THREE-DIMENSIONAL PHOTOGRAMMETRIC FACIAL SOFT TISSUE ANALYSIS OF EGYPTIAN FEMALE ADOLESCENTS WITH ACCEPTED NORMAL OCCLUSION (CROSS SECTIONAL STUDY)

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ABSTRACT

Background: Soft tissue normal values represent useful guidelines for proper diagnosis and evaluation of orthodontic patients. The objective of this cross-sectional study is to determine the normal values of the vertical facial soft tissue of Egyptian female adolescents.

Methodology: Thirty female Participants 11-15 years of age with balanced facial proportions, full permanent dentition and Angle Class I molar and canine relationship were included in this study. Three-dimensional surface data was acquired using Planmeca ProMax 3D ProFace unit. The participant's data was admitted to the Planmeca Romexis 4.5.0.R software in the associated computer unit prior to the imaging procedure. For all processed images five standard anthropometric landmarks were identified to perform our measurements: Trichion (Tr`), Gnathion (Gn`), Nasion(N`), Subnasale (Sn`) and Sublabiale (Sl`).

Results: The mean anterior face height (Tr-Gn') for the total sample was found 172.6mm ± 7.99mm. While, the mean height of the forehead (Tr-N') for total sample was 63.6mm ±7.5mm. The mean morphological height of the face (N'-Gn) was 112.6mm ± 6.4mm The mean lower face height (Sn-Gn') was 64.2mm ± 5.3mm. The chin height (Sl-Gn') for the total sample was 22.9mm ± 2.6mm.

Conclusion: Soft tissue normal values represent useful guidelines for proper diagnosis and evaluation of orthodontic patients. Most of the facial measurements of Egyptian female adolescents were can be different or similar according to different ethnic groups.

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INTRODUCTION

Facial esthetics changed the whole perception of orthodontic diagnosis and treatment planning. Diagnosis based entirely on hard tissue evaluation has been thoroughly augmented by a broaden recognition of facial and smile appearance. Recently the goal of orthodontic treatment is shifting away from the creation of ideal dental and skeletal relationships towards placing more emphasis on the facial soft tissues. The facial soft tissue varies according to gender, age, race, and nutritive conditions[1].

Planmeca is a CBCT imaging unit with integrated 3D face scans system that can be used in soft tissue orthodontic diagnosis which was evaluated for its accuracy in a study by Hadir et al[2]. This technique acquires the patient's facial 3D photo in a radiation free process where the patient position, facial expression and muscle position remain unchanged resulting in perfectly compatible images. It has the advantage of combining both lasers and cameras in obtaining the three-dimensional facial volume.

The adult soft tissue normal values for Egyptians are well represented in the literature however, normative data are not available for the Egyptian female adolescent. The work presented in this study aimed to establish soft tissue norms for the Egyptian female adolescent population with the aid of a non-invasive 3D photography Planmeca ProMax 3D ProFace which was recently introduced to the market in 2015.

MATERIAL AND METHOD

This cross-sectional study was registered at the Evidence Based Center and approved by the Research Ethics Committee of the Faculty of Dentistry, Cairo University. All patients were informed about the study and informed written consents were signed. The participants in the present study were selected from the Department of Pedodontics, Faculty of Dentistry, Cairo University as females with an age range of 11 to 15 years and referred to the Department of Radiology, Faculty of Dentistry, Cairo University. Thirty female participants 11-15 years of age examined by the researcher and confirmed eligible after confirmation with the supervisors for having balanced facial proportions, Full permanent dentition, and Angle Class I molar and canine relation.

Three-dimensional surface data was acquired using Planmeca ProMax 3D ProFace unit **figure 1**. The unit consisted of; two laser beams, two cameras and LED light. The two laser beams scanned the whole face in fifteen seconds; the laser is class I according to the standard EN 60825-1:2007. It's a radiation-free process where a laser beam scans facial geometry; simultaneously two digital cameras in the revolving unit of the machine captured the color and texture of the face. The participant was instructed to look straight forward in an opposite mirror to adjust the head in the natural head position. Each participant was requested to swallow and rest his lips and to stay still during the revolving of the machine and was asked not to follow the machine with his/her eyes during the entire scanning procedure.
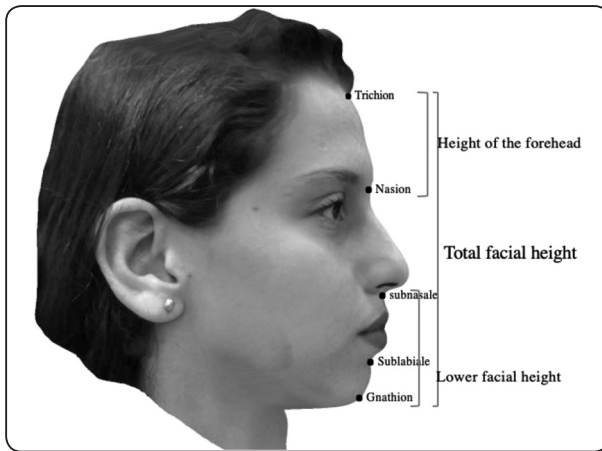

Fig. (1) Planmeca ProMax 3d unit

Fig. (2) Soft tissue vertical measurements of the total face.

The participant's data was admitted to the Planmeca Romexis 4.5.0.R software in the associated computer unit prior to the imaging procedure. The 3D volumes were uploaded on Exo CAD Matera 2019 software. "Grid" option was activated to visualize the coordinates for the ease of accurate identification of the landmarks (midline and horizontal planes). For all processed images five standard anthropometric landmarks were identified as defined by Farkas: Trichion (Tr`), Gnathion (Gn`), Nasion (N`), Subnasale (Sn`) and Sublabiale (Sl`).

RESULTS

The mean anterior face height (Tr-Gn') for the total sample was found 172.6mm ±7.99mm. While, the mean height of the forehead (Tr-N') for total sample was 63.6mm ±7.5mm. The mean morphological height of the face (N'-Gn) was 112.6mm ±6.4mm The mean lower face height (Sn-Gn') was 64.2mm ±5.3mm. The chin height (Sl-Gn') for the total sample was 22.9mm±2.6mm.

DISCUSSION

Soft tissue normal values represent useful guidelines for proper diagnosis and evaluation of orthodontic patients. The facial soft tissue varies according to gender, age, race, and nutritive conditions. The literature contains many soft tissue analyses of different ethnic background including Caucasians, African- American, Korean, Chinese and many others which are used to evaluate many aspects as; growth, lip thickness, lip length and many other values[3,4].

Cephalometric radiographs have been always the conventional orthodontic assessment technique and the most commonly used diagnostic tool that gives greater emphasis to the hard tissues rather than the soft tissues[5]. However, it faces different problems like image magnification, difficult localization of landmarks due to superimposition of anatomic structures, problems with patient head orientation and readings errors. Photographs were used in conjunction with cephalometric x-rays attempting to get accurate diagnosis for soft tissue measurements but at the end it is a 2D image for a 3D object; which lacks some informative measurements[6].

Planmeca is a CBCT imaging unit with integrated 3D face scans system that can be used in soft tissue orthodontic diagnosis which was evaluated for its accuracy in a study by Hadir el al [2]. The reliability of 3D stereo- photogrammetry has been evaluated by numerous studies which assured the reliability of using stereophotogrammetry for evaluating soft tissues[7,8].

In the current study, the mean total anterior facial height (Tr-Gn'), the forehead height (Tr-N') and the morphological facial height (N'-Gn') for Egyptian female adolescents were 172.6 mm, 63.6 mm and 112.62 mm respectively. **Sforza et al 2014[9]** performed a study on Sudanese adolescents where the forehead height was found to be shorter compared to that of Egyptians.

CONCLUSION

Soft tissue normal values represent useful guidelines for proper diagnosis and evaluation of orthodontic patients. Most of the facial measurements of Egyptian female adolescents were can be different or similar according to different ethnic groups.

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