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SIZE AND SHAPE ANALYSIS OF FEMALE NOSE IN MALAY ETHNIC

(ANALISIS UKURAN DAN BENTUK HIDUNG WANITA SUKU MELAYU)

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Abstract

Several non invasive methods have the results showed that been applied to quantify facial soft tissue morphology. Digital photography is one of the methods that has been used in the assessment of facial profile in different population. This study aims to determine nasal soft tissue differences among Malays in Peninsular Malaysia by applying geometric morphometric method with digital photograph. A cross sectional study was carried out on 20 participants from Bugis and Java females with aged range from 20-40 years. The photographs were captured using digital SLR camera (Nikon D80) and analyzed using finite element analysis in MorphoStudio™ software. Seven soft tissue landmarks were digitized on each frontal photograph and six on the lateral one. The study error for both samples was within acceptable limits as there were no statistical differences ($p>0.05$) in duplicated digitization. The results showed that the comparison of size revealed that Bugis females were smaller in upper and lower nasal region about 17- 33%. Bugis females shape showed differences in upper and lower nasal area by 20%. In lateral profile there was a decreased size in lower nasal area in Bugis females by 17- 33% and the difference in shape by 20%. The nasal region was significantly smaller in size and more different in shape for Bugis females than Javanese females. Computer aided photogrammetric analysis has the ability to depict and quantify local shape and size changes of nasal soft tissue differences between Java Malay and Bugis female groups.

Key words: digital photogrammetry, geometric morphometry, nasal Malay analysis

INTRODUCTION

In recent years, there was a considerable increase in the number of cosmetic surgical procedures being performed on the nasal region.[1] Most of these patients who underwent these procedures laid emphasis on preserving their ethnic features while achieving successful surgery out come.[2] A successful outcome in cosmetic nasal surgery requires accurate information for the preoperative enumerative data. There was a need for data which should contribute to satisfactory results.

Many anthropometric studies have been carried out to investigate the nose in various ethnic groups like Caucasian[3], African American[4] and Asian[5] populations. Other methods were aimed to achieve the most reliable results. One example is by using geometric morphometric incorporating statistical shape analysis such as Procrustes superimposition, Euclidean Distance Matrix Analysis (EDMA), and Finite Element Analysis (FEA).[6-10]

Malaysia is a multiracial country where Malays form the majority of the population. Few studies were carried out to evaluate facial soft tissue profile to define differences in Malay subjects.[11,12] However, the subjects were limited to one particular region with mixed ethnics.[11] Therefore, the aim of this study is to apply digital photogrammetry and geometric morphometric techniques to examine the nasal soft tissue in of two groups of Malay residing in the southern part of Peninsular Malaysia applying Mycranio photogrammetric imaging system.

MATERIALS AND METHODS

After obtaining ethical approval (No. 156.4 (5), dated 10 October 2005) from Human Research Ethics Committee, Universiti Sains Malaysia (USM). Twenty female participants from Johor state in Malaysia peninsular were included in the study. Ten of them were Java descendants and the other ten were Bugis. The participants were required to be

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18 through 40 years of age at the time of data collection. The subjects have no craniofacial deformities, no previous plastic or reconstructive surgery and no major trauma to the face. Demographic data were obtained, including age, date of birth, place of birth and parental heritage of Java and Bugis descendants

Mycranio Photogrametric system was produced as a result of collaboration between Universiti Sains Malaysia and Universiti Tekologi Malaysia. The set-up system consists of modified chair with photogrammetric control frame.[13] The photogram-metric control frame contains retro-targets that required for the orientation of the facial photographs for data acquisition (Fig 1). Four landmarks were captured in the target image prior to data capturing.

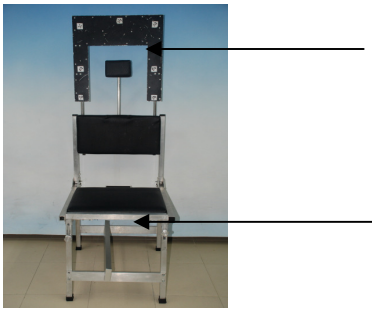


Figure 1. The modified chair and calibration frame[13]

Two were located vertically (superior and inferior) and the other two horizontally (left and right). These four landmarks are known as the calibration points and the distances were called calibration lengths.

After locating the calibration points and lengths, all participants' photographs were taken with Nikon D80. The camera was set up with 10.2 mega pixel resolution, standard flash, automatic programmed shutter speed and aperture value, focal length 50 mm. The camera was placed approximately 1 meter from the subject and the visual axis was paralleled to the floor of the room with the height approximately same with the subjects head height. The camera mounted on a tripod allowed it to be moved vertically or laterally (Fig 2). Standardized facial frontal and profile photographs were taken with patient in the natural head position, centric occlusion, and relaxed lip posture.[18]

The raw data was changed to bitmap format (bmp). The anthropometric landmarks were defined and located according to Farkas[3]. For each subject, 7 numbered landmarks in the frontal aspect and 6 numbered landmarks on the lateral aspect of the nose were defined in Table 1 and shown in Figure 3. These were digitized by using the Data Digitizer auxiliary program, and transferred to Morpho-Studio™ for further analysis.



Figure 2. The camera and participant for data acquisition method

Table 1. The numbers, abbreviations and definitions of the landmarks

Frontal Landmark	Lateral landmark	Abbreviation	Definition
0	0	n	The point in the midline of both the anatomic nose and the nasoanterioral suture
1,2	--------	mf	Maxilloanteriorale, where the maxilloanterioral and nasoanterioral sutures meet
3,4	4	al	Alare, the point where the nasal blade (ala nasi) extends farthest out
5	1	prn	Pronasale, the most prominent point on the nasal tip
6	3	sn	Subnasale, the midpoint of the columella base
--------	2	c	Highest point of the columella.
--------	5	ac	Alar curvature point



Figure 3. Facial soft tissue with landmarks and numbers denotation with triangles definition in frontal and lateral images

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To determine whether there was a size and shape difference between two groups, the generalized Procrustes analysis was applied.[8] This analysis is used to create a mean set of landmarks for the participants studied.[7-10] This is to ensure that all configurations were scaled to an equivalent size and registered with respect to each other. After that the FEA is used on the scaled coordinates (after Procrustes superimposition) to assess the difference between the groups to depict size and shape changes. The pseudocolour scale (Fig 4) was used to determine the degree of difference in the form of graphic display in size and shape differences e.g. if it is > 1 indicates the increasing in size. When the scale is at 1.33 mean 33% increased or if it is 0.67 is 33% decreased.[10, 14, 16, 17]

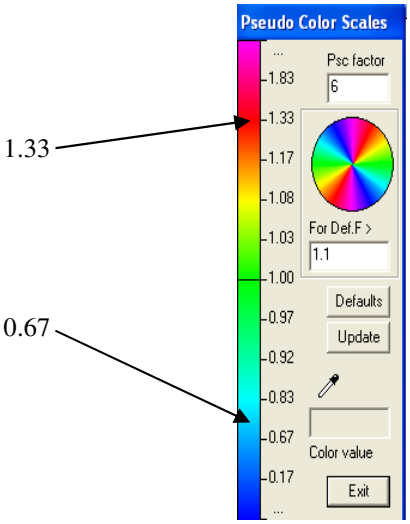


Figure 4. The pseudo colour scale[12,17]

RESULTS

The study error for both samples was within acceptable limits as there were no statistical differences ($p > 0.05$) in duplicated digitization. The comparison of size change revealed decreasing size of the middle lower nostril region about 17- 33% (pseudo colour scale was at 0.67-0.83) as shown in blue colour (Fig. 5) for Bugis females. The difference in the upper and lower nasal areas was noted about 17% (pseudo colour scale was at 1.17) were noted in average shape comparison (Fig. 6). Lateral profile results showed significant decreasing size of lower nasal area in Bugis by about 17- 33% (pseudo colour scale was at 0.67- 0.80) as shown in Figure 7. In addition to that Java's lower nasal region was significantly different in shape about 20% (pseudo colour scale was at 1.20) as indicated by red colour as shown in Figure 8.

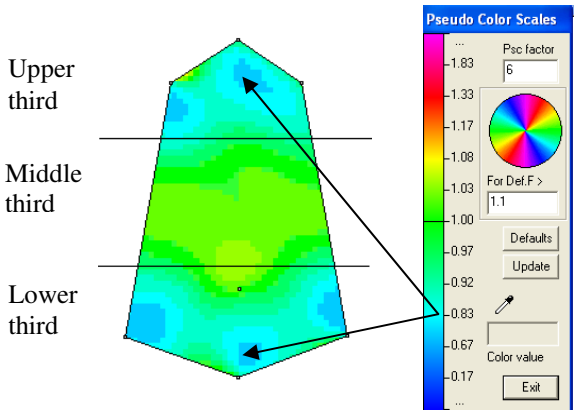


Figure 5. Comparison of mean Bugis and Java nasal configurations for size change in frontal area. The upper and lower frontal areas are blue (anisotropic) while the others are green isotropic (no change)

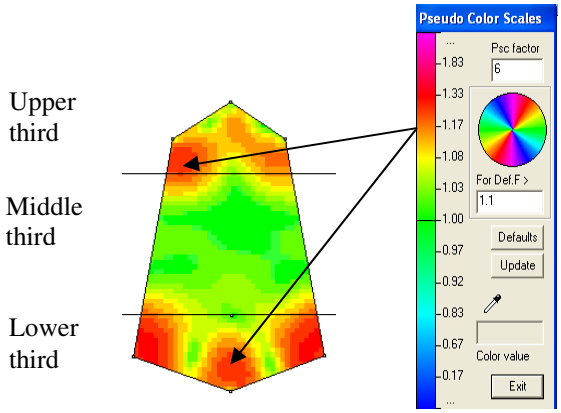


Figure 6. Comparison of mean Bugis and Java nasal configurations for shape change in frontal area. The upper and lower frontal areas are anisotropic (shape change) while the others are isotropic (no change)

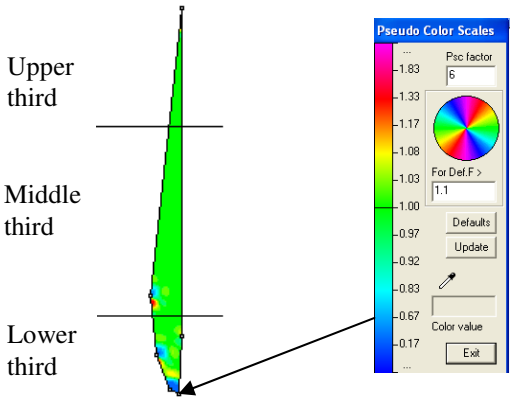


Figure 7. Comparison of mean Bugis and Java nasal configurations for size change in lateral profile. The lower nasal area is anisotropic (change) while the others are isotropic (no change)

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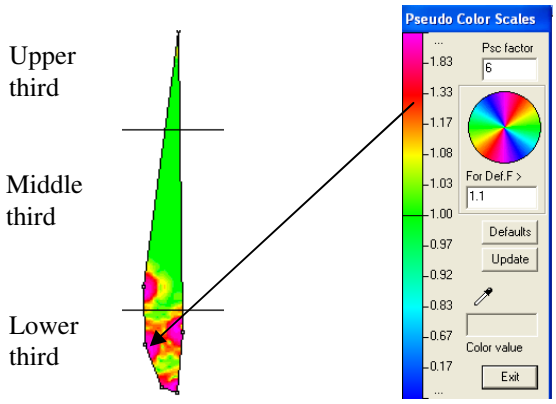


Figure 8. Comparison of mean Bugis and Java nasal configurations for shape change in lateral area. The lower lateral nasal area is anisotropic (change) while the others are isotropic (no change)

DISCUSSION

Data captured applying the geometric morphometric was of particular interest.[6] It depends on utilizing landmarks for identification and localization of information.[8] In the current study the difference in nasal morphology was assessed by generalized Procrustes analysis which was used to compute the average configuration of the nasal region in two groups.[6,7] Then the finite element analysis depicted the changes due to variation in shape and size.[10,15-17]

The present study is based upon cross sectional sample randomly selected from two main Malay subgroups. In spite of small sample size, the morphometric differences in nasal region between the two groups were detected. The comparison of the size and shape of the nose of Bugis and Java females showed differences which were mainly localized in the upper and lower middle and lateral nasal areas. In particular, the nose of the Bugis females was smaller and projected less than Java's. The results of this study were more reliable because they relied on powerful approach of geometric morphometric analysis.[15-17] It has long been recognized that there were major facial differences observed in Asian face in comparison with the Caucasian. [19] The differences were recorded in profile of the lower face and the nose.[3] Sim et al recorded less prominent nose with low nasal bridge and broad base, the alae were more flared, the nostrils were more horizontally oriented, the alar-columellar relationships were different, and the nasal tip was less defined in Chinese population.[5] Other studies applied the geometric morphometric using Euclidean Distance Matrix Analysis (EDMA) to assess the nasal features but in Turkish population. They studied the gender difference and re-corded an 86% increasing size of the lower nasal area in males and increasing nasal length for females.[18]

According to our knowledge there were no studies evaluated the soft tissue form of nasal area in Malay population. From here, the importance of this work was evident in most patients who desired facial cosmetic enhancement without sacrificing their ethnicity. However, further studies with bigger sample are suggested to obtain better result about the facial soft tissue in Malay population.

It was concluded that Bugis's female nose was smaller than Java's, especially at the upper and lower nasal area. Although the sample size is small but it can give us suggestions about morphological dissimilarity in Malay groups of different regions of Peninsular Malaysia.

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