ORIGINAL RESEARCH

Early Orthodontic Intervention in Cleft Lip–Palate and Noncleft Children with Developing Class III Malocclusion: A Clinical Study

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Abstract

Context: Orthopedic correction of skeletal class III malocclusion in a growing patient is crucial as it can circumvent future surgical procedures.

Aims: The aim of the study is to evaluate the dental and skeletal effects of early orthodontic intervention of developing class III malocclusion.

Settings and design: A final sample of 38 children in the age-group of 6–14 years having skeletal class III malocclusion was selected. Subjects were divided into two groups; group I—included 18 children (male—10, female—8) with surgically repaired cleft lip and palate and group II—20 children (male—14, female—6) without any cleft lip and palate.

Materials and methods: Cemented rapid maxillary expansion (RME) appliances with 11 mm hyrax screws were used in all patients. Elastic traction forces were applied to the reverse-pull headgear worn by the patients. Both pre- and posttreatment records along with lateral cephalograms were taken.

Statistical analysis used: The pre- and posttreatment mean and standard deviation measurements of the angular and linear observations were statistically analyzed with Statistical Package for the Social Sciences (SPSS) software (version 13) and were correlated through independent *t*-test and paired *t*-test.

Results: Following headgear therapy, improvement was greater in the cleft group than noncleft group with greater advancement of maxilla along with clockwise rotation of mandible in clefts.

Conclusion: Protraction mechanics with expansion can be employed successfully in repaired cleft lip and palate and noncleft prepubertal children having developing class III malocclusion, showing concave profile, and retrusive maxilla.

Keywords: Cleft lip and palate, Rapid maxillary expansion, Reverse pull headgear.

Key message: Accurate diagnosis and understanding of the individual growth pattern are crucial in the early interception of a class III malocclusion to achieve a more favorable facial profile.

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Introduction

Angle in his classification of malocclusion (1899) described class III as the mesial relationship of the mandible, wherein the mesiobuccal cusp of the maxillary first molar occludes in the embrasure between the mandibular first and second permanent molars. The most noticeable characteristics of class III malocclusion are skeletal, functional, and dental discrepancies characterized by concave profile, mandibular prognathism, maxillary retrognathism or both, and labial tipping of the upper incisors leading to an unpleasant aesthetic appearance of the face.[1,2] These features can also be accompanied by maxillary atresia, lower lip protrusion, anterior crossbite, absence of a zygomatic prominence, and excess of the facial lower third.[3,4]

Children affected with class III malocclusions along with congenital craniofacial anomalies like cleft lip and/or palate (CLP) are associated with anomalous growth of the midfacial area, unclear patterns of speech, velopharyngeal deficiencies, skeletal deformities and dental malformations leading to facial disfigurement, and low self-esteem of the child. Their management requires a thorough analysis of the situation, that is, the degree of palatal involvement in the cleft, tissue deficiency, surgical trauma, and scars resulting from surgical intervention for correction of the defect.[5] Several appliances for this early treatment have been advocated like class III Bionator, Frankel (FR-III), chincup, reverse twin-block, and protraction face mask treatment.[6] Orthodontic literature survey indicates maxillary protraction with a face mask is the most widespread protocol in the early treatment of class III malocclusion,[7] since it induces greater orthopedic change by redirecting the patient growth through the application of forces on sutural surfaces resulting in forward displacement of the maxilla and bone apposition with

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a significant sagital change and correction of malocclusion in younger children.[8]

The objectives of the study were to scrutinize the effects of early orthodontic treatment with reverse-pull headgear in class III malocclusion both cleft and noncleft children and to observe the changes in the hard and soft tissue structures associated with maxilla after early treatment. The lateral cephalogram is the most routinely used tool for the evaluation of changes in craniofacial relationships in orthodontic practice and has been employed in the present study to evaluate changes observed before and after treatment.

Materials and Methods

The study sample for this investigation included initially 42 children in the age-group of 6–14 years reported to the outpatient department of Pedodontics and Preventive Dentistry, SCB Dental College and Hospital, Cuttack, Odisha, India, during the period from January 2012 to June 2013, out of which four discontinued the treatment leaving a final sample to be 38 (male—24, female—14). The study sample was divided into two groups; group I—included 18 children (male—10, female—8) with surgically repaired cleft lip and palate with a mean age of 8.89 ± 1.60 years, and group II—20 children (male—14, female—6) without any cleft lip and palate with a mean age of 8.70 ± 1.87 years (Table 1). The study was approved by the ethics committee of SCB Dental College and Hospital.

Inclusion Criteria

- Patients with concave profile and skeletal class III pattern.
- Keen and compliant patients.
- Patients without any previous orthodontic treatment.
- Surgically repaired cleft lip and palate and noncleft patients without any associated syndrome.

Treatment Protocol

Pretreatment records along with lateral cephalograms (T1) were taken (Figs 1 and 2).

Appliance Design

The face mask (Delaire type) is a one-piece appliance formed of a forehead pad and a chin pad that are connected by heavy steel rods and two adjustable screws on a support bar for attaching elastics (Fig. 3A). Rapid maxillary expansion (RME) appliance was fabricated on the working model with a Hyrax screw of 11 mm expansion range (Fig. 3B) whose arms were embedded into the occlusal splint on posterior teeth. Vestibular hooks were incorporated into the splint in the region of the canine-premolar/deciduous molar region so that extraoral elastic can be engaged. The RME appliance was then cemented to the posterior teeth with glass ionomer cement (Fig. 3C).

Fig. 1: Pretreatment lateral cephalogram

All the patients were treated with the following treatment protocol:

- First phase: The RME appliance was activated daily twice by 90° rotation in the morning and evening by the patient/parents for 7 days or until the desired transverse width was achieved in cases of reduced transverse diameter.
- Second phase: Elastic traction forces (5/16 inch, 8 ounces) were applied from the face mask to the hooks in the expansion appliance 20–30° downward and forward to the occlusal plane (OL) bilaterally to obtain a protraction force of about 300–600 gm/side (Fig. 3D). All the patients were advised to use the face mask regularly except during meal times and parents were asked to maintain a daily routine regarding duration of reverse pull head gear (RPHG) worn by the patient.

All patients were treated at least to a positive dental overjet before the RME appliance was removed. The mean treatment duration was 10–12 months. Posttreatment records along with lateral cephalograms (T2) were taken (Figs 4 and 5).

Cephalogram Recording

All lateral cephalograms were taken with the same cephalostat (Orthophos XG) by the same operator (self) in the natural head position. The lateral cephalometry radiograph is taken from the left side of the child maintaining a target-film distance of 5 feet from the midsagittal plane and exposure with 85 kVp and 10 mA as recommended by Gaoz and White.

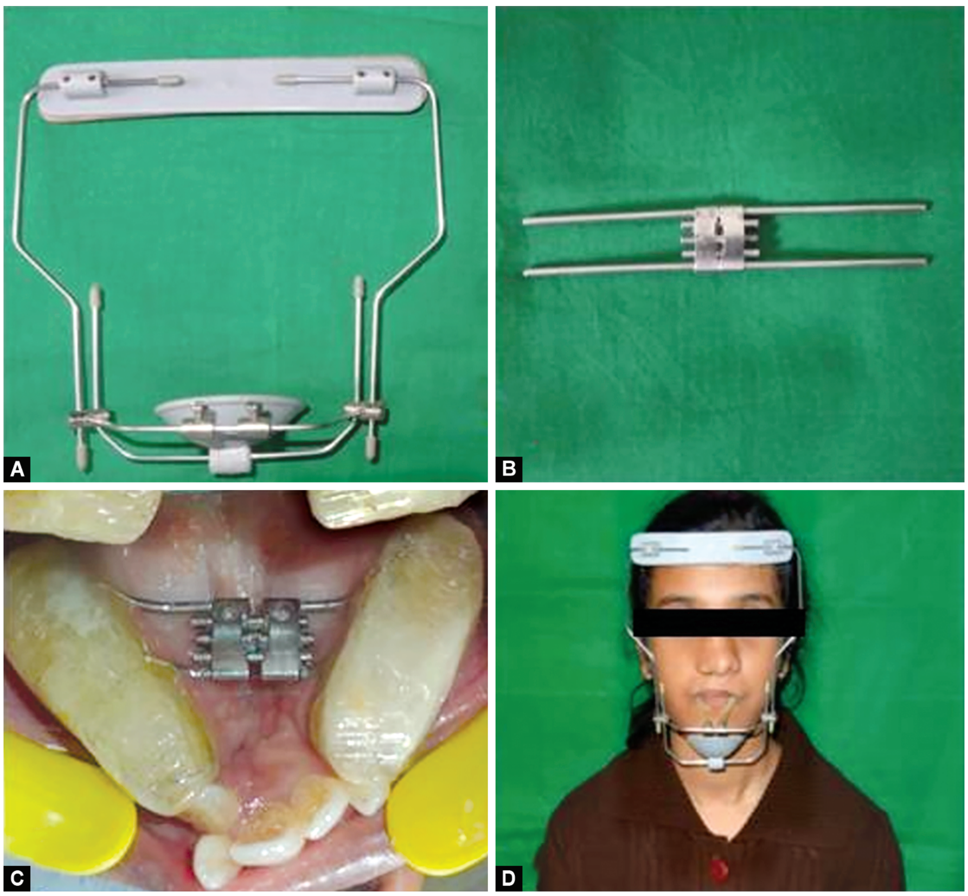
All the lateral cephalometric films were traced on the transparent cellulose acetate matte sheet of 0.003-inch thickness by a single operator. The hard tissue outline was traced first followed by the soft tissue outline using 3H lead pencil. All the selected reference points were first identified and then marked. If the bilateral structures cast double shadows on the film, the technique of averaging the bilateral images was followed and the selected reference planes were drawn. To check for intraobserver and interobserver reliability, 10 randomly selected radiographs were traced and reevaluated after 20-day intervals by the same investigator and another observer from the Department of Pedodontics and Preventive Dentistry. The cephalometric landmarks were identified and lines were constructed on all cephalograms (T1, T2) with a horizontal plane constructed 7° to

Table 1: Distribution of samples according to sex

	Cleft		*Noncleft*		*Total*	
Sex	*No.*	*%*	*No.*	*%*	*No.*	*%*
Male	10	55.56	14	70.00	24	63.16
Female	8	44.44	6	30.00	14	36.84
Total	18	100	20	100	38	100

χ^2, 0.849; df, 1; *p*, 0.357; shows distribution of samples by sex. Group I cleft group (n = 18) consisted of 10 males (55.56%) and eight females (44.44%); group II noncleft group (n = 20) consisted of 14 males (70%) and six females (30%)

Figs 2A to C: Pretreatment photographs: (A) Profile; (B) Class III molar relationship with negative overjet; (C) Anterior crossbite



Figs 3A to D: (A) Face mask (Delaire type); (B) Hyrax screw of 11 mm expansion range; (C) Intraoral view of the cemented acrylic splint; (D) Elastic traction forces applied the Sella-Nasion plane as the horizontal axis. Changes in midfacial structures were assessed for growth (T2-T1).

Superimposition

The pre- and postcephalograms were superimposed on SN at SA reference grid was established by the occlusal plane (OL) and its perpendicular plane (OLp) through the sella point on the initial cephalogram. Maxillary and mandibular skeletal changes were measured from the movement of the representative landmarks along the initial OL plane to OLp.

Fig. 4: Posttreatment lateral cephalogram

Statistical Analysis

The pre- and posttreatment mean and standard deviation measurements of the angular and linear observations were statistically analyzed with Statistical Package for the Social Sciences (SPSS) software (version 13) to find significance if any. Each parameter of pre- and posttreatment measurements in both the cleft and noncleft groups was correlated through independent *t*-tests and paired *t*-tests.

Results

The pretreatment measurements for different parameters of the skeletal maxilla revealed that the upper jaw (angle SNA) was significantly more retrognathic ($p < 0.001$) and the mean sagittal length of the upper jaw (relative maxillary length, RmaxL) was smaller in group I (cleft) compared to group II (noncleft). In the posttreatment values, only the SNA and *N* to *A* value shows a statistically significant difference between the two groups. Similarly, before treatment upper incisors are significantly more retroclined in the case of the cleft group than the nonclefts. The posttreatment values signified that following protraction therapy upper incisors were proclined in both groups with a comparatively greater value for nonclefts (Tables 2 and 3).

The pretreatment measurements of the skeletal mandible showed more prognathic lower jaw (SNB; relative mandibular length, RMndl) in the noncleft group than in the cleft group. In vertical assessment, only SN-MP was found to be significantly smaller in clefts than the noncleft group. The posttreatment values showed SNB was decreased in both the groups after treatment. Angular measurements like FMA and SN-MP increased

Figs 5A to C: Posttreatment photographs: (A) Profile; (B) Class I molar relationship; (C) Anterior positive overjet

Table 2: Pre- and posttreatment descriptive statistics in both cleft and noncleft group

	Pretreatment—T1			*Posttreatment—T2*		
	Cleft	*Noncleft*		*Cleft*	*Noncleft*	
	Mean ± SD	*Mean ± SD*	*Significance*	*Mean ± SD*	*Mean ± SD*	*Significance*
Skeletal maxilla measurement						
SNA	74.50 ± 1.14	77.65 ± 1.86	***	77.47 ± 0.93	79.40 ± 1.89	***
N to A on HP	−3.58 ± 1.82	−2.88 ± 1.87	NS	0.27±2.13	−0.57 ± 1.66	NS
RMxL	82.86 ± 1.43	84.45 ± 3.77	NS	85.91 ± 1.77	86.27 ± 3.55	NS
Maxillary dentoalveolar measurement						
U1 to NA (angle)	20.72 ± 3.66	24.15 ± 4.30	*	22.55 ± 3.53	26.85 ± 4.60	**
U1 to NA (linear)	2.14 ± 0.95	3.98 ± 1.41	***	3.11 ± 1.26	5.65 ± 1.59	***
U1 to A Pog (linear)	1.42 ± 0.94	3.20 ± 1.48	***	2.75 ± 0.91	4.70 ± 1.60	***
Skeletal mandibular measurement						
SNB (degree)	76.83 ± 1.06	80.15 ± 1.11	***	74.80 ± 0.87	79.05 ± 1.20	***
RMndL	90.42 ± 2.50	97.48 ± 3.09	***	92.52 ± 2.51	99.95 ± 3.17	***
Go-Pog	59.53 ± 2.04	63.73 ± 1.98	***	61.02 ± 1.93	65.42 ± 2.29	***
FMA (degree)	26.19 ± 3.21	25.98 ± 2.89	NS	30.44 ± 3.56	28.42 ± 2.93	NS
SN–MP (degree)	28.19 ± 2.17	30.13 ± 2.22	**	31.55 ± 2.35	32.12 ± 2.17	NS
Ar-Go	33.92 ± 1.5	37.4 ± 2.0	***	34.55 ± 1.25	38.35 ± 2.09	***
Gonial angle (degree)	128.9 ± 2.5	129.2 ± 2.6	NS	127.72 ± 2.16	128.10 ± 2.84	NS
Mandibular dentoalveolar measurement						
L1 to NB (degree)	22.75 ± 3.98	25.15 ± 3.22	*	20.83 ± 4.24	22.80 ± 3.38	NS
L1 to NB (linear)	2.81 ± 1.49	4.68 ± 0.96	***	1.97 ± 1.48	3.25 ± 0.80	**
L1 to MP (degree)	84.39 ± 2.21	83.88 ± 2.48	NS	80.69 ± 1.81	78.07 ± 2.18	***
L1 to MP (linear)	35.89 ± 2.94	35.93 ± 2.68	NS	37.52 ± 3.07	37.80 ± 2.61	NS
Maxillomandibular measurement						
Wits	−6.67 ± 2.77	−2.70 ± 1.88	***	0.83 ± 1.92	1.25 ± 1.00	NS
ANB (degree)	−2.39 ± 1.17	−2.50 ± 2.02	NS	2.61 ± 0.83	0.37 ± 2.28	***
Angle of convexity	−3.92 ± 4.27	−2.33 ± 2.18	NS	3.00 ± 4.01	2.12 ± 1.22	NS
Y-axis	58.36 ± 2.79	59.20 ± 3.50	NS	62.72 ± 3.17	61.37 ± 3.44	NS
Jarabak ratio	0.60 ± 0.02	0.63 ± 0.03	**	0.60 ± 0.01	0.62 ± 0.03	**
Interincisal angle	138.94 ± 3.04	129 ± 3.28	***	135.88 ± 3.82	128.05 ± 3.48	***

NS, not significant; SD, standard deviation; *significant at 5% level ($p < 0.05$); **significant at 1% level ($p < 0.01$); ***significant at 0.1% level ($p < 0.001$)

significantly in both groups with clefts showing greater downward and backward rotation of the mandible than nonclefts. The pretreatment statistics of the dentoalveolar mandible showed inclination of mandibular incisors to NB was more for nonclefts due to a more prognathic feature than the clefts. Postprotraction results revealed greater retroclination of mandibular incisors in a noncleft group than clefts (Tables 2 and 3).

There is no statistically significant difference in the sagittal intermaxillary relationship expressed by the ANB angle between the two groups. However, the pretreatment values for wits-appraisal and interincisal angles significantly differ between the two groups. Posttreatment results revealed improvement in wits appraisal, ANB, and angle of convexity with a decrease in interincisal angle in both the groups (Tables 2 and 3).

The pretreatment values of soft tissue showed upper lip (UL-E) was significantly more retrusive in the cleft group. The relationship of the upper and lower lip expressed by the distance LL-UL (EP) showed that following protraction the change in lower lip position for the CLP group is less than the noncleft group ($p < 0.001$) (Table 4).

Superimposition

The mean changes observed for different parameters in relation to superimposition revealed significantly more forward movement of point A (A-Olp distance) for cleft than noncleft ($p < 0.001$). Horizontal changes for maxillary dentition showed significantly greater forward movement of molars (UM-Olp) for the cleft group than nonclefts. Vertical changes showed significant extrusion on maxillary molars (UM-SN) in both groups with clefts taking the edge ($p < 0.001$). There is no significant difference observed in the position of molars (LM-SN, LM-Olp) (Table 5).

Discussion

The developing class III malocclusion in growing children is one of the most challenging problems to deal with orthodontic intervention since it involves midfacial retrusion. This condition is more prominent in children suffering from congenital malformation of cleft lip and palate both untreated or surgically treated.[9]

Clinical and experimental studies show that early treatment with maxillary protraction appliances with a face mask is very effective in promoting the growth of a deficient maxilla and correcting class III malocclusion.[10] The use of bonded palatal expansion screws for rapid palatal expansion (RPE) of palatal sutures offers a distinct advantage in conjunction with maxillary protraction with a face mask, as it helps to disarticulate the maxilla and initiate cellular responses in the sutures leading to expansion of the sutures and act as a positive

Table 3: Comparison of posttreatment (T2–T1) changes in measurements of cleft and noncleft group

	Cleft	*Noncleft*	
	Mean ± SD	*Mean ± SD*	*Significance*
Skeletal maxilla			
SNA	2.97 ± 0.61	1.75 ± 0.82	***
N to A on HP	3.86 ± 1.08	2.30 ± 0.75	***
RMxL	3.06 ± 0.59	1.83 ± 0.52	***
Maxillary dentoalveolar measurements			
U1 to NA (angle)	1.83 ± 0.71	2.70 ± 1.08	**
U1 to NA (linear)	0.97 ± 0.50	1.68 ± 0.95	**
U1 to A Pog (linear)	1.33 ± 0.45	1.50 ± 0.49	NS
Skeletal mandibular measurements			
SNB (degree)	−2.03 ± 0.47	−1.10 ± 0.53	***
RMndL	2.11 ± 0.68	2.48 ± 0.94	NS
Go Pog	1.50 ± 0.38	1.70 ± 0.41	NS
FMA (degree)	4.25 ± 0.97	2.45 ± 0.86	***
SN-MP (degree)	3.36 ± 0.72	2.00 ± 0.78	***
Ar-Go	0.64 ± 0.45	0.95 ± 0.39	*
Gonial angle (degree)	−1.22 ± 1.31	−1.05 ± 1.36	NS
Mandibular dentoalveolar measurements			
L1 to NB (angle)	−1.92 ± 0.46	−2.35 ± 0.49	**
L1 to NB (linear)	−0.83 ± 0.34	−1.43 ± 0.47	***
L1 to MP (angle)	−3.69 ± 0.62	−5.80 ± 0.62	***
L1 to MP (linear)	1.64 ± 0.38	1.56 ± 0.29	NS
Maxillomandibular measurements			
Wits	7.50 ± 1.75	3.95 ± 1.44	***
ANB ((degree)	5.00 ± 0.80	2.88 ± 1.78	***
Angle of convexity	6.92 ± 3.16	4.45 ± 1.52	**
Y-axis	4.36 ± 1.11	2.18 ± 0.34	***
Jarabak ratio	0.002 ± 0.01	0.003 ± 0.005	NS
Interincisal angle	−3.06 ± 1.46	−0.95 ± 1.00	***

NS, not significant; SD, standard deviation; *significant at 5% level ($p < 0.05$); **significant at 1% level ($p < 0.01$); ***significant at 0.1% level ($p < 0.001$)

Table 4: Pre- and posttreatment descriptive soft tissue statistics in both cleft and noncleft group

	Pretreatment -T1			*Posttreatment–T2*		
	Cleft	*Noncleft*		*Cleft*	*Noncleft*	
Soft tissue measurement	*Mean ± SD*	*Mean ± SD*	*Significance*	*Mean ± SD*	*Mean ± SD*	*Significance*
UL-E	−2.47 ± 0.55	−1.15 ± 0.49	***	0.36 ± 0.76	0.45 ± 0.58	NS
LL-E	3.17 ± 1.15	3.28 ± 1.31	NS	2.33 ± 1.41	1.65 ± 1.53	NS

LL, lower lip; *SD, standard deviation; UL, upper

reinforcement to the protraction forces of the face mask.[11] The bonded type expansion appliance has been advocated for clinical use since it offers the distinct advantage of reducing the number of appointments, facilitating correction of anterior crossbites in deep bite cases by anterior disocclusion with posterior bite blocks and also reducing buccal crown tipping during expansion due to the rigidity of the appliance framework with predictable clinical results.[12] The present longitudinal descriptive study was designed to evaluate the effect of Delaire type face mask (reverse-pull headgear) with bonded type of RPE appliance in cleft and noncleft children with developing class III malocclusion. The subjects of the study were selected from the ages between 6 and 14 years since it is the ideal time for interceptive and corrective orthodontic treatment with the advantages of growth spurts at its peak.

The pretreatment descriptive statistics revealed that the skeletal maxilla (SNA) is more retrognathic and the mean sagittal length of the upper jaw (RMxL) is smaller leading to decreased facial heights in children of group I (clefts) than group II (nonclefts). The possible explanation might be surgical palatoplasty in the early stage could have inhibited the vertical growth of the posterior region of the maxilla along with forward displacement of the maxillary base and anteroposterior development of the maxillary dentoalveolus particularly in unilateral cleft lip and palate patients which in agreement with previous studies.[13] The posttreatment results showed improvement in clinical profile and positive overjet are due to anterior movement of point A and increase in SNA, A-Olp distance, and *N* perpendicular to *A* more for cleft than the noncleft group, which is in agreement with previous studies.[14] The reason

Table 5: Pre- and posttreatment superimposition measurements in both cleft and noncleft group

	Pretreatment -T1			*Posttreatment–T2*		
	Cleft	*Noncleft*		*Cleft*	*Noncleft*	
Superimposition measurements	*Mean ± SD*	*Mean ± SD*	*Significance*	*Mean ± SD*	*Mean ± SD*	*Significance*
A-OLp	76.92 ± 2.43	81.53 ± 2.30	***	80.77 ± 2.15	83.30 ± 2.52	**
Pog-OLp	80.25 ± 1.66	85.25 ± 4.00	***	76.69 ± 2.04	83.70 ± 4.07	***
UM-OLp	51.94 ± 2.36	52.75 ± 2.23	NS	55.41 ± 2.49	55.72 ± 2.16	NS
LM-OLp	57.03 ± 3.56	57.23 ± 2.83	NS	57.86 ± 3.51	58.12 ± 3.00	NS
U1-OLp	75.69 ± 2.77	79.35 ± 2.67	***	78.94 ± 2.60	82.37 ± 3.28	***
L1-OLp	80.42 ± 1.91	87.53 ± 2.97	***	77.91 ± 2.15	85.10 ± 2.84	***
UM-SN	70.28 ± 2.62	71.85 ± 2.00	*	73.00 ± 2.90	72.95 ± 1.82	NS
LM-SN	71.00 ± 2.68	75.70 ± 2.56	***	71.88 ± 2.87	76.65 ± 2.73	***

NS, not significant; SD, standard deviation; *significant at 5% level ($p < 0.05$); **significant at 1% level ($p < 0.01$); ***significant at 0.1% level ($p < 0.001$)

behind greater skeletal advancement in clefts than noncleft may be due to the absence of firm palatal sutures. However, this is not in agreement with other studies where the resultant tissue scar from cleft surgeries inhibited the protraction of the maxilla in a cleft group than noncleft group.[15]

The pretreatment maxillary dentoalveolar descriptive statistics (U1 to NA (angle), U1 to NA (linear), U1 to A-Pog) showed the upper incisors are more retroclined in group I (clefts) than group II (noncleft). This can be attributed to the contraction of scars in the repaired lip of cleft lip and palate patients. The posttreatment results revealed a greater proclination of the upper anterior in noncleft group than that of the cleft group which is in agreement with previous studies.[15] The hyperplastic scar in repaired cleft lip could have restricted the lab version of upper anterior in the cleft children during protraction therapy.

Posttreatment opening rotation of the mandible is more significant in cleft than noncleft groups. The possible explanation may be greater upper first molar extrusion (UM-SN, cleft—2.72 ± 0.65, noncleft—1.10 ± 0.48) in a cleft group than the nonclefts which is a compensatory mechanism for the maxillary vertical growth discrepancy in the cleft patients.[16] A more posterior attachment of hooks in RME instead of mesial to canines causes more maxillary movement but undesirable sequel like molar extrusion.[17] The posttreatment RMndL and Go-pog values are not found to be statistically significant between cleft and nonclefts indicating that the maxillary protraction forces do not change the direction of mandibular growth.[18]

Comparing the lower incisor position of both groups with the clinical norm (LI to NB angle) we found they are more upright in the cleft group than the nonclefts. The possible reason may be cleft lip and palate patients with short mandibular bodies (Go-pog) usually force their tongue out into the alveolar cleft as a compensatory change to overcome decreased patency of their nasopharyngeal airway resulting in reduced retroclination of mandibular incisors.[19]

Superimposition of pretreatment and posttreatment results revealed changes in LI to NB (linear, angle), L1 to MP (angle) along with L1-Olp to be statistically significant ($p < 0.001$) showing retroclination of mandibular incisors in both the groups following maxillary protraction therapy. This may be due to a distally driving force on mandibular incisors during an intermediate stage of overjet correction of protraction facemask therapy or soft tissue pressure from the chin cup component of headgear. However, mandibular incisors were less retroclined in the cleft group which may be due to a compensatory functional shift in the position of the tongue to overcome decreased patency of the nasopharyngeal airway.

Maxillomandibular skeletal variables showed a more severe class III skeletal relationship in clefts than the nonclefts before the start of treatment. This can be attributed to a more retrognathic maxilla in clefts than the nonclefts. But following headgear therapy, improvement was greater in the cleft group than the noncleft group which might be due to greater advancement of the maxilla along with clockwise rotation of the mandible in clefts.

Prior to the initiation of treatment interincisal angle of the cleft group was found to be significantly ($p < 0.001$) more than the noncleft group. This might be due to less proclination of upper incisors in the cleft group because of surgical scar. The posttreatment interincisal angle also follows a similar trend in both groups. Although proclination of upper incisors following maxillary protraction therapy is more in the noncleft group, the significant ($p < 0.001$) reduction in interincisal angle following treatment in the cleft group can be attributed to the decreased lower incisor retroclination of clefts than the noncleft group.

The pretreatment descriptive statistics of soft tissue (UL-E, LL-E) showed the upper lip is more retrusive in clefts than nonclefts. This can be attributed to surgical repair of lip tissues. Interestingly forward movement of the upper lip was greater in the cleft group (cleft—2.83 ± 0.49) than the noncleft group (noncleft—1.60 ± 0.60). This result can be explained on the basis of the greater magnitude of maxillary protraction in clefts.[20]

Conclusion

The early treatment of anterior crossbite and concave facial profiles in cleft and general skeletal class III patients could produce dentoalveolar or orthopedic effects depending upon treatment modalities. Evaluation of treatment effects of protraction mechanics with palatal expansion showed significant improvement in hard and soft tissue structures of the face leading to an increase in maxillary length and improvement in soft tissue profile in both the groups while these changes are more marked in cleft children. However, long-term follow-up is recommended to assess the stability of protraction mechanics.

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