ORTHODONTIC CHALLENGES AND MANAGEMENT IN ANTERIOR MAXILLARY DISTRACTION OSTEOGENESIS IN CLEFT LIP AND PALATE

Renu Parmar[a], Krishnamurthy Bonanthaya[b], Pritam Shetty[c]

INTRODUCTION

Cleft lip and palate patients are borne with a challenging deformity that requires multiple surgical interventions in order to reach functional and esthetic harmony. Maxillary hypoplasia is common finding and 25%-60% of cleft cases present with Class III deformity requiring surgical intervention.

The hypoplastic maxilla in cleft patients can be treated using conventional Le Fort I advancement with or without bone grafting. However, the surgical advancement in some cases with severe palatal scaring is not an easy task and bares the problem of relapse[1]. On the bright side of the spectrum Distraction osteogenesis (D.O) played a huge role in managing midface hypoplasia (DO) was first introduced to the mandible by McCarthy et al.[2], then to the maxilla of cleft lip and palate patients by Polley and Figueroa[3]This offeredwonderful results in treating the hypoplastic maxilla as it allows global improvement in facial aesthetic

Many surgeons applied this valuable technique on cleft lip and palate patients and reported the effectiveness of midface DO[4].

Anterior maxillary distraction osteogenesis (AMD) A process of generating new bone between surgically separated anterior and posterior maxillary segments using a distractor. It not only allows for a correction of skeletal horizontal deficiency but also addresses a deficiency of the arch perimeter. The Increased arch perimeter can be used for placement of artificial prosthesis (**Fig . 1**)

(a) (b)

Fig. 1 a). Edentulous space after AMD and , b). a prosthetic ceramic bridge in place post restotation

[a] Consultant, Bhagvan Mahaveer Jain Hospital
[b] Professor, Bangalore institute of Dental Sciences
[c] Professor, Bangalore institute of Dental Sciences

However, there can be some complications and challenges in performing AMD and the purpose of this article is to present the various challenges encountered during and post AMD and some clinical tips of their management. The representative cases demonstrated were picked from at our cleft setup at BMJ Hospital, Bangalore, India.

The foremost thing is to stick to the basics of surgical orthodontic preparation. If the basics of pre surgical orthodontic preparation for orthognathic surgery are followed adequately it takes care of nearly 60%-70% of the burden of challenges in the management of the cases of AMD.

It always starts from step one. And, the first step is patient counselling.Cleft patients requiring surgical management of underlying mid-face deformity require adequate counselling regarding a fairly long pre and post-surgical phase of orthodontics and this is of utmost importance. Maintaining a good oral hygiene and keeping regular follow ups is as crucial as other steps in the entire orthodontic process. Lack of adequate oral hygiene leads to periodontal breakdown, decalcification of teeth and dental decay. This can be a big challenge in the course of treatment and if left unattended can often result in failure of the case (**Fig. 2**).

Fig.2 - Gingival inflammation and decalcification and dental decay in a case of AMD due to poor compliance in maintaining oral hygiene

The second step is adequate aligning of the maxillary and mandibular arch - Primary aligning should be done adequately and should be given sufficient time. Most cleft patients have constricted maxillary archesand severe rotations and mal-positioning of upper and lower anteriors, and ectopically positioned maxillary premolars and at times multiple missing dental units. (**Fig. 3**) There is always arequirement of good amount of arch expansion. Thus, expanding the maxillary arch using a quad –helix expander or a Niti expander is the appliance of choice (**Fig. 4**).

It is advised like in any other case of Orthognathic surgery that the surgical procedure be performed in 19x25 or 21x25 SS wire, so is in cases of AMD (**Fig. 5**)

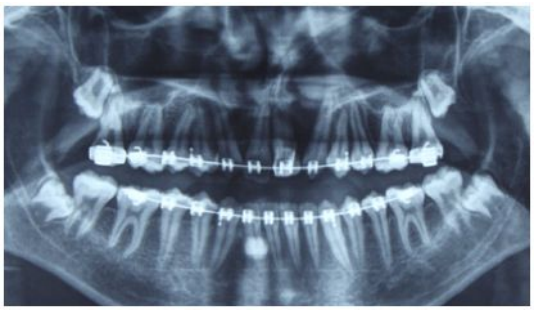
Fig. 3 – Severely constricted maxillary arch with diminished arch perimeter and ectopically erupted premolar

Fig. 4 – Quad-helix in-situfor expansion of severely constricted maxillary arch

Fig. 5 – Rigid 19x25 SS wire in place prior to AMD

Another important concern to look for prior to surgery in AMD cases is to check for the adequacy of root divergence. Root damage adjacent to the osteotomy site is one major, though not common complication (**Fig. 6a**). It can be avoided by adequately diverging the roots of the teeth adjacent to the planned osteotomy site(**Fig. 6b**).This can be done by using open coil springs or by giving v-bend in the rigid wire.

Fig. 6 a). Depicting damaged root of molar adjacent to AMD osteotomy site



b). diverged roots adjacent to the site of osteotomy

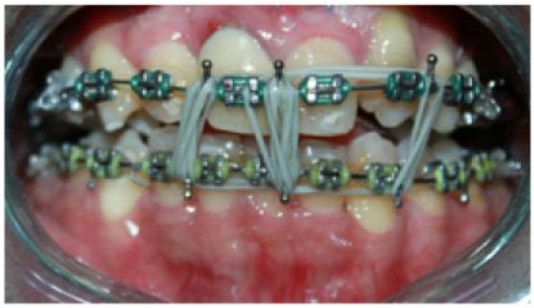
During the phase of distraction it is important to closely observe the process of activation of the screw. Premature consolidation is another complication (**Fig. 7**) which we have seen in our setup in two cases wherein the patient was lost to observation. This happened due to loosening of the device in the mouth. Thus, it is suggested that the hyrax distraction appliance should be cemented in the patient's mouth at least 24 hrs prior to the osteotomy and not on the operating table as contamination from blood and saliva during the surgical procedure can result in poor bond strength of the cement and hence debonding of the appliance.

Fig 7. – Premature consolidation of left segment represented by inadequate distraction in the concerned region

Another common problem which can be seen post consolidation phase is a persistent open – bite (**Fig. 8**). As, the distraction appliance is a dental borne entity in case of intra-oral hyrax device and the center of resistance of the maxilla lies far superior to it. The distraction force application is below the maxilla's center of resistance, thus a counter clockwise moment is created during the phase of distraction which causes an upward rotation of the maxillary occlusal plane (**Fig. 9a**). This upward rotation leads to an open bite. This bite can be closed with the use of vertical up and down or box elastics as the callus molding is possible in the first 4-6 weeks post distraction(**Fig. 9b**). However, poor compliance in wearing elastics can lead to a persistent open bite which is of skeletal nature. We suggest wearing of the elastics for 14-16 hrs/day for 6 weeks or more.

Fig. 8 - Persistent open – bite post con10solidation phase

Fig. 9 – a). Upward rotation of the maxillary occlusal plane due to counter-clockwise moment generated during the active phase of distraction.



b). Vertical box elastics to address the same.

Poor oral hygiene and poor compliance during the course of treatment is the primary reason of relapse after distraction (**Fig 10**). Relapse is also more prevelant in cases with thick and persistent palatal scars. However, maintaining adequate oral hygiene to avoid periodontal breakdown and regularity during the course of treatment can lessen the chances of relapse after distraction osteogenesis.

Also, during the post AMD Orthodontic phase, immediately placing a quad helix to reinforce anchorage and to maintain the distracted space and, restoring the edentulous space post distraction as quickly as possible can lead to reduction in the chances of relapse post distraction. (**Fig. 11 a&b**)

Fig 10 - Relapse after distraction (Poor periodontal status)

(a) (b)

Fig. 11 – a). Restoring the edentulous spacecreated post distraction using a removable partial prosthesis, and b) a quad helix in place during the post AMD orthodontic phase to reinforce anchorage and to maintain the antero-posterior space

Poor ossification of the distracted segment is a rare complication and the precise reason for it is not well known (**Fig 12**). We have seen two such cases of poor bone formation in our clinical setup and the obvious reasons in both were periodontal pockets in the roots of the teeth adjacent to the distracted segment. However, poor bone metabolism due to intrinsic or extrinsic metabolic derangements cannot be negated and needs more investigations.

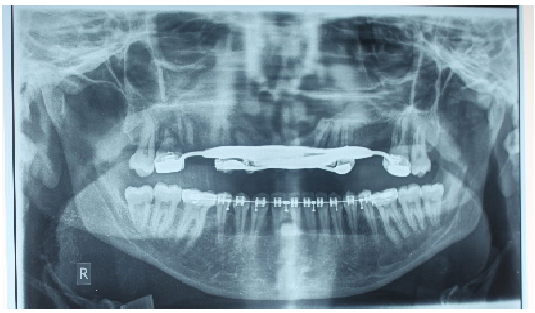


Fig 12. - Poor ossification of the distracted segment

CONCLUSION-

There are many advantages of AMD over Lefort I distraction. As, most cleft patients present with multiple missing dental units and, often a reduced arch perimeter. Anterior maxillary distraction has an added advantage over enmasse distraction osteogenesis in this context as the procedure leads to arch lengthening along with addressing the skeletal deficiency. Thus, the arch length gained helps in increasing the number of dental units thereby enhancing the often compromised masticatory table.

Another crucial advantage is when compared to the halo-frame of Lefort I distraction, the device used for AMD is more cost effective. It is the regular hyrax device. Thus, not only readily available but also cuts the cost.

Thus,Anterior segmental distraction osteogenesis of the hypoplastic cleft maxilla improves facial balance and aesthetics, and achieves stable occlusion while correcting dental-crowding without any detrimental effect on speech. The article presented certain challenges which we have face in the last decade while implementing this surgical procedure in our clinical set up and the various reasons for that and their management.

REFERENCES -

1. Thongdee, P. and Samman, N. (2005) Stability of maxillary surgical movement in unilateral cleft lip and palate with preceding alveolar bone grafting. Cleft Palate-Cra- niofacial Journal, 42, 664-674.
2. McCarthy, J., Schreiber, J., Karp, N., et al. (1992) Len- thening the human mandible by gradual distraction. Plastic and Reconstructive Surgery, 89, 1-10.
3. Polley, J. and Figueroa, A. (1997) Management of severe maxillary deficiency in childhood and adolescence through distraction osteogenesis with an external adjustable rigid distraction device. Journal of Craniofacial Surgery, 8, 181-185.
4. Rachmiel, A., Aizebud, D., Ardekian, L., et al., (1999) Surgically-assisted orthopedic protraction of the maxilla in cleft lip and palate patients. International Journal of Oral and Maxillofacial Surgery, 28, 9-14.