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Original research

Long-term stability of soft-tissue changes following maxillary distraction osteogenesis in adult subjects of cleft lip and palate

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ABSTRACT

Objective: To test the hypothesis that there is no long-term stability of soft tissue changes following maxillary advancement with distraction osteogenesis in adult subjects of cleft lip and palate.
Setting and sample: Oral Health Sciences Centre at PGIMER, Chandigarh; 15 consecutively treated adult subjects in the age range of 17–34 years with cleft lip and palate who underwent advancement of maxilla by distraction osteogenesis.
Materials and methods: Lateral cephalograms recorded prior to distraction, at the end of distraction, 6-months after distraction and at least 2-years after maxillary distraction of 15 subjects ($M = 8$, $F = 7$) in the age range of 17–34 years with complete cleft lip and palate were used for the evaluation of treatment outcome and long-term stability of the soft-tissue changes.
Results: The soft tissue profile, total soft tissue profile and nasolabial angle were improved significantly after immediate ($P < 0.001$), 6-months ($P < 0.01$) and 2-years ($P < 0.01$) of maxillary distraction. Forward movement of the nasal tip and nasal base were increased significantly ($P < 0.001$). The length and thickness of the upper lip was improved after various time intervals of maxillary distraction osteogenesis ($P < 0.01$). Approximately 25% of the changes following maxillary distraction were relapsed during first 6-months of post-distraction follow-up period.
Conclusions: Distraction osteogenesis of the maxilla improved the soft tissue profile by increasing the prominence of nose, moving the upper lip forward and normalizing the nasolabial angle. Approximately 75% of the changes were remained stable at the end of 2-years of follow-up of maxillary distraction osteogenesis.

1. Introduction

Maxillary distraction offers a solution for the correction of maxillary hypoplasia in cleft lip and palate subjects. It is widely accepted, predictable and stable technique in cleft lip and palate subjects [1–4]. This procedure is performed both in growing [2,5–8] and adult [9–12] patients. Distraction of maxilla not only allows correction of maxillary retrusion during mixed dentition period but also allows improvement in facial esthetics [1]. Although many studies are there in the literature mentioning the short-term and long-term outcomes of skeletal changes [2,5,8–10,13–15] following maxillary distraction but only few studies are there mentioning the soft-tissues changes [6,7,16] following maxillary distraction in cleft lip and palate subjects. However, there is not a single study to the best of our knowledge mentioning the long-term stability of soft-tissue changes following maxillary distraction particularly in adult subjects of cleft lip and palate. Thus the present study was designed to evaluate the long-term stability of soft-tissue changes following maxillary distraction osteogenesis in adult subjects of cleft lip and palate.

2. Materials and methods

2.1. Patients

The study was conducted on 15 ($M = 8$, $F = 7$) North Indian adult subjects in the age range of 17–34 years with complete cleft lip and palate who underwent advancement of maxilla by distraction osteogenesis. Among 15 subjects, 8 were with unilateral cleft lip and palate and 7 with bilateral cleft lip and palate. None of the subjects had received alveolar bone grafting. All the subjects had severe

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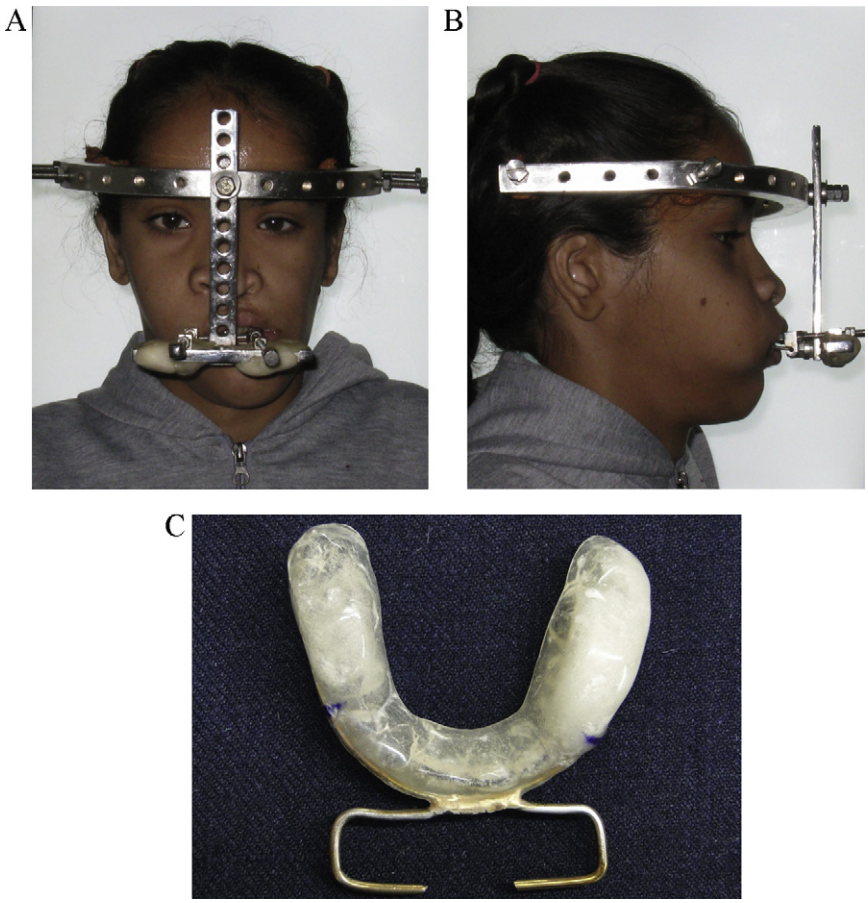

Fig. 1. The custom made rigid extraoral distractor device fixed in the patient. (A) Front view, (B) lateral view and (C) intraoral acrylic splint.

anteroposterior maxillary hypoplasia with Class-III malocclusion and reverse overjet.

2.2. Distraction procedure

In all the subjects' maxillary arch was prepared by multibonded fixed orthodontic appliance prior to distraction. After the preparation of maxillary arch, the multibonded appliance was removed and an alginate impression was made for intraoral splint fabrication. High Le Fort-I osteotomy with septal and pterygomaxillary disjunction was carried out. The splint was cemented to the maxillary arch with glass ionomer cement and the customized distractor was fixed. The design of the customized distractor is described in Fig. 1. After a latency period of 4–6 days, distraction was started at the rate of 1 mm/day by adjusting the screws attached to the traction wires of the intraoral splint. The distraction vector was along and parallel to the occlusal plane. All the subjects were followed up weekly and active distraction was continued until 5–8 mm of positive overjet was achieved. After the consolidation period of approximately 6–8 weeks, the distractor and occlusal splints were removed. The fixed orthodontic appliance was again bonded and the correction was retained by Class-III elastic traction (¼", 6 oz force). The average duration of orthodontic treatment after maxillary distraction was approximately 1 year. The same oral surgeon (VR) carried out the procedures in all the subjects. The study was approved by the Institute Review Board (IRB).

2.3. Recording of lateral cephalograms

The lateral cephalograms were recorded at the beginning of treatment, before distraction procedure (T_0), at the end of active distraction (T_1), 6-months after the end of active distraction (T_2) and at least 24-months after the end of active distraction osteogenesis (T_3). The mean time interval between the T_2 and T_3 was 25.5 ± 1.94 months. Few cephalograms were recorded in a different machine but the magnification was corrected accordingly. For the evaluation of skeletal and soft-tissue changes, lateral cephalograms recorded at T_0, T_1, T_2, T_3 were traced manually and considered for statistical analysis. All the cephalograms were traced and analyzed by the same investigator (AKJ). All the linear and angular variables were measured twice and the mean was considered for statistical analysis. Various cephalometric landmarks, linear and angular variable for the evaluation of skeletal changes following maxillary distraction is described in Fig. 2. Various landmarks, linear and angular parameters for the evaluation of soft-tissue changes are shown in Figs. 3 and 4.

2.4. Statistical methods

All the statistical analyses were performed with SPSS software (Version-13). The data were subjected to descriptive analysis for mean, range and standard deviation of all variables. ANOVA and post hoc test were used and probability value (P-value) 0.05 was considered as statistically significant level.

3. Results

The detail results of few important skeletal cephalometric measurements are described in Table 1. The SNM angle was increased significantly ($P < 0.001$) from predistraction (T_0) value of 65.16° to immediate post-distraction (T_1) value of 78.50°. During post-distraction follow-up period, the SNM angle was relapsed