ORIGINAL ARTICLE
IMMEDIATE IMPLANTS PLACEMENT & IMMEDIATE LOADING WITH FULLY DIGITAL FABRICATED IMPLANTS-SUPPORTED PROSTHESIS. A CONTROLLED CASE SERIES

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Abstract

Objective: The purpose of this prospective case series was to evaluate the clinical results of immediate implant loading using three-dimensional surgical planning software.

Materials and methods: The study included 84 patients that were treated by using computer 3D-planning and a consecutive immediate loading surgical protocol. All implants were and rehabilitated with a fixed CAD/CAM manufactured temporary structure. A total of 356 implants were placed, 67 of which were inserted directly into extraction sockets. The clinical indices included the following parameters: ISQ (Implant Stability Quotient) and, MBL (Marginal Bone Level).

Results: Only minor prosthetic complications were recorded. When installing implants, the average value of ISQ records was 62.8 and 74.6 ISQ after 5 months, respectively. All patients reached the 60-month follow-up period, after 12 months the average value of marginal bone MBL) was 0.91, ± 0.25. After 36 months the average value of MBL was 1.08 ± 0.42 mm. At the interval 60 months the average MBL value was 1.25 ± 0.37 mm. The cumulative survival rate was 97.8%. The results confirm the effectiveness of this surgical and prosthetic protocol.

Conclusions: Computer 3-dimensional virtual planning, in combination with immediate implant placement and immediate loading of temporary structures using CAD/CAM structures; allowed for a short treatment process with predictable aesthetic and functional results.

Keywords: Immediate Implants Placement; Immediate Loading; Digital Fabricated; CAD/CAM manufactured.
Introduction

Prosthetics rehabilitation with implant-supported fixed crowns and bridges, is becoming increasingly while widely spread and is considered as one of the most promising areas of prosthetics dentistry.1,3

Implant dentistry, based on Bränemark’s well-documented research and supported by numerous reports over the past decades, have confirmed its outstanding effectiveness.4,5

The absence of a tooth in the frontal area pushes the patient seek a quick solution for the closure of the gap. Practitioners need to find the most effective way to solve this problem. An adequate temporary restoration is therefore ubiquitous6.

Traditional protocols recommended placement of dental implants into the alveolar ridges with a 2–5 months healing period before restoration and loading of the dental implant.7

A real alternative that eliminates the above disadvantages may be implants with “immediate loading” using preliminary 3D planning implant placement and use CAD/CAM manufactured temporary structure that is not needs correction. This protocol reduces treatment time makes it more likely to get patient consent for implantology treatment.8,9

Immediate prosthetic concept consists of fixing the abutments and CAD/CAM manufactured temporary structure immediately after implant installation.10–12

Requirements for direct prosthetics are good quality bone tissue (type DI or DII); opportunity installation of an implant 10–15 mm long; the presence of an adequate keratinized zone gums; possibility of removing temporary prosthesis on implants from occlusion.

Computer aided dental implantation (CAI) planning was introduced more than 30 years ago with the goal of facilitating implantation planning and preventing intraoperative complications such as mandibular nerve damage, sinus perforation, fenestrations or dehiscence. Based on computed tomography (CT) and virtual planning software, the implants are positioned in an ideal position from a prosthetic point of view.13–15

Immediate placement of the implant after tooth extraction and immediate loading of the implant with a fixed temporary reconstruction is preferred by the patient as postoperative pain after flapless surgery is significantly reduced compared to the traditional open approach, with computer-aided design/computer-aided manufacturing (CAD/CAM) temporary and the final designs provide high quality and aesthetics of permanent prostheses.

Although computer-assisted implant placement and CAD/CAM have contributed to simplifying the patient rehabilitation workflow, the combination of immediate implant placement and immediate loading protocols is complex and requires a high level of organization between the implantologist, technician, and patient.16–18

The CAD/CAM protocol includes three sequential steps: scanning, CAD modeling and CAM production. The CAD component virtually designs a 3D outline of the final implant component. The CAM system produces the actual implant component according to the virtual design.

The purpose of this study was to evaluate the effectiveness of prosthetic rehabilitation of patients with combined immediate implant placement using Computer guided implant 3D planning and immediate functional loading of temporary structures using CAD/CAM.

Materials and methods

The study included 84 patients without any systemic diseases, with unilateral/bilateral missing teeth treated using a computer 3D planning immediate loading surgical protocol and rehabilitated with a fixed manufactured zirconium structure with CAD/CAM. Patients were given detailed information about the methods and concepts of immediate implant placement and immediate functional loading. All patients gave informed written consent to participate in the study and to publish the data obtained. All patients underwent a clinical examination and using computed tomography (CT) analyzed of residual bone. The DICOM (digital imaging and communication in medicine) files acquired with CT were also imported in a three-dimensional reconstruction software. Based on anatomical conditions and prosthetic planning, the position of the implants was virtually planned using 3D computer-aided design software (3Shape implant Studio).

Patients were advised to strictly follow the postoperative instructions. Postoperative medications including: Amoxicillin clavulanate (Augmentin, Manufactured by GlaxoSmithKline Group) 1gm: 1 tablet every 12 hours for 5 days. Non-steroidal anti-inflammatory drug Ibuprofen (Brufen, Kahira Pharm.)
600 mg: 1 tablet 3 times daily after meals for 4 days.

Before surgery, the patient washed with a 0.2% chlorhexidine solution for 1 minute. Local anesthesia was induced with a 4% solution of articaine with adrenaline in a ratio of 1:100,000. Implants were installed according to a pre-planned position according to a standard protocol. A total of 356 Bio3 implants GmbH (Germany) were placed, 67 of which were inserted into extraction sockets. Implants were placed with minimum of 35Ncm insertion torque value with the graded torque wrench. After installing the implants, the primary stability of ISQ (Implant Stability Quotient) implants was assessed by resonance frequency analysis (RFA) during implant placement, after 4-5 months of loading. Then, multi-unit abutments abutments were immediately placed their height adjusted and suturing was done using 3/0 black silk sutures (Ethicon Mersilk, Johnson & Johnson Pvt Ltd). The impression transfer was fixed before scanning. The scanner is a data acquisition system that records the 3D geometry of the infrastructure and converts the actual dental model into a virtual dental model. After impression transfer scanning, they have been removed from multiunit abutments. Based on the obtained intraoral scans, temporary prosthetic structures were manufactured in the technical laboratory; on the second day of implantation, after fitting in the oral cavity, they were fixed onto multi-unit abutments using screws. After fixation with 25Ncm temporary provisional structures the screw access area covered with composite material. In several temporary restorations, the occlusion required only minor adaptations due to precise digital preoperative planning. Final dental prosthetics was performed 4-5 months after implantation with CAD/CAM software (Procera-Software®, Nobel Biocare, Göteborg, Sweden) fabricate supported metal-ceramic or zirconium dioxide restorations. The accurately fitting prosthetic structures was screw retained with 25Ncm and the screw access area covered with composite material. CT image is taken before implants insertion and after prosthetic rehabilitation (stages of immediate implant placement with immediate loading are shown in the figures 1-8).

Figure 1. Planning implant placement on CT Program

Figure 2. Intraoral scanning before removal of old prosthetic structures

Figure 3. Intraoral view after implant placement

Figure 4. The impression transfer is installed on a multi-unit abutment and scanned

Figure 5. CT after 2 weeks after implant placement

Figure 6. Obtained intraoral scans for the production of temporary prosthetic structures
The clinical indices included the following parameters: ISQ, peri-implant marginal bone level (MBL), immediately (base line for comparison) and 3 months, 1 year, 3 years, and 5 years after implant installation, compared with values at last follow-up. The level of alveolar bone around each implant was evaluated by taking measurements exactly. The patient followed a regular maintenance program at the dental hygienist twice a year.

Statistical analysis

Statistical analyzes were performed using SPSS (SPSS 25.0®; SPSS Software Company, Chicago, IL, USA). Differences between observation periods were checked using the paired Student's t test.

Results

At the one-year follow-up appointment, healthy mucosal and stable crestal peri-implant conditions observed. The CT optimal prosthetic and osseous conditions. Only minor orthopedic complications were recorded. When installing implants, the average value of RFA records was 62.8 ISQ (Implant Stability Quotient) and after 5 months, respectively, 74.6 ISQ. All patients reached the 60-month follow-up period, after 12 months the average value of marginal bone resorption (MBL) was 091, ± 0.25, after 36 months the average value of the MBL value was 1.08 ± 0.42 mm, after 60 months the average MBL value was 1.25 ± 0.37 mm,

<p>| Table 1. Mean marginal bone loss (MBL) after prosthetic loading |
|----------------------------------|------------------|------------------|</p>
<table>
<thead>
<tr>
<th>Time after prosthetic loading</th>
<th>After 12 month</th>
<th>After 36 month</th>
<th>After 60 month</th>
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<tr>
<td>Average value of marginal bone</td>
<td>0.91±0.25mm</td>
<td>1.08±0.42 mm</td>
<td>1.25 ± 0.37 mm</td>
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The p values <0.05 were considered statistically significant

Cumulative survival rate was 97.8%. The results confirm the effectiveness of this surgical and prosthetic protocol. The patients were satisfied with the aesthetic and functional result of the treatment.

Discussion

Implant-supported fixed dentures can be an effective and best method of restoring the aesthetics and function of chewing, and can lead to a significant improvement in their quality of life.19,20

Prosthetic rehabilitation using implants is a long-term good solution for partially and completely edentulous patients, with a high rate of survival and success.21

Typically, the traditional implantation protocol includes several stages, after the installation of the implants, an osseointegration healing period lasting from 2 to 6 months and an oropedic stage that includes numerous visits to the prosthetists before the installation of the final prosthesis.22

Since its inception, implant dentistry has developed dynamically and now modern protocols of immediate implantation and immediate loading are an ideal, predictable procedure for replacing teeth and there by restoring aesthetics and function.23

The use of preoperative virtual three-dimensional implant planning allowed for controlled and immediate implant installation and immediate functional loading using accurately fitting provisional prosthetic structures was effective.24

There are now a large number of clinical trial reports reporting that immediate functional loading of dental implants can be as effective as implantation using traditional loading protocols.25,26

The clinical success of immediate functional
loading largely depends on a number of factors: patient selection, bone quality and quantity, number of implants placed and primary implant stability and occlusal load.8,27-32

Immediate loading of dental implants has several advantages such as reducing time, improving esthetic and occlusal function, eliminating temporary dentures, preventing reoperations and preserving residual alveolar bone and is considered a predictable procedure.33-36

It was found that the process of bone formation around dental implants is more activated in case of immediate loading resulting in a stable attachment ensuring final restoration.37

This article describes the use of protocol Immediate Implant Placement, Immediate Load, a technology that allows screw-retained and implant-supported temporary restorations using a completely digital protocol. With this accelerated digital treatment protocol, the transition to a restored dentition is achieved without the need for any physical impressions.

Optimized digital protocol, involves the production of an optimally aesthetic and functional prosthesis that ensures a precise and passive fit on multi-unit abutments screwed to the implants, providing proper lip support and rejuvenating aesthetics. The digital technology protocol allows you to design and manufacture the most ideal dentures for the selected dentition, taking into account patient photographs and digital scanning of the dentition and soft tissues.

An intraoral scanner is used preoperatively and intraoperatively to scan soft tissue and existing dentition using. After the implants are installed and the Multi-Unit abutments are placed on the inch, they are attached to the scan body and scanned in accordance with a special protocol to determine the exact position of the implants. Based on this information, a file of the optimal temporary prosthesis is created and from this file a temporary prosthesis on an implant with screw fixation is manufactured. The use of CAD/CAM protocol in prosthetics on implants has three advantages: accuracy (or accuracy of fit), durability and simplicity of design. Each of these advantages is discussed as follows. With this protocol, the prosthetic sequence is significantly reduced, providing digital restoration of aesthetics and function in one day.

Conclusions

Computer three-dimensional virtual planning, combination of immediate implant placement and immediate loading of temporary structures using CAD/CAM, allowed for a short treatment process with predictable aesthetic and functional results.

Declarations

Conflicts of interest and financial disclosures

The author declares that he has no conflict percent and there was no external source of funding for the research in question.

Ethical approval

The study was approved by the University ethics committee and was conducted in accordance with the Declaration of the World Medical Association.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Source of funding

The work was not funded.

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Fabrication Implants


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Немедленная установка имплантата, немедленная нагрузка с полностью цифровым изготовлением протеза поддерживаемого имплантатом; серия контролируемых случаев

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Абстракт

Цель: Целью этого проспективного исследования серии случаев была оценка клинических результатов немедленной нагрузки на имплантат с использованием программного обеспечения для трехмерного хирургического планирования.

Материалы и методы: В исследование были включены 84 пациента, пролеченных с использованием компьютерного 3D-планирования хирургического протокола с немедленной нагрузкой и реабилитированных с помощью фиксированной временной конструкции, изготовленной с помощью CAD/CAM. Всего было установлено 356 имплантатов, 67 из которых вставлены в лунки для экстракции. Клинические индексы включали следующие параметры: ISQ, MBL.

Результаты: Были зарегистрированы только незначительные осложнения при протезировании. При установке имплантатов среднее значение записей RFA составило 62,8 ISQ (Коэффициент стабильности имплантата) и через 5 месяцев соответственно 74,6 ISQ. Все пациенты достигли 60-месячного срока наблюдения, через 12 мес среднее значение маргинальной костной резорбции (MBL) составило 091, ± 0,25, через 36 мес среднее значение среднего значения MBL составило 1,08 ± 0,42 мм, через 60 мес. месяцев среднее значение MBL составило 1,25±0,37 мм, кумулятивная выживаемость составила 97,8%. Результаты подтверждают эффективность этого хирургического и ортопедического протокола.

Выводы: Компьютерное трехмерное виртуальное планирование, сочетание немедленной установки имплантатов и немедленной нагрузки временных конструкций с использованием CAD/CAM позволило сократить процесс лечения с предсказуемыми эстетическими и функциональными результатами.