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Cephalometric analysis of Malay children with and without unilateral cleft lip and palate

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Objective: To investigate the craniofacial morphology of Malay children with repaired UCLP and compare the data with non-cleft Malay children.

Methods: Twenty Malay children with repaired UCLP (12 boys, 8 girls; Mean age: 10.5 years) and 20 normal Malay children (8 boys, 12 girls; Mean age: 9.72 years) were recruited from the Combined Cleft Lip and Palate Clinic and the Department of Children's Dentistry and Orthodontics, Faculty of Dentistry, University of Malaya, Malaysia. Lateral cephalometric radiographs were taken with the head orientated parallel to the floor. Thirty-one linear and angular variables were measured on the lateral cephalometric radiographs with Dolphin Imaging Software Version 10.0 (Dolphin Imaging, Chatsworth, CA, USA). The data were analysed with the Mann-Whitney U test and the level of significance was set at $p < 0.05$.

Results: In the UCLP group, the girls had deeper overbites than the boys ($p = 0.011$), and in the Control group the girls had a significantly more acute cranial base angle (NSBa, $p = 0.017$) and a less protrusive lower lip (LL-E line, $p = 0.21$). The data for the boys and girls were combined. Subjects in the UCLP group had a more acute cranial base angle, shorter and more retruded maxillae and were more skeletal III than the subjects in the Control group. In the UCLP group, the upper and lower incisors were less proclined than in the Control group, the interincisal angle was more obtuse and the overjet reduced by 6 mm. There were no significant facial height differences. The nasolabial angle (Col-Sn-UL) was significantly more obtuse and the upper lip relative to the E line more retrusive in the UCLP group. There was no significant difference between the groups in facial heights or the maxillo-mandibular planes angle.

Conclusion: Malay children with repaired UCLP have small, retrusive maxillae. The mandible in this group of children was of normal size and position, relative to the cranial base. Pressure from the repaired upper lip may be responsible for the retruded maxillae, retroclined incisors and obtuse nasolabial angle.

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Introduction

The incidence of cleft lip, cleft palate and combinations of both conditions in Malay children is 1 in 941 live births.[1] Unilateral cleft lip and palate (UCLP) is the most common type of cleft lip and palate deformity. Children with repaired cleft lip and palatal deformities have an irregular dental arch, a Class III malocclusion, a retrusive maxillae and, to a lesser extent, a retrusive mandible. Some of children with UCLP also have a marked facial deformity and masticatory dysfunction.[2–8] Lateral cephalometric analysis is a convenient method to appraise the post-surgery craniofacial morphology of children with UCLP, and serial cephalometric records enable the impact of treatment on the growing face to be assessed. As there have been no cephalometric studies of the Malay children with UCLP, we aimed to investigate the craniofacial morphology of Malay children with repaired UCLP and compare the data with non-cleft Malay children.

Material and methods

Twenty Malay children (12 boys, 8 girls; Mean age: 10.5 ± 1.79 years) with UCLP who attended the

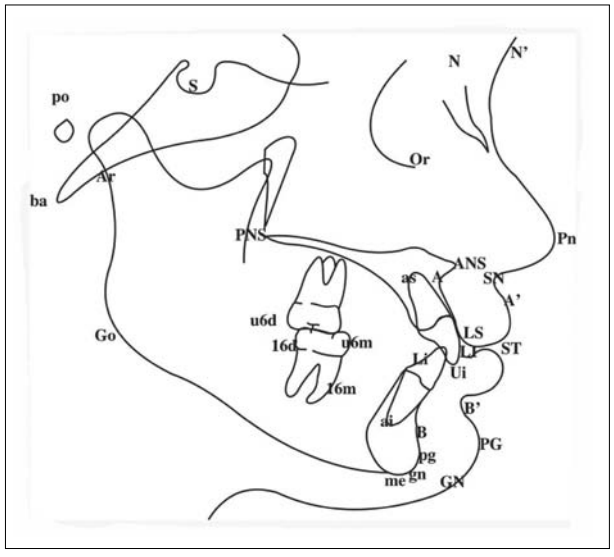

Figure 1. Cephalometric landmarks.

Combined Cleft Lip and Palate Clinic at the University of Malaya were selected for this study. The following criteria were used for selection:

1. Children between 7 and 13 years of age.

2. Repaired, non-syndromic complete unilateral cleft of the lip and palate. Primary surgical repair of the lip was carried out at 3 months of age and palatal surgery at 9 months of age.

3. No major orthodontic treatment and/or orthognathic surgery prior to the cephalometric examination. Subjects had palatal expansion with a quadhelix appliance prior to the alveolar bone graft

4. Second generation Malay.

Twenty non-cleft subjects (8 boys, 12 girls) were selected from the patients receiving dental treatment in the Department of Children's Dentistry and Orthodontics, Faculty of Dentistry, University Malaya. The subjects in the Control group were 9.72 ± 1.70 years of age. The following selection criteria were used:

1. Children between 7 and 13 years of age.

2. No facial clefts and/or other facial abnormality.

3. Skeletal Class 1 malocclusion or mild skeletal Class II malocclusion with either well-aligned arches or mild crowding. The arch length discrepancy was less than 4 mm.

4. No previous orthodontic treatment.

5. Second generation Malay.

Ethical and written approvals for this study were obtained from the Research Committee of the Dental Faculty of the University Malaya and from the participants and their parents. A questionnaire was used to confirm that all parents and grandparents were Malay and there had been no inter-racial marriages.

Radiographic procedures

All lateral cephalometric radiographs were taken with the same machine with the Frankfort horizontal plane parallel to the floor, with the lips in a relaxed position and the teeth in the retruded contact position. Thirty-one linear and angular variables were measured directly on the radiographs with Dolphin Imaging Software Version 10.0 (Dolphin Imaging, Chatsworth, CA, USA). The landmarks identified on the cephalometric films are shown in Figure 1.[5] All measurements were carried out by the same investigator.

Statistical analysis

Ten lateral cephalometric radiographs were selected randomly from the UCLP and Control groups, measured and remeasured a month later by the same investigator. Reproducibility was determined using the intraclass correlation coefficient (ICC). The result demonstrated that the method was highly reliable for the majority of measurements (Cronbach's alpha value > 0.8), except for Li-MP and Ar-Go, where Cronchbach's alpha values were 0.57 and 0.70, respectively. Since the Cronchbach's alpha values exceeded 0.4, Li-MP and Ar-Go were considered to have acceptable reproducibilities.

A Mann-Whitney U test was used to determine if there were gender differences in each group or if the children in the UCLP and Control groups differed from each other. All calculations were made using the Statistical Package for the Social Sciences (SPSS 12.0 for Windows) and the level of significance was set at $p < 0.05$.

Results

There were only three gender differences in both groups. In the UCLP group, the girls had deeper overbites than the boys ($p = 0.011$), and in the Control group the girls had a significantly more acute

Table I. Comparisons of the skeletal, dental and soft tissue variables in Malay boys and girls with and without unilateral cleft lip and palate.

Variables	UCLP group (N = 20)			Control group (N = 20)		
	Male Mean	Female Mean	*p*	Male Mean	Female Mean	*p*
Dentoskeletal measurements						
N-S-Ba (degrees)	128.2	126.2	0.355	131.4	128.0	**0.017**
N-S-Ar (degrees)	124.2	120.7	0.203	126.5	124.9	0.616
S-Ar (mm)	35.1	31.9	0.105	30.7	31.7	0.562
S-N (mm)	64.0	60.8	0.643	61.4	59.6	0.247
SNA (degrees)	77.0	79.5	0.113	81.5	83.4	0.463
SNB (degrees)	77.8	80.9	0.280	76.9	79.5	0.263
SNpg (degrees)	78.2	80.3	0.487	76.5	79.5	0.142
S-Ar-Go (degrees)	145.0	149.4	0.355	145.5	144.7	0.758
A-N-B (degrees)	-0.9	-1.4	0.877	4.6	4.0	0.396
A-N-pg (degrees)	-1.2	-0.8	0.877	4.9	4.1	0.396
SN-Mxp (degrees)	8.8	5.8	0.123	8.8	7.0	0.121
MMPA (degrees)	22.0	38.4	0.123	25.1	25.8	0.121
N-ANS (mm)	47.7	45.1	0.487	45.0	44.5	0.512
ANS-Me (mm)	62.7	59.2	0.487	58.4	57.6	0.728
N-Me (mm)	109.3	103.4	0.758	101.1	100.4	0.616
S-Go (mm)	72.9	66.8	0.396	66.1	66.8	0.643
Ar-Go (mm)	41.3	37.6	0.700	39.4	37.7	0.512
ANS-Me/N-Me (per cent)	55.9	55.9	0.758	55.2	55.2	0.616
S-Go/N-Me (per cent)	66.4	64.6	0.537	65.3	66.5	0.396
Ui/Mxp (degrees)	105.3	104.4	0.700	112.0	113.9	0.375
Li/Mp (degrees)	90.3	88.6	0.728	98.2	96.4	0.537
Ui/Li (degrees)	140.1	138.7	0.396	124.7	123.8	0.969
OJ (mm)	-3.0	-3.2	0.728	3.1	3.1	0.537
OB (mm)	0.7	4.1	**0.011**	2.1	2.7	0.296
ANS-PNS (mm)	45.4	43.4	0.787	43.4	45.0	0.758
Ar-Go-Me (degrees)	123.1	124.1	0.969	121.7	122.6	0.817
Go-Me (mm)	60.7	60.8	0.908	57.7	59.5	0.563
Soft tissue measurements						
Col-Sn-UL (degrees)	88.5	85.6	0.700	100.9	105.4	0.247
Pn-N'-Sn (degrees)	18.4	19.7	0.375	17.9	18.1	0.699
UL-E Line (mm)	-1.4	-1.6	0.589	3.4	1.2	0.076
LL-E Line (mm)	2.9	4.3	0.440	3.9	1.7	**0.021**

Significant values in bold

cranial base angle (N-S-Ba, $p = 0.017$) and a less protrusive lower lip (LL-E line, $p = 0.21$) than the boys (Table I). In light of the few differences, data for the boys and girls were combined.

There were 12 statistically significant differences between the UCLP and Control groups. Subjects in the UCLP group had a more acute cranial base angle (N-S-Ba, N-S-Ar), shorter and more retruded maxillae (ANS-PNS, S-N-A) and were more skeletal III (A-N-B, A-N-Pg) than the subjects in the Control group. In the UCLP group, the upper and lower incisors (Ui-Mxp, Li-Mp) were less proclined than in the Control group, the interincisal angle (Ui-Li) was more obtuse and the overjet (OJ) reduced by 6 mm. There were no significant facial height differences. The nasolabial angle (Col-Sn-UL) was significantly

Table II. Comparisons of the skeletal, dental and soft tissue variables in Malay children with and without unilateral cleft lip and palate.

	UCLP group (N = 20)		Control group (N = 20)		
Variables	Mean	SD	Mean	SD	*p*
Skeletal					
N-S-Ba (degrees)	127.3	4.7	129.3	3.5	**0.038**
N-S-Ar (degrees)	122.8	4.9	125.6	4.1	**0.022**
S-Ar (mm)	33.8	7.6	31.3	2.2	0.194
S-N (mm)	62.7	10.3	60.3	2.6	0.310
S-N-A (degrees)	78.0	3.3	82.7	3.8	**0.000**
ANS-PNS (mm)	44.6	7.9	45.4	2.9	**0.030**
S-N-B (degrees)	79.0	5.1	78.4	3.7	0.839
S-N-Pg (degrees)	79.1	5.0	78.3	4.3	0.705
S-Ar-Go (degrees)	146.8	8.0	145.0	5.8	0.766
Ar-Go-Me (degrees)	123.5	8.1	122.3	7.5	0.588
Go-Me (mm)	60.7	12.0	58.8	7.0	0.715
A-N-B (degrees)	-1.1	3.9	4.2	1.5	**0.000**
A-N-Pg (degrees)	-1.1	4.3	4.4	2.3	**0.000**
S-N-Mxp (degrees)	7.6	5.1	7.7	2.4	0.685
MMPA (°)	26.9	6.0	25.5	5.0	0.245
N-ANS (mm)	46.7	7.7	44.7	2.2	0.925
ANS-ME (mm)	61.3	10.9	57.9	4.5	0.850
N-Me (mm)	106.9	17.8	100.7	4.5	0.903
S-Go (mm)	70.4	14.5	66.5	5.6	0.914
Ar-Go (mm)	39.8	8.3	38.4	5.6	0.989
ANS-Me/N-Me (per cent)	55.9	2.4	55.2	2.2	0.291
S-Go/N/Me (per cent)	65.7	4.9	66.0	4.0	0.507
Dental					
Ui/Mxp (degrees)	105.0	6.9	113.1	5.7	**0.001**
Li/Mp (degrees)	89.6	8.1	97.1	5.8	**0.003**
Ui/Li (degrees)	139.5	10.7	124.1	8.5	**0.000**
OJ (mm)	-3.1	3.3	3.1	0.9	**0.000**
OB (mm)	2.1	2.9	2.4	1.4	0.304
Soft tissue					
Col-Sn-UL (degrees)	103.6	9.7	87.3	15.6	**0.001**
Pn-N'-Sn (degrees)	18.9	2.9	18.0	1.7	0.159
UL-E Line (mm)	-1.5	2.7	2.1	2.4	**0.000**
LL-E Line (mm)	3.5	2.8	2.6	2.0	0.180

Significant values in bold

more obtuse in the UCLP group. The upper lip relative to the E line was more retrusive than in the Control group.

Discussion

In agreement with previous studies, we found the maxillae in children with UCLP were more retrusive than the maxillae in the non-cleft children.[2–7,9] Many authorities attribute most or all of the deformity to the contraction of scar tissue following surgery. This view is supported by the findings that children with UCLP had normal maxillary growth before palatal surgery and that unoperated subjects with UCLP had normal anteroposterior maxillary growth.[3,10] The S-N-A angle in our UCLP subjects was 4.7 degrees less than S-N-A in the non-cleft subjects, but maxillary

length in the UCLP subjects was only 1 mm shorter than maxillary length in the non-cleft subjects. Bearing in mind that the subjects in our study were not randomly allocated to their respective groups and that we did have longitudinal records, we were unable to say how much of the deformity in our UCLP subjects was due to the morphogenetic pattern (i.e. early developmental disturbance of the maxillary growth due to the cleft) and how much was due to scar tissue contraction following surgery.[4]

We found small, but statistically significant, reductions in the saddle angle (N-S-Ba, N-S-Ar) in the UCLP group as compared with the Control group. This finding differs from several previous studies[5–7] that reported cranial base angulation was increased in cleft subjects, and in other studies that it did not differ significantly from non-cleft groups.[9,10] Some investigators have argued that post-surgical scarring is unlikely to affect the cranial base, and have attributed differences in the size and angulation of the limbs of the cranial base to genetic influences.

Subjects with Class III malocclusions, with and without cleft palates, tend to have a smaller cranial base angle that may contribute to the mandibular prognathism.[11–13] Although our UCLP subjects were skeletal III (the mean ANB angle was –1.1 degrees), the skeletal relationship appears to be due to maxillary retrognathism, as demonstrated by the S-N-A angle and short maxillae rather than the size and/or position of the mandible relative to the cranial base. In agreement with Doğan et al.[7] we found no statistically significant group differences in the length of the cranial base (S-N, S-Ar). Furthermore, the anterior and posterior vertical heights of our UCLP subjects were similar to those in our non-cleft group.

The upper and lower incisors were retroclined, the interincisal angle obtuse and the overjet significantly less in the UCLP group as compared with the Control group. Pressure from the repaired upper lip is generally considered to be the most likely cause of the upper and lower incisor retroclination and the negative overjet.[3,5,7,8] In agreement with others, an increased nasolabial angle (Col-Sn-UL) and retrusive upper lip relative to the E line accompanied the retrusive maxillae in the UCLP group. Again pressure from the repaired upper lip is believed to be responsible for the upper lip changes in this group.[3] On the other hand, the projection of the nose, as indicated by the Pn-N'-Sn angle, was not significantly different between the groups.

Conclusions

Malay children with repaired UCLP have small, retrusive maxillae.

The mandible in this group of children was of normal size and position, relative to the cranial base.

Pressure from the repaired upper lip may be responsible for the retruded maxillae, retroclined incisors and obtuse nasolabial angle.

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