Effect of post-pressing times on adaptation of maxillary heat cured acrylic denture base at posterior palatal seal area

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ABSTRACT

Background: The purpose of this study was to verify the influence of post- pressing time of acrylic resin (immediate, 6, 12 and 24 hour) on the dimensional accuracy of denture base whish is a critical factor in the retention and stability of the complete denture that may occur during polymerization shrinkage.

Materials and Methods: Forty maxillary stone casts were poured in plastic mold (Columbia Dentoform corp. NEW YORK, type III dental stone (Geastone, Zeus Sri Loc.Tamburine Roccastrada, GR, Italy). The stone casts were randomly assigned into 4 groups of 10 specimens each according to the post-pressing times into (immediate, 6, 12 and 24 h.). Heat cure acrylic resin denture base was constructed according to the previously mentioned pressing time, the resin base-stone cast sets were transversally sectioned with a manual saw device at the distal aspect of the molar area, anterior to the posterior palatal seal area. The gap between the resin base and stone cast was measured at five points in the right (point B) and left (point D) ridge crests, at the midline (point C), and at the right (point A) and left (point E) marginal limits (A), using a Leitz linear optical comparator microscope with a travelling stage capable of measuring 0.001 mm. Each measurement was repeated three times and the average was used as the linear gap distance for that point. The data were submitted to ANOVA.

Result: there was statistically significant difference between the pressing time in which the mean values of gap space in point E for 24h shows lowest value then point A, point B, and point D than the other post pressing time. The mean value in point C shows highest values which mean the greater gap space in palatal area.

Keywords: dimensional change, denture base, post-pressing time. **(J Bagh Coll Dentistry 2013; 25(1):1-4).**

INTRODUCTION

The dimensional changes that may occur in denture base influence on the retention and stability of complete denture this change may be partially compensated by water absorption [1], by the resilience of the gingival mucosa [2], and the saliva film formed between the resin base and the soft support tissue [3,4]. In addition, the base is also responsible for artificial teeth fixation and distribution of chewing forces over the tissue-bearing area, and other factors may influence the base dimensional stability, such as the resin-flasking method and the time-temperature correlation during the curing methods [5].

The combination of several factors such as polymerization shrinkage, thermal contraction by flask cooling, and strain caused by stress release during deflasking causes diminished adaptation of the denture to the tissue. The inaccuracy in the flange area may also cause instability and pressure points on the soft tissues, and the greatest effect of linear shrinkage is usually on the posterior palatal region of the maxillary denture, resulting in a gap between this area and the denture [6-7]. Therefore, the discrepancy between the base and supporting tissues is an important factor in the control of the amount of force necessary to dislodge the dentures [8,11,].

MATERIAL AND METHODS

Forty maxillary edentulous stone casts were prepared from an edentulous silicon mold (Columbia Dentoform corp. NEW YORK,). The mold was poured with type III dental stone (Geastone, Zeus sri Loc.Tamburine Roccastrada, GR, Italy) using a ratio of 30 mL water to 100 g powder according to manufacturer instruction. The stone casts were randomly assigned into 4 groups of 10 specimens each according to the post-pressing times into immediate, 6, 12 and 24 h. A uniform denture base plate was prepared by using Biostar machine [3]. The biostr plate (2mm thickness) then sealed with wax on the cast, this procedure was repeated for all the cast samples (1). The cast with corresponding denture base was flasked in the lower half of a traditional brass flask with (1:1) plaster: stone mixture as investing material (2). The first allowed to dry, then separating medium was painted for all the exposed stone surfaces. The upper half of flask was fitted on the lower half and second plaster: stone mixture was poured. The wax elimination procedure was proceeding and the denture base removed. Separating medium was applied on the surface of investing material and stone samples. Classic poly methyl methacrylate PMMA was used with monomer: polymer ratio of 1:3 (by volume) according to manufacturer instructions.

The prepared dough was packed according to one of the post-pressing times. The flask were transferred to a flask carrier or clamp and immersed in water according to the post-pressing times. After the curing cycle, the flasks were

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removed and allowed to bench cool then, the mold investment was removed while the cast with its denture base where the deflasked after 24 hr to be trimmed and fixed to their corresponding casts with instantaneous adhesive (2 drops on the premolar area) in order to prevent any movement during cutting procedure. Determination of the cutting line which was (39 mm) from anterior aspect of the base of the cast (where the whole length of the cast was 52mm) [3, 12].

The resin base-stone cast sets were transversally sectioned with a manual saw device at the distal aspect of the molar area, anterior to the posterior palatal seal area [3]. The gap between the resin base and stone cast was measured at five points in the right (point **B**) and left (point **D**) ridge crests, at the midline (point **C**), and at the right (point **A**) and left (point **E**) marginal border (Figure 1). Using a Leitz linear optical comparator microscope with a travelling stage capable of measuring 0.001 mm. Each measurement was repeated three times and the average was used as the linear gap distance for that point. The measurements were made at 5 points for each one [4].

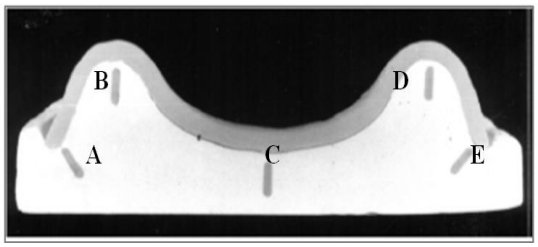

Figure 1. Points in the transverse section used to determine the dimensional changes in the base-stone set.

RESULTS

The mean values gap space was classified according to the point of transversally sectioned of each resin base-stone cast for each post pressing time (point **A** for right marginal border, point **B** for right ridge crest, point **C** for mid palatal point, point **D** for left ridge crest, point **E** for left marginal ridge).

Table 1: Descriptive statistics of the mean gap space in point {A} and P-value for groups of immediate, 6 hour, 12 hour, and 24 hour.

Post pressing time	Mean mm	S.D	F-test	P-value
immediate	0.208	0.0487	12.406	0.039
6 hour	0.188	0.0266		
12 hour	0.165	0.0227		
24hour	0.141	0.0202		

Table 2: Descriptive statistics of the mean gap space in point {B} and P-value for groups of immediate, 6 hour, 12 hour, and 24 hour.

Post pressing time	Mean mm	S.D	T-test	P-value
immediate	0.207	0.0327	12.508	0.038
6 hour	0.175	0.0378		
12 hour	0.172	0.022		
24hour	0.146	0.0291		

Table 3: Descriptive statistics of the mean gap space in point {C} and P-value for groups of immediate, 6 hour, 12 hour, and 24 hour.

Post pressing time	Mean mm	S.D	F-test	P-value
Immediate	0.535	0.028	9.193	0.049
6 hour	0.525	0.0341		
12 hour	0.507	0.0395		
24hour	0.494	0.0401		

Table 4: Descriptive statistics of the mean gap space in point {D} and P-value for groups of immediate, 6 hour, 12 hour, and 24 hour.

Post pressing time	Mean mm	S.D	F-test	P-value
immediate	0.203	0.0236	12.463	0.039
6 hour	0.195	0.0357		
12 hour	0.181	0.026		
24hour	0.149	0.0277		

Table 5: Descriptive statistics of the mean gap space in point {E} and P-value for groups of immediate, 6 hour, 12 hour, and 24 hour.

Post pressing time	Mean mm	S.D	F-test	P-value
immediate	0.214	0.0502	12.289	0.029
6 hour	0.197	0.0258		
12 hour	0.174	0.0246		
24hour	0.139	0.0274		

Table 6: LSD of multiple comparison tests between immediate & 6 hours tested groups at all point.

Point of sectioned	t-test	P-value	Sig
A	1.168	0.229	NS
B	1.599	0.145	NS
C	0.318	0.588	NS
D	0.314	0.513	NS
E	0.144	0.243	NS

Table 7: LSD of multiple comparison tests between immediate & 12 hours tested groups at all point.

Point of sectioned	t-test	P-value	Sig
A	6.611	0.033	S
B	6.248	0.035	S
C	4.186	0.041	S
D	3.176	0.041	S
E	5.139	0.042	S

Table 8: LSD of multiple comparison tests between immediate & 24 hours tested groups at all point.

Point of sectioned	t-test	P-value	Sig
A	31.04	P<0.01	HS
B	21.07	P<0.01	HS
C	18.957	0.005	HS
D	15.584	0.001	HS
E	15.109	0.001	HS

Table 9: LSD of multiple comparison tests between 12 hours & 24 hours tested groups at all point.

Point of sectioned	t-test	P-value	Sig
A	8.881	0.012	S
B	4.043	0.043	S
C	0.103	0.451	NS
D	6.891	0.018	S
E	7.295	0.023	S

DISCUSSION

Post-pressing time seems to be effective in promoting resin mass relaxation, and probably a possible technical condition to be applied to the laboratory routine. The suggested reason for allowing the flask to stand for some hours before polymerizing is to allow the resin mass to flow into all regions of the mold [5, 10]. In the present study, the immediate and 6-hour delayed time showed no statistically significant difference in gap space as shown in (table 6) when compared with the 12h and 24h which showed significant differences as shown in (table 7). This result indicated that when the post pressing time increase the gap space decrease, especially when compared between the immediate and 24 hours which showed highly significant difference as shown in (table 8). Due to resin mass to stay for a longer delayed time before polymerization this procedure probably also reduces the amount of residual monomer present in the resin dough by evaporation [15,16]. The largest base dimensional changes are observed in the denture posterior palatal seal because the edentulous maxilla consists of a relatively flat portion in the middle of the hard palate and an inclined slope toward residual ridge. Due to this geometric feature of the palatal concavity configuration the shrinkage occurring toward the residual ridge leads to lifting of the denture base in mid-palatal region [9, 13].

The differential in thermal contraction between the mold and the acrylic resin is believed to be the cause of residual strain in the processed denture and also considered to be the main contributor in strain release which occurs when the denture is separated from the cast [7, 14].

Testing the fit changes at the marginal borders significant differences where noticed among tested groups at both A and E points respectively, which may be attributed to the large horizontal force component resulting from force analysis at the ridge crest, so larger amounts of stresses may be generated at the marginal borders rather than the ridge crests leading to larger strains after denture deflasking. These valuable amounts of stresses may create general differences among tested groups [8, 17].

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