ANTERIOR FACE PROPORTIONS AND FACE HEIGHT-WIDTH RATIO IN GUJARATI POPULATION

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Abstract

Background& Aim: Anterior face measurements are required across various fields such as public health, apparel industries and many more. Very little or no data available on anterior face proportions and anterior face height-width ratio in Gujarati population. So the aim wasto establish normal values of anterior face height, width and anterior face proportion in gujarati population. **Methods:** 450 living subjects were measured for anterior face height (trichion-gnathion, tr-gn), anterior face width (zygion-zygion, zy-zy), Forehead height (trichion-glabella, tr-gl), Upper face height (glabella – subnasale, gl-sn) and Lower face height (subnasale-gnathion, sn-gn). **Results:** Mean values of anterior face height (tr-gn), anterior face width (zy-zy), forehead height (tr-gl), Upper face height(gl-sn) and Lower face height (sn-gn) were 175.36±13.89mm, 123.99±8.84mm, 50.75±9.63mm, 65.28±6.86mm and 59.33±8.96mm in males and 165.72±12.55mm, 117.59±8.9mm, 47.19±9.88mm, 64.22±6.74mm and 54.31±9.93mm in females respectively. Anterior face height-width ratio was < 1.55 in 83.18% of males and 80.51% of females, between 1.55-1.65 in 9.34% males and 10.6% of females and >1.65 in 7.48% of males and 8.89% of females respectively. Forehead height, upper face height and lower face height ratios were 29%, 37% and 34% in males and 28%, 39% and 33% in females respectively indicating that upper face height ratio is more in females compared to males and contribution of upper face is higher in gujarati population. **Conclusion:** Data obtained from this study may be helpful in forensic investigations, orthodontics and facial plastic surgeries.

Keywords: Anterior face height, anterior face width, anterior face proportions, facial morphometry.

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Introduction

Face is the anterior part of head extending from the adolescent position of hairline superiorly to the chin and the base of the mandible inferiorly and to the auricles on each side [1]. Face plays a vital role not only in interpersonal communication, mastication, deglutition and respiration but also conveys information about a person's age, gender, race, emotions, general well-being, and even personality traits[2]. Various measurements of skull are used by experts to reconstruct face in order

to establish biological and personal identity particularly in relation to forensic investigations[3].Comprehensive and accurate sets of human anthropometrical data is required in various industries such as the apparel industry, automobile industry, ergonomics, and public health[4]. For the better acceptance and to catch up with the needs of current market, such measurements should be obtained every 5 -7 years. Ideal reconstruction of face defects largely depends upon knowledge of face anatomy and detailed face measurements. Modification of muscles of facial expression in upper face area is required in forehead lift surgeries[5]. Facial measurements are also required to establish norms for facial beauty and attractiveness. There is scarcity of data regarding anterior face height, width and anterior face proportions in gujarati population. Various techniques used to obtain facial measurements are x-rays, ultrasound technologies, cadaveric measurements, MRI, CT scans and photographs etc. But x-ray and CT scans may unnecessarily expose the subjects to hazardous radiation. Ultrasound techniques require some degree of tissue contact which may lead to tissue compression and bones in certain parts of face are irregular which limits the use of ultrasound for facial measurements. Cadaveric measurements lack reliability due to embalming. MRI may produce altered measurements due to gravitational distortion of facial tissue in supine position and landmark obliteration during scanning. A scope of reference is necessary for each photograph in photographic measurements[6,7]. As all these techniques had its own disadvantages, we chose to obtain direct facial measurements of length and width in gujarati population using digital Vernier's calliper with the purpose of establishing normal values of anterior face height, width and anterior face proportions in Gujarat. The obtained database will be useful in forensic investigations, orthodontics and facial plastic surgeries.

Material and Methods

The present study was conducted in Gujarat on total 450 (214 males and 236 females) living subjects. Only those subjects aged between 17 to 25years having both parents of gujarati descent were selected. While selecting the participants, we ensured that the selected subjects are not having history of any plastic/reconstructive surgery, trauma or craniofacial abnormalities. The study was approved by institutional review board and informed consent from the subjects was taken. Keeping the subject's head in Frankfurt's horizontal plane, following soft tissue landmarks were identified: Trichion(Tr), Gnathion(Gn), Lateral most point on zygomatic bone(Zy), Glabella(Gl) and Subnasale(Sn). From these landmarks, we measured anterior face height (Tr-Gn), anterior face width (Zy-Zy), forehead height (Tr-Gl), upper face height (Gl-Sn) and lower face height (Sn-Gn) with the use of digital Vernier's calliper. From these measurements, following ratios were calculated: 1. anterior face height-width ratio by dividing anterior face height to anterior face width, 2. forehead height ratio, upper face height ratio and lower face height ratios were calculated by dividing these heights to anterior face height. The results obtained were tabulated and analysed. Considering the anterior face height –width ratio of 1.6 as standard, we determined the range of normal face height –width ratio as 1.55-1.65. Subjects with ratio below 1.55 were classified as short face and above 1.65 were classified as long face.

Results

Mean values of anterior face height, anterior face width, forehead height, upper face height and lower face height were higher in males compared to the females. Prevalence of short face was highest among both males and females. Upper face height ratio was higher in females compared

to males whereas forehead height and lower face height ratios were higher in males compared to females.

Table 1: Mean anterior face height, width, ratio and classification of face based upon ratio

Parameter	Male (214)	Female (236)	Shape of face
Mean Anterior face height (mm)	175.36±13.89 (Range: 136.78-205.92)	165.72±12.55 (Range: 136.22-196.82)	
Mean Anterior face width (mm)	123.99±8.84 (Range: 108.6-144.02)	117.59±8.9 (Range: 104.91-138.7)	
Ratio <1.55	178 (83.18%)	190 (80.51%)	Short
1.55-1.65	20 (9.34%)	25 (10.6%)	Normal
>1.65	16 (7.48%)	21 (8.89%)	Long

Table 2: Forehead height, upper face height and lower face height ratios

	Forehead height		Upper face height		Lower face height		Anterior face height	
	Male	Female	Male	Female	Male	Female	Male	Female
Range (mm)	33.22-75.16	31.22-69.2	51.91-81.6	52.31-81.3	42.44-78.46	41.2-74.6	136.78-205.92	136.22-196.82
Mean (mm)	50.75±9.63	47.19±9.88	65.28±6.86	64.22±6.74	59.33±8.96	54.31±9.93	175.36±13.89	165.72±12.55
Ratio	29%	28%	37%	39%	34%	33%		

Discussion

Facial reconstructive surgeries require accurate pre-operative planning and objective evaluation of postoperative results. Thoughtful clinical examinations before and after the procedures is essential to produce best aesthetic outcome. In the current study, we established facial soft tissue measurement norms by means of direct measurements on living human subjects which will help the surgeons to perform accurate evaluation and to take disciplined decision in gujarati population. In a study conducted by P.saraswathi in Chennai, percentages of normal, short and long faces were 24%, 63% and 13% respectively in females and 14%, 70% and 16% respectively in males where as in present study, these percentages are 10.6%, 80.51% and 8.89% respectively in females and 9.34%, 83.18% and 7.48% respectively in males which indicates that prevalence of short faces is higher in gujarati population compared to Chennai[8]. In Turkish population, long face was predominant face type with proportion of normal, short and long faces being 33.1%, 30.1% and 36.8% respectively whereas in our study, short face is predominant face type, furthermore in our study, mean anterior face width (zy-zy) was 123.99±8.84 in males and 117.59±8.9 in females whereas in Turkish people, it was 129.06±7.08 in males and 127.2±6.54 in females respectively which shows that Turkish faces are wider compared to gujarati population[9, 10]. In the present study, forehead height, upper face height and lower face height ratios were 29%, 37% and 34% in males and 28%, 39% and 33% in females respectively which indicates that the upper face height contributes more to the face in our study whereas studies conducted in Nepal and Mosul shows that lower face height

contributes more compared to upper face height[11, 12]. These facial proportions can serve a great value to the plastic and maxillofacial surgeons as well as orthodontists for gujarati population.

Conclusion

Values measured in this study differ in different ethnic groups. Assessment of facial proportions should be carried out during clinical examination and the findings should be compared with x-rays because Soft tissue thickness may show great variability. The data generated from this study may be useful in forensic sciences as well as planning surgery and evaluating post-surgical changes in people with cranio-facial defects.

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