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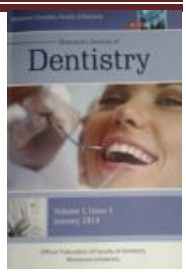
Thermoplastic Distal Extension Removable Partial Dentures *versus* Vitallium ones - Radiographic Evaluation



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Abstract:
Objectives: The thermoplastic material partial denture is more comfortable and seems to be highly aesthetic as it has the same color as the abutment. The flexible framework removable partial dentures can replace any number of teeth in a dental arch, similar to the cast metal removable partial dentures. The aim of this study was to evaluate radiographically the effect of distal extension removable partial denture either constructed from thermoplastics or vitallium materials on bone height change of abutment teeth.
Methods: Total number of ten healthy patients was selected and grouped into two groups. Group I received mandibular bilateral distal extension partial dentures constructed from vitallium and group II received mandibular bilateral distal extension removable partial dentures constructed from thermoplastic material. For every patient constructed conventional maxillary complete denture then radiographic evaluation was done at insertion of dentures and after six months from insertion.
Results: For both groups, there was no significant difference in bone loss between mesial and distal aspects. There was a statistically significant difference in bone loss between group I (Metallic RPD) and group II (Thermoplastic RPD) for mesial and distal aspects of the abutment. Group I (Metallic RPD) recorded a significant higher bone loss at mesial and distal aspects of the abutment teeth than group II (Thermoplastic RPD).
Conclusions: Thermoplastic mandibular distal extension removable partial denture material was superior to vitallium material regarding the preservation of abutment alveolar bone.

Keywords: *Distal extension removable partial dentures, vitallium, radiographic evaluation.*

Introduction

Removable dentures remain an essential prosthetic consideration inmany conditions of oral rehabilitation, especially when the edentulous spaces posterior to the anterior remaining teeth are to be restored [1]. Yet studies of removable partial dentures suggest that insertion of a partial denture constitutes a risk factor for periodontal health and supporting alveolar bone of the remaining teeth [2].

The disadvantage of a conventional metallic removable partial denture is that the rigid clasps damage the natural dentition as it engages the undercuts in addition to are not aesthetically pleasing. However, the main limitation of these metallic materials is the release of the toxic metallic ions that can lead to various adverse tissue reactions and/or hypersensitivity reactions [3-5].

Usage of thermoplastic resins in medicine has significantly grown in the last decade. The technology is based on plasticizing the material using only thermal processing in the absence of any chemical reaction. Thermoplastic resins could be used in dentistry to produce preformed clasps, metal-free removable dentures, occlusal splints, implant abutments etc. Most probably, further chemical development of elastomeric and polymeric materials will enlarge the domain of clinical applications of thermoplastics in dentistry [6].

Thermoplastics resins have fracture strength, wear resistance and flexibility. These characteristics make them usable for preformed clasps, partial denture frameworks, and artificial teeth for removable dentures [7].

The flexible framework removable partial dentures can replace any number of teeth in a dental arch, similar to the cast metal removable partial dentures. There is, however, one type of removable tooth replacement device that can (legally) be built only out of the flexible framework variety of material [8]. The aim of the work to evaluate radiographically bone height changes of the abutment in mandibular bilateral distal extension removable partial denture either constructed from vitallium or thermoplastic materials.

Patients and methods

Ten patients were selected from the prosthetic department, Faculty of Dentistry ،Mansoura University. They were from 45-60 years old with no systemic diseases relating to bone resorption, had maxillary complete edentulous arch against bilateral mandibular distal extension ridge .The remaining teeth extending from first premolar to first premolar, they were periodontally healthy with no mobility.

Procedures of denture construction

For all patients' periodontal therapy in terms of oral scaling; Upper and lower primary impressions were made with irreversible hydrocolloid impression material to produce diagnostic casts .Maxillary secondary impression was made by Zinc oxide eugenol (ZOE) impression. The mandibular diagnostic casts were surveyed and design of distal extension removable partial denture was designed as follow:-

I bar clasp assemblies were used on mandibular first premolars

- The reciprocation was provided by vertical minor connectors on the lingual surface of the abutments

connected with mesio-occlusal rest located on mandibular first premolars.

- Major connector in form of lingual bar was used, which extended from right to left mandibular first premolars teeth placed in attached mucosa at least 3 mm away from the gingival margins.
- Denture base connectors are designed to provide strength and avoid interference with placement of prosthetic teeth. Distal cingulum rests was act as indirect retainer in mandibular canine

Patient grouping

According to the type of the mandibular major connector used the patients were divided into two groups. Group I where RPD constructed from vitallium material. Group II where RPD constructed from thermoplastic material.

Abutment teeth were prepared for both groups as follows

Proximal guiding planes of 1.5 mm occluso-gingival height on mandibular first premolars.b). Mid buccal retentive undercuts of 0.01 inch were used in mandibular first premolars.c). Mesial saucer shaped occlusal rests were prepared in mandibular first premolars

Mandibular final impression

Impression was made for both groups to make the master cast. For all patients after construction of mandibular metallic RPD and thermoplastic RPD framework they were tried in the patient mouth [9].

Construction of thermoplastic framework carried out with the apparatus called Thermopress 400 injecting unit. Before the injection procedures make sure the injecting pressure was according to procedure demands (5 bars). Preheating temperature and time are also checked (20 minutes at 220°C). The corresponding cartridge of injecting material (quantity and color) was selected. The cartridge was introduced into one of the two heating cylinders after a vaseline base lubricant has been applied at its closed end. The cartridge membrane is pointed to the flask chamber. The excess of silicone vaseline lubricant on the margin of the heating cylinder is wiped out using a highly absorbent paper preheating

Jaw relation was registered and the denture base was processed with heat cured acrylic resin for group I and maxillary denture of group II and self-cure acrylic resin were used for processing of mandibular denture of group II .Intra oral adjustment of occlusion was done before denture insertion using articulating paper and selective grinding when indicated and then the dentures were inserted (Fig 1, 2)

Evaluation abutment interdental alveolar bone height

periapical X–ray film of the abutment teeth was taken immediately before and after 6 months of denture insertion according to standardization of the periapical radiograph and was performed as follows Corel draw 8 computer program was used to estimate abutment alveolar bone height changes [10].

Results

Non-parametric statistical methods were used .Mean and, standard deviation were used to describe data by Shapiro Wilk test (p>.05)These tests were run on an IBM compatible personal computer using the Statistical Package for Social scientists [SPSS] for windowsver.13 { SPSS Inc., Chicago, IL, USA}. Comparing the means of abutments alveolar bone resorption for group I and group II revealed that:-

- For both groups, there was no statistically significant difference in bone loss between mesial and distal aspects.
- There was a statistically significant difference in bone loss between group I (Metallic RPD) and group II (Thermoplastic RPD) for mesial and distal aspects of the abutment. Group I (Metallic RPD) recorded a significant higher bone loss at mesial and distal aspects of the abutment teeth than group II (Thermoplastic RPD).

Discussion

The ideal removable partial denture design principle is to transfer forces that are applied to removable partial dentures to the supporting teeth and tissue in atraumatic fashion [11].

Distal extension partial dentures are subjected to great stresses because their support is a combination of tooth and soft tissues and are subjected to rotations. Therefore, during the formulation of a design for a distal extension partial denture, all the possible movements that may take place must be kept in mind and all the components of the dentures may then be positioned to counteract or prevent as much of the rotation as possible [12].

A major concern with the use of a distal extension removable partial denture is the control of excessive torquing forces so, abutment distal wall evaluation is of concern to study the effect of partial dentures on abutment teeth [13].

Acetal resin is a biocompatible material so can use with patient allergic to Co-Cr alloys and have good physical properties make it suitable for construction of removable partial dentures components this based on the concept that because of the biocompatibility of acetal resin, it was considered as an removable partial dentures framework material for patients with allergic reactions to Co-Cr alloys. It is reported to have a sufficiently high resilience and modulus of elasticity to allow its use in the manufacture of retentive clasps, connectors, and support elements for removable partial dentures [14].

Also, acetal resin has a sufficiently high resilience and modulus of elasticity to allow its use in the manufacture of retentive clasps. Acetal resin is also strong, resists fracturing, and is flexible so, does not wear during occlusal forces and consequently will maintain vertical dimension over long periods of time.

From the results of this study in spite of presence of alveolar bone resorption in the distal side of the principle abutments were higher than the mesial sides in both groups, there was no a statistically significant difference in bone loss between mesial and distal aspects. Alveolar bone resorption occurs due to torquing force affect distal abutments. Distal extension removable partial denture the excessive torquing forces that may act on the abutments distally towards the edentulous area by time lead to distal wall resorption and tooth movement [11].

There was a statistically significant difference in alveolar bone loss around the abutment teeth between group I (Metallic RPD) and group II (Thermoplastic RPD). Group I (Metallic RPD) recorded a significant higher bone loss at mesial and distal aspects of the abutment teeth than group II (Thermoplastic RPD). This result may be due to the

resiliency of thermoplastic clasp assembly which led to reduction of the load exerted on the abutment.

This result were similar to the previous studies [12,13], when compared between cobalt chromium and acetal resin clasps, stated that a reduction of bone density of the acetal resin group was fewer than the metallic group due to reduced load distribution over abutment teeth , acetal resin clasp flexibility transmit less stress to the abutment compared to metal clasp and The force required to remove acetal clasp was significantly lower than that with chrom-cobalt clasp.

The retentive force for an acetal resin clasp may not be sufficient for removable partial dentures retention due to the significantly low retentive force required for removal due to its low modulus of elasticity. But they suggested that acetal resin clasps may be suitable for removable partial dentures where aesthetics or periodontal health is a primary concern.

Of course there were pervious suggestions by many others to use a thermoplastic resin for construction of removable partial dentures frame work [7, 8]. The flexible framework removable partial dentures can replace any number of teeth in a dental arch, similar to the cast metal removable partial dentures. There is, however, one type of removable tooth replacement device that can (legally) be built only out of the flexible framework.

Thakral et al. [14] in agree with our results stated that the stress distribution of the flexible partial dentures is accomplished by flexibility in the major connector behaving as a stress breaker. The tissue- supported saddles float on the edentulous ridge independently, without placing a stress load on the abutment teeth.

Also Phoenix et al. [10] added that acetal resin provides a higher standard of function by using the flexibility of the material to balance masticatory forces over the entire supporting ridge instead of individual support points As a result, the balanced distribution of forces can often lead to longer lasting appliances that may not require frequent relines.

Conclusion

Thermoplastic mandibular distal extension removable partial denture material was superior to vitallium material regards to preservation of abutment alveolar bone.

This research recommends

The comparison between the effect of bilateral distal extension removable partial dentures constructed from either the thermoplastic or the vitallium material on the alveolar bon ridges needs a further investigation

Figure 1: Upper complete denture against lower metallic distal extension RPD in the patient's mouth.

Figure 2: Upper complete denture against lower thermoplastic distal extension RPD in the patient's mouth.

Table 1: Comparison of bone level values at time of RPD insertion (T0), bone level values 6 months after RPD insertion (T6) and the difference (which represent the bone loss in mm) between group I (Metallic RPD) and group II (Thermoplastic RPD) for mesial aspect of the abutment.

	Bone level values at time of RPD insertion (T0)	Bone level values 6 months after RPD insertion (T6)	The difference (which represent the bone loss in mm)
group I (Metallic RPD) X±SD	2.11000±.460300	2.37500±.452073	-.26500±.043886
group II (Thermoplastic RPD) X±SD	2.28680±.321056	2.44360±.309231	-.15680±.040996
Independent samples t- test (P value)	.50 (NS)	.78 (NS)	.004*

X: mean; SD: standard deviation, * p is significant at 5% level of significance, NS; p is not significant at 5% level of significance.

Table 2: Comparison of bone level values at time of RPD insertion (T0), bone level values 6 months after RPD insertion (T6) and the difference (which represent the bone loss in mm) between group I (Metallic RPD) and group II (Thermoplastic RPD) for distal aspect of the abutment.

	Bone level values at time of RPD insertion (T0)	Bone level values 6 months after RPD insertion (T6)	The difference (which represent the bone loss in mm)
group I (Metallic RPD) X±SD	2.43380±.353109	2.75780±.344341	-.32400±.044164
group II (Thermoplastic RPD) X±SD	2.53200±.401346	2.73800±.418581	-.20600±.021806
Independent samples t- test (P value)	.69 (NS)	.93(NS)	.001*

X: mean; SD: standard deviation, * p is significant at 5% level of significance, NS; p is not significant at 5% level of significance.

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