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CLINICAL OUTCOME OF DIFFERENT TYPES OF ATTACHMENTS RETAINING MANDIBULAR KENNEDY CLASS I PARTIAL DENTURES

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ABSTRACT

Aim of the study: This study was conducted to assess and compare the effect of extracoronal OT CAP, telescopic crown and magnetic attachments in long span bilateral distal extension cases. Case evaluation: included patient satisfaction, clinical evaluation and radiographic evaluation. Clinical evaluation was performed using plaque index , gingival index , probing depth and periotest.

Materials and Methods: Thirty partially edentulous male patients (age ranging from 50-60 years) having Kennedy class I lower ridges with lower first premolar as last abutment were selected to this study .Removable partial dentures were constructed following the same technique, and using the same materials. All dentures were designed with combined denture bases, lingual bar as major connector .According the attachment type used to retain removable partial denture., patients were divided into three groups: **Group I**, received removable partial dentures retained by extracoronal OT CAP attachment (Rhein 83, Italy), **Group II**: received removable partial dentures retained by telescopic crowns exhibiting 10-12 degrees occlusal taper and **Group III**: received removable partial dentures retained by magnetic attachments (Dyna Magnet System, Holland) .Follow up visits were scheduled at time of denture insertion, six, twelve and eighteen months after denture insertion for inspection of the prosthesis and collection of the data. Case evaluation included patient satisfaction, clinical evaluation of the supporting abutments, which included recording of the gingival index and the clinical attachment level, abutment mobility (using periotest), as well as radiographic evaluation.Radiographs were performed for assessment of bone height mesial and distal to the abutments by serial standardized periapical radiographs made by long cone paralleling technique.

Results: In general, patients were satisfied with the appearance, fit, stability, retention and function of their dentures. They experienced an improvement in their chewing ability and esthetics mainly in group III. There was a slight gradual increase in the gingival index scores, clinical attachment level values throughout the follow up period, in all three groups. However, there were no statistically significant differences between the three groups clinically. Regarding abutment mobility, no statistically significant difference was observed in the mean values of the periotest scores in the three groups along the follow up period. comparing the three studied groups although telescopic attachment retained RPD (Group II)showed the highest mean values and magnetic attachment retained RPD (Group III) showed the least mean values of the periotest scores during

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the follow up period , there were no statistically significant differences the studied Groups. There was a statistically significant decrease in crestal bone height around the abutments, telescopic attachment retainer showed the statistically significantly highest crestal bone loss around the abutment, while the magnetic attachment retainer that showed the lowest crestal bone loss.

Conclusions: Telescopic retainers distribute more stresses on the abutments more than extracoronal and magnetic attachments. Magnetic attachment is considered minimal invasive procedure as it reduces only one abutment in comparison to two abutments in cases of extracoronal and telescopic attachments.

INTRODUCTION

Rehabilitation with removable partial denture necessitates precise denture design following the biomechanical principles. Forces that may produce torque on abutment teeth or resorption of the residual ridge should thus be controlled and minimized when designing RPDs especially distal extension bases.[1]

Although clasp retained partial dentures are commonly used in dental practice, the attachment retained partial dentures are increasingly used as acceptable treatment modality in distal extension cases. They provide good direct and indirect retention, transmit the functional load down the long axis of the abutment teeth and more esthetically acceptable. Although providing esthetic advantage; attachments require complicated clinical and laboratory procedures. They are subjected to wear and are difficult to repair and replace. Also, attachments are less effective on abutments having short crowns[2,3].

An effective type of retainer, possessing retention, support and splinting action between multiple abutment teeth is a double crown known as a telescopic retainer. Telescopic crowns have proven more effective than other direct retainers. They provide direct and indirect retention and axial loading of the abutment teeth. They are also more hygienic, provide good esthetics and cross arch stabilization [4]. Several studies revealed that telescopic crown retained partial dentures are reliable restorations providing reasonable clinical longevity [4-6]; it also fulfilled patient satisfaction, and was proved to improve patients' oral health-related quality especially in patients with few remaining teeth. [7]

Two basic principles usually guide the design of telescope retainers depending on the relation between the inner and outer components. The first one follows the traditional approach of rigid positional relationship between the inner and outer components. The more parallel the walls of the telescopic retainer and the less the taper angle of the coping, the greater the mechanical friction. This enhances interlocking between the coping with the overlying crown and results in high retentive strength. [8-10]

Rigid telescope design was believed to be more biologic and prolongs the tolerance of the abutment when occlusal forces are applied. Using rigidly constructed RPD whenever enough tooth support is available was reported to be the best way to preserve stability and efficiency of the dental arch. Soldering the secondary crowns adjacent to the edentulous space of bilateral distal extension restorations is one example for cross-arch splinting to provide bilateral support and stability. [11, 12]

Care should be taken in planning the correct retentive design of the inner copings, misdiagnosis in a Kennedy Class I could leave the patient with a tooth-borne denture that resembles a cantilevered restoration, which might cause tremendous pain and ultimate failure of the abutment(s), an incorrect design could cause the teeth to fracture, diminish supporting bone, or both, due to such unfavorable forces. An over-retentive design, when identified

in time, should be changed to a less retentive, self-releasing type. [13]

Magnets have become very popular as retainers for removable overdentures for both teeth and implant abutments. They are characterized by providing stress breaking effect. Also, strict parallelism between abutments is not required, hence, requiring no specific path of appliance insertion. Also, potentially pathologic lateral or rotating forces are eliminated providing maximum abutment protection [14]. Moreover, the magnetic field does not affect the surrounding tissues and well accepted by osseous and fibrous tissues [14, 15]. Dental magnets are alternatives for stud and bar attachments for retaining overdentures prostheses whether supported by teeth or implant [16-19].

Magnetic retention is indicated in distal extension cases where stress releasing effect is required to reduce torque on abutments induced by the inevitable movement of the denture base. They are thus preferred with abutments having questionable prognosis [20]. It was reported that, lower level of stresses were noted in abutments of magnetically retained bilateral distal extension partial dentures than in those retained by stud attachments or clasps. [21]

A new resilient extracoronal attachment the OT CAP attachment has been introduced with varying degrees of resiliency. Extracoronal OT CAP castable attachments have been successful approach for partially edentulous cases. The design of the retentive components control of the stresses transmitted to the abutments. In addition the elastic memory of the titanium "male" produces retention at the equator of the sphere. The nylon that incorporates the titanium spring also contributes to the functionality over a period of time [22]. Attempts to construct attachments based on REVERSE concepts leads to the introduction of reverse OT attachment. A comparative study on extracoronal OT CAP and reverse OT attachments used for retaining mandibular distal extension prostheses revealed that using OT CAP attachment caused significant reduction in bone reduction level around the terminal abutments[23]

The several advantages listed in the literature for telescopic crown, magnetic and extracoronal OT CAP castable attachments precision attachment made the appropriate selection of either of them difficult. Accordingly, this study was conducted to assess and compare the effect of extracoronal OT CAP, telescopic crown and magnetic attachment in long span bilateral distal extension cases. Case evaluation: included patient satisfaction, clinical evaluation and radiographic evaluation. Clinical evaluation was performed using Plaque Index, Gingival Index , Probing depth and Periotest

MATERIALS AND METHODS

Thirty partially edentulous male patients (age ranging from 40-50 years) having Kennedy class I lower ridges with lower first premolar as last abutment were selected from the outpatient clinic of the Prosthodontic Department, Faculty of dentistry, Ain Shams University according to the following criteria: patients were free from systemic diseases that may affect the results of this study, patients having functionally normal occlusion, normal maxillo-mandibular relationship and sufficient inter-arch distance not less than 7 mm, and patients were free from any signs of Temporo-mandibular joint disorders or bad oral habits.

RPDs were constructed following the conventional technique, all dentures were designed with combined denture bases, lingual bar as major connector according to the type of attachment, patients were divided into three groups: **Group I:** Patients in this group had received removable partial dentures retained by extracoronal OT CAP attachment (Rhein 83, Italy), **Group II:** Patients in this group had received removable partial dentures retained by telescopic crowns exhibiting a 10-12 degrees occlu-

sal taper. **Group III:** Patients in this group had received removable partial dentures retained by magnetic attachments (Dyna Magnet System, Holland).

Prior to treatment, a thorough periodontal therapy was performed to the remaining natural teeth and all patients were instructed in a strict maintenance care program. A provisional inter-occlusal wax record was made to mount the study casts on a mean value articulator. The occlusal planes were evaluated and over erupted teeth were identified. Slightly over erupted teeth were reduced and marked, any tooth interfere during excursive movements were detected and marked on the cast.

Abutment preparation:

For group I patients the two adjacent abutments on each side of the arch were prepared to receive two splinted ceramometallic crowns. Rubber base impression was made and poured into improved stone and removable dies of the abutment teeth were obtained and wax patterns for the abutments were constructed. The plastic pattern castable bar of the extracoronal OT CAP attachment was joined to the distal surface of the wax pattern of the lower canines and first premolars 1mm away from the gingival margin with the aid of surveyor to ensure parallism between the male portion of the attachment and the path of insertion Fig(1). Spruing, investing, burn out and casting were carried out ,the finished castings were tried in the patient's mouth and checked for seating, retention and proper adaptation to the finish line. Porcelain was then fired to the metallic crowns. The veneered crowns were placed on to the abutment teeth and rubber base impression was made and poured in dental stone. Wax pattern of the partial denture framework was made on the refractory cast. The female portions (Castable OT housing for cap) of the extracoronal attachments were attached to the wax pattern of the partial denture framework and were inserted onto the male portions. Casting procedures were completed and metallic framework was obtained. The retentive cap was inserted in the housing. Try in of the metallic framework was carried out to check proper seating and accurate insertion of the male portions of the attachment into the female portions.

While For group II patients, the two adjacent abutments on each side of the arch were reduced and contoured to a slight occlusal taper of about 10-12 degrees, the finish line was placed just beyond the crest of the free gingival margin. Rubber base impression was made and poured in type IV improved stone, wax patterns of the separate primary copings were milled on a milling machine with occlusal taper ranging from 10 to 12 degrees. A finish line for the secondary copings nearly 1mm occlusal to the finish line of primary copings was made. The primary copings were sprued, invested, cast, finished and polished .Try-in of the metallic

Fig. (1) Wax pattern of extracoronal OT CAP attachment

Fig. (2) Pimary coping for double bilateral telescopic crowns

primary copings was carried out then cemented to the abutments Fig(2). Rubber base impression was made and poured to produce the master cast. Wax pattern of the partial denture framework and secondary copings was made on the refractory cast. Casting of the wax patterns were carried out, and then the cast secondary crowns were soldered to the cast metal framework of the partial over denture. The finished and polished metallic framework with the soldered secondary copings was checked in the patient's mouth for complete seating and adequate retention between the primary and secondary copings of the telescopic retainers. Porcelain was fired to the metallic secondary copings soldered to the partial denture framework. Removable partial dentures were constructed to all the patients following the same basic principles as for group I patients.

Finally, for group III patients after root canal treatment, enough tooth structure was removed in order to create sufficient space for the magnet and the keeper, about 2 mm above the gingival margin of the abutments was left to create more lateral stability for the denture**.** The abutments were prepared to receive the small size (4mm in length and width) type Dyna Direct keeper .The keeper was cemented to the prepared root canal by resin based cement Fig(3). RPDs were constructed following the conventional technique. To ensure precise location of the magnets in denture fitting surface above the keeper, the direct pick-up technique was followed.

Fig. (3) : The cemented keepers

The denture fitting surface was adequately relieved all-around the small size magnets (4,8mm in diameter and 1,7mm in height) by grinding enough resin from the fitting surface of the denture to ensure proper denture seating. The pick-up procedure was performed under the patient`s biting force to avoid any changes in occlusal contact. Self cure acrylic resin used during pick up procedures was carefully smoothed and polished to prevent presence of rough surfaces that may encourage the growth and nourishment of bacteria and fungi.

For the entire patients, at the time of denture insertion, occlusal adjustment was performed. All patients were educated and instructed to maintain good oral, and denture hygiene. All patients were recalled 24 hours after denture placement to eliminate any arising complaints. Frequent follow-up appointments were scheduled to ensure proper oral and denture hygiene. Patients were recalled at six , twelve and eighteen months to follow up for evaluation of the dentures and data collection. Case evaluation: included patient satisfaction, clinical evaluation and radiographic evaluation .Clinical evaluation was performed using plaque index , gingival index , probing depth and Periotest .

I-Patient satisfaction:

The patients were asked to give their perception on the received partial denture using a questionnaire**.** **S**atisfaction after six months follow up period was checked regarding comfort, esthetics, retention[24]. When the score for a variable was high, patients were more satisfied.

5 = Strongly agree; 4 =Agree; 3 = Neither agree nor disagree; 2 =Disagree; 1 = Strongly disagree for each of these parameters.

II-Cinical evaluation:

a-Gingival Index:

The gingiva around the abutments was gently dried using cotton pellets and then each abutment was individually scored. Gingival index was scored

at mesio-buccal, mid-buccal, disto-buccal and mid-lingual surfaces for the first premolars. The mean of the four scorings was calculated. The gingival index was scored according to **Löe and Sillness**[25] **Grade (0):** Normal healthy gingiva. **Grade (1):** Mild inflammation, slight changes in color, slight edema and / or no bleeding on probing. **Grade (2):** Moderate inflammation, redness, edema, glazing, and bleeding on probing. **Grade (3)**: Severe gingival inflammation with marginal edema and redness as well as ulceration and spontaneous tendency for bleeding.

b-Clinical Attachment Level:

Clinical attachment level at the first premolar abutments was measured using a graduated periodontal probe [26]. The probe was gently inserted at each surface parallel to the long axis of the tooth between the abutment and the oral sulcularepithelium. Attachment level was recorded at the mesio-buccal, mid-buccal, disto-buccal and mid-lingual surfaces then mean of the four readings was calculated.

c) Abutment Mobility Assessment:

The mobility of the abutment teeth was evaluated using the periotest device (Periotest M-Medizintechnik Gulden – Germany). Percussions were made on the buccal surface of the abutments and then the micro-computer present in the hand-piece records the time consumed by the abutment to return to the original position. The tapping head was used to perform percussions, average results of the total readings were calculated and recorded. Periotest values (PTVs) have a range from -8 to +9 corresponds to 0 on the Miller index with no clinical evidence of tooth mobility [27].

III- Radiographic evaluation:

Radiographs were performed for assessment of bone height mesial and distal to the abutments using the digital radiography (Digora system). For standardization of the digital images of the abutments, the Digora system, together with the imaging plate, Rinn (XCP) film holder and the individually constructed radiographic template was used. The template was constructed to receive the Rinn XCP periapical film holder in a reproducible position and in a parallel relation to the long axis of the abutment [28].

The amount of bone loss was calculated by subtracting the measured distances between each radiographic evaluation made at the time of denture insertion and the recall appointments. Data were collected for all patients at different follow-up intervals, tabulated and statistically analyzed.

RESULTS

Statistical analysis was performed using SPSS version 12.0 for Windows (SPSS Inc., Chicago, IL, USA, One way analysis of variance procedure ANOVA of SAS) followed by Duncan's Multiple Range test was run to test the significance between different treatment modalities. Patient satisfaction data is categorical data , cross tabulation and chi-square test were used to test the effect of time as well as the effect of different attachments for the mean satisfaction scores in the three groups. The results of this study are represented in tables (1-5) . A probability level of $P \leq 0.05$ or less was considered statistically significant.

I- Patient satisfaction:

As regards esthetics Group I (Extracoronal OT CAP attachment retained RPDs) 90% of the patients were satisfied their esthetics, 80% of patients rehabilitated with telescopic retained RPD were satisfied their esthetics, while Group III (Magnetic retained RPDs), all patients satisfied their esthetics, comparing the three groups there was no statistically significant difference $P>0.05$.While for retention and comfort all patients reported that they agree with their RPDs, there was no statistically significant difference between the three groups. as shown in table (1)

TABLE (1): Prevalence of satisfaction scores in the three groups.

Group / Variable	OT CAP attachment) Group I		Telescopic attachment retained RPD Group II		Magnetic retained RPD Group III		*P*-value
	number	%	number	%	number	%	
Esthetics							
Agree	9	90%	8	80%	10	100%	**NS**
Disagree	1	10%	2	20%	-	-	
Strongly disagree	-	-	-	-	-	-	
Retention							
Neutral	-	-	-	-	-	-	**NS**
Agree	10	100%	10	100%	10	100%	
Strongly disagree	-	-	-	-	-	-	
Function							
Neutral	-	-	-	-	-	-	**NS**
Agree	10	100%	10	100%	10	100%	
Strongly disagree	-	-	-	-	-	-	

TABLE (2): Mean, standard deviation and Duncan's Multiple Range test for the effect of using different treatment modalities on gingival index during the follow up period.

Treatment modality	OT Attachment retained RPD (Group I)			Telescopic attachment retained RPD (Group II)			(magnetic attachment retained RPD (Group III)		
Time	Mean	S.D.	Dt dt2	Mean	S.D.	Dtdt2	Mean	S.D.	Dtdt2
Zero-time –6 M	0.025	0.001	A a	0.02	0.013	A`a	0.03	0.012	Aa
Zero-time – 12 M	0.03	0.01	A a	0.04	0.034	Aa	0.04	0.016	Aa
Zero-time–18 M	0.05	0.011	A a	0.04	0.021	A a	0.02	0.011	A a

S.D. = Standard deviation.

Dt1, Duncan's Multiple Range within the group Dt2 , between treatment modalities

II- Clinical Evaluation

a) Gingival Index

No statistically significant difference was found in the mean values of the gingival index in the three groups along the follow up period p>0.05. Comparing the three studied groups no statistically significant change was observed in the mean values of the gingival index score of the patients in group I (OT Attachment), group II (telescopic crowns) and group III (magnetic attachment), six , twelve and eighteen months after denture insertion as shown in table (2)

b) Clinical Attachment Level:

No statistically significant difference was found in the mean values of the clinical attachment level in the three groups along the follow up period as shown in table (3) .No statistically significant difference was observed in the mean values of the clinical attachment level changes comparing the three studied groups P >0.05.

c-Abutment Mobility (Periotest scores)

No statistically significant difference was observed in the mean values of the periotest scores in the three groups along the follow up period. Comparing the three studied groups although Telescopic attachment retained RPD (Group II) showed the highest mean values and magnetic attachment retained RPD (Group III) showed the least mean values of the periotest scores during the follow up period, there were no statistically significant differences between telescopic attachment retainer, OT Attachment retained RPD (Group I) and magnetic (magnetic attachment retained RPD (Group III) as shown in table (4) during all the recall appointments.

III-Radiographic Evaluation

No statistically significant difference was observed in the mean values of the crestal bone height changes of the abutments in the three groups at the end of the eighteen months follow up period, however significant difference was calculated for the three groups at the end of the eighteen months follow up period as evident in table (5). Comparing the three studied groups, Group II (Telescopic attachment) showed the statistically significantly highest crestal bone loss at the end of the eighteen months follow up period $P<0.05$, although group III (Magnetic attachment) less crestal bone loss compared to group I (OT attachment) the difference was statistically insignificantly $P>0.05$.

TABLE (4): Mean, standard deviation and Duncan's Multiple Range test for the different treatment modalities on the abutment mobility during the follow up period.

Treatment modality	OT Attachment retained RPD (Group I)			Telescopic attachment retained RPD (Group II)			magnetic attachment retained RPD (Group III)		
Time	Mean	S.D.	Dt dt2	Mean	S.D.	Dtdt2	Mean	S.D.	Dtdt2
Zero-time –6 M	0.31	0.05	A a	0.36	0.023	A`a	0.32	0.052	Aa
Zero-time – 12 M	0.46	0.035	A a	0.53	0.062	Aa	0.42	0.041	Aa
Zero-time–18 M	0.61	0.047	A a	0.82	0.02	A a	0.58	0.021	A a

S.D. = Standard deviation. Dt1, Duncan's Multiple Range within the group Dt2 , between treatment modalities

TABLE (5): Mean, standard deviation and Duncan's Multiple Range test for the different treatment modalities on crestal bone height changes during the follow up period.

Treatment modality	OT Attachment retained RPD (Group I)			Telescopic attachment retained RPD (Group II)			(magnetic attachment retained RPD (Group III)		
Time	Mean	S.D.	Dt dt2	Mean	S.D.	Dtdt2	Mean	S.D.	Dtdt2
Zero-time –6 M	0.54	0.21	A a	0.66	0.23	A`a	0.49	0.25	Aa
Zero-time – 12 M	0.68	0.26	A a	0.82	0.31	Aa	0.63	0.22	Aa
Zero-time–18 M	0.98	0.17	b a	1.22	0.42	bb	0.92	0.16	b a

S.D. = Standard deviation. Dt1, Duncan's Multiple Range within the group Dt2 , between treatment modalities

DISCUSSION

Combined tooth-tissue support has always been a problem that causes higher susceptibility of abutment loss in free-end saddle removable partial denture. Removable partial torque on abutment teeth should be controlled and minimized when designing removable partial dentures especially distal extension bases.[1] Different designs of retainers as the OT cap extra coronal attachment, telescopic and magnetic retained partial dentures have been introduced to control excessive torque forces acting on the abutment and preserve the abutment teeth and their related supporting structures. Based on the clinical radiographic findings of this study it seems reasonable to suggest that, the magnetic attachment is adequate to minimize the detrimental stresses transmitted to the abutment and OT CAP attachment transmits less stresses to the abutment supporting structures compared to telescopic attachments.

Magnetic retention is indicated in distal extension cases where stress releasing effect is required to reduce torque on abutments induced by the inevitable movement of the denture base. They are thus preferred with abutments having questionable prognosis.[20] It was reported that, lower level of stresses were noted on abutments of magnetically retained bilateral distal extension partial dentures than in those retained by stud attachments or clasps.[29]

The magnetic attachment systems offer simplicity in design, self-adjustment, inherent stress-breaking action, automatic repositioning after denture displacement, comparative freedom of lateral denture movement, and reduced trauma to retained roots and implants.[15,30,31]

The magnetic retained RPD (Group III) form of denture that is more stable and retentive than OT Attachment retained RPD (Group I) and Telescopic attachment retained RPD (Group II). In addition, the ease of removal and relocation of the retention and keeper elements and freedom of lateral denture movement may account for the results of this study.

All criteria for patient's selection was directed to control the adverse effect of systemic and local factors on bone resorption and avoid excessive load or undue forces on the residual ridge and abutments. For standardization in the present study, all mandibular arches were opposed by maxillary dentate arch or that with only one or two teeth missing restored by fixed restoration, since the type of opposing occlusion is an important factor that influence the magnitude of forces transmitted to the lower arch. Standard clinical and laboratory techniques were followed for denture construction for all patients to decrease variables that could affect the results of this study.

For group II (telescopic retained partial denture), to insure their stability and precision of the primary copings, they were milled on the milling machine with occlusal taper ranging from 10 to 12 degrees. Crowns with 6-12 degree taper angle are the most commonly in distal extension removable partial dentures. Increasing the taper angle of the telescopic retainers creates a stress breaking effect on abutment teeth of distal extension removable partial dentures.[9-11] The metal copings were highly polished to prevent plaque accumulation which may contribute to changes in oral ecology and affect gingival index scores.

For group III (magnetic retained partial denture) abutment height after preparation was 2mm occluso-gingivally to create sufficient space for the keeper, the magnet, and the artificial tooth, and allow for lateral stability of the denture.

The slight statistically insignificant increase in the mean values of the gingival index and clinical attachment level values, in all the studied groups could be explained by the fact that removable partial dentures acting as foreign body that increase the dental biofilm accumulation, especially on the surface of teeth in direct contact with the denture.[32,33]

Oral hygiene was found to be the most important factor associated with gingival inflammation, pocket formation and marginal bone loss of the abutment teeth..During the course of this study, patients were intensively instructed in proper oral and prosthetic hygiene the establishment of maintenance program described for the patients may account for the insignificant difference detected between the three studied groups .

Regarding abutment mobility assessment (periotest scores) no significant changes in tooth mobility were observed during the follow-up. The increased in tooth mobility may be a physiological adaptation to increased functional demands and this symptom is not necessarily indicative of a pathological condition,[34] others stated that, the wearing of a new removable partial denture is followed by a "settling" period that lasts about 1 to 1.5 months and leads to a reduction of the initial torque exerted on the abutment teeth this may explain the insignificant changes in tooth mobility observed during the follow-up[35]. The ease of removal and relocation of the retention and keeper elements and freedom of lateral denture movement may account for the least mean values of the periotest scores during the follow up period.

A study done to estimate risks of telescope loss and abutment tooth loss and to determine abutment tooth mobility over time revealed that, periotest values were decreased upon using telescopic crowns [36] , and the results confirmed by other authors who do not support the idea that telescopic retainers generally overload the abutment teeth and lead to increased tooth mobility [37]

The gradual bone loss in the supporting bone that was evident in this study after the insertion of the partial denture independent to the attachment design is supported by a common previous finding that even well-constructed dentures induce forces that contribute to gradual bone loss. Crestal bone loss observed in this study is explained by the fact that bone is continuously renewed by a bone formation and bone resorption. When bone resorption rate exceeds bone formation rate, bone loss occurs. [38]

For group of patients rehabilitated by OT attachment retained RPD, the improved retention of the RPD due to the use of the OT attachment with its retentive features decreased the denture movement in all directions and in turn decreased the vertical and lateral loads transmitted to the abutment teeth. This most probably minimized the denture base movement posteriorly, which prevents the rotational component of tissue-away movement and in turn controlled the torquing action on the abutments anteriorly and preserved its crestal bone and may explain the detected change in the crestal bone height around the abutment teeth in the studied patients during the flow up period .In addition the statistically in significant difference for the observed bone loss between the group I and group II studied groups may be due to the structural property of the attachment, The elasticity of the titanium male permits the "male" to be inclined slightly in all directions, these movements and the form of the "female" component of the attachment, with the center of gravity lowered to the level of the gingival level ,and may account for the results of this study. [22,23,39]

In group III (magnetic attachment), the retention forces are reduced, as well as the risk of abutment loss, by allowing the denture to rotate on the copings rounded occlusal surfaces. This will reduce the amount of lateral pressure on the teeth. In a study done to compare the load transfer and denture stability when using ball, magnet, and bar attachment retaining mandibular implant overdenture, it was revealed that, magnetic attachment induced least force on the implant.[40]

Magnetic attachment had no path of insertion restrictions, and the denture can move laterally in function without exerting significant lateral forces on the root. Moreover, it provides a degree

of self adjustment and a form of stress breaking for distal extension denture bases, consequently, it has a low potential for trauma to the supporting roots. In addition, magnet has a low point of action directing the occlusal forces more apically with the long axis of the root, thus, favorable the stresses on the root, [41,] this may explain the less crestal bone loss in abutments bearing magnetic attachment detected in this study.Magnetic attachment had no path of insertion restrictions, and the denture can move laterally in function without exerting significant lateral forces on the root. Moreover, it provides a degree of self-adjustment and a form of stress breaking for distal extension denture bases, consequently, it has a low potential for trauma to the supporting roots. [42]

Since the adaptation of patients` tissues plays a major role in enhancing the success of the dentures satisfaction of the patients was evaluated six months after denture insertion. Most of patients sharing in this study were highly satisfied with their dentures as regards appearance, retention, and chewing ability. This indicates that removable partial dentures constructed following biomechanical principles fulfill the objectives of dentures construction regarding both esthetics and function. Patients' satisfaction could be attributed to the meticulous care and frequent follow up to eliminate any complaint.

Patients rehabilitation with magnetically retained removable partial dentures were more satisfied by their dentures. This was primarily attributed to easier cleaning procedure and more accessible insertion which is explained by the fact that removable partial dentures for group I and II patients exhibit a single path of insertion compared to multi directional path required by magnetically retained removable partial dentures. Patients also expressed a feeling of security which could probably be due to the enhanced retention provided by magnetic attachments. [43]

This findings is confirmed by the results of a study that proved that the retention values were higher in magnetically retained distal extension removable partial dentures than for the l-bar retained distal extension bases.[44]

CONCLUSIONS

- Telescopic retainers distribute more stresses on the abutments more than extracoronal and magnetic attachments.
– Magnetic attachment is considered minimal invasive procedure as it reduces only one abutment in comparison to two abutments in cases of extracoronal and telescopic attachments.

REFRENCES

1- Carr AB, McGivney GP and Brown DT. 11th ed. McCraken's removable partial denture prosthodontics. 2005, St louis, Baltimore, Toronto: Mosby co.

2- Preiskel, H.W.: Precision attachments in prosthodontics: The applications of intracoronal and extracoronal attachments. 1st ed. Quintessence publishing Co., 1984.

3- Saito M, Miura Y, Notani K and Kawasaki T: Stress distribution of abutments and base displacement with precision attachment- and telescopic crown-retained removable partial dentures. J Oral Rehabil, 2003; 30(5): 482-7.

4- Widbom T, Lofquist L, Widbom C, Soderfeldt B and Kronstrom M: Tooth-supported telescopic crown-retained dentures: an up to 9-year retrospective clinical follow-up study. Int J Prosthodont, 2004; 17(1): 29-34.

5. Minagi S, Natsuaki N, Nishigawa G and Sato T: New telescopic crown design for removable partial dentures. J Prosthet Dent, 1999; 81(6): 684-8.

6. Igarashi Y and Goto T: Ten-year follow-up study of conical crown-retained dentures. Int J Prosthodont, 1997; 10(2): 149-55.

7. Wenz HJ, Hertrampf K and Lehmann KM: Clinical longevity of removable partial dentures retained by telescopic crowns: outcome of the double crown with clearance fit. Int J Prosthodont, 2001; 14(3): 207-13.

8. Ogata K, Ishii A, Shimizu K and Watanabe N: Longitudinal study on occlusal force distribution in lower distal-extension removable partial dentures with conus crown telescopic system. J Oral Rehabil, 1993; 20(4): 385-92.

9- Langer A: Telescope retainers for removable partial dentures. J Prosthet Dent, 1981; 45(1): 37-43.

10. Wenz HJ and Lehmann KM: A telescopic crown concept for the restoration of the partially edentulous arch: the Marburg double crown system. Int J Prosthodont, 1998; 11(6): 541-50.

11- Wostmann B, Balkenhol M, Weber A, Ferger P and Rehmann P: Long-term analysis of telescopic crown retained removable partial dentures: survival and need for maintenance. J Dent, 2007; 35(12): 939-45-

12- Gungor MA, Artunc C and Sonugelen M: Parameters affecting retentive force of conus crowns. J Oral Rehabil, 2004; 31(3): 271-283-

13- Smidt A: Telescopic restorations in prosthodontics. DT.2000;168-178.

14- Barrie RD and Gillings ED: Magnetic retention for complete and partial overdentures. Part I.J Prosthet Dent.,1981;45:484-493.

15- Gillings B:Magnetic retention for complete and partial overdentures. Part I. J Prosthet Dent. 1981;45:484-491.

16- Huang Y, Tawada Y, Hata Y and Watanabe F:The change in retentive force of magnetic attachment by abrasion. Odont.2008; 96: 65-68.

17- Carlyle L, Duncan J, and Richardson J: Magnetically retained implant denture. J Prosthet Dent.1986; 56: 583-586.

18- Naert I, Gizani S and Vuylsteke M: A 5-year prospective randomized clinical trial on the influence of splinted and unsplinted oral implants retaining a mandibular overdenture: prosthetic aspects and patient satisfaction. J Oral Rehabil.1992; 26: 195-202.

19- Boeckler AF, Ehring C, Morton D, Geis-Gerstorfer J and Setz JM: Corrosion of Dental Magnet Attachments for Removable Prostheses on Teeth and Implants. J Prosthodont.2009; 18: 301-308.

20- Gillings B: Magnetic retention for overdenture. Part II. J Prosthet Dent. 1983; 49(5): 607-618.

21- Pezzoli M, Highton R, Caputo AA and Matyas J:Magnetizable abutment crowns for distal-extension removable partial dentures. J Prosthet Dent. 1986; 55(4):475-480.

22. Berg T. and Caputo A.A.: Load transfer by a maxillary distal-extension removable partial denture with cap and ring extracoronal attachments. J Prosthet Dent,1992, 68:784-789.

23- Widbom T, Lofquist L, Widbom C, Soderfeldt B and Kronstrom M: Tooth-supported telescopic crown-retained dentures: an up to 9-year retrospective clinical follow-up study. Int J Prosthodont, 2004; 17(1): 29-34.

24- Heo YY, Heo JS, Chang WM, Park J. The patients' satisfaction following implant treatment. J KoreanAcad Prosthodont.2008; 46:569.

25- Loe H, Silness J.: Periodontal Disease in Pregnancy. I. Prevalence and Severity.ActaOdontol Scand. 1963;21: 533-551.

26- Silva-Boghossian CM, Amaral CS, Maia LC, Luiza RR and Colombo AP: Manual and electronic probing of the periodontal attachment level in untreated periodontitis. A systematic review. J Dent. 2008; 36: 651-659.11111

27- Berthold C, Holst S, Schmitt J, Goellner M and Petschetl A: An evaluation of the periotest method as a tool for monitoring tooth mobility in dental traumatology. Dental Traumatology.2010; 26: 120-128.

28- Robert A: Intraoral Digital Radiography: Elements of Effective Imaging. Compendium. 2012; 33(I):656-665.

29- Pezzoli M, Highton R, Caputo AA and Matyas J: Magnetizable abutment crowns for distal-extension removable partial dentures. J Prosthet Dent. 1986; 55(4): 475-480.

30- Robinson JE: Magnets for the retention of a sectional intraoral prosthesis. A case history. J Prosthet Dent. 1963; 13: 1167–1171.

31- Fhjimoto T, Niimi A, Murakami I and Ueda M: Use of new magnetic attachment for implant-supported overdentures. J Oral Implant. 1998; 24: 147–151.

32- Drake CW and Beck JD: The oral status of elderly removable partial denture wears. J Oral Rehabil. 1993; 20: 53–60.

33- Akaltan F and Kaynak D: An evaluation of the effects of two distal extension removable partial denture designs on tooth stabilization and periodontal health. J Oral Rehabil. 2005; 32: 823–829.

34- Rissin L, House J, Conway C, Loftus ER and Chauncey H: Effect of Age and Removable Partial Dentures on Gingivitis and Periodontal Disease. J Prosthet Dent. 1979;42:217.

35- Mahmood WA, Salim SA and Saharudin S: The Status of The Abutment Teeth in Distal Extension Removable Partial Dentures. Malaysian Dent J 2009; 30(1): 13-19.

36- Szentpétery V, Lautenschläger C and Setz JM: Longevity of frictional telescopic crowns in the severely reduced dentition: 3-year results of a longitudinal prospective clinical study.Quintessence Int. 2010;41:749–758.

37- Wenz HJ, Hertrampf K, Lehmann KM: Clinical longevity of removable partial dentures retained by telescopic crowns. Outcome of the double crown with clearance fit. Int J Prosthodont. 2001;14:207–213.

38- Baylink DJ, Wergedal JE, Yamamotos K and Manzke E: Systemic factors in alveolar bone loss. J Prosthet Dent.1974;31:486-496.

39- Nawar NH, Cheta NM: Evaluating biting force distribution and patient satisfaction in lower Kennedy class II removable partial denture retained with two different extracoronal attachments. Egypt Den J, 2015, 61(4):4901- 4918.

40- Tokuhisa M, Matsushita Y and Koyano K: In vitro study of a mandibular implant overdenture retained with ball, magnet, or bar attachments: comparison of load transfer and denture stability. Int. J. Prothodont. 2003; 16: 128-134.

41- John J. Rangarajan V.Savadi R. Kumar KS and Kumar PS: A Finite Element Analysis of Stress Distribution in the Bone Around the Implant Supporting a Mandibular Overdenture with Ball/O Ring and Magnetic Attachment. J. Indian Prostho. Soc. 2012; 12(1): 37-44.

42- Gillings BR and Samant A:Overdentures with magnetic attachments. Dent. Clin. North. Am., 1990:34:683-709.

43- Cheng T, Sun G, Huo J, He H, Wang Y and Ren YF: Patient satisfaction and masticatory efficiency of single implant retained mandibular overdentures using the stud and magnetic attachments. J. of Dent.2012; 40: 1018-1023.

44- Pezzoli M, Highton R, Caputo AA and Matyas J: Magnetizable abutment crowns for distal-extension removable partial dentures. J Prosthet Dent. 1986; 55(4): 475-480.