

DISTRACTION OSTEOGENESIS FOR RECONSTRUCTION OF MANDIBULAR BONE DEFECTS

Original
Article

ALTAIB ABD AL RAZIK MOHAMMED

ASSISSTANT PROFESSOR OF ORAL AND MAXILLOFACIAL SURGERY, FACULTY OF ORAL AND DENTAL MEDECINE SOUTH VALLEY UNIVERSITY

ABSTRACT

Introduction Reconstruction of mandibular defects is a challenging aspect for maxillofacial surgeons , alloplastic material, bone graft and free vascularized flaps can be used to manage this aspect however these procedures are associated with multiple complications

Aim of the study The aim of this study is to evaluate transport distraction osteogenesis for reconstruction of mandibular defects as more conservative methods

Subjects and methods patients presented with mandibular tumors were managed by surgical excision and subsequent reconstruction using transport distractors and followed postoperatively till full consolidation of the distracted segment occurred

Results Number of the patients was nine patients , 5 females and 4 males, the mean age was 28.7 year with standard deviation while the mean size of the surgical defects was 8cm And std ± 0.86603 , the mean period of activation was 12 week with std ± 1.25167 while the mean of consolidation period 3.2 months with std ± 0.44096 , good reconstruction of the mandible was obtained

Conclusion transport distraction osteogenesis is an effective valuable procedure for reconstruction of mandibular defects without donor site morbidity

Key Words: distraction. Osteogenesis , mandible, ameloblastoma. Reconstruction

Received: 29 March 2024, **Accepted:** 20 April 2024.

Corresponding Author: Altaib abdalrazik mohammed ,oral maxillofacial surgery, faculty of oral and dental medicine ..south valley university, **Mobile:** 00201223046874 , **E-mail:** kena20052006@yahoo.com

ISSN: 2090-097X, April 2024, Vol. 15, No. 2

INTRODUCTION:

Mandible is an important facial structure for supporting masticatory muscles, oropharynx and muscles of expression in addition to establishment of dental structures, ^[1], eating ,talking , swallowing, breathing and facial expressions depend on presence of intact mandible ^[2], mandibular defects due to trauma, infection, tumors, or congenital events can affect the mandibular functions ^[3]

The mandibular defects can be reconstructed using non vascularized graft, free flaps however these procedures are complicated with morbidity of the donor sites, infections and subsequent loss of the graft , furthermore free flaps need long operative time and high learning curve ^[4]

Recently transport distraction osteogenesis (TDO) - as a more conservative technique - can be used for mandibular reconstruction, where transport distraction depends on creation of bone transport disc from the remaining mandibular structure by osteotomy keeping intact soft tissue attachment of this disc to secure its blood supply ,then latency period should be elapsed for giving chance to form bone callus, then the distraction device is activated gradually to distract the callus till the transport disc reaches the desired site then ,consolidation period must be spent for the callus to be matured ^[5]

Transport distraction osteogenesis is experienced through different studies for mandibular reconstruction and recommended further studies was stated for evaluation of this new biotechnology ^[6]

MATERIAL AND METHODS

This study was carried out in the department of Oral

and Maxillofacial surgery , Faculty Of Oral And Dental Medicine South Valley University .since where ethical approval obtained from ethical committee of Faculty Of Medicine South Valley University , all the patients presented with mandibular tumors in need for surgical excision and reconstruction are selected for this study ,where consents from the patients were obtained and the procedure was explained for them, medically compromised patients were excluded from this study,

,routine laboratory investigations and medical fitness of the patient were evaluated, computerized tomography of maxillofacial region was obtained to determine the size of the lesion, safety margin and to design the transport distractor that is guided by reconstruction plate, all the devices throughout this study was manufactured by Arab Engineer company , Egypt, for each case ,the tumor was exposed supraperiostally through submandibular approach and additional intraoral approach , the adjacent bone

was exposed and the tumor excised surgically with at least 1cm safety margin using surgical bur mounted on high torque surgical motor with normal saline irrigation, the custom made reconstruction plates were fixed in its preplanned position and the distractor device was adjusted according to preoperative planning then transport disc was osteotomized, and fixed to the distractor which was activated to ensure free movement of the bony disc then it was returned to its original position, the wounds closed in layers, after 7 days latency period the distractor was activated, till reach the planed site, then the device left for consolidation, then the distractor arm was removed removed in another surgical operation, with subsequent prosthetic rehabilitation, the patients followed by panoramic x ray and ct, the results were analysed using origin pro 8.5 soft ware

RESULTS

As shown in table 1 Number of the patients was nine patients, 5 females and 4 males, the mean age was 28.7year with standard deviation, (std) ±12.22475, the mean size of the transport disc was about 2cm std ±0.39087, while the mean size of the surgical defects was 8cm and std ±0.86603, the mean period of activation was 12 week with std ±1.25167 while the mean of consolidation period was 3.2 months with std ±0.44096, As regards the pathological lesions, 6 patients had ameloblastoma, two patients had ameloblastic fibroma and one patient had desmoplastic fibroma, ramus and condyle was excised in two patients (figure 1,2) another 2 patients showed lesions in anterior regions (figure 3,4) and 5 patients had lesions affected the premolar molar region (figure 5) the results were satisfied for the patient and prosthetic appliances were designed for restoration of reasonable occlusions,

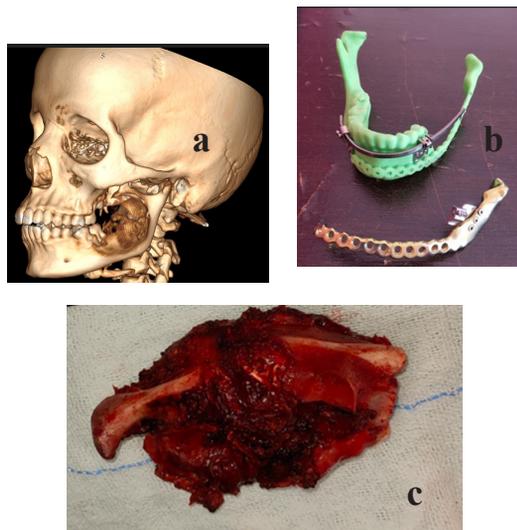


Figure 1 showing ameloblastoma affecting body and ramus of the mandible, b steriolithgraphic model for dsigning the distractor and reconstruction plate c- excised tumor

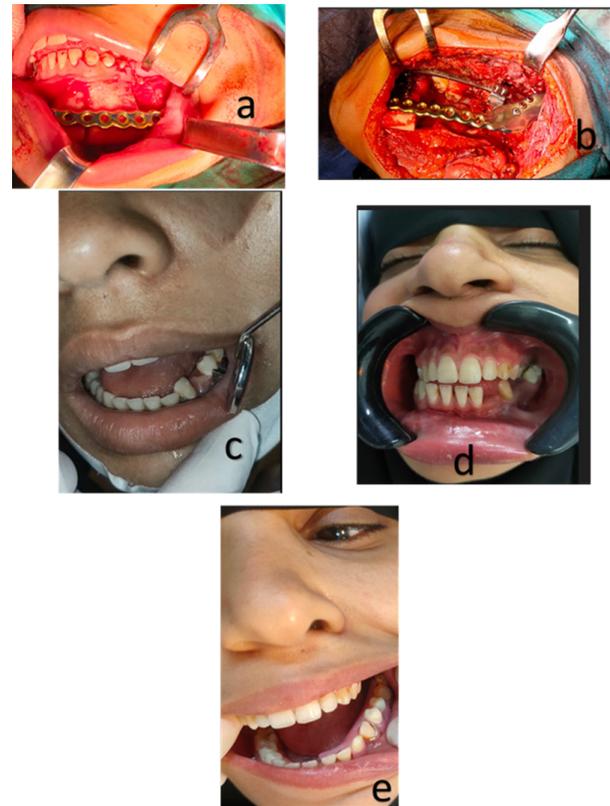


Figure 2 a osteotomy of transport disc b-fixation of the reconstruction plate c-distractionduring activation stage ,d-complete reconstruction of the defect, e- complete ste of teeth using acrylic denture

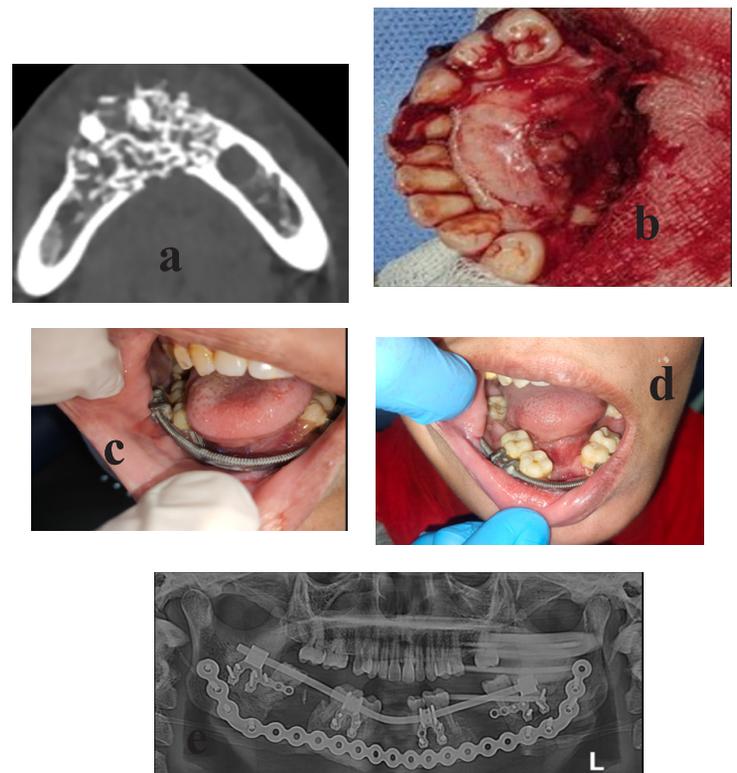


Figure 3 showing a ,axial view with anterior ameloblastoma, l b excised tumor ,c resulted defect d-reconstruction of the defect by two transeport discs, e- panoramic view showing approximation of the transeport discs

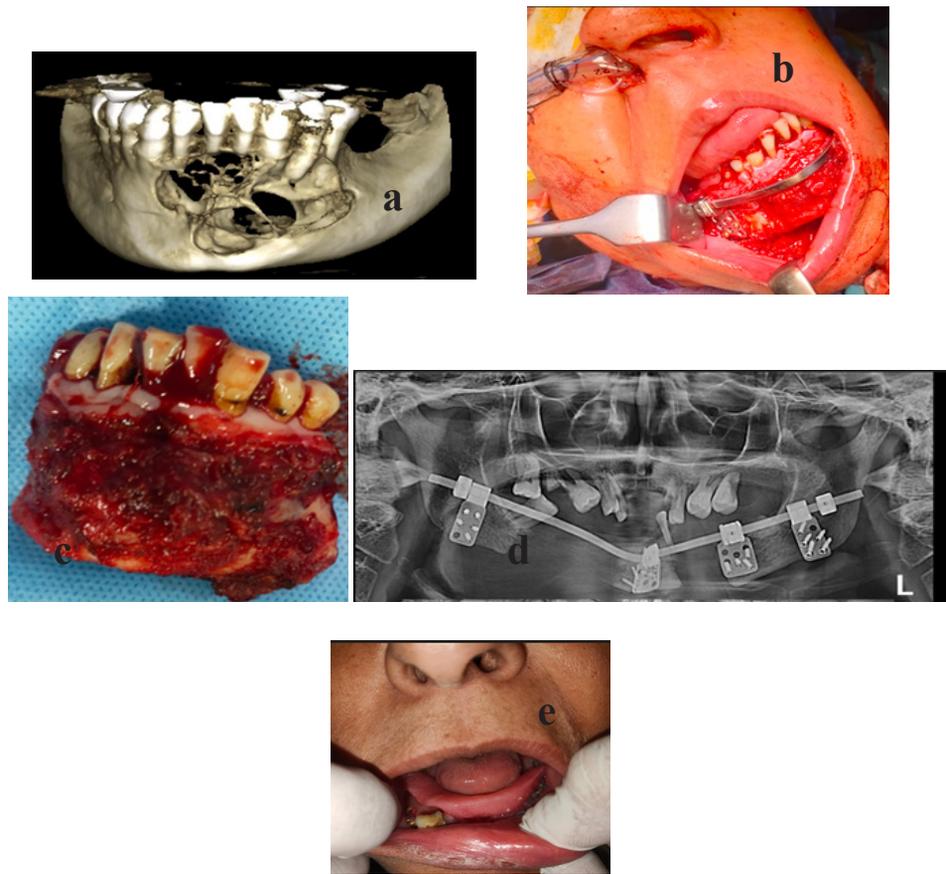


Figure 4 showing a- 3DCT with anterior mandibular ameloblastoma b- distraction fixed before excision of the lesion-c- large excised segment, d- panorama during distraction using only one distractor disc, e- the last photo showing using intraoral pink acrylic lingual plate to aid in molding of alveolar ridge during distraction

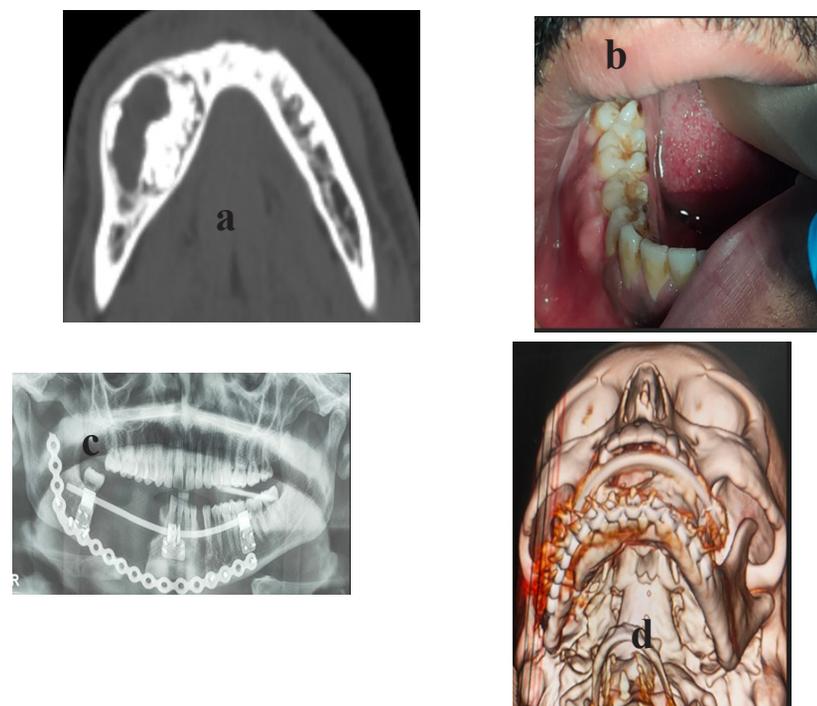


Figure 5 showing a axial section of ameloplastic fibroodontome, b photo swelling of the lower left site of mandible, c- defect before distraction, d- 3D CT showing reconstruction of the defect

DISCUSSION:

Reconstruction of mandibular defects is a great challenge for maxillofacial surgeons because mandible is an essential esthetic dynamic facial unit [7]. It is stated that mandibular defects equal to or less than 5cm can be reconstructed by non vascularized graft, but this procedure is complicated by infection and morbidity of donor site or even loss of the graft if it is grossly infected [8].

Vascularized graft can be used for reconstruction of mandibular defect that is more than 5cm specially in site with deficient soft tissue coverage or in oncological lesion that indicate postoperative radiotherapy, however this needs steep learning curve, and needs long time during operation and the type of the obtained bone is different [7]. Distraction osteogenesis is an effective surgical procedure providing both bony and soft tissue reconstruction with the same type of membranous bone of the mandible, furthermore distraction is simple in its manipulation [9]. So that distraction osteogenesis was used during this study to reconstruct the mandibular defects after surgical excision of the tumor.

Distraction of single osteotomy of shortened bone called monofocal distraction, while in case of bone defect that is reconstructed using single transport disc - that it is distracted to reach the opposing site (docking site) - it is called bifocal distraction, while on reconstruction of bone defect using two transport discs on both opposing sites till meet each other (at docking site) it is called trifocal distraction [10].

It is to be mentioned that the lingual soft tissue attachment to the transport disc must be kept intact to maintain good blood supply and this is in accordance to the study of Spagnoli [11], the width of transport disc through this study was ranged from 2 to 2.5 cm to keep sufficient soft tissue attachment for good blood supply and prevent its atrophy according to the literature [12,13], the consolidation period through this study was ranged from 3 to 4 month to obtain good bone quality and this is recommended by the study of Balaji [13]. Whose study was based on 9 case series, while it is recommended by another study to be 45 days consolidation period for every 15 mm distraction [9].

All the distraction devices through this study were intraoral designs and this is aesthetically more acceptable than extraoral devices that interferes with social contacts of the patients and complicated by skin scars, and this is in contrast to the study of Bansod and Lahiri [14] who preferred using extra oral device with their case study, while Balaji [13] preferred intraoral transport distractor through his study throughout this study all the defects reconstructed through using bifocal distraction except one defect constructed by using trifocal distraction (one disc on each side) because the defect was central at the anterior region of the mandible to keep facial symmetry, it is to be noted that that straight distraction is better and larger than arched distraction according to the study of Nelakandan and Bhrgava [5].

throughout this study, combination of distraction arm with guiding reconstruction plate was used in all cases except one case where distraction arm was used without accompanied reconstruction plate instead lingual guiding acrylic plate was used and good molding of distraction was achieved. The most challenging situation of transport distraction remains to be the obtaining of union at the docking site. Various techniques to create union at the docking site includes persistent compression, alternate compression-distraction, bone grafting, and adjunctive therapies such as electromagnetic waves, low ultrasound intensity and use of growth factors [15,16].

In this study reconstruction of the defects that is remained in the docking site were reconstructed using autogenous grafts in two patients and hydroxyapatite synthetic graft in two patients and left to heal by direct contact and miniplate in the other patients and this is in accordance to the study of Spagnoli [11], and Balaji [13] in this study two patients with condylar defects reconstructed by the reconstruction plate that was used alongside with the distractor arm this is in accordance to the study of Neelakandan et al [5] who used the reconstruction plate for reconstruction of the condyle in two patient through their study although distraction osteogenesis procedures take long time, but it has no morbidity of donor site, does not need steep curve of learning, and it needs less time of operation than free flap procedures, less team members during distraction are required also it can be used for reconstruction of defects more than 6 cm for both bony and associated soft tissue defects.

CONCLUSION

transport distraction osteogenesis is an effective valuable procedure for reconstruction of mandibular defects without donor site morbidity.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- 1-Chopra S, Enepekides D. The role of distraction osteogenesis in mandibular reconstruction. *Curr Opin Otolaryngol Head Neck Surg* 2007;15:197-201.
- 2- Gunbay, T., Akay, M.C. & Aras A., et al. (2009) Effects of transmandibular symphyseal distraction on teeth, bone, and temporomandibular joint. *J Oral Maxillofac Surg*, Vol.67, No. 10, pp: 2254-2265

- 3-Li T, Man Y, Bi R, Jiang N, Li Y, Zhu S Reconstruction of Mandibular Segmental Defects Using Transport Disk Distraction Osteogenesis. *J Craniofac Surg*, 28(8):2088-2092, 01 Nov 2017
- 4- 1. Likhterov I, Roche AM, Urken ML .Contemporary osseous reconstruction of the mandible and the maxilla. *Oral Maxillofac Surg Clin North Am*, 2019, 31(1):101–116
5. Neelakandan RS, Bhargava D (2012) Transport distraction osteogenesis for maxillomandibular reconstruction: current concepts and applications. *J Maxillofac Oral Surg* 11(3):291–299
- 6-Krishnan S and Subramaniam R. Bifocal distraction to regenerate segmental mandibular defects using a custom made device: a report of two cases. *Trauma Reconstr*. 2010 Jun;3(2):97-104
- 7- Potter JK. In: Bagheri SC, Bell RB, Khan HA (eds) *Current therapy in oral and maxillofacial surgery*, 2012, 1st edn. Elsevier Saunders, St Louis (MO), pp 483–496
- 8-Marechek A, AlShare A, Pack S, Demko C, Qureshy FA, Baur D. Nonvascularized bone grafts for reconstruction of segmental mandibular defects: is length of graft a factor of success? *J Oral Maxillofac Surg*. 2019;77(12):2557-2566.
- 9- Neelakandan, R.S., Zachariah, T., Kuchimanchi, P.K. et al. Versatility of Transport Distraction Osteogenesis for Reconstruction of Lateral Mandibular Ablative Defects. *J. Maxillofac. Oral Surg.* (2023). <https://doi.org/10.1007/s12663-023-01923-6>
- 10- Costantino, P.D., Shybut G. & Friedman C.D., et al. , (1990) Segmental mandibular regeneration by distraction osteogenesis. *Arch Otolaryngol Head Neck Surg*, Vol.116,pp: 535-545
- 11-(Spagnoli D Mandible Reconstruction with Transport Distraction Osteogenesis Atlas Oral Maxillofacial Surg Clin N Am 2008,16. 287–307
- 12-(Halis Ali Çolpak A, Demirbas A, Alkan A and Kütük N: Plate-guided transport distraction osteogenesis of mandible after the excision of an ameloblastoma with inferior alveolar nerve preservation and dental implant treatment: A case report with long-term follow-up *Oral and Maxillofacial Surgery Cases* 2019,5,1 100092
- 13-Balaji SM. Total reconstruction of mandible by transport distraction after complete resection for benign and malignant tumors. *Indian J Dent Res* 2016;27:205-12.
- 14- Bansod S and Lahiri J: Transport bone distraction osteogenesis of mandibular midline defect using custom made modified external device, *Egyptian Journal of Oral and Maxillofacial surgery* y2023, 14. 3,100-103
- 15-. Aaron RK, Ciombor DM, Simon BJ. Treatment of nonunions with electric and electromagnetic fields. *Clin Orthop Relat Res* 2004;419:21-9.
- 16-. Giotakis N, Narayan B, Nayagam S. Distraction osteogenesis and nonunion of the docking site: Is there an ideal treatment option? *Injury* 2007;38 Suppl 1:S100-7