Clinical demonstration of border molding using various materials: A review

Anna Jone, Ashish R. Jain*

ABSTRACT

Ideal impressions must be in the mind of the dentist before it is in his hand. He must literally make the impression rather than take it. Proper impressions are crucial in complete dentures as retention of the dentures is primarily dependent on the quality of the impressions. A good master impression will cover as much of the denture supporting areas as possible and has a good border seal. Without adequate retention, the dentures would be ill fitting, causing difficulties in speech and mastication and may even affect the physiological aspect of the denture wearer. Complete denture impression procedure has been evolving from day 1 through continuous development of impression materials. With so many materials available in the market, a dentist is spoilt for choice. Materials used in complete denture impression are however debatable as it can be agreed on that no single impression material is superior than the other. In this review, three materials have been selected to be compared for border molding followed by the final impression. The materials used for border molding are greenstick compound, putty type silicone, and mouth temperature wax followed by light body wash impression. All the three materials were demonstrated on the same patient using a special tray fabricated separately for each material. It was found that putty type silicone was the easiest to use as it can be done in a single step. However, from a learning student’s perspective, border molding using greenstick compound was much beneficial as any corrections could be rectified even though it was a time-consuming method of impression making.

KEY WORDS: Border molding, Clinical demonstration, Green stick compound, Mouth temperature wax, Putty type silicone

INTRODUCTION

An integral aspect of dentistry is the complete denture prosthodontics as complete tooth loss significantly compromises the quality of life and hence can only be improved by replacing it with a good set of dentures. An ideal complete denture should be retentive, stable, provide adequate support and be esthetically pleasing. The key in fabricating a good set of complete dentures is greatly dependent on the master impression as well as the existing ridge.1-5 Border molding according to glossary of prosthodontic terms is defined as the shaping of 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.6 Border molding is an important step in fabrication of dentures as accurate border molding will ensure in the production of an accurate final impression.7-11 The material originally employed for border molding was modeling compound used by the Green Brothers back in 1907.8-9 The technique, however, was a much tedious process as an average of 17 insertions of the special tray was needed for completion of border molding and may be tricky especially for a beginning student.9-10 Since then, many efforts have been taken to simplify the procedure without compromising the outcome. There are many techniques and materials that can be employed in border molding. However, it can be agreed on that no single technique or material is superior,11 as any material is valuable provided it is skillfully utilized. In this review, three materials used with different techniques were selected for comparison during border molding, i.e., sectional border molding technique using greenstick compound (Pyrax Polymars, Civil Lane, Roorkee, India) single-step technique using putty type silicone, and mouth temperature wax (D-R Miner, Iowa, Medford, U.S.A). These materials were used...
along with light body addition silicone (Zhermack S.p.A. Bovazecchino, Badia Polesine, Italy) as a final impression material.

MATERIALS AND METHODS

Fabrication of Special Tray

Before border molding, a well-adapted special tray of 2–3 mm in thickness should be fabricated from autopolymerizing acrylic resin (Bombay Burmah Trading, Wallace Street, Fort, Mumbai, India) [Figure 1a-c]. It has to be lined with a spacer and stoppers to ensure that the tray can be positioned properly in the mouth during border molding[1] [Figure 2a-c]. The special tray should be 2–3 mm short of the depth of the vestibules when the tissues are at rest and equipped with a handle placed in the anterior region of the tray for ease of tray placement[10] [Figure 3]. Any overextension of the special tray should be identified by checking it intraorally and all necessary adjustments should be executed before the commencement of border molding. Special attention should be given to ensure that all frenal attachments are adequately relieved.

Materials Used for Border Molding

Border molding using greenstick compound [Figure 4]

Greenstick compound (Pyrax Polymars, Civil Lane, Roorkee, India) is a Type I low fusing impression compound that follows ADA specification number 3. It is made up of three basic constituents, i.e., resins, filler, and lubricants.[11] Greenstick compound is a thermoplastic material that softens when it is heated and hardens when it is cooled and hence has no chemical reaction involved when it is setting. Greenstick compound is reusable and can be manipulated when it is heated, non-toxic, and non-irritant to the tissues has a good shelf life, economical and can be effectively used in combination with other materials for wash impression.[12]

Border molding using putty type silicone [Figure 5]

Putty type silicone (Heavy body Putty Polyvinylsiloxane Tray Material, Ivoclar Vivadent, Andheri West, Mumbai, India) is an addition silicone that was introduced after condensation silicones and has better properties than condensation silicones. Addition silicone also known as polyvinylsiloxane is an impression material that follows ADA specification number 19 consisting of a base and a catalyst that comes in separate tubes. They are dispensed evenly and are poured into the special tray to form an impression of the mouth.

---

**Figure 1:** (a) Blue colored acrylic special tray, (b) pink colored acrylic special tray, (c) green colored acrylic tray

**Figure 2:** (a) Spacer and stopper of the blue special tray, (b) spacer and stopper of the pink special tray, (c) spacer and stopper of the green special tray

**Figure 3:** Intraoral view of the special trays

**Figure 4:** Greenstick compound

**Figure 5:** Heavy body putty type silicone polyvinylsiloxane tray material with automatic dispensing device
with the help of an automatic dispensing device. It sets by a chemical reaction and hence is irreversible. It is available in various viscosities. Polyvinylsiloxane sets by additional polymerization reaction and no by-products are formed during the setting reaction. The material is hydrophilic which can be an advantage as moisture control is not critical during impression taking.

Polyvinylsiloxane has a very good accuracy, long shelf life, good dimensional stability, and a short setting time; however, it is slightly more on the expensive side.

Border molding using Iowa wax

Mouth temperature waxes are generally used in combination with other materials such as impression compound and polysulfide and are rarely used to record complete impressions. It comes in sheets or cakes and is commercially available as Iowa wax (D-R Miner, Iowa, Medford, USA). For this review, we have used Iowa wax for border molding [Figure 6].

Techniques Used for Border Molding

Sectional border molding

The technique used for border molding with greenstick compound is incremental or sectional border molding technique. In this method, border molding is done in sections, i.e., labial flange, buccal flange, distobuccal, and posterior palatal seal area. The labial flange is recorded first by softening the greenstick compound until it drooped over a flame and placed on the border of the tray corresponding to the labial flange. The greenstick compound is then rotated and pulled to prevent the formation of long strings. The greenstick compound is tempered in a bowl of warm water before placing it in the patient’s mouth to be molded. It is molded passively by extending the cheeks outward, downward, and then inward. The labial frenum is recorded accurately through a vertical motion to produce a labial notch that is long and narrow. The buccal flange is recorded one side at a time. The tempered greenstick compound is kept in the patient’s mouth and molded by retracting the cheek outward, downward, and inward. Buccal frenum will be recorded accurately by giving a horizontal and vertical motion to produce a wide V-shaped notch. The distobuccal area is then recorded by passively pulling the cheeks outward, downward, and inward.

<table>
<thead>
<tr>
<th>Year</th>
<th>Author and knjournal name</th>
<th>Materials used</th>
<th>Results</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Rizk[27] Cairo Dental Journal</td>
<td>Greenstick with metallic oxide wash impression, putty rubber with light body wash impression and medium body with light body wash impression</td>
<td>The mean forces required to dislodge the denture base for greenstick with metallic oxide wash was 1311.2 g, 1640.7 g for medium and light body wash, and 3401.4 g for putty and light body wash</td>
<td>Putty and light body rubber base exhibited highest retention followed by medium and light body rubber base and finally greenstick compound and metallic oxide.</td>
</tr>
<tr>
<td>2013</td>
<td>Yarapatineni et al.[20] Journal of International Oral Health</td>
<td>Greenstick with light body wash impression and putty type silicone with light body wash impression</td>
<td>Putty type silicone with light body wash had a higher retentive force (mean=4025.14) than greenstick with light body wash (mean=3835.07). However, it was found to be statistically insignificant ($P$=0.005)</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Al-Judy[28] IOSR Journal of Dental and Medicinal Sciences</td>
<td>Greenstick with metallic oxide and light body wash impression, putty type silicone with metallic oxide, and light body wash impression</td>
<td>Highly significant difference in retention between denture bases obtained from putty silicone border molding combined with light body and metallic oxide wash impression with a significance of $P&lt;0.05$</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Qanungo et al.[29] The Journal of Indian Prosthodontic Society</td>
<td>Greenstick with light body wash impression and polyether with light body wash impression</td>
<td>Greenstick with light body wash has a mean retention force of 9.05 kgf while heavy body with light body wash has a mean retention force of 8.26 kgf</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6: Iowa wax
The patient is also asked to open his or her mouth wide while moving the lower jaw from side to side. By doing so, the depth and width of the distobuccal flange will be delineated to accommodate the muscle attachments and movement of the coronoid process of the lower jaw. The posterior palatal seal area is the soft tissues running along the junction of hard and soft palate. It resembles a cupid’s bow and the posterior border of the posterior palatal seal should be tapering so as to blend with the palatal tissues. The posterior seal area is recorded by asking the patient to sit leaning forward while they perform the Valsalva maneuver [17].

**Single-step technique: (Using putty type silicone)**

Single-step technique border molding is possible when utilizing impression materials like putty type silicone. Here, the entire border of the special tray is loaded with putty type silicone and placed in the mouth. Passive border molding is done by pulling the cheeks and lips in an outward, downward, and inward motion followed by functional border molding by asking the patient to open and close his or her mouth, suck in his or her cheeks, pouting of the lips, and moving the lower jaw in left and right motion. With this technique, the entire border of the sulcus can be recorded by a single placement of the tray [Figure 8a and b].

**Single-step technique: (Using mouth temperature wax)**

Single step border molding was also the technique used for mouth temperature wax. The Iowa wax was first softened in a bowl of hot water so it can be loaded on the borders of the tray in a single go. The tray was then placed in the patient’s mouth where the passive border molding followed by functional border molding was done the same way as mentioned above [Figure 9a and b].

**DISCUSSION**

Proper recording of the denture bearing area in complete denture is crucial for the preservation of the health of tissues and underlying bone, function, as well as proper retention of the dentures. Border molding using greenstick compound is a time-consuming procedure as it is used in increments, and hence, the number of tray insertions increases as well. This, however, has its advantages as any corrections that are needed can be done with ease. Greentick compound is commonly used in dental schools. This could be due to the fact that greenstick compound is a relatively cost-effective material and is less technique sensitive which is ideal for a learning student.

In 2016, a survey conducted in Saudi Arabia showed that there was an increased use of polyvinylsiloxane as the choice of material for border molding rather than the traditional greenstick compound. As more new materials are being introduced, the choice of material is slowly moving away from these traditional materials. This could be mostly attributed to the fact that a good outcome could be achieved with comparatively less time expenditure as well as less inconvenience and discomfort to the patient. Apart from that, materials like polyvinyl silicone come in an automatic mixing system that ensures ease and even application of the material onto the special tray. Polyvinylsiloxane has also been reported to remain dimensionally stable for a long time (approximately up to a week). When disinfection protocols are followed for secondary impressions with polyvinylsiloxanes, the accuracy remains relatively unaffected. Pratten and Novetsky showed that polyether produced casts with finer soft tissue details. With all these factors, it is easy to see why in the past decade many dentists are starting to recommend using newer elastomeric materials.

Border molding using Iowa wax (mouth temperature
wax) had its limitations as it was extremely difficult to manipulate and use. The wax was not adapting to the borders of the special tray as well as greenstick compound and putty type silicone and hence may be the reason why there are very limited articles using Iowa wax solely as the border molding material available. It was also found that light body as a wax impression material over the Iowa wax was not ideal as the setting of the light body seemed to be hindered.

CONCLUSION

Border molding using greenstick compound and putty type silicone showed similar retention clinically with impression wax exhibiting significantly lower retention clinically. However, many articles have shown that putty type silicone exhibited the highest mean values for denture retention. Although putty type silicone was easiest to work with, we believe that for a learning student, border molding using greenstick compound would be more ideal as it is less technique sensitive and borders are recorded one section at a time which allows for easy correction of any defects. More studies will have to be done for better understanding of Iowa wax as a border molding material.

REFERENCES