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Comparative Evaluation of Relevant Cranio-Facial Parameters and Pharyngeal Airway Dimensions Between Children with or Without Cleft Lip and Palate - A Case Control Study

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Dr. Antik Bhattacharyya,
Final Year, Postgraduate Trainee, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India

Dr. Shreya Tripathi,
Postgraduate Trainee, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India.

Dr. Arkya Pratim Chakraborty,
Postgraduate Trainee, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India.

Dr. Shabnam Zahir,
MDS (Pedodontics), Professor and Head of the Department, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India

Dr. Siddhartha Chatterjee,
MDS (oral and maxillofacial surgeon), Fellowship in cleft and craniofacial surgery, Project Director and Chief Surgeon, ABMSS Cleft Centre, Kolkata and Shree Jain Hospital & Research Centre, Kolkata, West Bengal, India.

Dr. Krishnendu Chatterjee,
MDS (Orthodontics), ABMSS Cleft Centre, Kolkata, West Bengal, India.

Corresponding address: Dr. Antik Bhattacharyya,
Final year, Postgraduate Trainee, Department of Paediatric and Preventive Dentistry, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India.
Email ID: antikbhattacharyya2295@gmail.com.

Keywords:
Cleft lip and palate, craniofacial growth, maxillary retro-positioning, pharyngeal airways.

Abstract
Aim: This study aims to relate the sagittal deficiencies of maxilla, mandible, its relative position to the cranial base and dimensions of pharyngeal airways in the cleft patients comparing the same with the age matched non cleft control group to understand the discrepancies. A cross- sectional, case control, observational Study.
Material & methods: 30 Patients with repaired cleft palate (Group1) were compared with 30 non-cleft age matched controls between the age group 7-13years (Group 2), with the help of lateral cephalometry to understand the discrepancies in craniofacial features and pharyngeal airway dimensions between them.
Results: Following statistical evaluation, the results concluded that, children with cleft palate, the mandible and maxilla both were found retropositioned than normal control group, a relative mandibular prognathism was found. The pharyngeal airway showed significant changes, with increased airway in Upper Pharyngeal region.
Conclusion: Cleft Palate patients have smaller, retrognathic, and retro-positioned jaws, as well as a Class III skeletal connection. The study's current data would assist in the field's expertise by offering a better grasp of the orthodontic needs of cleft patients.

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1. Introduction:

Cleft lip and palate (CL/P) is the most prevalent among craniofacial birth defects, approximately affecting quarter of a million newborns worldwide each year. Cleft lip and palate affects roughly 1 in 600 to 800 live births (1.42 in 1000). It varies greatly between geographic locations and ethnic groupings. Asians had a higher frequency (0.82 - 4.04 per 1000live births) whereas Caucasians had a lower incidence (0.9 - 2.69 per 1000 live births). Africans have a low incidence (0.18 - 1.67 per 1000 live births). The Chinese had 1.76 orofacial clefts per 1000 live births, whereas the Japanese had 0.85 to 2.68 orofacial clefts per 1000 live births. It has serious physical, social, psychological, and economic consequences. Craniofacial abnormalities account for a considerable proportion of all human birth malformations.

The natural growth & development of craniofacial structures, the brain, the formation of each person's personality, and healthy living standards can all be impacted by abnormal airway dimensions as evidenced in cleft patients [1,2]. As a result, this anomaly has a substantial impact on the individual's growth, development, airway dimensions, and facial morphology, necessitating a thorough examination of the craniofacial traits. Growth abnormalities in the three planes of vertical, sagittal, and transverse growth are typically found in Cleft patients. The midface with sagittal deficiency, which results in a concave facial profile, is the most noticeable characteristic in patients with cleft [3,4]. Numerous techniques, including as CBCT,MRI, CEPHALOMETRY, etc., can be used to assess this sagittal insufficiency in terms of the dimensions of the maxilla, mandible in relation to the cranial base, and pharyngeal airway.

2. Materials and Methods:

This cross-sectional case control comparative study was carried out with the patients reporting to OPD of Guru Nanak Institute of Dental Sciences and Research, Panihati, Kolkata and ABMSS Cleft Centre Kolkata, Shree Jain Hospital & Research Centre. The study conducted within a period of 1.5 to 2 years. Number of Children were distributed in two groups following inclusion and exclusion criteria (Table 1):

- GROUP I (CONTROL GROUP) = 30 CHILDREN
- GROUP II (STUDY GROUP) = 30 CHILDREN

INCLUSION CRITERIA (CONTROL GROUP)	INCLUSION CRITERIA(STUDY GROUP)	EXCLUSION CRITERIA (CONTROL & STUDY GROUP)
• Children of both sexes • Age group 7 to 13 years. • Non- syndromic • Patients with class I and III Skeletal relation (maxilla & mandible) or Dental Malocclusion. • Patients who are indicated for Lateral Cephalograms. • Willing patients	• Children of both Sexes. • Age Group 7 to 13 years. • Patients with Cleft Lip andPalate defects that are surgically repaired. • Patients who are indicated for Lateral Cephalograms. • Patients whose Orthodontic treatment has not started. • Non-Syndromic • Willing patients.	• Children whose orthodontic treatment has already started. • Alveolar bone grafting done. • Skeletal relation other than Class I and III • Presence of any other syndromes or neuromusculardiseases. • Patients who are unwilling to engage in the study.

Table 1: Inclusion and Exclusion criteria

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Lateral Cephalogram was Collected from the data base of both the institute and comparativeevaluation was done on the following parameters.

1) Determining the mandibular length and the maxillary length by cephalometric analysis. Maxillary Length (Figure 1): Length between Anterior Nasal Spine (ANS) to Posterior Nasal Spine (PNS). Mandibular Length: Length between Gonion (Go) to Gnathion (Gn).

2) Determining the lower anterior face height and the total anterior face height by cephalometricanalysis. Lower Anterior Face Height (Figure 2): Distance Between Anterior Nasal Spine (ANS) to Menton (Me) Total Anterior Face Height: Distance Between Nasion (N) to Menton (Me).

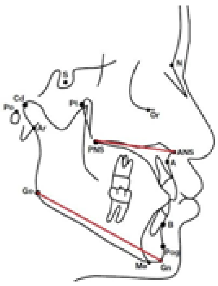
3) Determining the Facial angle by cephalometric analysis. Angle formed by FH plane intersecting with the line joining N to Pog. (Figure 3)

4) Determining the position of maxilla in respect to the cranial base by cephalometric analysis. Angle formed by SNA. (Figure 4)

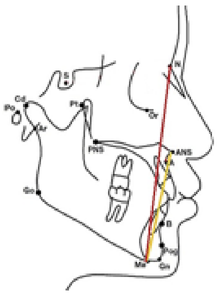
5) Determining the mandibular position in respect to the cranial base by cephalometric analysis. Angle formed by SNB. (Figure 5)

6) Determining the relative maxillary and mandibular position, to each other by cephalometric analysis. Angle formed by ANB. (Figure 6)

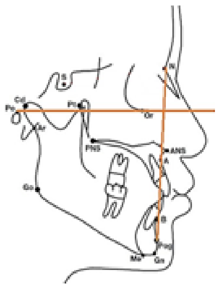
7) Determination of Lower and Upper pharyngeal airway measurements by cephalometric analysis. McNamara airway analysis was used for measuring the upper pharyngeal airway and LPA. Upper pharyngeal width was calculated from a point on the soft palate's posterior outlineto the nearest point on the pharyngeal wall's posterior wall. Lower pharyngeal airway width was measured from the intersection of the posterior border of the tongue and inferior border ofmandible to closest point on lying on the posterior pharyngeal wall. (Figure 7)



(Fig. 1)



(Fig. 2)



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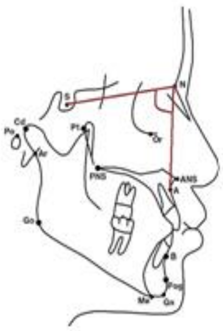

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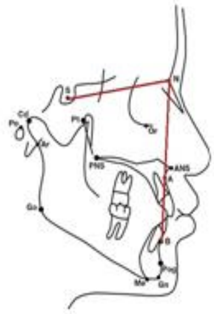

(Fig. 5)

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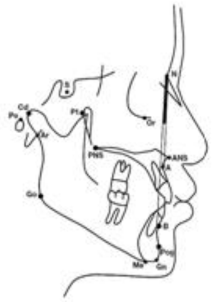
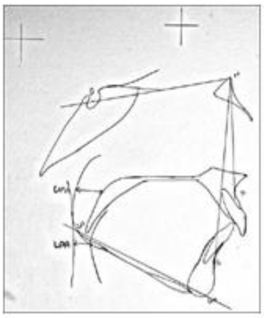


(Fig. 6)



(Fig. 7)

Statistical tests used:

- **Descriptive statistics:** Depending on the distribution of the continuous variables, descriptive statistics were reported using the mean of standard deviation. Categorical variables were described using frequency and percentages. The 95% confidence interval was maintained. The statistical significance level was set at 0.05. Following the applicationof each statistical test, the degree of freedom was calculated.

- **One way Anova:** Inferential statistics were performed using One way ANOVA statistics. The ANOVA tests the null hypothesis, which asserts that all samples are drawn from populations with identical mean values. The variance of the population is estimated twice. These estimates are predicated on a number of assumptions. The F-statistic is produced bythe ANOVA.

3. Results:

The data was entered using MS Office EXCEL 2016 and analyzed using IBM SPSS Version 25. Data sorting was done and the continuous variables were represented in terms of Mean and SD. Categorical variables represented using frequency and percentages. One-way ANOVA statistical test were used to fabricate inferential statistics. P value <0.05 was taken asstatistically significant.

The mean age group of the study population was 10.17±1.906. The details of the demographic characteristics have been mentioned in Table 2. The distribution of the gender has been mentioned in Graph 1 and the study population distribution in the different groups was represented in Graph 2. The distribution of males was more as compared to the females.

		Frequency	**Percentage**
Gender	**Male**	31	51.7
	Female	29	48.3
Group	**Study Group**	30	50.0
	Control Group	30	50.0

Table 2: Demographic Characteristics of the study population

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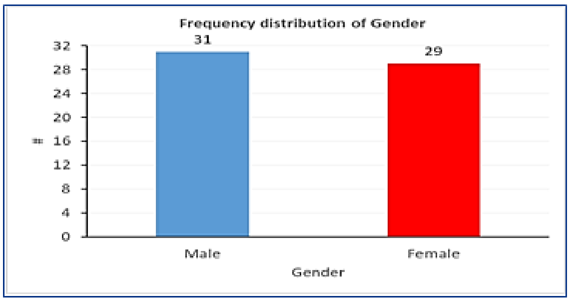
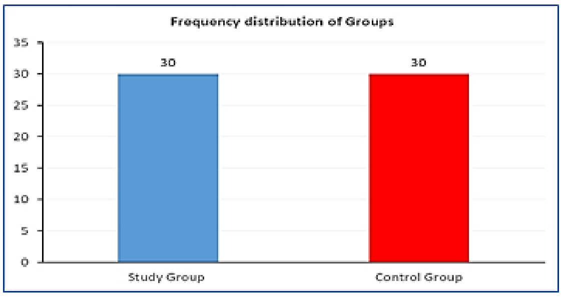
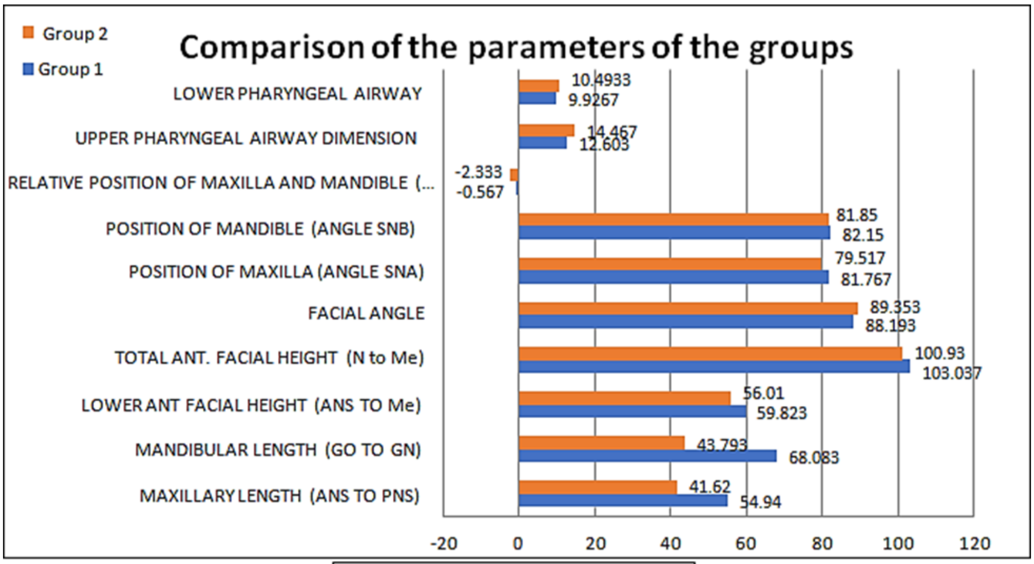


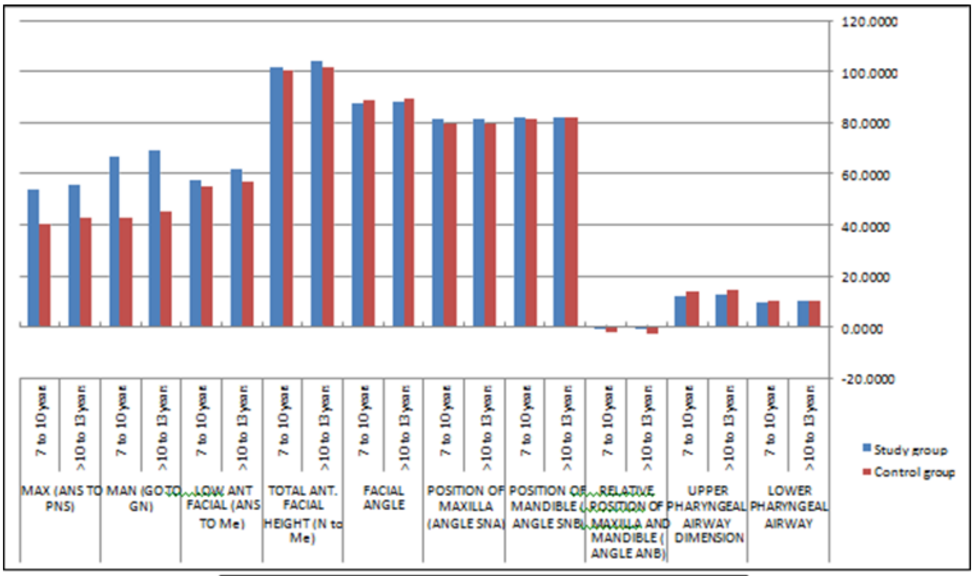
Graph 1: Graphical representation of the Gender



Graph 2: Graphical representation of Group



Graph 3: Age category-wise



Graph 4: Gender category-wise distribution

4. Discussion:

Cleft of lip & palate are one of the most frequent congenital defects affecting the orofacial area, with a wide range of prevalence across populations. It is most common in Asians and Native Americans (1/700 live births), intermediate in Caucasians (0.9 - 2.69 per 1000 live births), and rare in Africans (1/2500 live births). [5].

The defects that are commonly associated with Cleft patients have growth in all three planes, namely vertical, sagittal, and transverse planes, as well as abnormalities of the dental arch form,different types of malocclusion, facial deformities, and difficulties with masticatory functions and speech. Thus, changes in craniofacial traits between cleft and non-cleft people are seen. Which are more noticeable in the sagittal plane and less so in the transverse plane [5,6,7,8]. Soin the present study, Lateral cephalogram, which is a standardized, reproducible, lateral cephalometric radiograph were chosen to evaluate cranio-facial features in sagittal dimensions of repaired cleft and non-cleft children. They were economical, provide full view of skull and neck, and available in both the study centres, GNIDSR & ABMSS, CLEFT CENTRE. The effective radiation doze of Lateral Cephalogram is also less as compared to OPG and CBCT. According to the study by Li et al. the results showed the direct comparison, where the effective dosage for panoramic radiography is approximately 22.0 µSv, 4.5 µSv for lateral cephalometric assessment, and 61-134 µSv for CBCT examination [9].

In this study, the subjects chosen were surgically repaired following widely accepted protocolsfor repair. It was seen that their Orthodontic corrective treatment did not start before selecting the samples so that no interventions occur and study results can be natural of their own growthcapacities.

Sagittal growth differences mark a significant change in comparison [10,11]. Since this study dealt with skeletal landmarks of Lateral Cephalogram, unilateral or bilateral cases of Cleft Palate individually would not affect the results and so cleft palate patients were considered. It had been shown that no significant difference exists in the skeletal base parameters between the patients with bilateral and unilateral cleft, the data from bilateral clefts were pooled with that of the patients with unilateral cleft according to a study done by **Chaisrisookumporn N et al.** [12].

In a south Indian community, **Naduwinmani et al.** performed a cephalometric study of individuals with unilateral and bilateral cleft. They also discovered no statistically significant difference in skeletal parameters between unilateral and bilateral individuals. [13].

In this present study Cleft palate cases were chosen as they majorly affected the cranio-facial and skeletal changes associated with the defect rather than cleft lip cases which mainly affectedthe soft tissue changes.

Majorly in the Control group Class III skeletal samples were chosen as compared to Skeletal Class I Samples as most of the literature regarding cleft lip and palate cases summed up the fact that Cleft palate cases produced a relative skeletal Class III relationship. **Lacerda et al.** in their study concluded the fact of majority skeletal class III relationship of Cleft palate patients[11].

According to the study's findings, the cleft palate group's craniofacial and airway characteristics were significantly different from those of the non-cleft palate group.

In the present study the parameters chosen were: Length of Maxilla (ANS to PNS), Length of Mandible (Go to Gn), Lower Anterior Facial Height (ANS to Me), Total Anterior Facial Height (N to Me), Facial Angle, Maxillary Position (Angle SNA), Mandibular Position (angle SNB), Relative Position of Maxilla and Mandible (angle ANB), Dimension of Upper pharyngeal Airway (UPA), Dimension of Lower Pharyngeal Airway (LPA).

Maxillary growth in the sagittal direction has been observed to be less than normal. The length of the Maxilla measured from the Anterior Nasal Spine (ANS) to the Posterior Nasal Spine (PNS) is considerably shorter in cleft palate patients compared to normal patients in the control group. The cause is a cleft palate deformity and the resulting restriction of maxillary development. According to **Ross et al**, individuals with CLP have a delay in maxillary development, which results in maxillary retrusion. [14]. Factors such as genetic, facial pattern,severity of the cleft, effects of surgery may also affect maxillary arch dimensions [10]. In this study, a statistically significant difference between the group ($p<0.0001$) is

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found. A higher mean score was noted for the control group (54.94±2.21) as compared to the study group (41.62±1.53). Comparatively higher mean values in both the male and female population has been noted in the control group than study group depicting to the fact that overall anterio- posterior length of maxilla is more in non- cleft patients as compared to the cleft palate cases. Males had higher scores as compared to females in the control group. But in the cleft cases, female population had higher scores as compared to males. A statistically significant difference was noted for the male population between the groups. A statistically significant difference was noted between the males and the females in the control group.

The **Mandibular growth** in cleft patients were significantly less but close to normal. They showed a class III pattern due to deficiency of the midface & reduced maxillary growth causinga relative mandibular prognathism. Mandibular length (GO to GN) as measured and compared between the study and the control group, there was a statistically significant difference between the groups (p<0.0001). A higher mean score was noted for the control group (68.08±2.62) as compared to the study group (43.79±1.58) indicating that the growth of the mandible was significantly less in cleft patients as compared to normal. In this study, comparatively higher mean values in both the male and female population has been noted in the control group than study inferencing that overall growth of mandible in non-cleft patients are more. In case of mandibular growth according to this study, males had higher scores as compared to females in both the control group and the study group. No statistically significant difference was noted for the male or female population between the groups. There was no statistically significant difference between the males and the females in both the control and the study group.

Moss et al. in their study showed similar results with the present study where a class III relative prognathic mandible was noted [15]. According to our findings, a Mexican research by **Buraket al.** (2015) found that the majority of people with cleft had a skeletal Class III maxillomandibular connection [16]. **Loxpez et al.** (2018) discovered the skeletal Class III patterns was predominant in patients with Unilateral CLP and skeletal Class I patterns in individuals with Bilateral CLP in a Spanish investigation. [17]. From the findings of **Moss** and**Coupe** and **Subtelny**, the present study also proved the retro-position of the maxilla in patients with CLP. The present study also observed decreased midfacial length (100%) and overall maxillary retrognathism [15].

According to **Naduwinmani et al.** found no statistically significant difference between unilateral and bilateral patients when comparing the skeletal parameters. Their study showed maxillary deficiency in patients with cleft, but maxillary and mandibular length ratio was not statistically different from normal [12]. In contrast to our present study, a study in South Indian patients with cleft by **Johnson et al.** showed prevalence of Class I skeletal base pattern, followed by Class III and Class II skeletal base [18]. **Gupta et.al.** said in contrast that maximum subjects in his study were of Class II malocclusion. According to study by **Mario et.al.** the prevalence of malocclusions in subjects with a CLP was 82.1 per cent (molar relationships Classes II and III) [19]

Midface deficiency has been frequently reported in patients with CLP [20]. **Gesch et al.** (Germany, 2006) and **Goyenc et al.** (Turkey, 2008) stated that patients with unilateral CLP present maxillary retro-position and mandibular deficiency [21,22]. **Ana Lopez-Gimenez et al**. discovered the incidence of skeletal Class III pattern in patients with cleft palate in a studyof the Spanish population. [17].

Lower Anterior Facial Height, as measured from the Anterior Nasal Spine (ANS) to Menton (Me), was shown to be considerably lower in patients with cleft palate compared to those without clefts in this research. When the groups were compared, there was a difference that was statistically significant (p<0.0001). A higher mean score was noted for the control group (59.82±4.14) as compared to the study group (56.01±1.66), depicting in a shorter lower anterior growth of the face as compared to normal. This added more to the concavity of the facial profile in cleft patients. According to the study, comparatively higher mean values in both themale and female population was noted in the control group than study group that is the length of the lower anterior facial height noted was more in the non-cleft cases as compared to the cleft ones owing much to the midface deficiency in growth. Comparing growth, the males showed more growth in respect to Lower Anterior Facial Height than females in the non-cleft group. But

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reverse was noted in cleft-group No statistically significant difference was noted forthe male or female population between the groups. There was no statistically significant difference between the males and the females in both the control and the study group.

Thus, due to a lack of midface development, restricted maxillary growth, and a decrease in lower anterior facial height, individuals with cleft palate had a lower total anterior facial height when compared to non-cleft patients. The difference between the groups was statistically significant (p<0.0001). The control group had a higher mean score (103.04±1.9228) than the study group (100.93±1.575), indicating that children with cleft palate exhibited a disadvantage in anterior facial development when compared with normal children without clefts. The over- all length measured in non-cleft patients was found more in this study as compared to cleft patients. Males had higher scores as compared to females in the control group while the female population had higher scores as compared to males in the study group. No statistically significant difference was noted for the male or female population between the groups. There was no statistically significant difference between the males and the females in both the controland the study group. Similar findings have been noted in a study by **Gopinath et al.** mentioning the decrease in Lower anterior facial height and thereby total anterior facial height in cleft palate cases. Vertical facial height and sagittal depth measurements showed a significant decrease ($P < 0.05$) in their study [23].

The **Facial Angle** in this study was seen to be significantly different in the study group of cleftcases as compared to normal control group. There was a statistically significant difference between the groups (p<0.0001). A higher mean score was noted for the study group (89.35±1.27) as compared to the control group (88.19±1.05). The average value of facial angle is 87.8. It is formed by the angle formed by intersection FH plane (Frankfurt Horizontal plane)and N-Pog (Nasion-Pogonion).

In this present study the average value found is 89.35 which was more than the normal. It givesa relation of anterio-posterior positioning of the mandible in relation to upper face. Itsmagnitude increases in cases of skeletal class III pattern as noted in our case. A decrease in value than the normal would have indicated class II skeletal relationship. The Facial Angle was found to be higher in the cleft cases when compared to normal. Relative prognathism of the mandible as compared to maxilla thus can be noted creating a class III tendency in majority of the cases. No statistically significant difference was noted for the male or female population between the groups. There was no statistically significant difference between the males and thefemales in both the control and the study group. **Johnson et al.** and **Berkowitz et al.** concluded with similar results or classIII skeletal pattern[18, 24].

In terms of the cranial base as defined by SN in cephalometry, the angle formed by SNA gives a relative anterio-posterior position of maxilla in reference to the cranial base. In cases of a Class I skeletal pattern the average value of this angle is 82 degrees. In this study a statistically significant difference between the groups (p<0.0001) were seen. A higher mean score was noted for the control group (81.77±1.40) as compared to the study group (79.52±1.33) which indicated a **retro-positioning of the maxilla** in cleft patients as compared to the normal. The position of maxilla was found to be retro-positioned in cleft cases owing much to the deficiency in anterio-posterior growth as compared to the normal, non- cleft control group. Males had higher scores as compared to females in both the control group and the study group. A statistically significant difference was noted for the female population between the groups. There was a statistically significant difference between the males and the females in the studygroup.

The anterio-posterior positioning of the mandible in relation to the cranial base is measured by the angle SNB formed by SN (cranial base) and Point B on the mandible. The Average value of it is 80 degrees. In this study a higher mean score was noted for the control group (82.15±1.599) as compared to the study group (81.85±1.20). A statistically significant difference between the groups were noted (p<0.0001).

This study the average value of angle SNB was found to be 81.8 which was more than the average values of the position of maxilla in this study, representing a class III tendency in relevance. Comparatively higher mean values in both the male and female population has been noted in the control group than the study group. Males had higher scores as compared to females in the control group while the female population had higher scores as compared to males in the study group. No statistically significant difference was noted for the male or female population between the groups. There was no statistically significant difference between the males and the females in both the control and the study group.

The **ANB angle** which depicts the relative position of maxilla and mandible to each other is a positive angle and average angle value is 2 degrees in cases of class I patients. In this study the average value as found is (-2.99) which depicts the fact that the mandible was more forwardly placed than the maxilla, and denotes a skeletal pattern of class III development. Comparing the position of the mandible it was found that in cleft patients a relative mandibular prognathism was found when compared with the position of maxilla, giving it a class III tendency. When compared with non-cleft Class III control group cases, the mandibular growth was found to be less than normal. Comparatively higher (negative) mean values in both the male and female population has been noted in the study group than the control group. Males had lower scores as compared to females in both the control group and the study group. A statistically significant difference was noted for the female population between the groups. There was no statistically significant difference between the males and the females in both the control and the study group. The Negative value of the angle indicated maxillary retro-positioning and mandibular relative prognathism giving rise to class III tendency and negative ANB angle. The degree of cranial abnormalities varies, and certain dental and skeletal combinations may predict better or worse treatment results. Given the severity of these abnormalities, the combinations of maxillary retrusion, mandibular prognathism, protrusive upper incisors, and retrusive lower incisors in Class III indicate the necessity for orthodontic surgical treatment. [25, 26].

The **upper pharyngeal airway (UPA)** width is calculated from a point on soft palate's posterior border to the nearest point on the posterior pharyngeal wall. The region directly close to the posterior aperture of the nose is crucial in determining upper respiratory patency, therefore this is measured from the anterior half of the soft palate outline. The nasopharynx's head film outline is a two-dimensional depiction of a three-dimensional structure. When a patient swallows while having a radiograph taken, the soft palate appears inverted V-shaped due to the tensor and levator veli palatini muscles pulling the palate upwardly and backwardly during closure. The upper pharyngeal measurement is limited in its utility due to the structure of the soft palate. So proper positioning was noted during obtaining the lateral cephalograms. The average upper airway measurement for adults of both sexes is 17.4 mm (15-20 mm) The measurement increases with age.

In this present study, a statistically significant difference were noted in between the groups ($p<0.0001$). In the **study group** a higher mean score was seen **(14.47±1.11),** as compared to the **control group (12.60±.97).** This proves to the fact that the **upper pharyngeal airway dimensions are relatively more in cleft palate** cases as compared to normal children without cleft palate. This may be due to the fact of restricted growth of the maxilla in anterio-posterior directions due to the defect. Comparatively higher mean values in both the male and female population was noted for the control group than the study group. Males had higher scores as compared to females in the control group while the female population had higher scores as compared to males in the study group. A difference was noted for the female population between the groups which was statistically significant. There was a statistically significant difference between the males and the females in the study group.

In contrast to our finding, the study by **Kiaee et al.** found that the antero-posterior airway dimensions were considerably smaller in study individuals than in the control group, especially at the postnasal spine level, the base of the tongue, and epiglottis. [27].

According to studies by **Cheung et al**; **Sahidi et al**; **Diwakar et al**. similar with the results of this study. They demonstrated no significant difference or larger airway measurements in CLP patients than controls [28,29,30].

The **lower pharyngeal airway (LPA)** width is calculated from the point where the posterior border of tongue and the inferior border of the jaw meet to the nearest point on the posterior part of the pharyngeal wall. The average value for this measurement is 10 to 12 mm in adults. In the present study comparison was done between value of LPA between the cleft and non- cleft cases. The difference between the groups was significant statistically ($p<0.0001$). A higher mean score was noted for the study group (9.93±0.65) as

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compared to the control group (10.49±0.68). A relatively larger dimension was found in the cleft cases than as compared to normal, owing much to the forwardly placed positions of the mandible in cleft cases. Comparatively higher mean values in both the male and female population has been noted in the study group than the control group. Males had lower scores as compared to females in boththe control group and the study group. A statistically significant difference was noted for both the male and female population between the groups. There was a statistically significant difference between the males and the females in both the control and the study group.

Kimura et al. found no significant change in airway volume or cross-sectional area between the cleft and non-cleft groups in their investigation. However, the UCLP group's narrowest segment of the airway was narrower than the control group's (p=0.017). According to the findings of this study, the variation in measures of the narrowest region of the airway is implicated in the specific maxilla-facial morphology identified in UCLP patients. [31]. **Yoshihara et al**. showed similar marginal increase in Lower Pharyngeal Airway in cleft patients in their study [32].

Over-all for the study group, higher values were noted for the female population for the ANS to PNS, ANS to Me, N to Me, Facial Angle, Angle SNB, ANB along with upper and lower pharyngeal pathway parameters. Higher values among the male population were noted for the GO to GN, Angle SNA parameter. Comparatively, the control group had higher mean scores than the study group

Scope for future studies: A similar study can be further improvised by performing it on larger population for a longer duration, using more enhanced imaging techniques and also using advanced softwares for detailed quantification of data.

5. Summary & Conclusion:

For patients with cleft deformities to achieve the necessary function and aesthetic requirements, treatment must be started at the appropriate time and age. A multidisciplinary approach and care from specialists like oral and maxillofacial surgeons, otolaryngologists, geneticists/dysmorphologists, speech/language pathologists, pedodontists, orthodontists, prosthodontists, and others are therefore required for the successful management of a child born with a cleft lip and palate**.**

The best thing to do in a cleft scenario is to prevent it from happening in the first place. The major goal of Cleft Lip and Palate surgery is to educate parents and prospective moms and fathers. As a congenital deformity, cleft lip and palate impacts several structures and functions such as speech problems, aesthetics, feeding, nutrition, and so on. Patients with CLP should have their mental health and psychological impacts evaluated and assisted by psychological rehabilitation and treatment.

In the case of Cleft Patients, extensive dental therapy may be essential, but it shouldn't be made more difficult or complex than necessary to achieve a bearable level of dental perfection. A comprehensive approach is required for the treatment of Cleft Lip and Palate to be successful.

Comparing the Study and Control Group, the basic findings derived:

- Maxillary (ANS to PNS; Control 54.94, Study 41.62) and mandibular lengths (Go-Gn; Control 68.08, Study 43.79) are significantly reduced in the patients with Cleft Palate As compared to those without clefts.
- Maxilla (Angle SNA, Control 81.77, Study 79.52) and mandible (Angle SNB Control 82.15, Study 81.85) are retrognathic and are retro-positioned in most of the cases as compared to those without clefts.
- The maxillary retro-positioning, defective growth in anterior posterior direction, increase in facial angle (angle formed by OP-N, Pog; Control 88.19, Study 89.35), may result in relative forward positioning of the mandible giving it a Skeletal Class III appearance (angle ANB; Control -0.57; Study – 2.33) and concavity of the facial profile.
- The Lower Anterior Facial Height (ANS to Me; Control 59.82, Study 56.01) & Total Anteriorfacial height (N to Me; Control 103.04, Study 100.93) is reduced in cleft palate patients.
- The Upper Pharyngeal Airway Space (UPA; Control 12.60, Study 14.47) was significantly

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increased in patients with cleft palate as compared to those without clefts.

The present study will thus be beneficial, understanding the deficiencies due to cleft palate, changes in the skeletal structure owing to that and thereby management of the patient in later growth years of life orthodontically, surgically or with other multi-disciplinary management approaches.

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