**Abstract**

Nasal deformity is a major dilemma, associated with complete cleft lip and palate, before and after surgical management. The severity of the condition is dependant upon the degree of preexisting congenital deformity. This deformity is complex in nature as it involves all anatomic components regarding skin, mucous membrane, muscles, cartilage and bone (skeletal supporting structure). The aim of this study is to make qualitative and quantitative assessment of the maxillary bone in both groups, 20 patients were selected and divided into 2 Groups; Group I: 10 patients presented with unilateral cleft lip without palatal defect, while Group II consists of ten patients, suffering from unilateral cleft lip and palate, all of them underwent helical C.T. scan for the maxillofacial region using Somatom balance, single detector, Siemens, Germany. All data were tabulated and analyzed for comparison. There was statistically significant difference between both groups. The results of our study proved the presence of episolateral maxillary hypoplasia in patients with complete unilateral cleft lip and palate.

**Introduction**

Nasal deformity is an inevitable complication associated with complete cleft lip and palate, before and after surgical management. The severity of the condition is dependant upon the degree of preexisting congenital deformity. This deformity is complex in nature as it involves all anatomic components regarding skin, mucous membrane, muscles, cartilage and bone (skeletal supporting structure). Regarding muscle abnormal insertion; surgical correction is performed and the muscle fibers are detached from there abnormal insertion, approximated, aligned and sutured properly.

As far as concerning nasal cartilage a study was conducted by Li et al in 2002 and demonstrated no statistical significant difference between alar cartilage of the cleft and the non cleft side in weight, size, length and no evidence of hypoplasia. However a huge debate regarding the state of the underlying skeleton was conferred and discussed among different authors, with a group confirming that there is maxillary deficiency along the pyriform aperture or/and hole maxilla as Dado and Kerrahan in 1986 and Lo et al 2003 and another group suggesting that it is maxillary translocation rather than hypoplasia as Zemann et al., 2002.
PATIENTS AND METHODS

Our study included 20 patients divided into two groups: group I consist of ten patients, presented with unilateral cleft lip without palatal defect, while Group II consists of ten patients, suffering from unilateral cleft lip and palate. All patients under went thorough clinical and laboratory examination.

Radiographic Assessment

All patients underwent helical C.T. scan for the maxillofacial region using Somatom balance, single detector, Siemens, Germany, preoperatively.

CT technique:

1. **Parent counseling:** The nature of the procedure was explained to the parents of the infant and there approval was insured.

2. **Preparation:** The parents were instructed to fast the infant 3 hours before the procedure.

3. **Sedation:** Chloral hydrate oral sedation was given to the infant in a dose 50mg/kg prior to the procedure.

4. **Patient position:** The infant was placed in supine position with the Reid’s base line (inferior-orbital meatal plane) perpendicular to the table top.

5. **Technique parameters:** The computerized tomography was performed using spiral CT machine of 140 kvp, 200 MA, 64 seconds scan time and 256 x 256 matrix reconstruction.

6. **Steps of the study:**
   A. **Scout view.**
   B. **Adjustment of helical box to cover the entire area of interest.**
   C. **Helical acquisition.**

7. **Post processing:** Image every 5mm thickness and 5mm apart were obtained. Reconstruction of the image is at 2mm intervals.

Interpretation

**Aim:** To asses the difference between the normal and abnormal halves of the maxillary bone by:

1. **Qualitative assessment:** by assessing the position abnormality of both maxillae.
2. **Quantitative assessment:** by measuring the volume of the normal and abnormal halves of the maxillary bone.

Qualitative assessment:

**Assessment of the position of the maxilla:**

The relation of both maxillae on the cleft and non-cleft side was assessed as regards to coronal and sagital planes.

**Coronal** location was determined by assessing the relation between both maxillary tuberosities, using two imaginary lines:

1. **Line A:** Imaginary line passing from the central point of the tubercle of the Atlas to the central point of the body of the Atlas extending forward.

2. **Line B:** Imaginary line from the posterior edge of the maxillary tuberosity of the non cleft side perpendicular to line A and crossing to the contra-lateral cleft side. If this imaginary line passes anterior to the posterior edge of the maxillary tuberosity on the cleft side; this indicates that the cleft maxilla is displaced posteriorly. If this imaginary line passes posterior to the posterior edge of the maxillary tuberosity on the cleft side; this indicates that the cleft maxilla is displaced anteriorly.

Relation to the **sagital plane** was assessed by comparing the distance between the center of each canine (on the cleft and non cleft side) and line **A**, by measuring the length of lines (C and D).

1. **Line C:** A perpendicular line from the center of the canine on the non cleft side to line A.
2. **Line D:** A perpendicular line from the center of the canine on the cleft side to line A (Figure 1).

If the distance between line C was shorter than D, this means that the cleft half of the maxilla is displaced laterally.
Quantitative assessment method:

Automatic measurement of the volume of the bone of interest using computed software built within the CT device.

Steps of measurements:
1. Using the pencil marker to trace the area of the maxillary bone on the individual section.
2. Moving to the second level and retrace the area.
3. Moving downward with tracing till the end of the examination.
4. The machine automatically calculates the volume of the assessed half of the maxilla (normal and abnormal side), the premaxilla was excluded from calculation.
5. The same procedure is repeated on the other side (normal side).
6. Data were recorded in tables.

RESULTS

Assessment of the position and location of the affected half of the maxilla (qualitative) was done by assessing the axial cuts, while all infants were placed in supine position with the Reid’s base line (inferior-orbital meatal plane) perpendicular to the table top.

Group I: There was no displacement neither in coronal, nor the sagittal plane (line C and D were equal in all cases) (Figure 2).

Group II: In all cases the cleft half of the maxilla was displaced to a posterior position (coronal) (line B from the posterior edge of the maxillary tuberosity of non cleft side crosses anterior to the maxillary tuberosity of the cleft side of the maxilla). While there was no displacement in the sagittal plane (lines C and D were equal as in group I) (Figures 3 and 4).

Quantitative assessment of the maxillary volume

Quantitative assessment of the maxillary volume was done, using computed software for measuring both normal and abnormal halves of each patient in both groups. The statistical analysis was done using two-way analysis of variance.

Fig. (1) Schematic diagram of an axial cut in the maxilla of unilateral cleft lip and palate patient. Line A: dotted vertical line from the tubercle of the atlas to the center of the atlas. Line B: perpendicular to line A. Line C: A perpendicular line from the center of the canine on the non cleft side to line A. Line D: A perpendicular line from the center of the canine on the cleft side to line A.

Fig (2) Axial CT scan in case of right unilateral cleft lip with symmetric maxilla shows no posterior or lateral displacement in the cleft side segment.
The volume of the normal halves of the maxillae ranged from 2647.1 to 5762.2 cmm with a mean of 4130.91±1067 cmm. The volume of the abnormal halves of the maxilla ranged from 2610.9 to 5813.7 cmm with a mean of 4147.08±1078 cmm. The difference between the normal and abnormal halves was statistically not significant p>0.05.

**Group II**

The volume of the normal halves of the maxillae after excluding the premaxilla; ranged from 2711.47 to 5395.35 cmm with a mean value 3726.20±711 cmm. The volume of the abnormal half of the maxilla ranged from 2076.30 to 3728.57 cmm with a mean value of 2737.97±364 cmm. The difference between the normal and abnormal halves were statistically significant p<0.001. There was a difference between the volumes of the two halves of the maxilla ranging from 12.54% to 33.17%, with a mean of 26.21% table 1.

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**DISCUSSION**

Cleft lip and palate are the most common craniofacial deformities among the birth defects world wide. Clefts of the lip and palate are associated with deficiency in speech, mastication and deglutition. It has been estimated to occur as 1 in 600 to 1000 live births (Stanier and Moore, 2004).

Unilateral cleft lip is always associated with nasal deformity; that is believed to be caused by imbalance of the facial musculature, asymmetry of the supporting skeletal base and hypoplasia of the skeletal base (Bardach and Cutting, 1990).
The results of the lip correction are always satisfactory for the patients and the parent, while on the other hand, the nasal deformity may be the only evidence of a cleft (Cronin and Denkler, 1988).

Hypoplasia of the maxilla on the affected side as a contributing factor for nasal deformity is a subject of debate, some authors (Dado and Kernahan, 1986), (Fonseca et al., 2000), (Li et al., in 2002) and (Lo et al., 2003) suggested this hypothesis, while others (Fisher et al., 1999) and (Zemann et al., 2002) can not prove or deny this hypothesis as a contributing factor.

Preoperative quantitative assessment of the maxillary volume was done; using computed software program to measure the maxillary volume for all patients in both groups to compare maxillary volume on the affected and non affected sides.

In group I the difference between the normal and abnormal halves was statistically not significant $p>0.05$ indicating absence of maxillary hypoplasia. While in group II the present study showed the presence of maxillary volume reduction on the affected side ranging from 12.54% to 33.17% with a mean of 26.21%. This difference is statistically significant $p<0.001$.

Posterior recession proved by posterior location of the cleft side compared to the healthy one and maxillary hypoplasia proved by qualitative assessment on the cleft side, are matching findings. These findings on the cleft side suggested the presence of hypoplasia of the more posterior elements (+ cranial base) leading to failure of the posterior maxillary margin to reach its anterior distention.

Fisher et al., 1999 confirmed the presence of posterior displacement of the maxilla at the cleft side alar base compared to the non cleft side alar base. The presence of posterior displacement on the cleft side mentioned by Fisher et al., 1999 could run parallel to that proved in the present study.

Lo et al., 2003, performed their study using 3D imaging methods to measure the palatal surface area of un-repaired cleft patients among different cleft types. Their results showed that there is 17.7% reduction in the palatal surface area between cases with unilateral cleft lip and complete cleft palate compared to case with unilateral cleft lip without cleft palate and alvelous.

Dado and Kernahan in 1986 performed radiographic analysis of the mid-face of stillborn infant with unilateral cleft lip and palate; demonstrating a gross skeletal and soft tissue deficiency involving the maxillary complex, 35% difference in the maxillary sinus width and 37% difference in palatal shelf between the cleft and non cleft side. This deficiency was quantified as 19% between the cleft and non cleft sides of the mid face.

Zemann et al., 2002, performed analysis of midface asymmetry in models of 21 patients, age 3 months suffering from complete unilateral cleft lip and palate, using a 3D skull models that was constructed from CT scan data. Asymmetry and translocation was found in the maxillary, orbital and nasal regions. A deficiency in volume was not reliably found.

The presence of reduction in the maxillary volume estimated by 26% in our study is comparable to percent reduction in palatal surface area that was reported by (Lo et al., 2003) 17.7% and maxillary complex deficiency in sinus surface area and palatal surfaceare reported by (Dado and Kernahan, 1986) 35%, 37% respectively.

REFERENCES


