

Comparative evaluation of border molding, using two different techniques in maxillary edentulous arches - An in vivo study

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ABSTRACT

Background: This study was undertaken to compare the retention between sectional border molding using low fusing greenstick compound and single step border molding using condensation silicone (putty) impression material in three stages- A. Immediately following border molding, B. After final impression and C. With the finished permanent denture base.

Materials & Methods: In this study evaluation of retentive values of sectional border molding (Group I) (custom impression trays border molded with green stick compound) and single step border molding (Group II) (border molding with condensation silicone (putty) impression material). In both techniques definitive wash impression were made with light body condensation silicone and permanent denture base with heat cure polymerization resin.

Results: Group II was significantly higher (mean=8011.43) than Group I (mean=5777.43) in test-A. The t-value (1.5883) infers that there was significant difference between Group I and Group II (p =0.15). Group I was significantly higher (mean=6718.57) than Group II (mean=5224.29) in test -B. The t-value (1.6909) infers that there was significant difference between Group I and Group II (p=0.17). Group II was higher (mean=4025.14) than Group I (mean=3835.07) in test -C. The t-value was 0.1239. But it was found to be statistically insignificant (p=0.005).

Conclusion: Within the limitation of this clinical study border molding custom tray with low fusing green stick compound provided similar retention as compared to custom impression tray with condensation silicone in permanent denture base.

Key Words: Low fusing compound, maxillary edentulous arches, sectional border molding, silicone (putty) impression material, single step border molding.

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Introduction

Functioning of a complete denture depends to a great extent on the impression technique. Several impression techniques¹ have been described in the literature since the turn of this century when Greene brothers introduced the first scientific system of recording dental impression. Border molding is an important step in the fabrication of complete dentures. There are various factors associated with the retention of complete dentures, which may be broadly grouped as biological, physical and mechanical. These factors of retention can be achieved by means of an accurate border molding followed by an accurate final impression.

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.² Terminating the denture borders on soft resilient tissue will allow the mucosa to move with the denture base during functional and thereby maintain peripheral seal.

The original material used for border molding is low fusing compound³ and other materials used are autopolymerising resins, polyether, putty elastomeric impression materials, mouth temperature waxes and soft liners.⁴

Materials and Methods

The study was conducted on seven completely edentulous patients of age group between 45 to 60 yrs. The inclusion criteria were Maxillary edentulous ridges without any remarkable unilateral, bilateral or anterior undercuts, good neuromuscular control and no history of systemic diseases.

Procedure:

A preliminary impression was made with impression compound for each of the patient selected and the casts were poured in dental plaster. Two custom trays were fabricated for each patient. Two custom trays were prepared with auto polymerization resin with stops. The spacer was provided with thickness of 1.0 to 1.5 mm with additional relief of incisive papilla and midpalatine raphe and borders are 2 to 3mm short from the borders.⁴ The loops that were made out with

19-gauge stainless steel was attached to the maxillary special tray at the middle portion of the palatal surface.⁵

For the first custom tray border molding was done section wise with low fusing compound (Y Dent). For the second custom tray border molding done with putty (ZETA PLUS) in single step. After completing the border molding in two custom trays, retention was checked.

A testing device was made by fabricating two pulley units, which simulated first order of lever. The two pulley units acted as fulcrum, the pan with weight as the effort and load as the force-required to dislodge the denture. The first pulley unit was made non-adjustable where as the second pulley unit was assembled in a vertical rod that was adjustable. Both the pulley units were clamped on to the table. The adjustable vertical rod was fixed at the same level as the subject's occlusal plane, which was kept to the floor. The distance between the two pulley units and the distance between the nonadjustable pulley and the patient were maintained constant thought the study. A tension free nylon thread was passed over the pulleys. At one end of the nylon thread a loading pan was tied and the other end of the thread engaged the stainless steel loop. The patient was seated up right, erect on the dental chair. The position of the head was stabilized on the cephalostat so that the Frankfurt plane was parallel to the floor. The patient was instructed to open the mouth partially so that the tongue and lip would not come and contact with the wire (Figure No 1).

Then custom trays were placed in the patient mouth after rinsing with water and pressure was applied to seat the tray. Patient was instructed to raise his hand



Figure 1: Subject Undergoing the Test.

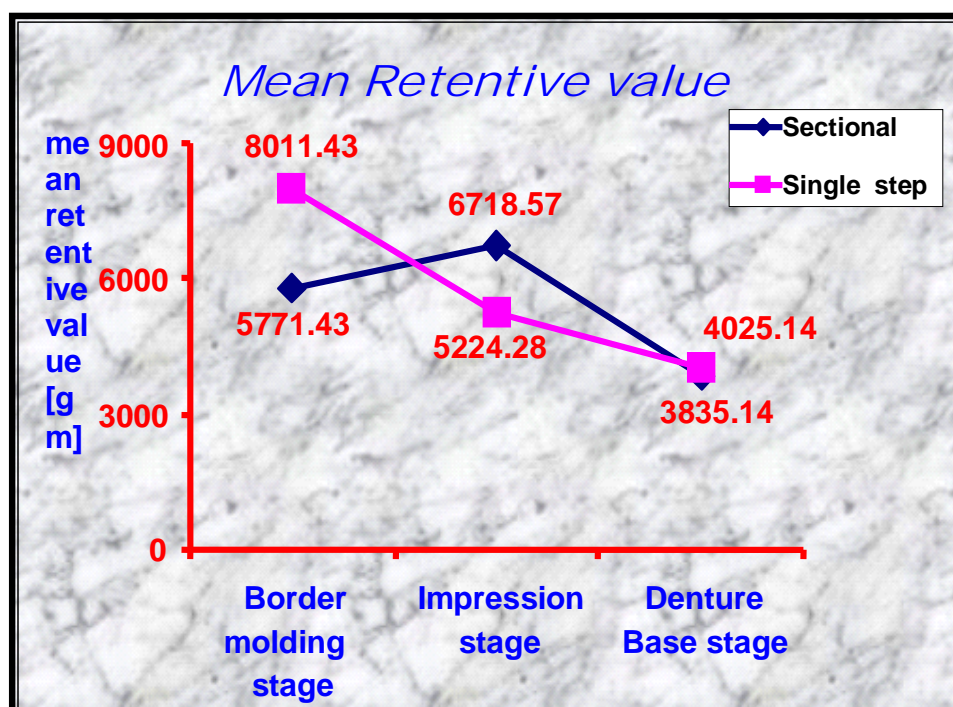
once the tray got dislodged and verified by the fall of the tray. Weights were loaded to the pan gradually and the weight at which the custom tray got dislodged was recorded. Prior to and after each test, the patient was asked to rinse his mouth with water. This was to maintain the constant quality and quantity of saliva for all the readings. After checking the retention in first custom tray the spacer was removed. Low fusing compound was 1mm scarpd⁵ off and tray adhesive was applied. Final impression was made with light-body elastomeric impression material (ORAN WASH). This impression was washed with water and placed back in to the mouth and retention was checked similar to that of the custom tray.

After checking the retention in 2nd custom tray the spacer was removed and tray adhesive (HERAEUS KULZER) was applied. Final impression was made with light-body elastomeric impression material and retention was checked similar to that of 1st custom tray. After checking the retention beading and boxing was done and cast was prepared. After complete setting of stone, the master cast was removed and denture base was fabricated, with heat cure polymerization resin with a thickness of 1.5 to 2mm thickness and the loop was attached to the middle portion of the maxillary denture base with the help of auto polymerizing resin and retention was checked similarly.

This procedure was followed for seven patients and the readings were noted for the two special trays, two impressions and two denture bases. Giving total 18 readings for each of the patient, thus 126 readings were obtained from seven patients.

Results

In this study evaluation of the retentive values of sectional border molding (Group I) and single step border molding (Group II) of seven subjects were compared at three stages 1) Border molding (test-A), 2) impression (test B), and denture base (test-C). The Table 1. Illustrates the mean retentive values (gms) of two groups in test-A and test-B and test-C. For the comparison of the data a multiple analysis were employed using student 't' test and paired 't' test with the help of statistical package for social science {SPSS} soft ware. The data in table II represents the inferential statistics for comparing two groups in test -A and test-B and test-C. Group II was significantly higher (mean=8011.43) than Group I (mean=5777.43) in test-A. The t-value (1.5883) infers that there was significant difference between Group I and Group II (p =0.15). Group I was significantly higher (mean=6718.57) than Group II (mean=5224.29) in test -B. The t-value (1.6909) infers that there was significant difference between



Graph 1: Mean Retentive Values (gm) comparing between the Groups at Three Stages (Group I & II)

Group I and Group II (p=0.17).

Group II was higher (mean=4025.14) than Group I (mean=3835.07) in test -C. The t-value was 0.1239. But it was found to be statistically insignificant (p=0.005).

Graph 1 showing the comparison of two groups at

between sectional border molding and single step border molding in three stages-

A. Immediately following border molding, B. After final impression and C. With the finished permanent denture base. The low fusing compound was used for

Table 1: Mean Retentive Value (gms)

Patient	Border molding Stage		Impression Stage		Denture Base Stage	
	Sectional	Single step	Sectional	Single step	Sectional	Single step
1	4500	10660	4750	5160	1500	2000
2	10660	12160	10250	4580	8700	8450
3	7000	7000	7580	5160	4730	5510
4	4250	4500	4250	5250	1416	2000
5	4160	8750	8850	5080	7080	6250
6	5250	8410	6500	6260	1860	1916
7	4580	4600	4850	5080	1560	2080

Table 2: t- test for three stages

Stage	Medium	N	Mean	SD	t - alue	P – value
Border molding Stage	Sectional wise	7	5771.43	2367.38	1.5883	0.15 Significant
	Single step	7	8011.43	2884.47		
Impression Stage	Sectional wise	7	6718.57	2282.71	1.6909	0.17 Significant
	Single step	7	5224.29	506.35		
Denture Base Stage	Sectional wise	7	3835.14	3038.07	0.1239	> 0.05 Insignificant
	Single step	7	4025.14	2685.96		

three stage.

The table II represents the inferential statistics for comparing two groups. Student’s t-test for individual samples is applied here. The t – value infers that there is significant difference between sectional and single step border molding at the Border molding stage and the Impression stage. But it is found to be insignificant at the Denture Base stage.

Discussion

A good and accurate impression will always ensure satisfactory retention, stability and comfort to the complete denture patient. There are various factors associated with the retention of complete denture, which may be broadly grouped as biological, physical and mechanical. These factors of retention can be achieved by means of meticulous border molding and an accurate final impression.

This study was undertaken to compare the retention

sectional border molding because of its easy manipulation properties, easy availability, popularity, and cost effectiveness.

The choice of material for single step border molding in this study was condensation silicone putty material, because of its excellent manipulative consistency, adequate working time, dimensional stability and ability of being molded with finger pressure prior to and after insertion in to the oral cavity.⁴

The most commonly used materials for final impressions are zinc oxide eugenol impression paste, irreversible hydrocolloid, polyether, light body addition and condensation silicone, soft acrylic resins and functional waxes.^{4,6,7}

In this study, light body condensation silicon was used for final impression as it is biocompatible, has good flow properties, adequate working time, and dimensional accuracy and stability and has pleasant colour and odour.

All the final impressions were recorded using selective pressure technique, which combines the principles of mucostatic and mucocompressive techniques. The advantage of this technique is that the non-stress bearing areas are recorded with the least amount of pressure and selective pressure is applied to certain areas that are capable of withstanding the force of occlusion suggested by Boucher.⁸

The material of choice for the permanent denture base was heat cure acrylic resin as it is the most widely used and universally accepted material.

Retention values at three stages: - A) border molding, B) impression and C) permanent denture base for seven selected patients were evaluated. Because the retention can be checked at this three stages. Verifying the retention at three stages helped us to evaluate whether the effect of the method of border molding is carried to further stages of dental construction or not.

Two custom trays were fabricated with auto polymerization resin. A loop was attached at the middle portion of the palatal surface^{5,9} which was the most reliable region for testing the retention of complete denture because the anterior attachment needed the greatest amount of force to dislodge the base, the posterior attachment needed the least.⁵ The custom trays borders were molded using the sectional and single step border molding technique and retention was tested using custom made testing device. Mostly testing devices are custom made^{10,11,12} and modified whipmix earpiece facebow also used⁵, but in modified ear piece facebow the subject's head position was not stable. Custom made testing device used in this study was very easy in testing the retentive values and was comfortable both the subject and the clinician. The subject's head position was stabilized by cephalostat with Frankfurt plane was kept parallel to the floor, so that vertical dislodging forces were applied to opposite path of insertion. The final impression was evaluated similarly. Later the cast was prepared and permanent denture base was fabricated with heat cure acrylic resin and the retention was tested in the same manner.

In single step border-molding technique a better retention was observed than the sectional border molding. This was because - 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, the simultaneous muscle movement resulted in a uniform recording of periphery, bilaterally which helped in achieving all-round peripheral seal.¹³

In sectional border molding the retention values were less, compared with single step border molding. It could be due to the Application of dry heat might have resulted in discrepancy in texture and flow property of material. The flow retained for a short period of time might have affected the technique. "It retains its flow for a short period that once it is displaced the surface cools and flows ceases. This causes an inaccurate impression if tissues are contacted before tray is properly seated for border molding.² When adding the material to an a tray border with an already set green stick mass, the bonding between the set and freshly added material may be compromised. This may be lead to the incorporation of errors in continuity.⁸ The softening temperature of low fusing compound may alter the tonicity of the muscle, which also results in compromising border molding. Multiple insertions during sectional border molding may alter the orientation of the tray incorporating errors.

After final impression, sectionally border molded tray performed better than the single step border molding which may be due to uniform scraping done along the border molded low fusing compound peripheries allowing adequate space for final impression material.⁸ It also aids in good flow of light body material all over the peripheral surfaces. Better peripheral seal was achieved due to more accurate recording of posterior palatal seal, which helped in improving the retention. In single step border molding using putty consistency elastomeric impression material, the peripheral areas of custom tray were not trimmed prior to the final impression. This may have resulted in altered flow of the light body material leading to variable or uneven thickness of light body, which may lead to decreased peripheral seal.

Differences in retentive values obtained from permanent denture base were statistically insignificant between the single step border molding and sectional border molding.¹⁴ While comparing the retention at the three stages border molding stage, final impression

stage and permanent denture base stage namely, the result showed less retention at permanent denture base stage. This may be because of technical errors, processing errors like those involved in packing, curing or volumetric shrinkage of acrylic resin, which resulted in improper fit of the permanent denture base with underlying soft tissue, the perfect adaptation of the denture base to the underlying soft tissues is impossible.¹⁵ Some errors might have been incorporated in the study since the application of force during the testing of retention in this study was at an angulation to the long axis, unlike the dislodging forces acting inside the mouth.

Conclusion

Under the limitations of the study, it can be concluded that the affect of retention of dentures is not overwhelmingly influenced by techniques followed and the materials used. Further clinical study is required to evaluate the long-term tissue response regarding these border molding techniques.

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