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CORRELATION OF CEPHALIC INDEX, FACIAL INDEX WITH SKELETAL AND DENTAL MALOCCLUSION USING MORPHOLOGICALLY MEASURABLE PARAMETERS IN MALES AND FEMALES

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ABSTRACT

Background: Cephalic and facial index is an important parameter on facial skeletal; specifically used for gender determination.
Materials and Methods: The permission to conduct the study was obtained from Institutional Ethics Committee. The total of 400 participants comprising of 200 males and 200 females were assessed after complying with inclusion and exclusion criteria. The cranial length, width, facial height and facial breadth were measured by using standard spreading calliper. The collected data was statistically analyzed by using paired 't' test and spearman's correlation.
Results: The mean cephalic index in both, male and female participants was 76.47± 2.225. In female and male participants, 164 & 156 had Mesocephalic, 29 & 35 had Dolicocephalic, and 7& 9 had Brachycephalic respectively. The value of spearman correlation with skeletal malocclusion and cephalic index was 0.637; with dental malocclusion and cephalic index was 0.697, which was highly significant (p= 0.000. Similarly, the spearman correlation with the skeletal malocclusion and cephalic index was 0.653; with the dental malocclusion and facial index was 0.735.
Conclusion: The correlation of cephalic and facial index with different skeletal and dental malocclusion was positive and confirmed the gender determination.

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INTRODUCTION

Malocclusion is a common clinical problem (Thilander*et al*., 2001). Various diagnostic aids are commonly used for the diagnosis of dental & skeletal malocclusion, for example clinical aids, radiographic aids, photographic aid etc. All have their own advantages with their own limitations. Cephalometric technique was introduced by Broadbent and Hofrath in 1931, which is widely used diagnostic aid for assessing and differentiating between skeletal and dental malocclusion (Dolly P Patel and Rahul Trivedi, 2013; Broadbent, 1981). Though an essential diagnostic aid for treatment planning of an orthodontic case, cephalometry has also three basic disadvantages: Patients are exposed to radiation. It requires a radiation source and a cephalostat which is not easily available everywhere.The cephalometric radiology is a costly diagnostic aid.Previous studies have shown relation between facial morphology and malocclusion with cephalometric techniques. (Porntip P. Siriwat and Joseph R. Jarabak, 1985) Studies have been done correlating different facial type with jaw morphology using cephalometric technique. (AbhishekhSingha Roy *et al*., 2012) All the previous studies which are there in literature correlate facial types with malocclusion using cephalometrics only. There are no studies which correlate facial type and malocclusion using clinically measurable morphological parameters of head and face. There was a strong need for this study as in our Country the census shows total population of 1.27 billion, out of this 70 % of population lives in rural areas where advanced diagnostic aids like cephalometric radiology are not available. Moreover there are many people who are economically backward who cannot even afforda Cephalometric radiograph. So there is a need for a study where head, face can be correlated with skeletal and dental malocclusion using only morphologically measurable parameters of head and face. So the present study is taken up to correlate the head, face with skeletal and dental malocclusion which will nullify the drawback in rural areas.

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MATERIALS AND METHODS

The study was conducted with permission of Institutional ethics committee. Total numbers of 400 participants were

selected with participants with age range of 18years - 30 years excluding Participants with congenital anomalies and syndromes, prior orthodontic therapy and participant with history of trauma in the cephalic and facial region. The study was conducted by Calculating the Cephalic index, Facial index, with intra and extra oral examination of Dental and skeletal malocclusion (Using point A & B) in males and females. Further correlation of all was observed. All participants were examined on the dental chair with relaxed position, with head in correct anatomical position. Cephalic and Facial index, Skeletal and Dental malocclusion were evaluated as follows.

Cephalic index: (Figure 1)

Standard spreading calliper is used for cephalic index. Maximum cranial length: Glabella to inion length. (Sanjay Gupta *et al*., 2013) Maximum cranial breadth: It was measured by allowing both tips of the spreading calliper to slide down along the lateral aspects of the parietal bones until the maximum width was recorded. Cephalic index= Maximum cranial breadth/ Maximum cranial length x 100. The participants were categorized according to the Table 1.

Facial index: (Figure 2)

A standard spreading caliper was used for measuring the facial parameters with Martin and Saller formulae for facial index. (Raji and Garba, 2010) The land marks for facial index are

1. Nasion: the anterior most midpoint of the nasofrontal suture.
2. Gnathion: in the midline lowest and anterior most point on the chin.
3. Zygomatic prominence: most lateral point of the Zygomatic arch.
4. Morphological facial height: Measured from nasion to gnathion.
5. Morphological Facial width: Bizygomatic distance.

Facial index=morphological height/facial width X 100. (Jeremic*et al*., 2013)

The participants were categorized according to the Table 2.

Assesment of skeletal mallocclusion (Figure 3)

Anetroposterior relationship between maxilla and mandible can be assessed by placing the index and middle finger at soft tissue point A and B respectively. (Raji and Garba, 1957)

- Class I participants: The skeletal pattern and the hand are at even level.
- Class II participants: Index finger is anterior to middle finger.
- Class III participants: Middle finger is ahead of fore finger.

Assesment of dental malocclusion (Figure 4)

"Angles classification" is based in the anteroposterior relationship of the teeth with each other.(Riolo and Avery, Chapter 6) Relation of maxillary permanent molar was assessed in the participant with mouth mirror; the occlusion was classified as:

- Class I: The mesiobuccal cusp of the maxillary first molar is aligned with the buccal groove of the mandibular first molar. There is alignment of the teeth, normal overbite and overjet and coincident maxillary and mandibular midlines. **(Figure 4a)**
- Class II: A malocclusion where the molar relationship shows the buccal groove of the mandibular first molar distally positioned when in occlusion with the mesiobuccal cusp of the maxillary first molar. **(Figure 4b)**
- Class III: A malocclusion where the molar relationship shows the buccal groove of the mandibular first molar mesially positioned to the mesiobuccal cusp of the maxillary first molar when the teeth are in occlusion. **(Figure 4c)**

After collecting all the data correlation of cephalic index, facial index were assessed with skeletal and dental malocclusion in males and females showing what type of cephalic and facial pattern will have what type of skeletal and dental malocclusion.

RESULTS

Total sample selected for the study were 400 (200= Females, 200= Males). Cephalic index was taken which stated the mean cephalic index of both male and female participants were 76.4766 with standard deviation of ±2.22590 (As per Table 3) out of 200 Females 164 were Mesocephalic, 29 were Dolicocephalic and 7 were Brachycephalic. Out of 200 Males 156 were Mesochepalic, 35 were Dolicocephalic and 9 were Brachycephalic. Thus in both the genders maximum number of participants had Mesocephalic cephalic index, secondly Dolicocephalic and least Brachycephalic (As per Table 4). The mean facial index of the total sample size is 87.5243 with standard deviation of ±3.19424 (As per table 5) in which, out of 200 female participants 155 were Mesoprosopic, 35 were leptoprosopic and 10 were euryprosopic. For male out of 200 participants 150 were Mesoprosopic, 39 were leptoprosopic and 11 were euryprosopic. Thus the facial index show majority of Mesoprosopic facial index, secondly the leptoprosopic, least with euryprosopic (As per Table 6). Total Class I Dental malocclusion in 400 participants were 325, class II were 56 and class III were 19. Out of 200 females, 160 were class I, 28 were class II, and 12 were class III. Similarly in males out of 200 participants, 165 were class I, 28 were class II, and 7 were class III. (As per table 7).Total Class I skeletal malocclusion in 400 participants were 325, class II were 60 and class III were 15.Out of 200 females, 163 were class I, 28 were class II, and 9 were class III. Similarly in males out of 200 participants, 162 were class I, 32 were class II, and 6 were class III (As per Table 8).All the three tables were correlated with each other and thus resulted in a correlation as given in Table 9.The spearman correlation is 0.637 with skeletal malocclusion and cephalic index, 0.697 with the dental malocclusion and cephalic index which shows highly significant correlation with the P value of 0.000 between skeletal malocclusion and dental malocclusion with cephalic.Similarly the spearman rank correlation is 0.653 with the skeletal malocclusion and cephalic index, 0.735 with the dental malocclusion and facial index.

DISCUSSION

Development of face

Development of face of the embryo starts by third to eight week of intra uterine life. They consist of three germ layers,

Figure 1. Measuring of cephalic index

Head shape	Range
Dolicocephalic	<74.9
Mesocephalic	75-79.9
Brachycephalic	80-84.9

Table 1: Category for classification for Cephalic Index, given by Martin &seller

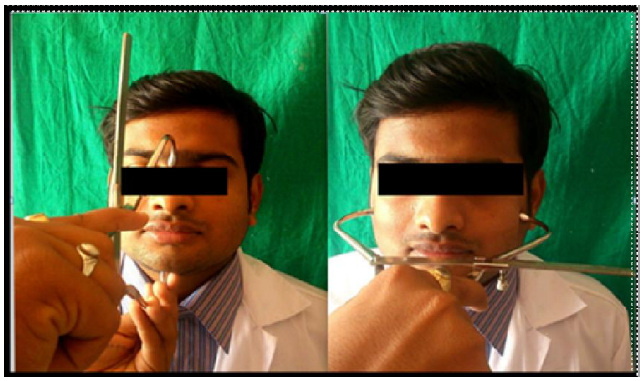

Figure 2. Measuring of facial index

Facial types	Range
Euryposopic:	(79,0 < FI <83,9)
Mesoprosopic:	(84,0 < FI < 87,9)
Leptoprosopic:	(88,0 < FI < 92,9)

Table 2: Category for classification for Facial Index, given by Martin & seller

Figure 3. Assessment of Skeletal Malocclusion

Figure 4. Skeletal Malocclusion
Fig. 4A: Class I Malocclusion
Fig. 4B: Class II Malocclusion
Fig. 4C: Class III Malocclusion

Table 3.

Descriptive Statistics			
	N	Mean	Std. Deviation
Cephalic Index	400	76.4766	2.22590

Table 4.

Gender	Cephalic Index			Total
	Dolicocephalic	Mesocephalic	Brachycephalic	
Females	29	164	7	200
Males	35	156	9	200
Total	64	320	16	400

Table 5.

Descriptive Statistics			
	N	Mean	Std. Deviation
Facial Index	400	87.5243	3.19424
Valid N	400		

Table 6.

Gender	Facial Index			Total
	Euryprosopic	Mesoprosopic	Leptoprosopic	
Females	10	155	35	200
Males	11	150	39	200
Total	21	305	74	400

Table 7.

Gender	Dental Malocclusion			Total
	Class I	Class II	Class III	
Females	160	28	12	200
Males	165	28	7	200
Total	325	56	19	400

Table 8.

Gender	Skeletal Malocclusion			Total
	Class I	Class II	Class III	
Females	163	28	9	200
Males	162	32	6	200
Total	325	60	15	400

Table 9.

	Cephalic Index	Facial Index
Skeletal Malocclusion	0.637	0.653
Dental Malocclusion	0.697	0.735

ectoderm, mesoderm and endoderm, which form the mesenchyme (derived from the lateral plate and paraxial mesoderm), neural crest and neural placodes (from the ectoderm) (Sadler, 2009). The facial prominences are formed by five swellings that appear in the fourth week and come from the first and second pharyngeal arch. They are basically made of mesenchyme that comes from the neural crest.(Moore and Persaud, 2008; Moore *et al*., 1996) The maxillary prominences are next to the stomodeum and the mandibular prominences are under it. The frontonasal prominence is a single structure and is ventral to the forebrain. Also, a couple of nasal placodes originated from the ectoderm, invaginate and form the nasal cavities. At the same time, the mesenchymal cells proliferate around the placodes, and the sides of these swellings form the medial and lateral nasal prominences. Each of these prominences is separated from the maxillary prominence by the nasolacrimal groove. Next, the maxillary prominences continue growing. They merge laterally with the mandibular prominences and forms the cheeks. At the midline they compress the medial nasal prominences and fuses. This forms the upper lip. The inter-maxillary segment is formed by the growing and merging of the nasal swellings and it gives rise to the primary palate, the philtrum of the lip, and the premaxillary part of the maxilla in which the four incisors grows with the completion of development of face.(Moore and Persaud, 2008; Moore *et al*., 1996)

Development of malocclusion

The forces of the muscles from the stomatognathic system interrelate at a very young age to change the normal forces of growth. The overall outcome of an individual is a result of growth and the influence of muscular forces. Because of these interactions varying patterns of faces are seen. Specific types of head and face are also associated with specific skeletal and dental occlusion.These normal and/or abnormal changes in muscle forces are the basis for development into different types of occlusion malocclusions. (Loudon, 2013) The dental malocclusion is a misalignment or incorrect relation between the teeth of the two dental arches when they approach each other as the jaws close. The term was coined by Edward Angle, the "father of modern orthodontics" (Gruenbaum, 2010). Malocclusion is a very common finding (Thilander *et al*., 2001) as it has multifactorial etiology. Malocclusion can also be due to vertical discrepancies. Long faces may lead to open bite, while short faces can be coupled to a deep bite. It can also be secondary to transverse skeletal discrepancy or to a skeletal asymmetry

Development of Skeletal malocclusion

The likelihood of birth defects in oro-facial tissues is high due to the structural and developmental complexity of the face and the susceptibility to intrinsic and extrinsic perturbations. Skeletal malocclusion is caused by the distortion of the proper mandibular and/or maxillary growth during fetal development. (Joshi *et al*., 2014) Anthropology plays one of the important role in the field of orthodontics. The present work in the literature shows that it is mostly used for the rational determination of normal arch (Izard *et al*., 1927). There is no literature showing correlation with head, face with skeletal and dental malocclusion till date. But few studies have done relating head and face. Porntip P. Siriwat*et al*. in 1985 conducted a study of 500 randomly selected orthodontic patients of 8 to 12 years, findings marked correlations between angle class of malocclusion and vertical facial dimensions. Cephalometric analysis, craniofacial landmarks, facial height ratio were assessed. The result came out with a correlation of the association between facial morphology and malocclusion. AbhishekhSingha *et al*. in 2012 conducted a study on 120 samples with 60 males and 60 females in the age range of 18 to 25years. Vertical facial type may be related to the morphological and dento-alveolar pattern of both maxilla and mandible which concluded with different types of vertical facial types. In our study it was found that specific type of head, face has specific type of dental and skeletal malocclusion. The reason for it might be probably attributed to the dominance of one germ layer on the other germ layers. This is the reason we see different patterns of head, faces and over all stature. In this study we found that Dolicocephalic head has leptoprosopic face and has skeletal and dental class II occlusion pattern. Mesocephalic head has Mesoprosopic face and skeletal and dental class I pattern, Brachycephalic head has euryprosopic face and has skeletal and dental class III or class I occlusion pattern. However the incidence head and

euryproscopic face was very less to conclude regarding class III or class I occlusion pattern.

Conclusion

Specific type of head and face does have specific type of dental and skeletal and dental malocclusion; this might be attributed to the dominance of germ layer during the time of growth. Thus results show the positivity towards the correlation of cephalic index, facial index with different skeletal and dental malocclusion. For example: Participants with dolichocephalic and eurycoprosopic facial type have more likely to have class III dental and skeletal malocclusion.

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