A comparative evaluation of three different techniques for single step border molding

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ABSTRACT

Statement of the Problem: *Border molding is one of the important biologic factors required to provide optimal retention of the denture by creating a peripheral seal.*
Purpose: *Previous studies have evaluated different materials individually for the purpose of border molding. The literature does not report about comparative evaluation of the efficiency of different materials for the purpose of one step border molding. This clinical study compares and evaluates the effectiveness of different materials for the purpose of one step border molding.*
Aims: *To evaluate and compare the effectiveness of different materials for the purpose of one step border molding.*
Methods and Material: *One step Border molding was completed for each subject by manual manipulation of the soft tissues adjacent to the tray borders using three different materials -1) Low fusing Impression Compound Type I b, 2) Heavy bodied Elastomeric Material : Polyvinyl Siloxane and 3) Modified Zinc Oxide Eugenol Impression Paste. Three examiners evaluated the border molding based on tissue contact, tissue displacement, bond to the tray and overall peripheral seal. Each criteria was scored on a scale of 1-5, with score 1 as bad while score 5 was considered excellent. The average of the score recorded by the three examiners for each criteria was considered.*
Results: *Heavy Bodied Elastomeric Material- Polyvinyl siloxane has the best efficiency, while Low fusing Impression Compound Type I a had the least efficiency amongst the three when used for the purpose of border molding.*
Conclusions: *One step border molding is an viable and advantageous alternative to conventional border molding (sectional border molding) as it results in reduction of chairside time, less discomfort for the patient and less efforts for the dentist.*

INTRODUCTION

Border molding is the shaping of the border areas of an impression material by functional or manual manipulation of the soft tissue adjacent to the borders to duplicate the contour and size of the vestibule.[1]

Peripheral seal is established when denture borders contact with the underlying or adjacent tissues and prevent passage of air or other substances. It is one of the important biologic factors that will provide optimal retention of the denture. Retention provides psychologic comfort to the patient and contributes dramatically to patient acceptance of the finished prosthesis.[2]

The original material used for this purpose was modelling compound, which was introduced in 1907 by the Green brothers.[3] Modelling compound is very advantageous as the material softens easily, but is quite hard at mouth or room temperature.

Peripheral areas can be molded with the least possibility of distortion or breakage of the previously completed section. Corrections or additions of the earlier molded segments can be easily accomplished. For these reasons modelling compound is still effectively used today by many dentists, and is the material of choice for teaching.[3]

The technique of using impression compound for border molding is usually divided into steps where sections of the borders are molded in separate applications. This is called as the sectional technique of border molding.

The technique for border molding taught at the University of Washington before 1976 required a minimum of 24 insertions of the trays, eight for the maxillary and16 for the mandibular, provided proper extensions were secured on the first insertion for each section.[3] Woelfel[4] and associates determined that seven dentists required an average of 17 insertions to secure a final maxillary impression on the same patient when utilizing modelling compound for border molding and impression plaster for the final impression.[4]

However, the technique of using modelling compound is difficult because the softened compound must be placed into the mouth without touching the lips, cheeks, or ridge.[3] It retains its flow for a short period of time. Therefore delay in seating the tray may lower the temperature and will often result in overextended borders. Also there is a high possibility of propagation of errors caused by discrepancy in one section affecting the border contours in subsequent sections.

An increase in the number of insertions makes the technique tedious and difficult.[3] It would be desirable if large areas or even the entire custom

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tray could be border molded with one insertion. This would result in reduction of chair side time, less discomfort for the patient and less efforts by the dentist. The technique which will allow simultaneous moldings of all borders is called one step technique having two general advantages. These are - 1) the number of insertions of the trays for border molding are reduced to one, and 2) Development of all borders simultaneously avoids propagation of errors.[5] The requirements of a material to be used for simultaneous molding of all borders are that it should (a) Have sufficient body to allow it to remain in position on the borders during loading of the tray,(b) Allow some preshaping of the form of the borders without adhering to the fingers, (c) Have a setting time of 3 to 5 minutes, (d) Retain adequate flow while seating in the mouth, (e) Allows finger placement of the material into deficient parts after seating the tray,(f) Does not cause excessive displacement of the tissues of the vestibule, (g) Be readily trimmed and shaped so that excess material can be carved and the borders shaped before the final impression is made.(h) Be sufficiently rigid after setting and trimming so that the final impression material will not crack or craze.[5] Previous studies have evaluated these materials individually for the purpose of border molding.[3,6,7] The literature does not report about comparative evaluation of the efficiency of different materials for the purpose of one step border molding.

This clinical study compares and evaluates the effectiveness of different materials for the purpose of one step border molding.

MATERIALS AND METHODS

Materials:

1. Low fusing impression compound
2. Type I b Modified Zinc Oxide Eugenol Impression Paste
3. Heavy body Elastomeric Material – Polyvinyl Siloxane

Methodology:

a. Inclusion and exclusion criteria: Subjects who presented with a well healed maxillary ridge with history of extraction six to twelve months ago, with U or V shaped arch form with normal depth of the palatal vault were included. Subjects who were old denture wearers or gave a history of pre prosthetic surgery or presence of undercuts or osseous defects (eg- tori) or any other anomalies were excluded. Patients were informed about the procedure and a written informed consent was signed by them.

b. Primary impression: Preliminary impressions were made in medium fusing impression compound type I a. Impression was beaded, boxed and poured with vacuum mixed dental plaster type II.

c. Fabrication of custom trays: Based on the principles of selective pressure technique spacer wax was adapted on the primary cast. Three Custom trays were fabricated in self cure acrylic/tray compound such that the tray extensions were 2mm short of the sulcus depth with tissue stops placed in the canine and first molar regions bilaterally. The trays were checked intra orally for each subject and adjusted for clearance in the vestibular region.

d. One step border molding: One step border molding was completed for each subject using the three different materials namely low fusing impression compound type i b, heavy bodied elastomeric material: polyvinyl siloxane and modified zinc oxide eugenol impression paste. For each subject, border molding using the three different materials was carried out at a gap of 48hours between two successive materials.

1. One step border molding using low fusing impression compound type i b: low fusing impression compound type i b available in the form of stick was finely powdered using a mortar and pestle. A 5cc syringe was then filled with the powdered compound. The compound was then softened by placing the syringe into a water bath with temperature maintained at 80^{O}C.[6] The softened compound was then syringed onto the borders of the tray .Border molding was accomplished by manual manipulation of the soft tissue adjacent to the borders to duplicate the contour and size of the vestibule.[Fig.1]

Fig.1: Border molding using low fusing impression compound type i b

2. One step border molding using heavy bodied elastomeric material - polyvinyl siloxane: heavy bodied elastomeric material - polyvinyl siloxane was used for border molding in this technique. The tray borders were coated with tray adhesive. The material was extruded onto the tray borders using a dispensing gun. Border molding was accomplished by manual manipulation as described in the method above. [Fig.2]

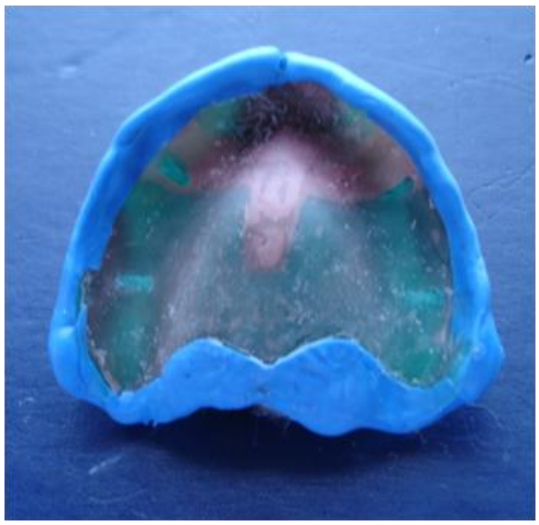

Fig.2: One step border molding using heavy bodied elastomeric material - polyvinyl siloxane

Fig. 3: One step border molding using modified zinc oxide eugenol impression paste

3. One step border molding using modified zinc oxide eugenol impression paste: modified zinc oxide impression paste was used for border molding. The filler content was increased to add to the bulk of the paste and amount of catalyst was also increased to allow faster setting of the material. The base paste and the catalyst paste were dispensed onto a glass slab and mixed with a spatula. The mixed paste was then loaded into a 5 cc syringe and syringed onto the tray borders and border molding was accomplished by manual manipulation as described earlier.[Fig.3]

e. Evaluation based on the aforementioned criteria: Three experienced prosthodontists evaluated the border molding based on the aforementioned criteria. Each criteria was scored on a scale of 1-5, with score 1 as bad while score 5 was considered excellent. The average of the score recorded by the three examiners for each criteria was considered. Criteria for evaluation included tissue contact, Tissue displacement, Bond to the tray and overall peripheral seal.

RESULTS

1. One step border molding using low fusing impression compound type I b (Table 1)

Table 1: One step border molding using low fusing impression compound type I b

Patient number	1	2	3	4	5	6	7	8	9	10	**Average score**
Evaluation Criteria Tissue contact	2	3	2	3	3	3	2	2	2	2	2.4
Bond to the tray	2	1	1	2	2	1	1	1	2	1	1.4
Tissue displacement	1	1	1	2	1	1	1	1	1	2	1.2
Overall peripheral seal	2	3	2	3	2	2	2	2	2	3	1.3

2. One step border molding using heavy bodied elastomeric material – polyvinyl siloxane (table 2)

Table 2: One step border molding using heavy bodied elastomeric material – polyvinyl siloxane

Patient number	1	2	3	4	5	6	7	8	9	10	**Average score**
Evaluation Criteria Tissue contact	3	3	3	4	3	3	3	3	3	4	3.2
Bond to the tray	4	4	4	4	4	4	3	3	4	4	3.8
Tissue displacement	3	3	4	4	4	3	4	3	4	3	3.5
Overall peripheral seal	4	4	4	3	4	3	3	4	4	3	3.6

3. One step border molding using modified zinc oxide eugenol impression paste (table 3)
The average results for the 3 materials are as shown in (table 4) and is represented as seen in (fig.4).

Table 3: One step border molding using modified zinc oxide eugenol impression paste

Patient number	1	2	3	4	5	6	7	8	9	10	**Average score**
Evaluation Criteria											
Tissue contact	3	3	4	3	3	3	3	2	3	2	2.7
Bond to the tray	2	3	2	3	2	2	2	2	3	2	2.3
Tissue displacement	4	4	4	3	4	3	3	3	3	4	3.2
Overall peripheral seal	3	3	3	3	3	3	2	3	3	2	2.8

Table 4: Average result for the three materials

Materials	**Low Fusing**	**Elastomeric**	**ZOE**
Tissue contact	2.4	3.2	2.7
Bond to the tray	1.4	3.8	2.3
Tissue Displacement	1.2	3.5	3.2
Overall peripheral seal	2.3	3.6	2.8

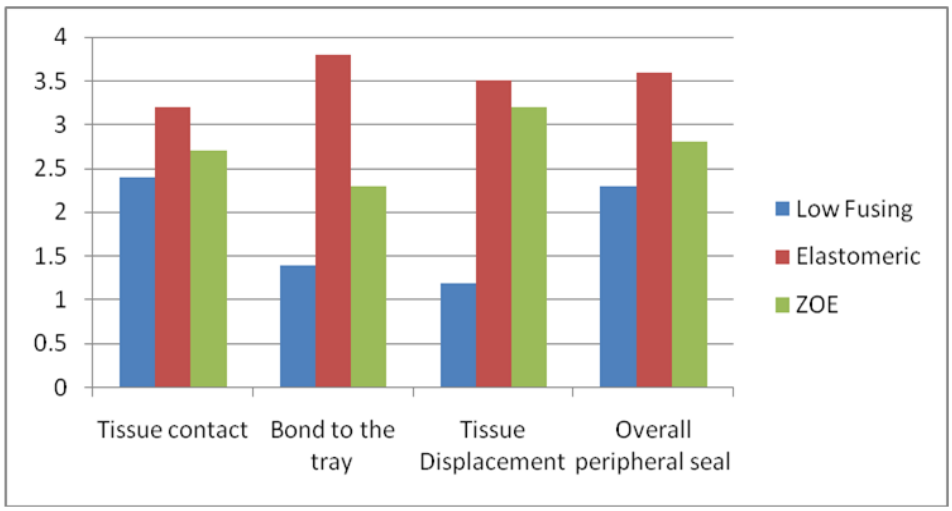

Fig.4: Graph showing results for the 3 methods used

DISCUSSION

Patients were selected according to the inclusion and exclusion criteria to obtain an ideal/optimal situation for single step border molding and eliminate any bias in evaluation and comparison due to presence of any unfavorable anatomical morphology.(eg-under cut or osseous defect)

Conventionally borders are molded using the sectional technique. Increased number of insertions makes such a technique quite tedious and difficult.[3] Also propagation of errors caused by discrepancy in one section can affect the border contours in subsequent section. Hence it would be desirable if large areas or even the entire custom tray could be border molded with one insertion. This would be advantageous in day to day practice as it results in reduction of chair side time, less discomfort for the patient and less efforts for the dentist.[5] One step Border molding should be carried out as a viable alternative to conventional border molding (sectional technique). Low fusing impression compound type I b, high viscosity elastomeric material and modified zinc oxide eugenol impression paste were used as these materials are commonly available in a daily/ day to day practice and can be used easily to carry out one step border molding. Low Fusing Impression compound type I b had the lowest efficiency as it is highly viscous when softened and it retains flow for a short time once displaced. In case of delay in seating the tray the compound cools and flow ceases resulting in inaccurate molding. Its use to a large extent is dependent on the operator.

Heavy bodied Elastomeric Material - Polyvinyl Siloxane had the best efficiency amongst the three as it has ease of manipulation, good initial flow, sets rigid and good working time required for simultaneous border molding.[5,6]

CONCLUSIONS

Within the limitations of this study, the following conclusions are drawn

1. One step border molding is a viable and advantageous alternative to conventional border molding (sectional border molding) as it results in reduction of chair side time, less discomfort for the patient and less efforts for the dentist.
2. One step border molding can be accomplished using the three routinely available materials i.e-using low fusing impression compound type i b, heavy bodied elastomeric material: polyvinyl siloxane and modified zinc oxide eugenol impression paste.
3. Heavy Bodied Elastomeric Material- Polyvinyl siloxane proved to be most efficient amongst the three when used for the purpose of border molding.

A study needs to be conducted on a larger sample size and it is needed to apply the techniques in patients with different clinical conditions.

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