EFFECT OF DIFFERENT BORDER MOLDING MATERIALS ON COMPLETE DENTURE RETENTION

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ABSTRACT

The history of complete denture impression procedures has been influenced largely by the development of impression materials from which new techniques and ideas arose. The purpose of this study was to compare the retention of complete dentures made by using different border molding materials where green stick compound, medium and putty rubber base were used. The results showed that there was statistically significant difference in retention between the three materials where putty rubber base showed the highest mean value of retention followed by medium body while, green stick compound showed the lowest mean value. However, on clinical examination the retention produced by the three materials was satisfactory.

INTRODUCTION

Prosthodontists (1-5) reported that aside the technique used in complete denture construction, materials used for complete denture impression are debatable. There was an agreement all over the past decades that no impression material was an answer to all our denture problems, as any material could be of value if it was skillfully and intelligently employed.

Metallic oxide paste following border molding with green stick compound was the most commonly used impression material in complete dentures because it is fast setting, capable of reproducing fine details, easily handled and has no significant dimensional changes subsequent to hardening. However, although it is an ideal impression material its use is contraindicated in older patients as it can be irritating to the palatal mucosa and fragments of the set impression material pose a possible aspiration threat. Also it is difficult to control at the borders and may distort when removed from undercuts. Polyether or polyvinyl siloxane are more appropriate materials to be used for the older patient and for the patient with undercuts, notably dry mouth or impaired cough (6).

The correct accommodation of the impression material in the peripheral sulcus for proper retention of the dentures and comfort of the patient is achieved with the use of silicone impression material. Using silicone and polyether impression materials for border molding have the advantages of simultaneous molding of all borders of either the maxillary or mandibular impressions, accomplishing border molding with one insertion of the...
tray thus producing a great time and motion advantage, functional movements performed by the patient are used and the technique is easily mastered (7). In addition silicone impression materials can be disinfected in any of the disinfecing solution with no alteration in accuracy. Thus, recently as an alternative to the conventional method where borders were molded with modeling compound, polyvinyl siloxane putty followed by light body impression material for the final impression is recommended in view of its ideal physical properties, simplicity, accuracy and convenience to the patient and clinician. Also the putty and light bodied exhibit good dimensional stability because of the greater bond strength between materials of putty and wash consistency (8,9).

The raised purpose of this study was to compare the retention of complete dentures made by using different border molding materials. Where green stick compound, medium and putty rubber base were used.

MATERIALS AND METHODS

Ten male patients were selected from the prostodontic clinic of Faculty of Dentistry, Misr University for Science and Technology with age ranging from 50-60 years. Patients having well formed alveolar ridges including proper height and thickness, no severe undercuts or bony exostosis, firm mucosa of moderate thickness all over the denture bearing area and with no signs of inflammation, ulceration or hyperplasia were selected.

For each patient upper secondary impression was taken three times. In the first impression border molding was done using putty rubber base followed by light body rubber base final wash while, in the second impression border molding was done using medium body followed by light body rubber base final wash. Finally the third impression was taken using green stick compound for border molding followed by metallic oxide impression paste final wash.

First impression: Adhesive for silicone impressions was painted on the borders of the tray and three mm inside and outside the borders. One scoop of putty rubber base (Swiss TEC, Coltene, Whaledent, Altstatten, Switzerland) was thoroughly mixed by hands with its catalyst for 30-45 seconds then rolled and applied to all the borders of the upper tray and across the posterior palatal seal area. The tray was then inserted by a rotating motion in the patient’s mouth, oriented in position and centered over the residual ridge by finger pressure applied bilaterally just anterior to the posterior palatal seal area. The patient was instructed to half close his mouth and simultaneous molding of all the borders was carried out in one step. Labial and buccal borders were molded by moving the lip and cheeks upward, forward and downward. The patient was asked to move the mandible laterally to mold the distobuccal border by normal functional range of the coronoid process and to swallow to record the functional position of the palate. The tray was removed when the impression material has set and examined for accurate details of the border limiting structures and rounded contours of borders. Any deficient sites were corrected and any material that extended within the tray was removed with a scalpel. Also excess material that has flowed onto the external portion of the tray was removed. Adhesive was once more painted on the tissue surface of the tray and equal amounts of base and catalyst light body rubber base (Swiss TEC, Coltene, Whaledent, Altstatten, Switzerland) were mixed and placed on the tray to cover the basal surface of the tray and the borders. The loaded tray was then seated in the patient’s mouth and molding was performed in the usual manner. The completed impression was removed from the patient’s mouth and inspected for acceptability. Any pressure areas if present were scrapped and a wash was made by applying thin mix of light body over the whole impression. The tray was reinserted in the patient’s mouth centralized, adapted and supported to allow the patient to remold the impression borders.

Fig. (1) Border molding with putty rubber base.
Second impression: Medium body rubber base (Swiss TEC, Coltene, Whaledent, Altstatten, Switzerland) was used for border molding by applying three inch strip of base and catalyst and mixing it on a mixing pad thoroughly for 30-45 minutes. The mixed material was placed on the borders and across the posterior palatal seal area of the upper tray after application of an adhesive and the same steps of the first impression using putty rubber base and light body final wash were followed.

Third impression: Sectional border molding was done using softened green stick compound (Perfection, SAIC, HUBAC Buenos Aires, Argentina). The compound was applied to the tuberosity region of the tray, then glazed over the flame and tempered in hot water. The tray was inserted in the patient’s mouth and the patient was asked to protrude and move the mandible from side to side. This procedure was repeated until the compound no longer turned downward and showed a mat rolled edge. The posterior palatal seal was functionally performed by applying the green stick compound at the posterior border of the tray from one hamular notch to the other and asking the patient to swallow. Buccal and labial tracing of the tray was carried out by adding soft compound section by section to the flanges and moving the cheeks and lips upwards forwards and downwards. Any excess compound flowing onto the ridge area was scrapped using sharp knife. Metallic oxide impression paste (Cavex Outline, Impression Paste Eugenol Free, Harlem Holland) was applied over the whole upper tray which was inserted in the patient’s mouth, centralized and supported with gentle pressure. The upper lip was raised slightly to allow the excess material to escape and pulled downwards to mold the labial flange. The patient was asked to perform some facial expressions and border molding was continued in the usual manner. After setting of the impression paste, the impression was removed and inspected for any pressure areas which if present were scrapped and a wash was made by applying thin mix of metallic oxide paste over the whole impression. The tray was reinserted in the patient’s mouth centralized and supported with gentle pressure to allow the patient to remodel the impression borders.
Upper impressions were poured into dental stone to obtain master casts on which heat cured acrylic trial denture bases were constructed. Each patient received three heat cured trial denture bases constructed from three master casts poured from the three different studied impression materials. To compare the retention between the three heat cured trial denture bases of each patient the method used by Sabet (10) was used in this study. A wire loop (0.9 mm in diameter) was performed on the geometrical center of the polished palatal surface to which the hook of a force meter (graduated up to 5000 gm) was attached. A vertical downward force was applied to dislodge each trial denture base while the patient was sitting in an upright position with the occlusal plane parallel to the floor and the force meter held in the palm of the hand. Readings were recorded and the collected data was tabulated and statistically analyzed to evaluate the difference in retention of the denture bases obtained from the studied impression materials (putty rubber base and light body final wash, medium rubber base and light body final wash and green stick compound and metallic oxide past final wash). For each patient clinical evaluation of retention of the three trial denture bases was done and the patients were requested to comment on the retention of each trial denture base.
The results of this study are shown in tables I, and figure 9. Data was presented as means and standard deviation (SD) values. Data was explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests of normality. The data didn’t show a normal distribution so Friedman test was used for comparison between the three materials. The Friedman test is the nonparametric equivalent of a one-sample repeated measures design. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with SPSS 15.0® (Statistical Package for Scientific Studies) for Windows.

The mean force required to dislodge the upper trial dentures bases was shown in table I from this table it was obvious that the mean force required to dislodge the upper trial denture bases was 1311.2gms for green stick compound and metallic oxide wash and 1640.7 gms for medium and light body rubber base wash and 3401.4 gms for putty and light body rubber base wash. There was a statistically significant difference in retention between the three materials. Putty and light body rubber base showed the highest mean value. This was followed by medium and light body rubber base. Green stick compound and metallic oxide showed the lowest mean value. However, on clinical evaluation the retention received by the three denture bases was acceptable.

**DISCUSSION**

Construction of a retentive complete denture for various edentulous patients is one of the goals of prosthodontists. As an irretentive denture disturbs all other goals as speech, mastication and in turn affects patient’s psychology.

Patients with well-formed alveolar ridges were selected to improve the retention and stability of the denture bases which is an important variable during the research. On the other hand, patients with atrophied or thin mucoperiosteum were excluded since there might be a source of soreness that may affect the retentive quality (11).

In this study denture retention was measured using the previously used method by Sabet (10) to compare retention obtained from green stick compound and metallic oxide wash to that obtained from putty and medium body rubber base followed by light body wash. The obtained data from this measurement showed that although clinical evaluation

| TABLE (I) The means (gm), standard deviation values and results of Friedman test for the comparison between the three impression materials |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Green stick compound and metallic oxide wash | Medium and light body rubber base wash | Putty and light body rubber base wash | $P$-value |
| Mean | SD | Mean | SD | Mean | SD |
| 1311.2 | 1261 | 1640.7 | 1250 | 3401.4 | 1382.3 | <0.001* |

*: Significant at $P \leq 0.05$
showed satisfactory denture retention for the three materials, yet statistically significant difference in retention between the three materials was obtained. Heavy body rubber base showed the highest mean value of retention followed by medium body rubber base then green stick and metallic oxide showed the lowest mean value. This finding supports the findings of Smith et al. (7) Appelbaum and Mehra (8), Mitchener and Omori (9) and Massad and Cagna (12) who recommend the use of rubber as a material for border molding and final wash impression.

The advantages of this approach are simplicity, ease of manipulation, decreased discomfort to the patient, short chair time and accurate reproduction of undercut areas. In addition rubber impression materials provide distinct advantages as border-molding materials. The dentist can select from a number of viscosities based on the clinical conditions at hand. For example, in the typical edentulous maxilla characterized as having average ridge dimensions, high-viscosity rubber works well as a border molding material. However, with severely resorbed edentulous mandible the use of medium-viscosity increases the material flow against the less substantial tissue. The material has clinically acceptable tear strength and sufficient elasticity. When soft and hard tissue undercuts are encountered during impression making, the impression can be retrieved from the mouth with clinically acceptable elastic recovery. Sequential additions of new impression material to existing, cured material in the tray will effectively adhere when polymerized. This permits a layering or build-up approach to impression making (12). Thus it is clear that the recent advances in impression materials has resulted in simplified approaches to impression making in removable prosthodontics.

CONCLUSIONS
Within the limits of this study, the following conclusions were drawn:

1- Dentures made using putty rubber base for border molding and light body final wash showed highest mean values of complete denture retention followed by medium body rubber base with light body final wash.

2- Green stick compound with metallic oxide final wash showed lowest mean values of complete denture retention.

3- The dentures made from the three materials showed acceptable retention on clinical examination.

REFERENCES


