



รายงานวิจัย

โครงการวิจัย

การประเมินเส้นรอยยิ้มและการเผยขอของเหงือกในวัยหนุ่มสาวไทย

ASSESSMENT OF SMILE LINE AND GINGIVAL DISPLAY
IN A GROUP OF THAI YOUNG ADULTS

โดย

อาจารย์ ทพญ. สุปราณี เบ็ญจสุพัฒนนันท์

สนับสนุนโดย
สถาบันวิจัย มหาวิทยาลัยรังสิต

2560

Abstract

Title: Assessment of smile line and gingival display in a group of Thai young adults

Researchers: Supranee Benjasupattananan and Papatpong Sirikururat

Institution: Faculty of Dental Medicine, Rangsit University

Year of Publication:

Publisher:

Sources:

No. of pages:

Keywords: smile line, gingival display, attractiveness

Copyrights: Rangsit University

This cross-sectional clinical study aims to 1. Determine prevalence of smile type in Thai young adults 20-35 years of age and compare different of smile type between male and female. 2. Evaluate the type of smile in combined with tooth shape which is the most attractiveness in the opinion of Thai young adults 20-35 years of age. **Materials and methods:** 400 volunteers Thai young adults, 159 males and 241 females, aged between 20-35 years participated in this study. Each volunteer was taken 3 photographs including lip in repose, social smile and maximum smile. The smile line was classified as low, average, high < 2 mm and high ≥ 2 mm. The gingival display in high smile line group was measured by using 2-mm diameter reference dot which was placed on the middle of the labial surface of the maxillary right central incisor. Chi-square test was used to compare proportions of each smile line type between male and female. Furthermore, 400 volunteers enrolled to rate the attractiveness score of 12 smile characteristics different in tooth shape and smile type. After that, the Wilcoxon signed-rank test was used to test the significance between both the variables. **Results:** The most common smile line in a group of Thai young adults population was average smile line (57.5%), followed by high smile line (34.3%) and low smile line (8.3%) respectively. Considering by gender, the highest proportions were average smile line for both male and female, 62.73% and 53.97%, respectively. The proportions of smile line type between male and female were statistically significant different ($p < 0.05$). No significant different was seen between male and female who have mean

maxillary gingival display ≥ 2 mm and < 2 mm in high smile line. Among 12 smile types, Rating score of photo of average smile line with square tooth shape had highest score from all other smile types statistically significant ($p < 0.05$). Moreover, the second highest scores are the set of high ≥ 2 mm smile line with square tooth shape, high < 2 mm smile line with triangle tooth shape and high < 2 mm smile line with square tooth shape. Whereas, the 3 bottom score are square, ovoid and triangle tooth shape of low smile line. **Conclusion:** Average smile line is the most common smile line in a group of Thai young adults. Additionally, the average smile line with square tooth shape has the highest attractiveness score.



Acknowledgement

The success and final outcome of this project required a lot of guidance and assistance from many people and this project was supported by Rangsit University. We would like to thank volunteers for taking the time to our project.

We are thankful and fortunate to get constant encouragement, support and guidance from our internal project guide which helped us in successfully completing our project work.



Content

	Pages
Abstract	ก
Acknowledgement	ค
Contents	ง
List of Tables	จ
List of Illustrations	ฉ
Chapter 1: Introduction	1
1.1 Background	1
1.2 Objective	2
1.3 Hypothesis	2
1.4 Definition of terms	3
Chapter 2: Review literature	4
Chapter 3: Methodology	9
3.1 Population and sample size	9
3.2 Materials	9
3.3 Exclusion and Inclusion criteria	9
3.4 Methods	10
3.5 Statistics used in this research	13
Chapter 4: Results and discussion	14
4.1 Results	14
4.1.1. Demographic Information	14
4.1.2. Describing smile type and attractiveness of smile type	14
4.2 Discussion	18
Chapter 5 Conclusion and suggestion	21
5.1 Conclusion	21
5.2 Suggestion	21
References	22
Appendix	23

List of Tables

	Pages
Table 1: Descriptive statistics of age and gender	14
Table 2: Numbers and percentage of each smile line type by gender	15
Table 3: Numbers and percentage of mean maxillary gingival in high smile line type by gender	15
Table 4: Descriptive statistics of attractiveness score of each smile type	16
Table 5: Statistic significant between 12 smile types	17
Appendix	
Table 1: Test statistics of the difference in proportions of each smile line type	23
Table 2: Numbers and percentage of each smile line type by gender	24
Table 3: Test statistics of the difference in proportions of each smile line type between male and female	24
Table 4: Test statistics of the difference in proportions of mean maxillary gingival display in high smile	25
Table 5: Test statistics of the difference in proportions of mean maxillary gingival display in high smile between male and female	25
Table 6: Numbers and percentage of mean maxillary gingival in high smile line type by gender	26
Table 7: Test statistics of normal distribution by Kolmogorov Smirnov	26
Table 8: Statistics of Wilcoxon signed-rank test	27
Table 9: Data collection of 10 pictures from observe 1 between 2 measures	29
Table 10: Test statistic of reliability of Observer 1 between 2 measures	29
Table 11: Data collection of 10 pictures from observe 2 between 2 measures	30
Table 12: Test statistic of reliability of Observer 2 between 2 measures	30
Table 13: Data collection of 10 pictures from observer 1 and observer 2	30
Table 14: Test statistic of reliability between observer 1 and observer 2	30
Table 15: Summary of test statistic of reliability from observer 1 and observer 2	31

List of Illustrations

Pages

Figure 1 : Three type of high smile, average smile line and low smile line

4

Figure 2: Example show lip in repose

10

Figure 3: Example show social smile

10

Figure 4: Example show photograph was taken in maximum smile.

11

The 2-mm-diameter reference dot was used to achieve more accurate determination of each measured dimension.

Figure 5: Show 12 smile types that were used to rate the score

12

Figure 6: Boxplot of 12 smile types

17



Chapter 1

Introduction

1.1 Background

The human smiles represent many things such as sincerity, gladness, personality and attractiveness. The smile can break barriers among human and increase the beauty of human face which bring about to make the impression at first sight. Therefore, the general smiles are both enjoyment smile and social smile. Enjoyment smile is involuntary, it's used when experiencing real pleasure, attain maximum muscle contraction of the lip, gingival and tooth display. On the other hand, social smile is voluntary and unstrained. It's used in greeting with moderate lip muscle contraction and attains a slight amount of teeth and gingival display (Ackerman & Ackerman, 2002).

At present, the smiles become one of the main factors in our life which people concern about them. Furthermore, esthetic smile is increasingly important in practice of restorative dentistry because the facial and smile attractiveness appears strongly connected to each other. The fact is that in social interaction, one's attention is mainly directed toward the mouth and eyes of the speakers face. As the mouth is the center of communication in the face, the smile plays an important role in facial expression and appearance. For this reason, the dentist should be able to learn how to detect the smiles and classified them in each type. Smile analysis was divided into three categories which are high smile line, average smile line and low smile line. High smile line reveals the total cervicoincisal length of the maxillary anterior teeth and a touching band of gingiva while average smile reveals 75% to 100% of the maxillary anterior teeth and interproximal gingiva. Low smile shows display less than 75% of the maxillary anterior teeth (Tjan, Miller & The, 1984).

Because smile line is important to restoration in esthetic zone, the proper technique should use to deal with each situation like a high smile line is more critical situation. The restoration and gingival tissues completely display in high smile line but low smile line is a less critical situation because the restoration interface will be hidden behind the upper lip.

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 (Hunt, Johnston, Hepper, Burden, & Stevenson, 2002). Another study also present 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 (Geron & Atalia, 2005). Moreover, there were factors that affect to esthetic smile for instance smiles arc (maxillary incisor in vertical position), maxillary central ratio, maxillary central symmetry, anterosuperior teeth proportion, gingival design, gingival exposure, buccal corridor, midline, tooth angulation, tooth color, anatomical tooth shape and lip volume (Machado, 2014).

The aim of this study were to determine the prevalence of smile type in a group of Thai young adults 20-35 years of age and compare the different of smile types between male and female. Furthermore, the attractiveness of smile characteristic in the opinion of a group of Thai young adults was evaluated.

1.2 Objective

1. To determine prevalence of smile type in a group of Thai young adults 20-35 years of age and compare different of smile type between male and female.
2. To evaluate the type of smile in combined with tooth shape which is most attractiveness in the opinion of Thai young adults 20-35 years of age.

1.3 Hypothesis

Hypothesis 1: There is different in smile line type in a group of Thai young adults

H_0 : There is no difference in proportions of low smile line, average smile line and high smile line

H_1 : At least 1 type of smile line has different proportion from the others

Hypothesis 2: There is different in smile line type in a group of Thai young adults between male and female

H_0 : There is no difference in proportions of low smile line, average smile line and high smile line between male and female.

H_1 : At least 1 type of smile line has different proportion between male and female

Hypothesis 3: There is different between proportions in a group of Thai young adults who have mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_0 : There is no difference in proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_1 : The proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line are different

Hypothesis 4: There is different between male and female in proportions in a group of Thai young adults who have mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_0 : There is no difference in proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line between male and female

H_1 : The proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line are different between male and female

Hypothesis 5: Among 12 smile types, there is at least 1 pair of smile type that is different in attractiveness score.

H_0 : All 12 smile types do not have difference in their attractiveness scores

H_1 : There is at least 1 pair of smile types that have difference in the attractiveness scores

1.4 Definition of terms

Smile line : The smile line is an imaginary line running from the incisal edges of the maxillary incisors and coinciding with the curvature of the lower lip.

Gingival display : The amount of gingival tissue that shows when you smile.

Attractiveness : The quality of being pleasing or appealing to the senses.



Chapter 2

Review literature

Classification of smile pattern

There are two basic types of smiles: the social smile and the enjoyment smile. Each type involves a different anatomic presentation of the elements of the display zone. The social smile or the smile typically used as a greeting is a voluntary, unstrained, static facial expression. The lips part due to moderate muscular contractions of the lip elevator muscles, and the teeth and sometimes the gingival scaffold are displayed in social smile. The enjoyment smile elicited by laughter or great pleasure, is involuntary. It results from maximal contraction of the upper and lower lip elevator and depressor muscles, respectively. This causes full expansion of the lips, with maximum anterior tooth display and gingival show (Ackerman & Ackerman, 2002).

Open smiles (smiles displaying teeth) is divided into three categories. High smile line reveals the total cervicoincisal length of the maxillary anterior teeth and a contiguous band of gingiva. Average smile line reveals 75% to 100% of the maxillary anterior teeth and the interproximal gingiva only. Low smile line displays less than 75% of the anterior teeth. The results from survey characteristic of an open smile type reveals 10.57% persons is classified as having a high smile, 68.94% person as having an average smile and 20.48% as having a low smile. These differences in smile type between men and women are significant statistically (Tjan et al., 1984).



Figure 1 : Three type of smile top, high smile; center, average smile line ; and bottom low smile line. Adapted from "Assessment of dynamic smile and gingival contour in young Chinese people" by Zhang YL et al 2015

The stage of smile

There are two stages in smile formation. The first stage is voluntary smile associated with elevation of the upper lip towards the nasolabial groove through the contraction of the elevator muscles while the second stage is spontaneous smile associated with higher elevation both in the lip and nasolabial groove under the action of three muscle groups including the elevator of the upper lip, the zygomatic major muscle and the upper fibers of the buccinator muscle. The appearance of half-shut eyes should accompany the final stage and represents the contraction of the periocular musculature. The half-shut look that accompanies the smile is a muscular trigger of the face that activates the centers in the temporal anterior area of the brain, which regulates the production of pleasant emotions. Therefore, without this final action of semi-closure of the eyes, the noticeable happy smile is probably a false smile (Carlos, 2010).

Recording the maximum smile

The best way to obtain a smile and stimulate the exposure of the incisors during smiling is word "cheese". In the same way, for evaluate the relationship between the teeth and upper lip, it is recommended the patient pronounce the sound of the letter "e" which causes the maximum elevation of the upper lip. The ideal record is both static and moving record. In the static record, image gathering should include close-up shots in frontal, sagittal, and oblique planes. For the moving records, video should be recorded and uploaded to a computer, and the best image selected (Zachrisson, 1998).

Golden proportion and gingival display associated with smile line

The Golden proportion is relation of maxillary anterior tooth width and smiles. The golden proportion has been described by the Pythagoreans in the sixth century BC. It is used to evaluate and apply in anterior teeth for restoration (Snow, 1999). The evaluation of "Golden Proportion" in individuals with an esthetic smile has been studied by took the frontal photograph, analyzed in program and measured the apparent mesiodistal width of each tooth from canine to canine then calculated the proportion of tooth. The result was that the golden proportion has been proposed in the literature as a useful application for achieving proportion and esthetics, no one has evaluated this proportion in esthetically accepted case. Therefore, the golden proportion wasn't a factor of esthetic smile (Mahshid et al., 2004).

The amount of gingival exposure had individual variability with difference factor such as upper lip and lower lip muscle mobility, lip vertical length, clinical crown height and skeletal relationship. In general, the gingival smile had more common characteristic of females than males. When increasing age, there were decrease in maxillary tooth exposure during a smile, and increasing in mandibular incisor exposure because of tooth wear and elastic of lip (Ritter, Gandini, Pinto Ados, Ravelli, & Locks, 2006).

Dynamic smile analysis

The dynamic lip-tooth characteristics during speech and smile are investigated in 50 patients (27 boys, 23 girls) with a mean age of 12.5 years. In this study used digital video to provide an accurate recording of the patient's speech, the posed social smile and the enjoyment smile which provided wide range of images for selecting the parameters of lip-tooth relationships during facial animation and variability in the posed social smile with time. In contrast, single digital photograph which is single frame capture method with digital photography is not insufficient for the evaluation of treatment effects or maturational changes (Ackerman et al., 2004).

The classification of the dynamic smile and quantification the gingival line, as well as apico-coronal displacement of the gingival zenith, in maxillary anterior dentition are taken in young Chinese people. Two-hundred subjects (100 men and 100 women; 20-35 years old) with healthy dentogingival tissue are evaluated the dynamic smile. The dynamic smile is captured by digital camera. The result show 45.5% of subjects has a high smile and 45.5% has average smile. The 58.2% of subjects present an upward gingival line. The gingival zenith of lateral incisor is coronal to the gingival line (Zhang et al., 2015).

Digital video graphic is used measurement of tooth display and lip position in smiling and speech. The twenty men were selected at random from native white Dutch and ranged from 35 to 55 years of age. Selection criteria were including first molars, no excessive dentofacial disharmonies, and no caries or periodontal diseases. The dynamics of the spontaneous smile by watch comical movie were captured twice with a digital video camera, transferred to a computer, and analyzed on video frame level. On the smiling and speech records, Length of teeth has measured in the maxilla and mandible at central and a lateral incisor, a canine, a first and a second premolar, and a first molar. A smile line and tooth and gingival display during smiling and speech can be measured by this digital video graphic method. On this study by view of the increasing esthetic demands of patients with regard to orthodontics, esthetic dentistry, and dental surgery treatment (van der Geld, Oosterveld, van Waas, & Kuijpers-Jagtman, 2007).

10 commandments of smile esthetics

1. Smile arc: Maxillary central incisors is important for determine an ideal vertical positioning for maxillary incisor at smiling. The maxillary incisal edges have slightly contouring the lower lip is the ideal smile arch which is explained as convex arc, curved arch, consonant arc, deep plate-shaped arc. When smiling, more contouring of maxillary incisor is younger smile looks but the older is more plane and mandibular incisor exposure. To gain the

ideal design of incisal contour, range of edge between central incisor and lateral incisor is 1.0-1.5 mm for women and 0.5-1.0 mm for men.

2. Ratio and symmetry of maxillary central incisor: An ideal width-height ratio that is more esthetic is 75-85% and symmetry of central incisor is needed to acquire an esthetic. A slight asymmetry of central incisor is clinically identified as unesthetic. In contrast, slight asymmetry of lateral incisor and greater asymmetry of canine may not be identified.

3. Proportion between anterosuperior teeth: Gold proportion is required for gain an esthetic which visible lateral incisor is 62% of central incisor width and visible canine is 62% of lateral incisor width.

4. Presence of anterosuperior spaces: All diastemas in esthetic zone have an impact to esthetic of smile therefore they should to be closed.

5. Gingival design: Modified gingival design is principle for determine gingival design that the gingival margin of central incisor is below canine (0.5-1.0 mm), lateral incisor is below central incisor (0.5 mm).

6. Gingival exposure: 3 mm is maximum limit of gingival exposure if greater is considered unesthetic. The high smile with gingival exposure not greater than 3.0 mm is most esthetic followed by medium and low smiles.

7. Buccal corridor: Buccal corridor does not impact on smile esthetic. Comparing of 3 level of buccal corridor, intermediate buccal corridor is most esthetic followed by narrow and wide respectively.

8. Midline and tooth angulation: Midline deviation equal to or greater than 2.0 mm and change in tooth angulation in the esthetic zone had to be corrected.

9. Tooth color and anatomical shape: There are 3 factors that affect an esthetic for example tooth color, good contact and proper embrasure. Papilla and contact relationship in central incisor is of 1:1 (half of occupied by the papilla and half occupied by contact).

10. Lip volume: It is one of 3 factors which are the current standard of beauty comprises. More lip exposure more young smile look (Machado, 2014).

Attractiveness of smile

Maxillary gingival display influenced on dental attractiveness ratings. One hundred and twenty university students were rating on a 10-point numerical scale by circling, where 1 point illustrated a very unattractive smile and 10 points illustrated a very attractive smile in seven photographs of a male and seven photographs of a female subject. Both groups of photographs showed level of gingival display from -2 to +4 mm. The images were displayed in a random order for 10 seconds each with black screen for 5 seconds interval between images. This study showed that the photographs with full height of incisor and no gingival tissue are more attractive than the photographs with gingival display more than 2 mm (Hunt et al., 2002).

From these review literatures were studied in other countries but there was no evidence or study about smile analysis in Thailand. Therefore, we decide to study this topic in Thai people within Rangsit University.



Chapter 3

Methodology

3.1 Population and sample size

Study design of this project was descriptive study. Yamane (1967) provided a simplified formula to calculate sample sizes. This formula was used to calculate the sample sizes. A 95% confidence level and $P = 0.05$ are assumed for this equation.

$$n = \frac{N}{1+N(e)^2}$$

Where n is the sample size, N is the population size which data from official statistics registration system in December 2015 and e is the level of precision.

From the equation, sample size of this study was 400 Thai young adults (20-35 years of age) with 95% confidence interval and margin of error of about five. The volunteers were enrolled and conduct to RSU dental clinic.

3.2 Materials

1. Canon 700 D camera
2. Macro lens 100 mm
3. Ring flash Canon MR 14EX II
4. Wooden board
5. Periodontal probe
6. Rubber dam sheet
7. Rubber dam punch
8. Cotton roll
9. Adobe Photoshop CS6 software
10. Microsoft PowerPoint 2010 (Microsoft Corporation, Redmond, WA, USA) software
11. Computer notebook (HP Envy 15-k034tx note book with Intel® Core™ i7-4510U CPU, 15.6 inch display)
12. Tripod set up

3.3 Exclusion and Inclusion criteria

All of the volunteers had full maxillary and mandibular dentition including second molar with no obvious dentofacial disharmonies, no symptom of facial paralysis or lip irregularities, 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 cross bite, no prosthesis in anterior region and healthy gingival appearance.

3.4 Methods

Detail of the method and test set up to record characteristic of smile. The photograph was taken by Canon 700 D camera macro lens 100 mm with ring flash Canon MR 14EX II with tripod set up with shutter speed is 1/25 focus is f32 ISO 800, at student lounge 5th floor building 12/1, building 4 and building 11 and save in JPEG file. The camera was adjusted to the volunteer's mouth level at a distance of 60 centimeters. The volunteer was set in upright position and head was supported by wooden board. Each volunteer was taken 3 photographs including lip in repose, social smile and maximum smile. The clinical crown height was measured in case of uncertainly as low smile line or average smile line. The gingival display was measured from gingiva 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 2-mm diameter reference dot which was placed on the middle of the labial surface of the maxillary right central incisor. After that, we compared a real dimension of reference dot to reference dot in a photograph and calculation of the actual distance.



Figure 2: Example show lip in repose



Figure 3: Example show social smile



Figure 4: Example show photograph was taken in maximum smile. The 2-mm-diameter reference dot was used to achieve more accurate determination of each measured dimension.

In the part of attractiveness rating, 400 volunteers enrolled to rate the attractiveness of smile. There were 3 random sets of 12 photographs. 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 used Likert scale.

The photographs were saved as a presentation in Microsoft PowerPoint 2010 (Microsoft Corporation, Redmond, WA, USA). The presentation was projected on computer. Total 12 photographs were different in tooth shape and smile line but have similar tooth color and no obvious gingival recession as shown in the following figure 5.




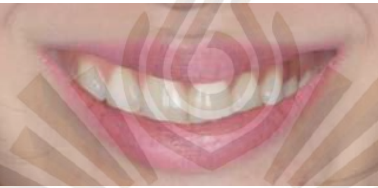










<div style="text-align: center;">Smile line</div> <div style="text-align: center;">Tooth shape</div>	Low smile line	Average smile line	High smile line Gingival display < 2 mm	High smile line Gingival display ≥ 2 mm
Ovoid				
Triangle				
Square				

Figure 5: Show 12 smile types that were used to rate the score

3.5 Statistics used in this research

Chi-square test was used to compare proportions of each smile line type between male and female. Descriptive statistics were used for explanation among age, gender and type of smile line. Furthermore, the attractiveness score collection was tested normal distribution by using Kolmogorov-Smirnov. The results reveal scores were not normally distributed. Hence, this data set will be tested by using Wilcoxon sign-rank test.



Chapter 4

Results and discussion

4.1 Results

The results were described into 2 sections as follows:

- Section 1 explains demographic (age and gender) of volunteers
- Section 2 describes data of smile line type, maxillary gingival display in high smile and attractiveness of smile type

4.1.1. Demographic Information

The first section aims to explain characteristics of 400 volunteers by using demographic data. There are only 2 demographics information collected in this research, which are age and gender.

Gender	Number of volunteers	Proportion of volunteers	Minimum	Mean	Standard Deviation	Maximum
Male	159	39.75%	20	21	1.71	29
Female	241	60.25%	20	21	1.75	30
Total	400	100.00%	20	21	1.73	30

Table 1: Descriptive statistics of age and gender

According to table 1, 241 of 400 volunteers are female, which account for 60.25% of total. The number is higher than male, which has 159 volunteers or 39.75%. In term of age, the youngest volunteer is 20 years old and the oldest volunteer is 30 years old. However, the average age of respondents in this research is 21 years old with 1.73 years old standard deviation. It indicates that majority of volunteers, who represents Thai young adults in this research, tends to have age range between 20 years old and 22 years old. Also, age profile between male and female is not significantly different.

4.1.2. Describing smile type and attractiveness of smile type

The second section describes characteristics of variables that are the key for analyzing in order to answer research questions. Variables in this research comprises of Smile line type, mean maxillary gingival display in high smile line and attractiveness of smile type.

Gender	Smile Line Type					
	Low Smile		Average Smile		High Smile	
	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers
Male	20	12.42%	101	62.73%	38	23.90%
Female	13	5.44%	129	53.97%	99	41.08%
Total	33	8.25%	230	57.50%	137	34.25%

Table 2: Numbers and percentage of each smile line type by gender

Regarding to table 2, Smile line is classified into 3 types; low smile line, average smile line and high smile line. The volunteers were checked to identify which smile line type they are. Overall, 57.50% of total volunteers have average smile line, followed by 34.25% of high smile line. There are only 33 volunteers or 8.25% who have low smile line.

Considering by gender, the ranking of smile line type is not different from total volunteers. The highest proportions are average smile line for both male and female, 62.73% and 53.97%, respectively. High smile line is also in the second rank, which 23.90% for male and 41.08% for female. Lastly, low smile line has the smallest number of volunteers, 12.42% for male and 5.44% for female. Nonetheless, it is clearly seen that the degree of proportions of each smile line type is different between male and female, even though they have the same order. From the result, male tend to have average smile line and low smile line than female. In contrast, female tend to have high smile line than male.

Gender	Mean maxillary gingival in high smile line			
	< 2 mm		≥ 2 mm	
	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers
Male	17	44.74%	21	55.26%
Female	48	48.48%	51	51.52%
Total	65	47.45%	72	52.55%

Table 3: Numbers and percentage of mean maxillary gingival in high smile line type by gender

High smile line is classified by using mean maxillary gingival. The cut off is 2 mm. Consequently, there are 2 types of high smile which are called "< 2 mm (less than 2 millimeters)" and "≥ 2 mm (greater than or equal to 2 millimeters)" in this research.

Table 3 presents the numbers and proportions of volunteers crossed between mean maxillary gingival and gender. In general, “ ≥ 2 mm” covers 52.55% of total volunteers, which is slightly higher than “ < 2 mm”, which has 47.45%. The pattern from each gender is also similar to overall pattern but the numbers are a bit different. 55.26% of male has mean maxillary gingival in high smile line ≥ 2 mm, which is a little higher than overall; and 44.74% is lower than 2 mm. In contrast with female, the proportion of “ ≥ 2 mm” is slightly less than overall, which is 51.52%; therefore, the proportion of “ < 2 mm” is higher than overall, which is 48.48%.

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 ≥ 2 mm oval	400	1	2.79	1.03	5
High ≥ 2 mm triangle	400	1	2.80	0.94	5
High ≥ 2 mm square	400	1	3.08	1.11	5
High < 2 mm oval	400	1	2.87	1.01	5
High < 2 mm triangle	400	1	3.03	1.01	5
High < 2 mm square	400	1	2.99	1.02	5

Table 4: Descriptive statistics of attractiveness score of each smile type

There are 12 types of smile considered in this research as described in Table 4. It can be grouped into 4 main types; low smile line, average smile line, high smile line ≥ 2 mm and high smile line < 2 mm. Each main type has 3 subtypes under it, which are oval, triangle and square tooth shape. The attractiveness of each smile type is measured by score, ranges from 1 to 5; the least attractive to the most attractive. According to table 4, each smile type has minimum score at 1 and maximum score at 5. However, the average scores are different. It can be implied that some smile types are perceived more attractive than other smile types.

Average smile line with square tooth shape has the highest attractiveness score at 3.86, followed by high ≥ 2 mm smile line with square tooth shape (3.08), and high < 2 mm smile line with triangle tooth shape (3.03). On the other hand, all 3 types of low smile line are ranked in the bottom. Their scores are 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.

	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	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow
Low square			Black	Yellow	Yellow	Yellow	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	Yellow	Yellow	Yellow	Yellow	Yellow
high >=2 triangle								Black	Yellow	Yellow	Yellow	Yellow
high >=2 square									Black	Yellow	Yellow	Yellow
high <2 oval										Black	Yellow	Yellow
high <2 triangle											Black	Yellow
high <2 square												Black

Table 5: Statistic significant between 12 smile types (yellow color as a statistically significant different, white color as no significant different)

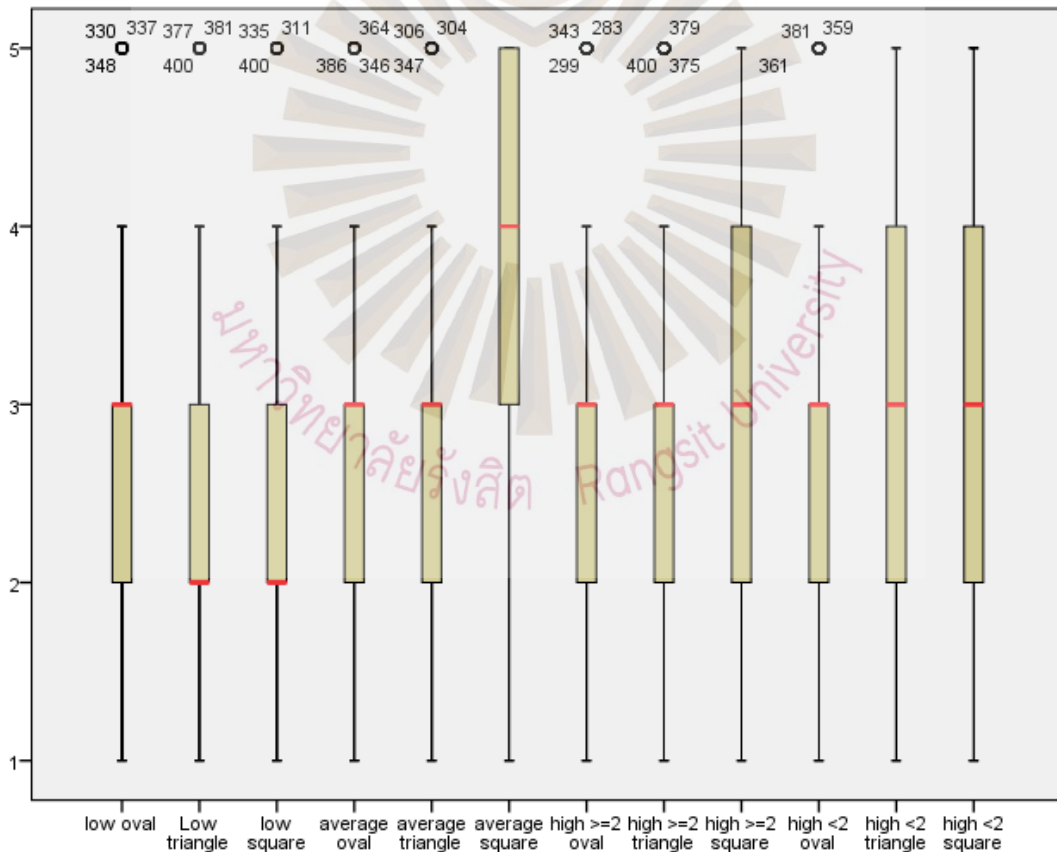


Figure 6: Boxplot of 12 smile types (red color as median of each smile type)

The boxplot depicts the distribution of attractiveness score of each smile type. The distribution of average smile line with square tooth shape is distinctive from other smile types. Its median is near 4, which is higher than the

others. Moreover, high ≥ 2 mm smile line with square tooth shape, high < 2 mm smile line with triangle tooth shape and high < 2 mm smile line with square tooth shape tend to have the similar distribution. The median of their attractiveness scores is around 3. For other smile types, they seem 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 are near 2 in the plot.

The most attractiveness tooth shape of average and high ≥ 2 mm smile line are square tooth shape while the attractiveness of oval and triangle tooth shape are not different. In high < 2 mm smile line, triangle tooth shape is more attractive than oval tooth shape and the attractiveness of square tooth shape is equal to that of triangle and oval tooth shape. Meanwhile the attractiveness of square, triangle and oval tooth shape are equal in low smile line.

4.2 Discussion

The goal of an esthetic makeover is to develop a peaceful and stable masticatory system, where the teeth, tissues, muscles, skeletal structures and joints all function in harmony. It is very important that when planning treatment for esthetics cases, smile design cannot be isolated from a comprehensive approach to patient care. Achieving a successful, healthy and functional result requires an understanding of the interrelationship among all the supporting oral structures, including the muscles, bones, joints, gingival tissues and occlusion.

An esthetics smile requires a perfect integration of facial composition and dental composition. The dental composition relates more specifically to teeth and their relationship to gingival tissues. A smile design should always include the evaluation and analysis of both facial and dental composition.

Because smile line is important to restoration in esthetic zone, the proper technique should use to deal with each situation like a high smile line is more critical situation.

Prevalence smile line of this study, on the smile type 400 Thai young adult subject, showed that average smile type, high smile type, low smile type are 57.5%, 34.3%, and 8.3% respectively. In our study, most subjects show average smile line followed by high smile line and then low smile line. However, the result of present study are different from those reported by Tjan et al., in 1984, on American youths with 454 full-face photographs of dental and dental hygiene students with open smiles (smiles displaying teeth). The subjects were 207 men and 247 women from 20 to 30 years of age. Each subject was compared, analyzed, and evaluated. Study subjects were classified with an average smile line in which 68.94% followed by 20.48% was low smile line and 10.57% was high smile line. Different from reported by Y Zhang et al., in 2015. Two-hundred young Chinese subjects (100 men and 100 women; 20–35 years of age) with healthy dentogingival tissue were recruited. The dynamic smile process was captured using a digital camera showed that high smile line, average smile line and low smile line were present 45.5%, 45.5% and 9% respectively. Moreover, the result of report by Al-Juboori MJ et al., in 2017, a randomized sample, consisting of 238

Malaysian aged between 18-35 years was used to carry out this study. Upon screening, the participant was asked to relax the lip and the lip length is recorded with a calibrated caliper. Smile line was then assessed by posed smile. Result showed that average smile line are most common followed by high smile line and low smile line were present 45%, 38.5% and 16.5% respectively but different rationale affect to result.

Puppin, et al. report shows women tend to have average and high smile line (55.9% and 37.7% respectively) and men tend to have average and low smile line (54% and 23.8% respectively). Another report by Peck, et al. conducted a study to investigate the smile line of North American population with a mean age of 15.5 years concluded that average (52.2%) and high (32.5%) smile line in women but male usually feature average and low smile line (48% and 33% respectively). Both of the report is similar to our results. In our study, the highest proportions are average smile for both male and female, 62.73% and 53.97%, respectively. High smile is also in the second rank, which 24.84% for male and 40.59% for female. Lastly, low smile has the smallest number of observations, 12.42% for male and 5.44% for female.

Several studies on various populations have reported a higher percentage of women had a high smile line and a very high smile line as compared to males. These results are in accordance with data reported by Dayakar, et al. showed the variation in periodontal visible during natural smile and maximal smile in both genders. 81.8% females were found to have a high smile line during natural smile line whereas only 18.2% males were found to have a high smile line during a natural smile. A similar pattern was seen during Maximal smile 76.2% females exhibited a high smile line as compared to 23.8% males.

Maxillary gingival display influenced on dental attractiveness ratings. 400 students were rating on a 5 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 of smile analysis 12 images show that average smile line with square tooth shaped found rating score mean 3.68 were rated as most attractive and more than other group significant difference while low smile line with ovoid tooth shaped found rating score mean 2.54 were rated as less attractiveness. Square tooth shape tends to attract more attention than any other tooth shape. Square, ovoid and triangle tooth shape within low smile line group weren't affected to attractiveness significant difference. However, Anderson, et al reported restorative dentists preferred round incisors for the female images. Orthodontists preferred round and square-round incisors for the female images. Laypeople did not significantly discriminate between any of the female incisor shapes. Restorative dentists, orthodontists, and laypeople share similarities and display differences when considering esthetic preferences in tooth shape. Orlagh et al. in 2002 examined the influence of maxillary gingival display on the attractiveness rating by 120 universities student (94 females, 26 males) were shown 7 photographs of a male and 7 photographs of a female subject each with levels of gingival display raging from -2 to +4 mm. Attractiveness ratings

were record on 10 point for each photographs. The most attractive photographs of this study revealed full height of the incisors and no gingival tissue while gingival display of more than 2 mm was rated as progressive less attractive.

However, from the study of Amjad 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 +2mm of gingival display in the short face subject as the most attractive. In contrast, orthodontists and general practice ranked the smile showing no gingival display (average smile line) as the most attractive in short face. For the long face, laypeople and general practitioner dentists ranked the smile showing no gingival display (average smile line) as the most attractive, while orthodontists ranked a +2 mm gingival display as the most attractive.

It can 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 had, attractiveness was not different. In average and high ≥ 2 mm smile groups, square tooth shape was the most attractive and followed by oval and triangle which are not different. In contrast, high < 2 mm could not be implied that what tooth shape was the most attractive but only explain that triangle tooth shape more attractive than oval and square was not different when compare with triangle and oval tooth shape. Tendency of smile line in high and average smile line associated with square tooth shape had the most attractiveness which may be the choice for choose restoration.



Chapter 5

Conclusion and suggestion

5.1 Conclusion

In population both male and female most common found average smile line. Female mostly found high smile line but tend in male is low smile line. Esthetic is a factor to decide for dental treatment planning .The restoration and gingival tissues completely display in high smile line but low smile line is a less critical situation because the restoration interface will be hidden behind the upper lip.

In our study, average smile line with square tooth shape is the most attractive, but other factor can be affect to evaluate esthetic example tooth color, lip position, lip curvature and facial type to consider attractive of smile which interest point to study in the future. Therefore, smile line should include being a factor to evaluate before treatment planning especially in high smile esthetic demand.

5.2 Suggestion

1. In part of attractiveness, male photographs should also be included for attractiveness rating score
2. Increase age range of population in our sample size
3. For further study, the different group of young adulthood should be considered.

5.3 Limitation

According to physical growth and development of young adulthood, the body reaches full height by the late teens, and physical strength increases into the late 20s and 30s (Whitbourne 2001). Our inclusion criteria which purposed to recruit Thai young adult age 20-35, the age of participants in this study ranged between 20-29 and mean age was 21 years old both males and females. The tendency of group age was early young adulthood that might influence the result of the study.

References

- Ackerman, M. B., & Ackerman, J. L. (2002). Smile analysis and design in the digital era. *J Clin Orthod*, 36(4), 221-236.
- Ackerman, M. B., Brensinger, C., & Landis, J. R. (2004). An evaluation of dynamic lip-tooth characteristics during speech and smile in adolescents. *Angle Orthod*, 74(1), 43-50.
- Amjad Al Taki, Thar Hayder Mohammed, and Ahmad Mohammad Hamdan.(2017). Influence of the Smile Line on Smile Attractiveness in Short and Long Face Individuals. *Hindawi International Journal of Dentistry*,1-7
- Carlos A.C. (2010). Aesthetics in Orthodontics: Six horizontal smile lines. *Dental Press J. Orthod*,15(1), 118-131.
- Geron, S., & Atalia, W. (2005). Influence of sex on the perception of oral and smile esthetics with different gingival display and incisal plane inclination. *Angle Orthod*, 75(5), 778-784.
- Hunt, O., Johnston, C., Hepper, P., Burden, D., & Stevenson, M. (2002). The influence of maxillary gingival exposure on dental attractiveness ratings. *Eur J Orthod*, 24(2), 199-204.
- Kapagiannidis, D., Kontonasaki, E., Bikos, P., & Koidis, P. (2005). Teeth and gingival display in the premolar area during smiling in relation to gender and age. *J Oral Rehabil*, 32(11), 830-837.
- Liang, L. Z., Hu, W. J., Zhang, Y. L., & Chung, K. H. (2013). Analysis of dynamic smile and upper lip curvature in young Chinese. *Int J Oral Sci*, 5(1), 49-53.
- Mahshid, M., Khoshvaghti, A., Varshosaz, M., & Vallaei, N. (2004). Evaluation of "golden proportion" in individuals with an esthetic smile. *J Esthet Restor Dent*, 16(3), 185-192; discussion 193.
- Machado, A. W. (2014). 10 commandments of smile esthetics. *Dental Press J Orthod*, 19(4), 136-157.
- Mundoor Manjunath Dayakar, Anna Shipilova, M. Rekha. (2017). Evaluation of Smile Esthetics by Photographic Assessment of the Dento-Labio-Gingival Complex. *J Dent Allied Sci* 2015;4:65-8.
- Ritter, D. E., Gandini, L. G., Jr., Pinto Ados, S., Ravelli, D. B., & Locks, A. (2006). Analysis of the smile photograph. *World J Orthod*, 7(3), 279-285.
- Snow, S. R. (1999). Esthetic smile analysis of maxillary anterior tooth width: the golden percentage. *J Esthet Dent*, 11(4), 177-184.
- Tjan, A. H., Miller, G. D., & The, J. G. (1984). Some esthetic factors in a smile. *J Prosthet Dent*, 51(1), 24-28.
- Van der Geld, P. A., Oosterveld, P., van Waas, M. A., & Kuijpers-Jagtman, A. M. (2007). Digital videographic measurement of tooth display and lip position in smiling and speech: reliability and clinical application. *Am J Orthod Dentofacial Orthop*, 131(3), 301 e301-308.
- Zhang, Y. L., Le, D., Hu, W. J., Zhang, H., Liang, L. Z., Chung, K. H., & Cao, Z. Q. (2015). Assessment of dynamic smile and gingival contour in young Chinese people. *Int Dent J*, 65(4), 182-187.

Appendix

Hypothesis testing

This section presents the results from hypothesis testing, which are related to research questions. This research comprises of 5 hypotheses as follow:

Hypothesis 1: There is different in smile line type in a group of Thai young adults. This hypothesis will be tested by using Chi-Square test.

Hypothesis 2: There is different in smile line type in a group of Thai young adults between male and female. The statistics that will be used is Chi-Square.

Hypothesis 3: There is different between proportions in a group of Thai young adults who has mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

Hypothesis 4: There is different between male and female in proportions in a group of Thai young adults who have mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

Hypothesis 5: Among 12 smile types, there is at least 1 pair of smile type that is different in attractiveness score. Since the scores were collected from dependent samples, the hypothesis will be tested by using Paired t-test if data is normally distributed. Otherwise, Wilcoxon sign-rank test will be used instead.

Hypothesis 1: There is different in smile line type in a group of Thai young adults

H_0 : There is no difference in proportions of low smile line, average smile line and high smile line

H_1 : At least 1 type of smile line has different proportion from the others

Chi-Square	Asymptotic significance
145.685 ^a	0.000

0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 133.3.

Table 1: Test statistics of the difference in proportions of each smile line type

Regarding to Table 1 Chi-Square value is 145.685 and asymptotic significance is 0.000. At significance level 0.05, the value of asymptotic is less than significance level. As a result, there is enough evidence to reject the null hypothesis, which means that there is at least 1 type of smile that has different proportion, comparing to the others.

Gender	Smile Line Type					
	Low Smile		Average Smile		High Smile	
	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers
Male	20	12.42%	101	62.73%	38	23.90%
Female	13	5.44%	129	53.97%	99	41.08%
Total	33	8.25%	230	57.50%	137	34.25%

Table 2: Numbers and percentage of each smile line type by gender

According to table 2, up to 57.5% of total volunteers have average smile line whereas only 8.25% have low smile line. Therefore, the difference in proportions of low smile line, average smile line and high smile line is statistically significance. The highest proportion of smile line type is average smile line.

Hypothesis 2: There is different in smile line type in a group of Thai young adults between male and female

H_0 : There is no difference in proportions of low smile line, average smile line and high smile line between male and female.

H_1 : At least 1 type of smile line has different proportion between male and female

Pearson Chi-Square	Asymptotic significance (2-sided)
15.913 ^a	0.000

0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 13.12.

Table 3: Test statistics of the difference in proportions of each smile line type between male and female

Table 3 shows value of Chi-Square, the statistics to test this hypothesis. The value equals to 15.913 with asymptotic significance (2-sided) at 0.000. At significance level 0.05, it can be concluded that proportions of smile line type between male and female are statistically significant different.

According to table 2, even though average smile line has the highest proportion for both male and female, the proportions of low smile line and high smile line are different. Proportion of low smile line is 12.44% for male whereas the number of female is only 5.44%. On the other hand, 41.08% of female has high smile line but male's number is just 23.90%. As a result, it indicates that male and female have different smile line type.

Hypothesis 3: There is different between proportions in a group of Thai young adults who has mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_0 : There is no difference in proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_1 : The proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile type are different

Chi-Square	Asymptotic significance
0.358 ^a	0.550

0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 68.5.

Table 4: Test statistics of the difference in proportions of mean maxillary gingival display in high smile

The result from table 4 presents that Chi-Square of the test is 0.358. Asymptotic significance value is 0.550, which is higher than significance level 0.05. Consequently, there is no enough evidence to conclude that proportions of high smile line in a group of Thai young adults who have mean maxillary gingival display " ≥ 2 mm is different from the one whose values are < 2 millimeters.

Hypothesis 4: There is different between male and female in proportions in a group of Thai young adults who have mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line

H_0 : There is no difference in proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line between male and female

H_1 : The proportions of mean maxillary gingival display ≥ 2 mm and < 2 mm in high smile line are different between male and female

Chi-Square	Asymptotic significance (2-sided)	Fisher's exact test (2-sided)
0.155 ^a	0.694	0.707

0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 18.98.

Table 5: Test statistics of the difference in proportions of mean maxillary gingival display in high smile between male and female

Fisher's exact test (2-sided) in table 5 equals to 0.707. Comparing with significance level 0.05, the value is higher. As a result, there is no enough evidence to conclude that male and female have different proportions of mean maxillary gingival display in high smile line between ≥ 2 mm group and < 2 mm group.

Gender	Mean maxillary gingival in high smile line			
	< 2 mm		≥ 2 mm	
	No. of volunteers	% of volunteers	No. of volunteers	% of volunteers
Male	17	44.74%	21	55.26%
Female	48	48.48%	51	51.52%
Total	65	47.45%	72	52.55%

Table 6: Numbers and percentage of mean maxillary gingival in high smile line type by gender

Table 6 shows that all the figures are quite similar to each other. “< 2 mm” numbers are 44.74% for male and 48.88% for female. Also, 55.26% is proportion of “≥ 2 mm” in male and 51.52% is the female's number.

Hypothesis 5: Among 12 smile types, there is at least 1 pair of smile type that is different in attractiveness score.

H_0 : All 12 smile types do not have difference in their attractiveness scores

H_1 : There is at least 1 pair of smile types that have difference in the attractiveness scores

In order to test the hypothesis, the attractiveness score of each smile type is test normal distribution by using Kolmogorov-Smirnov. The result is presented in table 7.

Smile type	Kolmogorov-Smirnov statistics	Sig.
Low oval	.196	.000
Low triangle	.236	.000
Low square	.223	.000
Average oval	.201	.000
Average triangle	.226	.000
Average square	.221	.000
High ≥ 2 mm oval	.201	.000
High ≥ 2 mm triangle	.207	.000
High ≥ 2 mm square	.172	.000
High < 2 mm oval	.209	.000
High < 2 mm triangle	.195	.000
High < 2 mm square	.195	.000

Table 7: Test statistics of normal distribution by Kolmogorov Smirnov

The sig. values shown in table 7 are 0.000 for all smile types. It means that the attractiveness scores are not normally distributed. Hence, this hypothesis will be tested by using Wilcoxon sign-rank test.

Low oval	-0.382	-0.777	-3.989	-3.649	-11.492	-3.604	-4.178	-7.320	-5.062	-7.175	-6.632
	0.703	0.437	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Low triangle	-0.423	-3.311	-2.661	-10.781	-3.400	-3.735	-6.942	-4.583	-6.678	-5.744	
	0.672	0.001	0.008	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Low square		-3.026	-2.195	-10.542	-3.250	-3.105	-6.391	-4.157	-6.320	-5.401	
		0.002	0.028	0.000	0.001	0.002	0.000	0.000	0.000	0.000	0.000
Average oval		-0.735	-10.192	-0.202	-0.305	-4.705	-1.617	-3.861	-3.504		
		0.463	0.000	0.840	0.760	0.000	0.106	0.000	0.000	0.000	
Average triangle			-10.957	-0.888	-0.807	-4.739	-2.127	-4.326	-4.151		
			0.000	0.375	0.420	0.000	0.033	0.000	0.000	0.000	
Average square				-8.840	-10.478	-7.229	-8.971	-6.975	-9.356		
				0.000	0.000	0.000	0.000	0.000	0.000	0.000	
High \geq 2 mm Oval					-0.129	-4.304	-1.374	-3.825	-2.814		
					0.898	0.000	0.170	0.000	0.005		
High \geq 2 mm Triangle						-4.308	-0.787	-3.447	-3.030		
						0.000	0.431	0.001	0.002		
High \geq 2 mm Square							-3.304	-0.939	-1.301		
							0.001	0.348	0.193		
High < 2 mm Oval								-2.767	-1.893		
								0.006	0.058		
High < 2 mm Triangle									-0.501		
										0.616	

Table 8: Statistics of Wilcoxon signed-rank test

Table 8 presents the statistics of Wilcoxon signed-rank test and asymptotic significance value of each pair of smile types. From 66 pairs of smile types, 50 pairs of smile types have their attractiveness scores significance different from each other as their asymptotic significance values are less than significance level (0.05). Within those 50 pairs, average smile line with square tooth shape score is 3.68 and second highest scores are the set of high \geq 2 mm smile line with square tooth shape, high < 2 mm smile line with triangle tooth shape and high < 2 mm smile line with square tooth shape, which are 3.08, 3.03 and 2.99, respectively. In other words, the top bottom score are 3 types of low smile line.

On the other hand, there are only 16 pairs that have no enough evidence to say that the attractiveness scores are different with each other because the asymptotic significance values are higher than significance level (0.05).



Weighted kappa calibration

For both observers, the values are ranged into 3 groups as follow:

- Group 1: Greater than or equal to 2 mm but less than 3 mm (≥ 2 mm but < 3 mm)
- Group 2: Greater than or equal to 3 mm but less than 4 mm (≥ 3 mm but < 4 mm)
- Group 3: Greater than or equal to 4 mm but less than 5 mm (≥ 4 mm but < 5 mm)

To measure reliability of each observer and among 2 observers, Weighted Kappa Calibration is a statistic to use. Kappa value can be interpreted as follow:

Kappa	Interpretation
< 0	Poor agreement
0.0 – 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 1.00	Almost perfect agreement

The reliability of Observer 1 between 2 measures

		Measure 2		
		≥ 2 mm but < 3 mm	≥ 3 mm but < 4 mm	≥ 4 mm but < 5 mm
Measure 1	≥ 2 mm but < 3 mm	3		
	≥ 3 mm but < 4 mm		3	
	≥ 4 mm but < 5 mm			4

Table 9: Data collection of 10 pictures from observe 1 between 2 measures

According to 10 pictures that were measured by observer1, every picture gets the same result in both measures.

Kappa Test Value	Approximate Significance
1.000	0.000

Table 10: Test statistic of reliability of Observer 1 between 2 measures

Kappa Test Value is 1.000 significant 0.000 (< 0.05). It means that the consistency of Observer 1 is absolutely perfect agreement

The reliability of observer 2 between 2 measures

Number of pictures		Measure 2		
		≥ 2 mm but < 3 mm	≥ 3 mm but < 4 mm	≥ 4 mm but < 5 mm
Measure 1	≥ 2 mm but < 3 mm	3		
	≥ 3 mm but < 4 mm		3	
	≥ 4 mm but < 5 mm		1	3

Table 11: Data collection of 10 pictures from observe 2 between 2 measures

According to 10 pictures that were measured by observer2, there is only 1 picture that was recorded in different range. The other 9 pictures were recorded in the same range in both measures.

Kappa test value	Approximate significance
0.851	0.000

Table 12: Test statistic of reliability of Observer 2 between 2 measures

Kappa Test Value is 0.851 with significant 0.000 (< 0.05). It means that the consistency of Observer 2 is in a level of absolutely perfect agreement

The reliability between observer 1 and observer 2

Number of pictures		Observer 2		
		≥ 2 mm but < 3 mm	≥ 3 mm but < 4 mm	≥ 4 mm but < 5 mm
Observer 1	≥ 2 mm but < 3 mm	3		
	≥ 3 mm but < 4 mm		3	
	≥ 4 mm but < 5 mm		1	3

Table 13: Data collection of 10 pictures from observer 1 and observer 2

According to 10 pictures, there is only 1 picture that was recorded in different range by Observer 1 and Observer 2. The other 9 pictures were recorded in the same range by both observers

Kappa test value	Approximate significance
0.851	0.000

Table 14: Test statistic of reliability between observer 1 and observer 2

Kappa Test Value is 0.851 with significant 0.000 (< 0.05). It means that the consistency between Observer 1 and Observer 2 is in a level of absolutely perfect agreement

As a result, the measurement of each observes as well as between 2 observers are absolutely perfect agreement.

	Obs1 * Obs1	Obs2 * Obs2	Obs1 * Obs2
Kappa test value	1.000	0.851	0.851
Approximate sig.	0.000	0.000	0.000

Table 15: Summary of test statistic of reliability from observer 1 and observer 2

