



Subject Area : Orthodontics

ESTHETIC PERCEPTIONS AND SMILE VARIABLES BETWEEN EXTRACTION AND NON-EXTRACTION TREATMENTS FOR CLASS I AND CLASS II MALOCCLUSIONS IN SOUTH INDIAN POPULATION

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ARTICLE INFO	ABSTRACT
Received 17 th April, 2025 Received in revised form 25 th April, 2025 Accepted 18 th May, 2026 Published online 28 th May, 2026	Objective: An esthetic smile is what which increases the attractiveness of face. It enhances the acceptance of an individual in the society by improving the initial impression in interpersonal relationships. Every individual desires for an esthetically pleasing smile making it an important factor in Dentofacial esthetics. The primary purpose of this study was to evaluate the difference in esthetic perception between extraction and non-extraction treatments in class I and class II patients subjectively by panel raters and objectively by measuring the smile variables, and to determine the parameter of more significance in smile esthetics. Methods: 10 Laypeople, 10 Orthodontists and 10 General dentists perform subjective evaluations of the smile esthetics. A visual analog scale was used to score each photograph. Six variables were measured from the post treatment frontal smiling photographs by using the ruler tool in Photoshop. Results: The results showed that the golden proportion was statistically significant and the layperson esthetic perception was borderline significant. Conclusion: This study concluded that golden proportion was the only parameter that showed statistical significance, hence showing that the golden proportion was not followed.
Key words:	
Golden proportion, smile, esthetic perception, class I and class II, Extraction and Non extraction	
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INTRODUCTION

Smile is one of the most important expression contributing to facial attractiveness. It is the first thing that is noticed about anybody. The science of smiling was initiated by Charles Darwin. People express their emotions through smile and also it plays an important role in facial beauty¹. According to Hulsey, "Smile is one of the most effective means by which people convey their emotions"². Patients have become increasingly conscious of a beautiful smile. It has become the primary objective of orthodontic treatment and the main reason that patients seek orthodontic treatment.³

Assessing patient's smile allows the clinician to see what needs to be done, what can be done, and what should be accepted. The perception of smile esthetics is subjective and is influenced by personal experiences. Numerous studies have concluded that dental professional and general population differ considerably in their preferences for smile esthetics. Moreover, among the dental professionals, the orthodontists are more analytical than the general dentist. This is due to the special training of

orthodontist to observe and evaluate features that do not seem to influence the general dentist and the public. Understanding the components of an esthetically attractive smile is essential to achieving patient satisfaction⁴.

The primary purpose of this study was to evaluate the difference in esthetic perception between extraction and non-extraction treatments in class I and class II patients subjectively by panel raters and objectively by measuring the smile variables, and to determine the parameter of more significance in smile esthetics.

MATERIALS AND METHODS

Source of Data

Post treatment frontal smiling photographs (canon, 750) were used. Photoshop software (Adobe systems, CS6) will be used to crop the photos to show only the perioral area and are converted to black and white images to minimize the influence of other facial characteristics and skin color and stored in JPEG format. Power point (Microsoft) is used to show the photographs to the raters in random order.

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Inclusion Criteria

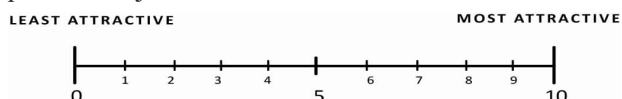
- Participants whose pretreatment overjet were 0-4 mm and >4 mm (Angles class I and class II)
- Completed orthodontic treatment.
- Patients who were orthodontically treated without extraction and with extraction.
- All permanent dentition.
- Pretreatment records (study models, lateral cephalograms)

Exclusion Criteria

- Participants with large skeletal discrepancy for which surgical orthodontic treatment were indicated.

METHOD OF STUDY

- 10 Laypeople, 10 Orthodontists and 10 General dentists perform subjective evaluations of the smile esthetics.



- A visual analog scale will be used to score each photograph with 0 on the left (very unattractive) and 10 on the right (very attractive). The raters will not be provided with any information about the participants.
- The following 6 variables will be measured from the post treatment frontal smiling photographs by using the ruler tool in Photoshop.

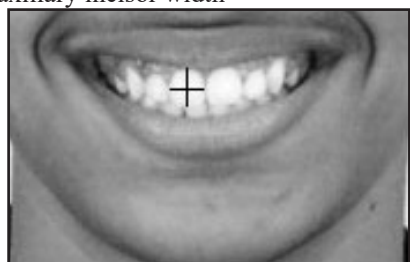
The following 6 variables are measured:

- Smile arc ratio.
Distance of the maxillary incisor edge to inter canine connecting line
Distance of the lower lip to the inter canine connecting line.



- Maxillary incisor show.

Distance of the maxillary incisor edge to upper lip
Maxillary incisor width

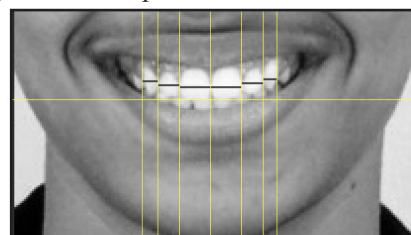


- Upper and lower dental midlines.

Two anatomical landmarks were taken as reference, nasion and the base of the philtrum or cupid's bow in the center of the upper lip⁶. Ideally maxillary central incisor midline should coincide with the facial midline. If not then, midline between maxillary central incisor should be vertical and parallel to facial midline. Midline deviations more than 2mm must be corrected

- Tooth number displayed.
Exposed maxillary teeth.
- Gingival exposure.

According to Tjan ⁸ et al, gingival exposure is determined by the smile line classified as high, medium or low. Gingival exposure up to 3mm is acceptable and more than 3mm is considered unaesthetic. High smile line with gingival exposure not greater than 3mm is more esthetic followed by medium and low smiles. High smile line is characterized by total exposure of clinical crowns and continuous strip of gingival tissue. Medium smile line –great (75%) or total (100%) exposure of clinical crowns and interdental or interproximal papillae. Low smile line-clinical crown exposure not greater than 75% and no gingival tissue exposure.



- Golden Proportion

According to Levin ²⁹, visible lateral incisor should count for 62% of central incisor, and the same way canine should count for 62% of lateral incisors. The mesiodistal dimension are measured at the widest mesiodistal portion and parallel to the incisal edge of the tooth.

Statistical Analysis

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp., will be used to perform statistical analyses.

Descriptive Statistics

Descriptive analysis of all the explanatory and outcome parameters was done using mean and standard deviation for quantitative variables, frequency and proportions for categorical variables.

Inferential Statistics

Mann Whitney Test was used to compare the mean Smile arc ratio, Maximum Incisor & mean Gingival Exposure show between Class I & II subjects as well as between Extraction and Non-extraction conditions in each Class. Chi Square Test was used to compare the Upper & lower midline coinciding & no. of teeth displayed between extraction and non-extraction

conditions in Class I & II subjects.

Student Paired t test was used to compare the mean Golden Proportion values on Right & Left sides in Class I & II subjects as well as between the right & left sides in Extraction and Non-extraction conditions among Class I & II subjects. Kruskal Wallis Test was used to compare the mean VAS scores for smile perception between 03 raters in different classes. Friedman's Test was used to compare the mean VAS scores for smile perception for classes by each rater. The level of significance was set at $P < 0.05$.

RESULTS

When 80 photographs of individuals which comprised of 20 class I extraction, 20 class I non-extraction, 20 class II extractions, 20 class II non-extraction cases were assessed for the six smile esthetic parameters and were rated by the three groups that is Lay person, General dentist and Orthodontist, the results showed significant values for golden proportion.

In Class II subjects, the mean Mesio-distal width of estimated Lateral Incisor by Golden proportion method on the Right & Left sides was significantly lesser [3.50 ± 0.35] as compared to the actual Mesio-distal width of Lateral Incisor [4.05 ± 0.52]. This difference in was statistically significant at $P < 0.001$.

Similarly, the mean Mesio-distal width of estimated Canine by Golden proportion method on the Right & Left sides was significantly lesser [2.51 ± 0.32] as compared to the actual Mesio-distal width of Canine [3.27 ± 0.39]. This difference in was statistically significant at $P < 0.001$.

In Class I subjects, in extraction condition the mean Mesio-distal width of estimated Lateral Incisor by Golden proportion method on the Right & Left sides was significantly lesser [3.90 ± 0.40] as compared to the actual Mesio-distal width of Lateral Incisor [4.64 ± 0.42]. This difference in was statistically significant at $P < 0.001$.

Similarly, the mean Mesio-distal width of estimated Canine

Table 1: Comparison of mean Golden Proportion values on Right & Left sides in Class I subjects using Student Paired t test

Sides	Parameter	N	Mean	SD	Mean Diff	P-Value
Right	Central x 0.62	40	4.15	0.45	-0.70	<0.001*
	Lateral	40	4.85	0.62		
	Lateral x 0.62	40	3.01	0.39	-0.82	<0.001*
	Canine	40	3.83	0.56		
Left	Central x 0.62	40	4.15	0.45	-0.70	<0.001*
	Lateral	40	4.85	0.62		
	Lateral x 0.62	40	3.01	0.39	-0.82	<0.001*
	Canine	40	3.83	0.56		

Table 2. Comparison of mean Golden Proportion values on Right & Left sides in Class II subjects using Student Paired t test

Sides	Parameter	N	Mean	SD	Mean Diff	P-Value
Right	Central x 0.62	40	3.50	0.35	-0.55	<0.001*
	Lateral	40	4.05	0.52		
	Lateral x 0.62	40	2.51	0.32	-0.76	<0.001*
	Canine	40	3.27	0.39		
Left	Central x 0.62	40	3.50	0.35	-0.55	<0.001*
	Lateral	40	4.05	0.52		
	Lateral x 0.62	40	2.51	0.32	-0.76	<0.001*
	Canine	40	3.27	0.39		

In Class I subjects, the mean Mesio-distal width of estimated Lateral Incisor by Golden proportion method on the Right & Left sides was significantly lesser [4.15 ± 0.45] as compared to the actual Mesio-distal width of Lateral Incisor [4.85 ± 0.62]. This difference in was statistically significant at $P < 0.001$.

Similarly, the mean Mesio-distal width of estimated Canine by Golden proportion method on the Right & Left sides was significantly lesser [3.01 ± 0.39] as compared to the actual Mesio-distal width of Canine [3.83 ± 0.56]. This difference in was statistically significant at $P < 0.001$.

by Golden proportion method on the Right & Left sides was significantly lesser [2.88 ± 0.26] as compared to the actual Mesio-distal width of Canine [3.53 ± 0.47]. This difference in was statistically significant at $P < 0.001$.

in Non-extraction condition the mean Mesio-distal width of estimated Lateral Incisor by Golden proportion method on the Right & Left sides was significantly lesser [4.39 ± 0.35] as compared to the actual Mesio-distal width of Lateral Incisor [5.06 ± 0.73]. This difference in was statistically significant at $P < 0.001$.

Table 3. Comparison of mean Golden Proportion values on Right & Left sides in Extraction and Non-extraction conditions among Class I subjects using Student Paired t test							
Condition	Sides	Parameter	N	Mean	SD	Mean Diff	P-Value
Extraction	Right	Central x 0.62	20	3.90	0.40	-0.74	<0.001*
		Lateral	20	4.64	0.42		
		Lateral x 0.62	20	2.88	0.26	-0.65	<0.001*
		Canine	20	3.53	0.47		
	Left	Central x 0.62	20	3.90	0.40	-0.74	<0.001*
		Lateral	20	4.64	0.42		
		Lateral x 0.62	20	2.88	0.26	-0.65	<0.001*
		Canine	20	3.53	0.47		
Non-Extraction	Right	Central x 0.62	20	4.39	0.35	-0.66	<0.001*
		Lateral	20	5.06	0.73		
		Lateral x 0.62	20	3.13	0.45	-0.99	<0.001*
		Canine	20	4.13	0.49		
	Left	Central x 0.62	20	4.39	0.35	-0.66	<0.001*
		Lateral	20	5.06	0.73		
		Lateral x 0.62	20	3.13	0.45	-0.99	<0.001*
		Canine	20	4.13	0.49		

Table 4. Comparison of mean Golden Proportion values on Right & Left sides in Extraction and Non-extraction conditions among Class II subjects using Student Paired t test							
Condition	Sides	Parameter	N	Mean	SD	Mean Diff	P-Value
Extraction	Right	Central x 0.62	20	3.48	0.28	-0.50	<0.001*
		Lateral	20	3.98	0.45		
		Lateral x 0.62	20	2.47	0.28	-0.77	<0.001*
		Canine	20	3.24	0.38		
	Left	Central x 0.62	20	3.48	0.28	-0.50	<0.001*
		Lateral	20	3.98	0.45		
		Lateral x 0.62	20	2.47	0.28	-0.77	<0.001*
		Canine	20	3.24	0.38		
Non-Extraction	Right	Central x 0.62	20	3.52	0.42	-0.60	<0.001*
		Lateral	20	4.12	0.59		
		Lateral x 0.62	20	2.55	0.37	-0.76	<0.001*
		Canine	20	3.31	0.40		
	Left	Central x 0.62	20	3.52	0.42	-0.60	<0.001*
		Lateral	20	4.12	0.59		
		Lateral x 0.62	20	2.55	0.37	-0.76	<0.001*
		Canine	20	3.31	0.40		

Similarly, the mean Mesio-distal width of estimated Canine by Golden proportion method on the Right & Left sides was significantly lesser [3.13± 0.45] as compared to the actual Mesio-distal width of Canine [4.13 ± 0.49]. This difference in was statistically significant at P<0.001.

In Class I subjects, in extraction condition the mean Mesio-distal width of estimated Lateral Incisor by Golden proportion method on the Right & Left sides was significantly lesser [3.48 ± 0.28] as compared to the actual Mesio-distal width of Lateral Incisor [3.98 ± 0.45]. This difference in was statistically significant at P<0.001.

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Similarly, the mean Mesio-distal width of estimated Canine by Golden proportion method on the Right & Left sides was significantly lesser [2.55 ± 0.37] as compared to the actual Mesio-distal width of Canine [3.31 ± 0.40]. This difference in was statistically significant at $P < 0.001$.

DISCUSSION

The goal of an orthodontic treatment is to achieve an esthetic smile at the end of the treatment and this is why most of the individuals seek orthodontic treatment. Photographs have always been the gold standard⁸ for evaluating smile and this is how it is clinically assessed, this allows the clinician to see what needs to be done, what can be done, and what should be accepted. The perception of smile esthetics is subjective and is influenced by personal experiences and social environment

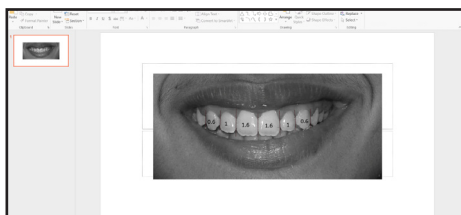
There are many parameters to assess smile esthetics, in this study we have used six parameters being the Smile arc ratio, Maxillary incisor show, Midlines, Gingival exposure, Number of tooth displayed and Golden proportion and also the esthetic perception was assessed among the Lay person, General dentist and Orthodontist.

The golden proportion was used by ancient Egyptians and described geometrically by Euclid. This proportion is associated with aesthetics and harmony in several fields such as architecture, sculpture, music, poetry and human face²⁹. It represented by the Greek letter “phi”.¹⁶

The golden proportion is based on the theory that a relationship exists between beauty in nature and mathematics. Applied to smile design, it says that the width of the maxillary lateral incisor, from frontal view, should be in golden proportion to the width of the maxillary central incisor. The maxillary lateral incisor should be 62% of the width of the maxillary central incisor, and the width of the maxillary canine should be 62% of the width of the resulting lateral incisor²⁰.

In 1973 Lombardi was the first one to publish his theory in which dental and facial esthetic are at most pleasant when width of central to lateral and lateral to canine have a repeated proportion, when viewed from the front. He used the term “Golden Proportion” and is 1.61803 to 1²⁰.

Levin suggested the use of the theory of Golden proportion to relate the successive width of the anterior teeth, as viewed from the labial aspect. He said that the “width of the central incisor should be in golden proportion to the width of the lateral incisor and that the lateral incisor should be in golden proportion to the width of the canine, when viewed from the front”²⁹. The golden proportion was popularized in orthodontics and oral surgery by Ricketts, who reported to repeatedly find the 1:1.618 ratio in a series of lateral and frontal cephalometric radiographs¹⁶.



In an article published by Shubhangi Jain³³, et al. in 2019

significant variation from the golden proportion was found in all smile group in proportions of both the lateral incisor and canine. This variation was maximum in wide smile for both lateral incisor as well as canine followed by narrow smile. The least deviation from golden proportion was seen in average smile patient.

Peck et al.²⁵ indicated that dental professionals and laypeople judge facial esthetics differently because dentists are trained to observe features that are not obvious to the general public.

In this study when the comparison of smile arc ratio and maximum incisor show between class I and II subjects was done, there was no significant difference found. The smile arc ratio in Class I is relatively lesser than in class II. In case of Maxillary incisor show the values were almost the same. In case of Non extraction for both smile arc ratio and maximum incisor show was relatively lesser when compared to Extraction. However, the difference between the Extraction and Non extraction has borderline significance ($P = 0.05$).

When the test was done to compare the mean smile arc ratio and maximum incisor show between Extraction and Non extraction in Class II there was no significant difference found. The smile arc ratio is relatively more in Non-extraction case and the Maxillary incisor show is relatively more in Extraction case. No significant difference was found in case of midline, number of tooth displayed and gingival exposure. There was significant difference seen in the Golden proportion values on Right & Left sides in Class I and II subjects in both Extraction as well as Non extraction cases. When the mean VAS scores were compared for smile perception between three raters there was no significant difference seen between the three groups, however the lay person showed borderline significance ($P = 0.05$).

Considering the result obtained it was highlighted that the Golden proportion was not followed by the clinicians during the orthodontic treatment which is one of the most important parameter for achieving an esthetic and harmonious smile.

CONCLUSION

This study concluded that there was no relevance for the following parameters i.e., the smile arc ratio, midlines, gingival exposure, maximum incisor show and tooth number displayed. Golden proportion was the only parameter that showed statistical significance, hence showing that the golden proportion was not followed. Due to the failure to follow golden proportion, the other parameters also could not be well assessed, hence enlightening us on the importance of following the golden proportion for every case. If the golden proportion was followed, then the other parameters might have shown significance and the smile would have been more pleasing and attractive and accepted by different groups of people.

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