Does facial appearance of dentofacial deformity influence the need for orthognathic surgery: The Malaysian perception

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A B S T R A C T

Aim: This study evaluates perception toward facial appearance in dentofacial deformity and the need for orthognathic surgery among the public with and without dental backgrounds.

Materials and Methods: A questionnaire consisting of 12 facial photographs of cases with dentofacial deformity or malocclusion in varying severity was used. A hundred individuals were selected to answer the questionnaire. The perception of facial appearance (FAS), treatment need score (TNS), and knowledge regarding dentofacial deformity were used for the evaluation.

Results: Significant differences were found between dental and non-dental when the respondents' knowledge in all the questionnaire items ($p < 0.05$) was assessed. However, no significant difference was found in the mean of FAS and TNS in all the presented cases (normal, borderline, severe). Pearson correlation between perceived FAS and TNS was statistically negative for severe and normal cases, whereby a decrease in FAS for severe cases showed an increase in TNS, and an increase in FAS for normal cases showed a decrease in TNS.

Conclusion: Respondents with dental background had sound knowledge of dentofacial deformity. A poorly attractive respondent with dentofacial deformity showed a greater need for orthognathic surgery.

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Introduction

Facial attractiveness has long been a desirable physical characteristic in all societies, where facially attractive people are known to be treated better than less attractive people. It was believed that the factors and components that contribute to facial attractiveness were not arbitrary.^{1,2} They are mainly contributed by the skeletal features underlying the soft tissues. The lower face is also largely influenced by the occlusal relationship of the maxillary and the mandibular dentition.^{3–5} A major consequence of dentofacial deformity is malocclusion, in addition to a lack of facial attractiveness, which negatively affects the psychosocial function. Multiple studies have reported that dentofacial deformity can significantly affect patients' psychosocial function and, hence, their quality of life.^{6–8}

Most patients visiting orthodontic clinics seek treatment to improve dental function and aesthetics.^{9,10} The objective of orthodontic treatment is to improve facial aesthetics while establishing the ideal occlusion. Unfortunately, for non-growing patients with severe dentofacial deformity, orthognathic surgery is the only solution. Many studies have shown that the outcome of orthognathic surgery can positively benefit the patients' psychological health.^{8,11,12}

An assessment of the need for orthodontic treatment should include the objective evaluation of dentofacial appearance. One of the standardized techniques that are most commonly used for assessing malocclusion for orthodontic treatment involves a rating system, which uses an index to determine dental health and the aesthetic impairment component.^{13–16} However, the assessment of dentofacial attractiveness is difficult to quantify, as judgments for facial attractiveness vary greatly between individuals and cultures. While historians and artists believe that symmetry and averageness contribute to the ideal of facial beauty, the review of the literature suggests that a distinguishing facial feature, which is contributed by the occlusion and gender-specific characteristics, leads to an intuitive idea of attractive. There are numerous ways to assess dentofacial attractiveness qualitatively and quantitatively.¹⁷ One of the pioneer standardized rating scales for aesthetics consists of 10 standard reference photographs demonstrating different levels of dental attractiveness.

In developed countries, the idea of undergoing orthognathic surgery has been widely popular among the public.^{18–22} The decision to opt for orthognathic surgery in severe cases of malocclusion is highly dependent on the influence made by the referring dentist. However, in Malaysia, a limited number of cases of orthognathic surgery have been reported in the past twenty years.²³ The main reason for the refusal to undergo surgery is believed to be socio-cultural differences among Malaysians, be it laypersons or dental practitioners. The perception of defying

cosmetic surgery to improve facial appearance for aesthetic purposes is believed to be strongly against moral and religious reasons. Yet, there is no report that lends credence to this reasoning. In addition, public awareness about dentofacial deformity and orthognathic surgery has never been studied in Malaysia.

Therefore, the purpose of this study is to evaluate the knowledge of dentofacial deformity and the perception of dentofacial deformity affecting facial appearance and treatment needs among Malaysians. This study also compares the knowledge and perception of individuals with dental and non-dental background about dentofacial deformity.

Materials and Methods

An approval to conduct this questionnaire-based study was obtained from the IIUM Research Ethics Committee (IREC-760). This cross-sectional study consisted of 100 respondents attending a dental polyclinic in an institution on the east coast of Malaysia. The sampling frame for the respondents included individuals attending polyclinic for dental treatments, family members accompanying the individuals, and clinical staff members in the institution. The sample size was determined using the Altman's nomogram, based on the desired statistical power of 0.95. The inclusion criteria for the respondents were 1) age of more than 18 years; 2) no apparent facial deformities, craniofacial abnormalities, or psychological problems; and 3) medically and physically capable of participating in the questionnaire. Patients undergoing orthodontic or orthognathic treatment or review were excluded from this research. The respondents were selected using convenience sampling and, then, divided into two groups according to their dental education background.

For the questionnaire design, 12 clinical cases presenting malocclusion and with or without accompanying dentofacial deformity were selected by an orthodontist, based on several criteria. Lateral cephalograms were traced for cephalometric analysis using Eastman Standard.²⁴ The analysis was done by two dentists and further verified by an orthodontist. Measurements for cephalometric analysis include ANB value, incisal inclination indicative of dental compensation, and the aesthetic E-line for soft tissue. These cases were, then, divided into three groups, according to the overall assessment and cephalometric values. ANB angle, incisal inclination, and asymmetry were set as the primary predictors, while soft tissue evaluation (E-line) was a secondary predictor. The division of the groups was summarized in Table 1. Their facial photodocumentations were presented to the respondents for reference (see Fig. 1). Informed consent from these twelve cases was obtained prior to the commencement of this study.

Table 1.

Summary of criteria used for division of groups based on severity of dentofacial deformity

	Normal	Borderline	Severe
ANB angle	0° to 5°	5° to 7° for Class II -1° to -3° for Class III	> 7° for Class II < -4° for Class III
Incisal inclination	Mandibular incisal 93° ± 6° Maxillary incisal 109° ± 6°	Maxillary incisal 101° to 102° for Class II skeletal base Mandibular incisal 85° to 86° for Class III skeletal base	> 100° of maxillary incisal inclination for Class II skeletal base < 83° for mandibular incisal for Class III skeletal base
Facial asymmetry	No facial asymmetry	Mild to moderate facial asymmetry	Severe facial asymmetry
Aesthetic E-line (Rickett's)	Both lips should be behind this line, with the upper lip by around 4 mm and the lower lip by around 2 mm		

The questionnaire was divided into three sections (refer to Appendix) to assess the socio-demographic background, knowledge regarding dentofacial deformity, and perception of facial attractiveness and the need for surgical treatment. Seven questionnaire items — regarding facial appearance, malocclusion, speech, mastication, social health, orthodontic treatment, and surgical treatment related to dentofacial deformity — assess the knowledge on the dentofacial deformity. The perception of facial attractiveness and the need for treatment were assessed based on visual analog scores given to each of the 12 selected cases.

These questions were designed based on earlier studies for assessing the knowledge and perception of dentofacial deformity and orthognathic surgery.^{1,5,10,25} Content validity was assessed, and the mean item-content validity index (I-CVI) and the scale-content validity index (S-VCI) were found to be relevant (CVI > 0.7). The pretesting of the questionnaire was done on 20 randomly selected patients attending the polyclinic for dental treatment. The questionnaire was finalized after modifying ambiguous questions based on the validity assessment.

The collected data was entered and analyzed using the Statistical Package for the Social Sciences (SPSS) Version 22.0. The respondents' knowledge of dentofacial deformity was evaluated using a chi-square test, whereas mean FAS and mean TNS were analyzed using an independent *t*-test. Pearson correlation was used to measure the strength and the direction of the linear relationship between FAS and TNS.

Results

Twelve lateral cephalometric radiographs of healthy males and females were examined, traced, and divided into three groups according to the severity of their dentofacial deformity based on the ANB angle, which indicates the magnitude of a jaw discrepancy. A paired *t*-test was used to test the inter-examiner calibration between two cephalogram tracers. The results showed no significant difference in the tracing reading of all the cephalometric variables between the two examiners with *p*-value > 0.05.

In total, 100 respondents were selected for this study. Table 2 shows the distribution of the respondents according

Fig. 1. Facial photographs of selected cases included in the questionnaire.

Table 2.
Demographic background of respondents

	Dental (<i>n</i> = 50)	Non-dental (<i>n</i> = 50)	Total percentage (<i>n</i> = 100)	<i>p</i> -value
Gender				0.682
Male	18	21	39	
Female	32	29	61	
Age				^a 0.001
18 – 30 years	43	25	68	
31 – 45 years	6	13	19	
> 45 years	1	12	13	
Race				0.242
Malay	50	47	97	
Chinese	—	3	3	
Religion				0.213
Islam	50	47	97	
Buddhist	—	2	2	
Others	—	1	1	
Education level				^a 0.002
Post-degree level	1	2	3	
Degree level	37	17	54	
Diploma	6	16	22	
Pre-University	2	1	3	
Secondary school	4	11	15	
Others	—	3	3	

^a*p*-value < 0.05; Independent *t* test.

to their gender, age, race, religion, education level, and dental background. Fifty of the respondents had a dental education background and the remaining respondents did not have any dental background. There was no significant difference in the respondents based on gender, race, and religion ($p > 0.05$). The majority of the respondents were from the same age group, with 68% of them being in the age group 18-30 years ($p < 0.05$). There was a statistically increased percentage of participants with degree and diploma as their highest level of education.

In general, the responses to items regarding dentofacial deformity affecting facial appearance, malocclusion, speech, mastication, social health and its surgical treatment suggest that more than 70% of the respondents had knowledge. However, only 33% of the respondents indicated that severe dentofacial deformity could not be corrected by orthodontic treatment alone. The percentage of the respondents having knowledge on dentofacial deformity based on dental background is presented in Table 3 and Fig. 2. It was found that respondents with a dental background were more aware of

Table 3.
Percentage of correct knowledge on dentofacial deformity based on dental background

Questionnaire Items	Total (<i>N</i> = 100) (%)	Dental (<i>N</i> = 50)	Non-dental (<i>N</i> = 50)	<i>p</i> -value
Q1. Facial appearance	78	95% (48)	70% (35)	^a 0.001
Q2. Malocclusion	80	95% (48)	64% (32)	^a 0.000
Q3. Speech	71	88% (44)	54% (27)	^a 0.001
Q4. Mastication	72	84% (42)	60% (30)	^b 0.024
Q5. Social health	70	90% (45)	50% (25)	^a 0.000
Q6. Orthodontic treatment	33	45% (23)	20% (10)	^a 0.000
Q7. Surgical treatment	77	95% (48)	58% (29)	^a 0.000

^a*p*-value < 0.01; χ^2 test.

^b*p*-value < 0.05; χ^2 test.

Fig. 2. Number of correct responses between dental and non-dental background.

the conditions presented by questions than those without a dental background. A significant number of dental respondents had knowledge of items regarding facial appearance, malocclusion, speech, mastication, social health, and surgical treatment, with their correct responses ranging from 84% to 95%. On the contrary, only 50%–70% of non-dental respondents could correctly mark the same questionnaire items (p -value < 0.05). However, when asked about the correction for severe dentofacial deformity, only 45% and 20% of the dental and non-dental respondents, respectively, responded that severe dentofacial deformity cannot be corrected by orthodontic treatment alone.

In general, the mean FAS and the mean TNS calculated for each group of the dentofacial deformity for all respondents were recorded in Table 4. The mean FAS for severe, borderline, and normal cases was 4.0, 5.6, and 6.4, respectively. There was no significant difference in FAS in the severe, borderline, and normal groups with p -value > 0.05 . In the case of TNS, no significant difference was found between severe, borderline, and normal groups, given the mean TNS for severe, borderline, and normal cases was 6.6, 4.4, and 3.4, respectively. Although statistically not

Table 4.

Mean perceived Facial Appearance Score (FAS) and perceived Treatment Need Score (TNS) in total respondents

	Mean FAS (SD)	^a p -value	^b Mean TNS (SD)	^b p -value
Severe	4.0 (1.6)		6.6 (2.2)	
Borderline	5.6 (1.4)	0.064	4.4 (1.8)	0.406
Normal	6.4 (1.5)		3.4 (1.6)	

^a p -value > 0.05 One-way ANOVA between three groups within FAS.

^b p -value > 0.05 One-way ANOVA between three groups within TNS.

Table 5.

Comparison of mean of perceived FAS of dental and non-dental respondents using independent t-test

	Mean FAS of dental	Mean FAS of non-dental	p -value
Severe	3.7 (1.4)	4.3 (1.9)	^a 0.075
Borderline	5.4 (1.3)	5.9 (1.5)	^a 0.065
Normal	6.1 (1.4)	6.7 (1.6)	^a 0.051

^a p -value > 0.05 ; Independent t test.

significant, the severe group revealed relatively lower mean FAS and relatively higher TNS than the other groups.

In Table 5, the mean perceived FAS for dental and non-dental respondents was compared. In severe cases, the mean perceived FAS of the dental respondents was 3.7, while non-dental respondents scored 4.3. The mean perceived FAS of dental and non-dental respondents for the normal group was 6.1 and 6.7, respectively. The p -values showed no significant difference in the mean FAS of dental and non-dental respondents in all cases ($p > 0.05$). The results indicated that there was an agreement in the

Table 6.

Comparison of mean of perceived TNS of dental and non-dental respondents using Independent t test

	Mean TNS of dental	Mean TNS of non-dental	p -value
Severe	6.7 (2.1)	6.4 (2.2)	^a 0.579
Borderline	4.7 (1.8)	4.1 (1.8)	^a 0.152
Normal	3.5 (1.7)	3.3 (1.6)	^a 0.488

^a p -value > 0.05 ; Independent t test.

Table 7.

Correlation between perceived FAS and perceived TNS for different dentofacial deformity and dental background

		Mean FAS	Mean TNS	Pearson correlation, r	p -value
Severe	Dental	3.7	6.7	−0.599	^a 0.000
	Non-dental	4.3	6.4	−0.235	0.100
Borderline	Dental	5.4	4.7	−0.531	^a 0.000
	Non-dental	5.9	4.1	−0.463	^b 0.001
Normal	Dental	6.1	3.5	−0.396	^b 0.004
	Non-dental	6.7	3.3	−0.168	0.243

^a p -value < 0.01 , Pearson correlation.

^b p -value < 0.05 , Pearson correlation.

Fig. 3. Correlation between perceived FAS and perceived TNS for different severity of dentofacial deformity and dental background.

perceived FAS of the respondents with a dental background and without a dental background.

The comparison of the mean TNS calculated for dental and non-dental respondents is shown in Table 6. The results indicate no significant difference in the perceived TNS for dental and non-dental respondents with p -value > 0.05 . For normal cases, the TNS of dental and non-dental respondents was relatively low (3.5 and 3.3, respectively), while for the severe group, it was high; dental respondents scored 6.7 and non-dental 6.4.

The correlation between the perceived FAS and the perceived TNS for different dentofacial deformity and dental background is presented in Table 7. All groups showed a statistically significant correlation between FAS and TNS, except for severe and normal cases by non-dental respondents ($p > 0.05$). There were significant correlations between the perceived FAS and TNS among dental respondents regardless of the severity of the cases, with a strong negative correlation in severe and borderline cases ($r = -0.599$ and $r = -0.531$, respectively). However, the correlation for severe and normal cases in non-dental respondents was weak, with the Pearson correlation coefficient, r , of -0.235 and -0.168 , respectively. Figure 3 shows the strength and the direction of the linear relationship between FAS and TNS of dental and non-dental respondents for each severity group.

Discussion

The key findings of this study were (1) the majority of respondents had sound general knowledge related to dentofacial deformity regardless of their dental background, with 70% correct answers in all but one questionnaire item regarding treatment with orthodontics; (2) respondents with dental background had better knowledge on dentofacial deformity; (3) the perception of facial attractiveness and treatment needs were the same in different severity of dentofacial deformity regardless of dental background; and (4) there was a strong negative correlation between perceived facial attractiveness and treatment needs in all groups of severity for dental respondents and in severe and borderline groups for non-dental respondents.

Understanding patients' perception of facial attractiveness is the most crucial part of any orthodontist and maxillofacial surgeon practice, as the perception of facial attractiveness varies based on gender, age, social and educational background.^{1,2,26} Various studies regarding the awareness and perception of dentofacial appearance in different educational backgrounds reported that laypersons without dental education background and non-regular dental attenders scored least, whilst orthodontic patients scored the highest in perceiving dentofacial appearance.^{1,26,27} People with dental education were reported to

be more aware of aesthetics during their dental education. Not only that, orthodontic patients showed more interest and had high aesthetics expectations. In addition, a previous study done by Tufekci *et al.* also reported that those who had dental background were found to be more conscious of their skeletal profile, and the perception of beauty and attractiveness can be influenced by the level of specialty.²⁷ This is in agreement with the current study whereby the dental respondents reported significantly more knowledge in dentofacial deformity when compared to the non-dental respondents.

A previous study done by Ngeow *et al.* reported poor acceptance of the public for surgery. The refusal to accept cosmetic surgery is thought to be caused by the different socio-economic and socio-cultural status among the Malaysians.^{23,28} This is evident in the current study where the majority of the respondents perceived that skeletal discrepancies could be corrected by orthodontic treatment. This indicated that the public had generally poor knowledge of dentofacial deformity and its treatment options. This can also explain how the public has low acceptance toward orthognathic surgery as the treatment for dentofacial deformity.

In contrast, some people refrain from undergoing orthognathic surgery because of the in-depth knowledge they have about the risks of complications, burden of care, and lack of internal motivation.²⁹ A study done by Hagensli *et al.* looked at why patients avoid orthognathic surgery. They found that 52% of the unoperated patients opted out of the elective surgery because their malocclusion and skeletal deformity was not particularly severe compared to the scope of surgical treatment.³⁰ Moreover, the lack of external motivation and support from family and friends also led to the refusal of treatment. Financial problems can also cause a deferment of interceptive treatment, possibly leading to a severe skeletal discrepancy in adulthood.¹¹

In an article written by Sousa, A. D., less attractive people faced more judgment and reactions from other people due to their facial deformity.³¹ Although the current study did not show any significance of perceived facial attractiveness and perceived treatment needs of different severity groups, there was a significantly strong correlation between perceived facial attractiveness and perceived treatment needs in severe and borderline cases. In this study, we found a negative correlation between facial attractiveness and treatment needs, whereby a lower perceived facial attractiveness score in severe dentofacial deformity showed a higher perceived treatment need. This indicated that when the perceived facial attractiveness was low, there was a high perceived treatment need. This is in agreement with the general indication of orthognathic surgery to correct dentofacial deformity to improve facial aesthetics.²²

In conclusion, respondents with dental background showed sound knowledge about dentofacial deformity.

The perception of facial attractiveness and treatment needs of patients with dentofacial deformity is not influenced by dental background. In addition, a poorly attractive person with dentofacial deformity was perceived to have a higher need for orthognathic surgery. Despite these findings, the conclusion made from the study needs to be carefully interpreted as external validity lacks strength. The authors recommend that this study should be expanded to other parts of the country to gain a wider representation of facial aesthetics among the Malaysian population.

Ethical Approval

The approval to conduct this questionnaire-based study was obtained from the International Islamic University Malaysia (IIUM) Research Ethics Committee (IREC-760).

Patient Consent

Written patient consent for clinical photographs had been obtained to publish clinical photographs.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors report no conflicts of interest related to this study.

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Questionnaire for the study “Perception on facial appearance of dentofacial deformity”

Background of the Study

The dentofacial deformity is a condition that affects the position, size, shape, or orientation of the facial skeleton. This abnormal skeletal pattern is caused by an imbalance in

skeletal growth due to genetic problems, congenital problems, pathologic conditions, or trauma. Although uncommon, this condition results in an imbalance of facial harmony and malocclusion and causes improper chewing, speech impediments, impaired breathing, as well as psychosocial challenges. It can be treated with combined orthodontic treatment and orthognathic surgery, which can improve the physiological function and have a positive psychosocial benefit. In Malaysia, a limited number of cases have been reported for dentofacial deformity treated by surgery when compared to other developed countries. In the past decade, the small number of surgery is thought to be due to differences in socio-cultural and religious beliefs among Malaysians. The other reason could be the lack of awareness of this condition and the available treatment. Nevertheless, there has been a slight increase in the prevalence of dentofacial deformity treated by orthognathic surgery in this country. Therefore, it will be of added value for both orthodontists and oral and maxillofacial surgeons to understand the level of perception and the status of knowledge about the disorder through this questionnaire survey.

Aim of Study

The aim of this study is to conduct a questionnaire survey to quantitatively evaluate the perception and knowledge of dentofacial deformity and to differentiate them between participants with a dental background and without a dental background.

Research Intervention

This research involved the participation of selected patients attending Orthodontic Specialist Clinic, Kulliyyah of Dentistry, IIUM Kuantan Campus, with a clinical presentation of malocclusion and various forms and severities of dentofacial deformity. Full face photographs of the selected patients were used for the study and included in the questionnaire. These photographs were seen by 100 participants to answer the questions for the survey.

Information to Survey Participants

Facial appearance and attractiveness are sensitive issues. Patients' photographs constitute an important part of medical records in orthodontic and oral surgery units. Such photographs can aid in the diagnostic process and long-term follow-up. They are also beneficial for the use of teaching and research purposes. Patients involved in this study have given their consent to display their photographs to the respondents of this survey questionnaire. Photos in

this booklet are entirely private and confidential, and they should only be used by the researchers involved in this study.

Confidentiality

Under Personal Data Protection Act 2010, patients may possess the rights to protect the confidentiality of their personal data, regarding collection, custody, retention, management, control, use (including analysis or comparison), non-disclosure, erasure, and/or dealing with or disposing of any personal data in or for this study.

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