Acta Scientific Dental Sciences (ISSN: 2581-4893)

Volume 6 Issue 5 May 2022

Review Article

The Effect of Cleft Lip and Cleft Palatal Repair and Unrepair on Nasomaxillary Complex.

Pradeep Subbaiah[1]*, Suma S[2] and Jyothikiran H[3]

[1]*Lecturer, Department of Orthodontics, JSSAHER, Mysuru, India*

[2]*Reade, Department of Orthodontics, JSSAHER, Mysuru, India*

[3]*Associate professor, Department of Orthodontics, JSSAHER, Mysuru, India*

***Corresponding Author:** Pradeep Subbaiah, Lecturer, Department of Orthodontics, JSSAHER, Mysuru, India.

DOI: 10.31080/ASDS.2022.06.1367

Received: March 15, 2022

Published: April 28, 2022

Abstract

Aims and Objectives

- To compare the influence of cleft lip and palate repair on craniofacial morphology of patients with cleft lip and palate.
- To compare the growth among operated and unoperated patients.

Material and Methods: A total of 36 individuals with cleft lip and palate (eighteen unoperated and eighteen operated) were chosen for the study. The purposive sampling approach is used for sampling. The patients were categorized into two groups, which were then subdivided into three subgroups, with six patients in each. A statistical evaluation was performed via descriptive statistics, including the independent "t" test and ANOVA.

Result

Cranial base relationships

There was no significant difference in the mean N-S-Ba in this study (p = 1 for birth to 3 years, p = 0.575 for 6 - 12 years, and 0.786 for 12 to 20 years) and S-N (p = 1 for birth to 3 years, p = 1 for 6-12 years, and p = 0.106 for 12-20 years) value (Table -1, figure 1-3) values were detected in both the operated and unoperated cleft groups. According to the findings, there was no variation in the cranial base angle or anterior cranial base length.

Maxillary spatial positioning

The analysis revealed that in the unoperated group, the maxilla was normal from birth to three years (mean 82.33^0) and six to twelve years (mean 82.5^0), but protrusive (84.6^0) from twelve to twenty years. The mean value of SNA in the operated group was 76^0 from birth to three years, 77^0 from six to twelve years, and 79^0 from twelve to twenty years, indicating that the maxilla is retrusive in all three subgroups. (Table -2)

Conclusion: In an unoperated group, the maxilla was average until the age of twelve years, after which it became prognathic. This demonstrates that the maxilla has an average growth potential in the unoperated group. The maxilla was retrognathic in the operated group, indicating that surgical correction of the cleft lip and palate impacts maxillary development.

Keywords: Cleft Lip and Palate; Nasomaxillary Complex; Operated; Unoperated

Introduction

Unilateral and bilateral clefts of the lip and palate are pretty joint developmental deformities in the human population, affecting about 1 in 800 -1200 patients [1]. Females are more likely to have a palate cleft, whereas males are likelier to have a lip cleft.

For centuries the Inca civilization celebrated children born with a cleft lip [2]. Such an abnormality was one of the most valuable adornments and those who were affected by it showed of their hair lip with pride. However, the Incas are an exception, because most people during history have considered such physical malformations to be deformities. The idea that "when God marks somebody, there is a reason" is still a popular concept. This implies that individuals who bear physical deformities are also morally deformed. Such a belief promulgates an incorrect view of the real issues.

Man has a rather definite idea of just what he should look like [3]. He is liberal enough to allow certain individual differences; but the basic physiognomical pattern is set. A man may have a withered arm or a club foot, but facial aberrations may prove a much greater handicap as the unfortunate individual tries to take his place in society. And when this critical attitude toward facial deformities is combined with the individual's own hypersensitive psychic response, the problem becomes even more complex.

Attempts to solve the cleft palate problem have mainly been surgical and these procedures are started early in life, in some cases only days after birth [4]. In the largest group of cases, the surgeon is finished with his work before the child starts school and does not have to worry about psychological and sociological difficulties brought on by inadequate esthetic correction and speech defects. The problem then becomes the figurative soccer, passed back and forth with the medical and dental professions, with a lateral to the speech instructor and psychiatrist thrown in for good measure. Several men felt that we needed a re-evaluation of our criteria for success and failure in these cases. What may be a magnificent surgical closure of a cleft palate at the age of two may be total psychological and sociological failure by the age of twenty.

Furthermore, a bone closure of a palate at two years may be a precarious bony union at twenty, but also a micro-maxilla and significant facial deformity. The surgery alone does not provide a comprehensive solution. Several questions arise to befuddle us. Why do we see such wide variations in facial appearance among the cleft palate group? Why do we see more marked deformities in adults where an operative technique used Can tissue resulting from soft tissue repair hold back growth and development? Questions like these inspired the current study to look into the discrepancies between this congenital deformity and the typical pattern, as well as the disparities in growth between treated and untreated cleft lip and palate patients.

The surgical repair of cleft lip or palate or both influence the growth of maxilla and mandible as shown impact of lip repair on craniofacial morphology of children with full bilateral cleft lip and palate revealed a reduction in premaxillary anterior protrusion and lingual tilting of the upper incisors. Such an effect on premaxillary projection is normally helpful, unless the extreme lip pressure, negative development pattern, or both retro places the midface morphology beyond acceptable sagittal boundaries.

The current study aims to see if there is a difference in maxillary and mandibular growth, as well as changes in the relationship of the maxilla and mandible to one another and their relative position to the cranial base, between operated and unoperated patients by measuring S-N length (cranial base length), maxillary spatial positioning (SNA, SN-ANS angle, SN-PP angle, and Co-A distance), and mandibular spatial positioning (SNB (N-Mc, SN-ANS, SN PNS and S-Godistance

Material and Methods

A total of 36 individuals with cleft lip and palate (18 unoperated and 18 operated) were chosen for the current study. Purposive sampling was used to collect the data. The patients were classified into two groups, which were then subdivided into three subgroups, each with six patients.

Group A consists of unoperated cleft lip and palate patients, who are further subdivided into three age groups as follows.

- Subgroup A1: Birth - 3 years
- Subgroup A2: 6 - 12 years
- Subgroup A3: 12 - 20 years

Group B consists of individuals with surgical cleft lip and palate, which be further subdivided into three age groups as follows

- Subgroup B1 - Birth - 3 years
- Subgroup B2 - 6 - 12 years
- Subgroup B3 - 12 - 20 years.

The informed authorization for the study was signed by the patient or the patient's parents. The ethics committee approved the study of J. S. S. Dental College and Hospital Mysore.

Before situating the individuals, the sagittal plane should be at a right angle to the direction of the X-ray and the mandible should be parallel to the floor.

The individuals were taught to retain their jaws in centric occlusion and were instructed to do so while the X-ray was taken with their lips relaxed. Standardized lateral cephalograms taken with the target film distance of 5 feet; 80 Kvp, 8 ma and 0.7 seconds exposure time were used.

On the acetate tracing film [5], a standard tracing of the skeletal and dental tissue profiles were created, as well as standardized points, planes, angles, and linear measurements. To prevent errors when tracing, orientation markers were added on the tracing film.

Methods of data collection

The research was based on a standardised lateral cephalogram of the patients. The cephalometric parameters [6,7] were measured by hand, and the following characteristics were assessed

- Angle and length of the cranial base.

Ba-S-N angle and S-N length.

- Maxillary spatial positioning.

SNA angle, SN-ANS angle, SN-PP angle, Co-A length.

Results

Means, SDs and Student's "t" Test are presented in tables 1 through 5.

Age Group	Cephalometric Measurement	Unoperated		Operated		t-test
		Mean	SD	Mean	SD	Unoperated Vs Operated
0-3 yrs.	BaSN (degrees)	128.5	2.51	128.5	2.1679	1 (ns)
	SN (millimetres)	60.6667	1.9664	60.6667	1.7512	1(ns)
6-12 yrs.	BaSN (degrees)	130.6667	1.0328	129.8333	3.3714	0.575(ns)
	SN (millimetres)	67.6667	2.5033	67.6667	1.8619	1(ns)
12-20 yrs.	BaSN (degrees)	131.1667	4.2622	130.6667	1.0328	0.786(ns)
	SN (millimetres)	69.8333	1.9408	71.5	1.2247	0.106(ns)

Table 1: Means, SD, and t Test Results for the Cranial Base Cephalometric Measurements.

ns = Non-Significant ($p > 0.05$).

Cranial base shows enough stability and remains uninfluenced by the surgical repair of cleft lip and palate, partly for being distant from the surgical area. This was noticed from the nonsignificant differences observed between the measurements that represented the angle and length of the cranial base of unoperated patients and the operated patients (Table 1).

Age Group	Cephalometric Measurement	Unoperated		Operated		t-test
		Mean	SD	Mean	SD	Unoperated Vs Operated
0-3 yrs.	SNA (degrees)	82.333	1.2111	74.8333	1.1690	0.000 (s)
	SN-ANS (degrees)	86.8333	4.7924	85.6667	2.0656	0.596 (ns)
	SN-PP (degrees)	15.3333	3.0768	14.6667	1.7512	0.654 (ns)
	Co-A (millimetres)	73.333	3.3267	69.000	2.000	0.021 (s)

6-12 yrs.	SNA (degrees)	82.5	1.9748	74.1667	2.1370	0.000 (s)
	SN-ANS (degrees)	86.333	7.0261	84.8333	5.4559	0.789 (ns)
	SN-PP (degrees)	8.5	3.2711	8.6667	4.3665	0.942 (ns)
	Co-A (millimetres)	81.000	3.3466	68.8333	4.5789	0.000 (s)
12-20 yrs.	SNA (degrees)	84.6667	5.3166	73.1667	3.1252	0.001 (s)
	SN-ANS (degrees)	90.1667	5.4191	85.6667	4.7610	0.091 (ns)
	SN-PP (degrees)	9.8333	3.7103	11.5	5.5045	0.552 (ns)
	Co-A (millimetres)	84.1667	4.2622	67.1667	1.7224	0.000 (s)

Table 2: Means, SD, and t Test Results for the Maxillary Cephalometric Measurements.

s = Significant; ns = Non-Significant

Premaxilla was retropositioned during growth because of lip and palate repair. SNA and Co A showed lesser values and statistically significant differences with statistical significance at 5% levels, respectively on operated patients. However, the same statistical pattern was not observed for the SN-ANS angle, which represents the skeletal maxillary anterior projection. Although the SNA angle decreased almost 8 degrees in the age groups of birth to three and six to twelve years and decreased by 11 degrees in age group of twelve to twenty years group, SN-ANS angle decreased only by 1 degree in birth to three, 2 degree in six to twelve and 4 degree in twelve to twenty years of age groups. Palatal plane angle was not influenced by the surgical procedure.

Age Group	Cephalometric Measurement	Unoperated		Operated		t-test
		Mean	SD	Mean	SD	Unoperated Vs Operated
0-3 yrs	SNB (degrees)	74.5	2.5884	76.8333	2.4833	0.142 (ns)
	Ar-Go-Me (degrees)	132.5	4.4609	123.8333	2.8577	0.002 (s)
	SN-GoGn (degrees)	32.6667	2.8048	31.5000	1.3784	0.382 (ns)
	Co-Gn (millimetres)	90.5	3.2711	91.000	1.4142	0.738 (ns)
6-12 yrs	SNB (degrees)	78.6667	1.5055	77.6667	3.8816	0.569 (ns)
	Ar-Go-Me (degrees)	132.000	4.6476	126.000	4.000	0.038 (s)
	SN-GoGn (degrees)	33.8333	6.4317	31.1667	3.7639	0.401 (ns)
	Co-Gn (millimetres)	111	6.9857	108.8333	4.8751	0.547 (ns)
12-20 yrs	SNB (degrees)	78.6667	3.9833	78.8333	5.6716	0.954 (ns)
	Ar-Go-Me (degrees)	138.3333	8.0911	126.1667	2.6394	0.006 (s)
	SN-GoGn (degrees)	34.5000	5.6125	35.000	3.7417	0.860 (ns)
	Co-Gn (millimetres)	117.6667	6.0222	118.3333	9.3310	0.886 (ns)

Table 3: Means, SD, and t Test Results for the Mandibular Cephalometric Measurements.

s = Significant; ns = Non-Significant

The cephalometric values referring to the mandible (SNB, SN-GoGn and Co-Gn) showed no alteration after lip-palate repair. The only statistically significant difference found in Ar- Go-Me which showed more vertical growth pattern in unoperated patients as compared to operated patients.

Age Group	Cephalometric Measurement	Unoperated		Operated		t-test
		Mean	SD	Mean	SD	Unoperated Vs Operated
0-3 yrs	ANB (degrees)	4.6667	3.0768	-1.1667	1.1690	0.001 (s)
	β(angle)	24.5000	5.5408	35.8333	3.4881	0.002 (s)
	Wits appraisal	3.667	3.7771	-2	1.7889	0.008 (s)
6-12 yrs	ANB (degrees)	3.1667	1.4720	-1.667	1.5055	0.000 (s)
	B (angle)	32.1667	2.7142	43.5000	2.8810	0.000 (s)
	Wits appraisal	1.9167	2.0104	-3.6667	2.8048	0.003 (s)
12-20 yrs	ANB (degrees)	4.1667	3.8166	-3.1667	2.3166	0.002 (s)
	β(angle)	30.000	5.9330	42.8333	6.9976	0.006 (s)
	Wits appraisal	4.1667	3.7639	-4.000	3.7417	0.004 (s)

Table 4: Means, SD, and t Test Results for the maxillomandibular Cephalometric Measurements.

s = Significant

Facial convexity dramatically reduced in the operated patients when evaluated by the ANB, Beta angle and Wits appraisal, as a consequence of the premaxillary retropositioning induced by lip palate repair.

Age Group	Cephalometric Measurement	Unoperated		Operated		t-test
		Mean	SD	Mean	SD	Unoperated Vs Operated
0-3 yrs	N-Me (millimeters)	81.5000	3.2771	81.3333	1.7512	0.915 (ns)
	S-Go (millimeters)	57.500	2.0736	56.3333	1.7512	0.317 (ns)
	SN-ANS (millimeters)	41.6667	2.4221	42.8333	2.0412	0.388 (ns)
	SN-PNS (millimeters)	38.1667	3.4881	31.1667	3.3116	0.005 (s)
6-12 yrs	N-Me (millimeters)	102.1667	3.6560	105.8333	7.4140	0.303 (ns)
	S-Go (millimeters)	70.5	6.4420	71.8333	4.3089	0.682 (ns)
	SN-ANS (millimeters)	46.500	1.3784	45.3333	5.5377	0.627 (ns)
	SN-PNS (millimeters)	42.6667	1.2111	40.3333	2.0656	0.038 (s)
12-20 yrs	N-Me (millimeters)	113.333	4.8442	108.6667	2.7325	0.067 (ns)
	S-Go (millimeters)	76.1667	3.6560	76.3333	4.4121	0.945 (ns)
	SN-ANS (millimeters)	46.8333	4.1673	51.1667	5.5648	0.158 (ns)
	SN-PNS (millimeters)	47.5000	4.0373	41.667	4.5898	0.042 (s)

Table 5: Means, SD, and t Test Results for the Facial Height Cephalometric Measurements.

s = Significant; ns = Non-Significant

The only significant vertical alteration directly related to lip palate repair was registered in posterior face height, probably because of the premaxillary downward rotation following cleft lip and palate repair. There is no significant difference in total facial height, posterior facial height and upper anterior face height

Discussion

A detailed understanding of both the skeletal and dental features that contribute to a specific malocclusion is vital in dentofacial orthopaedics since these features may impact the approach to therapy [8].

Dentistry and other associated sciences have joined forces to establish a team of specialists specializing for treating cleft lip/palate patients, with surgical and orthodontic procedures playing the most significant roles. Craniofacial development in cleft lip/palate patients differs from that in ordinary people [9], and this may have a key influence on treatment demands and result.

Cephalometry is now widely accepted as the primary method for understanding the intricacies of dentofacial skeletal structures. Description, morphological outlines, measurement, and change in skull growth may all be properly determined by cephalometric radiography.

Studies evaluating maxillary and mandibular arch sizes, intercanine and intermolar breadth, angle and length of the cranial base, development velocities, and dental placement have shown that surgical and orthodontic therapies can restore craniofacial growth in such patients.

This study aimed to examine if there was a difference in maxillary and mandibular development between operated and unoperated patients by measuring and comparing S-N length (cranial base length), TABLE -1 maxillary spatial placement (SNA, SN-ANS angle, SN-PP angle and Co-A distance) table no.

Cranial base relationships

In this study, there was no significant difference in the mean N-S-Ba (p = 1 in the birth to 3 years group, p = 0.575 for the 6 - 12 years age group, and 0.786 for the 12 to 20 years age group) and S-N (p = 1 in the birth to 3 years group, p = 1 for the 6 - 12 years age group, and p = 0.106 for the 12 to 20 years age group) values between the operated and unoperated . There was no variation in the cranial base angle or anterior cranial base length, according to the findings (Table -1, Figure 1-15).

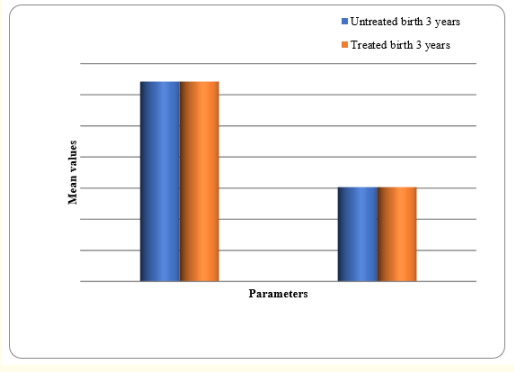

Figure 1: Mean values for cranial base cephalometric measurements in birth to 3 years.

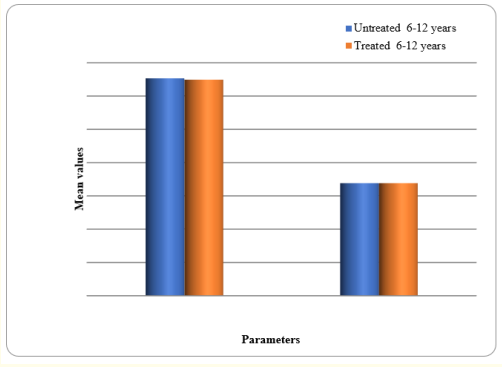

Figure 2: Mean values for cranial base cephalometric measurements in age group of 6 to 12 years.

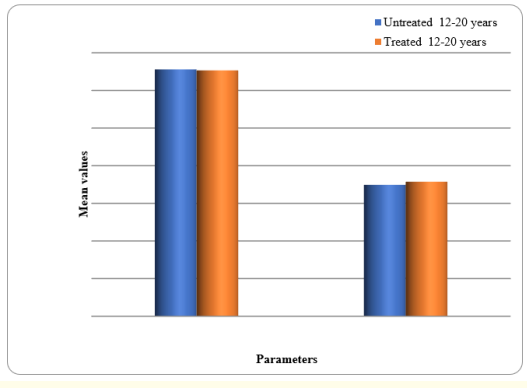

Figure 3: Mean values for cranial base cephalometric measurements in age group of 12 to 20 years.

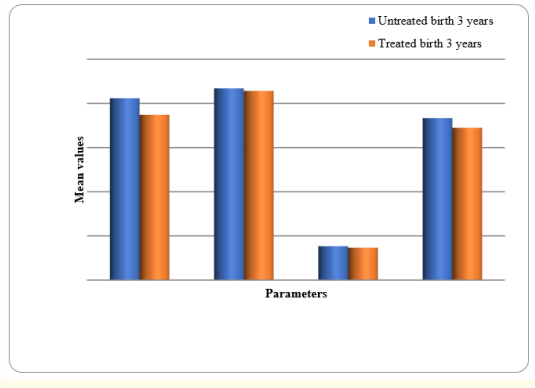

Figure 4: Mean values for maxillary cephalometric measurements for the age group of birth to 3 yrs.

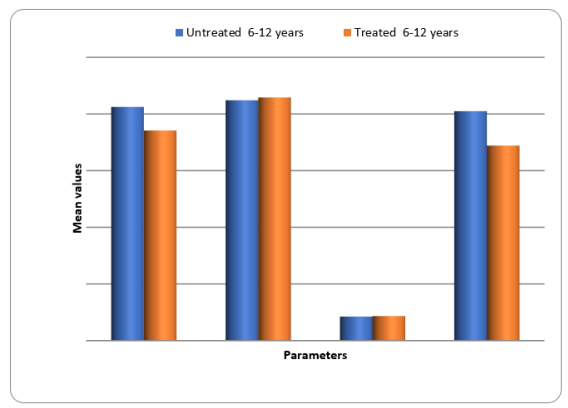

Figure 5: Mean values for maxillary cephalometric measurements for the age group of 6 to 12 yrs.

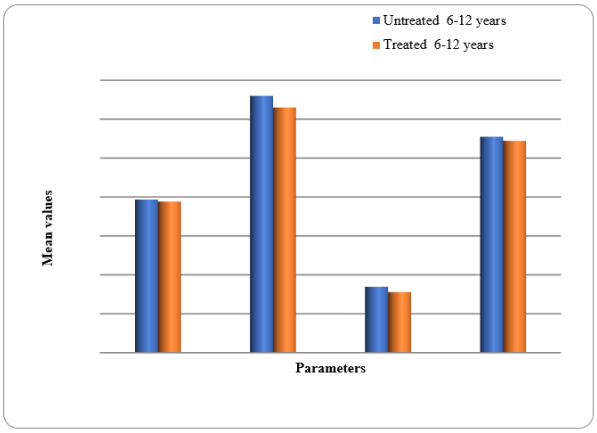

Figure 8: Mean values for mandibular cephalometric measurements for the age group of 6 to 12 year.

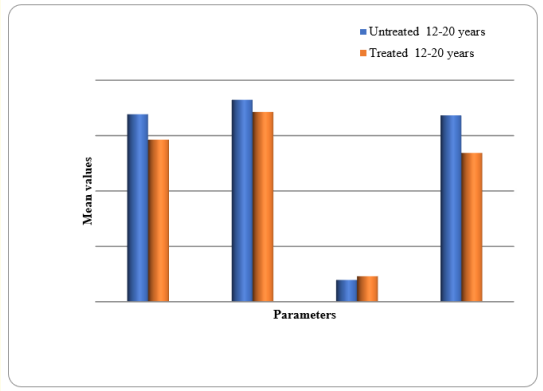

Figure 6: Mean values for maxillary cephalometric measurements for the age group of 12 to 20 yrs.

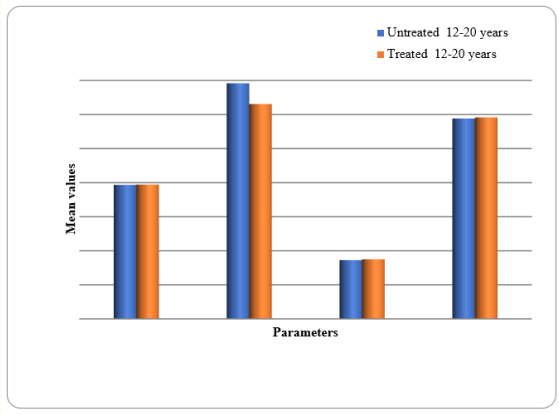

Figure 9: Mean values for mandibular cephalometric measurements for the age group of 12 to 20 years.

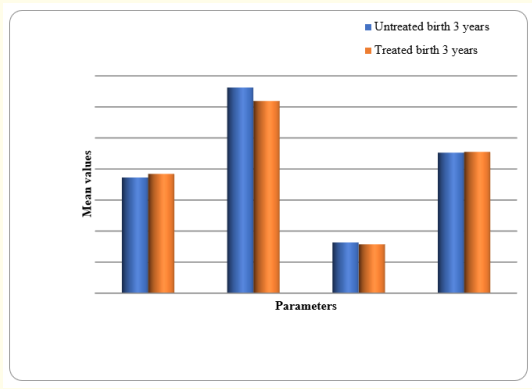

Figure 7: Mean values for mandibular cephalometric measurements for the age group of birth to 3 years.

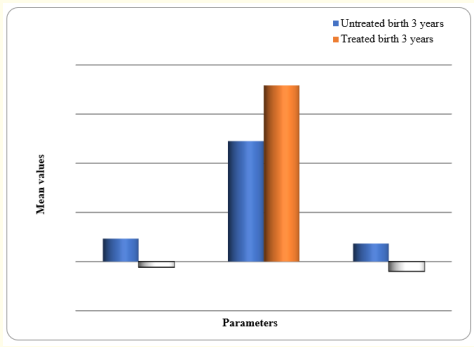

Figure 10: Mean values for maxillomandibular relationships cephalometric measurements for the age group of birth to 3 years.

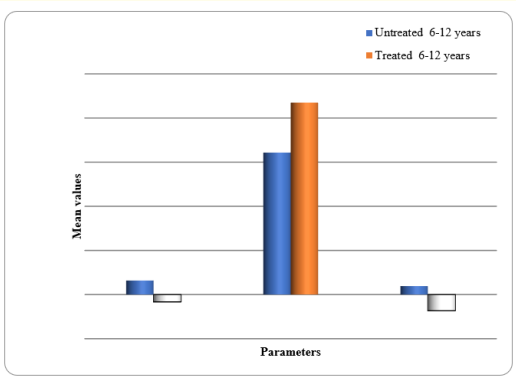

Figure 11: Mean values for maxillomandibular relationships cephalometric measurements for the age group of 6 to 12 years.

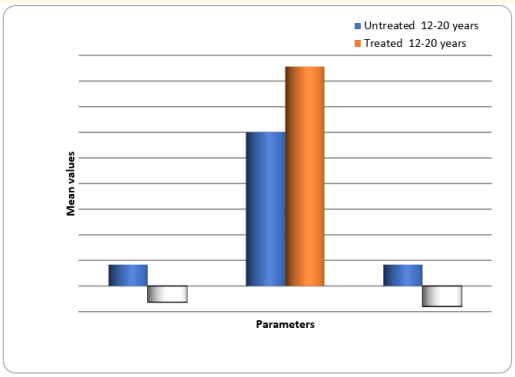

Figure 12: Mean values for maxillomandibular relationships cephalometric measurements for the age group of 12 to 20 years.

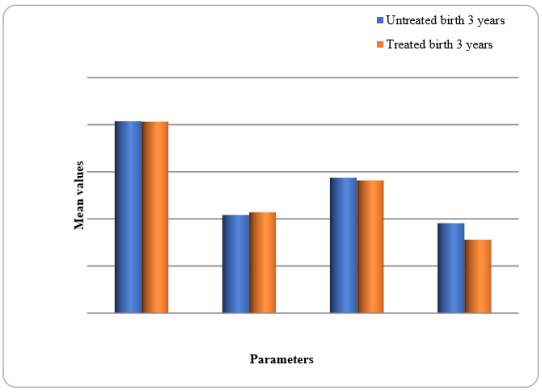

Figure 13: Mean values for facial height cephalometric measurements for the age group of birth to 3 years.

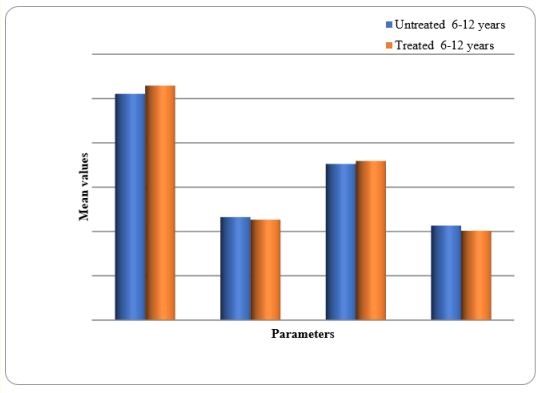

Figure 14: Mean values for facial height cephalometric measurements for the age group of 6 to 12 years.

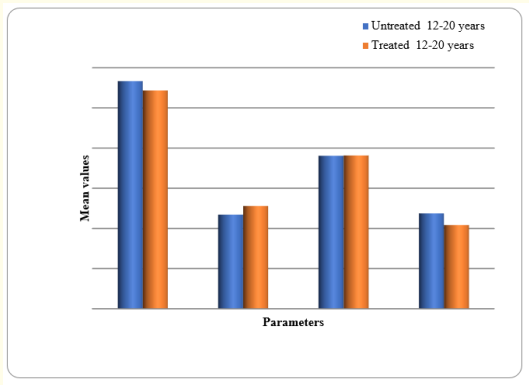

Figure 15: Mean values for facial height cephalometric measurements for the age group of 12 to 20 years.

Our results agree with the results of Bishara[7]; Krogman[10] 1982, et al., Smahel 1984 [11], Ross [12] and but different from Bishara., *et al*. [13]., whose study showed a reduction in the cranial base angle.

Maxillary spatial positioning

Following previous reports, we found that the most striking features of the unilateral cleft lip and palate patients resided in the maxilla. The following are the differences between the maxillas of operated and unoperated patients

- **Angle S-N-A**

There was a substantial difference in the mean SNA values between the unoperated and operated groups. The study found that

in the unoperated group, the maxilla was standard from birth to three years (mean 82.33^0) and 6 to 12 years (mean 82.5^0), but protrusive (84.6^0) from twelve to twenty years of age. The mean value of SNA in the operated group was 76^0 from birth to three years, 77^0 from six to twelve years, and 79^0 from twelve to twenty years, indicating that the maxilla is retrusive throughout all three subgroups. This variation in angle SNA was also statistically significant (p 0.05). table no. 2 Our findings correspond to those of Bishara., *et al.* [13]. Bishara., *et al.* [14] hypothesized that the protrusive impact of the cleft lip and alveolus was offset by the vertically and retrusive impact of the cleft palate.

- **Angle SN-ANS**

The anteroposterior dimension of the maxilla in the palatal plane was identical in all three unoperated groups and in their respective operated groups, and the difference was statistically insignificant (p > 0.05). Our findings match those of Omar Gabriel Da Silva Filho [15]. We discovered that the restricting impact of anterior maxillary development caused by lip restoration is selective and occurs inside the alveolar bone. The lip correction had less of an effect on the basal part of the premaxilla (SN-ANS) than on the alveolar region (SNA and Co-A both reduced in the operated Group). These lowered cephalometric values (SNA and Co-A) indicate that the surgically constructed muscle bridge can impact the alveolar bone but has less influence on the sagittal expansion of the premaxillary basal structure (SN-ANS).

- **SN-PP angle**-

In both groups' respective age groups, no substantial difference (p > 0.05) was identified in the palatal plane. compared to healthy patients, both groups had a higher palatal plane angle. This conclusion is consistent with recent research on children with unilateral cleft lip and palate by Krogman., *et al*. [16], Smahel Z [17].

- **Co-A length**

The average Co-A (effective maxillary length) measurements of the unoperated and operated cleft lip and palate groups differed significantly. The operated cleft participants in all three subgroups showed substantially higher values than the corresponding operated subgroups (group A1B1; p = 0.021, group A2B2; P0.001, and group A3B3; p0.001). Mars and Houston [18], as well as Krogman., *et al*. [16], discovered a reduction in Co-A value.

Generally, the values demonstrated that the maxilla in the unoperated cleft lip palate group was near normal and retrusive in the operated group. The observed midfacial hypoplasia in the operated group might be the result of surgical intervention. Scar tissue has been linked to the restriction of normal maxillary growth in surgically treated patients[12]. Although there is no injury to the bone itself because of surgery, the fibrous scar tissue that forms at the bony growth sites may hinder appropriate maxillary remodeling and growth in a downward and forward direction. The intensity of the cleft is closely proportional to the level of interference because more extensive treatments must be conducted on mobilization tissue to heal a substantial defect, leading to considerable scar tissue and delayed maxillary development.

Conclusion

- There was no significant variation as in cranial base angle (Ba-S-N) or anterior cranial base length (S-N).
- In an unoperated group, the maxilla was average until the age of twelve, whereas the maxilla becomes prognathic between the ages of twelve and twenty. This demonstrates that the maxilla seems to have an overall growth potential in the unoperated group. The maxilla was retrognathic in the operated group, indicating that surgical correction of the cleft lip and palate impacts maxillary development.
- The antero - posterior length of the maxilla appears to be predicted when measuring the SN-ANS angle, but the angle SNA indicates a retrognathic maxilla; this demonstrates that the restraining impact of lip repair is limited and situated inside the alveolar bone. Lip restoration has less of an impact on the premaxilla's basal portion than on its alveolar portion.

Summary

A sample of 36 participants with unilateral cleft lip and palate was chosen for the current investigation. 18 of them were operational, while the other 18 were not. The participants were separated into three age groups based on their birth to three-year-old status, six to twelve-year-old status, and twelve to twenty-year-old status.

In this study, 11cephalometric planets 06 planes, 11 angles, and 13 linear measures were utilized to assess the differences in the morphology of the maxilla, mandible, cranial base, and face.

There was a substantial difference between the groups. In the operated group, the maxilla exhibited reduced growth in the anteroposterior plane compared with the unoperated group. There was no discernible change in the mandibular morphology. However, the linear measurement and Mandibular plane angles are similar in the two groups, the gonial angle was found to be greater in the unoperated group, particularly in the twelve to twenty-year-old age group. As a result, the maxilla was discovered to be retruded in the operated group, and those who had cleft lip and palate treated at a young age revealed skeletal class III malocclusion due to the retruded maxilla. The restricting impact of scar tissue developed because of the surgical treatment for the early repair of cleft lip and palate was demonstrated.

A study was conducted to obtain information about the craniofacial morphology and growth differences among operated and unoperated subjects. This also aids in our understanding of the impact of treatment on lip and palate closure. This will aid us in making an accurate diagnosis and treatment plan.

Acknowledgment

None.

Conflict of Interest

No Conflict.

Funding Source

No source of financial assistance.

Bibliography

1. William G Shafer., *et al*. "Tounich - A text book of oral pathology, 4th Edition.
2. Per-Inger Branemark and Kenji W. "Higuchi, Marcelo Ferraz De Oliveira-Rehabilitation of complete cleft lip and craniomaxillofacial defects. Textbook of oral and maxillofacial surgery". 1st edition: 1-2.
3. Touro M Graber. "A cephalometric analysis of the development pattern and facial morphology in cleft palate". *Angle Orthodontist* 19.2 (1949): 91-98.
4. Pedro Ribeiro Soares de Ladeira and Nivaldo Alonso. "Protocols in cleft lip and palate treatment: systematic review". *Plastic Surgery International* (2012).
5. Thomas Rakosi. "An atlas and manual cephalometric radiography". Wolfe Medical Publication Ltd (1982).
6. Alexander Jacobson and Richard L Jacobson. "Radiographic cephalometry from basics to 3-D imaging". *Quintessence Publishing Company* (2006).
7. Samir E Bishara. "Cephalometric evaluation of facial growth in operated and unoperated individuals with isolated clefts of the palate". *Cleft Palate Journal* 10.3 (1973): 239-246.
8. Wilton M Krogman., *et al*. "A longitudinal study of the craniofacial growth pattern in children with clefts compared to normal, birth to six years". *Cleft Palate Journal* 12.1 (1975): 59-84.
9. Claudia Zuniga., *et al.* "A comparative study between children with and without cleft lip and palate". *Cleft Palate- Craniofacial Journal* 37.3 (2000): 281-285.
10. Wilton M Krogman., *et al*. "Sex differences in craniofacial growth from one month to ten years in cleft lip and palate". *Cleft Palate Journal* 19.1 (1982): 62-71.
11. Smahel Z. "Craniofacial morphology in adults with bilateral complete cleft lip and palate". *Cleft Palate Journal* 21.3 (1984): 159-232.
12. R Bruce Ross. "Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Part 1: treatment affecting growth". *Cleft Palate Journal* 24.15 (1987): 5-23.
13. Samir E Bishara., *et al*. "Facial and dental relationships of individuals with unoperated clefts of the lip band/or palate". *Cleft Palate Journal* 13.3 (1976): 238-252.
14. Samir E Bishara., *et al*. "Dentofacial relationships in persons with unoperated clefts: Comparisons between three cleft types". *American Journal of Orthodontics and Dentofacial Orthopaedics* 87.6 (1985): 481-505.
15. Omar Gabriel Da Silva Filho., *et al*. "Influence of lip repair on craniofacial morphology of patients with complete bilateral cleft lip and palate". *Cleft Palate - Craniofacial Journal* 40.2 (2003): 144-153.
16. Wilton M Krogman., *et al*. "A longitudinal study of the craniofacial growth pattern in children with clefts as compared to normal, birth to six years". *Cleft Palate Journal* 12.1 (1975): 59-84.

17. Smahel Z and Mullerova Z. "Craniofacial morphology in unilateral cleft lip and palate prior to palatoplasty". *Cleft Palate Journal* 23.3 (1986): 225-232.

18. Michal Mars and William JB Houston. "A preliminary study of facial growth and morphology in unoperated male unilateral cleft lip and palate subjects over 13 year of age". *Cleft Palate-Craniofacial Journal* 27.1 (1990): 7-10.