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Original communication

Radiographic assessment of facial soft tissue thickness in South Indian population – An anthropologic study

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ABSTRACT

Facial reconstruction is a technique used in forensic anthropology to identify an unknown person. Various methods used for facial reconstruction are drawings, sculpture and computer aided image building which is mainly based on facial soft tissue thickness measurement. Several methods have been established for measuring facial soft tissue thickness (FSTT) with each one having certain limitations. There is limited data available on FSTT among South Indian population. Hence the present study was ventured to determine the FSTT among South Indian adults and also to find FSTT difference between male and female.

308 subjects of South Indian origin (18–27years) having full set of permanent dentition who require orthodontic treatment were included in the study. Subjects were assessed for Body Mass Index (BMI) and diagnostic digital x-ray of lateral cephalogram (LC), Lateral oblique (LO) view and posterior-anterior (PA) view was obtained. The digital image was transferred to Adobe Photoshop CS4 software and 23 different soft tissue points were measured.

Mean FSTT was more in males compared to females except for three landmarks. Statistically significant difference was observed in 20 landmarks when height and weight was compared in males, whereas in females only 12 landmarks showed significant difference. BMI showed good correlation with FSTT in both males and females, which was confirmed by linear regression. The best regressor in terms of estimating FSTT in association with age/sex/BMI were nasion, sub nasale, labial superioris, labrale inferius, gnathion, inferior border of zygomatic, right and left gonion. Stepwise discriminant analysis using all variables showed 94.8% of overall accuracy in sex determination.

The observation of present study suggests that LO and PA view along with LC gives information regarding mean FSTT among South Indian population. Even though BMI plays a dominant role in determining FSTT, but age, sex, height and weight should also be considered with care while facial reconstruction. Additionally the present regression equation contributes towards increase in the specificity of the tissue depths and can be used in real cases by allowing the practitioners to calculate individual tissue depth.

1. Introduction

Face is a most important part of our body as it plays an important role in communication. Forensic facial reconstruction is the scientific art of visualizing a face on the skull for personal identification.[1] It is generally accepted that facial reconstruction can be divided into four categories: 1. Replacing and repositioning damaged or distorted soft tissue on to a skull. 2. The use of photographic transparencies and drawings in an identikit type system, 3. The technique of graphic, photographic or video superimposition and 4. Plastic or three dimensional reconstruction of a face over a skull using modelling clay.[1–3] There are two basic methods of modelling the face: morphoscopic and morphometric. In morphoscopic method, an "anatomical approach" of reconstructing the musculature, fat and skin is done whereas in morphometric method, average facial soft tissue depth

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measurements are used which are gathered by previous researchers over various anatomical sites of the skull and jaws.[1,3–5]

Different methods that have been established for measuring FSTT are puncture, X-ray, Computer Tomography (CT) imaging, ultrasound, Magnetic resonance Imaging (MRI) and very recent one is Cone Beam Computer Tomography (CBCT).[6–8] FSTT has been carried out in various race using Cadavers through puncture. The accuracy of this method is questionable and it as an inherent error, mainly because of degree of dehydration of human soft tissue which is marked during initial stages.[1] CT imaging, MRI and ultrasound gives better accuracy in establishing FSTT, but they have potential radiation hazard. Apart from this they are expensive, time consuming, technique sensitive procedures and are not freely available.[1,6,7] CBCT is emerging newer technique and is specific imaging technique for head and neck region. Even though it has low radiation dose, but is also expensive, technique sensitive and not freely available.[8] On the contrary X-ray imaging appears to be one of the easy, less time consuming and less expensive technique. Even though radiation exposure is the limitation of this method, it is possible to minimize radiation dose by recording facial features, profile and all measurement points can be recorded by using only one or two views.[2,6,9] Conventional X-ray imaging as been replaced by digital X-rays because in digital X-rays the exposure to radiation dose can be adjusted. A study by Heiko V et al, on comparison between conventional and digital cephalometric radiography, they observed that in digital cephalometry the radiation dose can be adjusted and it is low when compared to conventional method.[10]

On literature search we found limited data related to mean FSTT in South Indian population. Thus the study was designed to determine the FSTT in South Indian population using digital LC, LO and PA view, to determine difference in FSTT between males and females and also to correlate FSTT with age and other body parameters.

2. Materials and methods

Study was conducted on 308 individuals (152 males and 156 females) of South Indian origin, aged between 18 and 27years. After obtaining ethical committee clearance, subjects who were advised for diagnostic radiographs for orthodontic treatment were considered for the study.

Individuals with average Indian height and BMI of 18–26.5 according to World Health Organisation (WHO) chart were included for the study.[11] Individuals treated for head and neck pathology, patients who underwent or undergoing orthodontic treatment and individual treated for any facial fractures, facial deformities, asymmetries, and distortions were excluded from the study. After meeting inclusion and exclusion criteria, written informed consent was obtained from each individuals and details of the their Indian origin, height, weight and BMI was noted. Diagnostic digital radiograph of LC, LO and PA view was obtained using Kodak 8000C digital panaromic and cephalometric system. For LC the standard specification used was KV-78, MA-12 and exposure time of 0.080 s. For PA KV-82, MA-12 and exposure time of 1.60 s and for LO view KV-82, MA-12 and exposure time was 1.60 s. The image was saved in JPEG format. Later the recorded image was transferred to Adobe Photoshop CS4 extended for further measurement of FSTT. A total of 23 landmarks were measured. On LC-12 landmarks, LO- 9 landmarks and in PA view one landmark each on right and left side was measured (Figs. 1–3).

Intraobserver variability was checked for 20 samples to determine the reliability and accuracy of the method by simple random sample.

Descriptive statistical analysis was done by calculating the mean, standard deviation (SD). Comparison of FSTT between males and females was done using student 't' test. Co-efficient correlation of

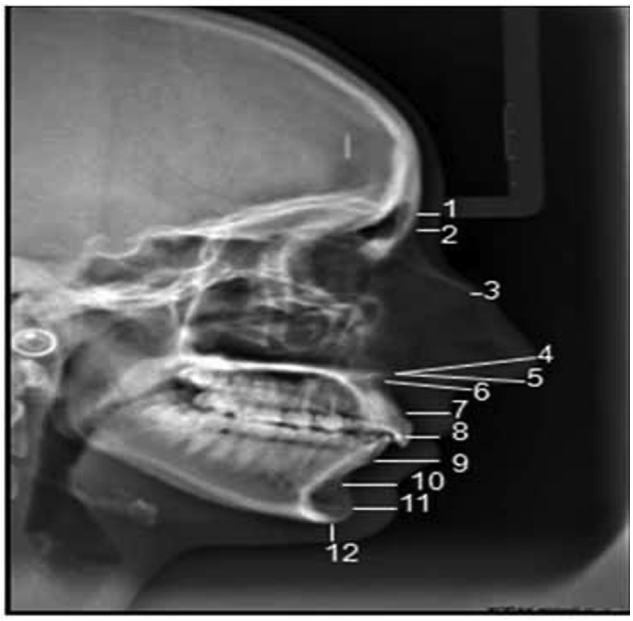

Fig. 1. Photograph showing lateral cephalogram with various position of measurement points: 1. Glabella, 2. Nasion, 3. Rhinion, 4. ANT, 5. INT, 6. Sub nasale, 7. Labrale superius, 8. Stomion, 9. Labrale inferius, 10. Labio mentale, 11. Pogonion, 12. Gnathion.

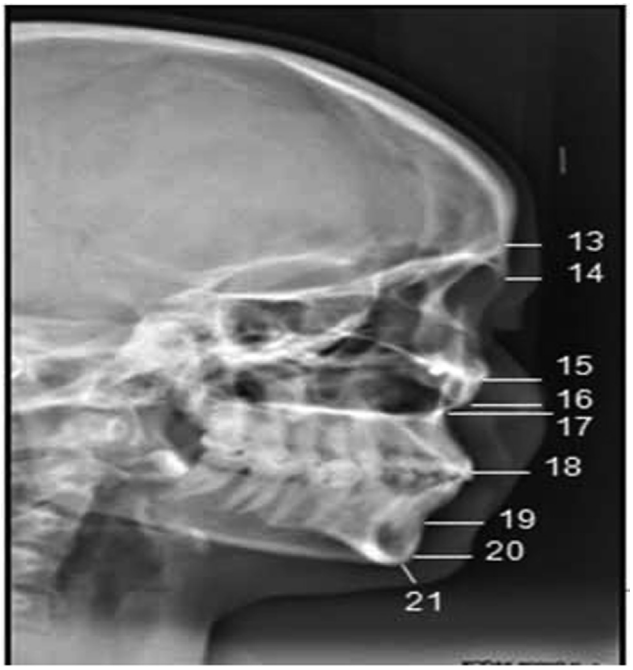

Fig. 2. Photograph showing lateral oblique with various position of measurement points: 13. Lateral frontal, 14. Lateral supra orbital, 15. Lateral zygomatic, 16. Inferior border of zygomatic, 17. Sub zygomatic, 18. Lateral lip, 19. Lateral labio mental, 20. Lateral mental, 21. Intermediate mental.

FSTT at different landmarks to height, weight, age and BMI in males and females was performed. Stepwise discriminant function analysis was also applied to study the sex classification in the FSTT measurements. We considered three attributes as independent variables (sex was coded as −1 for females and +1 for males) and FSTT as dependent variable. Linear regression analysis was carried out to find the best regressor for determining the FSTT. All the statistical operations were carried out using SPSS software version 10.0.