

Prosthodontic Management of Segmental Mandibulectomy Patient with Guidance Appliance and Overlay Denture

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Abstract Patients who undergo segmental or hemi-mandibulectomy suffer from various postoperative problems in esthetics and function. The solution to such problem is providing a mandibular guidance appliance to correct mandibular deviation to resected side due to loss of muscle action on the affected side. This article describes the treatment of a female patient who underwent segmental mandibulectomy on right side secondary to adenoid cystic carcinoma of the base of tongue. An acrylic guidance appliance was constructed to help control the mandibular deviation and co-ordinate masticatory movements. The prosthesis was worn continuously by the patient for 1 month which corrected the occlusion on the left side. To compensate for the open-bite caused due to rotation of mandible following partial mandibulectomy, an overlay removable partial denture was given. The patient was satisfied with the improvement in esthetics and mastication.

Keywords Segmental mandibulectomy · Guidance appliance · Frontal plane rotation · Open bite · Overlay denture

Introduction

The sequelae of mandibulectomy or disabilities resulting from resection include impaired speech articulation,

deviation of mandible during functional movement, compromised control of salivary secretion, difficulty in swallowing, problems with mastication and severe esthetic disfigurement. Improving esthetics and mastication are the reasonable objectives in these patients. As Curtis and Cantor [1] said, one of the most difficult areas in maxillofacial prosthodontics is the rehabilitation of patients with radical surgery for carcinoma of tongue, floor of mouth and mandible.

Case Report

A 40 year old female patient reported to the Department of Prosthodontics, Tamilnadu Government Dental College & Hospital, Chennai with complains of difficulty in mastication due to deviation of lower jaw and unesthetic appearance. The treatment history included resection of the right side base of the tongue along with segmental mandibulectomy due to adenoid cystic carcinoma of the base of tongue, modified radical neck dissection, reconstruction with pectoralis major myocutaneous (PMMC) flap and post-operative radiotherapy. She was diagnosed to have a lateral discontinuity defect of the mandible following right mandibular resection posterior to the premolars.

Intra-oral examination revealed resection of the right side of the mandible along with the dentition posterior to the second premolar, resection of right side base of tongue and reconstruction. The bony mandible was resected completely from the premolar region along with the ramus and the condyle. Partial glossectomy with base of the tongue resection was done on the right side. The tip of the tongue was not involved. The resected area was reconstructed with the PMMC flap. There was rotation of the mandible to the right side also leading to an open-bite on

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Fig. 1 Pre-treatment frontal view of the patient



Fig. 2 Pre-treatment intra-oral view

the right side progressively increasing from anterior to posterior teeth and impaired occlusion on the left side. In the maxillary arch, the right molars were absent (Figs. 1, 2).

The extent of mandibular deviation was measured both extra-orally and intra-orally. Extra-orally the deviation of the mandibular midline from the facial midline was around 5 mm at rest and the deviation increased progressively with opening. Intra-orally the maxillary dental midline approximated to 1 mm from the mesial incisal edge of the mandibular left lateral incisor.

The treatment plan was to fabricate a mandibular guidance appliance or an acrylic guiding flange to guide the mandible following frontal plane rotation. A mandibular guidance appliance was fabricated in two parts. The first part consisted of buccal and lingual flange, extending into the buccal and lingual sulcus, connected with two stainless steel wires on the occlusal surface passing in between 1st

and 2nd premolars, and first and second molars and the second part is the actual flange which guides the mandible. After the mandibular guidance therapy, there was residual open bite on the right side. This residual open occlusal relation on the right side was planned to be corrected using an overlay denture in the mandibular arch.

The detailed steps in treatment of mandibular deviation and deranged occlusion included the following.

Fabrication of Mandibular Guidance Appliance

Fabrication of the 1st Part of Guidance Appliance

The preliminary impressions were made in stock tray with irreversible hydrocolloid (Zelgan Plus, DENTSPLY India Pvt.Ltd, Gurgoan, India) (Fig. 3) and casts were poured in type III dental stone (Kalstone, Kalabhai Karson Pvt. Ltd, Mumbai, India).

The mandibular cast was duplicated for fabrication of the first part of the guiding flange and on the duplicated mandibular cast, two 19 gauge stainless steel connecting wires were placed from the buccal to lingual sulcus crossing the occlusal surface interdently between the 1st and 2nd premolars and first and second molars. The wax-up of the buccal and lingual flanges connected by the wires was done using modelling wax (The Hindustan Dental products, Hyderabad, India). This part was processed in heat cure acrylic resin (DPI Heat Cure, Dental Products of India, Mumbai, India), finished and the fit was checked in the patient (Fig. 4a, b).

Fabrication of the 2nd Part of Guidance Appliance (The Guiding Flange Part)

The next step was to manipulate the mandible to the un-resected side to a static centric position and obtain



Fig. 3 Preliminary impression made with irreversible hydrocolloid

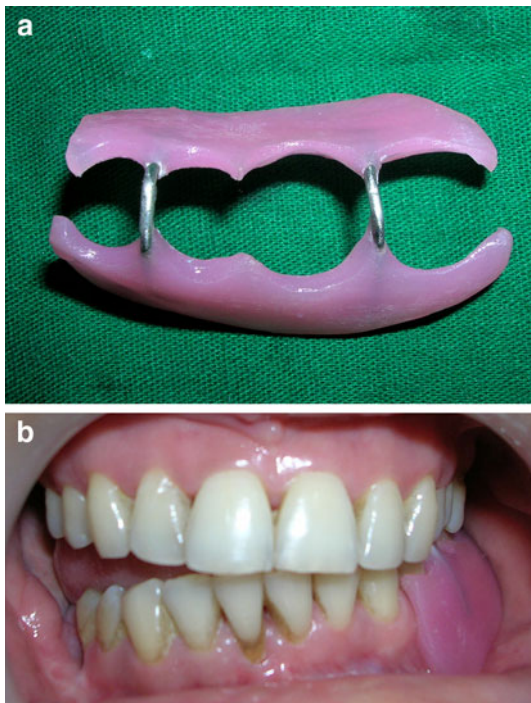


Fig. 4 a The first part of the mandibular guiding flange appliance. b Viewed intraorally



Fig. 5 Impression for the guiding flange with impression compound

the impression for the second part or the actual guiding flange using impression compound (Rolex Impression Compound, Ashoo Sons, Delhi, India) (Fig. 5). The flange part made with impression compound was processed in heat cure acrylic resin and fused with the first part using self-cure acrylic resin (DPI Self Cure, Dental Products of India, Mumbai, India) in the articulated models and inserted in the patient's mouth (Fig. 6a, b).

The patient was advised to use the guidance appliance continuously for a period of 6 weeks with regular follow-up. The patient was recalled every week for a review to assess the patient's mandibular closure with the guiding flange. The guiding flange helped to guide the mandible so as to achieve optimal occlusion on the unaffected side. After the period of use of the guiding flange for about 1 month, the patient was able to close the mandible so as to bring occlusion on the left side. After 1 month, the duration

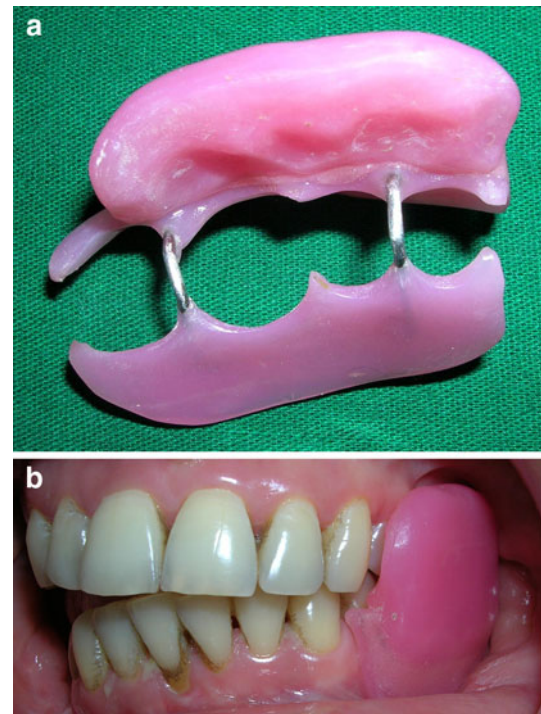


Fig. 6 a Completed mandibular guiding flange appliance. b Viewed intraorally

of wearing the guiding flange was gradually reduced over a period of next 2 weeks. Henceforth the patient was able to maintain the position without the guiding flange (Fig. 7). The amount of deviation corrected using the guidance flange as noted in the mandibular anteriors was 6 mm when compared with pre-treatment midline markings. Though the patient was able to occlude on the left side, an open-bite



Fig. 7 Frontal view of the patient after guidance therapy

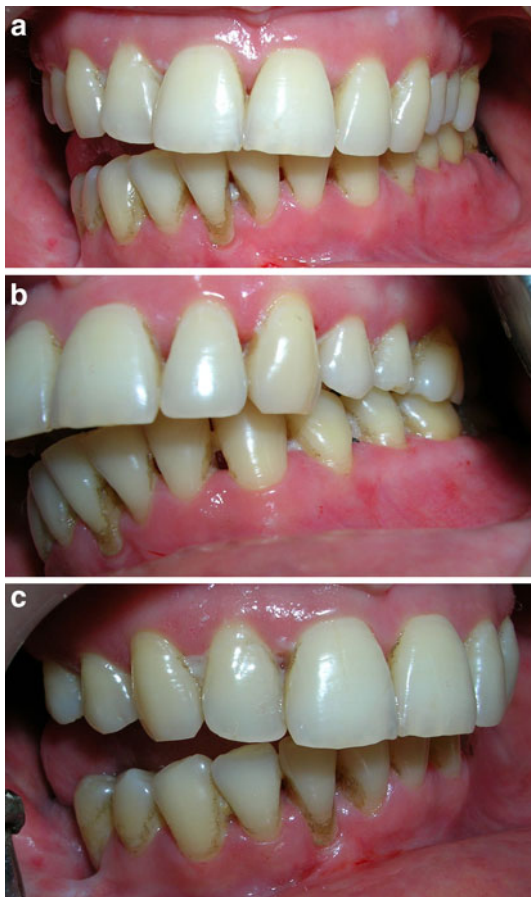


Fig. 8 a Intraoral view of occlusion post guidance therapy. b Occlusion established on *left side*. c Open-bite on *right side*

could be noted on the right side progressively increasing from anterior teeth to the posteriors (Fig. 8a, b, c).

Fabrication of Mandibular Overlay Denture

The open occlusal relation between the right maxillary and mandibular teeth was planned to be corrected with a mandibular overlay denture covering the remaining tooth structure. A custom tray was fabricated with self cure acrylic resin for the mandibular arch and final impression made with addition silicone impression material (Aquasil, Dentsply, Germany) and cast was poured in die stone (Ultrarock, Kalabhai Karson Pvt. Ltd, Mumbai, India) (Fig. 9a, b). The casts were mounted with interocclusal bite using green stick compound (DPI Pinnacle, Dental Products of India, Mumbai) (Fig. 10). The undercuts were blocked out, record base was constructed with self-cure acrylic resin and teeth setting was done for the mandibular overlay denture. The waxed up prosthesis was tried in the patient's mouth and checked for occlusion (Fig. 11). The replacement in the mandibular arch was extended only up

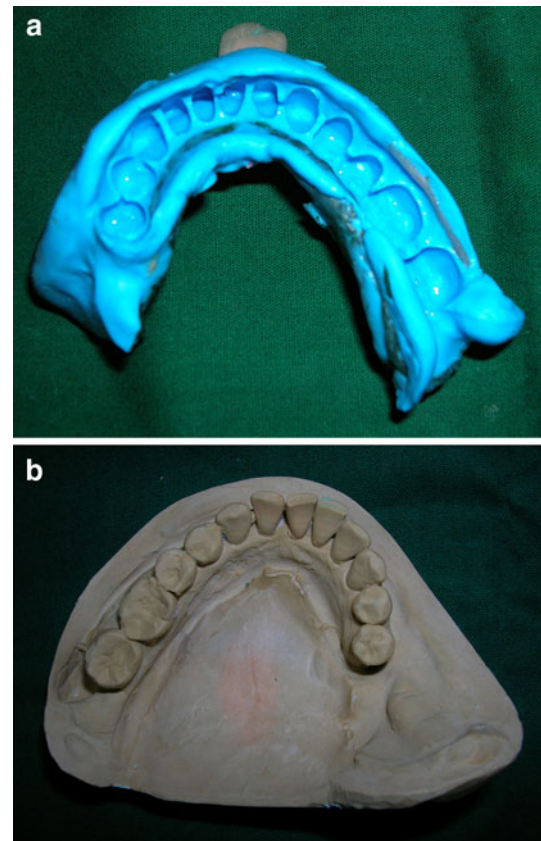


Fig. 9 a Mandibular final impression made for overlay denture. b Mandibular cast for making overlay denture



Fig. 10 Interocclusal bite for articulation



Fig. 11 Intra-oral view of wax trial

to second premolars as the opposing molars in the maxillary arch were also absent. The denture was processed with heat cure acrylic resin, finished and inserted in the patient's mouth (Fig. 12a, b, c). With the overlay denture the patient was able to maintain optimum occlusion bilaterally. The patient was recalled to check for occlusal harmony and comfort. The patient did not report any problem in the post treatment phase. The patient could appreciate the change and was happy with the outcome of the treatment (Fig. 13).

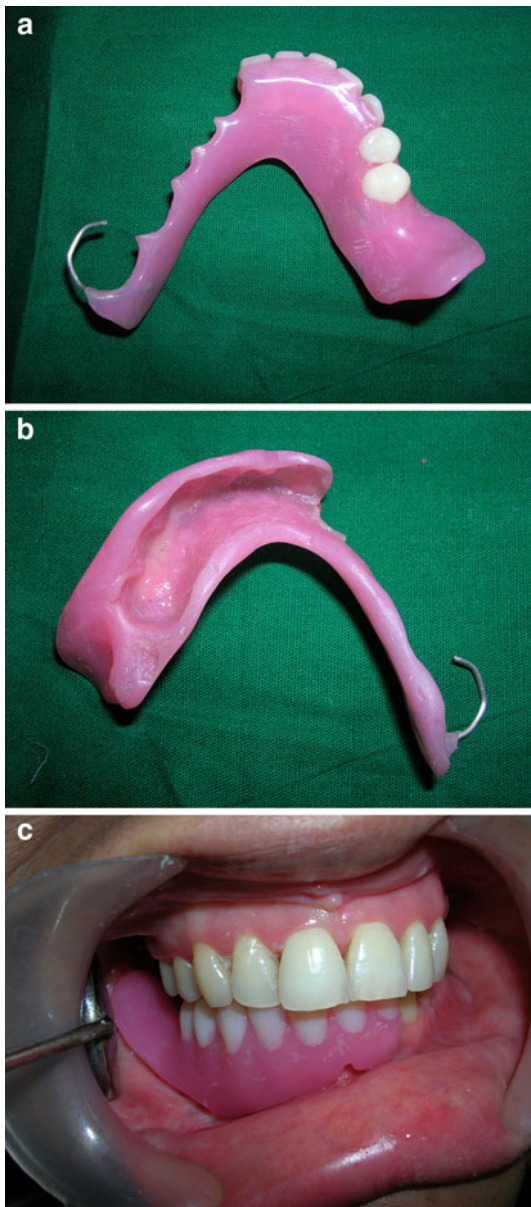


Fig. 12 a Processed overlay denture-occlusal surface. b Processed overlay denture-tissue surface. c Post treatment intraoral occlusion with overlay denture



Fig. 13 Post treatment view of the patient

Discussion

The patient discussed in this case report has lateral resection of mandible on the right side involving the dentition posterior to the second premolar. It may be discussed as the class IV situation as per Cantor and Curtis classification. Though this classification is proposed for edentulous mandible, it holds good for dentulous situation also [2, 3]. The functional disabilities of tongue-mandible resections are primarily dependent on the amount of tongue resected, method of closure and amount of deviation of mandible. Following resection of mandible, the part of the bony mandible and teeth that remains has to articulate with normal structures of maxilla. When a part of mandible has been resected, the movements of the mandible in the functional range and occlusal proprioception differ from that of movements and occlusion of the normal mandible. The remaining mandibular segment will retrude and deviate towards the surgical site. When opening the mouth, the deviation increases, leading to an angular pathway of opening and closing. The normal hinge movement parallel to the sagittal plane is lost. During mastication, entire envelope of motion occurs on the surgical defect side [4].

The amount of deviation of mandible to the resected side depends on the amount of soft and hard tissue surgically removed, the method of surgical site closure, degree of impairment of tongue function, the presence, absence and state of remaining teeth, loss of proprioceptive sense of occlusion which also depends on the teeth remaining and the time at which prosthodontic therapy was initiated [5]. The contributing factors that determine the severity of

mandibular deviation includes scar contracture, tight wound closure and muscle imbalance secondary to primary resection. Mandibular deviation is most severe following primary closure of base of tongue lesion. It also depends on the amount of soft tissue loss, fibrosis due to radiation therapy and radical neck dissection [4, 6]. The mandibular surgical resection also significantly alters the maximum occlusal force [7] and masticatory performance seems to improve with prosthodontic rehabilitation [8]. Occlusion can only be developed in these patients to static centric position record rather than a truly repeatable centric relation. Hence no articulator can actually reproduce the movements of an interrupted mandible [9].

The frontal plane rotation occurs due to loss of proprioceptive sense of occlusion, which leads to un-coordinated and less precise movement of the mandible. Also, because of the absence of attachment of the muscles of mastication on the surgical side, there is significant rotation of the mandible upon forceful closure. When the force of closure increases, the remaining mandible actually rotates through the frontal plane [6]. It has been discussed that the primary determinant for the abnormal position of mandible could be the action of remaining suprahyoid muscle [4], could be due to the uncompensated influence of the contralateral muscle, especially the internal pterygoid muscle [10].

The factors that have to be considered while giving a mandibular guidance therapy are (1) Timing of rehabilitation—the results are better if the guidance therapy is initiated at an early stage, (2) Whether the guidance therapy should be given for the maxilla or mandible—accordingly a guidance ramp or flange is to be given respectively, (3) It is only an interim treatment to correct the deviation as much as possible, and occlusion is the primary determinant [6]. Several prosthesis have been used to reduce or eliminate mandibular deviation like inter-maxillary fixation [6], cast metal mandibular resection restoration [10], acrylic guidance flange, cast metal guidance flange prosthesis [5], guidance ramp in the maxillary [6], crowns with a maxillary prosthesis to guide hemi-mandible [11], functionally moulded palatal ramp [12], twin occlusal table in the maxillary arch [13]. A mandibular guidance flange can be used when the mandible can be positioned in an un-interrupted way, whereas if some resistance is encountered in positioning the mandible, a maxillary guidance ramp in acrylic is suggested, as acrylic can be adjusted when the relationship improves. A cast metal guidance flange allows only for minimal adjustment but an advantage of acrylic guidance flange is that it allows for some adjustments [6].

Surgical resection of a portion of the mandible, muscles of mastication, and some teeth can cause an imbalance of the remaining muscles of mastication, altered and restricted mandibular movements and decreased forceful mandibular

closure [7]. The basic objective in rehabilitation of such patients is retraining the remaining mandibular muscles to provide an acceptable maxillomandibular relationship of the remaining portion of the mandible. The mandibular guidance flange can be given to achieve an acceptable maxillomandibular relationship [9]. The use of mandibular guidance flange as treatment for segmental hemi-mandibulectomy has been reported [5, 10, 14–16]. Earlier the mandibular guidance therapy is initiated, more successful is the result [10]. The flange engages the maxillary teeth during mandibular closure, and hence directs the mandible into an optimal intercuspal position. Presence of teeth in both the arches is important for effective guidance and reprogramming of the mandible [6]. The four significant factors that affect the amount of rehabilitation include the site and extent of surgery, the effect of radiation, presence or absence of teeth and psychological aspect [1].

The occlusal relationship that is finally obtained depends on the degree of reduction of mandibular deviation, the amount of frontal plane rotation and limitation from remaining structures. Successful guidance therapy or complete correction of deviation depends on the extent of soft tissue loss, tight wound closure, radiation therapy, radical neck dissection and delay in initiation of guidance therapy [6, 10]. These factors can be contributory in this patient that, even after the guidance therapy, though occlusion was established on the left side, there was still open-bite on the right side. Desjardins RP has explained that for some patients whose mandibular muscles cannot be retained to achieve occlusal contact between maxillary and mandibular teeth, more definitive prosthodontic management may be indicated [9]. The open-bite was corrected with an overlay denture, to establish occlusion on either side. Maximum possible extension of denture flange is aimed on the normal side and on the resected side to enhance stability and support. An overlay denture is a reversible, conservative and economic solution to these situations which allows esthetic and functional rehabilitation which is also the patient's expectation from treatment [17].

Conclusion

The result of mandibular resection includes esthetic deficit, functional disabilities, occlusal disabilities and most importantly psychological distress to the patient. A mandibular guidance therapy interferes with the deviated mandibular movement and modifies and corrects the neuromuscular control of the patient. The appliance is used as an interim basis to aid the neuromuscular system of the patient adapt to the repositioning of the deviated mandible to correct occlusion. In some patients the correction of

mandibular rotation with guidance appliance is not complete due to various reasons. In such a situation an overlay denture improves the patient's form and function to a great extent.

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