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EFFECT OF DIFFERENT CLIP MATERIALS OF BAR ATTACHMENT ON THE POCKET DEPTH ON TOOTH- SUPPORTED OVERDENTURE RANDOMIZED CONTROLLED CLINICAL STUDY

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ABSTRACT

Background: Nowadays mandibular tooth overdentures retained by bar attachment are used on a wide scale as a substitute for the conventional complete denture thus further studies are required to verify this replacement.

Methodology: Fourteen patients were randomly categorized into two equal groups. In the first group (Group I) patients received mandibular tooth-supported overdentures retained by metal bar attachment with plastic clip material while in the second group (Group II) patients received mandibular tooth-supported overdentures retained by bar attachment with PEEK clip material. All patients were scheduled for recall visits and pocket depth of around abutment was recorded at the time of loading, six months, and twelve months.

Results: Regarding pocket depth: (Group I) was significantly higher than (Group II) after 6 and 12 months. Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data were summarized using mean and standard deviation. Comparisons between groups were done using an unpaired t-test. Comparison over time within the same group was done using paired t-test. P-values less than 0.05 were considered statistically significant.

Conclusion: Within the limitations of this study: Tooth-supported overdenture retained by bar attachment with plastic clip is less recommended than tooth-supported overdenture retained by bar attachment with PEEK clip.

KEYWORDS: overdenture, bar attachment, clips, abutments mandible, pocket depth

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INTRODUCTION

Tooth-supported Overdentures offer many advantages over conventional complete as conventional complete dentures show many disadvantages related to retention, support and stability. One of the most important functions of tooth-supported overdenture is the preservation of the remaining alveolar supporting bone as it increased the stability and retention of the denture [1,2]. Retaining natural teeth also preserve sensory input from the periodontal receptors which are more precise than that obtained from oral mucosa[3]. Periodontal receptors also play important role in the masticatory-salivary reflex by regulating the range and type of the masticatory stroke. Thus, overdentures are more beneficial as they provide functional, psychological, as well as biological advantages for the patient. [4,5]

Dental attachment is a mechanical device for the fixture retention and stabilization of dental prostheses. It consists of the matrix (female component) which is usually attached or cemented within the normal or expanded contours of the abutment tooth crown and the Matrix (male component) which is attached to the denture framework. [6]Among the different types of attachments used are, stud, bar and magnetic attachments which are the most commonly used**.** Furthermore, other attachment systems are used as the telescopic retainer. [7,8]

One of the most important functions of bar and clip attachments is the retention and stability of the denture which is important to make the patient feel comfortable and improve the level of satisfaction of denture-wearing patients.[9] Bar attachments not only improve retention and stability but it also distributes forces on the abutments and the supporting structure by splinting the abutments together, the retention, stability and patient comfort is provided by guide the denture into place, also this bar attachment improves the chewing efficiency by decreasing the forward sliding of the lower denture and improve patient satisfaction by maintaining the proper occlusion and minimizing the trauma of the underlying supporting tissues[9,10]

The availability of enough vertical and buccolingual space is an important factor to used bar attachment as it is important for proper placement of the bar, sleeves, teeth arrangement and providing enough acrylic denture base thickness in an attempt to minimize the incidence of denture fracture in the area of bar attachment .[11]

Two basic types of bar attachments depended on the shape and the performed action, Bar joints type (Resilient type) which allowed resilient movements between male and female parts of the attachment while the Bar units type (Rigid type) allowing no movement between male and female parts of the attachment [12,13].

Bar attachments can be used as a retainer for tooth. The bar is available as prefabricated plastic patterns that are adapted on the master cast and then cast in the alloy of choice then the bar is attached to the tooth abutment through clips, cement or a combination of both. [14,15, 16]

Different types of clip materials may be used for the bar attachment and the most common type is The plastic clip which can be easily replaced on the chairside when its retention has decreased [16] Polyetheretherketone (PEEK)became an important high-performance thermoplastic candidate for replacing plastic clip housing. [17,18] (PEEK) is a semicrystalline linear polycyclic aromatic thermoplastic. In 1978 a group of English scientists in 1978 was first developed these materials and then In the 1980s, PEEK was used for industrial applications, such as aircraft and turbine blades By the late 1990s excellent strength properties were discovered by the PEEK, it is insoluble in common solvents, and has a high resistance to wear and irradiation. Besides, PEEK exhibits good biocompatibility in vitro and in vivo, causing neither toxic mutagenic effects nor significant inflammation which may appear clinically .[19,20,21,].

The purpose of this study was to evaluate the effect of PEEK clip and plastic clip of bar attachment on the pocket depth of the abutment at six months and twelve months

The hypothesis for this study was null i.e. that there will be no influence of different clips materials on the pocket depth around the abutment over time and there will be no difference between both treatment modalities

MATERIALS AND METHODS

Patient evaluation and examination:

Fourteen male edentulous patients for standardization of the factors that may affect the bone loss with the remaining two lower canines were selected from the outpatient clinic of Removable Prosthodontic Department, Faculty of Oral and Dental Surgery, Misr University for Science and Technology. All patients were free from any debilitating diseases that may affect the treatment and to avoid the possible effect of age-related changes on the mucosa, residual ridge and bone around the abutment all patient's ages ranged between 50- 55 years. All patients were chosen to be free from TMJ problems as well as had normal maxilla -mandibular relationship (Angle class I) with enough inter arch which is one of the most important factors in our studies. the opposing occlusion was selected to be a mucosa-supported complete denture for all patients as the type of opposing occlusion is a critical factor that influences the magnitude of forces transmitted to the abutments this occlusion was chosen to standardize and control the amount of the occlusal force applied to the abutments.

Examination of the abutments:

The periodontal condition of the abutment was evaluated using periapical radiographs and measuring pocket depth using periodontal prob. Before starting the treatment any Inflammation, pocket formation, and poor zone of attached gingiva affecting the abutments were all eliminated. Mandatory scaling was done the or removal of plaque.

Abutment preparation:

All patients were subjected to an endodontic treatment of the remaining canines. After endodontic therapy is completed enough reduction of the abutments will be prepared 1 to 2 mm above gingiva to dome shape then the remaining dentin is smoothed and polished leaving the surface smooth to decrease plaque accumulation that may be attached to the rough surfaces. **(Figure 1)**

Fig. (1) Dome shape abutment preparation

Tooth supported overdenture retained by bar attachment construction

All patients were rehabilitated by lower overdenture retained with bar. The primary impression with alginate (Cavex Holland BV) was taken in properly selected stock and then the Study cast was poured. A preliminary maxillomandibular relation record was taken to mount the casts on the articulator in attempt to determine ridge relationship, interridge distance, ridge shape and form that couldn't be determined during the clinical examination.

A special tray was constructed on the study cast and a Secondary impression was taken using alginate materials then a die stone (Type IV die

stone, Ultrarock, Kalabhai Karson Pvt. Ltd., Mumbai, India) was used to pour the secondary impression the then the wax pattern was built on the abutments with placing the plastic bar between the two abutments and then the wax pattern was sprued and cast into metal. Try-in of the metallic bar with copings was made to ensure accurate fitting and passive placement then cementation of the casting to the abutments was done by Resin reinforced glass ionomer cement (Pattern resin, GC Corp, Tokyo, Japan).**(Figure 2)**

Fig. (2) : Metallic bar with coping

And when the metallic bar with coping was cemented on the abutments another secondary impression was taken using rubber base materials (Aquasil™ Ultra Monophase. DECA, Regular Set-Dentsply, Germany) medium rubber base on the borders and light rubber base on the fitting surface.

Jaw relation record registration was made, then a try-in stage was done to check the correct vertical dimensions and centric relation.

The fourteen patients were randomly allocated and categorized into two equal groups each of them including seven patients. Allocation followed a sequence of random numbers contained in sealed, opaque envelopes, which were prepared by a researcher without contact with other trial procedures. Numbers were generated by Microsoft Excel software (Microsoft Excel 2003; Microsoft Corporation) following a 1:1 ratio according to a simple randomization scheme.

The first group (Group I: The Control group) received mandibular overdenture retained with bar attachment with a plastic clip and The second group (Group II: The Test group) received mandibular overdentures retained with bar attachment with a PEEK clip**. (Fig 3)**

The finished denture had been delivered with the needed occlusal adjustments and all patients were recalled monthly for follow up to check the denture and for oral hygiene needed and the pocket depth was evaluated clinically at baseline (during the healing period), 6 months and 12 months later.

Fig. 3 (A: plastic clip in Group I), (B: PEEK clip in Group II)

Pocket depth evaluation

By using a graduated periodontal probe called a pressure-sensitive probe (Hawa Click-Prob, Kerr, Switzerland) the periodontal pocket depth was measured by applying constant pressure during all measurements and the pocket depth was measured in six sites (the mid-buccal, mid-lingual, mesiobuccal, mesiolingual, distobuccal and diso-lingual sites) around each abutment in both groups. The periodontal probe was inserted parallel to the long axis at the measured abutment tooth at each of the six sites and this insertion was done inside the gingival crevice.

RESULTS

Statistical methods

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data were summarized using mean and standard deviation. Comparisons between groups were done using an unpaired t-test. Comparison over time within the same group was done using paired t-test. P-values less than 0.05 were considered statistically significant.[22]

1. Effect of PEEK clip and plastic clip of bar attachment on the pocket depth around the abutments at the first interval period (0-6 months)

The calculated mean of pocket depth around the abutment retained by PEEK clip of bar attachment was found (1.32) while The calculated mean of pocket depth around the abutments retained by a plastic clip of bar attachment was found (3.70) at the first interval loading (0-6 months), a significant differences between (The PEEK clip) and the (plastic clip) at the first interval period were (p<0.001) as shown in Table (1) and Figure (4).

TABLE (1) The mean, standard deviation (SD) values of pocket depth of different groups after 6 months

	Pocket depth after 6 months		P value
	Mean	Standard Deviation	
PEEK clip materials	1.32	0.22	< 0.001
plastic clip materials	3.70	0.25	

significant (p<0.05) ns; non-significant (p>0.05)

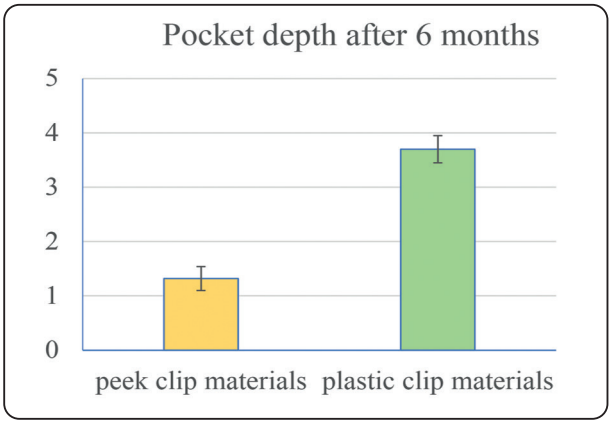

Fig (4) Bar chart representing pocket depth for different groups after 6 months

2. Effect of PEEK clip and plastic clip of bar attachment on the pocket depth around abutment at the first interval period (6-12 months)

The calculated mean of pocket depth around the abutments retained by a PEEK clip of bar attachment was found (2.11) while The calculated mean of pocket depth around the abutment retained by a plastic clip of bar attachment was found (4.48) at the second interval loading (6-12 months), a significant differences between (The PEEK clip) and the (plastic clip) at the second interval period where (p<0.001) as shown in Table (2) and figure (5)

TABLE (2) The mean, standard deviation (SD) values of pocket depth of different groups after 12 months

	Pocket depth after 12 months		P value
	Mean	Standard Deviation	
PEEK clip materials	2.11	0.28	< 0.001
plastic clip materials	4.48	0.37	

significant (p<0.05) ns; non-significant (p>0.05)

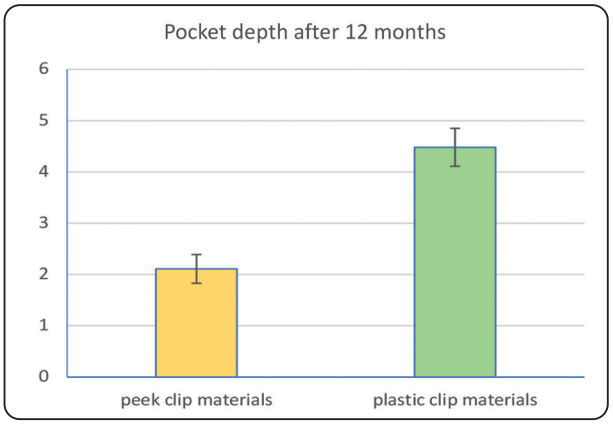

Fig (5) :Bar chart representing pocket depth for different groups after 12 months

3. Effect of PEEK clip of bar attachment on the pocket depth around the abutment after 6 and 12 months respectively.

The calculated mean of pocket depth around the abutment retained by a PEEK clip of bar attachment at the first interval loading (0-6 months) the was found (1.32) while The calculated mean of pocket depth around the abutment retained by a PEEK clip of bar attachment was found (2.11) at the first interval loading (0-6 months), a significant differences between both evaluation follow up periods (6 months and 12 months) where (p<0.001) within the same group as shown in Table (3) and figure (6)

TABLE (3) The mean, standard deviation (SD) values of pocket depth within same group (PEEK clip materials) after 6 months and 12 months

	PEEK clip materials		P value
	Mean	Standard Deviation	
Pocket depth after 6 months	1.32	0.22	< 0.001
Pocket depth after 12 months	2.11	0.28	

significant (p<0.05) ns; non-significant (p>0.05)

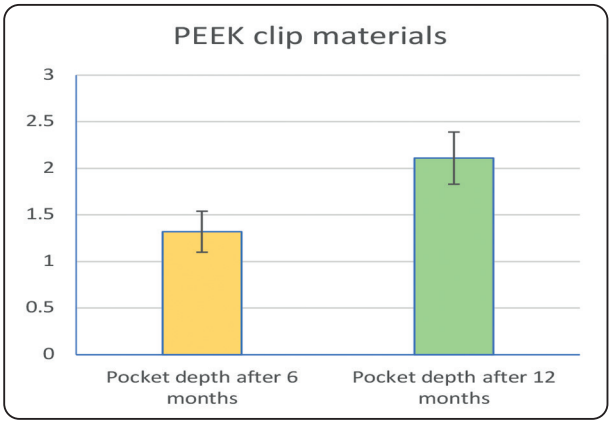

Fig. (6) : Bar chart representing pocket within same groups (PEEK clips materials) after 6 and 12 months

4. Effect of plastic clip of bar attachment on the pocket depth around the abutments after 6 and 12 months respectively.

The calculated mean of pocket depth around the abutment retained by a plastic clip of bar attachment at the first interval of loading (0-6 months) the was found (3.70) while The calculated mean of pocket depth around the implants retained by a plastic clip of bar attachment was found (4.48) at the first interval loading (0-6 months), a significant differences between both evaluation follow up periods (6 months and 12 months) where (p<0.001) within the same group as shown in table (4) and figure (7)

TABLE (4) The mean, standard deviation (SD) values of pocket depth within same group (Plastic clip materials) after 6 months and 12 months

	Plastic clip materials		P value
	Mean	Standard Deviation	
Pocket depth after 6 months	3.70	0.25	< 0.001
Pocket depth after 12 months	4.48	0.37	

significant (p<0.05) ns; non-significant (p>0.05)

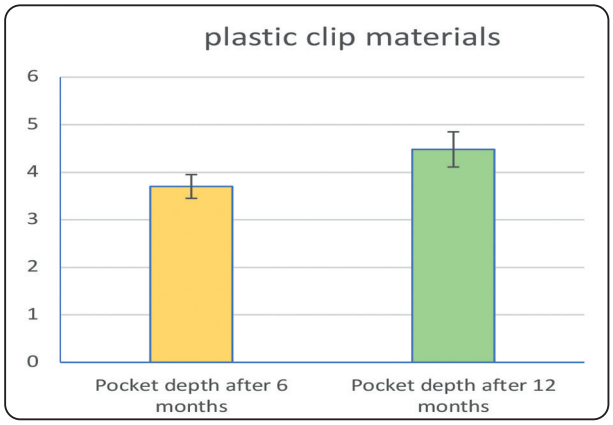

Fig. (7): Bar chart representing pocket within same groups (Plastic clips materials) after 6 and 12 months

DISCUSSION

When values were collected after six and twelve months intervals the results of the current study shows a significant increase in bone loss around the abutments in the control group when compared with the test group which show less bone loss around the abutment Hence these results rejected the null hypothesis that there will be no influence of different clips materials on the pocket depth around the abutment by time and there will be no difference between both treatment modalities.

The results of this study showed that after six months the mean pocket depth around the abutments in the control group was 3.70 and then slightly increased to 4.48 after twelve months. On the other hand, the mean of the pocket depth around the abutment in the test group was 1.32 after six months and then increased slightly to be 2.11 after twelve months. The significant difference in bone resorption between the two groups may be attributed to PEEK materials showing favorable stress distribution in all aspects around the abutments teeth. [23,24,25]

Outcome coincides with the research about the favorable PEEK materials as the biological properties and mechanical properties of the PEEK materials and its flexure and low modulus of elasticity make it more flexible thus enhancing more flexion behavior which is the main cause of its favorable distribution of stress[26,27,28].

In another systematic review, the author agrees with our observation that PEEK materials cause favorable stress distribution as when used as a precision attachment it shows decreases strain on the natural abutment and thus decreases bone loss around the abutment [29] some studies mentioned one of the important properties of PEEK which agree with our study results that the PEEK materials are more rigid than the plastic materials and some author found that when the rigidity increased and even load distribution will occur [30,31]

There was also a statistically significant difference between 6 months and 12 months within the same group for both different groups. Increasing in bone loss around the abutment after 12 months is less than increasing bone loss after 6 within the same group and this is due to bone remolding which occurs within the first six months[32,33,34] and the increase in pocket depth at twelve months is due to undesirable occlusion forces subjected to the prosthesis[35]

Bar attachment is preferred over other types of attachment as it causes stress distribution between the abutments but it still causes bone resorption so

The general increase of bone loss around the abutments in both groups after 6 and 12 months is due to the fact that the attachment is excrete load on the abutment and causes torque on the abutment [36]

CONCLUSIONS

Within the limitations of this study: Tooth-supported overdenture retained by bar attachment with plastic clip is less recommended over tooth supported overdenture retained by bar attachment with PEEK clip as a PEEK clip preserve abutment and decreases strain on it more than a plastic clip

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