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THE EFFECT OF FRAMEWORK MATERIAL ON PARTIAL OVERDENTURE SUPPORTING STRUCTURES

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ABSTRACT

Purpose: In this study the effect of two partial denture framework materials on the bone tissues surrounding a the implants, in an implant retained partial overdenture is compared.

Materials and Mehods: 12 partially edentulous patients with mandibular kennedy class I configuration were selected for this study. They were divided into two groups; Group 1 received a mandibular implant retained partial overdentures with a framework made of cobalt chromium. Group 2 received implant retained partial overdentures with a framework made of acetal resin. The results were evaluated using cone beam ct.

Results: The results showed that bone changes produced in metallic framework partial overdentures were greater than the changes produced in acetal resin framework partial overdentures.

Conclusion: Acetal resin partial denture framework produced less bone changes in the supporting structures than metallic framework partial dentures.

INTRODUCTION

In recent years the demand for aesthetics has led to the use of new materials, like acetal resin, as removable partial denture frameworks, instead of the traditional metallic cobalt chromium alloys This has allowed the manufacture of tooth-colored retentive clasps and frameworks, thus improving denture aesthetics, particularly that acetal is available in sixteen shades of vita shade guide. [1-3]

The use of chromium-containing base metal alloys as partial denture framework materials is due to their high strength, corrosion resistance, high modulus of elasticity, low density, and low cost, yet their appearance has long been recognized as an obstacle to patient appearance. [4]

Acetal resin, also known as polyoxymethylene (POM), is a thermoplastic material, and has a lower modulus of elasticity than both polymethylmethacrylate (PMMA) denture base materials, and cobalt chromium alloys used for partial denture frameworks. [5,6]

Acetal resin is now being studied as an implant-retained partial overdenture framework. Implant-retained partial overdentures are becoming a trend

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now, because they solve the problem of retention, particularly in free-end saddle cases, where a distal implant would greatly improve the retention as well as the stability of the partial denture. [7]

A variety of attachment systems have been successfully used to retain partial overdentures to implants including ball and socket, bar attachments, magnets and telescopes. [8][9]

Owing to the limited space requirements within prostheses, ease of cleaning, affordability, and lower technique sensitivity, unsplinted attachments are preferred by many practitioners as the retentive unit of implant-retained overdentures.[10][11][12]

One of the most crucial elements in the success of an implant appears to be the amount of stress to the implant, and thus many researchers have focused on understanding the effect of various conditions on the implant. Therefore, this study was conducted to examine the effect of different partial denture framework materials, namely acetal resin and cobalt chromium alloy, on the implants in an attachment retained partial overdenture.

MATERIALS AND METHODS

12 partially edentulous patients who attended the Department of Removable Prosthodontics, Faculty of Dentistry, The British University in Egypt, were enrolled for this study and signed an informed consent. Patients' age ranged from 45 to 60 years. Exclusion criteria included patients with systemic diseases affecting bone quality or resorption [13], temporomandibular joint dysfunction; severe attrition or parafunctional habits.[14] Each patient had a kennedy class I configuration, and has been partially edentulous for one to three years. Single bilateral implants (NeoBiotech) were placed in the edentulous first molar area of the distal extension ridges using a standardized two-stage submerged surgical protocol. (figure1)

Fig. (1)

Four months after implant insertion special trays were constructed on the study cast and final impressions were recorded for the arches using medium- and light-bodied polyether material (Impregum F and Permadyne LV, 3M ESPE)

The partial overdenture design constructed for all patients consisted of lingual plate major connector, premolar abutments with RPI clasps (Mesial Occlusal Rest, Proximal Plate and I bar retentive arm).

The patients were then divided randomly into two groups according to the overdenture framework material; **Group I** consisted of 6 patients who received implant-retained partial overdentures with frameworks made of conventional cobalt chromium alloys. **Group II** consisted of 6 patients who received implant-retained partial overdentures with frameworks made of acetal resin.

Ball attachments (NeoBiotech) were screwed onto the implants (figure 2), and white spacer rings were placed over the head of the ball to blockout the area under the attachment and housing and prevent the flow of acrylic resin into the areas with undercuts. The housings were then snapped on over the ball abutments,and the fitting surfaces of the partial dentures were relieved to provide a space for accommodating the protruding attachments. The housings were picked up to the fitting surface of the partial dentures using autopolymerized acrylic resin in a chairside direct pick up technique.(figure3)

Fig. (2)

Fig. (3)

Radiographic evaluation

Patients were recalled at 6 and 12 months for follow up using cone beam CT to evaluate bone level around the implants. To standardize data collection, the bone level was measured around each implant from the buccal, lingual, mesial and distal aspects, then an average of these readings was taken. This was repeated at the time of implant insertion, after 6 months and after 12 months.

RESULTS

Mean ± Standard Deviation (SD) and P value for the comparison of bone changes (mm) within acetal and vitallium frameworks at different time intervals.

	Acetal	Vitallium	P-value
	Mean ± SD		
Baseline – 6 months	0.45 ± 0.09[b]	0.60 ± 0.12[b]	0.006*
6 months – 12 months	0.38 ± 0.15[b]	0.31 ± 0.13[c]	0.220NS
Baseline - 12 months	0.84 ± 0.11[a]	0.91 ± 0.11[a]	0.175NS
P-value	0.000*	0.000*	

: significant at P ≤ 0.05; NS: non-significant at P>0.05

Means with different superscript letters within the same column are statistically significantly different at P ≤ 0.05

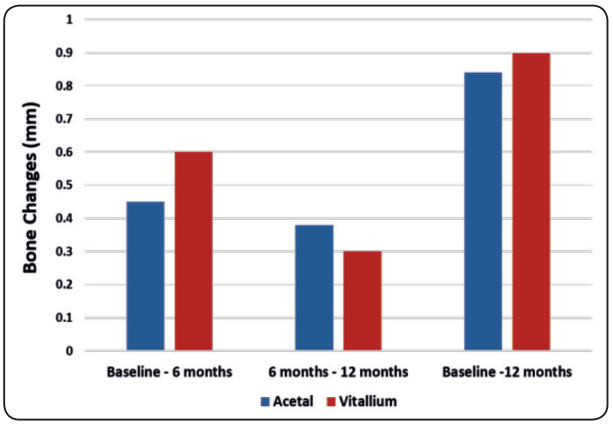

Fig. (4)

The results show that the bone loss occurring in Group I patients, who received vitallium partial dentures was greater than in Group II receiving acetal partial dentures, particularly in the first 6 months.

DISCUSSION

In this study, all patients with systemic diseases affecting the bone, temporomandibular joint dysfunction or parafunctional habits have been excluded to avoid the effects these variations may cause to the crestal bone loss surrounding the implants.

An ideal removable partial denture is designed to transfer the forces falling on it to the underlying abutments and tissues in an atraumatic fashion.

The results of this study showed that the bone loss that occurred in Group I patients, who received metallic framework partial dentures, was greater than the bone loss that occurred in Group II patients, who received acetal resin partial dentures. This could be attributed to the fact that the cobalt chromium alloy has a higher modulus of elasticity than acetal resin, thereby resulting in a higher pressure being transmitted to the underlying implant with attachment, causing greater bone changes in the areas surrounding the implant. This is in accordance with recent studies, which stated that the modulus of elasticity and nanohardness of a material are factors that directly affect the amount of pressure transmitted by the material and the extent of the area to which it is transmitted . [15]

It was also stated that materials with a low modulus of elasticity may flex and absorb impact energy from impact force, acting as a shock absorbent and resulting in decreased stress transmission to the underlying tissues, translated as a relative decrease in the amount of bone loss surrounding the abutment. [15]

In contrast, other studies stated that a material with a higher modulus of elasticity results in even transmission of pressure and wider area of transmission resulting in less stress concentration on specific underlying areas, and thereby lower levels of ridge resorption. [16]

Furthermore, it was stated that a properly designed major connector ought to be rigid to perform its functions properly, which include distribution of forces throughout the arch and reducing the load to any one area while effectively controlling prosthesis movement. A flexible major connector can manifest itself as damage to the periodontal support of abutment teeth, injury to residual ridges and impingement of underlying tissues, resulting in greater bone loss. [17]

CONCLUSION

This study investigated the influence of two different partial denture framework materials on the supporting structures of implant-retained partial overdenture. Within the limitations of this study, acetal resin framework material produced less bone changes around partial overdenture supporting structures than the metallic framework.

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