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A novel technique for single step border moulding using new thermoplastic material (Polycaprolactone)

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Abstract

A well-fitting denture is important for the patient satisfaction and it can be achieved by adequate extension and reproducibility of peripheral tissues. A single step border moulding provides shaping of impression material along the borders of an impression tray by manipulating the soft tissues to duplicate the contour and size of the vestibules without propagation of errors. Over the years various materials are introduced for border moulding. In this case-report a new thermoplastic material (PCL) is used as single step border moulding as PCL is biocompatible, reusable and cost-effective material.

Keywords: Single step, border moulding, thermoplastic, polycaprolactone

Introduction

The well-fitting denture is always the prime requirement for edentulous patients and for that retention of the denture is of prime importance. Retention is defined as the resistance to displacement away from tissue surface. Retentive denture requires effective atmospheric pressure which is also called as emergency retentive force and is effective only when there is an adequate peripheral seal as well as post palatal seal.

The process of shaping impression material along the borders of an impression tray by manipulating the soft tissues to duplicate the contour and size of the vestibules is known as border moulding [1].

Conventionally border moulding is performed using low fusing impression compound, as introduced in 1907 by the Green brothers [2]. This technique for border moulding using low fusing impression compound is usually divided into various steps where sections of tray borders are moulded in multiple applications and there by establishing PPS as a continuation of border moulding as was proposed by Boucher. Over the years, the sectional border moulding method has proved disadvantageous due to an increase in the number of insertions that makes the technique tedious, erroneous and difficult [3].

It would be desirable if large areas or even the entire custom tray could be border moulded with one insertion. This would result in reduction of chair side time, patient's discomfort and efforts of the dentist. The technique which will allow simultaneous mouldings of all borders is called one step technique having two general advantages. These are-

1. The number of insertions of the trays for border moulding is reduced to one.
2. Development of all borders simultaneously avoids propagation of errors.

Drago [4] compared the number of post-insertion adjustments required with dentures made from border moulded definitive impressions made by using the sectional technique with the number required with dentures made using the single-step technique. No significant differences were found in the number of post-insertion visits in 1 year for dentures made by either technique.

With the introduction of the single step technique, elastomers (polysulfide, polyether, or polyvinyl siloxane impression materials) have gained popularity as a border moulding material. Elastomers exhibit a high degree of accuracy, dimensional stability, ease of manipulation and adequate working and setting time [5]. Hard acrylic resin and silicone materials have been used for this purpose and both have serious deficiencies [6].

Limitations of these materials include the odour and staining associated with polysulfides, the inadequate working time of polyether, and the thick and over-extended borders obtained

Because of the putty-like viscosity of polyvinyl siloxane [5]. Single-step border moulding is more Technique sensitive, as the entire vestibular sulcus and posterior palatal seal area need to be recorded accurately in a single insertion. Hence, the material used for this technique should provide optimum working time, have adequate body, and permit the correction of border moulding by additions. However additions if made to a single step border moulded material would again introduce all the disadvantages that are associated with sectional moulding. In cases where over-extensions or corrections need to be done in single step border mouldings, it would be prudent to remove the entire material and then repeat the border moulding with fresh materials as in case of elastomers, acrylics or Type II zinc oxide eugenol pastes. However in these cases using fresh material is often perceived as non-economical by the dentist. Hence there is a need for a material that can be used for single step border moulding satisfying the properties needed for a single step border moulding material as well as can be reused for the same patient in case of any discrepancies. One such material that satisfies these requirements is thermoplastic Polycaprolactone (PCL).

Polycaprolactone (PCL) is a biodegradable polymer that has been intensively investigated as a biomedical material. It is biocompatible, has good water, oil, solvent and chlorine resistance, low melting point, low viscosity, mechanically strong and is easy to process. The toxicology of PCL has been studied as part of the evaluation of Capronor (the biodegradable polymer system for the sustained subdermal delivery of contraceptive steroids, it is currently regarded as non-toxic and tissue compatible. PCL is especially appealing for such applications as it also has the lowest unit price amongst all of the common off-the-shelf biodegradable polymer products [7].

A simplified technique for single-step border moulding is presented here by using Polycaprolactone (PCL) thermoplastic border moulding material.

Technique

1. Make maxillary and mandibular preliminary impressions by using adequately extending stock edentulous trays and irreversible hydrocolloid impression material (algitec). Mark the anterior and posterior vibrating lines on the soft palate by using indelible pencil (Indelible Pencil; Lee Mark) and transfer the lines to maxillary impression to outline the posterior palatal seal area.
2. Pour the primary casts in Type II gypsum (Kalrock; Kalabhai Karson) and mark the outline of the custom tray and spacer on primary cast. Uniform polyethylene Spacer is adapted on diagnostic cast to provide relief to the underlying important structure. Four tissue stops are made, two in the canine region and two in the molar region. After that custom tray is fabricated using auto-polymerizing tray material (acrylic resin tray material). Adjust the borders of the custom impression trays 2 mm short of limiting structures on the casts, except in the posterior palatal seal and retromolar pad areas. Verification of the custom trays is done intraorally to eliminate over-extended or under-extended borders and confirm adequate relief for frenal attachments. Remove the tray from the oral cavity, wash it under running tap water, and dry it with compressed air.
3. Beads of Polycaprolactone are put in hot water in a temperature regulated bath [figure 1]. Kneading is done till a homogenous soft mass is obtained. The mass will

lose the opaque white hue and become transparent during the process.



Fig 1: Beads of Polycaprolactone are put in hot water

4. Now material is moulded with wet fingers into a thin rope and then placed on the borders of the flanges of the tray. Take care that the borders are dry to enable the material to stick to the tray border. The soft and workable nature of the material facilitates adaptation and shaping on the borders of the custom tray. Adapt the material to the posterior palatal seal area outlined by the anterior and posterior vibrating lines [figure 2].

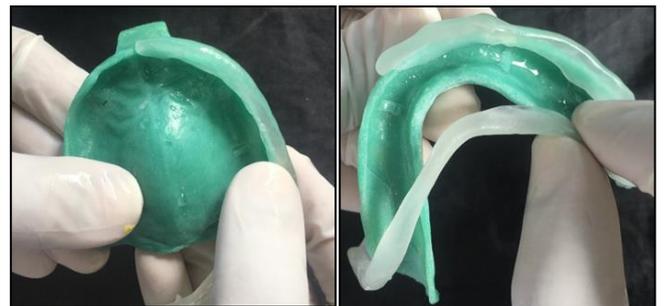


Fig 2: Manipulation of material and adapting it on borders of the custom tray



Fig 3: Border molding done with polycaprolactone]

5. Place the custom tray on the maxillary edentulous ridge and carry out the single-step border moulding procedure by following established clinical guidelines for manual and perform functional movements for border moulding. When the material becomes opaque white, the tray is removed from the mouth. Verify the retention and adequate peripheral seal in the custom tray [figure 3]. After that remove spacer and make relief holes and then apply silicone adhesive before making final impression.
6. Make the maxillary and mandibular final impressions with low-viscosity polyvinyl siloxane material (honigum;

DMG). Continuously mould the borders during the maxillary and mandibular final impressions [figure 4].



Fig 4: Final impression with low-viscosity polyvinyl Siloxane material

Discussion

Various attempts have been made to simplify complete denture fabrication by modifying steps and materials. Single step border moulding is more straight forward than sectional border moulding owing to the reduced number of tray insertions and avoids propagation of error. This technique is usually used with elastomeric impression materials, which may not provide sufficient time to mould the material intraorally, not allow preshaping of the form of the borders without adhering to the fingers and record the peripheral tissues of the denture bearing area.

The present technique uses thermoplastic tray material (polycaprolactone) for moulding tray borders, offering extended working time, is cost effective and is less time consuming. Furthermore, correction of border moulding is possible as polycaprolactone is reversible material and with the addition of new material also. The technique uses materials that are readily available, and no special armamentarium is required for manipulation of material.

Clinical studies should be conducted to compare the retention and tissue reproducibility of denture bases fabricated using this and other single step techniques of border moulding.

Summary

A simplified technique for single step border by using polycaprolactone is described in this article. The technique is straightforward and can be performed easily with routinely available dental equipment and material is cost effective which makes this the material of choice for single step order moulding procedures which can be mastered easily.

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