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A CLINICAL STUDY ON ANTERIOR MAXILLARY DISTRACTION USING HYRAX APPLIANCE

Dental Science

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KEYWORDS

Introduction

Maxillary hypoplasia is a common finding found in patients secondary to cleft lip and palate. It's quite challenging for an surgeon when it comes to the correction of this deformity. Although many tecahniques have been used for the correction, however which is the best still remains quite challenging to say. However surgical techniques and methods have been improved. Conventionally it has been corrected by lefort 1 osteotomy since 1970's. However this technique had many draw backs post surgical tissue scar, velopharyngeal incompetence, high relapse rate.[1,2]

Distraction osteogenesis has opened a new perspective in treatment of CLP since 1990's.instead of causing immediate transposition it allows progressive movement of maxilla allowing better skeletal and soft tissue adaptation[3,4,5].

Maxillary distraction osteotomy (DO) was introduced in 1997 using a rigid external distraction (RED) device It was moreuseful for the treatment of CLP patients as it gave more stability and had fewer limitations of the amount and direction of advancement[6]. However it was shown by many studies that extensive distraction osteogenesis with RED also caused some amount of velopharyngeal insufficiency following maxillary distraction as seen after lefort 1. Anterior maxillary segmental distraction (AMSD), which was first reported by Karakasis, marked the premier application for the correction of maxillary hypoplasia secondary to CLP. Compared with the traditional maxillary distraction osteogenesis , AMSD showed less negative effects on velopharyngeal closure.[7,8]Tooth borne distractors showed easier application taking anchorage from teeth, however they caused dentoalveolar damage such as teeth tilting, periodontal stress and bone fenestration.

The aim of our study was to see the post surgical stability following anterior maxillary segmental distraction using the tooth borne palatal distractor after wassmund osteotomy.

Material and method

7 patients older than 14 years were included in the study which was conducted in department of oral and maxillofacial surgery, SGT dental college. Cases were included in the study irrespective of gender, type of cleft lip and palate, and the amount of advancement needed. The patients were evaluated using Orthopantomogram and lateral cephalograms preoperatively and at 3 months postoperatively (ie, before appliance removal) and at 6 months postoperatively. The distractor was fabricated extraorally on a cast and cemented into the patient's mouth the day before surgery. The initial deficiency, amount of advancement achieved, and relapses at 6 months, if any, were studied. The data were tabulated and analyzed.

Technique

A hyrax expansion screw was made preoperatively using patients cast .the appliance was oriented in such a way that it will make the movement in anteroposterior direction rather than the transverse direction. The appliance was made before surgery for passive fit than adjustments were made accordingly. Under general anesthesia with nasoendo tracheal intubation. Horizontal maxillary vestibular incision was marked from ist molar to the other side ,mucoperiosteum is reflected upwards exposing the osteotomy site uptoinfraorbital foramen. A buccal linear osteotomy cut made over the apices of maxillary teeth from the pyriform rim upto the predermined distraction site. Lateral nasal cut made. Both cuts repeated on the other side using osteotome. Vertical inter dental osteotomy made through buccal cortex, than it is extended from buccal alveolus to palatal bone. Same technique followed on the other side. Anterior maxilla is down fractured and mobilized keeping the palatal pedicle intact. Prefabricated hyrax appliance is than inserted and 4 bands were cemented. The distraction procedure was initiated after 5 days of latency period. The distraction device was activated once per day at a rate of 0.8 mm of the hyrax screw. Patients were recalled every 3 days. The distraction was discontinued after attaining the over jet of 4 mm [Figure 1]. Intermaxillary elastics were used in order to correct the patients' open bite. Consolidation period was 8 weeks and hyrax appliances were removed only after seeing sign of callus in the radiographs (FIGURES 1-20).

Results

All the distractions were completed smoothly with midfacial deformities efficiently corrected, and no insufficiency of velopharyngeal closure or speech function deterioration was found .The cephalometric analysis showed that there's pretty large improvement for maxilla, as the mean overjet was increased by 14.28 mm. Comparison of cephalometric analysis among the three time points-before surgery (T1), after distraction (T2), 2 years after treatment (T3), including SNA, NA-FH, Ptm-A, U1-PP, overjet and PP (ANS-PNS)-showed statistically significant ($P < 0.05$) (TABLE1) improvement between T1, T2 and T1, T3, while no significant difference was found between T2 and T3. Comparative evaluation between T1 and T2 showed that the mean value of SNA was improved by 10.73°, NA-FH by 10.64°, and Ptm-A by 13.91 mm ($P = 0.001$). This data indicated that the maxilla had been significantly moved forward with AMSD for correcting midfacial deformities. Improvement of U1-PP demonstrated that the anterior height of maxilla was increased by 6.34 mm. Evaluation of maxillary sagittal depth by PP showed a great increase of 10.02 mm. What's more, palatopharyngeal depth and soft palatal length had no significant changes by contrastive results of the PNS-PPW and PNS-U. Similar results were found by comparing these measurements between T1 and T3. However, comparative evaluation between T2 and T3 showed no significant change. only 2 of 10 patients showed a relapse of 3 mm, because this patient lost follow up thus delayed tooth replacement

Cephalometric index	Case 1		Case 2	
	Be-fore	Af-ter	Be-fore	Af-ter
SNA	66	69	74	76
SNB	71	71	80	75
ANB	−5	−2	−6	1
Wits	−3	0	−14	−2
U1 to SN	104	118	99	104
IMPA	88	90	79	95
Inclination angle	77	84	82	75
Gonial angle	131	134	142	135
Jarabak ratio (%)	64	65	66	65
GoGn-Sn	39	37	38	38
Nasolabial angle	73	65	116	91

SNA:Sella-Nasion-A point, SNB: Sella-Nasion-B point, ANB: A point-Nasion-B point, IMPA: Incisor mandibular plane angle

Table 1: cephalometric analysis (SNA and SNB Angles pre and post distraction)

Discussion

DO with the help of a hyrax screw incorporated in an acrylic plate was found to be effective in the treatment of two cleft lip and palate patients suffering from maxillary deficiency. Vertical cuts were made between two premolars on either side. Horizontal cuts were made similar to conventional Le Forte 1 osteotomy. The anterior segment of maxilla was mobilized to attain free movement of osteotomized segments for smooth distraction. Caution has to be taken with the palatal bone cut by the osteotome. If the palatal mucosa gets lacerated in a transverse direction it is not advised to proceed further with distraction, because the application of anteroposterior distraction will probably create an enlarging oronasal fistula. Wunderer osteotomy cannot be used in such cases because in that we have to give a palatal mucosal transverse incision. Dolanmaz et al[9]described an technique which included essentially an alveolar osteotomy of maxillary anterior teeth in which we don't touch the nasal floor in a noncleft patient, rather than a true anterior maxillary segmental osteotomy. The accuracy of distraction depends mainly on the planning of vector. To achieve the vector we need to simulate model surgery preoperatively. Greater accuracy can be achieved by using a tooth-borne distractor. The method of fixing the appliance to the teeth with bands also allows better tooth position control than an acrylic splint, and it may also be more difficult to remove an acrylic splint than a band[9]. In all the cases same technique was used to move the retruded maxilla forward for correction of the Class III malocclusion. In Bell's original case report,[10]correction of class 3 malocclusionwas done by immediate segment transposition followed by bone grafting. However, the use of a distractor enables the anterior maxilla to be moved gradually, thereby eliminating the need for bone grafting. Further- more, the technique allows the regeneration of bone in the gap caused by distraction and also causes soft tissue genesis on the palate and the alveolus. This enables the actual forward movement of the anterior maxilla, whereas Bell's technique involved a primarily forward tilting movement hinging on anonpliable palatal mucosa. The regenerated bone will not shrink like nonvascularized bone graftwhich was used in previous studies, and should therefore provide ample bone volume for dental implant placement. This technique is not expected to be widely used, but would be of particular interest to surgeons on specific indications such as existing crowding of the dental arch in a Class III malocclusion from a retruded maxilla. As the technique generates more space at the buccal segment, it would enable a crowded dental arch to be properly aligned by orthodontics without a need for dental implants. In cases where premolars have been inadvertently removed, implants could be placed for dental rehabilitation. The forward movement of the entire anterior maxillary segment also improves upper lip and paranasal prominence in cleft lip and palate patients. An integrated treatment plan by orthodontists, prosthodontists, and surgeons are important to bring optimal improvement of the malocclusion and esthetics.[11] However, in the method used in this study, there is no need for surgical insertion or removal of the intraoral device.[12]Another disadvantage of DO is lack of vector control which can result in anterior open bite.13 Nevertheless, this disadvantage can be overcome by callus molding immediately after completion of distraction phase. Orthognathic surgery is well known among orthodontists and oral and maxillofacial surgeons. After a patient has been orthodontically prepared, movement of the maxilla and mandible can be completed within a matter of a few hours. However, higher risk of morbidity, need for a longer surgery time, requirement of fixation, and relapse tendency can be considered as some disadvantages of Le Fort 1 osteotomy when compared with this DO method.[14]

CONCLUSION:

By employing maxillary DO with internal devices, a successful treatment outcome, including improvement in jaw function, good esthetics, and occlusal stability with no relapse, was achieved in maxillary deficient cases suffering from cleft lip and palate. t should be noted that this study included only ten cases; further research on more cases is needed to evaluate this method more comprehensively.

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