

## PROSTHODONTICS



### Effect of different means of retention on single midline implant supporting mandibular overdenture

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#### Abstract

**Purpose:** This study was conducted to evaluate the effect of locator attachment versus retention silicone lining material on the supporting structure of a single midline implant supporting mandibular overdenture and retention of the prosthesis.

**Methods:** Sixteen patients with completely edentulous mandibles were selected for this study and divided into two groups. In all patients, a single implant was placed at midline area after cone beam radiography was performed. Group I was retained with locator attachment, while Group II was retained with silicone material. Follow-up was carried out at denture insertion, six months and 12 months following insertion. Peri-implant bone loss as well as posterior bone loss was evaluated using cone beam computerized tomography and retention was evaluated using forcemeter device and wire hook attaches to the prosthesis.

**Results:** There was a statistically significant difference in peri-implant bone loss between the two groups during the 2nd follow up period ( $P \leq 0.05$ ). There was a statistically significant difference in peri-implant bone loss between the two groups at the 2nd follow up period and at the end of the study period ( $P \leq 0.05$ ). There was no statistically significant difference in-posterior bone loss between the two studied groups ( $P \leq 0.05$ ) and regarding retention there was no statistically significant difference between the two groups along the follow up periods.

**Conclusion:** From the results obtained from this study, it could be concluded that locator attachment showed lower peri-implant bone loss than Retention. Silicone material in the overall follow-up period with a statistically significant difference. This was attributed to the decrease in the effect of the resiliency of attachments and Silicone over time, and the more permanent effect of locator attachment.

**Key words:** Single implant, overdenture, attachments.

#### Introduction

Edentulism affects oral and general health, as well as quality of life.<sup>1</sup> Rehabilitation using a complete denture for those with compromised alveolar bone often results in denture soreness, problems in retention and stability, and low masticatory efficiency. Implant-retained overdentures are widely used for the rehabilitation of edentulous jaws because they can increase prosthesis retention, enhance chewing function, and reduce resorption of alveolar bone by regulating neuromuscular adaptation.<sup>2-3</sup>

Comparing two or more implant-retained mandibular overdentures; with conventional complete dentures will certainly promote function and enhance success rates.<sup>4-5</sup> However, the York consensus statement recommends at least two implants to support mandibular overdentures in edentulous patients.<sup>6</sup> An overdenture retained by two implants placed in the interforaminal area (canine region) has greatly improved denture stability, retention, and masticatory efficiency,<sup>7</sup> it is difficult to obtain complete parallelism between bilateral implants and excessive cost, and the effect of the different angulations of the two implants on the retention of the overdenture may be considered as a shortcoming of the bilateral implant overdenture.<sup>8</sup> A single midline implant placed in the sympheseal area can be considered an economical therapeutic alternative to conventional complete dentures for geriatric patients, as it can solve the problem of high cost and; achieve the same retentive properties, high durability, and success rate.<sup>9,10</sup> The maintenance cost is an important factor in the selection of the appropriate type of implant attachment. Locator and ball attachments have been reported to achieve favorable outcomes. Ball attachment is often employed in single implants because it is an elastic retainer that allows for slight rotation of the overdenture and passes the load to the surrounding bone tissue. However, the high maintenance cost of this attachment type limits its application.<sup>11-13</sup> Retention.sil is a silicone liner with very

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high tensile strength, (available in three friction strengths: hard, medium, and soft; 200 g, 400g, 600 gr), which is perfectly suited to ensure a stable position of the denture, especially in cases of implants with inadequate angulations, providing a good path for insertion of the prosthesis. This material combines the cushioning effect of the soft denture liner with the retentive force of the female portion of the attachment.<sup>14</sup>

#### **Materials and methods**

Sixteen completely edentulous patients were selected for this study, they were clinically free from any systemic diseases with suitable inter arch distance and normal ridge relationship and form. The residual ridge had adequate bone width of not less than 6mm in the anterior region of the mandible and sufficient length of not less than 17 mm. Preoperative cone-beam CT with the patient wearing a radiographic stent with a gutta-percha size of 80 was fitted in the area of the midline. The gutta-percha was used as a reference point when a cone beam CT scan was performed. Bone width and height were estimated using a cone-beam—CT scan at the proposed implant site. The patients were prepared for surgery. A crestal incision was made that extended 10 mm mesial to and distal to the midline. A full-thickness mucoperiosteal flap was then created. A point drill of 2 mm diameter was held in a vertical direction and moved up and down during drilling, and a pilot drill with diameter 3.25 mm was then used to widen the osteotomy. The final drill of diameter 3.75 mm was then used to shape the osteotomy according to the selected implant diameter and length. Appropriate irrigation was performed and the implant was positioned in the mandibular symphysis and oriented perpendicular to the occlusal plane. The implant used had a diameter of 4.00 mm and a length of 13 mm. A cover screw was placed over the implant fixture and screwing was performed until complete sealing was achieved. The mucoperiosteal flap was then repositioned and sutured with interrupted black silk 000 sutures. Ten days later, the sutures were removed, the dentures were relieved, and relining was performed in relation to the implant site using a tissue conditioning material. After complete healing, the tissue conditioner was removed, a rubber base impression was made under biting force for the lower denture, and relining was performed using heat-cured acrylic resin.

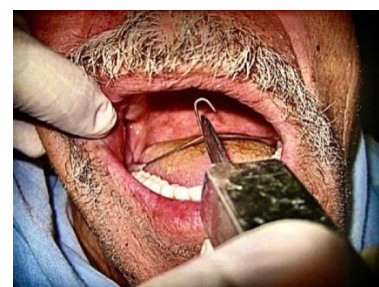
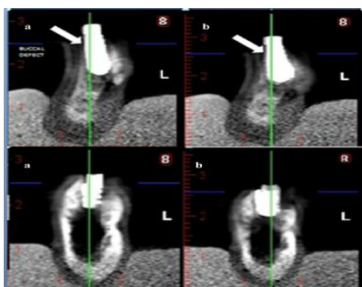
The patients were recalled four months after surgery. The implant was palpated and exposed by using a sterile punch. The cover screw was placed over the implant fixture and screwing was done until complete sealing. The mucoperiosteal flap was then repositioned and sutured by interrupted sutures using black silk 000. Ten days later sutures were removed, dentures were relieved and relining was performed in relation to implant site using tissue conditioning material. After complete healing, tissue conditioner was removed and rubber base impression was made under biting force for the lower denture, relining was done using heat-cured acrylic resin.

The patients were recalled four months after surgery. The implant was palpated and exposed by using a sterile punch. The cover screw was unthreaded with a finger using an unscrew instrument.

The patients were randomly assigned to two groups. Group I received a single midline implant-supported overdenture and was retained by locator attachment, whereas Group II received a single midline implant-supported overdenture and was retained by retention. Sil 400 gr. fig 1 and 2.



**Fig.1. Denture fitting surface with metal housing Fig2.Fitting surface of denture after setting of Retention Sil**



**Fig. 3 CBCT for midline implant Fig.4 Wire hook in the geometric center Fig.5 Retention measurements**

For retention measurements, the geometric center of the lower denture was relatively identified, and a rigid wire was used to make a retentive hook within the geometric center to be attached to the force meter to begin the evaluation and measurement of retention. A wire with a hook was attached to the denture

base with self-curing acrylic resin to allow (force meter)device to exert a vertical dislodging force on the denture fig 3.

Follow up visits were scheduled at the time of denture insertion, 6 and 12 months after overdenture insertion for inspection of the prosthesis and collection of the data (radiographic evaluation) and retention measurements using forcemeter fig 4 and fig 5.

**Results**

Patients expressed satisfaction of their prosthesis. Clinically, no pain was elicited with palpation or percussion, no exudates was observed in relation to the implants). On studying the effect of time on peri-implant bone loss and retention in the two studied groups:

**Table 1. Locator attachment group in the first 6 months showed high mean values of peri-implant bone loss of 0.51 mm than in the next follow up which had mean values of was 0.36 mm. The difference was statistically significant.**

	0-6 months		6-12 months		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
Group 1 (locator)	0.51	0.06	0.36	0.05	0.008

**Table 2. Retention. Sil showed lower mean values of peri-implant bone loss of 0.45 mm in the first follow up than in the following six months which was 0.54mm and the difference was highly significant.**

	0-6 months		6-12 months		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
Group II(Retention.Sil)	0.45	0.08	0.54	0.04	0.04

**Table 3. locator group showed lower mean values of peri-implant bone loss in the 2<sup>nd</sup> follow up period than Retention. Sil group. The difference was statistically significant.**

	Group I (locator)		Group II (Retention. Sil)		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
0-6 months	0.51	0.06	0.46	0.08	0.139
6-12 months	0.36	0.05	0.54	0.038	0.001*
0-12 months	0.88	0.06	0.98	0.098	0.05*

**Table 4. There was no statistically significant difference in posterior bone loss between the two groups in the different follow up periods with P ≤ 0.05.**

	Group I		Group II		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
0-6 months	0.73	0.12	0.74	0.07	0.78
6-12 months	0.47	0.06	0.41	0.09	0.205
0-12 months	1.19	0.14	1.13	0.08	0.388

**Table 5. In comparison between the two groups, there was no statistically significant difference between mean retention values at 0 to 6 months and after 6-12 months and at the whole follow up period in the two groups**

	Group I		Group II		P value
	Mean	Std. Deviation	Mean	Std. Deviation	
0-6 months	334.4	24.7	287.4	22.9	0.0576*
6-12 months	313.6	17.8	267.3	10.8	0.0592*
0-12 months	302.7	11.5	353.9	10.2	0.189

**Discussion of methodology:**Patients were selected free from any systemic diseases to avoid any disease that may affect healing, complicate the surgical procedures, or prevent successful osseointegration.<sup>15</sup>

Patients with sufficient buccolingual width of the edentulous ridge were selected to ensure that at least 2 mm of bone remained around the implant to preserve bone nutrition and vitality.<sup>16</sup>

Single implant-supported overdentures may be appropriate for the treatment of edentulism in geriatric patients because of diminished functional demands and the realization that implant/patient life expectancy is limited.<sup>9</sup>The midline of the mandibular arch was selected for the placement of a single implant because it constitutes an excellent host site for an implant in terms of bone quantity and quality.<sup>17</sup>

Retention.sil is a silicone matrix with a very high tensile strength, which is perfectly suited to ensure the resilient position of the denture. It is available in three friction strengths: hard, medium, and soft (600, 400, and 200 g, respectively).<sup>14</sup>

Radiographic interpretation is a standard method used to evaluate the rate of bone change with height. For the evaluation of implant success, radiographic examinations were performed as in follow-up clinical trials, which were designed for the evaluation of oral implant success.<sup>18</sup> The Preoperative cone beam CT was performed for each patient in the study because the bone dimension and vital structure appear in the cone beam with accurate dimensions.<sup>19</sup> Adding attachments within the implant fixture enhance the outcomes of the prosthetic treatment because of increased retention forces, support and stability and decrease the rate of the alveolar ridge resorption. There are many researches agreeing with that opinion.

**Discussion:** Single implant-retained overdentures did not differ from those retained by two implants in terms of patient overall comfort and satisfaction, but had the advantage of lower cost and shorter treatment duration.<sup>20</sup>At denture insertion and till six month follow up Group I (locator) showed higher statistically significant values of peri-implant bone ( 1st follow up period) than that revealed in Group II (Retention Silicone), and that was due to the highly noticeable resiliency and cushioning effect of Retention silicone which worked on distribution of stresses evenly on the ridge. Conversely, in the 2nd follow, Retention silicone showed a statistically significant higher value of peri-implant bone loss than the locator, which was attributed to the reduced efficiency of Retention. silicone, which should be periodically applied.

Both groups revealed a significant decrease in the amount of peri-implant bone as well as in the posterior molar area distal to the implant during the overall follow-up period. According to Cochran<sup>21</sup>, peri-implant bone remodeling after implant placement is more accentuated in the first six months after surgery.

There was a significant difference in the values of retention during first and second follow up periods as the first group using locator showed more retention values with significant difference than the second group with retention silicone and in the last follow up period the retention values decreased fo the two groups and that may be due to wear in the housing material of the locator attachment and degradation of the silicone material in the fitting surface

**Conclusion:** From the current study it was concluded that:

1-Implant-retained mandibular overdenture using a single implant is a treatment protocol that simplifies the surgical and laboratory procedure to a great extent to geriatric patients.

2- Retention Sil is a good silicone liner that combines the cushioning effect of a soft liner with the high retentive qualities of the implant overdenture; however, periodic maintenance is required; otherwise, the resiliency of the material is lost.

3- Locator attachment can give good results when used with single midline implant overdentures, they showed lower peri-implant bone loss than Retention Sil.

#### **Conflict of Interest and Authorship Conformation Form**

All authors have participated in (a) conception and design, or analysis and interpretation of the data; (b) drafting the article or revising it critically for important intellectual content; and (c) approval of the final version. The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript the following authors have affiliations with organizations with direct or indirect financial interest in the subject matter discussed in the manuscript.

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**Ռետենցիոն տարբեր միջոցների ազդեցությունը շարժական ստորին ծնոտի պրոթեզին աջակցող մեկ միջին իմպլանտի վրա**

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### **Ամփոփում**

**Նպատակը.** Այս ուսումնասիրությունն անցկացվել է գնահատելու տեղորոշիչի կցման ազդեցությունը սիլիկոնային երեսպատման նյութի պահպանման նկատմամբ մեկ միջին գծի իմպլանտի հենարանային կառուցվածքի վրա, որն աջակցում է ստորին ծնոտի ատամնաշարին և պրոթեզի պահպանմանը:

**Մեթոդներ.** Այս հետազոտության համար ընտրվել են 16 հիվանդներ, որոնք ունեն ամբողջովին անատամ ծնոտներ և բաժանվել երկու խմբի: Բոլոր հիվանդների մոտ մեկ իմպլանտ է տեղադրվել միջին գծի տարածքում համակարգչային շերտագարության հսկողությամբ: I խումբը պահպանվել է լոկատորով, իսկ II խումբը պահպանվել է սիլիկոնե նյութով: Հետազոտությունն իրականացվել է ատամնաշարի տեղադրման ժամանակ վեց ամիս և 12 ամիս հետո: Պերիիմպլանտային ոսկրային կորուստը, ինչպես նաև ոսկրային կորուստը գնահատվել է համակարգչային տոմոգրաֆիայի միջոցով, իսկ ռետենցիան գնահատվել է ֆորսաչափ սարքի և պրոթեզին ամրացված մետաղական կետիկի միջոցով:

**Արդյունքներ.** Հետագա 2-րդ ժամանակահատվածում երկու խմբերի միջև առկա էր պերիիմպլանտային ոսկրային կորուստի վիճակագրորեն նշանակալի տարբերություն ( $P \leq 0.05$ ): Պերիիմպլանտային ոսկրային կորուստի վիճակագրորեն զգալի տարբերություն կար երկու

խմբերի միջև 2-րդ հետևողական շրջանում և հետազոտության վերջում ( $P \leq 0.05$ ): Հետևի ոսկրային կորստի վիճակագրորեն զգալի տարբերություն չկար երկու հետազոտական խմբերի միջև ( $P \leq 0.05$ ), իսկ պահպանման դեպքում երկու խմբերի միջև վիճակագրորեն նշանակալի տարբերություն չկար հետագա ժամանակաշրջանների ընթացքում:

**Եզրակացություն.** Այս ուսումնասիրությունից ստացված արդյունքներից կարելի է եզրակացնել, որ տեղորոշիչի կցումը ցույց է տվել ավելի ցածր պերիիմպլանտային ոսկրային կորուստ, քան ռետենցիան: Միլիկոնային նյութը ընդհանուր հետևողական ժամանակահատվածում՝ վիճակագրորեն նշանակալի տարբերությամբ: Դա վերագրվել է ժամանակի ընթացքում կցորդների և սիլիկոնների առաձգականության ազդեցության նվազմանը և տեղորոշիչի ամրացման ավելի մշտական ազդեցությանը:

**Влияние различных средств ретенции на одиночный срединный имплантат, поддерживающий съемный протез нижней челюсти**

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**Резюме**

**Цель:** Это исследование было проведено для оценки влияния крепления локатора по сравнению с ретенционным силиконовым прокладочным материалом на поддерживающую структуру одиночного срединного имплантата, поддерживающего съемный протез нижней челюсти, и на удержание протеза.

**Методы:** Для этого исследования были отобраны 16 пациентов с полной адентией нижней челюсти, которые были разделены на две группы. Всем пациентам после рентгенографии конусным лучом был установлен один имплантат в области средней линии. Группа I была сохранена с насадкой-локатором, а Группа II была сохранена с использованием силиконового материала. Последующее наблюдение проводилось при установке протеза, через шесть месяцев и 12 месяцев после установки. Потеря костной массы вокруг имплантата, а также потеря костной ткани в задней части оценивалась с помощью компьютерной томографии с коническим лучом, а ретенция оценивалась с помощью устройства для измерения силы и проволочных крючков, прикрепленных к протезу.

**Полученные результаты:** Во время 2-го периода наблюдения наблюдалась статистически значимая разница в потере костной массы вокруг имплантата между двумя группами ( $P \leq 0,05$ ). Была статистически значимая разница в потере костной массы вокруг имплантата между двумя группами во 2-м периоде наблюдения и в конце периода исследования ( $P \leq 0,05$ ). Не было статистически значимой разницы в потере костной ткани в задней части между двумя исследуемыми группами ( $P \leq 0,05$ ), а в отношении ретенции не было статистически значимой разницы между двумя группами в течение периодов наблюдения.

**Вывод:** Из результатов, полученных в этом исследовании, можно сделать вывод, что прикрепление локатора показало меньшую потерю костной массы вокруг имплантата, чем ретенция. Силиконовый материал в общем периоде наблюдения со статистически значимой разницей. Это было связано с уменьшением эффекта упругости насадок и силикона с течением времени и более постоянным эффектом насадки-локатора.