An innovative approach to the prosthodontic management of Class III mandibular defect

ABSTRACT
Class III mandibular resection due to surgical treatment of jaw tumor produces a discontinuity in the mandible which is severely incapacitating to the patient. It leads to a deviation and rotation of the mandible which depends on the amount of tissues resected the manner of surgical site closure, loss of proprioceptive sense of occlusion, the presence, and condition of teeth, and the time of initiation of prosthodontic therapy. These put together makes the task of prosthodontic rehabilitation quite arduous. Guide flange prosthesis is a comparatively simple and cost-effective method of restoring the esthetics and function to an acceptable level. This clinical report describes an innovative and simplified approach to impression making (sectional two-step impression) to minimize trauma to the underlying and circumoral fragile tissues postsurgery, and to the fabrication of buccal guide flange (wrought wire supported and reinforced guide flange) for prosthetic rehabilitation of a patient with Class III mandibular resection.

Keywords: Class III mandibular defect, sectional 2 step impression, wrought wire supported guide flange

INTRODUCTION
A Class III resection produces an imperfection in the normal contour of mandible in the midline or farther toward the intact side, leaving half, or less of the mandible remaining.[1] This discontinuity enfeebles the patient with marked facial disfigurement, decreased masticatory function secondary to unilateral closure, altered occlusion, diminished speech ability, impaired deglutition, weakened coordination of tongue and teeth, and compromised control of salivary secretions.[2‑4]

The consequential deviation, postmandibulectomy, is toward the defect and emerges when to gain primary closure of surgical defect the margins are drawn closer to it. Radical neck dissection in combination with mandibulectomy minimizes available tissue for wound closure and maximizes deviation [Figure 1]. Further, there is a loss of pterygoid muscles on the side of resection thereby altering the mesiolateral movements of the jaw. This is accompanied by inferior rotation of the mandibular occlusal plane due to displacement by the pull of suprahyoid musculature and rotation around the fulcrum of remaining condyle. In addition, loss of elevator muscles and temporomandibular ligament on the defect side allow mandible to fall vertically away from its normal position due to effect of gravity. The deviation compounded by rotation results in loss of intercuspation on the palatal aspect of the remaining posterior teeth. The maximum intercuspation position shows a shift toward the resected side with loss of the normal shield pattern of envelope of motion in the frontal plane.[5] Moreover, the mandible does not move toward the unresected side and in saggital plane the protrusive excursions are lost.[5]

Saumya Pandey, Sushil Kar1, Naresh Kumar Sharma2, Arvind Tripathi1

Department of Prosthodontics, Purvanchal Institute of Dental Sciences, Gorakhpur, 1Department of Prosthodontics, Saraswati Dental College and Hospital, Lucknow, 2Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, BHU, Varanasi, Uttar Pradesh, India

Address for correspondence: Dr. Saumya Pandey, Department of Prosthodontics, Purvanchal Institute of Dental Sciences, Gorakhpur, Uttar Pradesh, India.
E-mail: drsaumyapandey@gmail.com

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The objectives of a prosthesis placed on the defect side in such a situation are cosmetic replacement of missing teeth and adjacent structures to support normal facial contours, program the muscles to closure at a more normal position, and prevent supraeruption of opposing natural teeth.\(^6\)

**CASE REPORT**

**History and clinical examination**

A 45-year-old man was referred to the Department of Oral and Maxillofacial Surgery, Saraswati Dental College, Lucknow, India, by a dental practitioner, with the chief complaint of pain in the right posterior region of lower jaw for 15 days. The pain was dull and nonradiating and increased during meals. Patient’s history indicated an episode of trauma to which he lost the mandibular anterior teeth 15 years ago. He had a habit of tobacco chewing 8–10 times daily for the past 25 years and smoking 5–6 bidis (unfiltered tobacco) daily since 20–25 years. He kept tobacco in the lower buccal sulcus. The patient, a watchman, came from a poor socioeconomic status and mentioned that to keep him awake during the night hours, he indulged in tobacco chewing and smoking.

Extraoral examination showed no obvious facial asymmetry and no lymph nodes were palpable. Intraoral examination revealed a very poor oral hygiene status, missing mandibular anterior teeth 33, 32, 31, 41, and 42 following trauma; mobile teeth 44, 46, 47; nonvital 12; and white patches over the anterior teeth 33, 32, 31, 41, and 42 following trauma; mobile teeth 44, 46, 47; nonvital 12; and white patches over the lower buccal sulcus. The patient, a watchman, came from a poor socioeconomic status and mentioned that to keep him awake during the night hours, he indulged in tobacco chewing and smoking.

Surgical intervention

Incisional biopsy was carried out on the right side and excisional biopsy on the left side. Following incisional biopsy, the lesion was diagnosed as squamous cell carcinoma of alveolar mucosa which comprises about 10% of all oral malignancies\(^7,8\) and occurs more frequently in lower jaw in molar region. The lesion may be flat, ulcerative, or exophytic and tend to spread rapidly.\(^9\) Hemimandibulectomy with supraomohyoid neck dissection of the right side was planned and performed as definitive surgical treatment.\(^10\)

Surgery was carried out under general anesthesia, part preparation was done with betadine, the patient was draped and extended submandibular incision was given about four fingers width below the lower border of mandible to save marginal mandibular and cervical branches of facial nerve and have better exposure in a curvilinear fashion extending just below mastoid process to the midline, and later, lip split was done by extending this incision vertically in midline. The skin was deepened through platysma throughout its length and upper skin flap was elevated with allis forcep and layer-wise dissection was carried out further to expose submandibular gland along with associated lymph nodes of Level I \(a\) and \(b\). Dissection was carried out along internal jugular vein and Level II and III were also separated and removed. Following neck dissection, a lip split incision was given to facilitate hemimandibulectomy which was then carried out with a Gigli saw. Wound was closed in a layer-wise manner and suction drain was placed to avoid wound dehiscence.

**Physical therapy**

Following surgery, the patient was referred to the Department of Prosthodontics at the same institute. Physical therapy was initiated a week after surgery and involved gentle pushing of mandible away from the defect; opening of mouth as wide as possible while holding the mandible to stretch the musculature and resection site and repeated opening and closing while maintaining the mandible in its normal position.

**Prosthodontic evaluation and rehabilitation**

Three weeks after surgery, the patient was examined for rehabilitation. The surgery resulted in a Cantor and Curtis Class III defect. Although he reported pain over the suture line, yet the healing was satisfactory. The mandible had only six teeth remaining, i.e., 34, 35, 36, 37, and 38, deviated toward the defect side and had scissor’s bite. As suggested by Robinson and Rubright, the patient was evaluated for fabrication of guidance prosthesis by manually guiding the mandible to centric occlusion.\(^11\) It was observed that the patient lacked the motor coordination to close to centric occlusion but was amenable to guidance. An interim prosthesis was planned to guide the mandible to a more normal position during the healing phase. This was a maxillary Hawley’s appliance with a palatal flange and was to be replaced by a definitive cast partial prosthesis with buccal guide flange in mandibular arch and a maxillary Hawley’s appliance.

**Impression making**

Preliminary impressions for the prosthesis fabrication were made in alginate (Zermack, Germany) wherein the mandibular impression presented certain difficulties. In the absence of teeth and bone, the tongue virtually behaved as a fluid and expanded to obliterate the lingual vestibule. In addition, the movements of the tongue were discordant and forceful enough to push the dentulous stock impression tray and prevent its correct seating. A resected mandible
on the right, edentulous ridge in the midline and remaining mandibular teeth on the left side contributed to an uneven occlusal plane and made it arduous to provide a consistent thickness of impression material throughout the impression in a stock tray. The intricate job was further impeded by lingual inclination of remaining teeth (34, 35, 36, 37, and 38) due to rotation of mandible which interfered with the seating of tray. Moreover, the fragile and compromised tissues in the midline due to lip split incision did not allow manipulation of lips and cheek needed to secure a complete impression without eliciting pain, thereby reducing the patient cooperation.

To achieve a complete extension, impression technique for the mandibular arch was modified. Instead of making an impression of the whole arch in a stock tray, two sectional impressions were made in alginate: one for right side incorporating the edentulous region in the midline and dentulous segment up to tooth 36 (impression A) and the other for dentulous segment from 38 to 34 and extending past the midline to cover the edentulous portion (impression B). They were poured in improved dental stone and casts thus obtained were labeled as Cast A and Cast B [Figure 2]. The sectional impressions needed a smaller tray, lesser quantity of the impression material, did not impinge on the intraoral tissues, and facilitated correct seating due to more degrees of freedom. A saw cut was made between 35 and 36 at a 90° angle to the central fossa of 36 and median groove of 35 on both the sectional Casts A and B [Figure 2]. The fragments were named A\textsubscript{1}, A\textsubscript{2}, B\textsubscript{1}, and B\textsubscript{2}. The portions A\textsubscript{1} and B\textsubscript{2} were joined with cyanoacrylate resin (Fevikwik) [Figure 3]. Double thickness of base plate wax was adapted on the cast thus obtained. Two orientation stops were cut over buccal cusp of 34 and distobuccal cusp of 37. A self-polymerizing acrylic resin custom tray was fabricated over it, trimmed finished, to make putty wash impression and final casts were poured.

**Palatally based interim guidance prosthesis**

Jaw relations were recorded by gently guiding the mandible to the position desired postoperatively, i.e., intercuspating on the nonresected side and casts were articulated. Wrought wire clasps were adapted to maxillary posterior teeth and maxillary Hawley’s appliance was made. The bony undercut below mandibular posterior teeth was blocked out with wax and a palatal ramp was added to Hawley’s appliance on the nonresected side. The prosthesis was inserted in patient’s mouth, was worn during the healing period till the completion of definitive guiding prosthesis [Figure 4].

**Definitive prosthesis**

The framework design as dictated by the basic prosthodontic principles included rigid major and minor connectors to support and stabilize the prosthesis, clasping of as many teeth as possible to retain it, and a guiding mechanism to guide the resected mandible in place. According to design, it is a Class II removable partial denture with buccal guide flange on the nonresected side. Surveying was done to locate and measure the retentive undercuts, determine areas of tooth/bony interferences that may prevent insertion of denture along its selected path, identify proximal tooth surfaces that can serve as guide plane and for tripodning the cast.

**Procedure**

Mouth preparation included oral prophylaxis of remaining teeth, composite restoration in Class V cavity in 34, long occlusal rest seat preparation on mesial fossae of 35 and 37, and on distal fossae of 34 and 36. Following mouth preparation, single mix impression (addition silicone medium body) was made in custom tray. Maximum soft tissue coverage was attempted since some extension into the soft tissue areas on the resected side was tolerable and the casts were poured. The framework was designed to have lingual plate major connector, embrasure clasps on 34, 35 and 36, 37, and
a strut on the buccal aspect of 36 and 37 to support wrought wire reinforced guide flange. It was fabricated, finished, polished, and checked in the mouth for positive contact with teeth. The buccal strut should contact the teeth but not engage any undercut.

Jaw relations were recorded by manipulating the mandible to intercuspation on the nonresected side. In teeth arrangement, although the metal base rested on the ridge, the wax rim extended past the remaining mandibular ridge onto the soft tissue. This extension beyond the bony resection termed an outrigger makes the placement of more number of teeth possible, thereby improving the esthetics.[8] In the finished dentures, slight space exists beneath the outrigger when the tissues rest, yet during function, the soft tissues contact the undersurface of the prosthesis.

**Fabrication of guide flange**

A 17-gauge wrought wire was bent as “W” and soldered to the buccal strut using silver solder. Autopolymerizing resin was added over this reinforcement in dough stage and guided maxillomandibular movements performed. The resin was allowed to progress to complete polymerization extraorally. It was finished and polished after 8 h to allow polymerization shrinkage to occur and residual stresses to release [Figure 5]. Since the mandible presents an angular path of closure the extension extends superiorly in a diagonal manner and allows for the normal overjet and overbite of the maxillary teeth. The prosthesis was tried in the patient’s mouth and care must be taken not to impinge the gingivae of maxillary teeth [Figure 6].

**DISCUSSION**

Functional rehabilitation of mandibular discontinuity is perplexing. Although surgical reconstruction with free flaps have significantly reduced the incidence of these defects, the cost of reconstruction, unavailability of efficient surgical/prosthetic setup at primary treatment center, and absence of any insurance coverage are the prime deterrents to these surgeries in developing countries, especially more so in patients of poor socioeconomic status. Resection of a major portion of mandible is indicated when invasion is strongly suggested by clinical or radiographic evidence.[10] There were chances of tumor cells extending along the inferior alveolar nerve and jeopardizing an apparently safe margin of resection since the tumor extended from canine to first molar region, and close to the inferior alveolar nerve canal. Immediate reconstruction with either a stainless steel/titanium reconstruction plate or microvascular free flap was not done since the facility for evaluation of frozen section of tissue adjacent to the margin could not be availed due to financial considerations. Placement of a recon plate or microvascular reconstruction is advised only if further radiotherapy is not required in the postoperative phase.[12,13]

The surgery produced a discontinuity defect along with the rotation of mandible. The prosthodontic treatment for the patient was aimed at achieving acceptable occlusal relationship and minimizing the resultant deviation till definitive surgical treatment was done. Early initiation of postresection physical therapy helps reposition the mandibular fragment toward a more normal position and to minimize the effect of scarring that will make deviation more severe and less amenable to prosthodontic intervention.[5,14]

The treatment modalities advocated for discontinuity defects include intermaxillary fixation, removable guide flange prosthesis, implant supported prosthesis, and palatally based guidance prosthesis. Intermaxillary fixation to minimize deviation complicates feeding. Implant supported prosthesis could provide replacement to only three anterior teeth; moreover, radiation therapy postmandibulectomy does not favor implant prosthesis. A palatal guide as definitive...
prosthesis does not contribute to the replacement of teeth and
to the esthetics. Hence, mandibular guide flange prosthesis was
selected over other treatment modalities as resection guidance
restoration is considered only in the absence of primary wound
complications and presence of mandibular teeth.\[11\]

Acrylic guide flange offers the advantage of periodic revision
and adjustment as an improved relationship is obtained. It
is cost effective and is spared of the technique sensitivity
of a metal guide flange. An acrylic flange during periodic
adjustment becomes thin and loses strength; hence, an
innovative approach to the fabrication of guide flange
was attempted. An autopolymerizing acrylic guide flange
reinforced with wrought wire was made to overcome this
disadvantage. The wrought wire bent as “W” provides
reinforcement as well as a base to add the acrylic while
developing the flange.

At the insertion appointment, occlusal relationships should
be checked. Furthermore, the soft tissue extensions on the
defect side should be carefully verified for impingement
by the prosthesis as these tissues may have little sensory
innervations and might not elicit pain immediately in
response to trauma.

CONCLUSION

Guidance therapy is most successful in patients where the
resection involves only bony structures with minimal sacrifice
of tongue, floor of the mouth, and adjacent soft tissue.
A wrought wire-based guide flange is an innovative, cost
effective, and simple modality to restore the function and
esthetics of patient with discontinuity defect [Figures 7 and 8].
Nevertheless, surgical reconstructions offer best prognosis
in resurrecting the condition to near normal.

Declaration of patient consent

The authors certify that they have obtained all appropriate
patient consent forms. In the form the patient(s) has/have
given his/her/their consent for his/her/their images and other
clinical information to be reported in the journal. The patients

Figure 5: Cameo surface of the prosthesis

Figure 6: Guidance prosthesis during closure

Figure 7: Preoperative photograph of the patient

Figure 8: Postoperative photograph of the patient
understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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