Adenomatoid Odontogenic Tumor of Mandible: Transport Distraction Osteogenesis

Ravi S Patil*, Snehalata Patil,**

*Asso. Prof (Oral & Maxillofacial Surgeon) Dept. Of Oral & Maxillofacial Surgery, **M.D.S. Asso. Prof (Endodontist) Dept.Of Conservative Dentistry & Endodontics, NET's Navodaya Dental College & Hospital, Navodaya Nagar, Raichur-584103, Karnataka, India

Abstract: Transport distraction osteogenesis (TDO) may be defines as the biological process of new bone formation between the surfaces of bone segments that are gradually separated by incremental traction. Grafts, flaps, and synthetic materials have been used to reconstruct the mandible. Unfortunately, grafts and flaps result in added morbidity, and may be of limited availability. Synthetic materials generally retain the characteristics of a foreign body and fail to fully replace living tissues in appearance or function. TDO has been proposed as an alternate method of reconstruction, through which mandibular defects could be replaced by new bone grown from the remaining mandible. Transport distraction osteogenesis is a promising treatment for reconstructing the defect of the mandible.

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Author for correspondence: Dr Ravi S Patil, H.No:6-2-77/47/51, 70-74, R.No:302, 3rd Floor, Vaishnavi Heaven Apartment, Siddanath Colony, Yergera Road Or Mantralayam Road, Opp. Forest Office Quarters, Raichur 584101, Karnataka, M:9743512188, E-Mail:drravipatil6@gmail.com

Introduction: The deformities usually involve a combination of osseous and soft tissue deficiency and are among the most challenging problems in maxillofacial surgery, many options are available for mandibular reconstruction, including reconstruction plates, and particulate bone grafts, block bone grafts, and micro vascular free tissue transfer. It is important to appreciate the six primary goals of mandibular reconstruction; restoration of osseous continuity, osseous bulk, alveolar height, arch form, width and alignment, maintenance of the bone graft or graft durability, acceptable facial form and appearance.[1]Distraction for regeneration of bone an attempt has been made to review various devices as well as the outstanding studies done in the past for understanding the methodology. Lengthening of underdeveloped bones inclusive of the maxillofacial complex has been obtained by distraction osteogenesis,[2]although distraction osteogenesis has been widely used in long bones for several decades; it is not until the 1990s that this technique became a common method in mandibular lengthening. Anew bone is created after, osteotomy followed by gradual separation of bony fragments.[3] First described by Codivilla in 1905, but was popularized and studied extensively through the work of Professor Gavrill A. Ilizarov, beginning in 1951.[4]There are several reports of successful extensive mandibular reconstructions using different distraction appliances that use multidirectional control of bone segments.[5]Transport distraction osteogenesis (TDO) may be defines as the biological process of new bone formation between the surfaces of bone segments that are gradually separated by incremental traction. Transport distraction osteogenesis is a novel reconstructive modality in the armamentarium of a maxillofacial reconstructive field.[6]

Case report: An 18 year old female patient complains of swelling on lower right back region of mouth since 3 months, initially it was a size of peanut and gradually increased to present size. Swelling is oval in shape, located supero-inferiorly at lower border of mandible just below the level of occlusion measuring about 2.5 cm. Antero-posteriorly 1cm away from right corner of mouth and about 3cm from gonial angle measuring about 3.5 cm. Extraoral examination revealedfacial asymmetry due to swelling over lower right posterior region in relation to first molar, premolar and canine(Figure.1).On Palpation swelling was hard and firm in consistency, non tender, with skin over the swelling was normal. Intraoral examination revealed swelling on lower right region in relation to mesial aspect of canine to mesial aspect of first molar. Swelling is oval in shape supero-inferiorly and medio-laterally, hard and firm in consistency with expanded cortical plate more on buccal and mild on lingual side with displaced lateral incisor and canine (Figure. 2).

Orthopantamogram and lateral cephalogram x rays revealedlarge unilocular radiolucent lesion involving from alveolar crest superiorly and middle portion of mandible inferiorly with intact lower border measuring about 2.5cm. Anteriorly, involving mesial to 31 and posteriorly involving mesial to first molar with impacted first premolar in which lamina dura was discontinued and apical 1/3rd of root was resorbed. Displaced lateral incisor and second premolar with

rotated canine was observed (Figure.3 and 4). Occlusal radiograph revealed large round unilocular lesion with expanded cortical plates measuring about 3.5cm and impactedfirst premolar. Incisional biopsy was performed and histopathological report confirmed as adenomatoid odontogenic tumor (AOT). Case was planned for segmental resection and reconstruction by transport distraction osteogeneses.

Operative procedure: Nasotracheal intubation performed with 7.0mm cuffed tube on left side followed by scrubbing and painting was done with savlon, saline and betadine respectively, and then draping was done. Surface marking for Apron incision(Bilateral submandibular) was made and 2% lignocaine with 1:80,000 adrenaline was deposited along the line of marking. Subplatysmal dissection was made and flap was raised up to the lower border of mandible. External carotid artery and facial artery was identified and secured with ligation on right side. Dissection was carried out along the right body of mandible towards tumor. Reflection was continued up to masseter muscle superiorly to expose the lateral surface of ramus. Exposure of the tumor site was made by reflection of muscle on lingual as well as on buccal side (Figure.5).Bleeding vessels are identified and cauterized. After complete exposure of tumor segmentalre section was made distal to first molarand mesial to central incisorin fourth quadrantusing disc with maintaining 1.5 to 2.0 cm safe surgical margin on both sides(Figure.6).In the third quadrant one more vertical osteotomy cut was made with disc at the site of extracted 34 region(Figure.7).Reconstruction was planned by using transport distractor with guiding reconstruction plate consisting of 2.5mm reconstruction plate with 2.5mm x 8mm screws and transport distractor was 1.5mm miniplate with 1.5mm x 8mm screws with activation of distractor about 2mm intraoperatively (Figure.8). Angulated part of reconstruction plate was fixed to the ramus part and transport distractor was fixed to the osteotomy cut fragment in the third quadrant(Figure.9).Copious irrigation was done with povidine-iodine. No. 12 drain was placed and sutured. Closure was done by using rotational masseter flap over the reconstruction plate in ramus region and lingually by using lingual mucosa with catgut 3-0, vicryl 3-0 and 4-0.Submucosal suturing was done by using vicryl 3-0, 4-0, on buccal side subdermal suturing was done by using catgut. Activation part of the distractor was kept open extraorally at posterior region for post operative

Figure.1 Preoperative right facial profile

Figure.2 Preoperative intraoral lesion on right side of mandible

Figure.3 Preoperative Orthopentamogram x ray

Figure.4 Preoperative lateral view of skull x ray

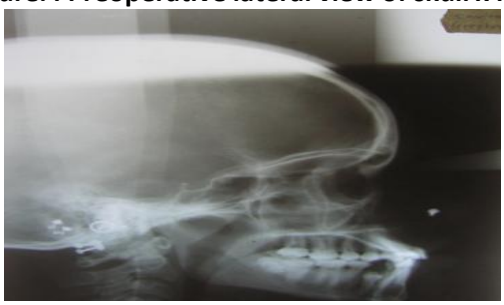

Figure.5 Exposure of tumor site

Figure.6 Resection of tumor on right side of mandible

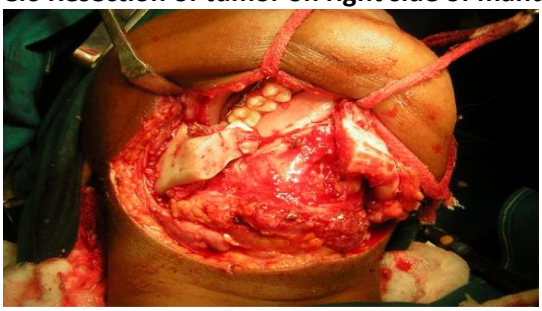

Figure.7 Segmented disk of bone for transport from left side to right side (towards resected side)

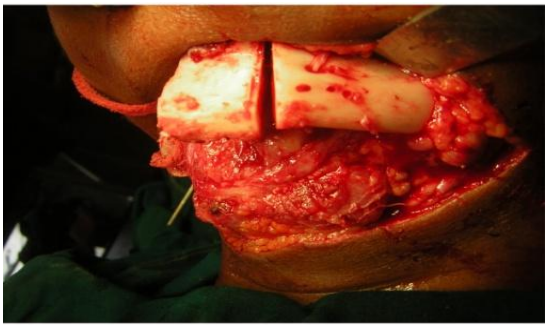

Figure.8 TDO device and components

Figure.9 Placement of TDO device from resected end on right side to bone to be transport from left side

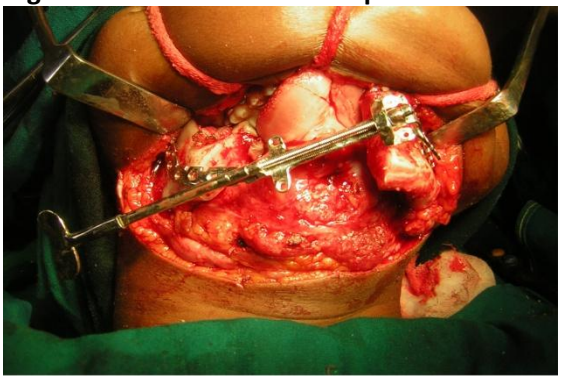

Figure.10 Postoperative right profile with TDO activation component

activation and skin sutured with Ethilon 4-0(Figure 10). Distraction activation and its completion were maintained according to the activation schedule postoperatively.

Discussion: Mandible remains an important component of the skeletal framework as it speech, oral competence, mastication, deglutition, airway support, and maintains the facial projection. Vital position of the mandible mandates its anatomic, functional, and esthetic restoration following resection. The TDO is a creation of bone and soft tissues to restore the defect by moving disk of bone followed by formation of new bone,[6]despite of advantages of extra oral distraction devices the patients were apprehensive of wearing bulky external devices due to social inconvenience and the potential of permanent facial scars. These disadvantages and limitations were the primary driving force for the evolution of mandibular lengthening and widening for the development of intraoral devices. The initial development of intraoral mandibular distraction devices progressed in two directions; miniaturization of external devices and modification of available orthodontic devices.[2]

However intraoral devices have design limitations primarily related to the limited size of the device and restricted access to the oral cavity. Bone transport is a distraction osteogenesis technique for treating long bone defects that result from trauma, oncologic resection, or congenital anomalies. The concept includes resection of a pathologic bone followed by gradual transport of an osteotomized healthy bone segment (transport disk) via a distraction device

across the area of defect. As the transport bone segment is advanced new bone tissue is generated, gradually filling the defect. After the transport disk reaches the opposite host bone segment, the intervening fibrous tissue is removed followed by application of compression between the transport and host bone segments at the docking site.[2]The attraction of applying the distraction technique for mandibular reconstruction is its lack of donor site morbidity and its ability to increase the overlying soft tissues by inducing histogenesis. Transport distraction osteogenesis offers many advantages over microvascular free tissue transfer. It was found that microvascular free tissue transfer is technically difficult and invasive with significant donor site morbidity. Free flaps often result in inadequate bone for mandibular rehabilitation with osseointegrated dental implants. In transport osteogenesis the callus formed during gradual distraction has all the characteristics of an ideal transplant material that requires no mechanical stimulation. The first application of transport (bifocal) distraction osteogenesis for reconstructing segmental mandibular defects was done by Constantino et al. in 1990. The regenerated bone had a similar diameter to the preexisting mandible, and the inferior alveolar artery and vein were found to recannulate through the regenerated bone,[1]an internal plate-guided distraction device described by Herford5 uses a straight distraction rod. The rod bridges a segmental defect in an arched reconstruction plate like a bowstring, which limits the depth of its application from the bow.[5]

Bone transport has been sporadically used to treat bone defects caused by trauma or bone resection. Distraction of bone segments in these cases allows mandibular reconstruction without bone grafting. Most importantly, mandibular distraction recreates the alveolar ridge with its attached mucosa. The major advantage being regeneration of hard as well as soft tissue without morbidity to donor site and so that functional rehabilitation of the patient is possible.

Grafts, flaps, and synthetic materials have been used to reconstruct the mandible. Unfortunately, grafts and flaps result in added morbidity, and may be of limited availability. Synthetic materials generally retain the characteristics of a foreign body and fail to fully replace living tissues in appearance or function. Distraction osteogenesis has been proposed as an alternate method of reconstruction, through which mandibular defects could be replaced by new bone grown from the remaining mandible.[2]Distraction osteogenesis is a promising treatment for reconstructing the defect of the mandible. It shares all the advantages of auto genous bone graft with minimal donor site morbidity. Transport distraction osteogenesis using indigenous distractors is a reliable yet affordable option for reconstruction of mandibular defects.

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