



Research Paper

Impression Techniques for Patients with Limited Mouth Opening- A Review

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ABSTRACT: Limited mouth opening is a common occurrence in prosthodontic practice. It may occur due to burns, genetic disorders, oral cancers, scleroderma, surgical treatment for neoplasms etc. The prosthetic treatment of such patients presents difficulties in all the stages of rehabilitation. This mainly leads to compromised impressions and prosthesis. Traditional impression methods were extremely cumbersome and it is very difficult for proper tray insertion and alignment. Mouth opening smaller than size of the tray is a challenging factor for a prosthodontist. This will affect fabrication of a successful prosthesis. It may be necessary to modify the standard impression techniques to fabricate a prosthesis successfully. Digital impressions represents a new technology to replicate hard and soft tissue virtually and will provide high accurate images. It also enables to see positive images and magnify, evaluate and correct immediately before submitting to the laboratory. A broad search of published literature was performed using the keywords impressions, limited/restricted mouth opening, microstomia, trismus, sectional tray, hybrid impression and digital impressions from 2000 to 2021 in Medline, Google scholar and internet. This article aims to review and give basic knowledge of various modifications of the standard impression methods, digital impressions and hybrid impression techniques for patients with limited mouth opening.

KEYWORDS: Impressions, limited/restricted mouth opening, microstomia, trismus, sectional tray, hybrid impression, digital impressions

Received 15 Nov., 2022; Revised 28 Nov., 2022; Accepted 30 Nov., 2022 © The author(s) 2022.
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I. INTRODUCTION

The common causes of limited mouth opening include congenital disorders, infections, trauma, iatrogenic, neoplasia, chemotherapy, radiotherapy, temporomandibular joint disorders, drugs, psychogenic and oral sub mucosal fibrosis.^[1] Another cause of the decreased range of opening is the tetanic contraction of the masseter muscle that can occur during bruxism or mechanical trauma.^[2] All prosthetic procedures require wide mouth opening in order to obtain perfect impressions. Different modifications are necessary to achieve a successful prosthesis. The custom made impression tray for impression making may help to resolve such issues. Several custom trays are available on the market varying in size, design and elasticity, but it is still not suitable for all extremely restricted cases. Intra oral scanning and digitalized three dimensional printing technologies had been incorporated in order to achieve good and perfect digital dental models in a short time. Analog techniques requires experienced prosthodontist and dental technicians and may compromise patient's comfort, so digitalizing the area of interest might overcome the shortcomings.^[3,4] This article reviews various modifications of the standard impression methods, Digital impressions and hybrid impression techniques for patients with limited mouth opening.

II. MATERIALS AND METHODS

Electronic databases were searched using Medline, PubMed, and Google for the keywords: impressions, limited/restricted mouth opening, microstomia, trismus and digital impressions from 2000 to 2021. Selection criteria included case reports and review articles focusing mainly on the impression techniques of patients with restricted mouth opening and its recent advances. The majority of the selected articles were case reports. So for summarizing various techniques, it was explained under 3 headings: Analog, Digital and Hybrid technique.

III. ANALOG TECHNIQUE

1. SECTIONAL TRAY TECHNIQUES

Priorities must be established based on the restorative and reconstructive needs of the patient. In the laboratory, the tray is usually placed and removed from the cast in a vertical motion. In a mouth with limited opening, a more horizontal motion was used. Tray should be designed in such a way that it precisely fits and separates easily in the mouth. Any locking mechanism that aids to fit but limits separation should be avoided.^[5] Sectional trays are of different types. They can be either segmented anteroposteriorly or mediolaterally.

1.1 Anteroposteriorly sectioned stock trays

Two identical stock trays were selected. The first set of tray was cut anteroposteriorly in two sections with a disk following a line that bisected the tray into one-third and two-third pieces passing to the right side of the midline. The larger section of the tray included the handle. The second tray was cut anteroposteriorly to the left side of the midline. Right and left side impressions were taken separately using elastomeric impression material. First, the right side of the impression was poured with dental plaster. After it was set, the left side of the impression was positioned on the cast and poured, ensuring not to displace the cast seated in the impression and was held with finger pressure until plaster was set.^[6, 7, 8]

1.2 Mediolaterally sectioned stock trays

In this technique, the selected stock tray was sectioned mediolaterally. The impression was made in the posterior segment first, and then the anterior segment was used to make impression with the posterior impression in the mouth. Both the impressions were taken out separately, assembled, and then poured with dental plaster.^[6]

2. TECHNIQUE USING IMPRESSION COMPOUND

This techniques can be done either by taking a sectional impression, which was trimmed to the midline. Then, the impression of the other section was made with impression compound. Both the impressions were removed and reassembled outside the mouth and was poured to obtain a preliminary cast or by dividing the ridge into three segments, two posterior and one anterior extending between canines. Impression compound was shaped corresponding to these segments to obtain segmental impressions.^[9,10]

3. TECHNIQUE USING VARIOUS CONNECTIONS

3.1 Orthodontic expansion screw

The use of an orthodontic expansion screw (2 guide pins and a screw) without the screw axis, serves as a guide or key and keyway to fabricate a split custom tray. Preparation of a butt joint along the 2 pieces of a maxillary tray. The expansion screw is placed vertically in the handle of the custom tray to accommodate the limited space. The length of the guide pins in the expansion screw can be reduced for easier insertion and removal if necessary. Maxillary and mandibular trays require different locations for the key and keyway. For the maxillary tray, the holes must be located in the overlay piece and the guide pins are placed in the other half for better access. For the mandibular tray, guide pins are placed in the overlay piece and holes are located in the other half^[11, 12]

3.2 Cross pins and slots

Cross-pin placed on one section and slot placed on the other section of the handle of the tray. Impression compound was used to make preliminary impressions and tray sections were reassembled extra orally.^[13]

3.3 Magnets

In this technique, a magnet was embedded in acrylic formed around the handle of one-half of the cut stock tray and a metal plate was attached on the other half. After the sectional impressions were made, the two halves of the impression were aligned outside the mouth aided by the magnetic attraction^[14]

3.4 Interlocking type of a handle

Handle functions as an anterior lock and has two parts, the male and the female unit. The male unit has an external and an internal flange having an interconnecting isthmus, the female unit has an internal recess of which the terminal ends approximate the width of isthmus. The press button functions as a posterior lock and has a male and female part. These buttons are commercially available.^[11, 15]

3.5 Spring

After fabrication of a custom tray, a V-shaped slit was made in the middle producing a locking mechanism. Then free ends of the spring were fixed to the left and right sides of the modified custom tray with self-curing acrylic. This tray can be bent according to the clinician's needs and reassembled upon the residual ridge, using the V-shaped slit at the midline as guidance.^[16]

4. FLEXIBLE TRAY TECHNIQUES

4.1 Flexible impression trays

In this technique, a non-rigid tray was fabricated using Putty material. It was mixed in sufficient quantity to cover all the important anatomic regions of the arch and allowed to polymerize, and then tray was removed

filled with injectable silicone material to obtain a more detailed impression. Stabilization of the tray had to be done by placing it into a nondisplacing mix of dental plaster before it was poured.^[6, 8, 11]

4.2 Flexible plastic trays

Horse- shoe- shaped flexible plastic tray was selected. Round bur was used to make holes. Impression was taken using silicone putty impression material. Loaded tray need to be squeezed in order to insert through the limited oral opening. After material was set, it was removed later, a wash impression was made using light body silicone impression material.^[17]

4.3 Reinforced flexible impression trays

Flexible impression tray was made using putty silicone material. Then a 19- gauge orthodontic wire was formed into a “U”- shape corresponding to the arch form. A cross bar made of the similar dimension wire was soldered to connect the two arms of the horseshoe wire. This was encapsulated with auto polymerizing resin for additional strength. This was incorporated within the putty impression while it is polymerizing in the mouth. This helped in preventing the excess flexibility of the impression and prevented it from distortion while removing from the mouth.^[6]

IV. DIGITAL TECHNIQUE

Data acquisition can be obtained via medical scans and surface scans [Medical scans includes computed tomography (CT), cone beam computed tomography (CBCT) or magnetic resonance imaging (MRI) and surface scanners include laser scanners, structured light scanners, facial scanners and intraoral scanners]. Photogrammetry—the extraction of three-dimensional measurements from two-dimensional images of the anatomical parts using specific software—is also used in producing 3D surface models of patients. Designs were fabricated using CAD software. After obtaining a model of the prosthesis or the cast, fabrication was done either by the conventional workflow or directly by 3D printing. This integrated technique reduces chair time and improve patients comfort.^[3, 18, 19]

V. HYBRID IMPRESSION TECHNIQUE

Adali et al reported inaccuracies were found while scanning functional areas such as the oral vestibule and error accumulation due to a large area scan (stitching of multiple images), so a combined digital pickup and functional impression showed better results.^[4]

Stapleton reported a case where he had used hybrid digital technique. Initially intraoral scans of both arches were taken but was unable to capture everything required due to limited opening. So he incorporated an altered cast impression technique. Where he combined the impression and printed cast to allow fabrication of a hybrid altered cast.^[20]

VI. CONCLUSION

Limited mouth opening poses problems during the fabrication of prostheses and it was difficult by using conventional procedures. Since impressions were the first step, operator should have a proper knowledge regarding various methods. Using a sectional, flexible, locking custom impression tray results in an accurate impression for such patients. Major drawbacks are additional time, materials, labor and patient discomfort. This leading us to digital workflow. But in this era, a small percentage of dental offices own a digital scanner and fewer have a 3D printer, a design software, CAD-CAM milling unit. So modified analog-digital techniques bridging the available analog and digital technologies can help us offer a lot more to our patients.

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