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A SIMPLE METHOD FOR ACCURATE POSITIONING OF MANDIBULAR RECONSTRUCTION PLATE DURING SEGMENTAL RESECTION OF THE MANDIBLE

Ayman F. Hegab*; Mohmmad A. Shuman** and Hatem H. Alahmady***

ABSTRACT

Purpose: A critical factor in the mandibular reconstruction is to maintaining the accurate preoperative three-dimensional relationships of the bony and soft-tissue components. The aim of the present study is to illustrate the technique of adaptation and fixation of the mandibular reconstruction plate during mandibular segmental resection without the need for removal of the plate during resection of the tumor. **Methods:** using a prospective study design, patients with confirmed benign mandibular tumor undergoing mandibular resection were enrolled in this study. Via intraoral approach, the plate adapted and fixed to the mandible before resection. Tumor resection was done with the plate in place. Postoperative evaluations include midline deviation, occlusal discrepancies, Hardwar's related complication (plate exposure, screws loosing), and cosmetic result. **Results:** the sample composed of 17 patients (seven females & ten males) with confirmed benign mandibular tumour. The cosmetic results were good and satisfactory in all the patients. Patients self-report of occlusion satisfaction were good in all the patients. **Conclusion:** the results of this study suggest that, the adaptation and fixation of the mandibular reconstruction plate before tumor resection could be consider as a reliable, good and easy technique to maintain the accurate preoperative occlusion with minimal surgical effort and optimal surgical time.

KEY WORDS: Mandibular tumors, mandibular defects, reconstruction plate

INTRODUCTION

The mandible is a unique bone in the head and neck and is very important for a number of reasons; airway stability as it supports the tongue base, speech, deglutition, mastication, and the shape of the lower face. Reconstruction of mandibular defects represents a challenge to the oral and maxillofacial surgeons. The most common indication for mandibular reconstruction remains ablative surgery for neoplastic processes of the oral cavity. Other causes of mandibular defects include trauma, infection, osteoradionecrosis, and congenital deformities. [1, 2]

Many techniques used for reconstruction of the mandibular defects including bone grafts both autogenous and heterogenous, reconstruction plating system or combination of them.

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With any technique for mandibular reconstruction, a critical factor in restoring form and function is to maintaining the preoperative three-dimensional relationships of the bony and soft-tissue components. It is crucial to accurately restore the mandibular segments to their preoperative alignment after ablative surgery. [2- 4]

Several surgeons used external fixator to maintain the bone-positioning during mandibular resection to maintain the preoperative relationship of bone especially the proximal stump. A modified repositioning system has been used for bone-positioning after segmental resection of the mandible by Iwai et al. [5] This system consists of 2 pairs of T-shaped plates, acrylic positioning blocks and positioning screws. A simple bone–positioning technique was reported by Tominaga et al [3], using a combination of bone plates and a flexible tube filled with acrylic polymer. The flexible tube is solidified by injection of acrylic monomer. Disadvantages of these techniques are the use of extra oral approach, time consuming procedure, intermaxillary fixation and a lot of surgical instruments are required.

Other method used for establishing an original positioning of the mandibular bone stumps is the use of intermaxillary fixation with miniplates from mandible to maxilla. This technique resolves the problem of extraoral approach but is not without disadvantages. Its disadvantages include injuries to roots of the teeth and inadequate stability of the proximal bone stump and extended time of surgery. [6]

PATIENT AND METHODS

After obtaining institutional approval (Al-Azhar University Hospital, Cairo, Egypt) and informed written consent, patients with confirmed benign mandibular tumor undergoing mandibular resection were enrolled in this study.

Technical design

Preoperative selection of the plate size was done with the aid of digital panoramic x-ray with 1:1 corrected magnification and lateral cephalometric radiographs (fig 1). All the cases were approached through intra-oral approach for both resection and reconstruction.

Intraoperative plate contouring was done before resection of the tumor. Adaptation of the plate to the mandibular bone continued until the plate was passively seated. In the case of buccal or labial swelling and gross bulging of the bone by the tumor, debulging of the buccal or labial bone to the level of adjacent normal bone contour with surgical burs or osteotomes was done followed by adaptation of the plate to the bone (fig 2). The reconstructive plate was fixed from each end to the bone.

A minimum of three bicortical screws were used to fix the plate to the proximal stump using the transbuccal trocar. Resection was done while the plate in place with surgical burs and suitable osteotomies (fig.3). After resection; the stability of the plate was verified and the occlusion was cheeked for any deviation. The wound was irrigated and closed by interrupted sutures.

Postoperative evaluation includes

- According to Occlusion (patients satisfaction) and clinical examination: Good (Neutrocclusion), Fair (malocclusion not functionally significant) and Poor (significant Malocclusion)
- According to Cosmetic outcome: good, fair, and poor
- Hardwar's -related complications (plate exposure and/or screws loosing),

RESULTS

Seventeen patients (seven females & ten males) with confirmed benign mandibular tumor (fourteen ameloblastoma & three central giant cell granuloma)

were enrolled in this study. The patients were treated at the department of oral and maxillofacial surgery, Al-Azhar university hospital from 2003 till 2005. Their ages ranged from 21 to 42 years with mean age of 33.3 year. The size of the resected segment range from 6 cm to 12cm. The follow up period was ranged from 2 to 5 years with mean of 3.5 years.

The stability of the reconstruction plates was good as confirmed by clinical and radiographic examinations (fig 4) and early mobilization of the mandible was possible in all patients and they were able to use the remaining teeth satisfactorily. The cosmetic results were good and satisfactory in all the patients. Patients self-report of occlusion satisfaction were good in all the patients. Clinical intraoral examination revealed good occlusion without midline deviation in the all patients. Plate exposure occurred in one male patient with plate bridging the anterior mandible after resection of central giant cell granuloma. The patient treated in the outpatient clinic by refreshment of the surgical site and re-suturing and daily regular care for two weeks with antibiotic coverage to prevent infection.

Six months postoperatively, one patient showed poor cosmetic result because of late bending of the reconstruction plate and loosing of the screws that hold the plate over the distal stump at the chin region. The plate bending resulted in delayed mid line deviation. This patient underwent a second surgery for replacement of the reconstruction plate. On the other hand, other patients showed no deviation in the mid line.

Fig. (1) Preoperative panoramic view

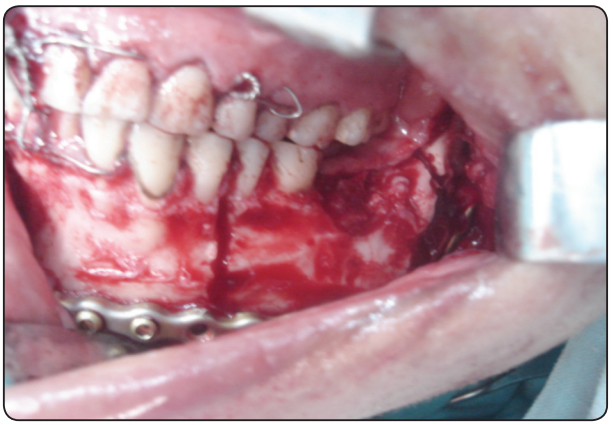

Fig. (2) Reconstruction plate adaptation and resection

Fig. (3) Reconstruction plate in place after resection

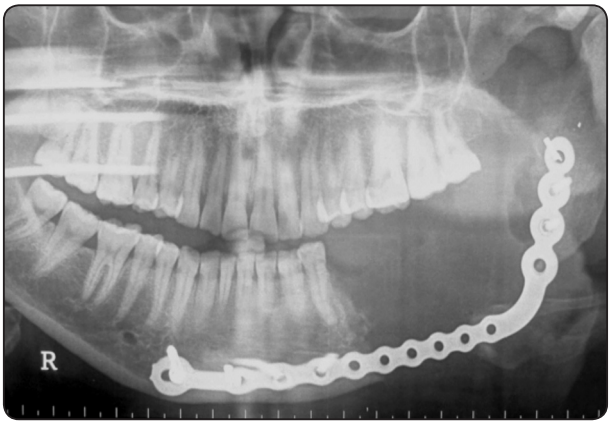

Fig. (4) Postoperative panoramic view

DISCUSSION

The processes of rehabilitation and reconstruction of the oral cavity following the resection of pathologic lesions remains a complex challenge. Reconstruction of segmental mandibular defects necessitates maintaining a proper contour and occlusal relationship. The mandible assists in verbalization, oral competence, mastication, deglutination, and airway support, yet it is also a major aesthetic highlight of the face. So that, the accurate repositioning of the remaining bone stumps after resection to their original relations is a prime goal.

Mandibular reconstruction plate not only restores the shape of the mandible but also serves as a template for the bone graft. Interruption of mandibular continuity produces both a cosmetic and functional deformity [1, 2].

Several studies have reported on the various complications associated with the use of reconstruction plates such as wound dehiscence with plate exposure, infection from loosening and breakage of screws, plate fracture and unsatisfactory facial contour.

It has been shown that resection and reconstruction of the anterior mandible crossing the midline significantly increases the incidence of complications and the need for revision or plate removal [3]

The size of bridged defects has been found to correlate with the incidence of hardware-related complications in that patients with defects longer than 5 cm are more likely to have plate failures [7]. Similarly, Arden et al [8] and Disher et al [9] have documented unacceptably high rates of hardware-related complications with anterior mandibular defects compared with lateral defects.

In the current study, plate exposure occurred with one patient with plate bridging the anterior mandible after resection of central giant cell granuloma and the defect size was about 12cm.

One of the major problems imposed to mandibular reconstruction surgeries, has to do the adaptation of the prosthesis to the patient's jaw with specific features of the lesion that retard the accurate adaptation. Moreover, the time spent on the adaptation of the reconstructive plate to the mandible is very long time.

Since the mandible is supported by bilateral loose joints between the condyle and the temporal bone which have a wide range of motion, it is difficult to fix the residual bone fragments into their original position once bone continuity is severed. Inadequate positioning of the bone fragments can result in postoperative malocclusion and\or temporomandibular symptoms. [12]

Beside that the mandible is strongly attached by 11 muscles 4 muscles attached to the ramus (masseter, temporalis, lateral pterygoid,and medial pterygoid) and 7muscles attached to the body (platysma, buccinators, anterior belly of digastric, genio-glossus, genio-hyoid, mylohyoid, and superior constrictor muscle of the pharynx). This making the remaining stumps moved abruptly to unwanted directions after discontinuity of the mandible eliciting another problem which is the effort and time consumed to repositioning these stumps to their original site.

Many surgeons adapt and fix the reconstruction plate to the mandible with screws then unscrew the plate to facilitate tumor resection followed by refixation of the plate to the previous site [10, 11]

In a different manner, others refix the reconstructive plate using a combination of bone plates and a flexible tube filled with acrylic polymer. The flexible tube is solidified by injection of acrylic monomer and a modified system (based on Leibinger's titanium-positioning system) can be used for reposition the residual mandible easily and accurately without interfering with the reconstructive procedure but these techniques required an extraoral approaches and more time.[3]

These techniques are useful, but require extended time, extensive experience, specialized skills, and extraoral approaches with maximal effort. In this study, the reconstruction plate was not unscrewed during tumor resection. Moreover, no need for extraoral approaches as the reconstruction plate can be fixed directly to the mandibular bone which results in accurate adaptation of the plate to the anatomical bone.

In the current study, intraoperative plate contouring was done before resection of the tumor by adapting and fixing the plate to the mandibular bone resulted in reduced operating time and surgical effort keeping the resected remaining stumps in their original positions. Decreased exposure time to general anesthesia, minimal blood loss, and lessened wound exposure time are all significant patient benefits from reduced operating time.

Many years of clinical experience and a review of the literature have shown that titanium reconstruction plates currently used for mandibular defects are often subject to excessive stress. This may lead to fatigue fractures of the plate. The cortical bones can also be overstrained as consequence of such fatigue. This results in enlargement of the screw holes which then loosen [13, 14].

So, the use of reconstruction plate alone for mandibular reconstruction is not an accepted technique for long term survival as most plates will fail over time. In our study we used the reconstruction plate as a temporary reconstruction for the mandibular defect during the follow up period for the benign tumors.

Six months postoperatively, delayed plate bending and looseness of the screws was done in one patient with ameloblastoma in the body-angle region and angular reconstruction plate was used for this patient. The patient underwent a second surgery for change of the plate.

Shibahara et al [14] concluded that fractured plates were more common among patients with a segmental defect that did not cross the midline in whom an angular-type plate was used and no bone grafting was performed.

Midline deviation resulted from inaccurate plate adaptation, the plate not passively seated on the mandible or instability of the proximal stump. Adaptation and fixation of the reconstructive plate before tumor resection provide accurate adaptation of the plates and prevent midline deviation and occlusal discrepancies. All the patients in the present study reported satisfactory results for the occlusion and cosmetic results.

CONCLUSION

The results of this study suggest that, the adaptation and fixation of the mandibular reconstruction plate before tumor resection and resecting the tumor without removal of the plate, could be consider as a reliable, good and easy technique to maintain the accurate preoperative occlusion and other relations of the mandible with minimal surgical effort and optimal surgical time.

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