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Effect of Two Attachment Modalities on Single Midline Implant Supporting Mandibular Overdenture

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Abstract

Purpose: This study aims to evaluate the effect of ball and socket attachment versus Retention Sil material when used with a single midline implant supporting mandibular overdenture on its supporting structure.

Materials and methods: Fourteen patients with completely edentulous patients were selected for this study and divided into two groups. In all patients single implant was placed at the area of the midline after cone beam was taken. ***Group I*** was retained with ball and socket attachment, while ***Group II*** was retained with Retention, Sil material. Follow up was carried out at denture insertion, six months and twelve months after overdenture insertion. Peri- implant bone loss as well as posterior bone loss was evaluated using cone beam computerized tomography.

Results: There was a statistically significant difference regarding peri-implant bone loss within the two groups in the 2nd follow up period with P ≤0.05. There was a statistically difference regarding peri-implant bone loss between the two studied groups in the 2nd follow up period and at the end of the study period with P≤ 0.05. There was no statistically significant difference regarding posterior bone loss in the two studied groups with P ≤ 0.05.

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

KEY WORDS:

Single implant, overdenture, attachments.

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Introduction

Edentulism affects oral and general health as well as quality of life [1]. Rehabilitation using a complete denture for those who suffer from a compromised alveolar bone often results in denture soreness, problems in retention and stability, as well as low masticatory efficiency. Implant-retained overdentures are widely applied for the rehabilitation of edentulous jaws as since it can increase prosthesis retention, enhance the chewing function and reduce the absorption of alveolar bone by regulating neuromuscular adaptation [2, 3]

When comparing two or more implant-retained mandibular overdentures, to a conventional complete denture, it will certainly promote function and enhance success rates [4, 5]. However, the York consensus statement recommended at least two implants to support a mandibular overdenture for edentulous patients [6]. An overdenture retained by two implants placed in the interforaminal area (canine region) has greatly improved denture stability, retention and masticatory efficiency [7], but the difficulty to obtain complete parallelism between bilateral implants and excessive cost and the effect of the different angulations of the two implant on the retention of the overdenture may be considered as shortcoming of bilateral implant overdenture[8]. The single midline implant placed in the sympheseal area can be considered an economical therapeutic alternative to conventional complete denture for geriatric patients, the single implant can solve the problem of the high cost, achieve the same retentive properties, high durability and success rate[9,10].

During the selection of the appropriate type of implant attachment, maintenance cost is an important factor. Locator and ball attachment have been reported to achieve favorable outcomes. Ball attachment is often employed in single implants because it's an elastic retainer that allows for the slight rotation of the overdenture and passes the load to surrounding bone tissue. However, high maintenance cost of this attachment type has limited its application[11-13]. Retention.sil is a silicone liner with very high tensile strength, (available in three friction strengths-hard, medium and soft; 200 gr, 400gr 600 gr), which is perfectly suited to ensure a stable position of the denture especially in cases of implant with inadequate angulations providing a good path of insertion of the prosthesis. This material acts to combine the cushioning effect of the soft denture liner with the retentive force of the female portion of the attachments. [14].

Materials and methods

Fourteen 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 17mm.

A preoperative cone beam CT with the patient wearing a radiographic stent with a gutta percha size 80 fitted in the area of the midline. The gutta percha was used as a reference point when cone beam CT scan was made. Bone width and height were estimated on the cone beam CT scan at the proposed implant site.

The patients were prepared for the surgery. Crestal incision was made that extended 10 mm mesial and distal to the midline. A full thickness mucoperosteal flap was raised. A point drill of 2mm diameter was held in a vertical direction and moved up and down during drilling. A pilot drill with diameter 3.25mm was then used to widen the osteotomy. Then the final drill of diameter 3.75mm was used to shape the osteotomy according to the selected implant diameter and length. Proper irrigation was carried out and the implant was positioned in the mandibular symphysis and oriented perpendicular to the occlusal plane. The implant used had a diameter of 3.75 mm and length of 13 mm.

A 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.

Patients were recalled four months after surgery. The location of the implant was palpated and then they were exposed using a sterile punch. The cover screw was unthreaded by finger using unscrew instrument.

Patients were randomly assorted into two groups. Group I received a single midline implant-supported overdenture and retained by ball and socket attachment, while Group II received a single midline implant-supported overdenture and retained by Retention. Sil 400 gr. (**fig 1**) & **fig (2).**

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).

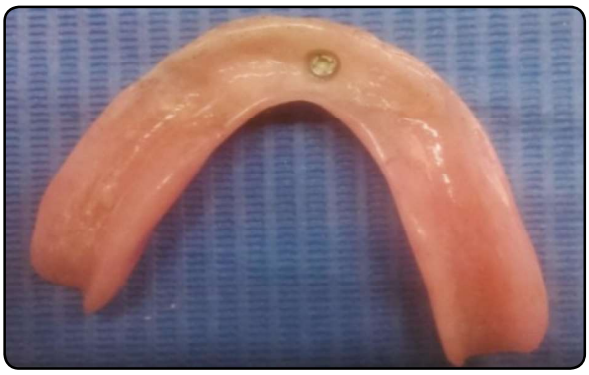

FIG. 1. Denture fitting surface with metal housing

FIG. 2. Fitting surface of denture after setting of Retention Sil

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 in the two studied groups:

Table (1) *Ball and socket 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 (Ball and socket)	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) *Ball and socket group showed lower mean values of peri-implant bone loss in the 2nd follow up period than Retention. Sil group. The difference was statistically significant.*

	Group I (Ball &socket)		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

Discussion

Discussion of methodology

The patients were selected free from any systemic diseases to avoid any disease may affect healing, complicate the surgical procedures or prevent successful Osseo integration [15]. Patients with sufficient bucco-lingual width of the edentulous ridge were selected to ensure at least 2 mm thickness of bone remaining around the implant to preserve bone nutrition and vitality [16].

Single implant–supported overdentures may be appropriate for the treatment of edentulism in geriatric patient groups because of diminished functional demands and the realization that implant/patient life expectancy is limited [9].The midline of the mandibular arch was selected for placement of the single implant because of the symphysis constitutes an excellent host site for an implant in terms of bone quantity and quality[17].

The selection of Retention.sil is a silicone matrix with very high tensile strength, which is perfectly suited to ensure a resilient position of the denture. It is available in three friction strengths - hard, medium and soft (600 gr, 400 gr and 200gr) [14].

Radiographic interpretation is a standard method used to evaluate the rate of bone change in height. For evaluation of implants success, radiographic examinations were done as in follow up clinical trials, which were designed for the evaluation of oral implants success [18] The preoperative cone beam CT was taken for each patient in the study because the bone dimension and vital structure appear in the cone beam with accurate dimensions [19].

Discussion of Result

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

Both groups revealed a significant decrease in the amount of peri-implant bone as well as that in the posterior molar area distal to the implant during the overall duration of follow up. According

to ***Cochran*** [21] peri-implant bone remodeling after implant placement is more accentuated in the first 6 months after surgery.

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 good silicone liner combining the a cushioning effect of a soft liner with high retentive qualities of the implant overdenture, however periodic maintenance is required otherwise resiliency of the material is lost.
3. Ball and socket attachment can give good results when used with single midline implant overdentures, they showed lower peri-implant bone loss than Retention Sil.

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