ORIGINAL RESEARCH

An Assessment of Skeletal Craniofacial Asymmetry in South Indian Population

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ABSTRACT

The present study was undertaken to assess the skeletal craniofacial asymmetry in South Indian population by a posteroanterior cephalometric radiographic method. The skeletal craniofacial structures on one side of the face were compared with that of the other, by drawing various triangles representing different craniofacial regions.

The sample consisted of 60 subjects (30 males and 30 females) aged between 18 to 25 years, who were mainly dental college students from South India. Overall 52 X-rays were obtained, with four errors each in the male and the female groups.

The results revealed that the total facial structures in the South Indian population were larger on the left side (statistically insignificant). The cranial base area exhibited a greater degree of asymmetry than any other component area of the face, which might be due to the inaccuracy at the condylar point.

Keywords: PA Ceph, Skeletal asymmetry, Craniofacial.

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INTRODUCTION

The American College Dictionary defines symmetry as follows, the correspondence, in size, form and arrangement of parts on opposite sides of a plane, line or point.[1,3,4]

Cephalometric radiographic studies, like those of Mulick,[8] Letzer[7] and Kronman,[6] have shown the presence of asymmetry in the normal facial features.

If this were true, then it would be reasonable to believe that a pleasing, normal, symmetrical face with normal occlusion of the teeth would present a certain degree of asymmetry in the craniofacial skeleton.

AIMS AND OBJECTIVES

- To assess the skeletal craniofacial asymmetry in South Indian population by a posteroanterior cephalometric radiographic method.
- To compare the skeletal craniofacial structures on one side of the face with that of the other, by drawing various triangles representing different craniofacial regions.
- To measure the surface area of the above triangles and compare the surface area of one side of the face with that of the other.
- To evaluate the distribution of any such asymmetry and its range in South Indian population.

MATERIALS AND METHODS

Materials

For the present study 60 subjects (30 males and 30 females) with the age ranging from 18 to 25 years, with a mean of 21 years, and who were natives of Karnataka (an Indian state), were clinically examined and selected. They were mainly college students.

Natural head position radiographs were taken with the patient in the cephalometer looking straight ahead into the cephalostat. The patients were observed from the side to ensure that the pupil was in the middle of the eye and the head was repositioned if there was even a slight discrepancy. Bilateral head support in the transverse plane was achieved by the ear rods.[9-11]

The observer then examined the subject's facial symmetry by standing in front and keeping his eyes at the level of the subject's head. It was made sure that the patient's head did not tilt or tip. To minimize the subjective error in selection, a panel of three orthodontists examined each person, and the subjects were selected when the three agreed.

Armamentarium Used

Frontal cephalogram of patients, 0.3 H lead pencil, 0.36 μm lead acetate paper, tracing table, vernier caliper, etc. (Fig. 1).

Methods

Posteroanterior radiographic cephalograms of the 60 subjects with teeth in centric occlusion were taken, using a standardized cephalometric technique (Figs 2 and 3). The distance between the transporionic axis and film was kept constant for each subject to minimize the magnification error. The central ray of X-rays passed through the center of the midsagittal plane so the magnification of right and left sides of the face was the same.

With the X-ray source behind the patient's head and the film cassette in front of the patient's face, the X-ray beam passed perpendicular to the patient's coronal plane. The following cephalometric landmarks were located and traced (Fig. 4):

1. Sella turcica
2. Condylar point
3. Mastoidale
4. Anterior nasal spine
5. Zygomatic
6. Molar point
7. Incisor point
8. Gonion
9. Menton.

To assess the relative asymmetry of the component areas of the facial complex, the method of triangulation was used. Each left and right side was divided into several triangles using the reference points (Fig. 5).

Triangles Used

1. *Triangle A:* To represent the cranial base region.
2. *Triangle B:* To represent the lateral maxillary region.
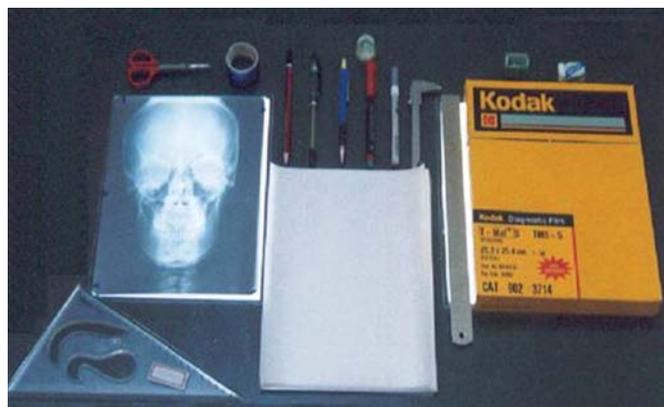3. *Triangle C:* To represent the upper maxillary region.

Fig. 2: Posteroanterior radiographic cephalograms

4. *Triangle D:* To represent the right and left middle maxillary regions.
5. *Triangle E:* To represent the right and left lower maxillary regions.
6. *Triangle F:* To represent right and left dental regions, and
7. *Triangle G:* To represent the mandibular region.

The measurements were made to the nearest 0.5 mm and the surface area in the male and female groups were calculated using the geometrical formula as follows:

$$S = 0.5 \times L \times H$$

where,

S = surface area

L = length of the base of the triangle, and

H = height of the triangle.

A test of variance was employed with randomly selected ten cephalograms (5 males and 5 females). Measurements were calculated with the following formula:

$$\text{Variance ratio (F)} = \frac{\text{Mean square between samples}}{\text{Mean square within samples}}$$
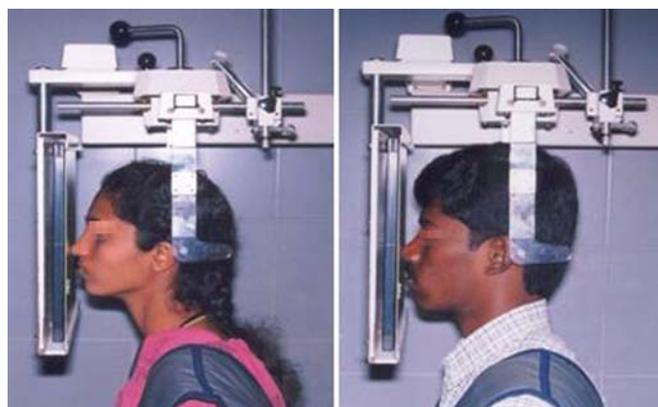

Fig. 1: Armamentarium

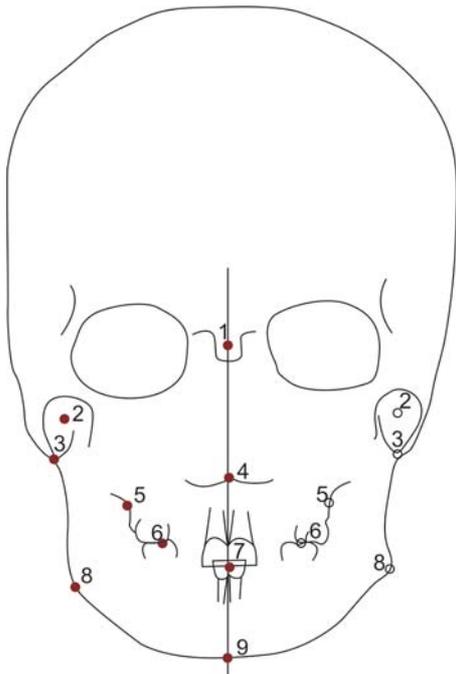**Fig. 3:** Standardized cephalometric technique used with teeth in occlusion

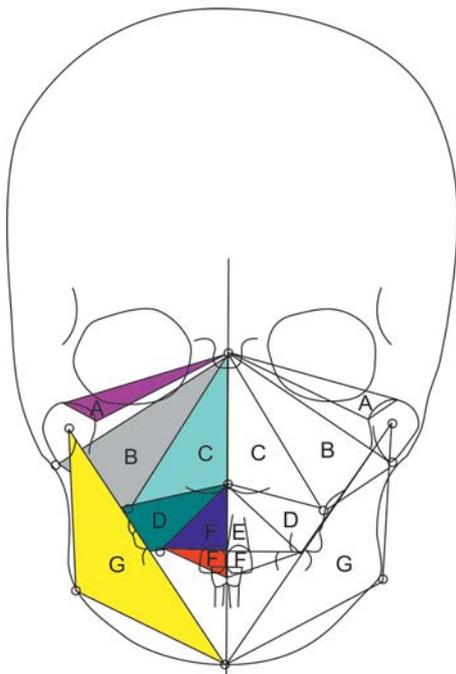**Fig. 4**: Cephalometric landmarks that were located and traced

Fig. 5: Method of triangulation using the reference points

It was observed with the above formula that there was no significant difference between these readings (p = 0.05) to the extent, which may interfere with the results.

STATISTICAL ANALYSIS

The mean, standard deviation and standard error were calculated for each parameter. The significance of difference between mean values was evaluated in same group by the paired student t-test. Differences were considered statistically significant when the p-value was 0.05 or less.

RESULTS

Overall 52 X-rays were obtained, with four errors each in the male and the female group.

Male group: The cranial base region (triangle A) was found to be significantly larger on the left side, (p = <0.001). Also, the total facial structure was bigger on the left than on the right.

Female group: The cranial base region (triangle A) and lower maxillary region (triangle E) were found to be larger on the left side (p = <0.001 and 0.03), whereas the upper maxillary region (triangle C) was found to be larger on the right side (p = <0.01). The total facial structure was bigger on the left than on the right.

Combined (male + female) group: The cranial base region (triangle A) and the lower maxillary region (triangle E) were found to be significantly larger on the left than the right side, (p = < 0.001 and 0.03). The total maxillary area was found to be larger on the left side than on the right, which was not statistically significant (Table 1).

DISCUSSION

The human facial skeleton is made up of numerous constituent parts, each of which is capable of having individual variations between the right side and the left side.

Inspite of certain limitations, cephalometric radiography is a well-established research and clinical tool for the orthodontist. The triangulation method has been a valuable and conventional diagnostic procedure for the analysis of overall facial asymmetry in terms of its components as it represents the face in various regions. The validity of the anatomical landmarks has been established by earlier investigators.[2,5,10]

For the present study, the sample selected comprised of subjects in an older age group, from 18 to 25 years. This was done because most of the growths of craniofacial bones are completed after 16 years of age. Earlier investigations of this type[6,8,12-17] have mostly been on relatively younger subject where the dentofacial dimensions continue to change due to growth.

In their findings, Letzer and Kronman[6] have found asymmetry as a dominant feature, however, they did not mention which side was larger.

Vig and Hewitt[13] found similar asymmetry with the left side being larger than the right side. The mandibular and the dentoalveolar regions exhibited a greater degree of symmetry. They supported the concept of compensatory adaptation during growth to bring an integration of facial components.

No.	Region	Right side			Left side			Difference between right and left side			
		Mean	*SD*	*SE*	*Mean*	*SD*	*SE*	*Mean of difference*	*SE of difference*	*t-value*	*p-value*
A	Cranial base	201.4	24.6	3.4	244.5	38.5	4.5	−43.1	4.2	10.18	<0.001 HS
B	Lateral maxillary	943.4	165.0	22.9	919.1	171.6	23.8	24.3	19.9	1.22	0.23 NS
C	Upper maxillary	837.6	109.7	15.2	819.5	142.8	19.8	18.1	14.3	1.27	0.21 NS
D	Middle maxillary	229.9	39.4	5.5	227.7	38.7	5.4	2.2	5.7	0.39	0.70 NS
E	Lower maxillary	253.1	34.7	4.8	267.5	46.7	6.5	−14.4	6.4	2.27	0.03 S
F	Dental	70.8	18.5	2.7	72.4	19.5	2.7	−1.6	1.1	1.52	0.13 NS
G	Mandibular	1605.4	278.9	38.7	1634.8	268.7	37.3	−29.4	27.2	1.08	0.28 NS
	Total facial surface area	4141.6	439.8	61.0	4185.6	477.0	66.1	−44.0	46.3	0.95	0.35 NS
	Total maxillary triangles (B + C + D + E)	2267.2	210.3	29.2	2233.9	247.6	34.3	33.4	25.5	1.31	0.20 NS

Table 1: Combined (male + female) group

S: Significant; NS: Not significant; HS: Highly significant

Shah and Joshi[11] have also found similar asymmetry, but with the right side being larger than the left side.

One point that should be stressed is that all the investigators have not used the same methods and measurements for studying asymmetry of the face. Moreover, the sample number has also varied. Hence, the comparison of the findings of this study with those of the other investigators have been done on a very general basis. With this reservation it can be said that this study confirms the reports of the earlier workers that a certain amount of asymmetry is present in normal, pleasing facial features.

CONCLUSION

1. Normal pleasing and symmetrical faces do exhibit some skeletal asymmetry. The soft tissue of the face tries to minimize the underlying asymmetry.
2. The total facial structures in the South Indian population was found larger on the left side (statistically insignificant).
3. The cranial base area exhibited a greater degree of asymmetry than any other component area of the face.
4. One of the possible etiological factors for the production of a greater amount of asymmetry in the cranial base region could be the inaccuracy in location of the condylar point.

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