including amniotic membrane transplantation (AMT) and autologous retinal transplantation (ART).[31] They differ from the various ILM flap techniques in that tissue is placed in the macular hole to help occlude the macular dehiscence. In AMT, the amniotic membrane is cut and inserted into the vitreous. When the amniotic membrane is placed inside the opening, it could theoretically release some of the growth factors that promote closure.[32] Further research is needed to determine long-term outcomes and determine when this procedure is most appropriate.

So far, neither national nor international guidelines have been developed for the treatment of incomplete macular holes. Thus, the correct approach - to treat or not to treat lamellar macular holes - is still a matter of debate.

Platelet-rich plasma (PRP), whose therapeutic value is equal to that of stem cells, is currently one of the most promising therapy agents in regenerative medicine. It is increasingly being used in different areas of medicine including aesthetic dermatology, orthopedics, sports medicine and surgery. One possibility is the use of highly concentrated autologous platelet-rich plasma for macular hole surgery. Autologous blood products such as simple

blood clot and platelet rich plasma,[33-35] as well as several tissue glues comprising nonautologous blood products and synthetic molecules are also tried for facilitating hole closure.[36-39]

The article reports recovery surgery using autologous platelet rich plasma to treat these complex macular holes.

In this clinical study of 11 macular hole patients underwent recovery surgery using autologous platelet rich plasma (PRP), we could observe morphological and functional improvement in the long-term follow-up. Thus, preventing further progression even at stages that are more visually limiting also seems to be an argument in favor of earlier surgical intervention.

When considering the results of our study, two different outcomes need to be taken into account. On the one hand, there was a morphological improvement in the foveal structure and prevention of progression. On the other hand, measurements show that visual acuity improves functionally.

The use of autologous PRF appears to be a safe and effective alternative treatment for macular holes. Our study is limited by its small sample size, lack of control group, and inhomogeneous lens status. Further studies are needed to compare the advantages of the different techniques and approaches and to determine the most efficient method.

Conclusion

During the surgical treatment of patients with primary and secondary macular holes the use of autologous platelet rich plasma promotes the anatomical closure of the holes, as a result of which metamorphopsias and central scotomas disappear and an increase in visual acuity is observed.

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Institutional Review Board Statement

The study was conducted by the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee).

Informed Consent Statement

Informed consent was obtained from patient involved in the study.

Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

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ՍԵՓԱԿԱՆ ԱՐՅԱՆ ԹՐՈՄԲՈՑԻՏՆԵՐՈՎ ՀԱՐՈՒՍՏ ՊԼԱԶՄԱՅԻ ԿԻՐԱՌՄԱՆ ԱՐԴՅՈՒՆՔՆԵՐԸ ՄԱԿՈՒԼՅԱՐ ՊԱՏՌՎԱԾՔՆԵՐԻ ՎԻՐԱԲՈՒԺԱԿԱՆ ԲՈՒԺՄԱՆ ԺԱՄԱՆԱԿ

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Ամփոփում

Հետազոտության նպատակն էր գնահատել բարձր խտացված թրոմբոցիտներով հարուստ աուտոպլազմայի (PRP) կիրառման երկարաժամկետ արդյունքները, որն օգտագործվել էր մակուլային անցքիպատռվածքների վիրաբուժական բուժման ժամանակ:

Նյութեր և մեթոդներ. Վիրահատական բուժման համար ընտրվել է 11 հիվանդ (11 աչք), որից 9-ը իգական սեռի և 2-ը տղամարդ: 10 հիվանդ (10 աչք) ունեցել է դեղին բծի պատռվածք, որից 8-ը՝ 4-րդ աստիճանի, իսկ 2-ը՝ 3-րդ աստիճանի դեղին բծի պատռվածք ք, իսկ մեկ հիվանդ՝ հետտրավմատիկ դեղին բծի պատռվածք: Առաջնային մակուլայի պատռվածքով հիվանդների տարիքը եղել է 59-75 տարեկան, իսկ տրավմատիկ մակուլայի պատռվածքով հիվանդը՝ 32 տարեկան:

Բոլոր հիվանդների մոտ վիրահատությունից առաջ և հետվիրահատական շրջանում կատարվել է վիզոմետրիա, տոնոմետրիա, օֆտալմոսկոպիա, բիոմիկրոսկոպիա, ակնագնդի էխոգրաֆիա, ցանցաթաղանթի օպտիկական համակցված տոմոգրաֆիա:

Թրոմբոցիտներով հարուստ պլազման վիրահատարանում առանձնացվել է ստերիլ պայմաններում: Հիվանդներին վիրահատել են տեղային անզգայացմամբ (2% 2մլ Լիդոկաին և 0,75% 2մլ բուպիվակաին), ինչը ներառել է պարս պլանա վիտրէկոմիա, հետին հիալոիդային մեմբրանի պարտադիր հեռացում, ցանցենու ներքին սահմանային մեմբրանի փիլինգ, թրոմբոցիտներով հարուստ արյան պլազմայի ներմուծում պատռվածքի շրջան և 8% օկտաֆտորոպրոպան (C3F8) գազային էնդոտամպոնադա;

Արդյունքներ. Վիրահատության ընթացքում և հետվիրահատական շրջանում որևէ բարդություն չի եղել: Վիրահատությունից հետո 7-րդ օրը կատարվել է մակուլայի օպտիկական համակցված տոմոգրաֆիա: Բոլոր11 դեպքերում եղել է մակուլայի անցքերի անատոմիական փակում: Տեսողության սրությունը չափվել է 3-րդ և 14-րդ օրերին: Միջինում կար տեսողության սրության բարելավում 2 տողով՝ ըստ Սնելենի գծապատկերի,մետամորֆոպսիայի անհետացում և պատկերի աղավաղում:

Հետազոտության ընթացքում հիվանդների մոտ 6 ամսվա ընթացքում կատարակտի զարգացում, ցանցաթաղանթի պատռվածք կամ անջատում, ուշ էնդոֆթալմիտ կամ որևէ այլ բարդություն չի եղել:

Մեր դիտարկումները ցույց են տվել, որ առաջնային կամ երկրորդային մակուլյար պատռվածքների վիրաբուժական բուժման ժամանակ թրոմբոցիտներով հարուստ արյան պլազմայի կիրառումը հանդիսանում է անվտանգ և էֆեկտիվ մեթոդ: Տվյալ մեթոդի շնորհիվ կարելի հասնել մակուլյար պատռվածքների անատոմիական փակման և տեսողության սրության բարձրացման:

Եզրակացություն. Առաջնային և երկրորդային մակուլյար անցքերով հիվանդների վիրաբուժական բուժման ընթացքում աուտոլոգ թրոմբոցիտներով հարուստ պլազմայի օգտագործումը նպաստում է մակուլյար պատռվածքների անատոմիական փակմանը, ինչի հետևանքով անհետանում են մետամորֆոպսիաները և կենտրոնական սկոտոմաները և նկատվում է տեսողության սրության բարձրացում:

РЕЗУЛЬТАТЫ ИСПОЛЬЗОВАНИЯ СОБСТВЕННОЙ БОГАТОЙ ТРОМБОЦИТАМИ ПЛАЗМЫ КРОВИ ПРИ ХИРУРГИЧЕСКОМ ЛЕЧЕНИИ МАКУЛЯРНЫХ РАЗРЫВОВ

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Абстракт

Цель этого исследования состояла в том, чтобы оценить долгосрочные результаты высококонцентрированной богатой тромбоцитами аутоплазмы (PRP), используемой в качестве дополнительной операции на макулярном отверстии.

Материалы и методы: Для оперативного лечения включены 11 пациентов (11 глаз), из них 9 женщин и 2 мужчины. У 10 пациентов (10 глаз) были первичные разрывы желтого пятна, из которых 8 глаз имели разрывы желтого пятна 4 степени и 2 глаза имели разрывы желтого пятна 3 степени и один пациент имел посттравматический разрыв желтого пятна. Возраст пациентов с первичным макулярным разрывом составлял 59-75 лет, с травматическим макулярным разрывом — 32 года.

Всем пациентов до операции и в послеоперационном периоде выполняли визиометрию, тонометрию, офтальмоскопию, биомикроскопию, эхографию глазного яблока, оптическую когерентную томографию сетчатки. Пациенты были оперированы под местной анестезией (2% 2мл лидокаина и 0,75% 2мл бупивакакаина) следующим образом: витрэктомия 25 Калибр стандартной парс плоскость с обязательным удалением задней гиалоидной мембраны, после чего производили отслоение внутренней пограничной мембраны сетчатки, выполняется с большим объемом. Обогащенную тромбоцитами плазму отделяли в стерильных условиях в операционной и вводили в область макулярного отверстия в конце операции, а в глаз вводили 8% газ октафторпропан (C3F8).

Результаты: Осложнений во время операции и в послеоперационном периоде не было. Оптическую когерентную томографию макулы выполняли на 7-е сутки после операции. Во всех 11 случаях произошло анатомическое закрытие макулярных отверстий. Остроту зрения измеряли на 3-й и 14-й день. В среднем отмечалось улучшение остроты зрения на 2 строки по таблице Снеллена, исчезновение метаморфопсии и искажения изображения.

При наблюдении за больными в течение 6 мес развития катаракты, разрывов или отслойки сетчатки, позднего эндофтальмита и других осложнений не отмечено. Наши наблюдения показали, что использование обогащенной тромбоцитами плазмы крови при хирургическом лечении первичных или вторичных макулярных разрывов, включающий в себя парс плана витрэктомию, обязательное удаление задней гиалоидной мембраны, пиллинг внутренней пограничной мембраны сетчатки, введение богатый тромбоцитами плазма крови в область разрыва и газовая эндотампонада, является безопасным и эффективным методом. Благодаря этому методу удается добиться анатомического закрытия макулярных разрывов и повышения остроты зрения.

Заключение: При хирургическом лечении больных с первичными и вторичными макулярными разрывами применение аутологичной обогащенной тромбоцитами плазмы способствует анатомическому закрытию отверстий, в результате чего исчезают метаморфопсии и центральные скотомы и наблюдается повышение остроты зрения.

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RESEARCH ARTICLE

METHOD OF FACIAL SKIN REJUVENATION USING ELECTROSTIMULATION

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Abstract

Objectives: Purpose of the study evaluation of the cosmetic effect using patches by the company "Aganyan" for facial rejuvenation.

Materials and Methods: The study was carried out in 106 participants with presence of perioral wrinkles of the skin. Participants applied four patches (2 copper and 2 zinc) on the face in the area of wrinkles crosswise according to the instructions. The patches were applied for eight hours every third day for three months. Perioral wrinkles were assessed by comparing photographs at the beginning and at the end of the study for each individual case. The efficacy was assessed according to the International Global Aesthetic Improvement Scale (GAIS). Visual confirmation of clinical improvement was also obtained by Life Viz 3D camera pictures.

Results: After analyzing the photographs taken before and after using the patch and a personal conversation with each participant, the following data were obtained from participants:

- a decrease in puffiness and dark circles under the eyes was noted: 6 out of 15 men, 34 out of 91 women;
- smoothing of small mimic wrinkles was noted: 24 women out of 106 people;
- lifting of the face oval was noted: 14 women out of 106 people.

Evaluation of the effectiveness of the GAIS procedure on M03 and M05, 2/3 of patients had significant improvement as assessed by physician and participants according to GAIS. Most of the patients also showed significant improvement at visit M12. After analyzing the photographs taken before and after the experiment, and a personal conversation with each patient of the cosmetology profile, the following results were obtained: in 38% of patients, puffiness and dark circles under the eyes decreased, in 23% of participants fine facial wrinkles were smoothed, in 12% of participants the oval of the face was tightened. Our results suggest that patches by the company "Aganyan" can serve as a novel therapy for controlled skin rejuvenation, effective wrinkles and folds.

Conclusion: The results of the studies provide a basis for concluding that the method of skin. The patches by the company "Aganyan" have proven its effectiveness through electrical stimulation with low intensity current in patients in different age groups, the study revealed a large number of positive cosmetic effects.

***Keywords:** Wrinkles; Skin rejuvenation; Novel method of electrostimulation*

Introduction

The aging process of the skin is complex and depends on many internal and external factors. Internal skin aging occurs over time and is influenced by genetic factors. The main clinical signs of skin aging include wrinkles and uneven pigmentation. The most common causes of wrinkles are age-related changes and ultraviolet radiation.[1,2]

Wrinkles can be

Static wrinkles: These wrinkles are visible at all times and do not change in appearance with facial movements.

Dynamic wrinkles: These are expression lines that may appear as folds when the skin is not moving, and deepen with facial movements or expressions. Dynamic wrinkles appear when expressing emotions, such as fear, worry, joy, sadness, or surprise.[3] Cosmetologically manipulations can solve this problem. In modern aesthetic medicine, a variety of methods are used to rejuvenate the skin of the face.[4-6] Esthetic medicine differs from other medical care because it is not based on saving lives, but on improving the quality of life for the client. A person's autonomous decision is an indicator for esthetic treatments that will improve the client's self-image, self-esteem, and appearance to others. Medical estheticians work in accordance with strong, ethical considerations in every meeting with the client.

This includes reaching consensus in deciding which esthetic treatments to do. Over the past decade, there has been a growth in the popularity of both non-surgical and surgical cosmetic procedures. These include both medically indicated surgical techniques and more gentle procedures used to maintain skin tone. Even 10 years ago, plastic surgery methods were mainly used for skin rejuvenation and correction of age-related changes. Surgical methods were used mainly to change the shape and appearance of the face, and this is not a way to improve the internal condition of the skin, rather the opposite (since blood circulation in the affected areas is impaired).[7,8] Fear of surgery, use of anesthesia, long rehabilitation period, failure to achieve the desired results testify in favor of non-surgical methods.

Non-surgical methods are used can solve the following problems of age-related skin changes:

- smooth out wrinkles caused by muscles of expression (age related);
- significantly tighten the skin and correct the oval of the face;
- narrow the enlarged pores;
- enhance the natural production of anti-aging substances.

The methods of non-surgical facial rejuvenation are mainly aimed at renewing the surface layers of the skin, at improving the internal structure, i.e., to stimulate your own collagen.[9,10] Modern therapies use a variety non-surgical facial rejuvenation method, these procedures include laser rejuvenation, photo-rejuvenation, radio frequency, ultrasound, electro-optical synergy, thermae, ozone rejuvenation, chemical peels, microdermabrasion, injectable fillers, neurotoxins, platelet-rich plasma mesotherapy, botulinum therapy, etc. to rejuvenate the skin.[11-14] Among the popular methods of facial rejuvenation, mesotherapy should be noted.[15-17] This technique consists in injecting special preparations into the skin of the face: bioactive substances, preparations based on hyaluronic acid and fibroblasts- the key elements of the cell involved in the formation of collagen. These beneficial micro-injections contribute to effective facial rejuvenation. One of the most effective methods of facial rejuvenation is laser rejuvenation. The laser effectively penetrates the inner layers of the skin without damaging its outer layer. The technique of laser rejuvenation allows you to renew the cellular structure of the skin, make the skin smooth and elastic.[18-20] Ozone rejuvenation is a common method of facial rejuvenation.[21] Ozone stimulates the microcirculation of blood in the skin tissues, promotes the renewal of subcutaneous tissue, which leads to an improvement in complexion and provides a rejuvenating effect. Ozone is used in the form of injections into problem areas of the face and neck. Thermae is also a widely used facial rejuvenation method.[22,23] Under the influence of special radio frequency radiation, the temperature of the skin tissue rises, which leads to an increased production of cola gen and elastane, which are responsible for the smoothness, firmness and elasticity of the skin. However, the physical and chemical methods of the listed methods of treatment have certain disadvantages. The main disadvantage of modern methods of

physical rejuvenation is that they deliver external energy to the entire mass of tissue, affecting both cells and the extracellular matrix; this changes the function and architecture of the tissue being treated. Themain disadvantage of chemical rejuvenation methods is that, although they only target cells,they involve the delivery of external moleculesthat can trigger a tissue response outside the target. This uncontrolled subsequent reaction can lead to clinical complications such as burns,vascular deformity of the skin, tumors, keloids, hypertrophic scars, skin contraction, facial paralysis, necrosis, intravascular penetration, and infection. Among the non-invasive methods of skin rejuvenation, electrostimulation can be used to achieve numerous cosmetic effects, such as: regeneration, toning, skin rejuvenation, etc.[24,25] One of the most important innovations when it comes to aesthetics is the new medical advancements. The search for optimal and safe combinations, scientifically substantiated protocols for the correction of involutional changes in the skin of the face is a current trendin dermatocosmetology. An example of a device with a similar effect is the patches by the company “Aganyan”, which will be discussed in our article. The uniqueness of this invention is that electrical stimulation can be used for long-term stimulation with low voltage and current without the use of wires and batteries. Here we report on a novel, non-invasive method of skin rejuvenation using electrostimulationplasters of "Aganyan" company.

Purpose of the study is evaluation of thecosmetic effect using the patches by the company “Aganyan” plasterfor facial rejuvenation

Materials and Methods

This was an open, pilot study conducted on 106 volunteers under the control of dermatologists.All the volunteers signed a consent form containing the information relative to the natureand procedures of the study. This study was conducted according to the ethics of the “Helsinki declaration”.
Patients had a presence of peri-oral wrinkles of the facial skin.

Table 1: Distribution of participants in the cosmetology profile

Age (range)	M	F	Total
30-39	3 (20%)	45	48
		(49.5%)	(45.3%)
40-49	5	27	32
	(33.3%)	(29.7%)	(30.2%)
50-59	7	19	26
	(46.7%)	(20.8%)	(24.5%)
Total	15	91	106
	(100%)	(100%)	(100%)

Inclusion criteria: healthy women; thepatient's desire and ability to take part in the study; the presence of scales on skin over nano-labial lines, lower and upper lips, marrionete lines that show wrinkles of mild and moderate degrees according to the Merz Aesthetics Scale (MAS in the validated 5-point, where 0=no wrinkles, 1=mild wrinkles, 2=moderate wrinkles, 3=severe wrinkles, and 4=very severewrinkles) [26]. Exclusion criteria: The presenceof somatic, endocrine, oncological, infectious and skin diseases, blood diseases, pregnancy, lactation, the presence of permanent filler in marionette lines, skin, peels, mesotherapy and surgery performed within 6 months prior to thisstudy. Participants in front of a mirror independently assessed signs of aging on his face, comparing with the standard of the scale. The doctor, having his own subjective opinion of the clinical picture on a visual scale (during consultation and analysis of photographs) exhibited the degree of severity wrinkles and folds in points, depending on the study design: either their subjective assessment. Participants were informed of the purpose of the study and the use of any photographs obtained in which the patients could not be identified. All participants provided written consent to be included in this study and to use facial images for the purposes of the study. Each participant was given a set of patches by the company “Aganyan”, and a special brochure, in which the method of application was indicated in detail. Participantsapplied four patches (2 copper and 2 zinc) on the face in the area of wrinkles crosswise according to the instructions. The patches were applied for eight hours every third day for threemonths. The wearable patch includes a flexible substrate, a binder an adhesive layer, with an electrode foil attached to it. Skin moisture is fullof minerals, and is accepted as an

electrolyte medium. Zinc foil thickness 0.025mm and Copper foil thickness 0.025mm (Figure 1). The electrical stimulation is caused by applying at least two electrodes but preferably four, to the skin for better results to create interferential forelectrotherapy. Participants were warned that if any discomfort (redness, itching of the skin, etc.) occurs, they should immediately stop using the patch and inform the investigators. The participants tactilely and visually assessed the effects of the patch for three months. They recorded their observations in special brochures, which were later analyzed by researchers. All participants in the experiment were photographed before and after using the patch for visual assessment (Figure 2, 3). The electrostimulation therapy with patch like electrodes can be conveniently performed for long periods of time, ranging from about 1 hourto 10 hours or even more. Clinical assessment of treatment results (satisfaction by subject and investigator physician) was performed. The immediate results were assessed 1 month after the course, long-term results at the in 3 months of observation. Perioral wrinkles were assessed by comparing photographs at the beginning andat the end of the study for each case studied. Theefficacy was assessed according to the International Global Aesthetic Improvement Scale (GAIS Table 3) on the 1st (M01), 2nd (M02), 3rd (M3), 6th (M06) month of complex therapy. Visual confirmation of clinical improvement was also obtained by Life Viz 3Dcamera pictures.

Results

After analyzing the photographs taken before and after using the patch (Figure 1-3) and a personal conversation with each patient, the following data were obtained in participants:

- A decrease in puffiness and dark circles under the eyes was noted on: 6 of 15 (men), and 34 of 91 (women);
- Smoothing of small mimic wrinkles was noted on: 24 of 106 people (all women);
- Lifting of the face oval was noted: on 14 of 106 people (all women).

Evaluation of the effectiveness of the GAIS procedure on M03 and M05, 2/3 of participants had significant improvement as assessed by physician and patient according to GAIS (Table 3). Most of the patients also showed significant improvement at visit M12 (Table 3).

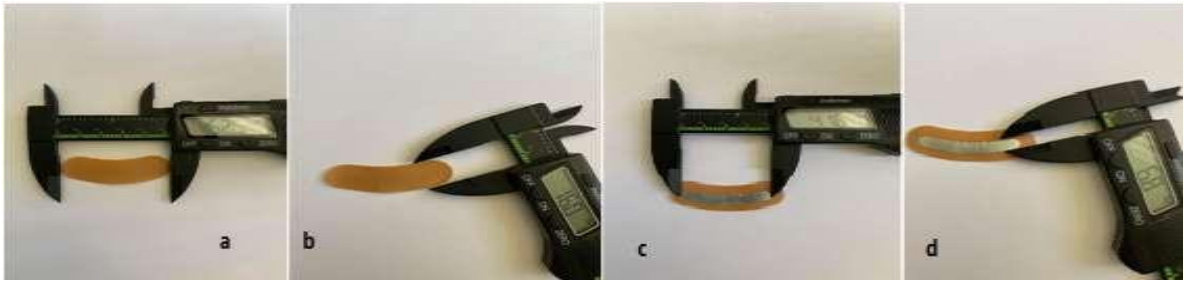

Figure 1: The wearable patches by the company "Aganyan" includes a flexible substrate, a binder an adhesive layer, with an electrode foil attached to it. Zinc foil thickness 0.025mm and Copper foil thickness 0.025mm

Figure 2. Patient at baseline (a) and (b) 12 weeks after skin rejuvenation using electrostimulation method under the eye's region

Figure 3. Patient at baseline (a) and 12 weeks after skin rejuvenation using electrostimulation method nasolabial and marionette region (b)

Table 2. Global Aesthetic ImprovementScale (GAIS) Degree Description	
SCORE	**TREATMENT RESULT**
1	Exceptional improvement-excellent corrective result
2	Very improved-marked improvement of the appearance, but not completely optimal
3	Improved patient-improvement of the appearance, bettercompared with the initial condition, but a touch-up is advised
4	Unaltered patient-the appearancesubstantially remains the same compared with the original condition
5	Worsened patient-the appearancehas worsened compared with the original condition

Table 3: GAIS indicators		
Visit	Doctor	Participants
M01	2.6 ± 0.5	2.5 ± 0.51
M02	2.8 ± 0.46**	2.9±0.31*
M03	2.7 ± 0.48**	2.5 ± 0.73
M06	1.8 ± 0.64*	1.7 ± 0.66*

Note: The value is statistically significantly different ($p < 0.05$): * from that of the indicatorat the M01 visit. After analyzing the photographs taken before and after the experiment, and a personal conversation with each patient of the cosmetology profile, the following results were obtained: in 38% of participants, puffiness and dark circles under the eyes decreased, in 23% of participants fine facial wrinkles were smoothed, in 12% of participants the oval of the face was tightened (figure 4). The "Aganyan" plaster has proven itseffectiveness through electrical stimulation with low intensity current in participants indifferent age groups, the study revealed a large number of positive cosmetic effects.

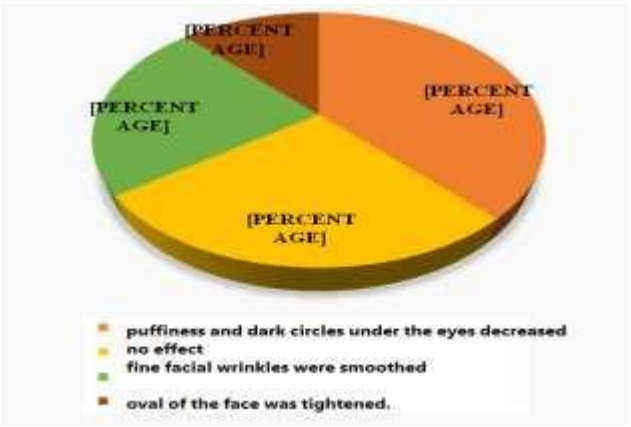

Figure 4. Effectiveness of the method of skin rejuvenation using electrostimulation method

Discussion

With age, the people have a deepening of the nasolabial fold, drooping of the corners of the mouth and loss of the border of the lips.[27-29] The appearance of perioral wrinkles often prompts patients to seek treatment.[30,31] The number of requests for cosmetic procedureswith permanent or temporary fillers (as a method of reduction in the number and depth of wrinkles, and giving lips desired volume) is growing with varying results. However, the number of less serious complications is also increasing, even with the use of safe molecules such as hyaluronic acid.[32,33] According to statistics from the American Society for Aesthetic Plastic Surgery (ASAPS), dermal fillers (from English to fill; syn: dermal fillers) occupy a leading position among the most popular non-surgical aesthetic procedure es.[34] One of the treatment options for these patients is soft tissue augmentation with skin fillers.[35] Skin fillers can provide the patient aesthetic result as these materials have the ability to reduce the appearance of wrinkles and give the face a more youthful appearance. Among non-surgical procedures according to statistics, fillers based on stabilized hyaluronic acid for the correction of involutional skin changes occupy a leading position.[36] For patients with early static lines and folds (≤ 2 degrees of contraction and ≤ 1 degrees at rest according to rating scales) for rejuvenation, physicians have the right tools in their hands toprevent or slow down skin aging. Injection procedures will be required to correct problems, and other methods, such as energy therapy,(electro-optical synergy), can be combined for optimal results. The effect of the skin bio- revitalization procedure is provided by an increase in the body's production of its own hyaluronic acid, which helps to normalize the water balance.[37] At the same time, all metabolic processes are improved, local blood flow is enhanced, which provides an increase inskin elasticity, a decrease in flabbiness, and an improvement in complexion. In the complex of non-invasive skin rejuvenation methods, the electrostimulation method is very popular.[39] Unlike contemporary physical methods that affect all tissue components, electrostimulationis an intervention at the cellular level, which precisely targets cell membranes through electroporation without affecting the extracellular matrix architecture. Unlike chemical interventions, electrostimulation is a n on-invasive procedure that does not involve the application of external molecules.[40] This study presents results of using "Aganyan" plaster to address facial wrinkles and folds. Theelectrodes are made of different metals such as zinc and copper, and not connected to any electrical device such a voltage or current source. The difference in potentials causes electrons to flow on the surface of the skin fromone of

the electrodes to another. In this sense, one of the electrodes can be considered as a cathode, while another electrode can be considered as an anode. The difference in potentials can be created only when the electrodes are of different metals. These ranges of voltages and electrical currents appear to be very safe for humans with no side effects whatsoever. At the cellular level, the electrostimulation therapy with patches stimulates an increase in adenosine triphosphate (ATP), the energy that fuels all biochemical functions in a human body. It alsobumps up protein synthesis, which is necessary for tissue repair. When exposed to the "Aganyan" plaster, a low-intensity electric current is passed through the skin. Microcurrents activate protein synthesis (collagen and elastin), promote the renewal of epidermal cells, blood flow, lymph outflow, which increases the activity of metabolic and regeneration processes and, as a result, disappears puffiness and dark circles under theeyes. By increasing the tone of the muscles or, conversely, relaxing, if they were in a state of tension, the effect of smoothing out fine mimic wrinkles is achieved. Muscles trained after stimulation tighten the oval of the face, remove flabbiness and swelling of the skin, give the face a well-groomed and rejuvenated look. Ourresults show that low-intensity electric can improve skin function. The indisputable advantages of this invention are the absence of side effects on the human body.[38]

Conclusion

Our results suggest that patches by the company "Aganyan" can serve as a novel therapy for controlled skin rejuvenation, effecting wrinkles and folds.

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Conflict of interest and financial disclosure

The author declares that he has no conflict of interest and there was no external source offunding for the present study. None of the authors have any relevant financial relationship(s) with a commercial interest.

Consent statement

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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ԴԵՄՔԻ ՄԱՇԿԻ ԵՐԻՏԱՍԱՐԴԱՑՄԱՆ ՄԵԹՈԴ ԷԼԵԿՏՐՈՍՏԻՄՈՒԼՅԱՑԻԱՅԻ ՄԻՋՈՑՈՎ

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Ամփոփում

Նպատակը. Դեմքի երիտասարդացման համար "Aganyan "կպչուկի օգտագործմամբ կոսմետիկ էֆեկտի արդյունավետության գնահատականը:

Նյութեր և մեթոդներ. Հետազոտությունն իրականացվել է մաշկի ծայրամասային կնճիռների առկայությամբ 106 մասնակիցների մոտ: Մասնակիցների մոտ ցուցումների համաձայն "Aganyan "կպչուկները խաչաձեւ փակցվել են դեմքի կնճիռների հատվածում (2 պղինձ և 2 ցինկ): Կպչուկները կիրառվել են ութ ժամ՝ յուրաքանչյուր երրորդ օրը, երեք ամսվա ընթացքում: Պերիորալ կնճիռները գնահատվել են՝ համեմատելով լուսանկարները ուսումնասիրության սկզբում և վերջում յուրաքանչյուր առանձին դեպքի համար: Արդյունավետությունը գնահատվել է Էսթետիկ բարելավման միջազգային

սանդղակի (GAIS) համաձայն:Կլինիկական բարելավման տեսողական հաստատումը ստացվել է նաև Life Viz 3D տեսախցիկի նկարներով:

Արդյունքներ. Կպչուկները օգտագործելուց առաջ և հետո արված լուսանկարները վերլուծելուց և յուրաքանչյուր մասնակցի հետ անձնական զրույցից հետո մասնակիցներից ստացվեցին հետևյալ տվյալները.

- նկատվել է այտուցների և աչքերի տակ մուգ շրջանակների նվազում՝ 15 տղամարդկանցից 6-ի մոտ, 91 կնոջից 34- ի մոտ;
- նշվել է մանր միմիկական կնճիռների հարթեցում՝ 106 մասնակիցներց- 24 կնոջ մոտ;
- նշվել է դեմքի օվալի բարձրացում՝ 106 մասնակիցներց-14 կնոջ մոտ:

Պրոցեդուրաների արդյունավետությունը գնահատելիս համաձայն GAIS-ի M03 և M05 հիվանդների 2/3-ի մոտ ցույց է տվել զգալի բարելավում, որը գնահատել են բժիշկը և մասնակիցները:
Մեծ մաս հիվանդների մոտ նույնպես զգալի բարելավումներ են ցույց տվել M12 այցելության ժամանակ: Վերցված լուսանկարները վերլուծելուց հետո փորձարկումից առաջ և հետո, և յուրաքանչյուր հիվանդի հետ անձնական զրույցից ստացվել են հետևյալ արդյունքները՝ հիվանդների 38%-ի մոտ այտուցվածությունը և աչքերի տակ մուգ շրջանակները նվազել են, մասնակիցների 23%-ի մոտ դեմքի նուրբ կնճիռները հարթվել են, մասնակիցների 12%-ի մոտ դեմքի օվալը ձգվել է:Մեր արդյունքները հուշում են, որ "Aganyan "կպչուկը կարող է ծառայել որպես նոր թերապիայի մեթոդ մաշկի վերահսկվող երիտասարդացման, արդյունավետ է կնճիռների և ծալքերի համար:

Եզրակացություն. Ուսումնասիրությունների արդյունքները հիմք են տալիս եզրակացնելու, որ "Aganyan "կպչուկի օգտագործմամբ դեմքի մաշկի երիտասարդացման մեթոդը ապացուցել է իր արդյունավետությունը ցածր ինտենսիվության հոսանքով էլեկտրական գրգռման միջոցով տարբեր տարիքային խմբերի հիվանդների մոտ, ուսումնասիրությունը մեծ թվով դրական կոսմետիկ ազդեցություն է հայտնաբերել:

МЕТОД ОМОЛОЖЕНИЯ КОЖИ ЛИЦА С ПОМОЩЬЮ ЭЛЕКТРОСТИМУЛЯЦИИ

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Абстракт

Цель: исследования оценка косметического эффекта при использовании пластыря «Аганьян» для омоложения лица.

Материалы и методы: Исследование проведено у 106 пациентов с наличием периоральных морщин кожи. Участники накладывали четыре пластыря (2 медных и 2 цинковых) на лицо в области морщин крест-накрест согласно инструкции. Пластыри накладывались на восемь часов каждый третий день в течение трех месяцев. Периоральные морщины оценивались путем сравнения фотографий в начале и в конце исследования для каждого отдельного случая. Эффективность оценивали по Международной шкале глобального эстетического улучшения (GAIS). Визуальное подтверждение клинического улучшения также было получено по снимкам с камеры Life Viz 3D.

Результаты: После анализа фотографий, сделанных до и после использования пластыря и личной беседы с каждым участником, от участников были получены следующие данные:

- отмечено уменьшение отечности и темных кругов под глазами: у 6 из 15 мужчин, у 34 из 91 женщины;
- отмечено разглаживание мелких мимических морщин: у 24 женщин из 106 пациентов;
- отмечена подтяжка овала лица: 14 женщин из 106 пациентов.

При оценке эффективности процедуры GAIS на M03 и M05 у 2/3 пациентов значительное улучшение по оценке врача и участников в соответствии с GAIS. Большинство из пациентов также продемонстрировали значительное улучшение при посещении M12. После анализа сделанных фотографий до и после

эксперимента и личная беседа с каждым пациентом косметологии профиля были получены следующие результаты: у 38% пациентов отечность и темные круги под глаза уменьшились, у 23% пациентов разгладились мелкие мимические морщины, у 12% пациентов овал лица подтянулся. Наши результаты показывают, что пластырь «Аганян» может служить новым методом терапии для контролируемого омоложения кожи, эффективных морщин и складок.

Заключение: Результаты исследований дают основание для вывода о том, что пластырь «Аганян» доказал свою эффективность при электростимуляции током низкой интенсивности у пациентов разных возрастных групп, при исследовании выявлено большое количество положительных косметических эффектов.

Content

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