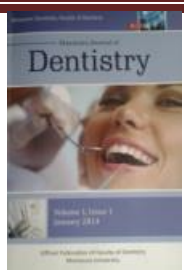
Telescopic versus Bar attachments for three-implants assisted mandibular overdenture (Comparative study of retention)



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Abstract:
It could be hypothesised that attachments, which provide more retention against dislodgement forces, will be associated with more favourable parameters of oral function.. This in vivo study is designed to provide data regarding retention force and chewing efficiency at insertion, after 3 and 6 months of function with the use of bar clip (group1)&telescopic attachments(group 2) in mandibular overdenture treatment. Six healthy male completely edentulous patients will be selected from the outpatient clinic of Prosthodontic Department, Faculty of dentistry, Mansoura University, Egypt. Each patient will receive three dental implants in the 2 in the canine region of the mandible bilateraaly and one in the midline and two suprastructure modalities (bar and telescopic attachments). The retention force of the attachments at insertion , after 3 and six months was measured in a standardized way. The amount of retention that was related to the attachment were evaluated. The difference in retention force at insertion , after 3 and 6 months observed for bar-clip attachments. Decrease of bar-clip retention from at insertion to 3& 6 months at bar attachment (from 20.07 to 9.1 and 6.5 , respectively). Slight differences in retention force at insertion, after 3and 6 months were observed for telescopic attachments.(mean retention 8.5).chewing efficiency at insertion , 3 and 6 months was measured in s standardize way. The mean chewing efficiency illustrates statistically significant higher mean among bar attachment than telescopic attachment at insertion , after 3 and 6 months. Chewing efficiency illustrates increased mean by increasing number of cycles.
Purpose:The aim of this within patient study was to evaluate the effect of linear distribution of implant supported mandibular over denture using bar and telescopic attachments on the retention and chewing efficiency.
Methods:Six male patients ofSix healthy male patients ranged between 48-60 years old were included in the study. For each patientrecieveda conventional complete denture before implant surgery was performed in the midline and two canine areas. After healing period, the conventional denture was converted into implant supported overdentureattached to three implants and checked forretention at insertion and 3 and 6 months later by forcemeter and masticatory efficiency was evaluated at insertion 3 and 6 months later by two-colored chewing gum.Repeated Measures ANOVA test was used to compare more than 2 studied periods with post Hoc test Tukey test. Two & three Way ANOVA tests were used to assess the effect of combination of 2 or 3 independent factors on continuous parametric outcome (retention and chewing efficiency).

Results: Mean retention illustrates statistically significant higher value among Bar attachment than telescopic at insertion (20.07 and 8.5) , while there is statistically significant lower value among bar than telescopic attachment(6.5 and 8.83). Repeated Measures ANOVA illustrates statistically significant decrease of retention from at insertion to 3& 6 months at bar attachment (from 20.07 to 9.1 and 6.5 , respectively). Mean chewing efficiency illustrates statistically significant higher mean among bar attachment than telescopic attachment at insertion , after 3 and 6 months. Chewing efficiency illustrates increased mean by increasing number of cycles.
Key words:overdenture, retention, chewing efficiency, implant overdenture

Introduction

Edentulism contributes, with both esthetic and psychological changes, to a known deficiency of oral function. Edentulous -related functional issues such as poorly preserved dentures and reduced chewing ability are commonly documented. (1)
According to the Academy of Prosthodontics (2), a dental implant is a prothetic device made of alloplastic materials inserted under the mucosal and/or periosteal layer into the oral tissue and on or inside the bone to provide retention and support for fixed or removable dental prostheses (fixed dental prostheses, removable dental prostheses) and to support maxillofacial prostheses.
Several attachment systems with removable implant overdentures have been successfully used. There are several goals for the use of attachments for implant retained overdentures, including: improved retention, stability, overdenture support, comfort, functionality and more appropriate psychologically(3)
The most widely used implant overdenture attachments are: magnets, bar-clips, ball and sockets. Bars and balls are the two main designs. In the denture base, one uses plastic or metal clips to connect a ball abutment independently attached to each implant. (4)
Telescopic attachment consists of an inner or primary telescopic coping permanently attached to the abutment and a detachable outer or secondary telescopic coping attached to the removable prosthesis, while the secondary coping engaged the primary coping of the telescopic unit which retains the prosthesis.(5)
According to cune et al. (6), the bar-clip attachment was the most widely used retention system. With a bar within a short period of time to avoid axial rotation and micro motion of the implant and therefore.

For mandibular three-implant overdentures, high implant survival and success rates, healthy peri-implant tissues (7) and favorable bone loss peri-implant rates have also been reported.(8) It has been reported that the use of an anterior implant in the mandibular three-implant overdentures could prevent rotation by preventing tissue intrusion in the anterior part of the denture.(9)

Retention is characterized as a quality inherent in a prosthesis that acts to resist the forces of dislocation along the path of placement .Also ,dentureretention is defined as "The resistance to vertical stresses, or the resistance of the denture to removal in direction opposite to that of its insertion.(10)

The masticatory efficiency (ME) can be defined as the ability to shred a given portion of food in a certain time and may be measured by the individual's ability to fragment natural or artificial foods (11)

Material and Methods :

Six healthy completely edentulous male patients were selected from the outpatient clinic of Prosthodontic Department, Faculty of dentistry, Mansoura University in Egypt according to the following criteria: all patients have maxillary and mandibular residual alveolar ridge covered with healthy firm mucosa, sufficient mandibular residual alveolar ridges verified by digital panoramic x-ray and ridge mapping, one year at least after last extraction, Angle's class I maxillomandibular relation, sufficient inter-arch space. Exclusive criteria were parafuncional habits, smoking, alcoholism, systemic disorders affecting bone as diabetes, history of radiation therapy in the head and neck region, TMJ or neuromuscular disorders. For each patient, conventional complete denture was constructed and inserted. After one month of using denture, bone supported sterolithographic surgical guide was constructed by the aid of CT cone-beam software for exact site and angulations of dental implants to be used as a surgical guide for implants placement. After local anesthesia,Biohorizons Tapered Internal Implantthree implant of 3.8 mm diameter and 12mm length were surgically inserted in the canine areas and midline using flapless surgical approach . A post insertion panoramic x-ray was made to evaluate the implant positions. After three months of osseo-integration period the dental implants were exposed and healing abutments were placed for one week. Then open tray functional impression was made for all patients using two long transfer copings, and implant analogues were attached to the transfer coping before impression pouring. Then patients were randomly classified into two equal groups:

Group (I) (Bar-clip attachments) (Figure 1) CAD CAM bar clip was constructed by a verification index (jig) was made , MMR record , the master cast and resin bar was scanned using scanner , CAD Designing, send to CAM for manufacturing , casting , finishing & polishing the bar , inserted intraoral , direct pick up of the clip and finishing and polishing the denture

Group (II) (Telescopic attachments) (Figure 2): CAD CAM telescopic attachment was constructed by verification index (jig) was made , MMR record, scan master cast , CAD designing for the primary copies(for 4mm. height , 5.3 mm. diameter) and vertically parallel walls,send CAM for manufacturing ,casting finishing and polishing , inserted intraoral ,scan primary copies on the master cast(same manner as primary copies then finishing and polishing ,inserted intraorally, direct pick up of secondary copies and finishing and polishing the denture. For both groups; retention and masticatory efficiency were evaluated at time of insertion ,3 months and 6 months after insertion .

Evaluation of Retention According to Burns et al. , the mandibular overdenture was modified so that 2 hooks were attached; one on each side at the midlabial flange, an orthodontic wire (18 guage diameter) was attached to the hooks passing over the occlusal surface of posterior teeth. Dentures were inserted intra-orally and the "pull" end of the force gauge was connected to the wire at the midpoint and adjusted to measure peak force needed to dislodge the overdenture in Newton (N) (Figure 6). The force gauge was pulled vertically upward until denture retention was lost and the prosthesis moved vertically, and then reading was recorded 5 times and means value was calculated.Fig.(3)

Masticatory efficiency measurement:

masticatory efficiency was evaluated using According the two-color chewing gum method as instructed by Schimmel et al.

Samples of a two-color chewing gum were prepared from Gums in the flavors "mint" (white color) and "strawberries" (pink color).

five samples of chewing gum were chewed in different cycles with different number of strokes 5,10,20,30 and 50. Fig.(4)

Electronic assessment:

Each sample was taken photo of from both sides, then scanned and saved in fixed size(1175*925) pixels. Unmixed parts were selected in ratio to the mixed parts A PC (Intel Pentium_ 3, 2GHz, 256 MB) with MS Windows XP and a Digital camera were used. A ratio finally was computed for the unmixed fraction (UF) using the following formula:

$$\frac{(Pixelswhitesidea + Pixelswhitesideb) - 2XPixelsofscale}{2\,XPixelsall}$$

Statistical analysis and data interpretation:

Data were fed to the computer and analyzed using IBM SPSS Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. Qualitative data were described using number and percent. Quantitative data were described using mean, standard deviation for parametric data after testing normality using Shapiro–Wilk test. Significance of the obtained results was judged at the (0.05) level. Student t-test was used to compare 2 independent groups of parametric variables. Repeated Measures ANOVA test was used to compare more than 2 studied periods with post Hoc test Tukey test. Two & three Way ANOVA tests were used to assess the effect of combination of 2 or 3 independent factors on continuous parametric outcome (retention and chewing efficiency).

Results:

Table (1): comparison of retention change during follow up between bar & telescopic attachment .

Retention	Bar attachment	Telescopic attachment	Student t test, P-Value
At insertion	20.07±0.153	8.500±0.436	P<0.001*
3 months	9.10±0.173	8.867±0.058	P=0.091
6 months	6.50±0.458	8.833±0.057	P=0.001*
Repeated Measures ANOVA, P value	<0.001*	0.289	
Post HOC Tukey test	P1<0.001*	P1=0.303	
	P2<0.001*	P2=0.289	
	P3=0.017*	P3=0.423	

P1: difference between at insertion and after 3 months , P2: difference between at insertion and after 6 months, P3: difference between after 3 & 6 months

Table (4) shows that mean retention illustrates statistically significant higher value among Bar attachment than telescopic at insertion (20.07 and 8.5) , while there is statistically significant lower value among bar than telescopic attachment(6.5 and 8.83). Repeated Measures ANOVA illustrates statistically significant decrease of retention from at insertion to 3& 6 months at bar attachment (from 20.07 to 9.1 and 6.5 , respectively)

Table (2): comparison of chewing efficiency between bar and telescopic attachment at different chewing cycles.

Chewing efficiency	Cycles	Bar attachment	Telescopic attachment	Student t test, P-Value
At insertion	5	1.319±0.002	0.142±0.002	<0.001*
	10	2.540±0.002	2.018±0.003	<0.001*
	20	8.962±0.003	6.362±0.002	<0.001*
	30	14.040±0.003	13.969±0.001	<0.001*
	50	227.66±0.003	125.46±0.003	<0.001*
3 months	5	0.762±0.003	0.376±0.001	<0.001*
	10	0.926±0.001	2.045±0.002	<0.001*
	20	4.543±0.002	7.043±0.004	<0.001*
	30	11.535±0.003	14.255±0.002	<0.001*
	50	150.49±0.001	128.38±0.002	<0.001*
6 months	5	0.382±0.001	0.385±0.001	0.02*
	10	0.7690±0.001	2.124±0.002	<0.001*
	20	4.323±0.002	7.151±0.003	<0.001*
	30	6.064±0.001	14.199±0.002	<0.001*
	50	140.56±0.002	129.28±0.004	<0.001*

Parameters described as mean±SD

Table (1) shows that mean chewing efficiency illustrates statistically significant higher mean among bar attachment than telescopic attachment at insertion , after 3 and 6 months. Chewing efficiency illustrates increased mean by increasing number of cycles.

Mean chewing efficiency illustrates that;

At insertion;

At 5 cycles is 1.319 versus 0.142 , 10 cycles is 2.54 versus 2.018 , 20 cycles is 8.962 versus 6.362, 30 cycles is 14.04 versus 13.96 and 50 cycles is227.66 versus 125.46 for bar attachment versus telescopic attachments , respectively.

After 3 months;

At 5 cycles is 0.762 versus 0.376 , 10 cycles is 0.926 versus 2.045 , 20 cycles is 4.54 versus 7.043, 30 cycles is 11.535 versus 14.255 and 50 cycles is 150.49 versus 128.38 for bar attachment versus telescopic attachments , respectively.

After 6 months;

At 5 cycles is 0.382 versus 0.385 , 10 cycles is 0.769 versus 2.124, 20 cycles is 4.323 versus 7.151, 30 cycles is 6.064 versus 14.199 and 50 cycles is 140.56 versus 129.28for bar attachment versus telescopic

Discussion:

The increased retention and stability for telescopic attachments come the apical friction between the primary and secondary copings and the increased vertical dimensions of the telescopic attachments. The increased retention and stability of telescopic attachments concurred with another study in which the authors noted that casting nodules on the surfaces of the secondary crowns create wear tracks (scratches) on the polished surface of the primary crowns which may result in cold metal fusion and increased adhesive friction and retention of telescopic attachments used to retain overdentures. In addition, the

increased vertical height of the attachment can cause an increased tactile sensation, osseopreception, and increased axial transmission of masticatory force to the ridges. (12)

As agree with van Kampen et al. (13) evaluated initial retention force, loss of retention force after 3 months of function, and postinsertionmaintenance and complications associated with the use of magnet, bar-clip, and ball attachments in mandibular overdenture treatment.
Uludag et al.(14) stated that with bar with clip attachment, bar with two distal locator attachments, and a bar with clear locator attachments, after 6 months of clinical function, there is a decrease in retention from the initial testing to the final pull-out test. This decrease was significant for all designs.

For both groups, the unmixed fraction (UF) significantly decreased when the number of chewing strokes increased. As during chewing, the food bolus or food particles are reduced in size, mixed together and with saliva by contacting cusps of posterior teeth as postulated by Prinz et al.(14)

Weijenberg et al. (14) stated that increasing the number of chewing cycles for the same patient results in more mixing between particles of two-colored chewing gums. For Group I (bar clip attachment), the UF significantly increased with advance time, while in group II the UF significantly decreasrd advance with time. This may be due to the effect of retention and stability of the prosthesis on masticatory performance. This is in agreement with Van der Bilt et al. (14) who affirmed that good oral function depends on the retention, stability and the attachment of the denture.

Conclusions:

1) Placement of three mandibular implant in the anterior area is a reliable option for maximizing retention and chewing efficiency, in comparison to two mandibular implant assisted overdenture.

2) Patients rehabilitated with overdenture retained by telescopic or bar clip attachments had significant improvement in masticatory efficiency when compared with conventional denture. However, the masticatory efficiency still was found to be significantly lower in telescopic as compared to Bar clip attachments.
3) The chewing efficiency is increased with the increasing of the retention .

Recommendations:

- Prospective studies are need to monitor retention of bar and telescopic attachments and to evaluate retention of denture base relationship after more prolonged time in three implant assisted overdenture..

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