Original article

Photogrammetric Analysis of Nasolabial Angle and Mentolabial Angle norm in Malaysian Adults

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Abstract

Introduction: While measurement of nasolabial angle and mentolabial angle is an important clinical examination in pre-orthognathic surgery assessment, data on non-western population is limited. This study was therefore conducted to determine the range of nasolabial angle and mentolabial angle in normal Malaysian adult with comparison of males and females. ***Materials and Methods***: A total of 50 Class I males and 52 Class I females aged 19-30 years from three main ethnic groups were randomly selected from dental students, medical students and staffs in dental clinic of Hospital Universiti Sains Malaysia (HUSM). The photographic set-up consisted of a 50mm Nikon DAT camera held in position by a tripod. The photos taken in JPEG format were digitalized and analysed using ProVixwin software. Independent t-test was used to compare any possible gender difference in nasolabial and mentolabial angles. ***Results:*** The mean of nasolabial angle and mentolabial angle for male was 92.99? and 130.44? whereas for females it was 95.04? and 130.73? respectively. Gender differences were found to be insignificant for both nasolabial angle and mentolabial angle.***Conclusion***: Despite having great variation in our population, the nasolabial angle and mentolabial angle are gender independent.

Key Words: Orthognathic surgery, Nasolabial angle, Mentolabial angle

Introduction

Physical appearance has gained its importance in this modern society. Social acceptance, psychological well-being, and self-esteem of one are in close relation to his/her physical appearance[1]. "Being esthetic is ordinary in our society"[1]. A pleasing and attractive face is a balanced and complimentary match of the nose, lips, eyes, and ears, together with a harmony of the jaws and teeth accentuated by the color and texture of the skin and hair[2]. In order to have a pleasing physical appearance which is acceptable by the society, people are willing to change their facial proportion. Unattractive facial proportions can be modified through dentofacial orthopedics, orthognathic surgery, and esthetic soft tissue and/or hard tissue surgery, either alone or in various combinations[3]. Malkoc et al suggested that analysis of the soft tissue should be taken into consideration for correct evaluation of an underlying skeletal discrepancy because of individual differences in soft tissue thickness[4]. Fernandez-Riveiro et al.[5] highlighted possible anomalies in the hard tissues could be masked or exaggerated by the overlying soft tissues. In other words, facial soft tissues did not always follow the underlying dentoskeletal profile[5]. Comprehensive soft tissue analysis is vital in the pre-orthognathic surgery assessment as the soft tissue profile may differ between different age group, sexes and ethnic groups. To optimize facial attractiveness, norms are used to define what acceptable facial traits are and to establish a range of values within which lies acceptability[6]. These norms are used as a guide in which through various treatments, facial unattractiveness with underlying discrepancies should be brought closer to the ideal norm. Therefore, this study was designed to determine the norms of nasolabial angle and mentolabial

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angle for our population and to identify possible gender difference. Similar studies in analyzing nasolabial and mentolabial angles were conducted in other countries using photogrammetry and lateral cephalometry, yet no similar study had been carried out in Malaysia[1,3,4,5,10,11].

Materials and Methods

Hundred two (102) subjects aged from 19-30 years (50 males and 52 females) were randomly selected from dental students, medical students, and staffs of dental clinic in Hospital Universiti Sains Malaysia (HUSM). A brief questionnaire which included general information such as name, age, gender and race was completed for all subjects. Written consent was obtained from all the subjects. This study had been approved by the HUSM research and Ethics Committee (Human and/or Animal).

Inclusion criteria were aged between 19-30 years, Class I skeletal relationship and occlusion with minor or no crowding, normal growth and development, good facial symmetry and full dentate. On the other hand, exclusion criteria were previous facial trauma, previous orthodontic treatment, previous maxillofacial or facial plastic surgery, facial nerve palsy, dentofacial deformity, syndromic deformity and denture wearer.

The pilot study conducted before this study, it showed no significant difference in photogrammetric angular measurement of images taken using 35mm camera or 50mm camera. 30 subjects (15males and 15 females) were examined in the pilot study; two images were taken with 35mm and 50mm respectively. The nasolabial angle was reported to be 93.92 $\pm$ 8.64 degrees for 50mm camera and 93.95 $\pm$ 8.71 degrees for 35mm camera respectively with $p=0.988$. On the other hand, the mentolabial angle was found to be slightly wider in with using 35mm camera. However, the p-value was found to be 0.87. The result showed insignificant difference in angular measurement for images taken using 50mm camera and 35mm camera, therefore 50mm camera was chosen in this study to determine the norms of nasolabial angle and mentolabial angle in Malaysian adult due to the fact that it provides a closer view of the subject and thus measurement can be made with higher accuracy.

Photographic set-up

The photographic set-up was consisted of a tripod (Manfrotto 141RC) holding a 50mm Nikon DAT camera. Manual setting of the camera was used by a single operator. The subjects were standing on a line marked on the floor which is 100cm from the camera and were asked to relax the face. Photographs of the subjects were taken from the front and from the side. Photographs taken in JPEG format were then being digitalised and analysed using Provixwin software (Figure I). In order to minimize intra-operator variability, for each photograph of the subject, it was analysed twice with one week apart and mean of the two measurements was used as the result for the particular subject.

The following landmarks and angular measurements are shown in Figure I:

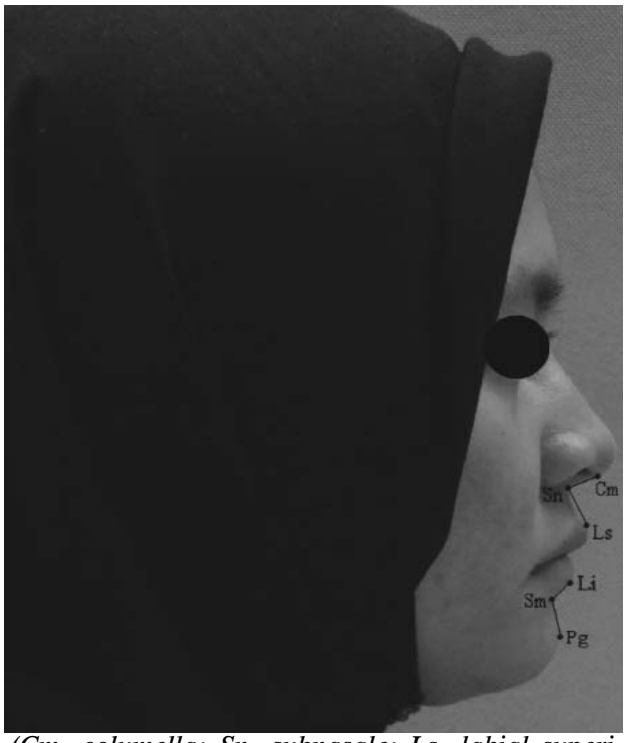
Columella (Cm): the most inferior and most anterior point of the nose

Subnasale (Sn): the point where the nasal septum meets the upper lip in the midsagittal plane

Labial superior (Ls): the most anterior point of the upper lip Labial inferior (Li): the most anterior point of the lower lip Supramental (Sm): the deepest point in the concavity between the lower lip and the pogonion Pogonion (Pg): the most anterior point of the chin Cm-Sn-Ls: the nasolabial angle

Li-Sm-Pg: the mentolabial angle

Figure I: Landmarks and angular measurements used in this study.



(Cm, columella; Sn, subnasale; Ls, labial superior; Li, labial inferior; Sm, supramental; Pg, pogonion; Cm-Sn-Ls, nasolabial angle; Li-Sm-Pg, mentolabial angle)

Statistical analysis was done using SPSS 18.0. Independent t-test was used to compare the angular measurements between males and females.

Results

Descriptive data for mean, maximum, minimum, range, and standard deviation together with the result of comparison between male and female using independent t-test for nasolabial angle and mentolabial angle norm determination are shown in Table I. The nasolabial angle was found to be more acute in males than in females (males = 92.99 ± 8.82 degrees, females = 95.04 ± 8.17 degrees). The mentolabial angle showed great variability in both males and females with slightly wider measurement in females (males = 130.44 ± 13.08 degrees, females = 130.73 ± 11.60 degrees). However, no significant gender differences were shown for both nasolabial angle and mentolabial angle.

Table 1: Average values for nasolabial angle and mentolabial angle in males and females with application of independent t-test

	Mean	SD	Minimum	Maximum	Range	Independent t-test
NLA (Cm-Sn-Ls)						
Male (n=50)	92.99º	8.82	76.0 º	114.5 º	76.0 º -114.5 º	p=0.226
Female (n=52)	95.04 º	8.17	77.0 º	114.5 º	77.0 º -114.5 º	
MLA (Li-Sm-Pg)						
Male (n=50)	130.44 º	13.08	104.0 º	163.0 º	104.0 º -163.0 º	p=0.906
Female (n=52)	130.73 º	11.60	91.0 º	156.5 º	91.0 º -156.5 º	

NLA: Nasolabial angle; MLA: Mentolabial angle; SD: Standard deviation;

Discussion

The primary objective of this study was to determine the norm of nasolabial and mentolabial angles in normal Malaysian adult. Type of malocclusion is one of the factors causes changes in soft tissue profile of the face, thus only Class I subjects were selected for this study. According to Fernandez-Riveiro et al, most facial changes occur before age 18; although growth and reshaping continue throughout life[5]. Therefore the subjects aged 19-30 were chosen for a more accurate result. Moreover, people in this age group are believed to be more concern with facial aesthetic and are more determine to change their facial feature compare to other age groups. This is agreed by Soh et al.[7] in which they had pointed out the recent trend of more adults seeking orthodontic treatment and orthognathic surgery in their study done in Singapore. Full dentition is one of the inclusion criteria. Subjects who were partially dentate were not chosen. Anterior teeth are essential for labial support. The lips lose its support if the underlying teeth were missing. The upper lip is less prominent in the extraction group[8]. Subsequently, soft tissue profile of the face is changed. Hence, extraction of teeth can increase the nasolabial angle[6]. Likewise, Cummins highlighted that upper and lower lips were more retrusive after the extraction of premolars. In addition, the nasolabial angle was significantly larger among the female extraction group[8]. In order to get the norm of nasolabial and mentolabial angles for normal Malaysian adult, subjects who had previously undergone orthodontic treatment, maxillofacial surgery or facial plastic surgery were excluded. This is because orthodontic and orthognathic surgical treatment can influence significantly the cranial hard-tissue structures and lead to adaptions of the facial musculature[9,10]. Furthermore, Eggensperger et al stated that surgical procedures to correct skeletal deformities result in changes in shape and position of the overlying soft tissue[11].

From this study, the nasolabial angle showed wider measurement in females (95.04 ± 8.17 degrees) in comparison to the males (92.99 ± 8.82 degrees). Fariaby et al.[12] reported a nasolabial angle of 98 ± 10 degrees for females and 97 ± 11 degrees for males. Likewise, Malkoc et al.[4] stated the nasolabial angle of 102.94 ± 10.43 degrees for females and 101.09 ± 10.19 degrees for males.

Females have a wider nasolabial angle generally[1,4,11,12]. The mean of nasolabial angle for both sexes is more acute for Malaysian compare with other western countries. Gender difference was found to be insignificant, this is coincided with the report of Fernandez-Riveiro et al.[1] and Fariaby et al[12]. However, the result obtained was contradictory to that in Croatia where significant sexual dimorphism was concluded[13].

The mean of mentolabial angle for both sexes (males = 130.44 ± 13.08 degrees, females = 130.73 ± 11.60 degrees) is similar to those reported by Fernandez-Riveiro et al.[1] (males = 130.75 ± 9.64 degrees, females = 131.45 ± 11.01 degrees). Great variation was demonstrated in this study for both genders, ranged from 104.0-163.0 degrees in males and 91.0-156.5 degrees in females. Nasolabial angle showed the males have a more significant acute angle compared to the females[14-16]. No gender difference was shown from this study, coincident to those of Fernandez-Riveiro et al[1]. The opposite was argued by Malkoc et al.[4], Fariaby et al.[12], and Anic-Milosevic et al.[13] in which gender had an impact on mentolabial angle.

Orthognathic surgery can improve the quality of life of patients with dentofacial deformities by giving to them a more balanced and harmonious facial form with excellent stability and function for the long term[2]. Prior to surgery, a thorough examination on both dentoskeletal pattern and soft tissue should be carried out. The soft tissue covering the teeth and bones can vary so greatly that the dentoskeletal pattern may be an inadequate guide in evaluating facial disharmony[6]. Nasolabial and mentolabial angles are two important guides in orthognathic surgery. Any deviation of these angles from the norm should be noted in pre-orthognathic surgery assessment. McCollum and Evans[2] had emphasized on the importance to predict not only the occlusal and skeletal relationships but importantly the soft-tissue outcome. Thus, restoring these angles to its norm is one of the aims of treatment for the patient. By knowing the norm of these angles in a population, outcome of the surgery can be more perfect and social-acceptable accordingly. The weakness of this study was the result is not specific to any ethnic groups as the subjects were randomly chosen from three main ethnic groups in Malaysia. Scavone mentioned that every ethnic group showed specific dentofacial characteristics in each ethnic group[17]. Different ethnic group groups may have different skeletal base pattern and facial features, which in turn, may reflect changes in the soft tissue profile of the face. For example, lip prominence and facial divergence are strongly influenced by racial and ethnic characteristics[18-20]. Therefore, in the future, attention should be focused on each ethnic group in effort to obtain the precise result and to avoid any possible ethnicity difference.

Conclusion

Soft tissue profile of the face especially the nasolabial angle and mentolabial angle should be revised in planning of orthognathic surgery and orthodonthic treatment as it contributes to the success of the treatment. The parameters obtained from this sample can be used in comparison with records of other subjects with the same characteristics and following the same photogrammetric technique. The results showed slightly wider nasolabial angle in females and similar measurement in mentolabial angle for both sexes. Large variability was found for both nasolabial and mentolabial angle. However, the impact of sex was insignificant for both these angles.

References

1. Fernandez-Riveiro P, Smyth-Chamosa E, Suarez-Quintanilla D, Suarez-Cunqueiro M. Angular photogrammetric analysis of the soft tissue facial profile. *Eur J Orthod*. 2003;**25**(4):393-9.http://dx.doi.org/10.1093/ejo/25.4.393 PMid:12938846

2. McCollum AGH, Evans WG. Facial Soft Tissue: The Alpha and Omega of Treatment Planning in Orthognathic Surgery. *Seminars in Orthodontics*. 2009;**15**:196-216. http://dx.doi.org/10. 1053/j.sodo.2009.03.004

3. Gulsen A, Okay C, Aslan BI, Uner O, Yavuzer R. The relationship between craniofacial structures and the nose in Anatolian Turkish adults: A cephalometric evaluation. *Am J Orthod Dentofacial Orthop*. 2006;**130**:131.e15-.e25 PMid:19064675 PMid:12142898 PMid:15953894

4. Malkoc S, Demir A, Uysal T, Canbuldu N. Angular photogrammetric analysis of the soft tissue facial profile of Turkish adults. *Eur J Orthod*. 2009;**31**(2):174-9. http://dx.doi.org/10.1093/ejo/cjn082 PMid:19064675

5. Fernandez-Riveiro P, Suarez-Quintanilla D, Smyth-Chamosa E, Suarez-Cunqueiro M. Linear photogrammetric analysis of the soft tissue facial profile. *Am J Orthod Dentofacial Orthop*. 2002;**122**(1):59-66. http://dx.doi.org/10.1067/mod.2002.125236 PMid:12142898

6. Bergman RT. Cephalometric soft tissue facial analysis. *Am J Orthod Dentofacial Orthop*. 1999;**116**(4):373-89.http://dx.doi.org/10.1016/S0889-5406(99)70222-2

7. Soh J, Chew MT, Wong HB. A comparative assessment of the perception of Chinese facial profile esthetics. *Am J Orthod Dentofacial Orthop*. 2005;**127**(6):692-9. http://dx.doi.org/10.1016/j.ajodo.2004.02.018 PMid:15953894

8. Cummins DM, Bishara SE, Jakobsen JR. A computer assisted photogrammetric analysis of soft tissue changes after orthodontic treatment. Part II: Results. *Am J Orthod Dentofacial Orthop*. 1995;**108**(1):38-47. http://dx.doi.org/10.1016/S0889-5406(95)70064-1

9. Schimmel M, Christou P, Houstis O, Herrmann FR, Kiliaridis S, Muller F. Distances between facial landmarks can be measured accurately with a new digital 3-dimensional video system. *Am J Orthod Dentofacial Orthop*. 2010;**137**:580.e1-e10.

10. Alam MK. *Bimaxillary proclination with spacing: Treatment for Esthetic Improvement*. *Bangladesh Journal of Medical Science*. 2009;**8**(4): 129-134. PMid:17954329 PMid:16207505 PMid:18263886

11. Eggensperger NM, Lieger O, Thuer U, Iizuka T. Soft tissue profile changes following mandibular advancement and setback surgery an average of 12 years postoperatively. *J Oral Maxillofac Surg*. 2007;**65**(11):2301-10. http://dx.doi.org/10.1016/j.joms.2007.06.644 PMid:17954329

12. Fariaby J, Hossini A, Saffari E. Photographic analysis of faces of 20-year-old students in Iran. *Br J Oral Maxillofac Surg*. 2006;**44**(5):393-6. http://dx.doi.org/10.1016/j.bjoms.2005.07.029 PMid:16207505

13. Anic-Milosevic S, Lapter-Varga M, Slaj M. Analysis of the soft tissue facial profile by means of angular measurements. *Eur J Orthod*. 2008;**30**(2):135-40. http://dx.doi.org/10.1093/ejo/cjm116 PMid:18263886

14. Kathiravan P, Alam MK, Norzakiah MZ. Cephalometric norms of Malaysian adult Indian. *International Medical Journal*. 2012. GS-6102015. Article in press.

15. Kathiravan P, Alam MK, Norzakiah MZ. Cephalometric norms of Malaysian adult Chinese. International Medical Journal. 2012. GS-6102014. Article in press.

16. Alam MK, Basri R, Purmal K, Sikder, MA Saifuddin M, Iida J. Cephalometric Lip

Morphology in Bangladeshi Population. *International Medical Journal*. 2012. In-Press.

17. Scavone H, Jr., Trevisan H, Jr., Garib DG, Ferreira FV. Facial profile evaluation in Japanese-Brazilian adults with normal occlusions and well-balanced faces. *Am J Orthod Dentofacial Orthop*. 2006;**129**(6):721 e1-5.

18. Mantzikos T. Esthetic soft tissue profile preferences among the Japanese population.*Am J Orthod Dentofacial Orthop*. 1998;**114**:1-7. http://dx.doi.org/10.1016/S0889-5406(98)70230-6

19. Alam MK, Leonardo SE, Sato Y and Iida J. A study regarding the awareness of facial appearance and?their profile of Indian-subcontinent laypersons. Presented in the 65th Annual Meeting of The Japanese Orthodontic Society, the 1st Joint Meeting of the Japanese Orthodontic Society and the Korean Association of Orthodontist held in Sapporo, September 13-15, 2006.

20. Leonardo SE, Alam MK, Sato Y and Iida J. The awareness of own facial appearance and profile in Japanese-Brazilian laypersons. Presented in the 65th Annual Meeting of The Japanese Orthodontic Society, the 1st Joint Meeting of the Japanese Orthodontic Society and the Korean Association of Orthodontist held in Sapporo, September 13-15, 2006.