



COMPARATIVE EVALUATION OF THE EFFECT ON RETENTION OF MAXILLARY CUSTOM TRAYS BY USING TWO DIFFERENT BORDER MOLDING TECHNIQUES WITH TWO DIFFERENT MATERIALS: AN IN-VIVO STUDY

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Abstract

Aim: The aim of the study was to use different border molding materials and techniques and evaluate which has better retention on the maxillary custom tray.

Materials and Methods: In this study, 20 patients were picked on the basis of inclusion and exclusion. Both sectional border molding using low fusing impression compound as well as single step border molding using putty addition silicone was done for each patient. A digital force meter was used to record the retention of the custom trays. The hook of the digital force meter was attached to the handle of the custom tray. And the device was pulled vertically downwards till the custom tray dislodges. And the data was tabulated and statistically analysed. **Results:** The sectional border molding has more mean value (5.023), while single step border molding has the less mean value (4.39). This difference appeared to be statistically highly significant ($t= 4.19, p= 0.026$).

Conclusion: Being the traditional and oldest method, sectional border molding using low-fusing impression compound still remains the best technique.

Keywords: Border molding, Digital force meter, Impression material, Retention, Techniques.

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1. INTRODUCTION

Particularly in senior people, dental illness has a significant impact on tooth loss and can end in full edentulism. Additionally, a significant loss results in issues with speech, chewing, and other stomatognathic processes, which makes sufferers feel isolated from others.¹ The quality of life in relation to dental health will finally improve with dentition restoration.² Complete dentures can be made to accomplish this. Treatment of an edentulous patient requires high skill levels and thorough understanding of both clinical and laboratory testing, and is very technique sensitive.³

A complete denture should be aesthetically beautiful and offer retention, stability, and support. Denture retention is one of the prosthodontist's most challenging cases, as has been demonstrated. Denture therapy that can tolerate occlusal stresses, retain patients, and remain stable are considered successful.⁴ By border moulding, the tray's borders can be precisely shaped to fit the shapes of the labial and buccal vestibule. Making the final impression and moulding the border are time-honored steps in the production of complete dentures.⁵ The history of complete denture impressions goes back to a time when wood or ivory blocks were cut to fit the intraoral features.⁶ There was no established method for creating impressions before the eighteenth century. The first material used as an impression medium was beeswax.⁷ Because of a detailed understanding of the oral tissues, their behaviour, and their response to manipulation for creating impressions, more sophisticated procedures are currently used.

The Green brothers created a low fusing impression compound in 1907, which was the initial material used for border moulding.⁷ This feature makes the border moulding procedure labour-intensive and time-consuming, as well as uncomfortable

for patients.⁸ Some studies advise using a range of border moulding materials, such as polyvinylsiloxane, polyether, acrylic resin, and tissue conditioner, due to the various drawbacks it possesses. The benefit of polyvinylsiloxane material is that it has good dimensional stability and strong elastic qualities, which prevent it from experiencing noticeable deformation while printing in undercut areas. It has been said that polyether produces the greatest outcomes and is less technique-sensitive. It has the benefit of concurrently capturing all boundaries, a simple to learn technique for insertion.^{9,10}

The sectional border moulding technique using low fusing impression compound and the single step border moulding technique using Putty addition silicone were used in this study in order to compare and evaluate the retention of the special tray using two different border moulding techniques and two different materials.

2. METHOD

20 candidates who were completely edentulous pursuing prosthodontic rehabilitation were arbitrarily selected as experiment subjects from the Department of Prosthodontics of the institution. Patients with well-formed ridges without flabby tissues or bony spicules were included in the study. Two similar special trays were fabricated for each patient (Figure 2). The trays were then tried in patients' mouth and borders were trimmed almost 2-3 mm from the tissue reflection. The distal end of the trays was checked for the extension, as it should cover both the hamular notches and it should be at least 2mm beyond the vibrating line. And a hole was made in the handle of the tray for placement of the hook of the digital force meter.

With one special tray, conventional (sectional) border molding using a low fusing impression compound was completed. (Figure 3). The other special

tray was used for single-step border molding using Putty addition silicone. (Figure 4). After taking the impression using light body addition silicone with both

trays (Figure5), a digital force meter was used to record the retention of the special trays.

Table I: Grouping of the Sample

GROUP	MATERIALS	METHODS
GROUP 1	LOW-FUSING IMPRESSION COMPOUND	SECTIONAL BORDER MOLDING TECHNIQUE
GROUP 2	ADDITION SILICONE	SINGLE-STEP BORDER MOLDING

GROUP: A

Technique 1: Sectional Border Molding Technique

With Low Fusing Impression Compound:

Using one of the custom trays, the Conventional border molding technique was accomplished with low fusing impression compound. Firstly the borders were checked in the patient's mouth. Then the low-fusing impression compound was heated over the flame by rotating it. The molted compound was loaded on the peripheries of the custom tray in increments to do border molding and record the sulcus depth properly. Buccal and labial sulcus dept was recorded by moving the lips and cheeks upward, forward, and downward followed by asking the patient to protrude and move the mandible side to side to record the Hamular notches. The posterior palatal seal was functionally recorded by performing the Valsalva maneuver (Figure 3).

After removing the wax spacer, and multiple holes were drill in the special tray for relief as well as to achieve retention.

Tray adhesive was applied over the tissue surface of the special tray. That was followed by making a definite impression with the light viscosity addition silicone. After the tray was completely set, the readings were recorded using a digital force meter (Figure 5).

GROUP: B

Technique 2: Single-Step Border Molding With Addition Silicone:

Using the other special tray Single step border molding was performed with Addition silicon putty material after applying the tray adhesive throughout the peripheral region.

The putty was mixed uniformly and rolled into a cylinder and then it was adapted over the peripheral borders. Border molding movements were carried out as mentioned in Group A. (Figure4). After removing the wax spacer, multiple escape holes were drilled. Tray adhesive was then applied over the special tray. Once the tray adhesive is dried, the definitive impression with the light viscosity addition silicone was made. (Figure5)

Measuring the Retention of Special Trays:

The retention of the special tray was recorded by placing the tray in the patient's mouth and inserting the digital force meter hook into the special tray's handle. The maximum load value for digital force meter used in this study is 20kg (44lb by 0.02lb). The patient was made to sit upright with the standardized head position so that the maxilla was parallel to the floor and a force was directed perpendicular to evaluate the retention. Force was applied by pulling the digital force meter vertically downwards. (Figure6). After taking three readings for

each border molding procedure, mean was deliberated. The retention was determined by the force value that was showed on the digital force meter screen at time of special tray displacement. In this study, the force needed to displace the maxillary special tray was recorded in Newton's. The

retentive values recorded were allotted to their representing groups collected data was tabulated and statistically analyzed to determine the difference in the retention of the special tray obtained from the two different border molding procedures and materials.



Figure 1: Digital Force Meter



Figure 2: Special tray fabrication for two different border molding procedures with two different materials.



Figure 3: Border molding using low fusing impression compound (Sectional border molding technique)



Figure 4: Border molding with putty addition silicone (Single step technique)

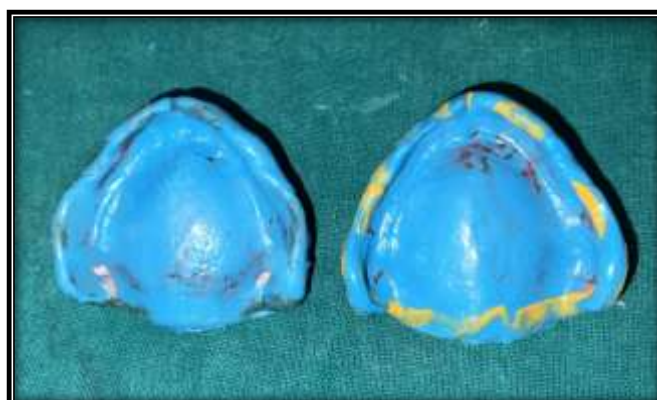


Figure 5: Secondary impression with Light Body Addition Silicone in two different Border Molding Materials



Figure 6: Recording Retention of Special Tray by Engaging Digital Force Meter

3. OBSERVATIONS AND RESULTS

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and was presented as Mean \pm SD.

Graphically the data was presented by bar diagram.

Group A: Retentive values obtained with sectional border molding technique with low fusing impression compound in Kg.

Group B: Retentive values obtained with single step border molding technique with putty addition silicone in Kg.

Table II: Descriptive analysis of sectional Border Molding (Group A)

Parameters	Value
Mean	5.023
SD	0.93
Median	5.22
Minimum	2.68
Maximum	7.41
95% CI (Lower-Upper Bound)	4.44-5.61

Table II shows that Group A has the maximum retention value of 7.41 and minimum value of 2.68 with mean value of 5.023.

Table III: Descriptive analysis of sectional Border Molding (Group A)

Parameters	Value
Mean	5.023
SD	0.93
Median	5.22
Minimum	2.68
Maximum	7.41
95% CI (Lower-Upper Bound)	4.44-5.61

Table III shows that Group A has the maximum retention value of 7.41 and minimum value of 2.68 with mean value of 5.023.

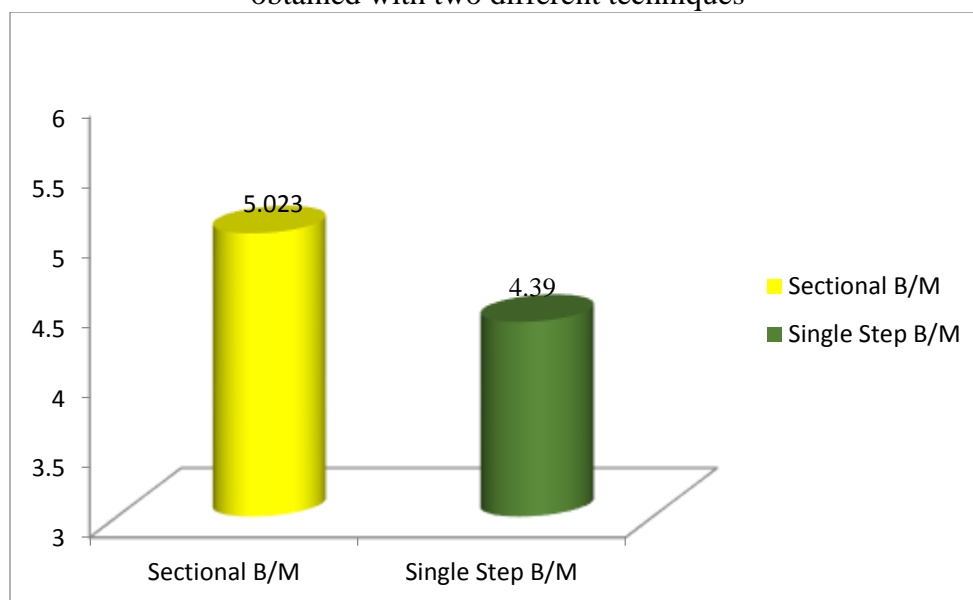
Table IV: Comparison of sectional vs single step Border molding

Group	Mean	SD	t test	p value
Sectional B/M	5.023	0.93	4.19	0.026*
Single Step B/M	4.39	1.04		

* statistically significant

Table IV shows that sectional border molding has the more mean value (5.023), while single step border molding has the less mean value (4.39). This difference appeared to be statistically highly significant ($t= 4.19$, $p= 0.026$).

Graph1: Comparison between the mean values of retention obtained with two different techniques



x-axis = two different Techniques.

y-axis = retentive values of two different techniques.

From the above graph it can be concluded that group A has more mean value than group B. Therefore, the difference between these two groups was found to be statistically significant ($P=0.026$).

4. DISCUSSION

The right to good oral and dental health belongs to everyone in the globe. Tooth loss and ageing are strongly correlated. Complete denture prosthodontics is one of dentistry's best and most crucial subspecialties.¹¹ The key elements influencing a complete denture's success

are retention, stability, and support. Retention offers the patient psychological comfort, stability offers physiologic comfort, and support ensures the prostheses' long-term viability. It is characterised as the resistance to removal in the inverse of the insertion direction.¹² Accurate border moulding and definitive

impression-making can accomplish these goals.¹³

Border moulding is described in GPT-9,¹² as "the sculpting of the border portions of an imprint material by functional or manual manipulation of the soft tissue next to the borders to mimic the shape and size of the vestibule."

According to SH Soratur¹⁴, the denture should cover the most area possible, extend to the movable tissues to establish a peripheral seal, and remain in constant touch with the tissue surface in order to have adequate retention. In complete denture prosthodontics, border moulding a custom tray is a time-honored practise to closely conform it to the tissues of the vestibule before taking the final imprint.¹⁵

The first substance utilised for border moulding was low-fusing impression compound.¹¹ It is favoured for sectional border moulding due to its simplicity, accessibility, beauty, and affordability. Numerous studies¹⁶ have tested elastomeric impression material (putty consistency) with low-fusing impression compounds in the literature and come to various conclusions. The biggest disadvantage of the putty-like consistency of elastomeric imprint materials is placement over the tray boundaries, which has thick, overextended borders and requires more time to mould into a rope.¹⁶

The retention of the unique maxillary tray was compared in this research, utilising two different border moulding techniques and two different border moulding processes. To avoid the variance in secondary impression, which could further lead to the dissimilarity in retention values obtained with these two materials, one was a sectional border moulding technique with low fusing impression compound, and the other was a single step border moulding technique using putty consistency addition silicone. In both cases, the master impression was then taken with light body addition silicone. Additionally, a hole was

drilled into the tray's handle to accommodate the digital force meter's hook. The retention of the customised tray was measured using a digital force metre by drawing it downward with vertical pressure following the conclusion of each border moulding procedure. For each tray, three readings were taken, and the mean of those values were recorded and statistically analysed as given in table IV.

In Table II, the sectional border moulding technique's maximum retention value is 7.41, its minimum value is 2.68, and its mean value is 5.023. In Table III, the maximum retention value for the single-step border moulding technique is 6.91, the minimum retention value is 2.03, and the mean retention value is 4.39. A p-value of 0.026, which is regarded as statistically significant, was found in the results. The sectional border moulding technique has better retention results than the single-step border moulding technique, as evidenced by the fact that the mean value of the sectional border moulding technique, which was 5.023, was higher than the single-step border moulding technique, which was 4.39, as shown in table IIV.

The outcomes were consistent with those of Anchal et al¹⁵, who compared and evaluated the retention of trial denture bases after heat curing the single-step border moulding technique using injectable heavy viscosity addition silicone with the sectional border moulding technique using low fusing impression compound. They came to the conclusion that, despite the retention appearing to be comparable on a clinical level, the sectional border moulding technique was more effective than single-step border moulding.

Furthermore, Yarapatineni et al¹³ compared the retention between sectional border moulding using low-fusing greenstick compound and single step border moulding using condensation silicone (putty) impression material in three stages, including A. immediately after border

moulding, B. after the final impression, and C. with the completed permanent denture base. In comparison to the single-step border moulding technique employing condensation silicone in a permanent denture base, they found that a unique tray with sectional border moulding and low fusing impression compound demonstrated higher retention values.

Following the final impression, John et al¹⁷ chose three materials to compare for border moulding. Greenstick compound, putty-type silicone, mouth-temperature wax, and a mild body wash impression were the materials utilised for border moulding. Even though silicone putty was the simplest approach to do in a single step, he came to this conclusion. However, from the perspective of a learner, the time-consuming traditional approach of border moulding with low-fusing impression cement was far preferable because any errors could be fixed.

An edentulous patient's post-insertion adjustment visits required by dentures created from low-fusing impression compound with thick body vinyl polysiloxane impression material were compared and analysed by Drago et al¹⁸ he came to the conclusion that the one-year post-insertion visits for both materials were comparable.

Sectional border moulding with low-fusing impression material, which is the conventional and oldest approach, continues to be the best way.

Limitations of the Study:

- The retentive values recorded were of the custom trays, therefore the values may differ after the complete denture insertion.
- The hook was placed in the hole made over the handle of the custom tray, hence the anterior retention was recorded instead of anterior and posterior both.
- Better head stabilization method could have been implied.

5. CONCLUSION

Within the limitations of the study, it can be concluded that:

1. Out of two techniques used, sectional border molding showed greater retention when compared to single step border molding.
2. Out of two material, low fusing impression compound showed better retention then putty addition silicone.

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