Original article

A study of craniofacial anthropometrics in Hyderabad (Deccan)—and a review of literature

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Article history

Received 16 July 2012
Revised 24 August 2012
Accepted 25 August 2012
Early online 27 August 2012
Print 31 August 2012

Abstract

The development of an anthropometric craniofacial data base is a necessary multidisciplinary initiative, and on anthropometry of the South-Indian face is inadequate. The purpose of this investigation is to obtain average parameters that define the soft tissue facial profile of the investigated population in order to provide an important reference for community, security, social and medical applications. In this pilot study, the faces of 40 young adults were studied with standardized photography and measurements, and the data collated to determine averages for the Deccan region ethnic sub-set. This data-set has been compared and contrasted with others in literature.

Key words: Craniofacial anthropometry, anthropometrics, Hyderabad Deccan, soft-tissue facial parameters

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Anthropometry (anthropos = man; metry = measure) is a science which developed for the purpose of understanding human physical variation; it refers to the systematic quantitative representation of the human body, specifically employing measurements of physical dimensions of living individuals and also human remains.

Knowledge of the absolute and relative variability in the size and shape of the human body is crucial to studies of human growth, population variation and clinical treatment, medico legal identification in forensics, re-construction, in plastic surgery as well as in the optimization of the fit of respirators, gas masks, oxygen masks, dust masks, and military helmets, etc.

Data on anthropometry of South-Indian face and particularly in Hyderabad, Andhra Pradesh is inadequate. The purpose of this investigation was to obtain average parameters that define the soft tissue facial profile of the investigated population.

The present work was undertaken as a pilot project in anthropometric measurement of South-Indian face.

Materials and Methods

Forty students of Deccan College of Medical Sciences, Hyderabad, in the age group of 20 to 25 years, including both sexes, were selected randomly. The subjects belong to Hyderabad proper since the time-period of two generations at least, thus establishing an ethnic sub-group.

Before starting the study, the subjects’ consent was duly obtained, particularly with reference to the publishing of their full-facial pictures, without identity-masking; this was endorsed and cleared by the Institutional Ethics Committee. Photographs of the subjects were taken in a standardized position: The subject was seated comfortably in a chair, with head and gaze, at the same level as the camera. The camera was fixed to a stand, and the distance of the camera from the subject was fixed at 120
The camera included flash-lighting, and the magnification factor of lens was 50. The subject’s face was well-illuminated, against a white background, which maximizes the contrast between the sclera and the skin, which is important to measure the intercanthal distance and outer canthal distance clearly on the photograph. The front view was photographed. All photographs were printed maintaining equal enlargement factor.

The craniofacial anthropometric points which were considered for the study are (Fig 1):

a) \( en \) (endocanthion): the inner corner of the eye fissure where the eyelids meet
b) \( ex \) (exocanthion): the outer corner of the eye fissure where the eyelids meet
c) \( gn \) (gnathion): in the midline, the lowest point on the lower border of the chin
d) \( n \) (nasion): the midpoint of the nasofrontal suture
e) \( sn \) (subnasale): in the midline, the junction between the lower border of the nasal septum and the cutaneous portion of the upper lip
f) \( A\)læ of nose, right and Left
g) \( A\)ngles of mouth, right and left

The above points were marked on each of the 40 standardized photographs (Fig 2) with a finely pointed marker pen. The distances between anthropometric points on the photograph were measured by a transparent plastic scale, in centimeters.

The various parameters measured on each individual photograph were (Fig 3):

a) \( Width \ of \ the \ eye \): the distance between the exocanthus and endocanthus on each side
b) \( Length \ of \ nose \): the distance from nasion to subnasale
c) \( Inter\)canthal distance: the distance between two endocanths
d) \( Width \ of \ nose \): the distance between alæ of a nose
e) \( Width \ of \ mouth \): the distance between the angles of a mouth

![Fig 3. The five measured parameters](image)

Results

Table 1: Measured averages of standard facial parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Average of measurements (in cms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Inter-canthal distance</td>
<td>0.65 ± 0.21</td>
</tr>
<tr>
<td>Nose length</td>
<td>1.19 ± 0.75</td>
</tr>
<tr>
<td>Eye width</td>
<td>0.63 ± 0.10</td>
</tr>
<tr>
<td>Nose width</td>
<td>0.98 ± 0.15</td>
</tr>
<tr>
<td>Mouth width</td>
<td>1.16 ± 0.45</td>
</tr>
</tbody>
</table>

Discussion

Large variation in anthropometric criteria between various racial and geographical groups can naturally be expected. “Caucasoid” are generalized to
have the lowest degree of projection of the alveolar ridge bones which contain the teeth, a notable size prominence of the cranium and forehead region, and a projection of the mid-facial region. "Negroid" traits are generalized to include more rounded eye sockets, broader, more rounded nasal cavity, a forward slanting facial profile (prognathism), and a dolichocephalic skull (proportionally longer from front to back). The subjects in this study were all adults. By this age, growth of the face is completed and there are less chances of variation of facial features.

Indians would belong to the subgroup of Caucasoid called Indo-Dravidian (Indo-European). In the present study, the width of the eye is equal to the intercanthal distance in most of the subjects and is comparable in males and females. This is correlating with the study of Leonardo da Vinci. The width of mouth is same in all subjects, and similar to the Divine proportions of da Vinci.

In our observation, the ala of the nostrils flare more laterally in all subjects, which differs from the Divine proportions of Leonardo da Vinci. Also, the mouth is not extending laterally to a line dropped from the medial margin of the limbus, in all our subjects.

The length of nose was found to be longer in males than females in the present study. The nose was found to be wider, i.e. is beyond the line drawn from the medial canthi, in both males and females of our subjects. This is outside of the limit recommended by da Vinci.

Other workers have changed the measurement methods to increase validity and reproducibility of such studies. Madsen et al photographically recorded subjects in a standing mirror-guided natural head position (NHP). Cephalograms taken at the same time were traced, orientated to a plumb line (true vertical) transferred from the photograph, and measured. NHP still represents a more validated craniofacial reference system than their investigated reference planes.

In addition to the use of direct measurements from radiographic and cephalometric studies, a very limited number of studies have assessed racial differences of structures that are more difficult to measure — such as the nasal cavity or the oral-pharyngeal cavities i.e. the vocal tract (VT). These studies used indirect measurement techniques such as acoustic reflection (both acoustic rhinometry and acoustic pharyngometry) and speech acoustics since those cavities/regions can serve as an acoustic resonator.

The most data on the adult so far has been reported by Farkas et al. The international sample demonstrated that in both the genders the vertical anthropometry measurements showed a higher frequency of identical values than horizontal ones. They made 14 anthropometric measurements, 10 of them used already by classic facial artists, Leonardo da Vinci and Albrecht Dürer, complemented by four measurements from the nasal, labio-oral and ear regions. The orbital regions exhibited the greatest variations in identical and contrasting measurements in comparison to North American White Caucasians (NAWC). Our study did not measure orbit, but found no significant variation in eye measurements. Farkas et al. reported that nose heights and widths contrasted sharply: in relation to NAW the nose was very or extremely significantly wider, in both sexes of Asian and Black ethnic groups. Our study result is agreeing well with this finding.

Fariaby et al. did their study on life-sized frontal and profile photographs, and measured nine linear and seven angular indices. The mean (S.D.) distance in mm between the two medial canthi was 31 (3), width of alar base 37 (3), length of nose 48 (4), width of mouth 50 (4), length of upper lip 20 (2), nasolabial angle 98 degrees (10 degrees), nasofrontal angle 130 degrees (9 degrees), and angle of throat 120 degrees (14 degrees). Most of the indices were similar in men and women. Our study shows an inter-canthal distance of 6.4, 7.4mm and again 9.7, 8.9 mm for nose width, in male and female respectively. Comparability is not possible, due to different magnification factors in the photographic technique employed.

Hwang et al. did a comprehensive comparative study which analyzed the soft tissue of two ethnic groups with normal occlusion and well-balanced faces i.e. Korean and European-American adults, measured simultaneously in a standardized manner.

Ngeow et al. have noted that the Malaysian Indian in general, has smaller measurements in 18 parameters, though within the range of those of the NAWC. Only the biocular width (ex-ex), nose width (al-al), and (left) ear length (sa-sa) of Malaysian Indians are more than the NAWC. Our Deccani population has ocular width similar to NAWC, but nose-width is larger, thus resembling the Ngeow population.

A Turkish population study clearly shows the anthropometric variation for fronto-occipital circumference, inner canthal distance, outer canthal distance, near and distant interpupillary distance, can-
thal index and circumference-interorbital index with age\(^8\). Shimizu et al, in Japan found that the proportion of the lower facial height was greater than the upper facial height, and this finding was more pronounced in women than in men; they also concluded a clear male–female difference in ageing\(^9\).

Extraordinary correlations have also been drawn in comparing cephalometric indices with other skeletal profiles and these may well impact prediction and early diagnoses of diverse maladies. Lippold et al found correlations between the measurement angles determining the vertical skeletal pattern of the craniofacial skeleton (facial axis, inner gonial angle, and mandibular plane angle) and the pelvic inclination and the lordotic angle. These craniofacial angles are determined by parameters that are based on the vertical relationship of the skull base to the mandible (facial axis) or the vertical type of the lower jaw itself (inner gonial angle and mandibular plane angle). The subjects analyzed in this study featuring a more horizontal type of craniofacial complex had lower inclination angles for the measured sagittal back shape parameters (upper thoracic inclination, lordotic angle and pelvic inclination). By contrast, patients with a more vertical craniofacial pattern had greater values for these parameters\(^10\).

**Conclusion**

The very wide and varied range of facial-parameter studies being carried out by various medical and dental disciplines, indicates a felt need for the acquisition, organization and standardization of all possible regional ethnic databases, to practically serve surgical departments as well as various professions. This pilot-study is a small but significant addition to that effort.

**Conflict of interest:** None

**Acknowledgements:** Dr. Iffathunnissa, Former Professor of Anatomy at Deccan College of Medical Sciences, has been instrumental in the concept, design, background research and execution of this project. We are deeply grateful for her guidance and mentorship.

**References**