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Review Article

Clinical guide to border moulding and secondary impression in complete dentures

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ABSTRACT

One of the major reason for a successful denture treatment is a good impression and the cast made out of it. It's a well known fact, that the denture can only be as good as the impressions made. Therefore, attention to every detail and depth of the impressions plays a pivotal role for a successful clinical result, for which border moulding is an essential procedure for the same. Impressions convey operator's extent of knowledge, understanding and the clinical results that can follow. A combination of a sound knowledge, along with acquired skill, experience, and patience can result in a successful and aesthetic prosthesis with adequate retention, stability and support with minimal post placement corrections. This article gives an insight into the necessary requisites to be followed during border moulding and secondary impression in making of a successful complete dentures.

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1. Introduction

Impression is a negative likeness or copy in reverse of the surface of an object.¹

Accurate impressions are to be greatly emphasized as dentures are made on the casts obtained from them. Recording of all the denture bearing tissues for complete dentures is important from many aspects like health of the tissues, function and retention of dentures as quoted by M.M. Devan – “Ideal impression must be in the mind of the dentist before it is in his hand”.^{2,3} This article gives guidelines for perfecting the art and science of border moulding and impression making for complete dentures.

1.1. For complete denture fabrication, the following two impressions are mandatory:

1.1.1. Primary (preliminary) impressions

Primary impression is the first working impression that is made after detailed case history recording. It is made using stock impression trays. The impression is poured using dental plaster to obtain a cast which is called Primary (preliminary) cast.

1.1.2. Secondary (final) impressions

Secondary impression is made using a custom tray that is fabricated on the primary cast. The impression is poured using dental stone to obtain a cast which is called secondary (master) cast.

1.2. Steps in making impressions

1. Preliminary examination of the patient
2. Positioning of the patient
3. Positioning of the operator

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4. Selection of Primary impression tray / Stock tray
5. Selection of the primary impression material
6. Making of primary impression of maxillary and mandibular arch
7. Fabrication of custom trays
8. Clinical verification of custom tray extensions
9. Border moulding of maxillary and mandibular arch
10. Selection of the secondary impression material
11. Making of secondary impressions of maxillary and mandibular arch

1.3. Preliminary examination of the patient

The operator must record detailed case history of the patient including extra-oral and intra-oral findings to enable choose a suitable impression material and technique.

1.4. Position of the patient

Patient to be made to sit in upright position to avoid gag and the impression material. The head and neck of the patient to be in line with the trunk to avoid neck pain. The occlusal surface of the patient to be at the level of the elbow of the operator. This allows comfortable and a clear working view for the operator.⁴ Chair height is modified as follows: for the mandibular impression - the patient's mandibular arch should be at the level with operator's elbow, for the maxillary impression-the patient's maxillary arch should be at a level with the operator's elbow.

1.5. Position of the operator: (Figure 1)

The primary cause of operator's musculoskeletal problems is faulty operator working posture.⁵

Therefore it is important to follow the correct operator position as mentioned.

For the mandibular impression, the operator should be in front of the patient and on the right side at 7 o'clock position for right handed operator. Left side at 5 o'clock position for left handed operator.

For the maxillary impression, the operator should be to the right and a little behind the patient at 11 o'clock position for right handed operator. Left side at 2 o'clock position for left handed operator.

1.6. Selection of primary impression tray/stock tray

An impression tray is the primary factor in accurate impression making. It is a receptacle which is used to cany, confine, control and make the impression. Primary impressions are recorded with stock trays which follow the outline of the denture-bearing area.⁶ The aim is to gain proper extension without distorting movable tissues and to provide uniform thickness of the impression material. If the impression material between tissues and tray is too thin, it may get distorted on removal or during cast pouring.

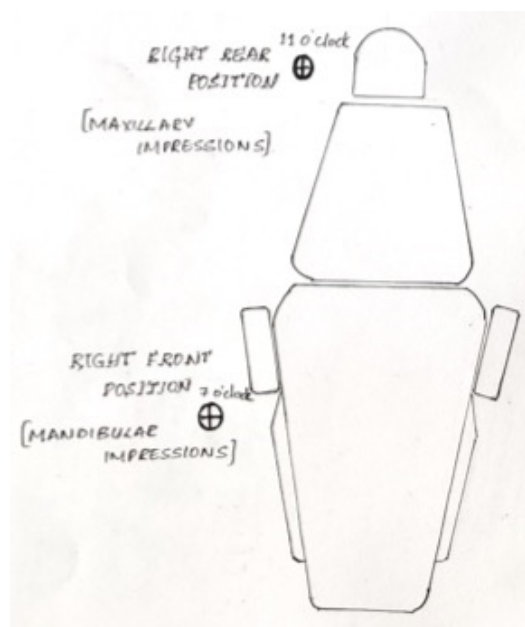


Fig. 1: Operator position while making impressions

However, if it is too thick, it may displace or distort movable tissues. Selection and adjustment of the tray plays a significant role in making an impression.⁶

The parts of an impression tray includes body and handle. The body consists of floor and flanges.

Stock trays can be classified as:

1. Perforated tray- for alginate / elastomeric impression material (Figure 2 a)
2. Non-perforated trays- for impression compound (Figure 2 b)

These can be made of either metal or plastic. Metal is preferred over plastic as rigidity of the impression tray is the prime requirement for a dimensionally stable impression.

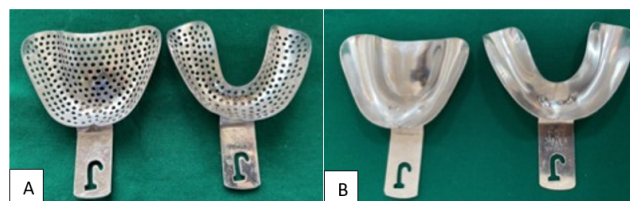


Fig. 2: a: Stock trays (Perforated); b: Stock trays (Non perforated)

To select the correct stock tray, a divider can be used. For the maxillary arch, the divider tips are placed in disto-buccal vestibule next to the tuberosity and the same width stock tray is selected. For the mandibular arch, the divider tips are placed in disto-lingual vestibule under the retro molar pad and the same width stock tray is selected. The stock tray should cover all the anatomical landmarks and should provide 4-5mm space for the impression material

1.7. Selection of Primary impression material

Selection of materials for primary impression making for complete denture depends on the preferred impression technique customised for the patient:

1. Alginate – indicated for patients with oral conditions like severe undercuts, hyperplastic tissue, knife edge ridges where mucostatic impression is preferred.
2. Putty material- when moderate undercuts are present where mucocompressive impression is preferred
3. Impression compound- when mild undercuts are present where mucocompressive impression is preferred

1.8. Making of primary impression of maxillary and mandibular arch

Primary impression is made with stock trays using mucostatic or mucocompressive impression technique with appropriate impression material as required. Primary cast is made from this impression using dental plaster/dental stone.

1.9. Fabrication of custom tray

A custom (special) tray should be constructed, according to the guidelines for border moulding. (Figure 3)

Custom trays can be made of

1. Autopolymerising Polymethyl methacrylate (PMMA resin)
2. Visible Light cure di-methacrylate resins
3. Pikka tray material - chemical cure poly-methyl methacrylate
4. Tray compound
5. Thermoplastic resin
6. Shellac base plate

For ease of custom tray removal from the primary cast, all deep undercuts and tissue irregularities if present should be adequately relieved or blocked out using baseplate wax. This is often referred to as blocking out of primary cast.



Fig. 3: Custom trays

Space for the secondary impression material has to be created. This wax is commonly called as "spacer."⁷

Different spacer designs like full spacer and partial spacer (I spacer, T spacer, mushroom spacer) have been advocated by various authors. The most commonly used spacer design is Boucher's spacer design for selective pressure technique which advocates application of one of baseplate wax thickness on the entire basal seat area except posterior palatal seal area and on mandibular ridge except buccal shelf area and retromolar pad of the primary cast. J.J.Sharry advocates placement of four tissue stops, 2 mm in width extend across the crest of the ridge from buccal to palatal / lingual aspect located in molar and cuspid regions. These tissue stops are intended to help in orientation of the custom trays and to maintain uniform thickness of secondary impression material. Additional wax called "relief wax" is applied in areas where excessive relief is required (eg. flabby tissues, deep tissue undercuts etc.,)

An outline denoting tray extension is marked on the primary cast 2mm short of the vestibule another line 4mm short from the sulcus depicting spacer outline is marked. The tray should be about 2 -3 mm thick with rounded edges. Tray handle should be 3-4 mm thick, 8-10mm in height, 8-10mm in width. The angulation of tray handle should mimic the position of anterior teeth. For maxillary tray, the handle should be angulated to about 10-15⁰ and for mandibular at 90⁰. Horizontal grooves may be made on the handle for better handling and grip.

1.10. Clinical verification of custom tray extensions:⁸

The custom tray is placed in the patient's mouth and checked for:

1. Stability- The tray should be checked for any movement against horizontal forces.
2. Tray borders must be smooth and rounded.
3. There must be enough clearance for labial, lingual and buccal freni.
4. Tray flange should be 2mm away from the sulcus throughout- (labial sulcus, buccal sulcus, lingual sulcus).
5. Posterior extension of maxillary custom tray should be till the hamular notch covering the tuberosity on either sides and posterior vibrating line.
6. Posterior extension of mandibular custom tray should cover the retromolar pad without interfering with the pterygomandibular raphe.

1.11. Border moulding of maxillary and mandibular arch:⁸

Border moulding is defined as shaping of the border areas of an impression tray by functional or manual manipulation of the tissues adjacent to the borders to duplicate the contour and size of the vestibule.

Border moulding can be performed by two techniques:⁹

1. Single step or simultaneous border moulding.
2. Incremental or sectional border moulding.

1.12. Single step or simultaneous border moulding:

In this technique, putty consistency of polyether or polyvinyl siloxane can be used.

The border moulding material is placed on the entire periphery of the custom tray and is refined in a single step.

1.13. Advantages:

Less clinical time.

Less possibility of error if placed correctly.

1.14. Disadvantages:

It requires skill and expertise (once moulded cannot be re-moulded/ modified).

1.15. Incremental or sectional border moulding:

In this technique, low fusing compound (green stick) is the material of choice. Other materials like tissue conditioners, waxes and resins can also be used. The border moulding material is placed incrementally over the periphery of the custom tray and refined sectionally. The sequence of border moulding is as follows.

1.16. Border moulding of maxillary arch:¹⁰ (Figure 4)

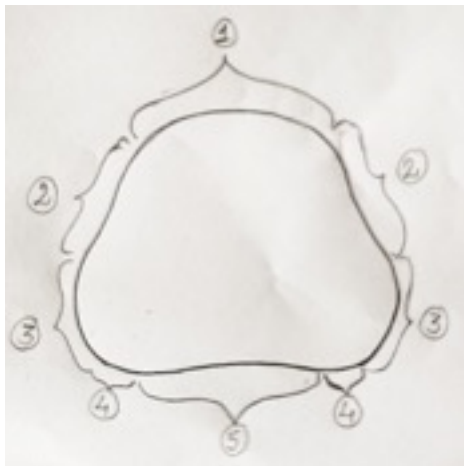


Fig. 4: Steps in maxillary border moulding

The maxillary arch border moulding can be completed in 6 steps as follow: (Table 1)

Border moulding of Mandibular arch:¹⁰ (Figure 5)

The mandibular arch border moulding can be completed in 8 steps as follows: (Table 2)



Fig. 5: Steps in mandibular border moulding

1.17. Check the border moulding: (Figure 6)

Smooth, uniform, rounded and matt appearance of green stick indicates correct border moulding. If shiny surface, it indicates improper moulding. Correction to be done by either resoftening the green stick material or by extending the borders - whichever is required.



Fig. 6: Border moulded custom trays

After completion of border moulding, the patient should be able to touch the entire upper lip with the tongue without displacement of the tray.

1.18. To check the retention after border moulding:

1.18.1. Maxillary tray

Resistance to upward and forward force on the handle indicates good PPS in the maxillary impression.

Resistance to downward force on the handle indicates correct labial border extensions and seal.

Resistance to buccal /lateral force indicates good border seal posteriorly.

1.18.2. Mandibular tray

Resistance to downward and forward force on the handle indicates good posterior seal of impression.

Resistance to upward force on the handle indicates correct labial border extensions and seal.

Table 1: Border moulding of maxillary arch

S. No	Anatomical area	Limiting structures	Method of moulding / activating
1	Labial vestibule	Labial frenum Orbicularis oris muscle	The lips are first elevated upward and outward and then retracted downwards and inwards. Material is pushed on either side of the origin of frenum to create the anterior seal by moulding the insertion area of the frenum.
2	Buccal Vestibule	Buccal frenum/freni Orbicularis oris muscle Buccinator muscle	Cheek is moved backwards and forwards. The cheek is elevated upward and pulled outward and then retracted downward and inward.
3	Disto-buccal vestibule	Buccinator muscle Coronoid process of the mandible	The cheek is elevated upward and outward and then retracted downward and inward with mouth half open and move the mandible laterally
4	Distal region	Pterygomaxillary raphe	Ask patient to open mouth wide "AAH" sound in normal unexaggerated manner
5	Posterior vibrating line	Junction of the posterior border of the aponeurosis and the muscular part of the soft palate	Patient is told to make "ah" sound in normal unexaggerated manner
6	Anterior vibrating line	Junction of the anterior border of the aponeurosis and the posterior border of the hard palate	Patient asked to say "AH" with short vigorous bursts /perform the Valsalva maneuver which consists closing the mouth and blowing out air through the nose.

Table 2: Border moulding of mandibular arch

S. No	Anatomical area	Limiting structures	Method of moulding / activating
1	Labial vestibule	Labial frenum Orbicularis oris muscle	The lips are first elevated upward and outward and then retracted downwards and inwards
2	Buccal Vestibule	Buccal frenum/freni Orbicularis oris muscle Buccinator muscle	Cheek is moved backwards and forwards. The cheek is elevated upward and pulled outward and then retracted downward and inward.
3	Disto buccal vestibule (masseteric notch)	Masseter muscle influencing the buccinator	Ask the patient to open mouth and close under finger pressure on the posterior finger rests
4	Distal region	Pterygo-mandibular raphe	Open mouth wide
5	Anterior lingual sulcus/ Sublingual flange area (from premolar to premolar are)	Genioglossus muscle Geniohyoid muscle	Patient is asked to protrude the tongue for the length of the flange and wipe the lip from side to side and to touch the anterior part of the palate for the width of the flange.
6	Middle lingual border / Mylohyoid region of lingual flange (premolar to molar area)	Mylohyoid muscle	Patient is asked to place the tip of the tongue in the upper opposite buccal sulcus for length Tip of the tongue in opposite lower buccal sulcus for the width.
7	Posterior lingual border/ retromylohyoid fossa area	Retromylohyoid curtain influenced by Superior constrictor medial pterygoid muscle	Patient is asked to swallow and to open the mouth and protrude his tongue and to close the jaw against pressure by operator placing index and middle finger on either side of the arch above the custom tray in the molar regions, move the tongue to the right and left buccal vestibules.
8	Retromolar pad	Muscle fibres of buccinator, temporalis, superior constrictor and pterygomandibular raphe	Open mouth wide

Resistance to Buccal /lateral force indicates good border seal posteriorly.

1.19. Materials for secondary impression making are

The materials used for secondary impression are

1. Zinc oxide eugenol impression paste
2. Light body Elastomeric impression material
3. Alginate impression material
4. Impression waxes

Zinc oxide eugenol impression paste is the most popular material for recording secondary impression in complete dentures.

1.20. Making of secondary impressions of maxillary and mandibular arch

1.20.1. Preparing the border moulded custom tray

The wax spacer is removed and 3 escape vents are made with no. 6 round bur in the midpalatine raphe area and one next to the tissue stops preferably, for maxilla. For the mandible, atleast 2 escape vents are made on the crest area on either side to permit excess material to flow out preferably next to the tissue stops.

1.21. Secondary impression

The impression that represents the completion of the registration of the surface or object. It is an impression made for the purpose of fabrication of the master cast on which the prosthesis is fabricated. This impression is made with custom tray / individualised tray (Figure 3) using selective pressure technique.

1.21.1. Mixing, loading and impression making

Zinc oxide eugenol impression material or light body consistency of addition polyvinyl siloxane material can be used according to manufacturer's instructions. The homogenous mixture is loaded in to the special tray and covering the borders. The tray with loaded impression material is inserted into the patient's mouth, correctly centered (using the tray handle and labial frenum as a reference) and seated in position. Tissue function is simulated by repeating all the border moulding movements and pressure is maintained till the material sets. The tray is withdrawn and the impression is rinsed in water, followed by careful examination of the impression surface. (Figures 7 and 8) If accurate, then the impression is disinfected before proceeding for pouring of dental stone to obtain a master cast.

1.22. Recent advances in materials

1. Dustless alginate



Fig. 7: Secondary impression with Zinc oxide eugenol impression paste

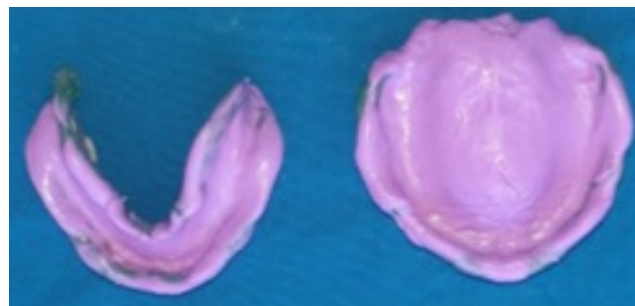


Fig. 8: Secondary impression with light body material

2. Chromatic alginate
3. Extended pour alginates (Millenium alginates)
4. Two paste alginates
5. Self disinfected alginate
6. Alginate with poly acrylamide
7. Flavoured alginate
8. Tray adhesive for alginate
9. Light activated polyether
10. Vinyl polyether siloxane

1.23. Recent advances in making secondary impression utilizing digital intraoral scanner

Computer-aided design and computer-aided manufacturing (CAD/CAM) technology is used in fabricating complete dentures. A special scan retractor is used in retracting the mobile tissues of lips, cheeks and vestibule while taking a digital impression. Complete dentures can also be fabricated with CAD/CAM technology using a traditional clinical recording method and scanning them.¹¹

2. Conclusion

As the saying goes – “A good impression lasts forever”. The same way obtaining a perfect impression makes the treatment successful. There are different materials and techniques available for impression making. For accuracy, one should know which material and technique best suits the condition of the patient. Knowing the intricate details

and steps to be followed in recording the impressions helps to ease the process and also in the success of the treatment.

3. Source of Funding

None.

4. Conflict of Interest

The authors declare no conflict of interest.

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