

## ORIGINAL RESEARCH

# Evaluation of the fit of the reprocessed maxillary complete denture bases

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**ABSTRACT:** *Background:* Reprocessing the permanent denture base after try-in is a common procedure in the complete denture fabrication. It is speculated that subjecting polymerized Poly-methyl methacrylate resin again to heat, during reprocessing can induce dimensional changes and a significant loss of intimate fit in the denture base to the tissues, can ultimately reduce the retention and stability of the complete denture. *Aim and Objectives:* The aim of the study is to evaluate the effect of reprocessing on the accuracy of fit of permanent poly-methyl methacrylate denture bases. *Material and Methods:* A resin edentulous maxillary model was duplicated and a total of twenty casts were poured with type III gypsum product. Group I: Permanent denture bases fabricated with heat polymerized Polymethylmethacrylate resin. Group II: Group I permanent denture bases with wax rims reprocessed with heat polymerized Polymethylmethacrylate resin. Both the group were evaluated for fit using a travelling microscope. *Results:* Statistical analysis revealed that at each measurement period the mean posterior palatal border openings were not significantly different for processed and reprocessed denture bases. ( $p > 0.05$ ). *Discussion:* Reprocessing permanent denture base under controlled laboratory conditions without significant dimensional change, will encourage the clinicians to use permanent record base during jaw relations and try-in. *Conclusion:* Maxillary permanent complete denture bases were not found to distort significantly as a result of first and second curing cycle. The central part of the posterior palatal border of the denture showed the greatest discrepancy, which was as less as 0.11 to 0.13mm. Reprocessing the permanent complete denture base in controlled laboratory conditions will not affect the fit and adaptation.

**Keywords:** polymethylmethacrylate resin, complete denture, permanent denture base

The introduction of polymers like polymethylmethacrylate to the dental field, was in the late 1930's.<sup>[1]</sup> With the availability of various types of polymers, considering the physical and esthetic properties, poly-methyl methacrylate demonstrates low toxicity and have been used successfully for the fabrication of denture bases till date.<sup>[2]</sup> The use of methyl methacrylate polymers and co-polymers for fabricating denture bases started extensively from 1940.<sup>[1,2]</sup> However one of the disadvantage encountered was the lack of dimensional stability due to substantial shrinkage during processing

which induced internal stresses.<sup>[3,4]</sup> Majority of the denture bases are fabricated using common polymers. Such polymers are chosen based on the availability, dimensional stability, handling characteristics, color and compatibility with oral tissues.<sup>[5]</sup> The established method for processing the acrylic polymers is packing it in a closed flask under compression followed by heat activation to induce polymerization of the acrylic resin.<sup>[6]</sup> In 1989, investigations based on the accuracy of polymethylmethacrylate resin for making dentures was reviewed by Takamata and Setcos.<sup>[6]</sup> They concluded that dimensional changes of the internal

surface of the denture do occur irrespective of the processing technique or the polymethylmethacrylate resin chosen. Maximum shrinkage is found to occur in the posterior palatal border region particularly, where the retentive seal and the stability of the prosthesis may be compromised.<sup>[7]</sup>

Using heat polymerized denture bases during jaw relations and try in procedure can ensure retention, stability thereby enable proper evaluation of jaw-relations and try-in procedures. It is often speculated by the dental practitioners that maxillary denture bases may undergo deformation after second processing, which might compromise retention. The following study is based on a research question that whether re-polymerizing poly-methylmethacrylate denture bases affects the fit. and conducted to assess the dimensional discrepancy after re-processing of permanent denture bases. The null hypothesis was that denture bases do not deform even after reprocessing.

#### MATERIAL AND METHODS:

A resin maxillary edentulous model was used for this study [Fig 1]. A master impression was prepared for this resin model using non-aqueous elastomeric impression material [Fig 2]. Ten edentulous casts were poured from this master impression, using type III dental stone, following the manufacturer's instruction.

A 2 mm thick shellac base plate (Supernal base plate, SD Dental Co., Lucknow) was adapted over each cast [Fig 3]. The temporary denture bases were processed using poly-methyl methacrylate resin (DPI Heat cure-The Bombay Burmah Trading Co., Ltd., Mumbai) by compression molding technique and cured at 71°C for one hour and then polymerized at 100° for 30 minutes in an acryliser



Fig- 1: Methyl methacrylate resin model

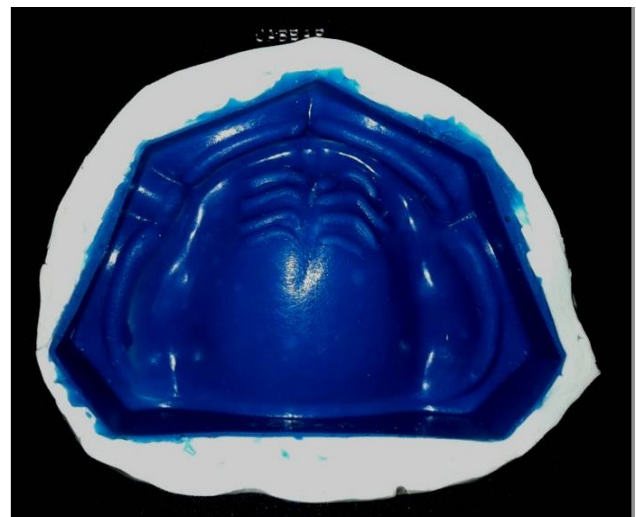


Fig- 2: Elastomeric impression of the master model



Fig-3: Temporary record base adapted over master cast



Fig-4: Processed Permanent denture base over the master cast



Fig- 5: Permanent record base over the acrylic resin model

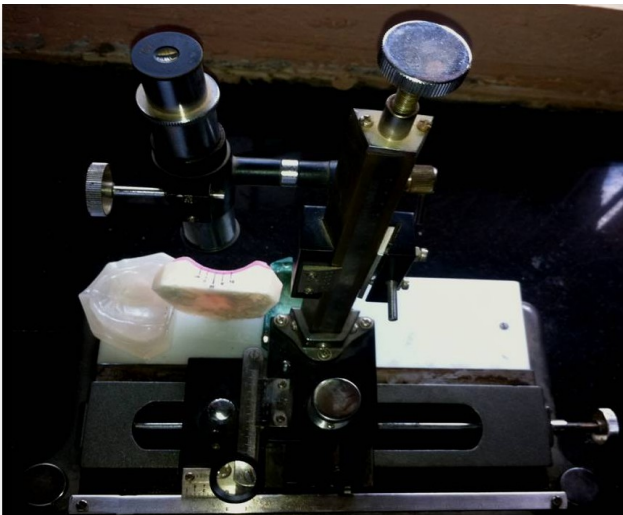


Fig- 6: Measurement with travelling microscope.



Fig-7: Reference points midline, 5mm and 10mm on each side of the midline

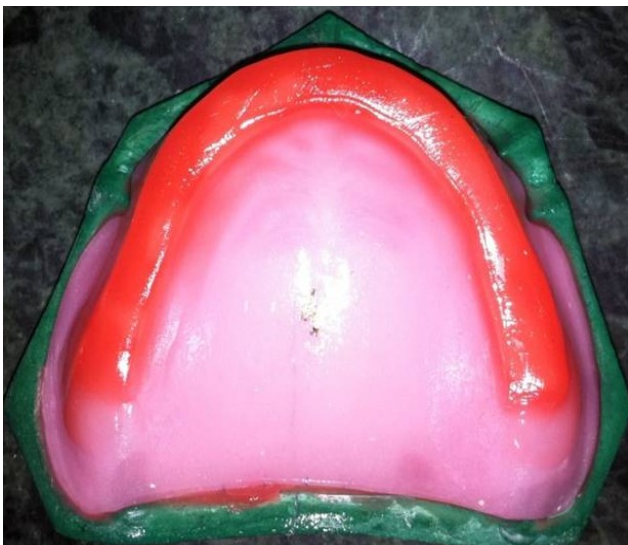


Fig- 8: Wax adapted over the processed denture base



Fig-9: Reprocessed denture base

(Confident, India).<sup>[8]</sup> After polymerization, the flask is removed from the water bath and allowed to cool. The expansion is of two types, extra oral expansion (due to its storage in liquid media) and intra oral expansion (due to imbibitions of intra-oral fluids).<sup>[4]</sup> The advantage of heat – polymerized, permanent, poly methyl methacrylate resin denture base is its strength, accurate adaptability and rigidity.<sup>[9]</sup> Apart from being used as a denture base material, they are also used as permanent denture base to ensure good retention and stability of the final denture during jaw relation and wax try in procedures. The thickness of the denture bases may vary from a single thickness of base plate wax, approximately 1.5 mm thick, to an excess of 4 mm. The thicker the denture base, the greater will be the fracture resistance because of its greater flexural strength.<sup>[10]</sup>

The retention of the maxillary denture base is chiefly dependent on the intimate contact of the posterior palatal seal area with the denture base. Shrinkage during processing may influence the adaptation of the permanent denture base. The difference in the density between monomer and polymer is an important factor influencing shrinkage (i.e.) the density of the monomer is lower ( $0.945\text{g/cm}^3$ ) than the polymer ( $1.16$  to  $1.18\text{g/cm}^3$ ). The mixing ratio of polymer to monomer is 3:1. Hence the low density monomer will try to attract as many polymers as possible, which induce shrinkage. While processing the maxillary denture, the residual monomer present in the posterior palatal seal area will migrate to that area where unreacted polymers are present and these are present in the bulkiest portion of the maxillary denture base that is the ridge area. This leads to increased degree of lifting of the denture base away from the cast in

the mid part of the posterior palatal region when compared with bulkiest portions.<sup>[11]</sup> Linear shrinkage of the maxillary denture bases before and after second processing cycle was found to be less than 1% with 0.2% occurring as a result of the second processing cycle which is statistically not significant according to the study conducted by Yeung, Chow, and Clark in 1995.<sup>[11]</sup> A simple method for determining the denture adaptation is to observe the fit after positioning it over the master cast.

In this study, the discrepancy values at various intervals in the post palatal region were evaluated using the travelling microscope. The data were analyzed using T squared test. The mean posterior border openings were not significantly different (p value=0.3) for the processed and the reprocessed maxillary permanent complete denture bases. From the values obtained it is noted that the discrepancy between the denture base and the model is greater in the midline when compared with the other regions. The observations in this study were in agreement with the study conducted by Anthony DH, on dimensional accuracy of various denture base materials, which showed that the discrepancy was greater in the central portion of the posterior border of the maxillary denture bases.<sup>[13]</sup>

In this study, wax was added to 4mm thickness to simulate the clinical situation, thereby providing a scope to evaluate the influence of additional material and its effect during re-processing. Clinically, the other causes for the loss of retention of the permanent denture base after reprocessing is thought to be due to loss of height or width of peripheral form due to excessive trimming or excessive polishing when the final dentures are finished or poor handling or storage. The choice of

impression material and impression technique is of greater concern when compared with factors to room temperature before it is opened. The finished permanent denture base was carefully seated over the master model [Fig 4, 5]. The adaptation between the palatal tissue surface of the maxillary denture base and master model was measured perpendicular to the model along the posterior palatal border with travelling microscope (Vernier microscope, 0.001mm resolution, Cosmo Lab Equipment, Haryana) [Fig 6].

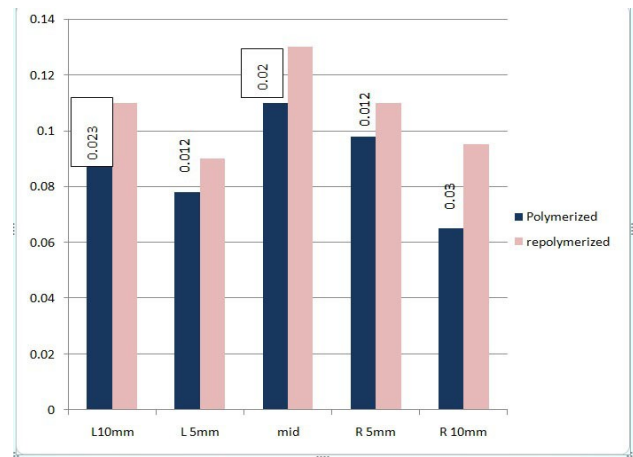
The measurements were made at, 5 and 10 mm on each side of the midline. The midline was determined by following a line from the incisive papilla along the median palatal raphe to the posterior border of the model [Fig 7]. A total of 50 measurements were made, 5 for each cast.

Occlusal rims were constructed over the permanent record bases with modeling wax of 4mm thickness [Fig 8]. Finished rims with permanent denture bases were processed in the same way as mentioned before. Later, the finished reprocessed denture base is readapted over the master model [Fig 9] and 50 measurements were made in the similar manner.

The data were analyzed and the resulting mean vectors were compared by the  $T^2$  test. Statistical analysis was carried out to evaluate the dimensional discrepancy observed in two groups.

## RESULTS:

The amount of posterior border opening at each measurement location for the 2 groups of permanent complete denture bases is illustrated in the graph [Fig 10]. The mean values at the mid line for processed and reprocessed denture bases were



**Fig-10: Graph depicting discrepancy observed for various reference points at the palatal border of the denture: x-axis – reference points; y-axis – discrepancy in mm.**

0.11±0.05mm and 0.13 ±0.07mm, at right 5mm interval 0.098±0.1mm and 0.11±0.05mm, at left 5 mm interval 0.078±0.14mm and 0.09 ±0.07mm, at right 10mm interval 0.065±0.17mm and 0.095±0.14mm, at left 10 mm interval 0.087±0.05mm and 0.11±0.9mm.

The data were analyzed using T squared test and the results revealed that the average discrepancy value at each intervals for the processed denture base ranged from 0.065 to 0.11mm and 0.09 to 0.13mm for the reprocessed denture bases. The mean posterior border openings between the maxillary denture base and the resin model were not significantly different for the processed and the reprocessed maxillary permanent complete denture bases.

## DISCUSSION:

The main purpose for this study was to investigate alterations in the dimensions of denture base from second processing. Based on the results it is very clear that the null hypothesis is validated through the study that there is no significant difference between the denture bases before and after processing. The two major dimensional changes seen with poly-methylmethacrylate resin prosthesis

are shrinkage and expansion. Shrinkage commonly occurs due to improper monomer/polymer ratio, whether the dentures are being subjected to single or double curing cycle.<sup>[14]</sup> This study is in agreement with the other study conducted on the mandibular denture base by Michael Robert Fenlon et al. Other materials light cured denture, injection moulded and microwaved denture bases are superior in fit,<sup>[12]</sup> the repolymerisation in such denture bases are not studied. Maxillary denture would not affect the fit and adaptation of maxillary denture bases. bases has the maximum discrepancy after processing at the palatal area which is vulnerable for loss of seal<sup>[7]</sup>. When they are reprocessed, the amount of discrepancy that may occur can be very crucial for retention. Although auto-polymerised acrylic resin denture bases are superior in fit when processed<sup>[6]</sup>, block outs during the fabrication can compromise the accuracy of jaw relations and trial

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where retention and stability is crucial. It should also be remembered that processing, finishing and polishing the denture in controlled laboratory conditions after re-polymerization would not compromise the fit of the denture bases.

#### CONCLUSION:

Distortion observed as a result of first and second polymerization cycle on the permanent maxillary denture base, was not found to be statistically significant to have an impact on the adaptation.

The greatest discrepancy was found in the central part of the posterior palatal border of the denture, which is as less as 0.11 to 0.13 mm.

Within the limitations of this study, it was concluded that reprocessing denture bases would not affect the fit and adaptation of maxillary denture bases.

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