Journal of Dental Applications

Open Access

Austin Publishing Group

Research Article

Influence of Polymerization Technique and Resin Type in Denture Misfit

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Received: July 04, 2014; **Accepted:** November 10, 2014; **Published:** November 12, 2014

Abstract

The aim of this study was to analyze the misfit of dentures polymerized by two methods: a water bath at fast cycle at 100 °C and 50lb pressure, and microwave energy, using specific resins for each technique. Ten maxillary complete dentures were prepared with Lucitone 550 and Vipi Wave resin (n=5). For standardization of samples in a single model, the teeth setting up and wax-up were made, with subsequent molding using silicone rubber for mold. The samples were embedded in flasks and the resin was pressed according to manufacturer instructions. After polymerization, they were subjected to sudden cooling, dipped in 10°C water. The pattern-prosthesis group was cut-off in canines and premolars distal region. The misfit analysis was performed by two calibrated examiners in positions: buccal (b), top of the alveolar ridge (TR) and anterior (mid-anterior third of the palate) and posterior (near the limit soft palate / hard palate).), with the aid of a stereoscopic microscope. Data were subjected to statistical analysis ANOVA 3-way and Tukey's test with significance level of 5%. Results showed that in millimeters there was no significant difference between the anterior and posterior regions. The anterior position analysis influenced the misfit. The polymerization techniques and type of resin showed no significant differences. It can be concluded that the technique of polymerization and the type of resin used did not differ from each other in the misfit of the denture base. The posterior region of the palate area showed greater misfit.

Introduction

The edentulous patients treatment is mostly performed with mucosuported complete denture prostheses, which are made of thermally activated acrylic resin. The characteristic of this material after polymerization, is the stiffness in all extension, which can result in some misfit or discomfort to the patient.

The acrylic resin, due to the characteristics of dimensional changes during processing caused by polymerization shrinkage and induced stresses releasing during cooling with regard to support tissues adaptation, show misfits that when cannot be controlled by molding technique and resin process can lead to clinical failures [1,2].

The denture base misfit directly influences their retention and stability, thereby requiring primarily attention upon polymerization. The polymerization techniques, as well as flasks cooling, should give the minimum change in thermal contraction of the resin to a more favorable result [2,3].

Classically, the polymerization of an acrylic resin for denture base is carried out by heating induction in hot water, and it is a slow process. Lately, with the aim of reducing work time, some polymerization techniques have been tried. However, acceleration process can result in greater porosity, dimensional changes and concentration of residual monomers.

Polymerization has been carried out with the use of microwave energy, which according to some authors it is a process similar to traditional hot water baths performance [4,5]. However, limited information about the relationship of this type of technique and the misfit of denture bases.

With the aim of reducing the processing time, a polymerization technique of temperature and pressure were introduced. Ming et al. 1996 used a process with a pressure of 6kgf/cm^2 to 120°C for 10 minutes for thermally activated acrylic resin, and they obtained good results, without the presence of porosities in 6 mm thick specimens.

These two polymerization techniques are widely used in prosthesis laboratories, without considering the prosthesis bases misfit.The aim of this study was to analyze the misfits of dentures polimerizated by two methods: water bath for rapid cycle at 100°C and 50lb pressure, and microwave energy, with a fast cooling in both techniques. The misfit was observed in three different regions: buccal (B), the top of the alveolar ridge (TR) and palate (P), both in front and posterior view.

The study first hypothesis is that microwave polymerization shows largest misfit than water bath polimerization. The second hyposthesis is that the posterior region has greater values of misfit.

Methods and Materials

Ten replicas of a toothless jaw model in type IV plaster (Dentisply Durone) were selected. On one of the models was made a wax-up base (n. 07 wax, Wilson) with a thickness of four strips.

For standardization of resin thickness, artificial teeth were mounted and used for the study to simulate as much as possible what happens in the laboratory. The teeth were randomly positioned, respecting only the alignment in the anterior-posterior, cervical-occlusal and gingival portion complemented with the sculpture, getting a maxillary complete denture in wax. This set of teeth was

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Citation: Macedo VC, Cotes C, Cabrini RR, Paes-Junior TJA, Carvalho RF and Kimpara ET. Influence of Polymerization Technique and Resin Type in Denture Misfit. J Dent App. 2014;1(6): 124-126.

performed only once, originated a pattern that was molded with silicone.

The complete denture wax was included in reproduction silicon (Silibor) getting the plaster model fixed at the bottom of a container and being poured the duplicator material to cover at least 5mm of occlusal area.

After silicon curing, wax denture set and model has been removed. This silicon was used as a standard template for next test specimens, where the teeth and model were fitted in location. Wax was put in molten state at silicon orifices and after cooling he wax replicas of denture were obtained.

Dentures were included in flasks with type 2 plaster (Herodent) on the base like procedure described by Anusavice (2005), but in a modified form, with care to isolate the basis of the models with vaseline. After crystallization of plaster, according to conventional procedure, the wax was removed with the aid of hot water.

The pressing of pressure technique was performed with thermally activated acrylic resin (Lucitone) according to the proportions indicated by the manufacturer, waiting thirty minutes to initiate polymerization. For the curing cycle, it was used the pressure technique, which was performed in an under pressure device. Conventional flasks were immersed with water at room temperature. The internal pressure was raised up to 50lb by compressed air injected, and the internal temperature reached 100ºC. After polymerization, they were subjected to fast cooling, dipped in water temperature of 10ºC.

In microwave polymerization technique, the Vipi Wave resin was submitted an including and pressing techniques described by the manufacturer, as well as the plastic muffle also intended to polymerization in a microwave oven. According to the manufacturer's instructions, the cycle used was 20 minutes at 20% power (900 W oven) and 5 min at 60% power. After polymerization, they were subjected to fast cooling and dipped in water temperature of 10ºC.

The denture misfit was analyzed after cut-off in distal canine and premolars region. This procedure divided the prosthesis in three slices, which were analyzed in the anterior and posterior part. The misfit measurements were performed in three different positions of analysis: buccal (B), the top of the alveolar ridge (TR) and palate (P), in a stereoscopy with an increase of 60 times, performed by two calibrated examiners. Data were subjected to ANOVA 3-way and Tukey statistical analysis with significance level of 5%.

Results

The misfit values for each slice in the different regions are listed in Table.

Table 1 showed that the highest value of misfit was found in the posterior region of the palate, but there were no significant statistical difference between techniques. The lowest misfit was found in the buccal area. The B, P and TR areas in the anterior and posterior sites showed no statistically significant difference between the techniques used.

Between the anterior buccal and posterior palatal site, there were statistical difference, as shown by different letters.

Table 1: Misfit values for each slice in the different polymerization technique and regions.

Polimerization technique	Anterior site			Posterior site		
	B	TR	P	B	TR	P
Microwave	0,7 C	11,6 BC	13,8 BC	2,3 BC	7,7 BC	29,6 A
Pressure	0,0 C	0,0 C	7,1 BC	5,6 BC	6,6 BC	16,3 AB

*Different letters show statistical diference.

Discussion

The retention of the mucosuported denture is closely linked to denture base adaptation to the oral mucosa. The contact between the oral mucosa of the patient to the denture base is proportionally to adhesion, and it is an extremely important factor for retention. Therefore, a misfit denture will show a lower retention, causing discomfort to patient.

The posterior site, especially in palate area, is responsible for posterior peripheral seal, and denture adaptation in this region is extreme importance not only to the stability, but also for prosthesis stability [6].

The results demonstrated that the greatest discrepancy was found in posterior area of the palate. These findings are in agreement with other studies that showed that the palate is the most affected site by the distortions [1,6,7]. Several factors responsible for misfit in this area include polymerization shrinkage of thermally activated acrylic resin [8,9], cooling method [1], base thickness [10] and shape of the palate [7].

Numerous studies tried to develop processing protocols with the intention of controlling the polymerization shrinkage or minimize the effects of this misfit causes in denture base. One proposal is to maintain the prosthesis immersed in water for water absorption resulting in expansion, which offsets polymerization shrinkage [3].

Plates in the palate [7] or a palatal anchor [12] can also be used to improve the misfit in the palatal area.

The contact between the denture base and the buccal area configures the peripheral seal and is also responsible for prosthesis horizontal stability. The results of this study showed no critical misfit in this region. The flange top area, which is the primary support zone, showed a slight misfit in the microwave polymerized group in the anterior region.

After polymerization, the cooling flask should be observed. Yeung and colleagues demonstrated that as slower the flask cooling, as lower the internal stresses. In other hand Consani and colleagues [3], did not found differences between the benchtop cooling and storage in water at 37°C.

Although it is not possible a direct comparison between studies due to different sample types and methods of misfits assessment, studies report the maximum misfit of 0.80 and 0.60 mm for the posterior site of palate, both for conventional technique [13]. For techniques used in this study, the values for same area were 29.6 for microwave and 16.3 for pressure technique. This difference between the findings may be related to the technique or to cooling method used. In view of this, future studies are needed to answer this question.

Conclusions

- There was an interaction between the anterior and posterior regions, whereas the posterior region showed greater misfit.

- The positions of analysis also showed influence in the misfit, with the palate as the region of greatest misfit.

- Regardless of the technique and resin used for denture base, the biggest misfit was observed in the posterior site of the palate.

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J Dent App - Volume 1 Issue 6 - 2014
ISSN : 2381-9049 | www.austinpublishinggroup.com
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Citation: Macedo VC, Cotes C, Cabrini RR, Paes-Junior TJA, Carvalho RF and Kimpara ET. Influence of Polymerization Technique and Resin Type in Denture Misfit. J Dent App. 2014;1(6): 124-126.