

# Assessment of Smile Line and Attractiveness in a Group of Thai University Students

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## Abstract

**Objectives:** To determine the prevalence of smile line in a group of Thai university students and to evaluate the attractiveness of smile line combined with tooth shape.

**Methods:** Four hundred university students (159 males and 241 females, ages 20-30 years old) voluntarily participated in the study. Maximum smile photographs were taken from each participant. Smile line was classified as low, average, high and very high smile line. Gingival display of the high smile line group was measured by using a 2-mm diameter reference dot which was placed on the middle of the labial surface of the right maxillary central incisor. All participants were enquired to rate the attractiveness score of twelve photographs which represented smile lines combined with tooth shapes.

**Results:** Most of participants exhibited average smile line (57.50%), followed by high (34.25%) and low smile line (8.25%), respectively. The highest proportions were average smile line for both male and female, 63.52% and 53.53%, respectively. The proportions of smile line types between male and female were statistically significant difference ( $p < 0.05$ ). Among 12 smile types, rating score of average smile line with square tooth shape received statistically significant highest score from other smile types ( $p < 0.05$ ). Whereas, all three bottom scores were square, ovoid and triangle tooth shape in low smile line.

**Conclusions:** The average smile line was the most frequently observed in both genders. The average smile line in combined with square tooth shape was scored as the most attractive.

**Keywords:** Smile line, Gingival display, Tooth shape, Attractiveness

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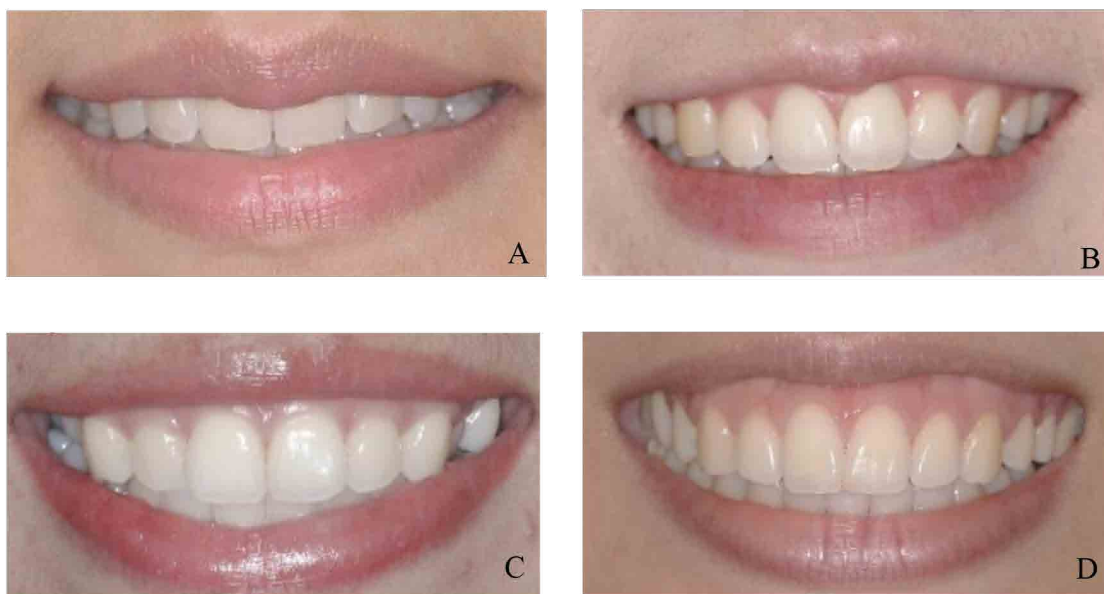
## Introduction

The human smile represents many things such as sincerity, gladness, personality, and attractiveness. The smile could break the barriers among human and increase the beauty of the human face which makes the impression at first sight (1,2). Therefore, the general smiles are the enjoyment smile and the social smile. The enjoyment smile is involuntary, it is used when experiencing real pleasure, attain maximum muscle contraction of the lip, gingival and tooth display. On the other hand, the social smile is voluntary and unstrained. It is used in greetings with moderate lip muscle contraction and attains a slight number of teeth and gingival display (3). At present, smiles become one of the main factors in which people are concerned about them (4,5). Furthermore, an esthetic smile is increasingly important in the practice of restorative dentistry because the facial and smile attractiveness appears to be strongly connected to each other. In socialization, one's attention is mainly directed towards the mouth and eyes of the speaker. As the mouth is the center of communication on the face, the smile plays an important role in facial expressions and appearances. The smile line is commonly used as a valid tool to assess the personal esthetic (2). For this reason, a dentist should be able to learn how to detect the smiles and classify each type (6). Smile line was classified into four categories which are very high smile line, high smile line, average smile line and low smile line (7). Very high smile line reveals 2 mm or more ( $> 2$  mm) of marginal and attached gingiva visible or more than 2 mm of root or gingiva apical to cementoenamel junction (CEJ) visible for the healthy but reduced

periodontium. High smile line presents between 0-2 mm ( $< 2$  mm) of marginal and attached gingiva visible or between 0-2 mm visibility of root and gingiva apical to the CEJ visible for the reduced and healthy periodontium. Average smile line shows gingival embrasures only visible. Lastly, gingival embrasure and CEJ are not visible in low smile line (Fig 1)

The maxillary gingival display is the one factor that affects to attractiveness. The photographs with full height of maxillary incisor and no visible gingival tissue is the most attractiveness while gingival display showed more than 2 mm is less attractiveness (8). On the other hand, the photographs of lip coverage around 0.5 mm of the upper central incisors and 2 mm lip coverage of the lower incisor crowns were highest esthetic rating score (9). Moreover, there were many factors that affect esthetic smile, for instance, smiles arc (maxillary incisor in vertical position), maxillary central ratio, maxillary central symmetry, anterosuperior tooth proportion, gingival design, gingival exposure, buccal corridor, midline, tooth angulation, tooth color, anatomical tooth shape and lip volume (10).

The aim of this study was to determine the prevalence of smile line in a group of Thai University students and to evaluate the attractiveness of smile line in combined with tooth shape.



**Fig 1. Four types of smile line. A: Low smile line, B: Average smile, C: High smile line and D: Very high smile line (These pictures were taken from the eligible participants in the study.)**

#### **Materials and Methods**

A prospective clinical study was approved by the Ethical Committee Board of Rangsit University (39/2559). Four hundred participants (159 males, 241 females) with excellent health were enrolled after obtaining their written informed consent. All participants were within the age range of 18 to 30 years old. The dentition was further screened for inclusion criteria as followed:

- full maxillary and mandibular dentition including second molar
- no obvious dentofacial disharmonies
- no symptom of facial paralysis or lip irregularity
- natural anterior teeth present with no severe maxillary anterior crowding and malposition
- no anterior carious lesion, no evidence of incisal wear > 1 mm into dentin

- no spacing, no anterior crossbite
- no prosthesis in anterior region
- no history of orthodontic treatment
- clinically healthy gingival appearance

The photographs were taken under tripod set up by Canon 700D camera (Canon Inc., Tokyo, Japan) 100 mm lens and mounted Canon Macro Ring Lite MR 14EX II with 1/25s shutter speed f32 ISO 800, in a controlled environment and saved in a JPEG format. The camera was adjusted to the level of the participants' mouth at 60 cm apart. The participants were set in an upright position and the head was held by a framed wooden board. Three photographs were taken of each participant including lip in repose, social smile and maximum smile. The clinical crown height was measured in case of uncertainty as low or average smile line. The gingival display from the maximum smile photograph was

measured from gingival band between the inferior border of the upper lip and the most superior point at the gingival margin of maxillary left canine to right canine by using a 2-mm diameter reference dot which was placed on the













middle of the labial surface of the maxillary right central incisor (Fig 2). The real dimension of reference dot was compared to the reference dot in the photograph and the actual distance was calculated.



**Fig 2. Photograph taken in maximum smile. The 2-mm-diameter reference dot (blue circle) was used to achieve a more accurate determination of each measured dimension.**

In the part of attractiveness score rating, 400 volunteers were enrolled to rate the smile attractiveness. The rating on 5-point numerical scale by circling, where 1 point illustrated a very unattractive smile, and 5 points illustrated a very attractive smile by using 5-point Likert scale (11). There were three sets of 12 photographs varied in tooth shape and smile line which were randomized to be evaluated by each participant. The sets of photographs were saved as presentation in Microsoft PowerPoint 2010 (Microsoft Corporation, Redmond, WA, USA). The presentation was projected as a slideshow

on the computer screen. Tooth color and gingival margin in every photograph were set in the same as Fig 3. Chi-square test was utilized to compare proportions of each smile line type between gender. Descriptive statistics were used for explanation among age, gender and type of smile line. The attractive scores were tested by using Wilcoxon sign-rank test. The significance level was set at  $p < 0.05$ . Data analysis was performed using Statistical Package for the Social sciences 18.0 for Windows (SPSS Inc., Chicago IL).

Smile line Tooth shape	Low smile line	Average smile line	High smile line (Gingival display < 2 mm)	Very high smile line (Gingival display > 2 mm)
Ovoid				
Triangle				
Square				

**Fig 3. 12 smile types that used to rate the attractiveness scores**

**Results**

**Demographic Information**

Out of 400 participants, 241 were female which accounted for 60.25% of the total. There were 159 male participants or 39.75%. The age

range of participants was 20 to 30 years old. The average age of respondents in this research was 21 + 1.73 years old. Moreover, the age profile between male and female was not statistically significant different. (Table 1)

**Table 1. Descriptive statistics of age and gender.**

Gender	Number of participants	Proportion of participants (%)	Minimum	Maximum	Standard deviation	Mean (years old)
Male	159	39.75	20	29	1.71	21
Female	241	60.25	20	30	1.75	21
Total	400	100	20	30	1.73	21

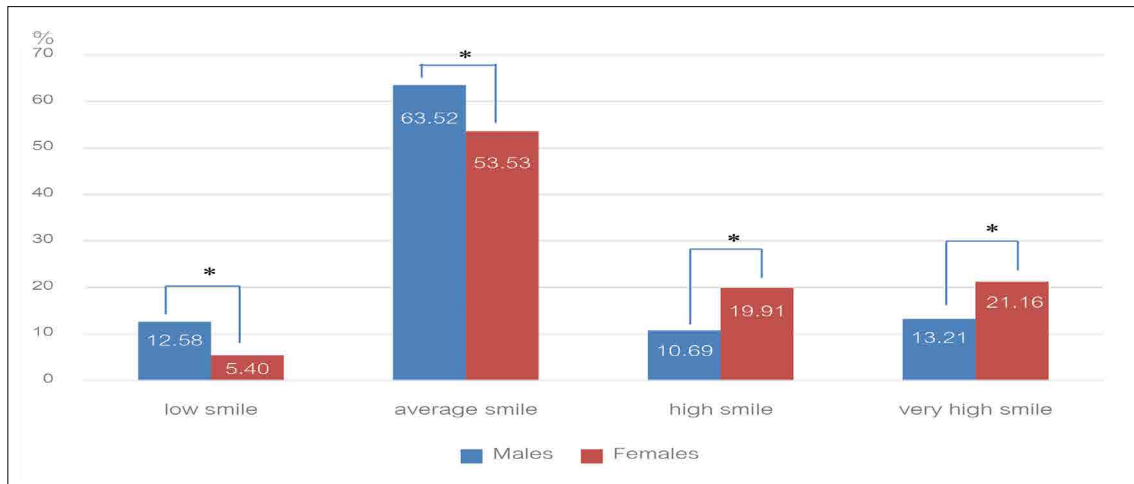
**Smile type**

The smile line of participants was categorized into 4 types: low smile line, average smile line, high smile line and very high smile line. Overall, 57.50% of the total participants showed the average smile line, followed by high smile line

and very high smile line (34.25%). There were only 33 participants (8.25%) who exhibited low smile line (Table 2). By gender, the ranking of smile line types was not different from the total number of participants.

**Table 2. Number and percentage of each smile types among gender.**

Smile Line Type of all participants							
Low Smile		Average Smile		High Smile		Very High Smile	
N	%	N	%	N	%	N	%
33	8.25	230	57.50	65	16.25	72	18.00



**Fig 4. Distribution and percentage of smile line types according to gender (\*Statistically significant  $p < 0.05$ )**

Regarding to Fig 4, The highest proportions were average smile line in both male and female, which were 63.52% and 53.53%, respectively. A very high smile line ranked secondly, which were 13.21% in males and 21.16% in females. Lastly, the smallest number of participants showed high smile line, at 10.69% for males and low smile line 5.40% for females. Nonetheless, it was clearly shown that the degree of proportions of each smile line type was different between male and female participants, even though they revealed the same order. From these results, males tended to show the average smile line and a low smile line. On the contrary, females tended to exhibit high smile line.

#### Attractive scores

There were 12 formats of smiles considered in this research as described in Table 3. They could be grouped into four main types: low smile line, average smile line, high smile line and very high smile line. Each main type composed of 3 subtypes: oval, triangle, and square tooth shape. The attractiveness of each smile type was measured by score, ranged from 1 to 5; the least attractive to the most attractive. According to table 3, each smile type has minimum score at 1 and maximum score at 5. However, the average scores were different. It might be implied that some smile types were perceived more attractiveness than the others.

**Table 3. Descriptive statistics of attractiveness score of each smile type.**

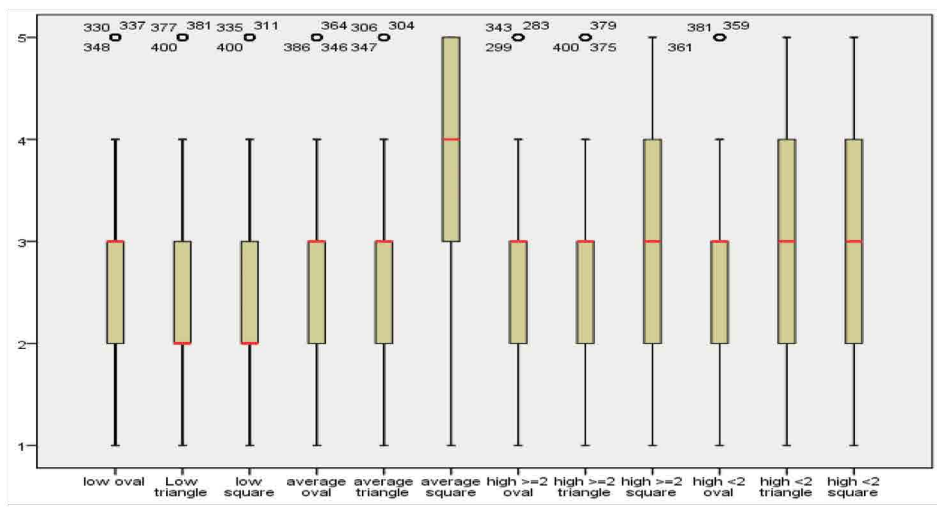
Smile Type	Number of volunteers	Minimum	Mean	Standard deviation	Maximum
Low oval	400	1	2.54	1.00	5
Low triangle	400	1	2.58	1.05	5
Low square	400	1	2.60	1.09	5
Average oval	400	1	2.78	0.98	5
Average triangle	400	1	2.74	0.86	5
Average square	400	1	3.68	1.22	5
High oval	400	1	2.79	1.03	5
High triangle	400	1	2.80	0.94	5
High square	400	1	3.08	1.11	5
Very high oval	400	1	2.87	1.01	5
Very high triangle	400	1	3.03	1.01	5
Very high square	400	1	2.99	1.02	5

Average smile line with square tooth shape showed the highest attractiveness score at 3.68, followed by high smile line with square tooth shape (3.08), and very high smile line with triangle tooth shape (3.03). On the other hand, all three types of low smile line were ranked in the bottom. Their scores were not much different; 2.54, 2.58 and 2.60 from low smile line with oval tooth shape, low smile line with triangle tooth shape and low smile line with square tooth shape, respectively.

The comparison of each smile types with different tooth shapes was shown in Fig 5. The average, high, very high smile lines with oval, triangle and square tooth shapes were more attractive than low smile line with oval, triangle and square tooth shapes statistically significant. Among average smile line, the square tooth shape was statistically significant more attractive than oval and triangle. As well as the very high smile line, the square tooth shape was the most attractive. The high smile line with triangle and square tooth shapes were more attractive than low smile line and average smile line with oval and triangle tooth shapes statistically significant.

	low oval	Low triangle	Low square	Average oval	average triangle	average square	high >=2 oval	high >=2 triangle	high >=2 square	high <2 oval	high <2 triangle	high <2 square
low oval	black			yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Low triangle		black		yellow	black	yellow	yellow	yellow	yellow	yellow	yellow	yellow
Low square			black	yellow	yellow	black	yellow	yellow	yellow	yellow	yellow	yellow
Average oval				black	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
average triangle					black	yellow	yellow	yellow	yellow	yellow	yellow	yellow
average square						black	yellow	yellow	yellow	yellow	yellow	yellow
high >=2 oval							black	black	yellow	yellow	yellow	yellow
high >=2 triangle								black	yellow	yellow	yellow	yellow
high >=2 square									black	yellow	yellow	yellow
high <2 oval										black	black	yellow
high <2 triangle											black	black
high <2 square												black

**Table 4: Comparing the attractive score of 12 formats of smile types with different tooth shape. (yellow color represented a statistically significant different, white color represented no significant different)**



**Fig 5. Box plot scores of 12 smile types (red color indicated median of each smile type)**

The boxplot depicted the distribution of attractiveness score of each smile type (Fig 5). The distribution of average smile line with square tooth shape is distinctive from other smile types. Its median was closed to 4, which was higher than the others. Moreover, very high smile line with square tooth shape, high smile line with triangle tooth shape and high smile line with square tooth shape tended to display the similar distribution. The median of their attractiveness scores was around 3. For other smile types, they seemed to have the same boxplot picture, including outliers, apart from low smile line with

triangle tooth shape and low smile line with square tooth shape which their medians were closed to 2 in the plot.

The most attractiveness tooth shape in average and very high smile line were square tooth shape. While the attractiveness of oval and triangle tooth shape was not different. In high smile line, triangle tooth shape was more attractive than oval tooth shape. The attractiveness of square tooth shape was equal to that of triangle and oval tooth shape. Meanwhile the attractiveness of square, triangle and oval tooth shape were equal in low smile type.

## Discussion

The prevalence of smile types from this study showed that the low, average, high and very high smile line for both genders were 8.25%, 57.50%, 16.25%, and 18.00% respectively. Most of the participants presented an average smile line followed by very high smile line and high smile line. However, the results of the present study revealed few differences from the previous studies. Tjan et al. 1984 studied on American youths with 454 full-face photographs of dental and dental hygiene students with smiles displaying teeth. The participants included 207 men and 247 women ages ranging from 20 to 30 years old. The participants were classified 68.94% with average smile line, followed by 20.48% with low smile line and 10.57% with high smile line (12). Another study from Zhang et al. 2015 which studied two-hundred young Chinese participants (aged ranging 20–35 years old) (13). The dynamic smile process was captured using a digital camera showed that high smile line, average smile line and low smile line were 45.5%, 45.5%, and 9% respectively. Moreover, the result of a report by Al-Juboori et al. 2017, which consisted of a randomized sample of 238 Malaysian participants aged between 18-35 years, was used to carry out this study. Upon screening, the participant was asked to relax their lip and the lip length is recorded with a calibrated caliper. Smile line was then assessed by posed smile. The results showed that the average smile line is the most common followed by a high smile line and a low smile line were present 45%, 38.5% and 16.5% respectively (14).

According to Peck et al 1992, the investigation of the smile line of the North American population with a mean age of 15.5 years old reported an average (52.2%) and high (32.5%) smile lines in females but males usually featured average and low smile line (48% and 33% respectively) (15). Another study from Sepolia et al. 2014 reported that Indians trend to have an average smile line during forced smile (59%) regardless of gender (16). These findings are accordance to our study that gender has tendency to relate to smile line. In our study, females inclined to show high smile more than males (at 41.07% for females and 23.9% for males).

Several studies on various populations have reported a higher percentage of women with high smile line and very high smile line as compared to men. These results are in accordance with data reported by Dayakar et al 2015, who showed the variation in periodontal visibility during natural smile and maximal smile in both genders (17). More than eighty percent (81.8%) of females were found to have a high smile line during a natural smile line whereas only 18.2% of males were found to have a high smile line during a natural smile. A similar pattern was observed during the maximal smile, 76.2% of females exhibited a high smile line as compared to 23.8% of males.

Maxillary gingival display did influence on dental attractiveness ratings. Four hundred students rated on a five-point numerical scale by circling, where 1 point illustrated a very unattractive smile, and 5 points illustrated a very attractive

smile. In our study of attractiveness from 12 images showed that the average smile line with square tooth shaped was rated mean score as 3.68 which was the most attractiveness and significantly higher than other group. While low smile line with ovoid tooth shape was rated mean score as 2.54 which was the least attractiveness. The square tooth shape tended to attract more attention than any other tooth shape. The attractiveness among square, ovoid and triangle tooth shape within low smile line group were not significant difference. The result of our study was similar to Sybaite and coworkers which average smile line, tangent to the zeniths of maxillary anterior teeth, was found to be the most attractive gingival amount amongst lay people, general practitioners and orthodontists (18). However, Anderson et al 2005 reported that restorative dentists preferred round incisors for the female images. Orthodontists preferred round and square-round incisors for the female images. Laypeople did not significantly differentiate between any of the female incisor shapes. The restorative dentists, orthodontists, and laypeople shared similarities and displayed differences when considering esthetic preferences in tooth shape (19). Hunt and colleagues in 2002 examined the influence of maxillary gingival display on the attractiveness rating by 120 university students (94 females, 26 males) were shown 7 photographs of a male and 7 photographs of a female subject each with levels of gingival display ranging from -2 to +4 mm. Attractiveness ratings were recorded on 10 points for each photograph. The most attractive photographs of this study were the ones with full height of the incisors and no gingival tissue while gingival display of more

than 2 mm was rated as progressive less attractive (8).

However, the study of Al Taki et al, 2017 showed the different results. The total of 3 groups (30 laypeople, 30 orthodontists, 30 general practitioner dentists) were engaged to rate the score (1-5) of each picture. The pictures had different level of gingival display with short face and long face. The laypeople rated the smile exhibiting high gingival display in the short face subject as the most attractive. In contrast, the orthodontists and general practice ranked the smile showing average smile line as the most attractive in short face. For the long face, laypeople and general practitioner dentists ranked the smile showing average gingival display as the most attractive, whilst the orthodontists ranked a high smile line as the most attractive (20). Smile line of both short and long face subjects was found to influence the smile attractiveness rating by various groups of raters.

It could signify that the knowledge, educational of dentistry, demographic background and different social may influence the perception of smile attractiveness. According to our study, low smile group could be implied that no matter what tooth shape you get, attractiveness among the group was not different. In average and very high smile groups, square tooth shape was the most attractive and followed by oval and triangle which were not different. On the contrary, high smile line could not be implied that what tooth shape was the most attractive but only explained that triangle tooth shape was more attractive than oval shape. For square tooth shape, it was not different when compare with triangle and oval tooth shape. With the limitation of the study,

other factors could be strongly affected to evaluate esthetic such as tooth color, lip position, lip curvature and facial type to consider the attractiveness of smile which are noteworthy issues to study in the future. To sum up, high and average smile line associated with square tooth shape were the most attractive. This might be used as a reference data for personalized smile design remarkably in the cases required interdisciplinary periodontal plastic surgery–restorative planning. These information may be helpful in the treatment of complex anterior restoration. Smile attractiveness characteristic has dominated clinical applicability for patient care.

### Conclusion

The average smile line was the most frequently observed in both genders in a group of Thai University students. Females presented higher tendency to reveal a high smile line. The average smile line with the square tooth shape was the most attractive. Therefore, smile line and tooth shape should be encompassed to be a crucial factor for treatment in esthetic zone.

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