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Evaluation of Two Denture Base Material on the Supporting Structures of Mandibular Tooth Supported Over Denture

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ABSTRACT

Purpose: To compare the effect of thermoplastic resin and heat cured acrylic resin denture base materials on pocket depth and bone height around two mandibular canines supporting mandibular tooth supported over denture. **Subject and Methods**: Ten patients having completely edentulous maxillary ridge and bilateral canine in the lower arch were selected. Root canal treatment and preparation were performed to obtain non coping abutment with amalgam plugs that covered with over denture. Maxillary complete dentures were constructed for all patients. Patients were divided into two equal groups. Group I: received thermoplastic mandibular over denture. Group II: received conventional heat cure acrylic resin mandibular over denture. Clinical and radio graphic evaluation were performed at denture insertion , after 6month and after 9month for both mandibular over denture. **Results:** Statistical analysis of bone height showed that group I (thermoplastic denture) has less bone resorption than group II (acrylic denture) which was statically significant. Statistical analysis of change in pocket depth showed that group I (thermoplastic denture) has less change in the pocket depth than group II (acrylic denture) which was not statistically significant. **Conclusion**: Within the limitation of this study thermoplastic over denture preserved pocket depth and bone height more than conventional heat cured acrylic resin.

KEYWORDS

Overdenture,
Thermoplastic resin, Bone height

INTRODUCTION

The primary goal of removable prosthodontics is not only to restore what is missing but also to preserve what is remain. Edentulism causes both aesthetic and functional disability, resulting in a psychological impact on the patients. Patients with few teeth used to be entirely edentulous after having complete dentures made for them. Preventive Prosthodontics, on the other hand, emphasises the value of any procedure that can prevent or delay future issues[(1)].

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The essential goal of over dentures is to keep the remaining hard and soft tissues intact. The purpose of over dentures is to disperse the masticatory strain throughout the edentulous ridge and abutments. An over denture delivers occlusal stresses to the alveolar bone via the retained tooth roots' periodontal ligament, strengthening the proprioceptive reflex[2].

It keeps teeth in place as part of the residual ridge, providing additional support. The denture sits on teeth pilings rather than soft, moveable tissues, allowing the occlusal load denture to withstand significantly more without moving. In comparison to traditional complete dentures, this treatment dramatically extended the life of remaining teeth[3].

Over dentures provide a patient with a sense of discrimination to touch and pressure that is not attainable with traditional complete dentures due to proprioception via periodontal fibres.

Tensile pressures on the periodontal ligament fibres in the case of mandibular abutments may result in bone deposition, allowing for enhanced stability, support, and retention of the lower denture[4].

Alveolar bone preservation is more important in the mandibular canines, especially in the anterior section[5].

Because the canines are the most densely innervated and sensitive of all the teeth, they are the best abutment teeth for over dentures. They are also kept in the system for a longer period of time due to their long triangular roots[6].

Thermoplastic dentures have emerged as a feasible option for treating diverse edentulous disorders thanks to recent advances in material science. It has a number of benefits over typical rigid denture bases. The denture base adapts effectively to the undercut areas because to its flexibility. The amount of adjustment necessary at the time of denture insertion is considerably reduced, resulting in fewer complaints of denture-induced trauma following insertion (ulceration)[7].

Because the material is flexible and strong, it may be manufactured thinner and lighter than traditional dentures. Flexibility is not a benefit for thermoplastic denture base materials in conventional complete dentures, since the retentive peripheral seal might be disrupted in function, affecting retention. The retentive values were not reduced as much when an abutment or attachment with the matching undercut was present. To give comfort, aesthetics, and function to partially edentulous patients, an attempt has been made to combine the advantages of two treatment techniques, over denture and flexible denture[8-10].

Despite the benefits of over denture therapy, there are also drawbacks, such as caries susceptibility or abutment periodontal deterioration due to poor oral hygiene. Recently, researchers have focused their emphasis on the use of gingival cervicular fluid analysis in the diagnosis of periodontal disease. It was discovered that healthy periodontal sites produced substantially less fluid than diseased area[11-12].

CBCT has already become an established diagnostic tool for different dental fields, such as endodontic, orthodontics dental traumatology, apical surgery, challenging periodontal bone defect, perioperative planning of periodontal surgery, scientific odontology, and dental implant surgery including bone quality evaluation[13].

The aim of this study is to evaluate mandibular tooth supported over denture with two different denture base materials (thermoplastic and convential heat cure acrylic resin denture base material) through evaluation of pocket depth and bone height changes around over denture abutment.

SUBJECT AND METHODS

Ten patients having age range from 45-60 years were selected from the Out Patient Clinic of Removable Prosthodontics- Department; Faculty of Dental Medicine for Girls, Al-Azhar University. Written consent was obtained from each subject after

explaining the study as well as giving information about treatment and follow up appointment and ethics committee approval of Faculty of Dental Medicine for Girls, Al-Azhar University was obtained (approval no:REC-PR-21-05). Patients criteria included in the study patients had completely edentulous upper arch (maxilla) and two mandibular healthy canines with good periodontal attachment, healthy alveolar mucosa free from inflammation or ulceration good bony support around canine.

Clinical steps of tooth supported over denture construction including, endodontic treatment of two canines, canines preparation to obtain dome -shape prepared canine about 1-2mm above gingival margin with round smooth round surfaces and amalgam plug is placed to close the orifice.

Primary impression was taken by alginate in a stock tray, after teeth preparation final impression was taken by medium form rubber base impression material in a custom tray made from self-cure acrylic resin. Construction of the occlusion blocks on master cast.

Using face- bow record to mount the upper cast, Maxillo mandibular relationship registration using wax waffer technique and mounting on the semi–adjustable articulator. The setting up of teeth and waxing up for try in was carried out to check speech, vertical and horizontal relationship and appearance. Denture processing was carried out and delivered to the patients.

Thermo plastic dentures have similar procedures as heat cured acrylic resin denture except that special flask designed for injection moulding technique.

The ten patients were divided into two equal groups, all patients were received upper conventional heat cured acrylic resin complete denture. Group I received mandibular tooth supported over denture constructed from thermoplastic material (flexiplast (Bredent- Germany).Group II received mandibular heat cured acrylic resin over denture(Acrostone).

Pocket depth measurements were obtained at denture insertion, after 6month and after 9month. Pocket depth was measured using William's probe from base of the pocket to free gingival margin at buccal- disto buccal – mesiobuccal-lingual – disto lingual–mesio lingual the mean value of six reading were calculated tabulated and statically analysed. (fig 1)

Figure (1) Pocket depth measurements using William's probe

Bone height measurements:- crestal bone height changes were evaluated with the aid of cone beam computed tomography (CBCT)(planmeca pro max® 3D classic) at denture insertion ,after 6 month and after 9 month. The bone height change were evaluated at(mid mesial, mid distal, mid buccal, mid lingual) of the tooth using software(Romexis®3Dimaging software) .through using the liner measurements system supplied by (CBCT). Horizontal line tangential to the apex of the root and perpendicular to its long axis. Two lines were drawn tangential to the mesial and distal surfaces of the tooth, parallel to each other and extending from the highest level of alveolar crest to the horizontal line. Similarly, buccal and lingual bone levels were calculated by using sagittal cross-sectional views. Average reading of four surface at each interval were calculated and tabulated for statistical analysis. The marginal bone loss was obtained for two intervals. This was done by calculating the difference in bone height between the reading at 6 months and at the denture insertion

time for the first interval, and the difference between reading at 9 months and at the denture insertion time for the second interval. All data was calculated, tabulated and statistically analysed [14]. (fig2)

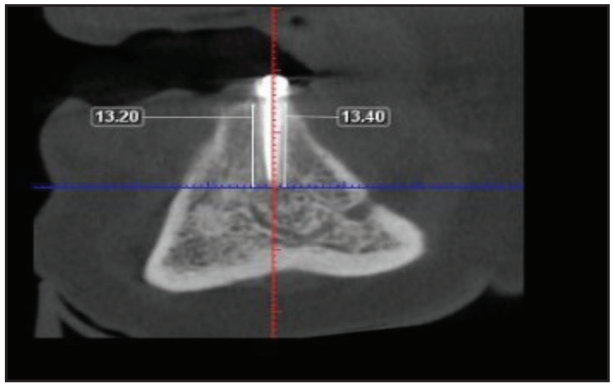

Figure (2) CBCT radiograph for bone height measurement

Data management and statistical analysis were performed using the Statistical Package for Social Sciences (SPSS) version 18. Numerical data were summarized using median, means, standard deviations, minimum, maximum and confidence intervals. Comparison between different observations was performed using repeated measures ANOVA test and Bonferroni post hoc test[15].

Categorical data was expressed as number and percentage and were compared using chi square test. All p-values are two-sided. P-values ≤0.05 were considered significant.

RESULTS

I- Bone height

Comparison of percent change between groups

In the first interval (from denture insertion to 6 months), group II (acrylic) recorded a higher mean decrease [-8.16%, range -12.74 to -4.51%] in comparison to mean decrease [-6.01%, range -7.21 to -4.28%] in group I (flexible) , with no significant difference between groups (p=0.075).

In the second interval (from 6 to 9 months), group II (acrylic) recorded a higher mean decrease [7.07%, range -7.98 to -6.25%] in comparison to mean decrease [-3.75%, range -5.59 to -2.7%] in group I (flexible) , with a significant difference between groups (p=0.009).

Overall (from denture insertion to 9 months), group II (acrylic) recorded a higher mean decrease [-14.67%, range -18.48 to -12.13%] in comparison to mean decrease [-9.54%, range -10.45 to -8.46%] in group I (flexible), with a significant difference between groups (p=0.009), (Table 1)**.**

Table (1) *Descriptive statistics and comparison of percent change of bone height between groups (Mann Whitney U) test*

		Mean	SD	Median	Min	Max	P value
First. Interval (from denture insertion to 6 months)	**Group 1 (Flexible)**	-6.01	1.24	-6.33	-7.21	-4.28	.075 ns
	Group 2 "Acrylic"	-8.16	2.94	-7.93	-12.74	-4.51	
Second. Interval (from 6 to 9 months)	**Group 1 (Flexible)**	-3.75	1.08	-3.49	-5.59	-2.70	.009*
	Group 2 "Acrylic"	-7.07	.68	-7.28	-7.98	-6.25	
Overall (from denture insertion to 9 months)	**Group 1 (Flexible)**	-9.54	.87	-9.63	-10.45	-8.46	.009*
	Group 2 "Acrylic"	-14.67	2.37	-14.63	-18.48	-12.13	

*Significance level p≤0.05, * significant, ns=non-significant*

II-Pocket depth

Comparison of percent change between groups

In the first interval (from denture insertion to 6 months), group II (acrylic) recorded a lower mean increase [30.37%, range 23.68 to 38.24%] in comparison to mean increase [34.74%, range 12.73 to 84.21%] in group I (flexible), with no significant difference between groups (p=0.530).

In the second interval (from 6 to 9 months), group II (acrylic) recorded a higher mean increase [19.37%, range 14.89 to 23.73%] in comparison to mean increase [5.83%, range 4.07 to 8.33%] in group I (flexible), with a significant difference between groups (p=0.009).

Overall (from denture insertion to 9 months), group II (acrylic) recorded a higher mean increase [55.55%, range 47.62 to 65.91%] in comparison to mean increase [42.34%, range 18.18 to 91.73%] in group I (flexible), with no significant difference between groups (p=0.117), (Table2)

Table (2) *Descriptive statistics and comparison of percent change of pocket depth (%) between groups (Mann Whitney U test)*

		Mean	SD	Median	Min	Max	P value
First. Interval (from denture insertion to 6 months)	**Group I (Flexible)**	34.74	28.81	25.00	12.73	84.21	.530 ns
	Group II "Acrylic"	30.37	5.88	29.63	23.68	38.24	
Second. Interval (from 6 to 9 months)	**Group I (Flexible)**	5.83	2.08	4.84	4.07	8.33	.009*
	Group II "Acrylic"	19.37	3.98	17.86	14.89	23.73	
Overall (from denture insertion to 9 months)	**Group I (Flexible)**	42.34	28.76	34.77	18.18	91.73	.117ns
	Group II "Acrylic"	55.55	7.02	52.78	47.62	65.91	

*Significance level p≤0.05, * significant ns=non-significant*

DISCUSSION

Preservation of natural teeth or roots is well known for reducing alveolar bone loss. With the preservation of teeth, sufficient periodontal proprioceptive receptor impulses are preserved, allowing for improved occlusal awareness, biting forces, and neuromuscular control. One of the most important functions of a tooth-supported over denture is to shift occlusal forces along the long axis of the supporting tooth, thereby reducing horizontal torque [16-18].

In the present study ten patient having upper edentulous ridge and lower mandibular ridge with only remaining two canine were selected with age of range from 45-60years because the catabolic process is significantly larger than the anabolic process in old age, to avoid the effect of old age on the degree of bone changes.

In this study, bilateral mandibular canine were selected to support over denture as they can withstand occlusal stress, Because of the size, shape, and length of their roots, as well as their strategic position at the corners of the dental arch, they are frequently kept.

They have a broad root surface area, a strong periodontal attachment, and a larger attachment epithelium [19, 20].

Endodontic treatment of the abutment is critical to the effectiveness of over denture therapy. It enables a short clinical crown to be used, allowing enough room for the underlying denture base and artificial tooth. Furthermore, the reduced crown alters the crown-to-root ratio, improving bone support. The second essential element is the increased denture retention provided by keeping the root, as well as the greatly reduced alveolar bone resorption [21].

Despite the fact that heat-cured acrylic resin is still the most used denture base material; thermoplastic resin is becoming more popular. The thermoplastic resin was used to build a mandibular over denture supported by two canines in this investigation. Thermoplastic is a biocompatible denture base material with special physical and chemical qualities [22, 23].

Pocket depth measurement by use periodontal probe (Williams markings) was carried out to asses severity of periodontal diseases ,because it's the most common method to assess the pocket depth [24].

Cone beam computed topography (CBCT) was the imaging technique use in this study .it provides greater measurement accuracy, when compared with two dimensional radiography (2D). It was reported that CBCT yielded submilimeter accuracy for liner measurements. CBCT provides shorter examination time, reduce radiation dose, better image sharpness, reduce image distortion, and increase x-ray efficiency [25].

The result of this study showed a higher median increase in the pocket depth in group II (acrylic denture) than in group I (thermoplastic nylon) with no significant difference between group (p=0.117). This may be due to that the flexible denture has enough flexibility to pass over under lying tissues with higher shock absorbable effect and minimal tissue irritation [26].

Statistical analysis of bone height showed that group I (thermoplastic denture) has less bone lose than group II (acrylic denture) which was statically significant. Due to The high resiliency of thermoplastic denture base allows a higher standard of function to balance masticatory force over entire supporting ridge instead of stress distribution lead to decrease the force directed to the tooth and consequently to the alveolar bone [27].

CONCLUSION

Within the limitation of this study it could be concluded that, the use of thermoplastic –resin as over denture base material preserve bone height around abutment teeth more than the conventional heat cured acrylic resin, regarding pocket depth heat cured affect pocket depth more than thermoplastic resin.

RECOMMENDATIONS

For future research, it is suggested that:

1. The number of the sample is increased.
2. Increasing the length of time spent studying.

Conflict Of Interest

The authors have no conflict of interest relevant to this study.

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