Mandibular Guiding Flange Prosthesis- A Technique Report

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Abstract: Loss of the continuity of the mandible destroys mandibular symmetry, function and presents a major challenge for prosthetic rehabilitation. These challenges include correction of deranged mandibular movements, disfigurement, functional difficulty seen during swallowing, speech and articulation, and deviation of the remaining mandibular structure to the surgical side. A corrective device known as guiding flange prosthesis (GFP) is used to limit these manifestations and guide the patient to reposition the mandible in the intercuspal position. As restoration of acceptable functional occlusion is one of the goals of maxillofacial prosthodontists, an interdisciplinary approach between oncologists/oral surgeons and prosthodontists is required while treating such patients. This technique report describes early prosthodontic management of two adults and one boy in his late childhood who had undergone hemi-mandibulectomy with acrylic GFP.

Keywords: Guide flange prosthesis, Hemi-mandibulectomy, Mandibular reconstruction, Maxillofacial surgery, Prosthodontics

Introduction:

Neoplasms associated directly or indirectly with the mandible necessitate surgical removal of the lesion and extensive resection of the bone [1].Depending upon the location and extent of the tumour in the mandible, various surgical resections can be performed [2,3].The resulting mandibular defects are generally divided into continuity and discontinuity defects [4]. Mandibular continuity defects are usually less debilitating when compared to discontinuity defects which lead to loss of proprioceptive sense of occlusion, uncoordinated movements of the mandible, deviation of remaini

ng mandibular segments towards the defect, and rotation of the mandibular occlusal plane inferiorly [1-3]. It destroys the balance and symmetry of mandibular function, leading to disfigurement, difficulty in swallowing, speech and articulation [1]. While opening the mouth, the mandibular deviation increases, leading to opening and closing in an angular pathway [1,3].Many factors are responsible for deviation and these include location and extent of resection, amount of soft tissue involvement, degree of innervations, whether the wound closure was tight or not, presence of remaining natural teeth etc [3]. In general, patients with extensive soft tissue loss resulting from tight wound closure, radiation therapy, and those requiring classical radical neck dissections exhibit the most severe mandibular deviation and dysfunction [3]. The benefits of primary surgical reconstruction have been well documented and immediate reconstruction of the mandible using hard and soft tissue grafts is generally preferred to optimize treatment outcome [4].Although immediate mandibular reconstruction restores facial symmetry, arch alignment and occlusion, masticatory function often remains compromised. Moreover, the clinicians must wait for an extensive period of time for adequate healing and acceptance of the graft before considering definitive prosthetic management [2].Prosthodontic intervention is required during this initial healing period, to prevent mandibular deviation.

The basic prosthodontic rehabilitation objective is to re-educate mandibular muscles to re-establish an acceptable occlusal relationship for the residual mandible, so that patients can control opening and closing movements [1,3]. Guiding flange prosthesis (GFP) is designed for patients who are able to achieve an appropriate mediolateral position of the mandible but unable to repeat it consistently for adequate function [2]. This prosthesis along with physiological exercise programs help retrain the patient's neuromuscular system and reduce mandibular deviation [3].GFP can be removable or fixed. Removable prosthesis requires support from both teeth and tissues and cannot be adequately retained if only a few teeth remain in the sectioned mandible. Fixed prosthesis gets support from only the teeth and can be given to patients who lack motor skills to manage a removable prosthesis [3]. To ensure optimal results and reduce the onset of mandibular deviation, the overall treatment planning must be completed prior to performing ablative and reconstructive surgery. A close coordination between surgeons and maxillofacial prosthodontists is imperative to improve esthetics, function and overall quality of life [4]. Although various techniques to reduce deviation following resection using a GFP in adult patients has been described, literature regarding management in children is scarce. This Case series describes various techniques involved in rehabilitating two adult patients and one patient in his late childhood who had undergone hemi-mandibulectomy with mandibular GFP. [2].

Case Reports

Case History 1:

A 67 year old male patient diagnosed with high grade leiomyosarcoma of the left maxilla and mandible underwent subtotal maxillectomy and hemi-mandibulectomy. Following surgical excision and soft tissue flap reconstruction, the patient was put on Ryle tube feeds. Two weeks following surgery, the patient presented with restricted mouth opening and mild deviation of the mandible to the affected side. Intraoral examination revealed a subtotal maxillectomy defect of the left maxilla (Aramany [5] class II) with presence of full complement of teeth on the contralateral and a mandibular discontinuity defect (Cantor Curtis [6] class II) reconstructed with pectoralis major myocutaneous flap extending from the left canine until the ramus. Moreover the mandibular contralateral side comprised of a full complement of teeth (Figure 1a). A GFP was planned for guiding the mandible to closure and prevent further deviation. A delayed surgical obturator was planned for the left maxilla to facilitate oral feeds.

Case History 2:

A 33 year old male patient diagnosed with squamous cell carcinoma of the left buccal mucosa underwent left subtotal maxillectomy and left hemi-mandibulectomy. Following surgical excision the patient was reconstructed with soft tissue flap. The patient reported one and half months following surgery with the following symptoms, restricted mouth opening, severe deviation of the mandible to the affected side, difficulty in mastication, speech and swallowing. Intraoral examination revealed a subtotal maxillectomy defect of the left maxilla (Aramany [5] class II) with presence of full complement of teeth on the contralateral side and a mandibular discontinuity defect (Cantor Curtis [6] class II) with reconstructed pectoralis major myocutaneous flap extending from the left canine until the ramus. Moreover the mandibular contralateral side was partially edentulous and a soft tissue graft on the left cheek was visualised (Fig 1a). Extra oral examination revealed facial disfigurement. A GFP was planned for guiding the mandible to closure and to prevent further deviation of the mandible to the affected side. A delayed surgical obturator was planned for the left maxilla to facilitate oral feeds.

Case History 3:

A 10 year old boy diagnosed with Juvenile Ossifying fibroma of the right mandible underwent hemi-mandibulectomy. Two weeks following surgery, the patient presented with satisfactory mouth opening and had continuous drooling of saliva. Clinical examination revealed Cantor Curtis [7] class II defect of the right mandible extending from the erupting mandibular central incisors until the ramus. Examination also revealed that the patient was in his mixed dentition phase and the mandibular defect was visualised with thick buccal mucosa, scarred tissue and

obliterated sulcus. A GFP was planned for guiding the mandible to closure and to prevent mandibular deviation followed by a temporary removable partial denture.

Prosthetic Intervention:

In cases 1 and 2, impressions (Algitex, DPI, Mumbai) were made (Figure 1b) and casts were fabricated. Two wrought wire (Konark Stainless steel gauge wire) clasps were fabricated in the premolar and second molar region of the mandible to provide retention. A modified clasp was constructed such that it engaged the buccal surfaces of the maxillary posterior teeth (Figure 1c). The prosthesis was then acrylised (DPI Cold cure clear; Dental products of India, Mumbai, India), trimmed, polished and evaluated in the patient's mouth for fit, initial stability, retention and extension (Figure 1d,2a). The inclination of the modified clasp was adjusted and once contact with the opposing teeth was established, self-cure resin was mixed and adapted on the modified clasp. In case 1, insertion of the GFP to guide mandibular closure and prevent further mandibular deviation was easier as the patient reported two weeks after surgery. However in case 2 as the patient reported one and half months after surgery it was difficult to achieve closure of the deviated mandible and hence the inclination of the GFP was sequentially altered to achieve closure of the deviated mandible. The patients were trained to open and close with the GFP in a smooth and unhindered path (Figure 1e,2b). The GFP was delivered (Figure 1f,2c) and post insertion instructions regarding usage and maintenance were given. The patient 1 was reviewed 24 hours after insertion followed by 15 days after insertion after which they were reviewed every month, for the next three months and flange was adjusted during the reviews to ensure adequate function. The patient 2 was reviewed 24 hours after insertion followed by 15 days after insertion after which they were reviewed every 15 days, for the next six months and the GFP was adjusted in every appointment to improve mandibular closure and prevent mandibular deviation. The GFP helped in drastically reducing the mandibular deviation in the case 2 and prevented mandibular deviation in case 1. The patient 1 was advised to discontinue wearing the GFP on the third month after insertion as the prosthesis prevented mandibular deviation, whereas the patient 2 was advised to discontinue wearing the prosthesis only after the end of 6 months as the patient was able to achieve functional closure of the mandible at the end of six months. The patients were then recalled at regular intervals such as after 6 months and one year for patient 1 and after 9 months and 1 year for the patient 2 to review whether the patients were able to achieve functional closure of the mandible and to evaluate if there were any deviations present.

Although management in dentate adult patients (case 1 and 2) proved to be effective, certain special considerations had to be undertaken while managing a 10 year old boy (case 3). Primary impressions and cast were fabricated following the method described for cases 1 and 2. Two wrought wire clasps were fabricated in the premolar and molar

region to provide retention. To prevent damage to the newly erupting teeth and the possible extrusion of the teeth till replacement of mandibular teeth on defect side, the guiding flange was directly constructed over the occlusal surfaces of the prosthesis to guide the mandibular closure without the modified clasp (Figure 3a). The prosthesis was finished, polished and tried in the patients mouth to evaluate initial stability and retention (Figure 3b). The inclination of the guide-flange was adjusted by selectively trimming or adding the clear auto-polymerizing acrylic resin (DPI Cold cure clear; Dental products of India, Mumbai, India). The prosthesis was delivered and post-insertion instructions were given (Figure 3c). The patient was reviewed 24 hours after insertion after which he was followed up at regular intervals for the next three months. At the end of three months, the patient was advised to discontinue wearing the GFP as it had significantly prevented mandibular deviation and the patient was able to achieve adequate mandibular closure. The patient was then recalled after 6 months and 1 year to evaluate whether he was able to achieve functional closure of mandible and also to check if there was any mandibular deviation. The patients were asked to wear the GFP at all times except while having food and were advised to maintain their oral hygiene.

Discussion:

Modern maxillofacial surgery offers a wide range of good results with mandibular reconstruction after cancer ablation [8,9]. The osseous grafts used for reconstruction are free fibula, iliac, scapula and femur graft, of which the free fibula graft has the least failure rate and donor site morbidity [10]. Amongst the soft tissue grafts, pectoralis major myocutaneous flap has proven to be successful [10]. While microvascular surgical approaches have proved valuable in restoring hard and soft tissue defects in the past decade, current trends in mandibular reconstruction include tissue engineering, virtual surgical planning and patient specific plates [11]. However, the failure of grafts or delay in healing due to infection, compromised underlying host defence, and advanced age of the patient result in unpredictable functional outcome and poor facial profile [8]. Osseointegrated implant rehabilitation as a secondary procedure after free-flap mandible reconstruction also has some excluding factors such as extent of disease, amount of remaining dentition, postoperative radiation therapy, patient preference, and expense [9].

Although osseous or soft tissue mandibular reconstruction improves the quality of life of patients, muscle removal causes deviation of the remaining mandibular segment towards the affected side and rotation of the mandibular occlusal plane inferiorly. The use of mandibular GFP reduces mandibular deviation by limiting the contraction of the cicatricial tissue on the operated side [8]. However if the mandibular deviations are not corrected, the muscular imbalance will compromise facial symmetry, arch alignment, occlusion and masticatory function. Though soft tissue grafts have been

used successfully in situations where hard tissue grafts cannot be used, the deviation of the mandible tend to be greater in patients undergoing reconstruction with soft tissue grafts. For reducing or preventing mandibular deviation in patients undergoing reconstruction with soft tissue graft, they should be put on an exercise program with GFP within 2 weeks after surgery [12,13]. The GFP trains the muscles of a patient with deviated and deranged mandible to achieve a successful and consistent mediolateral position [7,9,13]. In cases 1 and 2, the patients were reconstructed using pectoralis major myocutaneous flap following resection. In case 1 the patient reported within 2 weeks after surgery and the early initiation of the GFP for training the muscles aided in prevention of further mandibular deviation. The early initiation of the GFP also helped in achieving functional closure of mandible and correction of mandibular deviations within 3 months after surgery. However in case 2 as the patient reported one and half months after surgery the mandible was severely deviated to the affected side and it was difficult to train the muscles to correct mandibular deviation using the GPF. In the initial stage the patient was reviewed every 15 days and the GFP was sequentially altered such that the guiding flange contacted the buccal surfaces of the maxillary posterior teeth thereby generating a pulling force on the mandible during closing movement. The patient was able to achieve functional closure of the mandible and the mandibular deviations were corrected within 6 months after surgery. In the case 3. the patient reported within 2 weeks after surgery and the defect was primarily closed with no reconstruction. Though the mandible did not deviate to the resected side, the GFP was provided to prevent deviation of the mandible and to guide functional closure of the mandible. The GFP fabrication technique for the third patient was modified as the permanent teeth were erupting in the non-defect side and the position of the remaining teeth were not favourable for the placement of modified clasp. An acrylic ramp which served as guiding flange was constructed from the buccal aspect of the prosthesis to exert a pulling force, thereby guiding mandibular closure. The patient was able to achieve functional closure of the mandible within 3 months after surgery and also the deviation of the mandible was prevented.

Since cases 1 and 3 reported two weeks after surgery, the GFP tended to lessen the scar contracture, trismus, and eventually improved maxillomandibular relationship [12]. However, in case 2, as the patient reported one and half month after surgery, the scar tissue and muscular contractions had already set in making it difficult to guide the deviated mandible.

This case series helps us understand that for ensuring adequate function early referral and management is an important criteria. The earlier the mandibular guidance therapy is initiated in the course of treatment the more successful the patient's definitive occlusal relationship is restored [7,13]. Additionally, if impressions can be made prior to resection and guidance therapy initiated soon after surgical treatment,

scar contractures and deviation can be limited. A multidisciplinary approach and close collaboration between the maxillofacial surgeons and prosthodontists is imperative for long term success [16]. The acrylic GFP which is presented here is a simple and cost effective method for managing the mandibular deviation [13]. The technique modification done in this article can be incorporated in all clinical scenarios. If the reprogramming of muscles is achieved and the patient can occlude on his own, this prosthesis can be discontinued [7,9]. Thus, its prompt usage helps to prevent facial deformity and functional loss when the patient is scheduled for a delayed reconstruction of the mandible [8,17]. The limitation of using a GFP is that it requires tremendous patient cooperation as wearing the GFP continuously is an arduous task.

Conclusion:

Following surgical intervention, it is important for prosthodontists to functionally rehabilitate the stomatognathic system in combination with an effective mandibular exercise program. A mandibular GFP aids in restoring the physiologic oral activities of speaking, mastication, or deglutition to almost the original state of function. Its success depends on the type of the surgical defect, timely initiation, and cooperation of the patient.When treated with this corrective device in the initial healing phase, many of the post-resection sequelae can be alleviated. However, pre-prosthetic planning should always be considered before surgical resection of the mandible.

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Figure Captions

Figure1a- Intraoral examination
Figure 1b- Sectional impression
Figure 1c- Clasp assembly
Figure 1d- Initial trial
Figure 1e- Training with GFP
Figure 1f- Final GFP
Figure 2a- Initial trial
Figure 2b- Training with GFP
Figure 2c- Final GFP
Figure 3a- GFP

Figure 3b- Trial
Figure 3c-Insertion

Figures

Figure 1a- Intraoral examination

Figure 1b- Sectional impression

Figure 1c- Clasp assembly

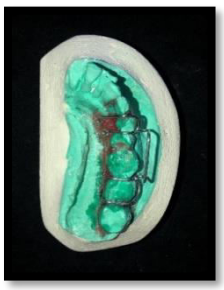

Figure 1d- Initial trial

Figure 1e- Training with GFP

Figure 1f- Final GFP

Figure 2a- Initial trial

Figure 2b- Training with GFP

Figure 2c- Final GFP

Figure 3a- GFP

Figure 3b- Trial

Figure 3c- Insertion