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Effect of lingual bracing arm incorporated with extracoronal attachment for mandibular distal extension base on abutment alveolar bone height change

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Abstract:

Purpose: To evaluate the effect of extracoronal attachment retainer unit with and without incorporation of lingual bracing arm on vertical alveolar bone height changes of abutment teeth in mandibular distal extension removable partial dentures. Materials and Methods: Eight patients were chosen for this study with maxillary completely edentulous arch opposed to mandibular distal extension ridges posterior to second premolar teeth. The patients were randomly and equally divided into two groups; (group I) received extracoronal attachment removable partial dentures with lingual bracing arm incorporated in the retainer unit and (group II) received extracoronal attachment removable partial dentures without lingual bracing arm. For each group, the abutment vertical alveolar bone height changes were evaluated radiographically at time, after 6 and after 12 months of RPD insertion.

Results:

No significant difference was noticed when comparing group I&II regarding crestal alveolar bone resorption along interval periods of the study.

Conclusion: lingual stabilizing arm is not obligatory for augmentation of bracing in extracoronal attachment distal extension RPD when abutment teeth have available occlusoginigival height.

Keywords: Extracoronal attachment removable partial denture, lingual bracing arm, distal extension bases

Introduction

Prosthetic rehabilitation of mostly edentulous patients incorporate fixed dental prosthesis or a removable dental prosthesis. The fixed treatment alternatives include dental implants, however because of economic factors, unavailability of bone or long treatment procedures, not all patients, can profit from dental implants. Removable treatment options could be either metallic RPD as a long term treatment modality or resin based RPD as an interim treatment option.(1)

Admittedly, attachment retained removable partial dentures (RPDs) represent one of the advanced solution to RPD prosthodontics regarding functional and esthetic qualities. The typical indication for precision attachment is in patients with bounded or free end saddle for whom high esthetic demands must be provided. In the majority of cases semiprecision attachments are utilized.(2)

Notably, the design of RPDs restoring distal extension base however, deemed to be problematic because of the quite difference between the periodontal support tissues of abutment teeth and residual ridge mucosa. As a result, rotary movement occurs around the fulcrum of the terminal abutments when functional occlusal load is applied on this kind of distal extension RPD. This phenomenon lowers the denture function, causes patient's discomfort and traumatizes the supporting tissues of the dentures.(3)

Attachment retained RPD constructed utilizing the altered cast impression technique helps to create an environment in which the abutments and the edentulous ridge support the base as harmoniously as possible. The result is a possibly more stable prosthesis that enhances the support for the occlusal relationship of the opposing dentition and the RPD restoration.(4)

Nevertheless, attachments can encourage stress concentration with Kennedy class I or II RPDs. There are several methods of controlling stress that include; stress breaking, splinted abutments, broad denture base coverage, occlusal harmony, loading techniques, dual impression procedure, lingual bracing arm in conjunction with attachment retainer unit. (5)

Through reviewing the available literatures, a few handful studies are published concerning the influence of bracing arms in conjunction with extracoronal retainers. Hence, this study was performed to judge the effect of lingual bracing arm incorporation to the extracoronal attachment retainer unit abutment crestal alveolar bone in mandibular distal extension RPDs.

Materials and methods:

Eight patients with age ranged from 45-55 years were chosen from outpatient clinic, Removable prosthodontic department, Faculty of dentistry, Mansoura University. **They had the following criteria:** They had Angle's class I maxillomandibular relationship, they had maxillary completely edentulous arches opposed by mandibular bilateral distal extension ridges posterior to second premolars **Fig. (1.a)**, abutments had a periodontal healthy condition verified by probing depth test. Also, the crown root ratio was not more than 1:1 as evaluated by periapical radiograph, the distance between the gingival margin of the remaining natural teeth and functional depth of the floor of the mouth was at least 8mm with no soft tissue undercut and the abutment premolars had adequate occlusoginigival height more than 4mm.

For each patient the following steps were carried out: panoramic radiographs were made. Periodontal therapy in terms of thorough oral scaling /pocket eradication and hygiene procedures. Upper and lower irreversible hydrocolloid impressions were recorded to obtain diagnostic casts. Lower diagnostic cast was surveyed and the partial denture was designed as follow; lingual bar extended from right to left mandibular second premolars to connect bilateral distal extension bases, extracoronal attachment and temporary indirect retainers.

The patients were randomly and equally classified into two groups according to the presence of bracing arm into: *Group I:* Patients received extracoronal attachment removable partial dentures with lingual bracing arms. *Group II:* Patients received extracoronal attachment removable partial dentures without lingual bracing arms were incorporated in the retainer unit. Construction of splinted crowns was performed to include the first and second premolars as follow: 1- Full crowns were prepared for the first and second premolars **Fig. (1.b).** 2- Auto polymerized acrylic resin special tray was constructed on the mandibular diagnostic cast. Rubber base impression was made and poured in dental stone.3- After waxing-up the crowns, the patrix of the attachments were aligned within their respective crowns, to be parallel to the path of insertion, by using a parallometer key mounted on the dental surveyor **Fig. (1.c).** 4- For group I, a step was cut in the lingual surface of the waxed-up crown using a milling machine so that the milled wax become parallel to the path of insertion. 5- The splinted crowns and the patrix part of the attachment assembly were invested and cast. 6- Crowns with attachments were tried-in intraorally **Fig. (1.d).** Mandibular overall impression was recorded using rubber base impression material. The mandibular master cast was modified. A processing clear cap was placed on the patrix. The modified master cast was duplicated with irreversible hydrocolloid impression material. The Wax framework was patterned to fulfil female part of the attachment, lingual major connector and temporary indirect retainer. The wax framework pattern was invested, burnt out and cast with chromium cobalt alloy. The metallic removable partial denture framework and the splinted crowns were tried-in. An altered cast impression was made using selective pressure impression technique for the bilateral mandibular distal extension ridges and poured in dental stone to obtain the altered cast upon which the lower record block was constructed. Upper secondary impression in zinc oxide-eugenol was made, poured in dental stone and upper record block was built. Jaw relation was recorded, maxillary and mandibular casts were mounted on semi adjustable articulator. Acrylic semi-anatomical teeth were arranged, the partial denture was tried in. The dentures were processed with heat cured acrylic resin and the temporary indirect retainer was removed. All crowns were cemented during insertion of removable partial denture **Fig. (1.e).** Radiographic evaluations were assessed immediately at time, 6 and 12 months of RPD insertion. Radiographic evaluations were made using digital periapical radiograph by using CorelDraw11 program.

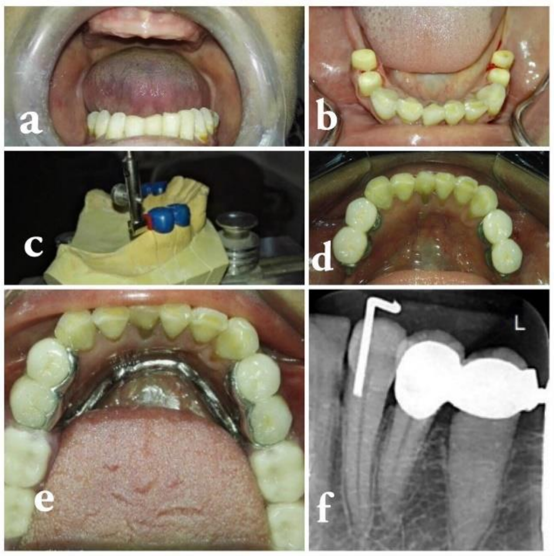

Fig. (1): a. A patient has completely edentulous maxilla opposed by bilateral distal extension ridges posterior to second premolars. **b.** Full crown preparation for the first and second premolars. **c.** Alignment of the patrix within the waxed-up crown using parallometer key. **d.** Intraoral try-in of the crowns. **e.** Insertion of the crowns along with metallic RPD. **f.** Digital periapical radiograph for measuring abutment alveolar bone height.

Standardization of the periapical radiograph was carried out as follow:

A standardized plastic film holder was used, the distance between the aiming ring and the film sensor was fixed at 10cm.Autopolymerizing acrylic template was constructed and designed to be seated on the occlusal surface of the first and second premolars.

Measuring mandibular alveolar bone height of first and second premolars:

According to ***Hausman et.al.***,[6] abutment interdental alveolar bone height was calculated by measuring the distance between the crown peripheral edge (CPE), instead of cemento-enamel junction (CEJ) and the interdental alveolar bone crest. **Fig. (1.f)**

Results:

Table (1): Shows mean amount of total abutment crestal alveolar bone resorption **(mm)** of abutment premolars and comparing mean amount of crestal alveolar bone resorption along the interval periods of study for **Group I**, **II** and Comparing mean amount of total abutment crestal alveolar bone resorption between Group I and Group II along the interval periods of study.

The mean amount of total abutment crestal alveolar bone resorption was found statistically significant after 1st 6 months (p=0.001*), 2nd 6 months (P=0.01*) and after 12

months (P=0.001*) of follow up periods where P≤ 0.05 level of significance.
The mean amount of total abutment crestal alveolar bone resorption was found statistically significant after 1st 6 months (p=0.021*), 2nd 6 months (P=0.001*) and after 12 months (P=0.005*) of follow up periods where P≤ 0.05 level of significance.

Comparing mean amount of total abutment crestal alveolar bone resorption of group I to group II was found statistically insignificant at 1st 6 months, 2nd 6 months and after 12 months of RPD insertion.

Table (1): Shows mean amount of total abutment crestal alveolar bone resorption **(mm)** of abutment premolars and comparing mean amount of bone resorption along the interval periods of study for **Group I**, **II** and Comparing mean amount of total abutment crestal alveolar bone resorption between Group I and Group II along the interval periods of study

Variables	**Abutment alveolar bone resorption for group I**		
	1st 6 months	**2nd 6 months**	**After 12 months**
$\overline{X}$	0.097	0.144	0.241
SD	0.01	0.04	0.03
Paired t-test	t=12.43	t=5.91	t=14.45
P-value	P=0.001*	P=0.01*	P=0.001*

Variables	**Abutment alveolar bone resorption for group II**		
	1st 6 months	**2nd 6 months**	**After 12 months**
$\overline{X}$	0.100	0.127	0.191
SD	0.04	0.02	0.04
Paired t-test	t=4.49	t=15.06	t=7.69
P -value	P=0.021*	P=0.001*	P=0.005*
Variables	**Group (I) (n=4)**	**Group (II) (n=4)**	**Student t-test**
1st 6 months	0.097±0.01	0.100±0.04	0.137
2nd 6 months	0.144±0.04	0.127±0.02	0.590
After 12 months	0.241±0.03	0.191±0.04	1.688

Discussion

The results revealed significant vertical crestal abutment alveolar bone resorption of the first and second premolars along all interval periods of the study for both groups. Although at the 1st six months interval period for the 1st premolar of group II, it was insignificant. In addition, total abutment crestal bone resorption was found statistically significant along interval periods of study for both group I& II.

These result may be attributed to three causes. The **first** one may be explained by ***Williams et al***. [7] They noted that: as extracoronal attachments have all, or part, of their mechanism lying outside the contour of the crown of the abutment tooth. As a result, loads transmitted outside the long axis of the abutments lead to vertical resorption of their alveolar bone.

Secondly: for *group I*, under functional loading, tissueward movements of the RPD occur. Consequently, the lingual stabilizing arm created a fulcrum at the point of origin from the framework resulting in stress transmission to the abutments. This is concurred with ***Saito et al.*** [8] They reported in their study that attachment retained RPD to which a lingual bracing arm has been incorporated, transmit more stress on the abutment teeth than those without a stabilizing arm. Moreover, it appears to be reasonable to assume that lingual bracing arm was connected more rigidly eventually, inducing more stresses.

With respect to *group II*, the extracoronal attachment utilized in this study allowed only vertical display of attachment RPD under function. As a result, abutments crestal bone resorption may occur. That's because the bracing components of the attachment will not be sufficient to resist lateral force under functional loading ultimately, this might result in transmission of stresses to the abutments.

Thirdly: the observations of the current study implied the broad stress distribution philosophy for distal extension base. The support is driven primarily from the abutments and secondarily from the ridge. Consequently a magnitude of stress is applied to the abutment teeth. This is might be compatible with ***Phoenix et al.*** [9] They assured that proponents of broad stress distribution philosophy believed that there are no moving parts that distort the RPD so, the residual ridges do not bear as much of the occlusal load.

Finally, yet the results revealed no significant difference when comparing both groups regarding crestal alveolar bone resorption throughout all time intervals. This finding could advocate that incorporation of lingual bracing arm might not be recommended. This is probably attributed to available abutment height that could provide adequate bracing, thereupon, obviate incorporation of the bracing arm. This could be in agreement with ***Preiskel*** [10]. He proclaimed unnecessity of lingual bracing arm in conjunction with extracoronal attachment with available attachment height.

Conclusion:

For the simplicity of the design and preservation of the abutment alveolar bone from resorption, the lingual bracing arm is not mandatory to be incorporated to the extracoronal attachment RPD of abutments with available occlusoginigival height.

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