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Laypersons' Perception Towards Gummy Smile and Facial Types: Acceptability and Treatment Benefit

Noraina Hafizan Norman

Centre of Paediatric Dentistry and Orthodontic Studies, Faculty of Dentistry, Universiti Teknologi MARA, Malaysia, noraina@uitm.edu.my

Anis Azyan Ahmad Othman

Ministry of Health Malaysia, anisazyan92@gmail.com

Nur Atiff Azhar

Ministry of Health Malaysia, atiffchan@gmail.com

Tong Wah Lim

Division of Restorative Dental Sciences, Faculty of Dentistry, the University of Hong Kong, Prince Philip Dental Hospital, Hong Kong, tongwah@hku.hk

Zethy Hanum Mohamed Kassim

Centre of Paediatric Dentistry and Orthodontic Studies, Faculty of Dentistry, Universiti Teknologi MARA, Malaysia, zethy@uitm.edu.my

See next page for additional authors

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Authors

Noraina Hafizan Norman, Anis Azyan Ahmad Othman, Nur Atiff Azhar, Tong Wah Lim, Zethy Hanum Mohamed Kassim, Sarah Haniza Abdul Ghani, and Melati Mahmud

ORIGINAL ARTICLE

Laypersons' Perception Towards Gummy Smile and Facial Types: Acceptability and Treatment Benefit

Noraina H. Norman^{*1}, Anis AA. Othman², Nur A. Azhar², Tong W. Lim³, Zehthy HM. Kassim¹, Sarah H. Ghani¹, Melati Mahmud¹

¹*Centre of Paediatric Dentistry and Orthodontic Studies, Faculty of Dentistry, Universiti Teknologi MARA, Malaysia*

²*Ministry of Health, Malaysia*

³*Division of Restorative Dental Sciences, Faculty of Dentistry, The University of Hong Kong, Prince Philip Dental Hospital, Hong Kong*

**Correspondence e-mail to: noraina@uitm.edu.my*

ABSTRACT

Smile aesthetic perceptions could have different impact on orthodontic and prosthodontic treatment management and options to the patient **Objectives:** To determine the laypersons' smile aesthetic perceptions; irrespective of age and gender, of gummy smile and its treatment need and benefit on three different facial types. **Methods:** Smiling frontal photographs of a male and female subject were altered to simulate three facial types (brachyfacial, mesofacial and dolichofacial) with different levels of gummy smile increase from 2.0mm to 5.0mm. A total of 150 laypersons ranging from 18-45 years old were randomly approached to rate the photographs. Perceptions differences were assessed using visual analog scale for each group. **Results:** Repeated measure ANOVA was applied and showed that the mean level of attractiveness among three different facial types based on gummy smile levels was not statistically significant. This suggests that the facial type does not influence the laypersons' ratings on gummy smile level. Further test found that the laypersons perceived 4.0mm gummy smile as borderline attractive while at 5.0mm is considered as unaesthetic. Chi Square test showed that there was statistically significant difference between the treatment need and attractiveness scoring ($p < 0.01$) whereby the treatment benefit is dependent on attractiveness ratings of gummy smile variables. **Conclusion:** Different levels of gingival show affect the laypersons' perception of smile attractiveness, regardless of the facial type. The higher the level of gingival show, as seen in 4-5mm categories is perceived to be unattractive and thus, more likely to benefit from treatment.

Key words: facial types, gummy smile, laypersons, perceptions, aesthetics

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INTRODUCTION

Good facial appearance with an aesthetically pleasant smile is desired for most adolescents and adults. It is known that facial aesthetics amongst societies is mainly based on subjective opinions rather than proven scientific data.¹ The perception on beauty differ from one individual to another with many different criteria observed.^{2,3} Evidently, the two most important criteria that influence the facial attractiveness of an individual are overall facial harmony and tooth alignment.⁴ Despite the fact that smile attractiveness has been related to face beauty in the past, the variables that affect smile aesthetics of an individual are the smile arc,^{5,6} maxillary gingival display,^{1,6-8} midline deviation⁹ and buccal corridors.¹⁰

With the above and many other studies reviewed, the maxillary gingival display variable or commonly known as gummy smile, another term used for excessive gingival display of the maxillary teeth, has been an important variable discussed in the literature in recent years.^{1,6,7} It is caused by many possible aetiological factors either from skeletal, dental or soft tissue origin⁹ Even though excessive exposure of maxillary gingiva can have a negative impact on the smile aesthetics, the reduction in its exposure can also be considered as unaesthetic.^{6,7} Therefore, it might be better to have some gingival showing during smiling than none at all. It was concluded that at least 1 mm or 2 mm amount of gingival showing generally regarded as aesthetic.⁷

Some previous studies^{9,10} that have been conducted showed the dependency of different variations of smile displays on different facial types. Patients with a brachyfacial structure have a lower facial height compared to dolichofacial patients that have a narrower and longer face. And since the proportion of the smile to the face varies as a result of these changes in facial dimension, the smile may be affected. The midline deviation of less than 2mm was more tolerable in euryproscopic facial type compared to mesoproscopic and leptoproscopic facial types.⁹ The mesofacial subjects with low buccal corridor percentage rated as more attractive than the other degrees of buccal corridor.¹⁰

The perceptions of smile attractiveness differ from one person to the next, and it is influenced by factors such as gender, age, personal experiences and ethnicity.¹¹⁻¹³ Recently, a study found that not only laypersons, but also dental professionals agrees that smiles has an effect on the perceived facial aesthetics of different facial types.¹⁴ However, many existing studies,^{1,3-8,15-17} evaluated the role of maxillary gingival display in smile attractiveness independently of the different facial types. This could have different impact on our treatment management and options to the patient. Hence, our objective is to determine the initial laypersons' perception; irrespective of age and gender, of gummy smile and its treatment need and benefit on three different facial types.

METHODS

The sample size was calculated using the G-Power Software with alpha (α) set at 0.05, the power of (1- β) of 80% and effect size of 0.25 to detect statistically significant differences among the rater groups. It showed that a total sample of 148 subjects was required for the study, increased to 50 subjects per group. Ethics approval was obtained from UiTM Ethics Committee before conducting a primary survey to select a front-view smiling facial photograph of one male and one female subject prior to the actual scoring. Three male and three female subjects were chosen that have the following selection criterias: general frontal symmetry, adequate maxillary incisors tooth display upon smiling and no obvious dental abnormalities or irregularities.⁹ Informed and written consents were taken from all the six subjects for permission to use their photographs for this research. Their photographs were taken using a digital camera (Canon 70D). Thirty individuals were asked to choose only one male and one female subjects among the six subjects that have the same attractiveness in their opinion.

After the primary survey concluded, one male (Figure 1) and one female subject (Figure 2) were obtained. Both subjects had their front-view smiling photographs altered using a photo editing software (CS5; Adobe

System, San Jose, Calif) with the assistance of an expert graphic designer and verification by an orthodontist. Their facial types were modified to create three different facial types, which were brachy-, meso- and dolichofacial. Each facial type was then modified to create a maxillary gingival display of 2.0mm, 3.0mm, 4.0mm and 5.0mm. Slight imperfections or asymmetries that could influence the assessment of attractiveness were modified or removed.

Each subject had 12 photographs and these photographs were organized in sequence order for both genders. The uppermost row is the brachyfacial type followed by mesofacial and dolichofacial at the lowermost row. The maxillary gingival display was gradually increased from 2.0mm to 5.0mm (from left to right picture). Figure 1 and 2 show 24 photographs labelled from A to L (male) and M to X (female) respectively. For easy viewing and scoring, these photographs were displayed on two different A2 size posters supported on hard cardboard.

Survey validation was conducted by having 30 respondents perform face validity while 4 experts performed content validity. The questionnaire was then finalized with four main areas of questioning. The respondents are required to grade the attractiveness of each photograph by selecting a point along a visual analog scale. The visual analog scale consisted of a bar labeled from very unattractive on the left and to very attractive on the right with value from 1 to 100.

The respondents need to determine whether each photograph requires treatment or not. The questionnaires were distributed to 150 respondents among the laypersons in Selangor state by stratified random sampling. All respondents had no dental or health background and were stratified into equal numbers within each age group and gender. The age of respondents was grouped into 29 years and below, 30 – 39 years and 40 years and above. Their participation in the research was voluntary in nature and was blinded of the researcher's objectives.

Statistical analysis was conducted using Statistical Package for Social Science (IBM SPSS) software package version 22. The statistically significant test of association was carried out at the level of $p=0.05$. To compare the attractiveness scores between groups, repeated measure ANOVA within group analysis was applied followed by pairwise comparison with confidence interval adjustment (MD = mean difference). The demographic data of the patients was analyzed descriptively.

RESULTS

A total of 150 laypersons participated in this study. The respondents were tabulated based on gender and age

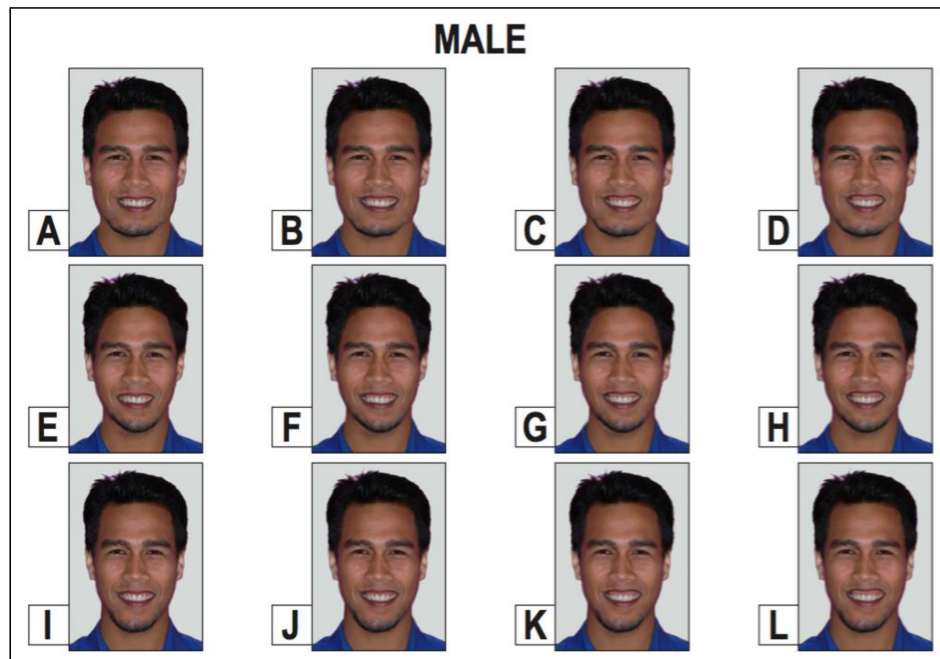


Figure 1. This selected male photograph was digitally altered and organized in sequence A-L. The uppermost row is the brachyfacial type followed by mesofacial and dolichofacial at the lowermost row. The maxillary gingival display was gradually increased from 2.0mm to 5.0mm (from left to right picture)

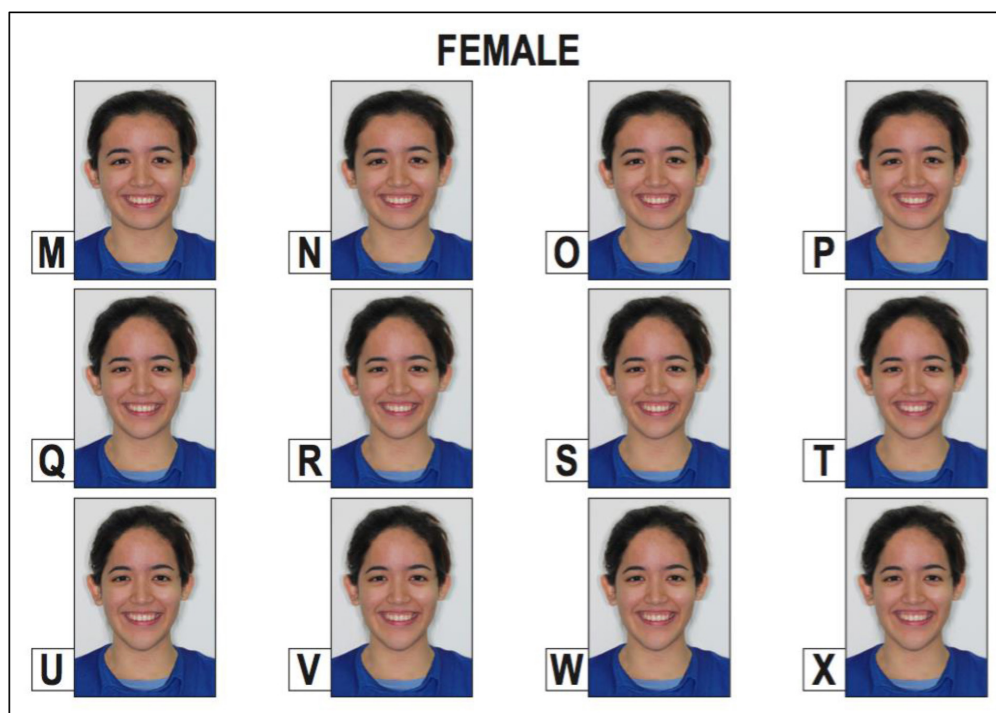


Figure 2. This selected female photograph was digitally altered and organized in sequence M-X. The uppermost row is the brachyfacial type followed by mesofacial and dolichofacial at the lowermost row. The maxillary gingival display was gradually increased from 2.0mm to 5.0mm (from left to right picture)

groups. There were 75 male and 75 female respondents. The age groups, consists of 50 respondents, were 29 years and below, 30 to 39 years and 40 years and above as shown in Table 1.

Table 2 depicts the mean difference comparison for each facial type within the gummy smile levels. Repeated measure ANOVA revealed there was a significant difference of mean level of attractiveness

Table 1. Distribution of respondents based on age group

| Gender | Age groups | | | Total |
|--------|------------|-------|------------|-------|
| | 29 & below | 30-39 | 40 & above | |
| Male | 25 | 25 | 25 | 75 |
| Female | 25 | 25 | 25 | 75 |
| Total | 50 | 50 | 50 | 150 |

Table 2. Comparison of level of attractiveness within each facial type based on gummy smile level

| Comparison | Brachyfacial | | Mesofacial | | Dolichofacial | |
|------------|------------------------|--------|---------------------|--------|----------------------|--------|
| | MD(95%CI) | p | MD(95%CI) | p | MD(95%CI) | p |
| 2mm . 3mm | 2.63 (0.53,4.74) | 0.006 | 5.04 (2.81,7.27) | <0.001 | 2.55 (-0.14,5.23) | 0.074 |
| 2mm . 4mm | 11.17 (8.16,14.18) | <0.001 | 12.69 (9.52,15.87) | <0.001 | 10.96 (7.53,14.38) | <0.001 |
| 2mm . 5mm | 18.51 (14.65,22.36) | <0.001 | 20.79 (17.09,24.50) | <0.001 | 18.80 (14.68,22.92) | <0.001 |
| 3mm . 4mm | 8.54 (5.98,11.10) | <0.001 | 7.65 (4.78,10.53) | <0.001 | 8.41 (6.09,10.73) | <0.001 |
| 3mm . 5mm | 15.88 (12.51,19.24) | <0.001 | 15.76 (12.19,19.32) | <0.001 | 16.25 (12.98,19.53) | <0.001 |
| 4mm . 5mm | 7.34 (5.09,9.59) | <0.001 | 8.103 (5.84,10.37) | <0.001 | 7.84 (5.24,10.45) | <0.001 |

*p<0.05

Table 3. Comparison of mean level of attractiveness among three different facial types based on gummy smile level

| Gummy smile level | Facial type | Mean level of attractiveness | 95% CI |
|-------------------|---------------|------------------------------|--------------|
| 2.0mm | Brachyfacial | 62.14 | 60.06, 64.23 |
| | Mesofacial | 63.10 | 61.01, 65.18 |
| | Dolichofacial | 61.33 | 59.25, 63.42 |
| 3.0mm | Brachyfacial | 59.51 | 57.57, 61.45 |
| | Mesofacial | 58.06 | 56.12, 60.00 |
| | Dolichofacial | 58.79 | 56.85, 60.73 |
| 4.0mm | Brachyfacial | 50.97 | 48.99, 52.96 |
| | Mesofacial | 50.41 | 48.42, 52.39 |
| | Dolichofacial | 50.38 | 48.39, 52.36 |
| 5.0mm | Brachyfacial | 43.64 | 41.45, 45.83 |
| | Mesofacial | 42.30 | 40.11, 44.49 |
| | Dolichofacial | 42.53 | 40.34, 44.72 |

Table 4. Statistical analysis results for Level of Attractiveness and Treatment Benefit *Association between the level of attractiveness and the treatment need (Chi Square Test)

| Maxillary gingival display | Facial type (Male subject) | p (Chi-square test) | Facial type (Female subject) | p (Chi-square test) |
|----------------------------|----------------------------|---------------------|------------------------------|---------------------|
| 2.0mm | Brachyfacial (A) | <0.001* | Brachyfacial (M) | 0.003* |
| | Mesofacial (E) | <0.001* | Mesofacial (Q) | 0.002* |
| | Dolichofacial (I) | <0.001* | Dolichofacial (U) | 0.001* |
| 3.0mm | Brachyfacial (B) | 0.001* | Brachyfacial (N) | <0.001* |
| | Mesofacial (F) | <0.001* | Mesofacial (R) | <0.001* |
| | Dolichofacial (J) | <0.001* | Dolichofacial (V) | <0.001* |
| 4.0mm | Brachyfacial (C) | <0.001* | Brachyfacial (O) | 0.003* |
| | Mesofacial (G) | <0.001* | Mesofacial (S) | <0.001* |
| | Dolichofacial (K) | <0.001* | Dolichofacial (W) | <0.001* |
| 5.0mm | Brachyfacial (D) | 0.002* | Brachyfacial (P) | 0.004* |
| | Mesofacial (H) | <0.001* | Mesofacial (T) | <0.001* |
| | Dolichofacial (L) | <0.001* | Dolichofacial (X) | <0.001* |

within each facial type group based on gummy smile level except for comparison of gummy smile level at 2.0mm and 3.0mm gingival showing in dolichofacial face.

Pairwise comparison with confidence interval adjustment was performed. The results showed that there were significant differences in all comparisons in brachyfacial, mesofacial and dolichofacial group. There was a significant difference of mean level of attractiveness within each facial type based on gummy smile level.

Repeated measure ANOVA between group analyses with regard to gummy smile level was applied. Assumptions of normality, homogeneity of variances and compound symmetry were checked and fulfilled. Simultaneously, the mean comparison between gummy smile level and facial type was tested in Table 3. All the means were in the boundary of each group confidence interval, which suggests that it is not statistically significant. From this, a facial type does not influence the respondent ratings on gummy smile level. This test also reported the respondents perceived 5.0mm gummy smile as unaesthetic but at 4.0mm gummy smile, respondents were in doubt of its attractiveness. This can be seen in Table 4, whereby the attractiveness scores show a declining trend from other lower levels of gummy smile.

Apart from gender and age group, the association from treatment benefit with the attractiveness scoring was also tested. Chi Square test showed that there was statistically significant difference between treatment benefit and attractiveness scoring, shown in Table 4. There was an association between the two variables whereby the treatment benefit is dependent on the level of attractiveness. The more unattractive a gummy smile is, the more likely the respondent feels they will benefit from treatment.

DISCUSSION

The aim of the present study is to determine the initial laypersons' perception; irrespective of age and gender, of gummy smile and its treatment need and benefit on three different facial types. In this study, the whole facial features of the subjects were included, not only the lower third of the face because every facial prominence, which were the forehead, nose, lips, chin and submental-cervical region, can be perceived as attractive or unattractive depending on its relative size, shape and position in relation to adjacent structures.¹⁸

A computed program software was used to make alterations of the face as previously reported.^{9,10} Other studies have used the same method to alter the photographs to study about facial and smile aesthetic.^{1,5,6,19,20} It has been demonstrated to be a reliable method to measure and evaluate the

acceptability of various smiling characteristics.⁹ The same manner is conducted in our study to determine which patients will benefit from a full correction of gummy smile based on the perception of the patient's facial attractiveness.

Kokich et. al. stated that 1.0 to 2.0mm of a gummy smile is regarded as aesthetic.⁷ Thus, it is already known that 2.0 mm is the acceptable value of gummy smile hence the reason 2.0 mm as a baseline of this study. However, findings show that respondents perceive 4.0 mm gummy smile as borderline attractive while at 5.0mm it is considered as unaesthetic. One could suggest that the Malaysian respondents were more accepting of gummy smile than other counterparts.

The hypothesis that there is no difference between the attractiveness level of the three different facial types and the gummy smile level can be accepted. Analyses findings show that the respondents can differentiate the difference between each gingival level. However, the facial types did not influence the respondents' scoring on gummy smile attractiveness and this is in contrast with the other previous studies which revealed that facial type appears more attractive in mesofacial face with less than 2.0mm midline deviation and 2% buccal corridor respectively.^{9,10}

One of the advantages of this study was that the equal number of respondents in terms of gender and age group. According to past studies, 150 and 160 respondents participated in their research respectively but both studies did not take into account the gender ratio of the respondents.^{9,10} Thus, they did not have equal number of gender for male and female respondents. With the homogenous number of both genders and age group of the respondents, this may reduce bias towards certain group in the results.

Facial aesthetic evaluation is an important criterion to guide clinicians in performing a proper diagnosis before any treatment is approached, as the treatment management should be determined by its aetiology. Facial height and maxillary lip length are two important parameters that require evaluation. A person with a normal facial height should have the same length of middle third of face with the lower third of face.¹⁷ While for the maxillary lip length, a normal value for a young adult female and a young adult male is 20 mm to 22 mm and 22 mm to 24 mm respectively. Some gummy smile patients may present with multiple aetiologies. In these circumstances, a sequence of treatment for gummy smile is indicated such as gingival surgery and orthognathic surgery.^{17,21}

In order for the treatment of gummy smile to succeed, especially in advanced case, multiple disciplines care are required from department of oral surgery, orthodontics, periodontics and restorative dentistry that work as a team approach.^{16,22}

CONCLUSION

The study can conclude that different levels of gingival show affect the laypersons' perception of gummy smile, regardless of the facial type. The higher the level of gingival show, the more likely the subject will benefit from treatment

CONFLICT OF INTERESTS

There are no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias the conduct and findings of this study.

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