

COMPARISON OF MAXILLARY ARCH DIMENSIONS BETWEEN UNILATERAL CLEFT LIP & PALATE AND NON CLEFT INFANTS

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ABSTRACT

The objectives of the study were to investigate the effects of unilateral cleft lip and palate on maxilla, for which our study compared the maxillary dimensions of both unilateral cleft lip and palate and non cleft infants. The study was performed in the Orthodontics department, children hospital, Lahore and the study design was Cross sectional Analytical. The sample consisted of ninety children, thirty with unilateral cleft lip and palate and sixty without cleft lip and palate.

Comparison of arch width between cleft and non cleft infants showed the width to be slightly more in the cleft infants but the difference was not statistically significant. Comparison of anteroposterior length and rotation of the right and left maxillary segments showed significantly different values.

This research contradicted the hypothesis that cleft lip and palate causes deficits in growth and volume in the maxillary region and supports the view point of bony dislocation of the major and minor cleft segments.

Key words: Complete unilateral cleft lip and palate, noncleft children, maxillary arch dimensions.

INTRODUCTION

The cleft lip and palate is a congenital malformation which is disfiguring and causes great psychological trauma to the family and child¹. It has a frequency of 88 to 175 per 100,000 live births per year². It is already known that varying degrees of intrinsic maxillary growth deficiency is seen in patients with cleft³. Compromised facial appearance, growth, speech and dental occlusion are also commonly related to cleft lip and palate⁴. A basic problem in treatment of unilateral cleft lip and palate is growth attenuation of the maxilla but there is no definite answer as to the reason of the attenuation⁵. Although cleft palate deformity was described hundreds of years ago, to this day, no agreed-upon management algorithm exists for patients with cleft palate⁶. Quantitative studies on fetuses with cleft lip, alveolus and palate clearly found deficits in growth and volume in the premaxillary region (Mooney et al., 1991). Other studies doubt the theory of tissue deficit and concentrate on maxillary segment dislocation⁷.

Many different surgical treatment protocols and adjunctive orthopedic/orthodontic procedures have been proposed to treat children with unilateral cleft lip and palate⁸ and also clinical and experimental studies have been performed to derive more insight into the problems of cleft lip and palate treatment and to improve treatment procedures⁹. Some of the researchers claim that surgical lip repair as well as repair of both cleft lip and palate is responsible for growth attenuation of the maxilla.¹⁰ According to one hypothesis, the mid facial deficiency in cleft lip & palate is genetically predetermined, while others have shown that in non treated patients, there are no visible deficiencies of the growth of the mid facial skeleton.¹¹ Ross¹² (1987) showed in a major multiple centre study that there is no difference in facial growth between cleft patients treated with or without presurgical orthopedics. However, many authors use a preliminary orthopedic procedure before cleft lip and palate surgical closure to prevent possible bone distortion following the rupture of muscle belts resulting from the cleft¹² and this is also supported by

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the work of Robertson (1983) who in a ten year follow up study by a single surgeon, demonstrated that better facial growth was achieved in patients treated with presurgical orthopedics when compared to control subjects.⁴ Determination of the morphological structure of the oral cavity of newborns with cleft palate compared with newborns without clefts might allow for conclusions regarding functional adaptation to disrupted oral cavity architecture in the population with cleft¹³. The predental and infant period can be divided into three phases: phase 1, from birth to around 3 months of age, before any surgery; phase 2, from 3 to 12 months of age, after lip surgery; and phase 3, from 12 months onwards, after primary palatal repair¹⁴.

In order to investigate the effects of unilateral cleft lip and palate on maxillary growth, our study compared the maxillary arch dimensions in both unilateral cleft lip & palate and non cleft children during the phase 1 of predental and infant period (from birth to around 3 months of age) to know whether growth attenuation is actually associated with unilateral cleft lip and palate.

As Maxillary dimensions are usually measured from dental casts¹⁴, our study also used 1:1 photocopy of the dental casts of both unilateral cleft lip & palate and non cleft children.

MATERIALS AND METHODS

Study casts of 20 children of the above mentioned age groups, ten with unilateral cleft lip and palate and ten children without any cleft lip and palate were obtained from patients visiting the children's hospital and institute of child health Lahore. The study sample was divided in two groups.

Group 1 Comprised thirty (30) children with unilateral cleft lip and palate and was further subdivided into: New born (10 Neonates), 1 Month (10 infants) and 3 Months (10 infants).

Group 2 Comprised sixty (60) normal children without cleft lip and palate and was further subdivided into New born (20 Neonates), 1 Month (20 infants) and 3 Months (20 infants).

Letters "c" and "n" were assigned to unilateral cleft and normal children respectively. Numerals "0", "1" and "3" were used for newborns, one month age and three months age children respectively.

With the consent of the parents, impression of the maxillary arches were recorded in silicon impression material and then poured in dental stone to obtain study casts. 1: 1 photocopy of the study casts was obtained and analyzed. The following anatomical landmarks and planes were used for the analysis.

- Point I (Incisal point) : Point on the top of the alveolar crest where the incisive papilla and labial frenum meet¹¹. (Fig. 1)
- Point C (cuspid point or bulge of canine) (Fig. 1).
- Point M (Molar bulge). (Fig. 1)
- Points T (tuberosity point): The posterior point of the tuber maxillare¹¹-on the right arch segment. (Fig. 2)
- Points T' (tuberosity point): The posterior point of the tuber maxillare¹¹-on the left arch segment. (Fig. 2)
- Point L : Most anterior point of the alveolar crest of the lateral segment¹¹. In non cleft children, the point L will occur on the point I. (Fig. 2)
- Retromolar line: The line passing through the right and left T points. (Fig. 1)
- M2 : Mid point of the T T' distance¹¹. (Fig. 2)
- I.C.W : Inter canine width (In millimeters). (Fig. 3)
- I.M.W: Inter molar width (In millimeters). (Fig. 3)
- A.P.L : Anteroposterior length from the Incisal point to the M2(In millimeters). (figure 3)
- R.L.M: Rotation of left maxillary segment with reference to the retromolar line. (In Degrees). (Fig. 4)
- R.R.M: Rotation of right maxillary segment with reference to the retromolar line (In Degrees). (Fig. 4)

For the same age range, the values of Inter canine width, Inter molar width, AnterioPosterior length and rotation of right and left maxillary segments for group 1 were compared with the values of Inter canine width, Inter molar width, anterioposterior length and rota-

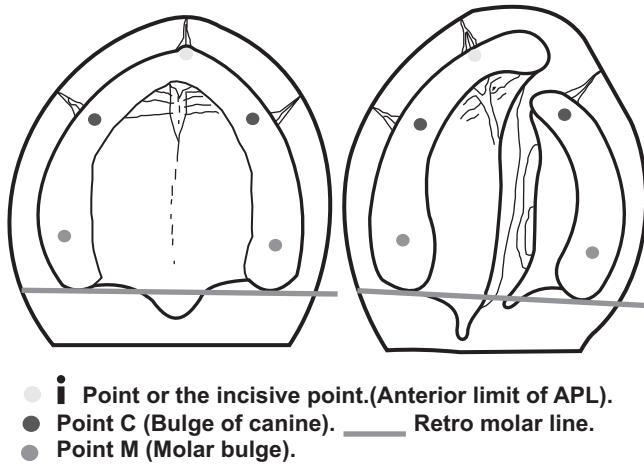


Fig 1. Selected Anatomical landmarks on study casts of both cleft lip and palate and non cleft children.

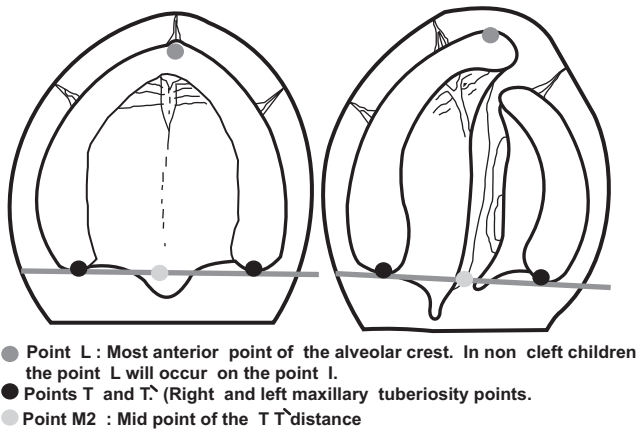


Fig 2. Selected Anatomical landmarks and constructed points on 1:1 photocopies of study casts of both cleft lip and palate and non-cleft children.

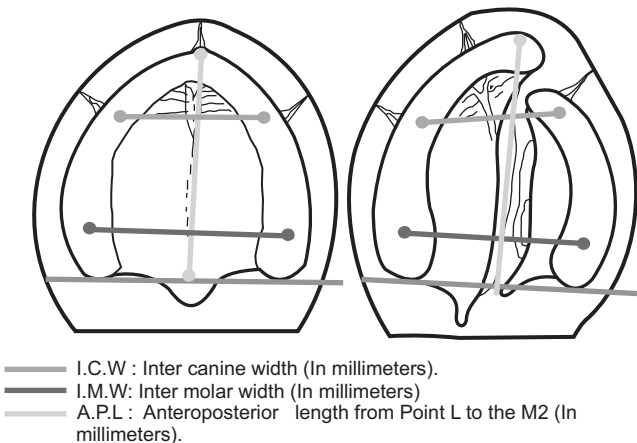


Fig 3: Constructed points on 1:1 photocopies of study casts of both cleft lip and palate and non cleft children

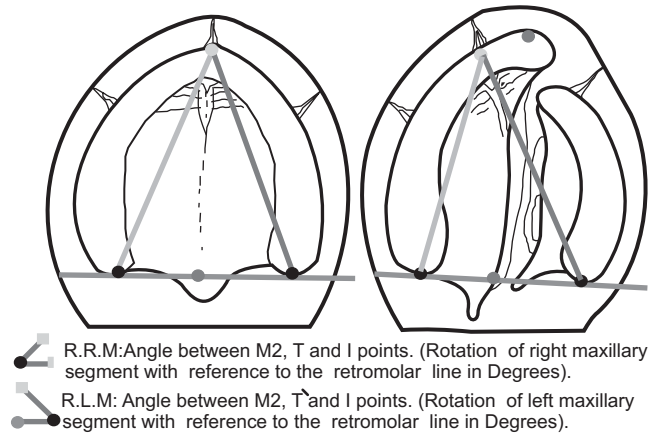


Fig 4: Constructed Angles on 1:1 photocopies of study casts of both cleft lip and palate and non cleft children

tion of right and left maxillary segments for group 2.

The difference was analyzed using the independent t-test. P value ≤ 0.05 was considered level of significance.

RESULTS

For both the groups and for the same age range, the mean values of the Anteroposterior length, intercanine width, intermolar width and rotation of the right and left maxillary segments and the comparison of cleft and non cleft groups are given in tables 1,2 and 3.

- Comparison of maxillary arch width of the cleft and non cleft children in all the three age groups (new born, one month and three month) showed the mean values of intercanine width and intermolar width to be slightly higher in the cleft children but the difference did not achieve statistical significance.
- Comparison of anterioposterior length of maxillary arch in the cleft and non cleft children in all the three age groups (new born, one month and three month) showed significantly higher values of anterioposterior length in the cleft children.
- Comparison of rotation of the right and left maxillary segments between the cleft and non cleft children in all the three age groups (new born, one month and three month) showed significantly different values. The major cleft

Variable name	Mean values	Mean Difference	t-value	P-value	Significance
Mean I.C.W (Neonates with cleft children) (mm)	23.55	0.900	1.35	0.186	Not significant
Mean I.C.W (Normal Neonates) (mm)	22.65				
Mean I.M.W (Neonates with cleft) (mm)	26.75	1.00	1.68	0.103	Not significant
Mean I.M.W (Normal Neonates) (mm)	25.75				
Mean A.P.L. (Neonates with cleft) (mm)	26.90	2.00	3.33	0.002	Significant
Mean A.P.L. (Normal Neonates) (mm)	24.89				
Mean R.L.M. (Neonates with cleft) (Degrees)	74.90	10.675	9.354	0.000	Highly Significant
Mean R.L.M. (Normal Neonates) (Degrees)	64.22				
Mean R.R.M. (Neonates with cleft) (Degrees)	52.30	-12.92	-16.811	0.000	Highly Significant
Mean R.R.M. (Normal Neonates) (Degrees)	65.22				

TABLE 1: NEW BORN CLEFT AND NORMAL CHILDREN COMPARISON OF MEAN LINEAR AND ANGULAR MEASUREMENTS

Variable name	Mean values	Mean Difference	t-value	P-value	Significance
Mean I.C.W (One month cleft infants) (mm)	24.3000	0.7000	1.226	0.231	Not significant
Mean I.C.W (One month normal infants) (mm)	23.6000				
Mean I.M.W (One month cleft infants) (mm)	26.60	0.65	1.69	0.101	Not significant
Mean I.M.W (One month normal infants)	25.95				
Mean A.P.L. (One month cleft infants) (mm)	27.90	1.93	3.84	0.001	Significant
Mean A.P.L. (One month normal infants) (mm)	25.97				
Mean R.L.M. (One month cleft children) (Degrees)	52.20	-14.05	-22.72	0.000	Highly Significant
Mean R.L.M. (One month normal infants) (Degrees)	66.25				
Mean R.R.M. (one month cleft infants) (Degrees)	74.30	10.10	10.933	0.000	Highly Significant
Mean R.R.M. (One month normal infants) (Degrees)	64.20				

TABLE 2: ONE MONTH OLD CLEFT AND NORMAL CHILDREN COMPARISON OF MEAN LINEAR AND ANGULAR MEASUREMENTS

TABLE 3: THREE MONTH OLD CLEFT AND NORMAL CHILDREN: COMPARISON OF MEAN LINEAR AND ANGULAR MEASUREMENTS

Variable name	Mean values	Mean Difference	t-value	P-value	Significance
Mean I.C.W (Three month cleft infants)(mm)	27.00	0.994	0.958	0.329	Not significant
Mean I.C.W (Three month normal infants)(mm)	26.32				
Mean I.M.W (Three month cleft infants)(mm)	28.4	1.00	1.686	0.103	Not significant
Mean I.M.W (Three month normal infants)(mm)	27.40				
Mean A.P.L. (Three month cleft infants)(mm)	30.70	2.27	3.45	0.002	Significant
Mean A.P.L. (Three month normal infants)(mm)	28.42				
Mean R.L.M. (Three month cleft infants)(Degrees)	73.20	9.25	9.852	0.000	Highly Significant
Mean R.L.M. (Three month normal children)(Degrees)	63.95				
Mean R.R.M. (Three month cleft infants)(Degrees)	52.20	-13.4	-23.55	0.000	Highly Significant
Mean R.R.M. (Three month normal infants)(Degrees)	64.20				

Key to tables 1,2 and 3.

Significant $P < 0.05$

(I.C.W): Inter canine width..

(I.M.W): Inter molar width.

(A.P.L): Anterioposterior length.

(R.L.M): Rotation of left maxillary segment with reference to the retromolar line.

(R.R.M): Rotation of right maxillary segment with reference to the retromolar line.

segment in all the three cleft groups was found to deviated out wards whereas, the minor cleft segment in these children was medially rotated.

DISCUSSION

Overall formation and development of the maxilla according to the type of cleft has been analyzed extensively however, controversy remains¹⁵. Many studies of treatment were made using patients of different ages^{12,13}, 9,10 small groups of patients^{18,16,17} and different

degrees of deformity^{18,19}. A good result is often handicapped by different and often difficult starting conditions such as primary displacement of jaw bases, anteroposition and infraposition of the premaxilla, laterally rotated maxillary stumps on the side, numerous malpositioned teeth, and the transverse length of the lateral maxillary stumps and upper teeth in specific clefts¹⁵.

The findings in all the three age groups support the theory of outward deviation of the major cleft segment

and medial rotation of the minor segment in unilateral cleft lip and palate and contradict the hypothesis that cleft lip and palate causes deficits in growth and volume in the maxillary region.

These results are in accordance with the findings of Prah C²⁰ and Bacher et al. (1998)²¹, Kramer's²² findings also contradict the hypothesis of unilateral cleft lip and palate resulting in deficits in growth and volume in the maxillary region. Kramer et al in 1992 showed that patients with unilateral cleft lip and palate initially demonstrated larger anterior and posterior arch width than the noncleft population but results of this study do not favour Kramer's findings to the level of significance.

Kiki LWM et al²³ in a study conducted in 1998 also measured the maxillary arch dimensions in non cleft normal children. The differences seen in the mean values described by Kiki et al and those found in this study might be due to individual variations, ethnic variations or measurement difference.

CONCLUSIONS

On the basis of above mentioned findings, it can be concluded that, no association was found between unilateral cleft lip and palate and deficits in growth and volume in the maxillary region. Considerable dislocation of the bony segments was however present in the cleft children. So this research contradicted the hypothesis that cleft lip and palate causes deficits in growth and volume in the maxillary region and supports the view point of bony dislocation of the major and minor cleft segments.

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