

Prosthodontic Management of Mandibular Deviation using Guide Flange Prosthesis in Hemimandibulectomy: A Review

Abstract

In the area of head and neck tumors it is often necessary to perform radical surgery to eradicate the disease completely. Very often unsightly and incapacitating defects of the face and oral cavity are left as a result of such treatment. It is inconceivable that the treatment ends with the elimination of the disease. The correction of these defects should always be accompanied by this rehabilitation so as to make them socially acceptable as before. These may be treated by the plastic surgeon, the prosthodontist, or both.

Key Words

Mandibular guidance therapy; Guide flange prosthesis; Hemimandibulectomy

Praval Pratap Singh¹, Simran Kaur Sahni², Kartika Nair³, Vinod Sargaiyan⁴, Pratibha Rawat⁵, Sandeep Gupta⁶

¹Assistant Professor, Department of Prosthodontics, Crown and Bridge, Maharana Pratap College of Dentistry & Research Centre, Gwalior, Madhya Pradesh, India

²Post Graduate Student, Department of Prosthodontics, Crown and Bridge, Maharana Pratap College of Dentistry & Research Centre, Gwalior, Madhya Pradesh, India

³Assistant Professor, Department of Prosthodontics, Crown and Bridge, Mansarovar Dental College, Bhopal, Madhya Pradesh, India

⁴Assistant Professor, Department of Oral Pathology, Maharana Pratap College of Dentistry & Research Centre, Gwalior, Madhya Pradesh, India

⁵Assistant Professor, Department of Prosthodontics, Crown and Bridge, Maharana Pratap College of Dentistry & Research Centre, Gwalior, Madhya Pradesh, India

⁶Reader, Department of Conservative Dentistry, Crown and Bridge, Maharana Pratap College of Dentistry & Research Centre, Gwalior, Madhya Pradesh, India

INTRODUCTION

Surgical treatment for neoplastic lesions of the oral cavity often requires resection involving the mandible, floor of the mouth, tongue and also the palate.^[1,2] While the surgical restoration of the mandibular resections has advanced dramatically with free-flap techniques, oral function and patient perceptions of function, as well as treatment outcomes, often indicate significant impairment.

In hemimandibulectomy cases mandibular deviation occurs due to loss of continuity of mandible, the related altered muscle function will clinically result in facial asymmetry causing significant esthetic deformities, functional compromise, and psychological sequel.^[3] In patients who have undergone mandibular resection, the remaining mandibular segment will retrude and deviate

towards the surgical side, at the vertical dimension of rest. The amount of deviation will be more or less evident depending on the location and extent of the resection, the remaining amount of soft tissue, nerve innervation involvement and the presence of remaining natural teeth. Upon opening the mouth, this deviation increases, leading to the opening and closing of the angular pathway. Loss of the proprioceptive sense of occlusion leads to the uncoordinated, less precise movement of the mandible. When Mandibular continuity is lost in segmental mandibulectomy, masticatory function is compromised because of muscular imbalance that results from unilateral muscles removed, loss of grinding table due to teeth lost, altered maxilomandibular relation, and decreased teeth to teeth contact which results in significant decrease in

occlusal force.^[4-6] The absence of the muscle of mastication on the surgical side results in a significant rotation of the mandible upon forceful closure. When viewed from the frontal plane, the teeth on the surgical side of the mandible move away from the maxillary teeth after the initial contact on the nonsurgical side has been established. As the force of closure is increased, the remaining mandible rotates through the frontal plane. Hence the term 'frontal plane rotation'.^[1] This factor, with the addition of impaired tongue function, may totally compromise mastication. The rehabilitation objective in mandibulectomy cases is to re-educate mandibular muscles to re-establish an acceptable occlusal relationship for residual hemimandible,^[7] so that patient could control opening and closing mandibular movements and minimize the scar formation that will make deviation more severe and less favourable for the prosthetic intervention. Early corrective Mandibular moment therapy like stretching exercises consisting of patient grasping the chin and moving the mandible away from surgical side. It can be started two weeks postsurgically and carried upto 6-8 weeks during post-operative healing period, then definitive prosthetic rehabilitation can be taken up. A review of the literature shows varying basic design of prosthesis used, that can be mandibular-based or palatally-based anchored on natural teeth or denture flange.^[2,3,7,9] The mandibular guide flange device for hemimandibulectomy patients presenting good natural teeth on the residual mandible fits generally over that teeth (base-plate) and has a guide plane (flange splint) extending into the maxillary buccal vestibule, and which rides on the buccal surfaces of several of the maxillary teeth: this is the mechanical system preventing the mandible from turning toward the resected side.^[8,10] Normally, patients can use a guide flange device all the day except while eating. The purpose of this article is to describe a new therapeutic possibility for the prosthetic management of hemimandibulectomy patients that foresees using only one device for both corrective mandibular movement therapy and masticatory function. This sort of device permits to use the same prosthesis both for eating and for mechanical correction of mandibular deviation. The severity and permanence of mandibular deviation is highly variable and is dependent upon a number of complex factors such as the amount of soft and hard tissue resected, the method of closure and so forth. Patients who are

closed with a myocutaneous or free flap soon attain an acceptable interocclusal relationship with adjunctive therapy, while some patients who are closed primarily, are never able to achieve an appropriate and a stable interocclusal relationship.^[1,2]

REVIEW OF LITERATURE

Robinson *et al.*,^[6] suggested that if the mandible can be manipulated into an acceptable maxillomandibular relationship, but lacks motor control to bring the mandible into occlusion, a cast mandibular resection restoration is appropriate. They further stated that fabrication of a provisional guide plane facilitates the fabrication of a definitive restoration. Dorsey J Moore *et al.*,^[7] described a technique which combines crowns with a maxillary prosthesis to guide the mandible into a functional occlusion. Mohamed A Aramany *et al.*,^[8] reported 14 patients who were treated by the use of immediate intermaxillary fixation after segmental resection of the mandible to eradicate cancerous lesions. They claimed that the use of intermaxillary fixation during the first 6 postoperative weeks reduces the degree of deviation. Fattore *et al.*,^[9] advocated a two piece gunning splint, both for intermaxillary fixation and as a guidance appliance for an edentulous patient, following hemisection of the mandible. In 1990, a review of 32 articles described outcomes of various mandibular reconstruction techniques and indicated that functional outcomes were provided for only 4% of the 782 patients evaluated. Prosthetic rehabilitation was presented for only 16 patients (2%) of all mandibular reconstructions.^[15] Hasanreisoglu *et al.*,^[10] suggested that for dentate patients, palatal guide ramps or mandibular guide flange prostheses are indicated. Beumer *et al.*,^[2] reported that if the mandible can be manipulated comfortably into an acceptable occlusion position, a cast metal guidance ramp will be appropriate. If some resistance is encountered in positioning the mandible, a guidance ramp of acrylic resin is suggested, as this material can be periodically adjusted as an improved relationship is obtained. They further stated that mandibular guidance therapy begins when the immediate post-surgical sequelae have subsided, usually at about two weeks after surgery. Initially, the patient should be placed on an exercise program. Nasrin Sahin *et al.*,^[12] described the fabrication of a cast metal guidance prosthesis with supporting flanges and retentive flanges for a patient, following a segmental mandibulectomy and claimed that the

patient was able to achieve a functional intercuspal position after the insertion of the prosthesis. Joshi *et al.*,^[13] described the fabrication of a mandibular guide flange prosthesis and suggested that a removable prosthesis is an effective alternative for most patients with mandibular defects, considering the poor prognosis, difficulty in decision making for the use of the implant and economic feasibility. Principe MA *et al.*,^[14] described a technique by which only 1 mandibular prosthesis can be used both for physiotherapy and eating, by simply inserting and removing the guide flange. Two precision attachments were inserted into buccal surface of the denture base with their matrix and the corresponding matrices were inserted into the transparent guide flange. Shailendra kumar Sahu,^[16] suggested that in patients with mandibulectomy definitive partial denture restorations are deferred until an acceptable maxillomandibular relationship is obtained or an end point in mandibular guidance therapy is reached. Guidance prosthesis and interim removable partial denture serve as training appliances till a cast partial denture can be fabricated for the patient. Within 3 weeks, the mandible was guided to the correct occlusal position. Simrat Kaur *et al.*,^[17] described the fabrication of mandibular guide flange and suggested that successful intercuspal position was accomplished with the use of the guidance appliance, combined with physiotherapy in a patient who underwent a hemisection of the mandible, subsequent to treatment for an ameloblastoma. Mandibular resection prostheses should be provided to restore the mastication within the unique movement capabilities of the residual function in the mandible. A common feature among all removable resection prosthesis is that all framework designs should be detected by a basic prosthodontic design. These include broad stress distribution, cross arch stabilization by using a rigid major connector, stabilizing and retaining components at locations within the arch to minimize the dislodgement and the replacement of the tooth positions which optimize the prostheses. Stability and function needs modification to these principles, that are determined on an evidence basis and greatly influenced by unique residual tissue characteristics and mandibular movement dynamics.

CLASSIFICATION OF MANDIBULAR DEFECTS^[11]

- Class I: Mandibular resection involving alveolar defect with preservation of mandibular continuity.
- Class II: Resection defects involve loss of Mandibular continuity distal to the canine area.
- Class III: Resection defect involves loss up to the mandibular midline region.
- Class IV: Resection defect involves the lateral aspect of the mandible, but are augmented to maintain pseudoarticulation of bone and soft tissues in the region of the ascending ramus.
- Class V: Resection defect involves the symphysis and parasymphysis region only, augmented to preserve bilateral temporomandibular articulations.
- Class VI: Similar to class V, except that the Mandibular continuity is not restored.

Mandibular discontinuity following traumatic accidents or tumor resection can create restorative difficulties. If mandibular continuity is re-established by grafting procedures, the grafted bone is subject to rapid resorption once loaded by occlusal force through a denture base. If grafted bone is allowed to heal undisturbed, however, it may serve as a site for implant placement. The grafted and implanted bone will be internally loaded and resorption can be slowed dramatically.

DISCUSSION

Segmental mandibulectomy as surgical treatment for squamous cell carcinoma results in deviation of the remaining mandibular segment toward the defect and rotation of the mandibular occlusal plane inferiorly. Mandibular deviation occurs primarily because of the loss of the tissue responsible for the movements.^[14] Loss of continuity also results in vertical rotation of the residual Mandibular fragment in inferior direction. Rotation is caused by the pull of the suprahyoid musculature on the residual mandibular fragment causing inferior displacement and rotation around the fulcrum of the remaining condyle. Gravity, loss of anchorage, loss of temporomandibular ligaments allows the mandible to fall vertically away from the normal position.^[8,14] The final outcome of the surgery are facial disfigurement, loss of occlusal contact, loss of lip contact. The associated problems are, decreased mouth opening difficulty in mastication, functional limitation of the tongue such as speech impairment, food bolus control, loss of taste sensation and lack of adaptability to prosthesis.^[7] The guide ramp serves as a prosthesis to minimize

radiation scarring of the healed tissues. Stretching of the tissues during healing minimizes the amount of scarring within the area. With scars there is a tendency to contract which in turn pulls the remaining mandible more and more towards the defect side, It is important that the angulation of the guide ramp be increased with time, this allows the mandible to come to a more favourable position.^[8,9]

The basic design of the guide flange prostheses will depend greatly on post-operative findings, as there are no type of appliances that will serve for every patient. However there are fundamental principles for the construction of a functional appliance: Every patient should maintain functional occlusion for mastication, and this may be accomplished by a guide plane.^[13] No articulator can reproduce the hemimandibular movements, therefore functional occlusal relation should be recorded and this relation might change at a later date, if mandibular control ability improves or differs.^[9] Using only one guide flange prosthetic device as that proposed in this work permits to re-educate mandibular muscles and use the same to eat. In this way patients are not obliged to use one device for the physiotherapy step and a second device to eat. The success of mandibular guidance therapy depends on the early beginning, the nature of the surgical defect and the patient's cooperation. Mandibular guidance therapy begins when the immediate postsurgical sequelae have subsided, usually within 2 to 3 weeks after surgery. This sort of therapy is most successful in patients whose resection involves only bone structures and minimally the tongue, the floor of the mouth and contiguous soft tissues. The presence of the teeth in both the arches is important for the effective guidance and the reprogramming of the mandibular movements. The patient in this clinical report retained all her teeth, except those on the defect site. Therefore, the patient had a better proprioceptive sense and was able to achieve the functional position after the insertion of the prosthesis. The main purpose is to re-educate the mandibular muscles to re-establish an acceptable occlusal relationship (physiotherapeutic function) for the residual hemimandible, so that the patient can control the opening and closing of the mandibular movements adequately and repeatedly. This is the beginning of an accomplished prosthetic rehabilitation by using a removable prosthesis, by which artificial teeth could warrant a stable occlusion. For better results, the prosthetic management can be combined with an exercise

program that can be started 2 weeks after the surgery. On opening completely, the mandible can be displaced by hand as forcefully as possible towards the nonsurgical side. These movements tend to lessen scar contracture, reduce trismus, and improve maxillomandibular relationships. The prosthetic device proposed was:

- Functional, as desirable occlusion can be reestablished.
- Esthetic, as Mandibular deviation can be corrected.
- Comfortable to wear, as cross arch support was derived.
- Easy to make, repair and better hygiene maintenance.

CONCLUSION

Because mandibular guidance therapy is most successful in patients whose resection involve only bony structures with minimal loss of soft tissue and no radical neck dissection or radiation therapy, the patients who are treated for ameloblastoma are ideal candidates for the use of a mandibular guidance therapy. For better results, the prosthetic management should be combined with an exercise program.^[18]

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