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**Epidemiology Of Long Face Pattern Among School Children
In An Urban Setup In Odisha, India.**

Running Title: Prevalence of Long Face Pattern.

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Abstract :

Aim: The study aimed to estimate the prevalence of long face pattern, classify its severity and establish any gender or occlusal relation predilection, if present , amongst school going children in an urban setup in Odisha's population.

Materials and Method : This study included 906 children(12 to 17 years) from upper primary and secondary schools in Bhubaneswar, Odisha. Facial morphology examination included direct observation of the face with lips at rest to identify individuals with long face pattern. After identification and based on photographic evaluation they were further classified into three subtypes, namely mild, moderate and severe. only moderate and severe subtypes were considered for actual prevalence estimation. The molar relation was also recorded for these individuals. binomial test and chi-square test were used for data analysis.

Results : prevalence of long face pattern amongst the study subjects was found to be 31.10% and actual prevalence was 10.6%. males had a higher predilection. Females had a greater predilection to be afflicted by the severe subtype. Long face pattern was more associated with Angle's class I and II type of occlusion irrespective of the severity. class I (Angle's) type of occlusion was most prevalent in males. In females, Class I and II type of occlusion was evenly distributed.

Conclusion : The mild subtype of long face pattern is more frequent amongst individuals of Bhubaneswar,Odisha.

Clinical significance : Epidemiological data focusing solely on the facial pattern and correlating severity in individuals with its prevalence is critical for clinicians to determine the prognosis of the treatment being considered.

Keywords: Craniofacial abnormalities, Diagnosis, Epidemiology, Lips, Long face.

Introduction :

An orthodontist's primary concern is the enhancement of facial aesthetics and balance.¹ The patient's facial type is important in the conceptualization of the orthodontic treatment protocol and determination of the treatment outcome.¹ There have been various facial type

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classifications based on view perspective, but the axial relationship is significant as orthodontists have found it challenging to treat.^{2,3} Filho C⁴ devised a facial morphology-based classification in which the face was categorized into five clinically subjective Variations: Facial Pattern(I, II, and III), Long and Short Face Pattern.⁵ The aforementioned analysis has a greater level of replicability and has been utilised frequently.^{5,6}

Long face syndrome refers to people who have considerably longer or inordinately exorbitant anterior lower facial heights.⁷ As a result, the face appears oval or tapered. Lip incompetence is expected in this pattern, and when the lips seal, perioral musculature contraction can be seen, emphasising the chin contour deficiency and a retrognathic mandible appearance. Excessive maxillary anterior and posterior dentoalveolar growth results in pronounced gingival and incisor exposure, which is the primary complaint of patients. A deficit may also be seen in the chin and zygomatic prominence, in addition to the prominent nasolabial depression. Upper lip length is generally normal, but it could be short, exacerbating the abnormality. Excessive lip vermilion exhibit at rest frequently impairs lower lip posture. In lateral view, the nose is long with narrow nostrils and a prominent nasal dorsum. Surgical orthodontics is usually warranted in this case.⁸⁻¹²

The inability to define this pattern by molar relationship, despite a preference for Class II, and the variation in the dental arch morphology such as deep or open bite, positive or negative overjet and crossbite can be objectified as the cause for perusal of long face pattern (LFP) research in different perspectives.⁸ The literature includes diverse data on LFP prevalence. Although Wolford and Hilliard¹³ did not specify the prevalence, they reported that this pattern is the most commonly found facial deformity and is frequently misidentified as anteroposterior mandibular deficiency. Woodside and Linder-Aronson¹⁴ identified 18% of young males(6 to 20 years) of Caucasian origin with long face pattern. On the contrary, Kelly Je et al¹⁵, discovered a prevalence of 1.5 % in an American population aged 12 - 17 years. They suggested surgical intervention for half the population(0.75%) due to facial unattractiveness. The low percentage mentioned in this survey may be due to the ferocity of the disfigurement on the patients and is similar to the 0.6% prevalence reported by Proffit et al.¹⁶ R gupta et al⁷, estimated the long face pattern subtypes prevalence amongst Jammu residents and discovered that the severe subtype was the least prevalent, with only 6% of males and 10% of females having it. This incidence is in contrast to previous studies conducted, It thus appears necessary to consider the magnitude of the vertical impairment's effect on the face in the analysis of the long face pattern prevalence.

There is a scarcity of epidemiological surveys that focus solely on the facial pattern, with an emphasis on the absence of lip competence and correlating the severity in individuals with its prevalence. This is critical for clinicians, particularly when determining the prognosis for the treatment to be pursued. Furthermore, as there are conflicting findings regarding the prevalence of the LFP. Thus, the goal of this study was to discern the prevalence and severity of LFP, as well as to correlate it with gender and type of molar relation among school-aged children in an urban setting in Odisha.

2.0 - Methodology :

2.1 - Study Population :

This study was conducted during the period march 2015 to september 2016(Institutional ethical approval: KIMS/KIIT/IEC/046/2014). This community level study was undertaken

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among the school going children in Bhubaneswar municipal corporation (BMC) area. A cluster sampling approach has been followed. Bhubaneswar City area was divided into three assembly constituencies (Bhubaneswar - North, Central and Ekamra). From each of these Assembly Constituency, 2 Upper primary -cum- Secondary schools was selected following simple random sampling, constituting a total sample of 6 schools. Schools imparting education in Odiya medium were selected so that the sample students would be of Odiya origin. From the selected samples of schools all the students in the age group of 12 to 17 years present, willing to participate in the study and provide consent for use of the data and photograph for academic purposes were covered.

2.2 - Sample size determination :

The formula used for the purpose was - $n = z_{1-\alpha/2}^2 P(1 - P)/d^2$. An assumed confidence level of 95% and anticipated population proportion of 14% was set. The study was conducted on 906 school going students (456 boys / 450 girls) in Bhubaneswar.

2.3 - Methodology :

Students who were present on the particular day and desiring to partake in the research were assessed. Based on the admittance guidelines, the participant should not possess any clinical syndromes, history of fracture or surgery associated with the skull or face. Participants with ongoing or previously completed orthodontic/ orthopedic treatment were included. An investigator experienced in facial morphology evaluation assessed all participants in ambient daylight, in natural standing head posture with lips relaxed, without the use of any special instrument. The Identifying criterion was lip incompetence. Once identified, participants were classified as mild, moderate, and severe, according to the severity. This classification method has been meticulously narrated and validated in prior studies that have shown inter- and intra-examiner agreement.^{8,9}

Lip incompetence, undue visibility of maxillary incisors at ease and/or gingiva at smile, and the existence of mild nonequivalence of the lower and middle facial thirds, even posturally, were categorized under the mild subtype. The existence of actual disparity between the lower and middle facial thirds, in addition to the traits already outlined in the previous subtype, was used to classify individuals with a moderate subtype. The severe subtype had a huge disparity between the lower and middle facial thirds, severe enough to be unappealing and was associated with attributes described in the previous subtypes.⁷

To determine the prevalence of patients with vertical facial impairment based on lip incompetency, the three subtypes of long face pattern together was considered for the estimation, but to estimate the actual prevalence of long face pattern amongst the study population only the moderate and severe subtype was considered.^{8,9}

Those participants identified to have the long face pattern based on lip incompetency were recalled and facial photographs (frontal, profile and frontal smiling) were taken.

After the facial evaluation and the categorization of the subtypes of long face pattern, the anteroposterior relation of the permanent first molar according to Angle was recorded with visual examination.

2.4 - PHOTOGRAPHIC TECHNIQUE :

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The pictures were taken according to the method proposed by Moorrees CF¹⁷, adapted to performing facial photographs in which the individuals in natural head position, lips unconstrained, focused into the reflected image of their eyes in a mirror before them. A digital camera (Nikon cool pix), was fixed to a tripod which had its height set to the center of the lens was compatible with the subnasale point at a distance of 90cm from the patient. As background for the photographs a white cloth suspended on a frame was used and was kept 40cm away from the patient. A plane mirror, frame was positioned 1.50m from the patient, with the goal to assist in the posture, so that the subjects could stare at their own eyes and maintain a straight posture during the snapshots. All photographic images were stored unchanged for further consideration by the examiner. All photographic images were numbered to hide data of the individuals. Evaluation of photographic images was performed with a laptop using Adobe illustrator and three measurements were taken -

- I. Hairline to Glabella.
- II. Glabella to subnasal.
- III. Subnasal to Chin.



Figure 1: Frontal, Frontal smiling and Profile photographs of mild (1a), moderate (1b) and severe (1c) subtypes of long face pattern.

2.5 - Statistical Analysis :

The data obtained by these measurements were used to classify long face patterns of the subjects and computed for statistical analysis using SPSS software (version 26.0, IBM,USA). Binomial test and chi-square test were used to analyze the data.

3.0 - RESULTS :

In this study, measurements of upper, middle and lower facial heights of identified long face pattern cases based on morphological and photographic analysis were taken and converted to absolute and percentage values for statistical analysis.

3.1 – Prevalence of long face pattern among subjects:

Out of the total, 282(31.10 %) participants ($P=0.000$, Significant) were found to have lip incompetency, indicative of long face pattern. The Chi square test revealed significant association (0.0044) of long face pattern in males(34.2%) than females (28%)(table 1).

3.2 – Severity of long face pattern :

The prevalence of mild, moderate and severe subtype was 20.5% , 9.3% and 1.3% respectively. The moderate and severe together (10.6%) was considered for the actual prevalence of long face pattern. Thus inferring that two third of long face pattern cases were mild (table 2).

3.3 - Severity of long face pattern and gender association :

In this study it was observed that all 12 cases (2.7%) of severe long face pattern were amongst females. The analysis implied severe long face pattern was more predominant in females while mild and moderate was more predominant in males($x^2=19.437 / p=0.000$, significant) (table 3).

3.4 - long face pattern and molar occlusal relation (angle's classification) :

The LFP was noted to be more analogous with class I and class II molar occlusal relation irrespective of its severity ($x^2=18.003/ p=0.001$,Significant) (Table 4).

3.5 - Long face pattern and molar occlusal relation association categorized by gender.

It was revealed from this tabulation that among the males, class I (69.2%) type of occlusion was found to be predominant In females it was seen that class I (47.6%) and II (42.9%) type of occlusion was evenly distributed. This indicated a statistically significant association of gender with the type of occlusion ($p = 0.001 / x^2 = 14.284$) (Table 5).

4.0 - DISCUSSION:

Hill¹⁸ suggested that the more complex the survey the more was the probability of encountering errors. Subjective facial analysis, conducted on the basis of absence or existence of a condition was an easier method of conducting a survey with good replicability once the examiner is calibrated. As there was scarce literature stating the prevalence of LFP in India . Following the concept of Hill in conducting a survey, a similar subjective facial analysis was selected to conduct this survey.

This study was conducted among the school going children in Odisha. The schools selected were those that imparted education in odia medium so that the study samples that were selected would be of odia ethnicity.

Based on the findings of this research, the prevalence of LFP amongst the study subjects was found to be 31.10% and was significant statistically ($p = 0.000$) (table 1). This prevalence can be considered to be high based on the findings obtained from other studies conducted.^{8,9}This high prevalence was in accordance to a studies conducted by Casdoso

MA et al⁹, Willems et al¹⁸ (29%), Proffit WR et al¹⁹, Bailey LJ²⁰ and chew et al²¹ (22%). The comparable prevalence could be due to the execution of a similar survey methodology to conduct the study. The results of Siritwat PP et al²² and Woodside DG¹⁴ et al was comparatively less than the results derived in this study. The difference in prevalence could be due to the different methods employed in assessment of prevalence and due to the fact that, in estimation of long face pattern in this study all the subtypes of long face pattern were clubbed together which was not the case in the other studies conducted.⁹ The high prevalence that was obtained in this study is probably due to the consideration of lip incompetency as the selection criteria for determination of long face pattern. Lip incompetency is obligatory in individuals with long face pattern however, this feature may be considered normal and is usually transitional and seen during the facial growth period.⁸

In this study, the prevalence of LFP was 34.2% in males and 28% in females, This difference in prevalence was statistically significant ($p = 0.044 / \chi^2 = 4.075$) (table 1). Comparative analysis of this finding of the study was not possible as literature search did not reveal any similar study conducted. A cephalometric study conducted found no gender predilection in this pattern.²³ This difference in results may be due to the different methodology employed to obtain the data furthermore, the population taken into consideration in this study was of different ethnicity as compared to other study.²³

Furthermore, the prevalence of mild and moderate subtype of long face pattern was found to be 20.5% and 9.3% (table 2). These results were in accordance to the results obtained by Cardoso MA et al⁹ who found a prevalence of 20.88% and 13.38% respectively in their study. The prevalence of severe subtype was found to be 1.3% (table 2) These results were in accordance to a study conducted by Kelly JE et al²⁴, Cardoso MA et al⁹, Proffit and White²⁵ who found a prevalence of 1.5%, 0.68% and 0.6% respectively in their study which is slightly less but comparable to the results obtained in this study.

As mild subtype of LFP was not considered in the estimation of prevalence of LFP, thus, the actual prevalence of long face pattern in this study was found to be 10.6% (9.3% for moderate subtype + 1.3% for severe subtype) (table 2). The results of this study were in accordance to the study conducted by Cardoso MA et al⁹, Woodside and Linder Aronson¹⁴ who found a prevalence of 14.06% and 18% in their study.

In this study, when the severity of long face pattern was categorized by gender (table 3) the results showed that all cases of severe subtype of long face pattern were seen among females (2.7%) whereas mild (23.7%) and moderate (10.5%) subtype of LFP was predominant in males. The results of which were statistically significant ($p = 0.000$). In a cephalometric study conducted no gender predilection was seen in long face pattern individuals which suggested that female subjects had a more severe skeletal deformity, enough to attain skeletal size similar to male subjects.²³ These findings were similar to the findings obtained in the present study, though the parameters of evaluation are different. Gupta R et al⁷ in their study also found females to be more affected by the severe subtype.

This study also tried to associate the molar occlusal relation (Angle's classification of malocclusion) with LFP (table 4). The findings suggested that LFP was more associated with class I and II molar relation irrespective of the severity ($p = 0.001$). This result was in accordance to the results obtained by Fitzpatrick BN¹², Schendel SA et al²⁶, Wolford LM et al¹³, Angelillo JC et al¹⁰ and Chew et al²¹ who found class II type of malocclusion to be predominantly present in individuals with long face pattern. Contradictory results were seen in studies conducted by Willems G et al¹⁸ and Boeck EM et al²⁷ who found class III type of malocclusion to be predominantly present in long face pattern individuals followed by class I and then Class II. The difference in results could be attributed to various factors such as geographical location, race, ecology, genetics and local environmental factors.²⁸

In this study, when the association of molar occlusal relation of subjects with long face pattern by gender (table 5) was evaluated, the data obtained revealed that class I type of occlusion was most prevalent in males (69.2%) with long face pattern. In females, Class I (47.6%) and II (42.9%) type of occlusion was evenly distributed, with class I type of occlusion being slightly more prevalent. The results revealed a statistically significant association of gender with the type of occlusion ($p = 0.001$). Literature search did not reveal any other study conducted to evaluate these parameters thus a comparative analysis could not be done. The reason behind finding class I type of occlusion to be more prevalent could be due to the inclusion of mild subtype of long face pattern which could be a transitional pattern that may correct on its own. The geographical location, race and ecology and local environmental factors would be another reason for the results obtained.²⁸

The limitations in this study was that it included only one subpopulation of india, so the results obtained cannot be generalized for the entire indian population. Literature search revealed that this is the first study of its kind to evaluate the gender predilection in the severity of long face pattern and the molar occlusal relation. Other studies in this regard need to be carried out in other Indian populations to substantiate or comparatively evaluate the findings obtained in this study.

5.0- CONCLUSION :

Within the limitations and based on the results obtained the following conclusion was derived:

The prevalence of long face pattern amongst the study subjects was found to be 31.10%. The actual prevalence (moderate and severe subtypes) was found to be 10.6%. males had a higher probability of having long face pattern. All cases of severe subtype of long face pattern was seen among females whereas mild and moderate subtype was predominant in males. Long face pattern was more associated with Angle's class I and II type of malocclusion irrespective of the severity. Angle's class I type of malocclusion was most prevalent in males. In females, Class I and II type of occlusion was evenly distributed.

CLINICAL SIGNIFICANCE :

Epidemiological data focusing solely on the facial pattern and correlating severity in individuals with its prevalence is critical for clinicians to determine the prognosis of the treatment being considered.

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Tables :

Table 1 : Prevalence of long face pattern among study subjects

Long Face Pattern	Male		Female		Total		Asymp. Sig* (1- Tailed)	□□,p* *
	No.	%	No.	%	No.	%		
Present	156	34.20	126	28.00	282	31.10	0.000	□□=4.075 p=0.044
Absent	300	65.80	324	72.00	624	68.90		
Total	456	100.00	450	100.00	906	100.00		

*- Binomial test for presence or absence of long face pattern.

** - Chi square test for gender comparison of long face pattern.

	Frequency	Percent
Absent	624	68.9
Mild	186	20.5
Moderate	84	9.3
Severe	12	1.3
(Moderate + Severe)*	96	10.6
Total	906	100

* actual inclusion for long face pattern.

Table 2 : Severity of long face pattern among study subjects.

Long Face Pattern	Male		Female		χ ² , p
	No.	%	No.	%	
Absent	300	65.8	324	72.0	χ ² =19.43 7p=0.000
Mild	108	23.7	78	17.3	
Moderate	48	10.5	36	8.0	
Severe	0	0.0	12	2.7	
Total	456	100	450	100	

Table 3 : Severity of long face pattern by gender

Table 4 : Molar occlusal relations of subjects with long face pattern

Type of Occlusion	Male		Female		Total		χ ² , p
	No.	%	No.	%	No.	%	
Class I	108	69.2	60	47.6	168	59.6	χ ² =14.28 4p=0.001
Class II	36	23.1	54	42.9	90	31.9	
Class III	12	7.7	12	9.5	24	8.5	
Total	156	100	126	100	282	100	

Long Face Pattern	Class I		Class II		Class III		Total		χ ² ,p
	No.	%	No.	%	No.	%	No.	%	

Mild	126	67.7	48	25.8	12	6.5	186	100	□□=18.00 3p=0.001
Moderate	36	42.9	36	42.9	12	14.3	84	100	
Severe	6	50	6	50	0.0	0	12	100	
Total	168	59.6	90	31.9	24	8.5	282	100	

Table 5: Molar occlusal relation of subjects with LFP categorized by gender