

Effect of different border molding materials on the retention of mandibular complete denture base

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Abstract

The history of complete denture impression procedures has been largely influenced by the development of new impression materials and techniques. There are various researches for achieving an optimum impression in different ways by different researchers. The problem of retention still plays a main challenging role in mandibular complete denture construction. The aim of this study was to compare the retention of mandibular complete denture bases made by using different border molding materials such as heavy body rubber base, medium body rubber base and modeling compound stick.

Fifteen mandibular completely edentulous patients were selected and three types of border molding impression were made for each patient. First, border molding with heavy body rubber base and final wash impression were made with light body rubber base. For the second, border molding was done using medium body rubber base followed by light body rubber base final wash. Finally, the third impression was made using modeling compound stick for border molding followed by zinc oxide eugenol impression paste for final wash. Three stone master casts were obtained for each patient and three denture bases were fabricated with heat cured acrylic resin. Then, retentive forces were measured by Handy Analog Push-Pull gauge after border molding, after final wash impression and on the resultant denture bases.

The results revealed that no statistically significance at (p value > 0.05) among three border molding materials. But denture base made by using medium body rubber base showed the highest mean value (2.227 kgf) of retention followed by that of heavy body rubber base, while that of modeling compound stick showed the lowest mean value. However, on clinical examination, the retention obtained by the three materials was acceptable in fabrication of complete denture for patients.

Keywords: border molding, complete edentulism, mandibular complete denture, retention

Introduction

Every human being all over the world has a wonderful right for the enjoyableness of oral and dental health. The loss of teeth by accident or disease has increased throughout ages which needs to

be replaced by mean of artificial substitute.

The elderly population is increasing among developing countries in recent years. There is a strong relationship between aging and tooth loss. In Canada, more than half of elderly people, above the age of 65 years are losing all of their teeth. Among elderly people over the age of 65 years in America, about one third of them

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was completely edentulous. In European countries, (46%) of elderly in United Kingdom, (65%) in Netherland and (69%) in Iceland are suffering complete edentulism [1]. So, simple and uncomplicated procedures in complete denture construction will be needed to meet this demanding conditions.

It is important for the complete denture to be functioned in the oral cavity harmonically with the normal neuromuscular activities although they are primarily mechanical devices. When there is inaccurate impression, the complete denture may have adverse effects on both oral and supporting tissues [2]. The impression making of complete denture can be considered difficult [3] and has been influenced by the advanced impression materials and techniques [4].

One of the most important factors in the success of complete denture treatment is having desired degree of retention and stability, which is also important for speech, mastication and esthetics. Retention is the ability of a denture to remain in contact with its supporting mucosa, i.e. the resistance to removal in a direction approximately at right angles to the occlusal plane [5]. To achieve such needed retention, it is necessary to obtain the peripheral seal by mean of border molding [6].

Border molding is the shaping of the border areas of an impression tray by functional or manual manipulation of the tissue adjacent to the borders to duplicate the contour and size of the vestibule. It is an important step in the fabrication of complete denture. Denture borders must be ended up in the soft and movable tissues so that the denture base can move freely during function without impairing peripheral seal [7]. It is not an easy task to capture the edentulous arch exactly [8].

Complete denture success mainly depends on impression accuracy [9] and thus choosing proper impression materials

is also important as well for success of complete denture. In impression making procedures for mandible must be included peripheral tracing technique with tracing compound [10].

Low fusing compound is the material used for border molding in early days. There are some materials such as auto-polymerizing resins, polyether, putty elastomeric impression materials, mouth temperature waxes and soft liner can also be used for border molding [11]. Impression modeling plastic used for border molding impression trays was introduced by the Green brothers in 1907 [12].

The most commonly used impression material in complete denture border molding was zinc oxide eugenol paste with modelling compound because of its fast setting, capability of reproducing fine details, easy handling and no significant dimensional changes after setting. Though it is an ideal impression material, its usage is contraindicated in some older patients due to its irritation to the palatal mucosa and pieces of set impression material has the risk of aspiration [13]. It is also difficult to control the borders and distortion can occur after removal from undercut. Hence the technique is a sectional molding, chair-side time is prolonged. It also requires skill and experience therefore it will be difficult for beginners to master it [9].

In both maxillary and mandibular impression, using silicone and polyether impression materials have the advantages of simultaneous molding of all border with one insertion of the tray thereby producing a great time and motion advantage [7]. Massad et al., used different viscosities of polyvinyl impression materials for border molding to produce an accurate impression of tissues that have different functional activity, character and mobility. They concluded that border molding can be

captured independently of the basal seat tissues [14].

Thus, recently as an alternative to the conventional method where borders were molded with modeling compound, polyvinyl siloxane heavy and medium body followed by light body impression material for the final impression is recommended in views of its ideal physical properties, simplicity, accuracy and convenience to the patient and clinician.

In this study, three different border molding materials: modeling compound stick, medium body rubber base and heavy body rubber base will be compared for their effects on the retention of the mandibular complete denture bases.

Materials and methods

This comparative study was carried out after approval of protocol from the Research and Ethics Committee. Fifteen mandibular completely edentulous patients (ten male patients and five female patients) were selected from prosthodontic clinic of University of Dental Medicine, Mandalay and Zi-Wi-Ta Dana Sanga Hospital, Mandalay with age ranging from 45-75 years.

The patients were selected according to the selection criteria like having healthy mucosa, well-formed mandibular edentulous arch and no signs of inflammation or flabby tissues. All patients were informed clearly about the study procedure and informed consent was obtained.

On the first visit, primary impression making was done with alginate impression material. Then the impression was poured with dental stone and close-fitting tray was constructed with self-curing acrylic resin. And then, the tray was duplicated to get three. The wire loops made of 0.8 mm gauge stainless steel were attached to each close-fitting tray at the

opposite of mid-incisal point. On the next visit, border molding and final wash impression making procedures were carried out.

For the first tray, border molding was done with heavy body rubber base (Alphasil Perfect, Muller-Omicron GmbH & Co.KG, Germany). For the second tray, border molding was done with medium body rubber base (MEDIUM VARIO, Muller-Omicron GmbH & Co.KG, Germany). And, sectional border molding was done by using softened modeling compound sticks (SYNIDENT STICK, Synimed, France) for the third tray. Patient has been instructed to perform functional trimming exercises for every border molding procedure (figure 1).

After completing the border molding, the three trays were randomly measured for retention by using Handy Analog Push-Pull Gauge with 30 minutes interval between each measurement. All readings have been recorded.



Figure 1. Medium body rubber base border

During the assessment of retention by push-pull gauge, the patient was seated in an upright position with the occlusal plane parallel to the floor.

After assessment, the tray adhesive was painted on the tissue surface of all

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trays except on the one with modelling compound stick.

Final wash impression was made with light body rubber base (Betasil LIGHT VARIO, Muller-Omicron GmbH & Co. KG, Germany) for the first and the second trays and Zinc oxide eugenol impression paste (SYNIDENT ZINCOGENOL, Synimed, France) for the third tray (figure 2).

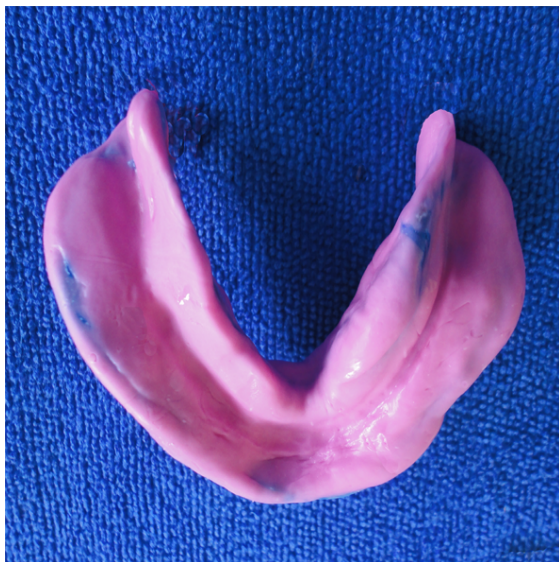


Figure 2. Medium and Light body rubber base impression

The retention was measured in the same way as that of close-fitting tray after border molding of these three impressions.

After checking the retention, the three impressions were poured with dental



Figure 3. The resultant denture base plate

stone by the method of boxing-in procedure to obtain dynamic casts. The three heat-cured acrylic denture bases were constructed with a thickness of 1.5-2 mm and the wire loops were attached to the opposite of the mid-incisal point with the help of auto-polymerizing resin (figure 3).

Then, the retention was measured as mentioned above. The best retentive base plate preferred by the patient was used in construction of mandibular complete denture.

The measurement was noted for every close-fitting tray after border molding, final wash impression and denture base plate.



Figure 4. Retention measurement on patient with Handy Analog Push-Pull Gauge

The data were recorded on the patient recording form during the intervention and analyzed by using Statistical Package for Social Science statistical software. The data were normally distributed and homogeneity of variances was verified. Therefore, analysis of variances (ANOVA) was used for repeated measures on each factor. Results were displayed by the descriptive statistics using frequency tables. The level of statistical significance was set at $P < 0.05$.

Results

This clinical study compares the effect of retention on mandibular complete denture bases by using three different border molding materials (heavy body rubber base, medium body rubber base and modeling compound stick). The results of this study are shown in table (1), (2) and (3). Data was presented as means and standard deviation (SD) values.

	Mean	S D	<i>P</i> value > 0.05
Putty rubber base	1.506	0.687	
Medium body rubber base	1.444	0.459	
Modelling compound stick	1.557	0.652	

Table (1) Mean comparison of retentive forces (kgf) among three trays after border molding with different border molding materials

	Mean	S D	<i>P</i> value > 0.05
Putty and Light body rubber base impression making	2.371	0.555	
Medium and Light body rubber base impression making	2.213	0.658	
Modelling compound stick and ZnOE impression making	2.882	0.876	

Table (2) Mean comparison of retentive forces (kgf) among three impressions after final wash impression making

	Mean	S D	<i>P</i> value > 0.05
Denture base plate of putty and light body rubber base	1.947	0.476	
Denture base plate of medium and light body rubber base	2.227	0.724	
Denture base plate of modeling compound stick and ZnOE impression paste	1.875	0.595	

Table (3) Mean comparison of retentive forces (kgf) among three resultant denture base plates obtained from the studied impression materials

The values obtained were compared as the mean forces required to dislodge the mandibular acrylic close-fitting tray after border molding. According to the tables, the mean force of (1.557 kgf) were required for modeling compound stick, (1.506 kgf) for putty rubber base and (1.444 kgf) for medium body rubber base. It was not statistically significant at the p value > 0.05 indicating that there was no difference in retention of denture base using three border molding materials.

On comparing the mean forces required to dislodge the mandibular acrylic close-fitting tray after final wash impression, the results showed that (2.371 kgf) for putty and light body rubber base impression making, (2.213 kgf) for medium and light body rubber base impression making, and (2.882 kgf) for modeling compound stick and zinc oxide eugenol impression paste, respectively. There was not statistically significant at the p value > 0.05 indicating that there was no difference in retention after final wash impression making by using different wash impression materials.

The modeling compound stick and zinc oxide eugenol impression paste impression making showed the highest mean value of retention. This was followed by putty and light body rubber base impression making. The medium and light body rubber base the lowest mean value of retention. However, on the clinical examination, the retention produced by all three final wash impression materials was satisfactory.

Finally, from the values obtained were compared as the mean forces required to remove and dislodge the mandibular trial denture base plates. It was obvious that the mean retentive force was (2.227 kgf) for base plate of medium and light body rubber base, (1.947 kgf) for base plate of putty and light body rubber base, and (1.875 kgf) for base plate of

modeling compound stick and zinc oxide eugenol impression paste, respectively. There was not statistically significant at the p value > 0.05 indicating that there was no apparent difference among these three resultant denture base plates.

The denture base plate of medium and light body rubber base showed the highest mean value on retention. This was followed by the denture base plate of putty and light body rubber base at lower mean value, and the denture base plate of modeling compound stick and zinc oxide eugenol impression paste as the lowest mean value. However, on the clinical evaluation, the retention received by the three resultant denture base plates was acceptable.

Discussion

Many authors suggested that elastomeric impression materials can be used for border molding and final wash impression. Some authors proposed the use of polyether impression material in complete denture impression making. By using these materials and techniques, the border molding impression can be done in single step and the patient's functional movement can also be captured in the impression [7].

Rizk compared the mean value of retention of complete denture and found that complete denture made by using putty and light rubber base were highly retentive than that was made by using green stick compound with metallic oxide final wash [13]. Hikmat also concluded that the denture bases produced by full putty silicone tracing material and light body silicone final impression materials showed the higher mean values of retentive forces than that of low fusing compound and metallic oxide impression paste [15].

In this study, both after border molding and final wash impression making, modeling compound stick and zinc oxide eugenol impression paste

performed better than putty, medium and light body rubber base impression making. This may be due to because of sectional application of material, it can be focused on section by section, allow the adequate space for final impression material and also the correction can be performed.

The highest retention forces were detected in the denture bases produced by border molding with medium body rubber base combined by light body rubber base final impression material as it was compared with other border molding procedure and materials. These findings are in line with the finding of Smith et al [7], Rizk [13] and Hikmat [15] who recommended the use of rubber base as a material of choice for border molding and final wash impression.

The possible factors for that higher retention forces on resultant base plate of rubber base impression materials are as follows; the entire peripheral seal was recorded simultaneously in single insertion, borders of uniform thickness with smooth continuity, the elasticity of the material also helped in accurate adaptation of the border tissues and the simultaneous muscle movement resulted in a uniform recording of periphery bilaterally which helped in achieving good peripheral seal.

While comparing the forces of retention among the three stages, final wash impression stage and resultant denture base stage showed lesser retention than border molding stage.

Apart from this, the distinct advantages of rubber base as border molding material are simplicity, ease of manipulation, decreased discomfort to the patient and short chair side time. Thus, it is clear that the recent advances in impression materials has resulted in simplified approaches to impression making in removable prosthodontics.

Conclusion

Within the limit of this study, it could be concluded that the denture bases made using medium body rubber base for border molding and light body final wash impression making showed the highest mean values of mandibular complete denture retention followed by heavy body rubber base and light body final wash. The denture bases made using modeling compound stick with zinc oxide eugenol impression paste final wash showed the lowest mean values of retention. The retention forces of all denture bases showed an acceptable retention for removable complete denture in clinical practice.

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