

ARTICLE INFO

Submitted: 07/07/2023

Accepted: 14/02/2024

Online: 24/06/2024

Facial Anthropometry and Aesthetic Preferences in Malay Women: A Comparative Study

Su Keng Tan^{a*}, Nurul Fatimah Hussien^b, Nurhaifa Adlina Mohd Yunos^b, Michelle Clare Mah^a, Roger Arthur Zwahlen^c

^aCentre of Studies for Oral and Maxillofacial Surgery, Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh Campus, Jalan Hospital, 47000 Sungai Buloh, Selangor, Malaysia

^bFaculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh Campus, Jalan Hospital, 47000 Sungai Buloh, Selangor, Malaysia

^cViceprimario, Unit of Maxillofacial and Oral Surgery, Ospedale Regionale Lugano, Civico, Via Tesserete 46, 6903 Lugano, Switzerland

*Corresponding author: drtansukeng@gmail.com

To cite this article: Tan SK, Hussien NF, Mohd Yunos NA, Mah MC, Zwahlen RA (2024). Facial anthropometry and aesthetic preferences in Malay women: A comparative study. *Arch Orofac Sci*, 19(1): 31–46. <https://doi.org/10.21315/aos2024.1901.OA03>

To link to this article: <https://doi.org/10.21315/aos2024.1901.OA03>

ABSTRACT

The study aimed to explore the relationship between Malay females' facial attractiveness with golden ratio, neoclassical canons, "ideal" ratios and "ideal" angles; and to compare self-perceived facial attractiveness and health-related quality of life (HRQoL) among Malay females with different skeletal patterns. Sixty-four young Malay female participants each completed a set of self-administered questionnaires and have five facial photographs taken. The self-assessed satisfaction with facial appearance and HRQoL were compared between participants with different dentoskeletal patterns. Seventy-seven facial anthropometry parameters related to the golden ratio, neoclassical canons, ideal ratios and ideal angles were measured. Subsequently, 15 sets of photographs representing different skeletal patterns were randomly selected. A panel of juries evaluated facial attractiveness using a 7-point Likert scale. The correlation between facial attractiveness and measured parameters was studied. Results indicated that mean rank FACE-Q Rasch scores of participants' self-rated satisfaction on their facial appearance and HRQoL were not significantly different statistically ($p = 0.06–0.81$) between Class I, II and III. One hundred and eighty juries (mean 24.33 ± 3.82 years old) were recruited. No statistically significant correlations found between facial attractiveness rated by juries and measured parameters related to the golden ratio ($r = -0.47$ to 0.36 ; $p = 0.08$ to 0.98), neoclassical canons ($r = -0.27$ to 0.43 ; $p = 0.11$ to 0.96), ideal ratios ($r = -0.32$ to 0.47 ; $p = 0.08$ to 0.96) and ideal angles ($r = -0.23$ to 0.28 ; $p = 0.31$ to 0.92). In conclusion, the study found that the golden ratio, neoclassical canons, ideal ratios, and ideal angles were not found to be correlated with the facial attractiveness of Malay females. Therefore, these guidelines should be used with discretion during treatment planning and outcome assessment for this specific ethnic group.

Keywords: *Aesthetic perception; facial anthropometry; golden ratio; Malay; neoclassical canon*

INTRODUCTION

Facial attractiveness is one of the key elements that impose one's overall physical attractiveness. It has been known to directly affect an individual's psychosocial function, e.g. self-esteem and social interaction. An attractive face is often associated with qualities such as healthy, intelligent, fertile, and successful. Hence, there is an anticipated rise in the demand for facial aesthetic treatments and computation of facial attractiveness has recently emerged as a new area of research. The groundwork, however, for the success of such technology might probably rely on quantitative methods to define facial attractiveness (Liu *et al.*, 2017). Nonetheless, it has not been established whether beauty can be objectively quantified or if it is primarily a subjective matter influenced by various factors.

Individual experiences, cultural and racial backgrounds, and upbringing are believed to shape one's perception of beauty. Self-perception of one's facial attractiveness has a direct impact on one's psychosocial well-being. For decades, researchers have been trying to quantify facial attractiveness and establish guidelines for what constitutes an attractive face. It is well-established that the perception of facial attractiveness is affected by a spectrum of factors, including psychological factors, different cultural contexts, social acceptance and expectations, socioeconomic status, ethnic origins and social demographic background (Alam *et al.*, 2015). However, some guidelines are widely adopted and have been applied universally, irrespective of gender and ethnicity. Nevertheless, the findings from various research (Mantelakis *et al.*, 2018; Shah & Nair, 2022) have reported contradictory results. Consequently, it remains controversial whether a single standardised guide can be generalised to all.

The concept of human body proportions has been introduced since the times of ancient Egypt and Greece. Both horizontal and vertical anatomical ratios, known as

the neoclassical facial canons, have been proposed as ideal ratios for a beautiful face. Therefore, sculptors, artists, and surgeons have relied on these canons for centuries. In addition to these canons, the golden ratio has also been suggested as an ideal beauty ratio. Researchers (Baker & Woods, 2001; Shell & Woods, 2004) have attempted to validate this relationship by evaluating aesthetic perception in patients before and after orthognathic surgery. While most patients showed improved facial aesthetic scores after treatment, some individuals moved further from the desired ideal values. Conversely, some researchers believed that an attractive face is very close to the average values of the norms and therefore developed some "ideal" ratios and "ideal" angles based on their collected data.

Interethnic differences in facial anthropometry and beauty perception are inevitable. For instance, Latin Americans prefer rectangular faces with wide mouths and large lips, whereas Koreans favour long, tapered faces with small mouths and lips (Bayome *et al.*, 2020). Conversely, Americans and Japanese show a preference for a more retruded lip compared to Africans (Harrar *et al.*, 2018). As globalisation has led to patients from diverse backgrounds seeking treatment, it becomes crucial for surgeons to have an understanding of the distinctive facial characteristics within various ethnic groups. Nonetheless, it is also important to involve the patient in treatment planning process to ensure that the outcome aligns with their expectations.

Currently, the literature exploring the perception of facial attractiveness among Malay ethnic is very minimal. Therefore, the primary objective of this study was to explore the relationship between Malay females' facial attractiveness with the recommended aesthetic guidelines, specifically the golden ratio, neoclassical canons, ideal ratios and ideal angles. In addition, the study also compares self-perceived facial attractiveness and health-related quality of life (HRQoL) among Malay females with different skeletal patterns.

MATERIALS AND METHODS

This prospective study was performed following the principles outlined in the Declaration of Helsinki and was approved by the local Human Ethics Committee (REC/03/2021-UG/IMR/224).

Phase 1

Participants were recruited among Malay female dental students of the Faculty of Dentistry, University Teknologi MARA, as photography models. Only Malay up to the third generation who identified via a self-administered online questionnaire with a healthy body mass index for Asians (18.4 to 24.9 kg/m²) were included. Those with a history of orthodontic or orthognathic treatment, maxillofacial trauma or surgery, obvious craniofacial deformity and uncertain ethnicity were excluded from the study. Written informed consent to participate in this study as well as permission to publish their photographs was obtained from all participants.

All participants filled up a set of online self-administered FACE-Q questionnaires related to facial appearance and HRQoL. The questionnaire includes the skeletal evaluation of satisfaction for face overall, forehead, eyebrows, eyes, nose, cheeks, lips, chin, lower face outline and jaw. Meanwhile, the FACE-Q HRQoL questionnaire consists of social function, psychological function and appearance-related psychosocial distress. Subsequently, a set of five photographs was taken of each participant with neutral facial expression in natural head position, i.e. 1 frontal, 2 three-quarter (left and right) and 2 lateral (left and right) views (Fig. 1). They fixed their gaze with their pupils at the height of their eyes in the mirror during the photography session. The photographs were taken on a green background. The digital camera Nikon 7500 was mounted on a tripod stand and fixed at a distance of 1.6 m from the subjects during the photography session. Their hair was covered, and all make-up and

jewellery were removed to reduce potential extraneous aesthetic factors.

All images were analysed with the MB ruler (MB Softwaresolutions, Iffezheim, Germany). According to already established methodologies (Ricketts, 1982; Kiekens *et al.*, 2008; Mizumoto *et al.*, 2009; Malkoc & Fidancioglu, 2016), the golden ratio, neoclassical facial canons, ideal ratios and angles were applied in this study (Table 1, Figs. 2 to 5). All analyses were performed by two researchers. Images from 10 participants were randomly selected and remeasured 2 weeks later by both researchers to determine intra- and inter-examiner reliability.



Fig. 1 Five photographs were taken of each participant in frontal, three-quarter and lateral views.

Table 1 Soft tissue facial anthropometry landmarks

Abbreviations	Soft tissue landmarks
Al	Alare
Ch	Cheilion
En	Endocanthion
Ex	Exocanthion
Gn	Gnathion
N	Nasion
Sn	Subnasale
Tr	Trichion
Gb	Glabella
Me	Menton
Zy	Zygion
Prn	Pronasale
Ls	Labiale superius
Li	Labiale inferius
Sl	Sublabiale
Sto	Stomion
Cph	Crista philtra
Pog	Pogonion
Gn	Gnathion
Ps	Palpebrale superius
Pi	Palpebral inferius
Go	Gonion
P	Pupil
X	Face width at bipupil level

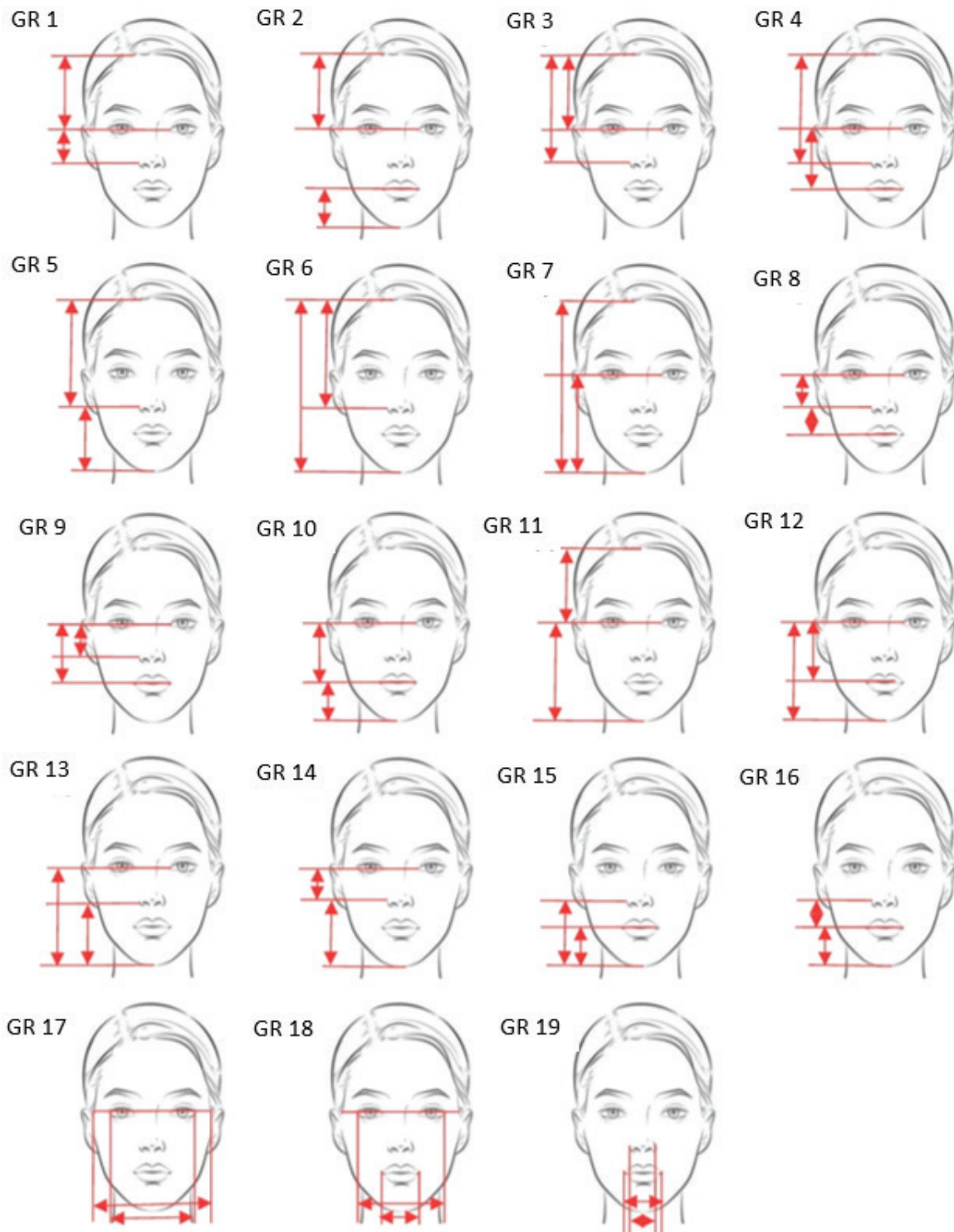


Fig. 2 The golden ratio-related parameters (GR) were measured in this study.

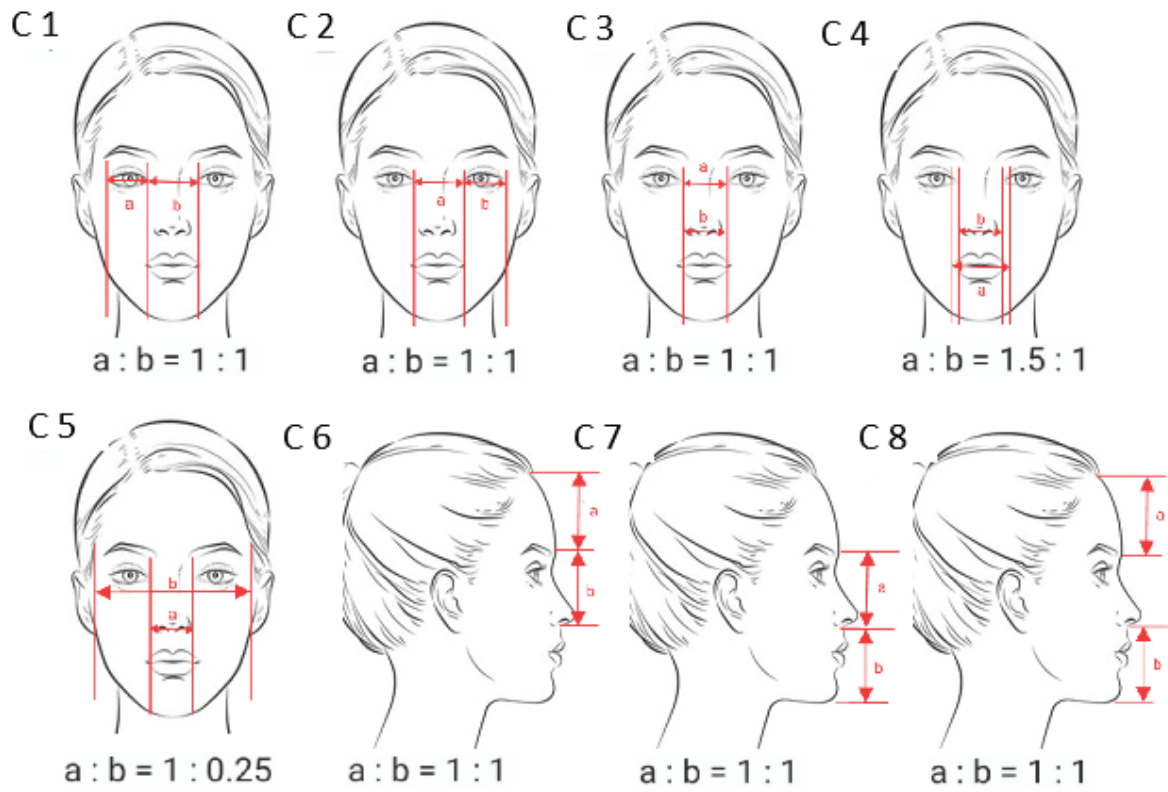


Fig. 3 The selected neoclassical facial canons-related parameters (C) were measured in this study.

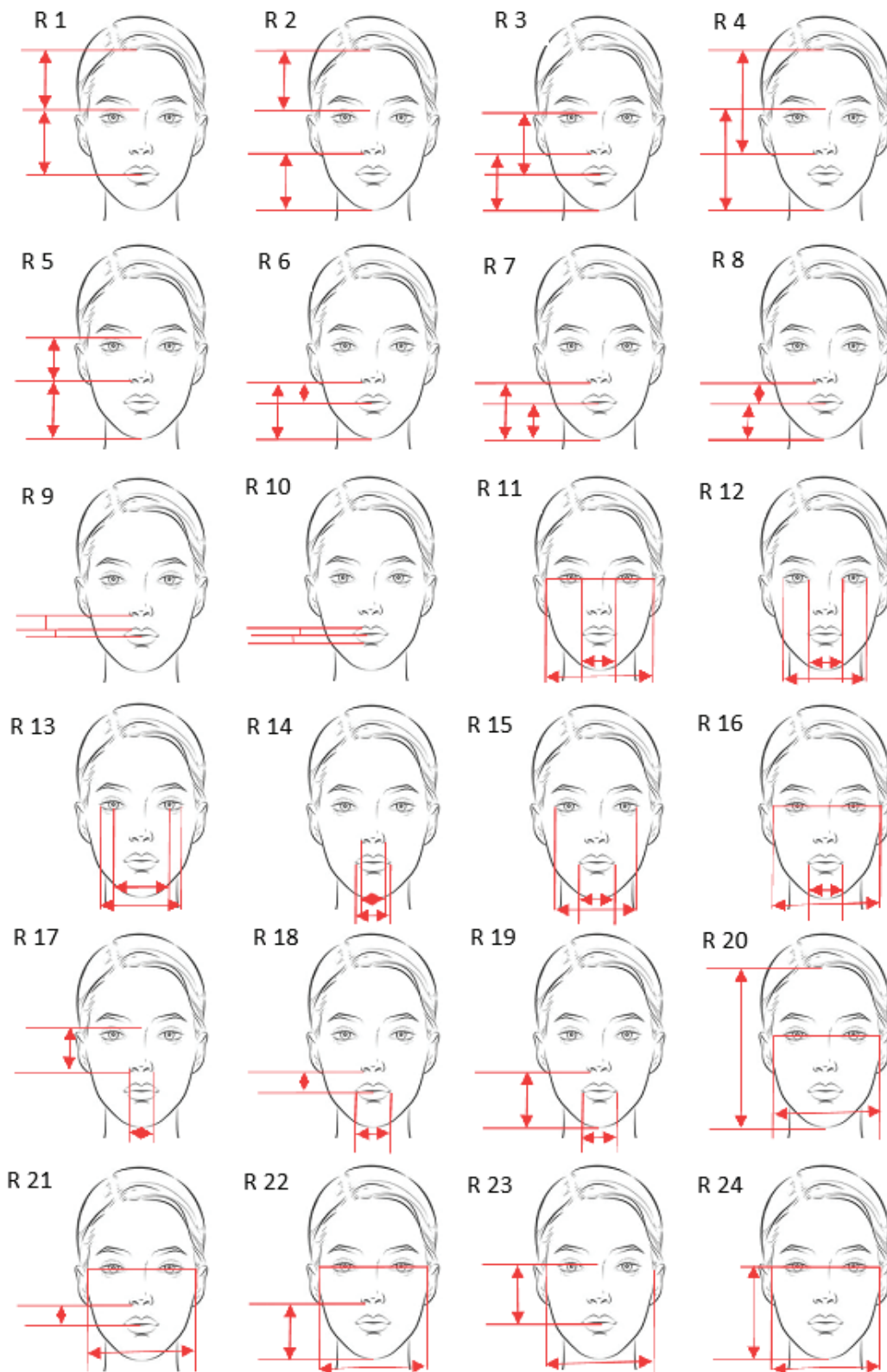


Fig. 4 Ideal ratio parameters (R) measured in this study.

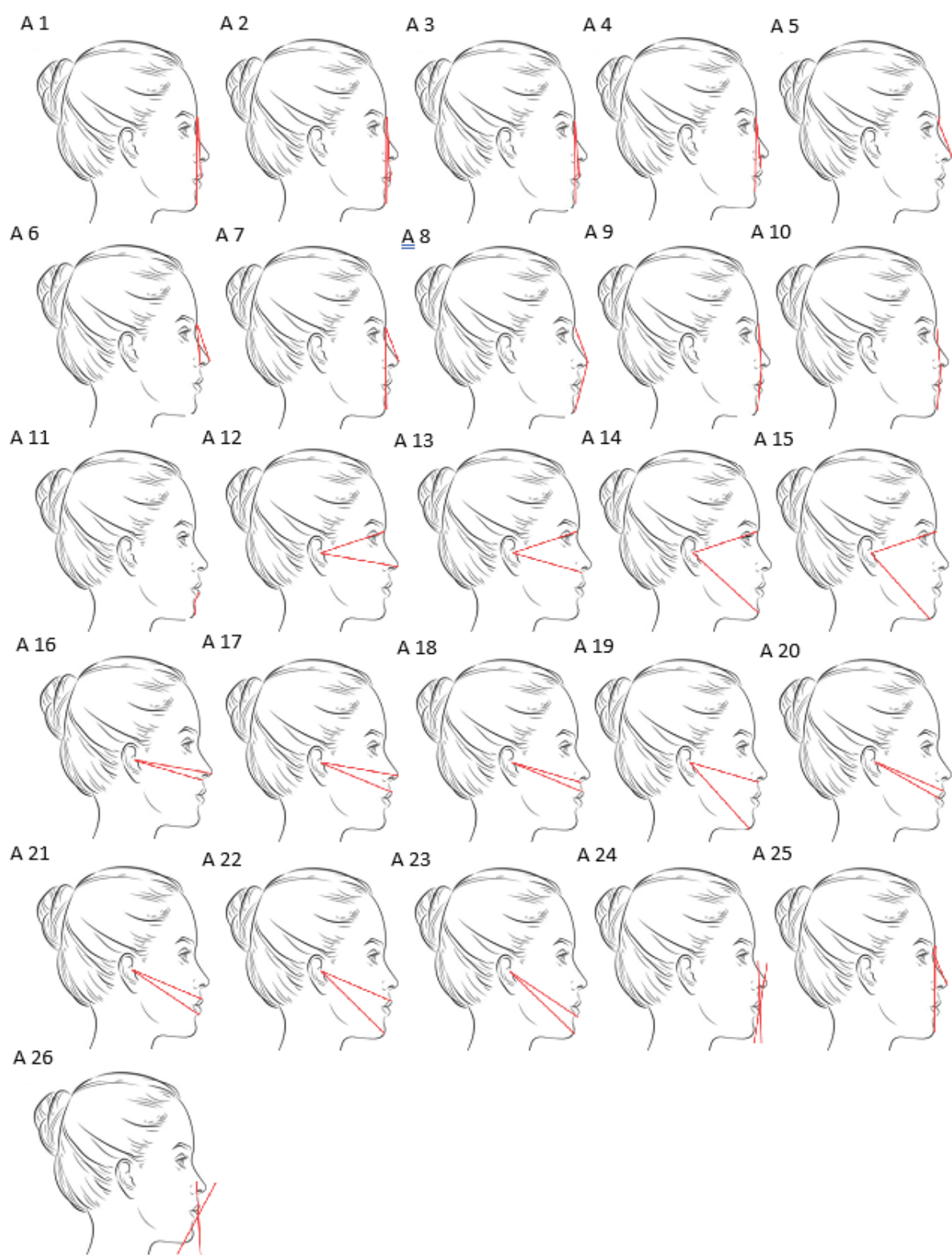


Fig. 5 Ideal angle parameters (A) measured in this study.

Phase 2

Fifteen sets of photographs (five each with skeletal Class I, II and III) were selected randomly. One hundred and eighty dental patients and/or their accompanying persons who attended the dental clinic, Universiti Teknologi MARA were recruited as the panel of juries for facial attractiveness evaluation. Only Malay up to the third generation (identified via a self-administered questionnaire) aged between 18 to 35 years old were recruited to be the juries. The jury evaluated all photographs based on a 7-point Likert scale (1 = extremely attractive; 7 = extremely unattractive). No time limit was set for the evaluation of the photographs. In addition, a question regarding the opinions of juries concerning the most important facial feature or element affecting facial appearance was included in the questionnaire.

Statistical analysis

Intra- and inter-examiner reliability were tested with the intraclass correlation coefficient test. Kruskal-Wallis H test was run to determine if there were differences in FACE-Q Rasch scores between photograph models of Class I, Class II and Class III skeletal patterns. The median score for each set of photographs is computed and those

with a score of ≤ 3 were considered as more attractive faces. The correlations between more- and less-attractive faces and targeted ideal values of the golden ratio, neoclassical canons, ideal ratios and ideal angles were analysed with the point-biserial correlation test. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 27.0 (Armonk, NY: IBM Corp, USA). A p -value of <0.05 is considered significant for all statistical tests.

RESULTS

In Phase 1 of the study, 64 dental students aged between 20 to 24 years old (mean: 21.73 ± 1.29) with a mean BMI of 21.61 (SD: 2.17) kg/m^2 were recruited as photography models. Twenty-two of them were identified as having Class I, 28 were Class II and 14 were Class III skeletal patterns. The mean rank FACE-Q Rasch scores of participants' self-rated satisfaction on their facial appearance and HRQoL were not significantly different statistically ($p = 0.06$ to 0.81) between Class I, II and III (Table 2). The intra-examiner (>0.90) and inter-examiner (>0.86) reliability were good for all golden ratio, neoclassical canons, ideal ratio and ideal angle measurements on the photographs.

Table 2 Comparison of FACE-Q mean rank Rasch scores between Malay females with Class I, II and III skeletal patterns

FACE-Q	Mean rank Rasch scores			p -value
	Class I (n = 22)	Class II (n = 28)	Class III (n = 14)	
Facial appearance satisfaction				
Face overall	34.57	31.29	31.68	0.81
Eyebrow and forehead	31.75	35.48	27.71	0.43
Eyes	26.02	37.55	32.57	0.09
Cheeks	25.43	37.68	33.25	0.06
Nose	28.93	35.63	31.86	0.44
Chin	35.02	32.45	28.64	0.59
Lips	29.73	34.66	32.54	0.63
Lower face and jawline	36.41	28.34	34.68	0.27
Health-related quality of life				
Psychological function	34.91	34.39	24.93	0.22
Social function	35.20	29.29	35.07	0.43
Appearance distress	28.52	33.00	37.75	0.34

Note: $p < 0.05$

A total of 180 participants (154 females, 26 males; mean 24.33 ± 3.82 years old) have been recruited as evaluation juries for the facial attractiveness of the photograph models. However, statistical analysis was not able to be computed for 7 out of 19 golden ratios, 2 out of 8 neoclassical canons, 9 out of 24 ideal ratios and 6 out of 26 ideal angles measurements. This is because these measurements were very

much alike for both more attractive and less attractive faces. There were no statistically significant associations found between facial attractiveness rated by juries and golden ratio ($r = -0.47$ to 0.36 ; $p = 0.08$ to 0.98) (Table 3), neoclassical canons ($r = -0.27$ to 0.10 ; $p = 0.33$ to 0.96) (Table 4), ideal ratios ($r = -0.32$ to 0.47 ; $p = 0.08$ to 0.96) (Table 5) and ideal angles ($r = -0.23$ to 0.28 ; $p = 0.31$ to 0.92) (Table 6).

Table 3 Correlations between golden ratio (GR) and facial attractiveness (targeted value = 1.618)

Parameters	Description	Mean score	
		r	p-value
GR 1	Tr-Ex : Ex-Al	^a	-
GR 2	Tr-Ex : Ch-Me	0.29	0.29
GR 3	Tr-Al : Tr-Ex	^a	-
GR 4	Tr-Al : Ex-Ch	0.08	0.77
GR 5	Tr-Al : Al-Me	0.07	0.82
GR 6	Tr-Me : Tr-Al	0.01	0.98
GR 7	Tr-Me : Ex-Me	^a	-
GR 8	Ex-Al : Al-Ch	0.36	0.19
GR 9	Ex-Ch : Ex-Al	0.36	0.19
GR 10	Ex-Ch : Ch-Me	-0.25	0.36
GR 11	Me-Ex : Ex-Tr	^a	-
GR 12	Ex-Me : Ex-Ch	0.32	0.24
GR 13	Ex-Me : Al-Me	0.31	0.26
GR 14	Al-Me : Ex-Al	^a	-
GR 15	Al-Me : Ch-Me	0.29	0.29
GR 16	Ex-Me : Al-Me	-0.47	0.08
GR 17	X(R)-X(L) : Ex(R)-Ex(L)	0.36	0.19
GR 18	Ex(R)-Ex(L) : Ch(R)-Ch(L)	^a	-
GR 19	Ch(R)-Ch(L) : Al(R)-Al(L)	^a	-

Notes: ^a Cannot be computed because at least one of the variables is constant; $p < 0.05$

Table 4 Correlations between neoclassical canons (C) and facial attractiveness (targeted value = 1)

Parameters	Description	Mean score	
		r	p-value
C 1	Ex(R)-En(R) : Ex(R)-Ex(L)	-0.27	0.33
C 2	Ex(L)-En(L) : Ex(L)-Ex(R)	-0.27	0.33
C 3	En(R)-En(L) : Al(R)-Al(L)	-0.27	0.96
C 4	Ch(R)-Ch(L) : 1.5 (Al(R)-Al(L))	^a	-
C 5	Al(R)-Al(L) : 1/4 (Zy(R)-Zy(L))	^a	-
C 6	Tr-N : N-Sn	0.10	0.72
C 7	N-Sn : Sn-Gn	0.26	0.36
C 8	Tr-N : Sn-Gn	-0.05	0.85

Notes: ^a Cannot be computed because at least one of the variables is constant; $*p < 0.05$

Table 5 Correlations between ideal ratio (A) and facial attractiveness

Parameters	Description	Target value	Mean score	
			r	p-value
R 1	Tr-N : N-Sto	1.000	0.12	0.66
R 2	Tr-N : Sn-Me	1.000	-0.11	0.70
R 3	N-Sto : Sn-Me	1.000	-0.30	0.27
R 4	Tr-Sn : N-Me	1.000	-0.11	0.70
R 5	N-Sn : Sn-Me	0.754	0.28	0.31
R 6	Sn-Sto : Sn-Me	0.333	0.29	0.30
R 7	Sto-Me : Sn-Me	0.667	0.34	0.21
R 8	Sn-Sto : Sto-Me	0.500	0.29	0.30
R 9	Ls-Sto : Sn-Sto	0.360	-0.32	0.24
R 10	Ls-Sto : Sto-Li	0.880	-0.08	0.79
R 11	En(R)-En(L) : X(R)-X(L)	0.200	a	-
R 12	En(R)-En(L) : Ex(R)-Ex(L)	0.333	0.47	0.08
R 13	P(R)-P(L) : Ex(R)-Ex(L)	0.700	a	-
R 14	Al(R)-Al(L) : Ch(R)-Ch(L)	0.625	a	-
R 15	Ch(R)-Ch(L) : Ex(R)-Ex(L)	0.600	a	-
R 16	Ch(R)-Ch(L) : X(R)-X(L)	0.400	0.09	0.76
R 17	Al(R)-Al(L) : N-Sn	0.625	a	-
R 18	Sn-Sto : Ch(R)-Ch(L)	0.400	a	-
R 19	Sn-Me : Ch(R)-Ch(L)	1.330	0.34	0.21
R 20	X(R)-X(L) : Tr-Me	0.783	0.25	0.37
R 21	Sn-Sto : X(R)-X(L)	0.225	a	-
R 22	Sn-Me : X(R)-X(L)	0.530	a	-
R 23	N-Sto : X(R)-X(L)	0.535	a	-
R 24	N-Me : X(R)-X(L)	0.860	-0.01	0.96

Notes: ^a Cannot be computed because at least one of the variables is constant; $p < 0.05$

Table 6 Correlations between ideal angles (A) and facial attractiveness

Parameters	Description	Target value	Mean score	
			r	p-value
A 1	Lsp-G-Pog	6.3	0.03	0.92
A 2	Lip-G-Pog	3.3	-0.10	0.73
A 3	Lsp-N-Pog	5.9	-0.11	0.69
A 4	A-N-B	7.1	0.18	0.52
A 5	G-N-Pn	140.3	-0.07	0.80
A 6	Pn-N-Sn	22.5	a	-
A 7	Pn-N-Pog	27.5	a	-
A 8	N-Pn-Pog	129.5	a	-
A 9	G-Sn-Pog	170.0	0.21	0.45
A 10	N-Sn-Pog	163.0	-0.19	0.50
A 11	Lip-B-Pog	125.5	-0.23	0.41
A 12	N-Po-Pn	23.6	a	-
A 13	N-Po-Sn	28.5	-0.20	0.49
A 14	N-Po-Pog	54.4	a	-
A 15	N-Po-Gn	57.0	a	-
A 16	Pn-Po-Sn	7.0	0.06	0.83
A 17	Pn-Po-Ls	14.5	0.10	0.73
A 18	Sn-Po-Ls	7.0	-0.14	0.62
A 19	Sn-Po-Gn	36.5	0.24	0.40
A 20	Ls-Po-Sto	2.8	-0.10	0.72
A 21	Ls-Po-Li	7.1	0.18	0.53
A 22	Ls-Po-Pog	17.1	0.28	0.31
A 23	Li-Po-Pog	12.5	0.23	0.42
A 24	(Sn-Lsp)-(Pog-Lip)	157.3	0.16	0.57
A 25	(G-Pog)-(N-Pn)	35.0	0.06	0.83
A 26	(B-Lip)-(Lsp-A)	125.0	-0.20	0.47

Notes: ^a Cannot be computed because at least one of the variables is constant; $p < 0.05$

Although there are some variations in opinion, the eyes have been selected as the most important facial part in affecting one's facial attractiveness by both Malay females' (29.7%) and juries' (55.6%) opinions (Table 7). On the other hand, the eyes (39.1%), eyelashes (17.2%) and eyebrows

(10.9%) have been selected by most of the Malay females as their self-rated most attractive facial part (Fig. 6). Meanwhile, the nose (23.4%), facial shape (17.2%), teeth (15.6%) and mouth (7.8%) have had the highest vote by them as their self-rated least attractive facial part (Fig. 7).

Table 7 The most important facial part in affecting one's facial attractiveness

	Malay females' opinion n = 64 (%)	Juries' opinion n = 180 (%)
Eye	19 (29.7)	100 (55.6)
Nose	5 (7.8)	22 (12.2)
Mouth/ lips	4 (6.3)	23 (12.8)
Cheek	–	10 (5.6)
Eyebrows	2 (3.1)	8 (4.4)
Teeth	16 (25.0)	8 (4.4)
Jaw	–	6 (3.3)
Chin	–	2 (1.1)
Forehead	–	1 (0.6)
Facial shape	12 (18.8)	–
Others	6 (9.4)	–

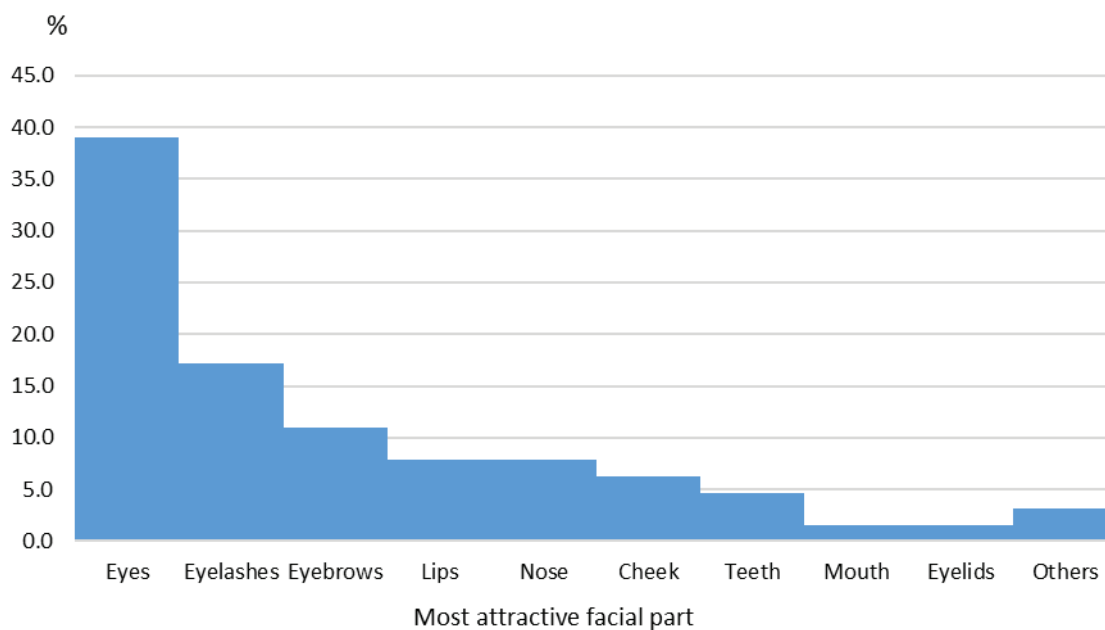


Fig. 6 Self-rated most attractive facial part by Malay females.

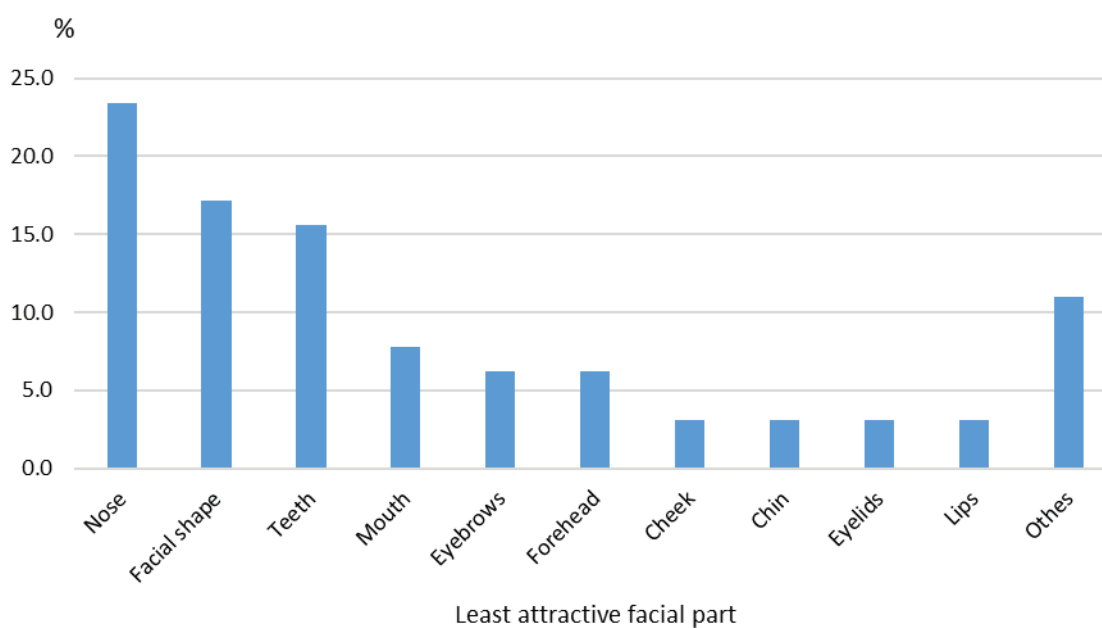


Fig. 7 Self-rated least attractive facial part by Malay females.

DISCUSSION

The present research has examined various aspects of the facial attractiveness of Malay females by exploring the perception of facial attractiveness without being constrained by the conventional concept of an ideal face. Additionally, some previous studies (Alam *et al.*, 2015; Kuroda *et al.*, 2009) have reported a preference for retruded mandibles among different ethnic groups. These have justified the reason for the recruitment of photography models with different skeletal patterns in this study instead of focusing on those with skeletal Class I pattern only.

In contrast to some earlier studies, beauty pageants or celebrities were not recruited as study subjects based on the rationale that extremely beautiful faces are unique and tend to deviate from the average (Dantcheva & Dugelay, 2015). Furthermore, unlike the studies (Mantelakis *et al.*, 2018; Shah & Nair, 2022) that presented the jury with a single frontal photograph, a set of five photographs showing frontal, three-quarter and lateral profiles on both sides was

provided to them. This approach aimed to offer a more comprehensive perspective on facial features for a better assessment of facial attractiveness.

Both Malay females and jury members consistently identified the eyes as the most important facial feature affecting a person's attractiveness, in line with the previous research (Saegusa & Watanabe, 2016) findings. This finding can be attributed to the common practice of individuals gazing at their conversational partner's eyes during communication. The teeth and facial shape were the second and third most popular choices for Malay females. This result could be associated with the recruitment of dental students as participants, who possess heightened self-awareness regarding orofacial features due to their extensive knowledge of norms. Additionally, they are knowledgeable about potential aesthetic improvements that can be achieved on these orofacial features through various dental treatments. Conversely, the mouth/lips and nose were more popular among the jury members. It is noteworthy that the "internal triangle," a

reverse triangle extending from the eyebrows to the chin and encompassing eyebrows, eyes, nose, lips, and chin, has been identified as containing the most critical elements for facial recognition and the perception of attractiveness (Marquardt, 2002).

Meanwhile, it was interesting to discover that the nose has the highest vote when participants assessed it as the least attractive facial feature in their self-perceptions. This finding may be attributed to the relatively broader shape of the Malay nose in comparison to noses of some other ethnic groups, such as Indians and Caucasians. This ethnic variation has likely influenced the participants' perceptions of their noses. Furthermore, the Asian nose often features a low nasal tip with relatively small and delicate lower lateral cartilages (Jang & Alfanta, 2014). Their nasal bones are characterised by being flat and thick, resulting in a lower radix and contributing to the popularity of rhinoplasty among Asians (Jang & Alfanta, 2014).

Validated self-appraised facial aesthetic questionnaires are notably scarce. FACE-Q is a well-developed and validated questionnaire which is generally used for outcome assessment to measure the patient's satisfaction towards their facial appearance and HRQoL (Pusic *et al.*, 2013). The tool is unique as the evaluation is exclusively based on the patient's perspective. The questionnaire's popularity is attributable, in part, to its simplicity and strong psychometric properties. In line with the principles of FACE-Q, it was employed in this study to compare facial aesthetic satisfaction and HRQoL among Malay females with different skeletal patterns. This study revealed that different skeletal patterns had no significant impact on self-perceived facial attractiveness or HRQoL. This outcome is consistent with the findings of a previous study (Alam *et al.*, 2015), which also failed to establish a correlation between facial index and the mean facial satisfaction evaluation score. However, it is noteworthy to observe that Malay females with a Class

I skeletal pattern, which generally regarded as the ideal facial profile, did not have significantly higher FACE-Q scores than those with Class II or III skeletal patterns in both self-perceived attractiveness or HRQoL when compared to. This finding was unexpected, particularly considering that the participants were recruited among dental students who had been exposed to the concept of a skeletal Class I pattern as the ideal facial profile throughout their education. It was interesting to find that Malay females with a Class I skeletal pattern achieved the highest mean rank score for the face overall, chin, lower face and jawline. In contrast, those with a Class II skeletal pattern obtained the lowest mean rank score for the lower face and jawline, while those with a Class III skeletal pattern had the lowest mean rank score for the chin. Although these results were not statistically significant, they were in line with expectations, as the chin, lower face and jawline are affected in individuals with Class II and Class III skeletal patterns. On the other hand, participants with different skeletal patterns were also observed to have no significant differences in their HRQoL. This could partly be attributed to the fact that many of them share a similar socioeconomic and educational background. Nevertheless, one could argue that this should be considered an advantage, as it could help alleviate potential confounding factors that could affect the study's results.

The golden ratio has been regarded as a global standard guideline for aesthetic ideals, biological efficiency and overall well-being across genders and ethnic backgrounds (Packiriswamy *et al.*, 2012). A recent study conducted in India (Shah & Nair, 2022) discovered that attractive faces tend to align closely with the golden ratio in comparison to less attractive faces. However, studies involving beauty pageant contestants yielded contrasting results. With the exception of one parameter, it was observed that all measured parameters among Miss Korea contestants have significantly deviated from the golden ratio (Bayome *et al.*, 2020). Additionally,

most of the facial measurements for Miss Universe and Miss Universe Thailand from the 21st century were reported to be significantly different from the golden ratio (Burusapat & Lekdaeng, 2019). Similarly, there was no correlation found between golden ratio and Malay female facial attractiveness in the present study.

Khoshab *et al.* (2022) reported in their systematic raw data analysis that no single ethnicity or gender consistently approximated neoclassical canons and golden ratio. Similarly, in this study, no neoclassical parameters were found to be correlated with facial attractiveness. A study focusing on beauty contestants from Korea and Paraguay yielded a similar outcome: out of eight parameters, only two for Koreans and one for Paraguayans did not significantly differ from neoclassical canons (Bayome *et al.*, 2020). Additionally, that study also reported significant differences in five out of the eight measured parameters between these two ethnic groups, highlighting the notable inter-ethnic variations in facial anthropometry (Bayome *et al.*, 2020). Furthermore, none of the ideal ratios or ideal angles were found to be correlated with facial attractiveness in our study. The consistent findings across various studies involving diverse ethnic groups have raised a significant question: should these parameters still be employed in treatment planning and outcome assessment for facial surgery?

The panel of jury who were recruited had no prior experience with orthodontic or orthognathic treatment. This precaution was implemented to prevent any biased perceptions that could be influenced by their past treatment experiences, thereby ensuring an impartial assessment of the opinions within the Malay population. However, one of the main limitations of this study is the high female-to-male ratio among the jury panel. While gender influence in attractiveness evaluation was not conclusive, the potential effect needs to be considered when interpreting the results of this study. Additionally, professionals and laymen

could have different perceptions on facial attractiveness due to their knowledge of established facial anthropometry guidelines. Therefore, it could be beneficial for future studies to recruit non-professional participants without relevant background knowledge to conduct self-perceived facial attractiveness to verify the result of the present study.

CONCLUSION

The golden ratio, neoclassical canons, ideal ratios, and ideal angles were not found to be correlated with the facial attractiveness of Malay females. Therefore, these guidelines should be used with discretion during treatment planning and outcome assessment for this specific ethnic group.

ACKNOWLEDGEMENTS

This study is funded by MyRA Research Grant, Universiti Teknologi MARA: 600-RMC/MyRA 5/3/LESTARI (077/2020).

REFERENCES

- Alam MK, Mohd Noor NF, Basri R, Yew TF, Wen TH (2015). Multiracial facial golden ratio and evaluation of facial appearance. *PLoS One*, **10**(11): e0142914. <https://doi.org/10.1371/journal.pone.0142914>
- Baker BW, Woods MG (2001). The role of the divine proportion in the esthetic improvement of patients undergoing combined orthodontic/orthognathic surgical treatment. *Int J Adult Orthodon Orthognath Surg*, **16**(2): 108–120.
- Bayome M, Park JH, Shoaib AM, Lee NK, Boettner V, Kook YA (2020). Comparison of facial esthetic standards between Latin American and Asian populations using 3D stereophotogrammetric analysis. *J World Fed Orthod*, **9**(3): 129–136. <https://doi.org/10.1016/j.ejwf.2020.06.003>

- Burusapat C, Lekdaeng P (2019). What is the most beautiful facial proportion in the 21st century? Comparative study among Miss Universe, Miss Universe Thailand, neoclassical canons, and facial golden ratios. *Plast Reconstr Surg Glob Open*, 7(2): e2044. <https://doi.org/10.1097/gox.0000000000002044>
- Dantcheva A, Dugelay JL (2015). Assessment of female facial beauty based on anthropometric, non-permanent and acquisition characteristics. *Multimed Tools Appl*, 74(24): 11331–11355. <https://doi.org/10.1007/s11042-014-2234-5>
- Harrar H, Myers S, Ghanem AM (2018). Art or science? An evidence-based approach to human facial beauty a quantitative analysis towards an informed clinical aesthetic practice. *Aesthetic Plast Surg*, 42(1): 137–146. <https://doi.org/10.1007/s00266-017-1032-7>
- Jang YJ, Alfanta EM (2014). Rhinoplasty in the Asian nose. *Facial Plast Surg Clin North Am*, 22(3): 357–377. <https://doi.org/10.1016/j.fsc.2014.04.001>
- Khoshab N, Donnelly MR, Sayadi LR, Vyas RM, Banyard DA (2022). Historical tools of anthropometric facial assessment: A systematic raw data analysis on the applicability of the neoclassical canons and golden ratio. *Aesthet Surg J*, 42(1): NP1–NP10. <https://doi.org/10.1093/asj/sjab339>
- Kiekens RM, Kuijpers-Jagtman AM, van 't Hof MA, van 't Hof BE, Straatman H, Maltha JC (2008). Facial esthetics in adolescents and its relationship to “ideal” ratios and angles. *Am J Orthod Dentofacial Orthop*, 133(2): 188.e1–188.e8. <https://doi.org/10.1016/j.ajodo.2007.07.013>
- Kuroda S, Sugahara T, Takabatake S, Taketa H, Ando R, Takano-Yamamoto T (2009). Influence of anteroposterior mandibular positions on facial attractiveness in Japanese adults. *Am J Orthod Dentofacial Orthop*, 135(1): 73–78. <https://doi.org/10.1016/j.ajodo.2006.12.021>
- Liu S, Fan YY, Guo Z, Samal A, Ali A (2017). A landmark-based data-driven approach on 2.5D facial attractiveness computation. *Neurocomputing*, 238: 168–178. <https://doi.org/10.1016/j.neucom.2017.01.050>
- Malkoc S, Fidancioglu A (2016). The role of ideal angles, ratios, and divine proportions in aesthetic evaluation of adolescents. *Aesthetic Plast Surg*, 40(1): 1–12. <https://doi.org/10.1007/s00266-015-0581-x>
- Mantelakis A, Iosifidis M, Al-Bitar ZB, Antoniadis V, Wertheim D, Garagiola U et al. (2018). Proportions of the aesthetic African-Caribbean face: Idealized ratios, comparison with the golden proportion and perceptions of attractiveness. *Maxillofac Plast Reconstr Surg*, 40(1): 20. <https://doi.org/10.1186/s40902-018-0161-5>
- Marquardt SR (2002). Dr. Stephen R. Marquardt on the Golden Decagon and human facial beauty. Interview by Dr. Gottlieb. *J Clin Orthod*, 36(6): 339–347.
- Mizumoto Y, Deguchi T Sr, Fong KW (2009). Assessment of facial golden proportions among young Japanese women. *Am J Orthod Dentofacial Orthop*, 136(2): 168–174. <https://doi.org/10.1016/j.ajodo.2007.07.029>
- Packiriswamy V, Kumar P, Rao M (2012). Identification of facial shape by applying golden ratio to the facial measurements: An interracial study in Malaysian population. *N Am J Med Sci*, 4(12): 624–629.
- Pusic AL, Klassen AF, Scott AM, Cano SJ (2013). Development and psychometric evaluation of the FACE-Q satisfaction with appearance scale: a new patient-reported outcome instrument for facial aesthetics patients. *Clin Plast Surg*, 40(2): 249–260. <https://doi.org/10.1016/j.cps.2012.12.001>
- Ricketts RM (1982). Divine proportion in facial esthetics. *Clin Plast Surg*, 9(4): 401–422.

Saegusa C, Watanabe K (2016). Judgments of facial attractiveness as a combination of facial parts information over time: Social and aesthetic factors. *J Exp Psychol Hum Percept Perform*, **42**(2): 173–179. <https://doi.org/10.1037/xhp0000149>

Shah R, Nair R (2022). Comparative evaluation of facial attractiveness by laypersons in terms of facial proportions and equate it's deviation from divine proportions - A photographic study. *J Oral Biol Craniofac Res*, **12**(5): 492–499. <https://doi.org/10.1016/j.jobcr.2022.06.004>

Shell TL, Woods MG (2004). Facial aesthetics and the divine proportion: A comparison of surgical and non-surgical class II treatment. *Aust Orthod J*, **20**(2): 51–63.