CME LIVE OPEN ACCESS

International Journal of Oral Health Dental Management

Research Article

A Novel Method to Control Force Vector during Distraction Osteogenesis

Tojan Chacko[1*], Varghese Mani[2], Supriya Goplalakrishnan[3], Jose Jacob[4], Anuradha. P[5], Vineetha V Menon[6].

Department of Orthodontics, Sree Anjaneya Institute of Dental Sciences, Modakkallur, Atholi, Calicut, Kerala 673315, India.

Corresponding Author: Supriya Goplalakrishnan, Department of Orthodontics, Sree Anjaneya Institute of Dental Sciences, Modakkallur, Atholi, Calicut, Kerala 673315, India.

Received: 2024 Mar 19 **Accepted:** 2024 Apr 10 **Published:** 2024 Apr 30

Keywords: Retruded maxilla, orthognathic surgery, craniofacial syndromes, Osteogenesis, Clinical Dental.

1. Introduction

Patients with cleft lip and palate typically present with a retruded maxilla and class III malocclusion. The cause of this deformity lies in early surgical correction, which results in scar tissue that restricts further maxillary growth. Traditionally, LeFort I osteotomy has been employed at a later stage to address this deformity and establish acceptable facial proportions. However, this technique has a significant drawback: the scar tissue often impedes the forward movement of the maxilla. Since Illizarov introduced distraction osteogenesis into dentistry, it has become an integral solution for various challenges including retruded maxilla. This approach has opened new avenues for treating complex skeletal malocclusions. In contrast to orthognathic surgeries, soft tissue responses have been reasonably favorable. However, vector control during maxillary distraction remained a challenging aspect during the initial years.

After its introduction by Park et al., micro-implants revolutionized orthodontics in a way no other invention has done. They have improved the scope of orthodontic treatment and enabled the successful management of many severe cases without surgery. However, patients with cleft lip and palate often still require surgical intervention. In such cases, micro-implants can be effectively combined to achieve optimal function and aesthetics. Controlling the proclination of incisors is one of the major concerns during distraction osteogenesis. In the following case, we combined micro-implants with a distraction device to advance the maxilla without causing undue proclination of the upper incisors.

2. Subject and methods

19-year-old male patient presented with the chief complaint of compromised esthetics and occlusion. Clinical and radiographic examination revealed surgically treated bilateral cleft lip and palate associated with midface hypoplasia, without any additional clinical signs suggestive of other syndromic diseases.

- Pretreatment photographs revealed
- Concave facial profile
- Retruded maxilla
- Negative overjet
- Treatment objectives
- Correction of facial concavity by maxillary advancement
- Correction of skeletal class III relationship
- Establishing ideal overjet and overbite without undue prolination of upperincisors

2.1. Treatment progress

The treatment journey began with presurgical orthodontics. Brackets were placed using 0.022" MBT. The initial objective at this stage was leveling and aligning. Once the initial alignment was achieved to an acceptable level, models were taken, and a hyrax appliance was fabricated. We chose a banded hyrax that was connected to the molars and premolars. In contrast to the usual hyrax, we changed the orientation of the screw in the appliance to be perpendicular to the midpalatal plane. This modification allowed for sagittal movement of the anterior maxilla upon activation. The anterior arm of the appliance was further modified to form a loop, which would accommodate a Medusa micro-implant. The arm terminated in an acrylic button, similar to a Nance palatal arch. Our objective was to control the undue proclination of the upper incisors.

Surgery was performed under general anesthesia. Osteotomy cuts were made, and the distractor was placed and checked intraoperatively for effectiveness. Two Medusa implants of size 2x12 were positioned as shown in Figure 1.

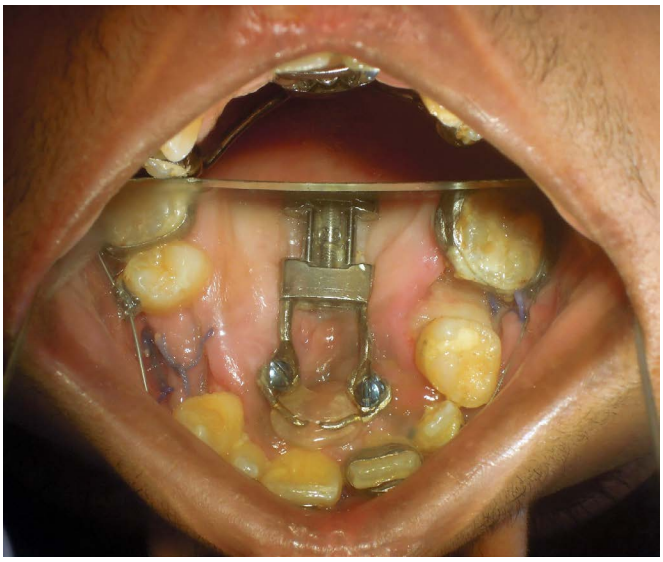

Figure 1: The subsequent steps followed the standard protocol for internal distractors.

3. Discussion

In surgically treated cleft lip and palate patients, maxillary skeletal deficiency presents a formidable challenge. Distraction Osteogenesis is a widely accepted technique for managing maxillary deficiency associated with cleft lip and palate [1]. This technique offers several advantages over orthognathic surgery, including reduced relapse tendency and better soft tissue adaptation. Wassmund pioneered maxillary distraction osteogenesis, followed by Rosenthal in 1927, who successfully attempted distraction in the anterior mandible. William Bell used a Wassmund osteotomy to correct anterior maxillary retrusion and class III malocclusion. Since then, distraction osteogenesis has been successfully employed by many authors to treat maxillary deficiency associated with both syndromic and non-syndromic conditions.

However, one of the major disadvantages associated with internal distractors is vector control. Undue proclination has been reported by various authors [2]. Microimplants have been used for more than two decades to facilitate difficult tooth movement. Various authors have also utilized microimplants as an adjunct to orthodontic treatment in craniofacial syndromes [3]. They argue for its use in cleft segment expansion and stabilization, guiding distraction when primary teeth are exfoliating, and addressing residual cants after vertical distraction of the ramus.

Vachiramon et al report that if the vector of midfacial distraction is not parallel to the occlusal plane, an open bite can develop. The authors recommend using vertical elastics to correct the deformity later on. However, this approach can result in extrusion of the upper and lower anterior teeth, which may not be an acceptable aesthetic outcome in most situations. In the present case, anterior maxillary distraction was achieved without significant difficulty in vector control. Medusa implants were used instead of regular micro-implants because they were less irritating to the tongue. This novel method of vector control appears promising; however, clinical trials are needed to establish its effectiveness unequivocally [4].

In this case, the authors successfully attempted to control the vector of anterior teeth using micro-implants. We believe that this innovation brings us a step closer to offering specialized care for patients with cleft lip and palate, helping them achieve the desired outcomes they truly deserve.

4. Conclusion

Our results highlight that distraction osteogenesis (DO) combined with micro-implants enables predictable movement of the maxilla in multiple planes. Achieving good vector control was feasible. This approach offers a simple, highly effective, stable, and predictable option for treating midface hypoplasia associated with cleft lip and palate. Notably, the therapeutic outcomes demonstrated significant improvements in both patient aesthetics and occlusal balance.

4.1. Ethics and consent

Given that this is not a formal study but rather a clinical tip (case presentation), it is our understanding that an ethical committee form may not be necessary. Informed patient consent has been obtained from both the patient and the parent.

Bibliography

1. Kloukos, D., Fudalej, P., Sequeira-Byron, P., & Katsaros, C. (2016). Maxillary distraction osteogenesis versus orthognathic surgery for cleft lip and palate patients. Cochrane database of systematic reviews, (9).
2. Sahoo, N. K., Jayan, B., Roy, I. D., & Desai, A. (2015). Evaluation of the hard and soft tissue changes after maxillary advancement with rigid external distractor in unilateral cleft lip and palate induced maxillary hypoplasia. medical journal armed forces india, 71, S355-S361.
3. Francis, C., Rommer, E., Mancho, S., Carey, J., Hammoudeh, J. A., & Urata, M. M. (2012). Vector control in internal midface distraction using temporary anchorage devices. Journal of Craniofacial Surgery, 23(7), S58-S61.
4. Vachiramon, A., Urata, M., Kyung, H. M., Yamashita, D. D., & Yen, S. L. (2009). Clinical applications of orthodontic microimplant anchorage in craniofacial patients. The Cleft palate-craniofacial journal, 46(2), 136-146.