

Research Article

A Photographic Assessment of Smile by Modifying Crown Height, Width and Angulation of Maxillary Lateral Incisor among Orthodontic Patients of Karachi, Pakistan

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Abstract: Background: Smile aesthetics vary culturally, influenced by media and the Golden Proportion in dental beauty. Challenges arise with missing lateral incisors, treated through composite build-up or canine substitution, highlighting the importance of crown dimensions and the need for clinician expertise in personalized treatments.

Objectives: The objective of the study is to evaluate the influence of altering height, width and angulation of maxillary lateral incisors on the perception of smile.

Materials and Methods: This cross-sectional study was conducted at OPD of Jinnah Medical and Dental College, Karachi from January 2020 to June 2020, on 120 orthodontic patients (44 males and 76 females) aged between 15 and 35 years. Photoshopped photographs of an ideal smile were shown to the participants. In an ideal smile photo, the width of lateral incisor was 62% of the width of maxillary central incisors. The pictures showed to the participants had modifications in terms of crown heights, width and angulation of only maxillary lateral incisor without doing any changes to the other maxillary teeth. The responses of the participants were graded on the basis of perception of attractiveness.

Result: Mean score for height, width and angulation changes were obtained. The highest score by males was given to lateral incisor whose length was increased by 1mm (6.87 ± 2.21) and in females; the highest score was given to lateral incisor which is modified by adding 0.5 mm increment (6.98 ± 1.05). Both males and females preferred narrow lateral incisors as esthetically attractive. The mean highest scores for the decrease in width given by males were 6.52 ± 2.52 and 6.8 ± 2.217 by females, respectively. Both males (6.37 ± 2.18) and females (6.64 ± 1.81) preferred 10 degrees of mesial angulation of lateral incisor as more esthetically pleasing. Changes in distal angulation of more than 5 degrees are considered unattractive by both genders. Mean values were 6.04 ± 2.15 for males and 6.00 ± 1.99 for females.

Conclusion: In conclusion females are more concerned to the change in height, while in terms of width both genders preferred narrower maxillary lateral incisors over wider ones. Both genders perceived a 10 degree mesially angulated lateral incisor as more attractive.

Keywords: Crown angulation, Crown height, Crown width, Lateral incisor, Photographic assessment, Smile esthetics.

INTRODUCTION

Assessing smile is a very subjective matter. The cultural definition of dental beauty differs across different populations, regions, countries, and even continents. Nowadays, the perception of aesthetics is greatly influenced by mass media especially social media which portrays the standards of beauty [1].

From a dental aesthetic viewpoint, maxillary centrals, laterals and canines are related to each other, their relationship is described as Golden Proportion [2]. It is the divine proportion that is considered important in defining the aesthetics of any object. It states that the width of laterals should be 62% of cen-

tral incisor width and canine width should be 62% of lateral incisors [3, 4].

After third molars, the most frequently congenitally missing tooth that is being reported in the literature is maxillary lateral incisor [5]. The lateral incisor is an important tooth from a smile standpoint. If they are missing or anomalous, this becomes a challenge not only for orthodontists but for restorative dentists as well [6]. A high prevalence of malformed or missing lateral incisor is reported in literature in cases with palatally impacted canines [7]. Genes are considered to be responsible for the disruption of lateral incisor development in cases with palatally displaced canines [8].

Two main treatment modalities available to cater to the above-mentioned problem are composite build-up in case of

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anomalous laterals and canine substitution in case of missing lateral incisors [9]. In both the scenarios, lateral incisor's crown height, width and angulation will be of utmost importance in predicting the successful outcome. Because there is a scarcity of literature on the impact of changes in lateral incisor crown height, width, and angulation on patients' perception of a smile, the clinician will be able to offer treatment depending on the patient's preferences if he or she has appropriate expertise [9, 10].

The objective of the study was to evaluate the influence of altering dimensions and angulation of maxillary lateral incisors on the perception of smile. The rationale behind conducting this study was to figure out which size and angulation of lateral incisor is considered aesthetically pleasing by the patients and to find out overall gender differences in the evaluation of smile aesthetics. The advantage of knowing the perception of patients regarding dental aesthetics is that the clinician would be able to fulfill the demands of patients by providing the treatment according to their desires.

MATERIALS AND METHODS

This cross-sectional study was conducted at OPD of Jinnah Medical and Dental College, Karachi from January 2020 to June 2020. Ethical approval was obtained from ERC (ethical review committee), JMDC (Approval Number 000016/20). The sample size was established on the results of the pilot study (20 orthodontic patients were asked to assess each photograph aesthetically by using visual analog scale. These VAS scores were later added in the final sample). According to the pilot study, sample size calculation was determined by using Openepi, on the basis of 85.6% prevalence, 5% margin of error, 80 % power and 95% confidence interval level, 120 sample size was calculated. The sampling method used was non probability convenience sampling technique. The patients visiting the outpatient department of orthodontics were enrolled in this study after taking their consents.

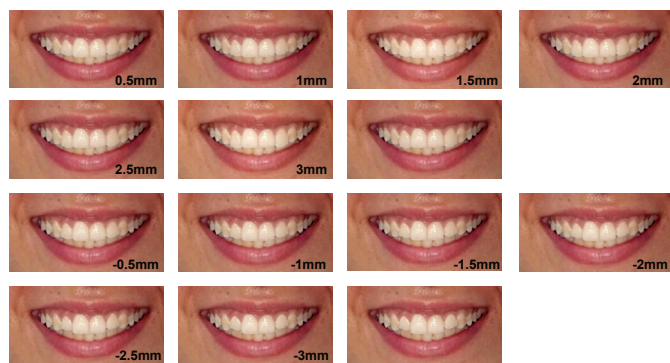


Fig. (1). Pictures of Variation in Crown Height of the Maxillary Lateral Incisors (the Pictures were Presented to the Patients in the Form of a Power Point Slideshow with Variations of 0.5 mm).

The inclusion criteria of this study were both males and females of age 15-35 years who agreed to participate in the study. The individuals who did not give the consent, mentally challenged or having syndromes like cleft lip and palate were excluded from the study.

A volunteer who was a house officer was selected as her smile characteristics were close to standard norms [11]. After getting a written informed consent from a volunteer, she was asked to stand 5 feet from camera in an upright position with the head in a natural position [12]. A colored photograph of the frontal pose was taken using a digital camera (Nikon D500; 16-80mm Lens New York, USA). After obtaining the permission from the volunteer, nose and chin was cropped out to avoid distractions. By the use of Adobe Photoshop 7.0 (Adobe Systems, San Jose, California, USA) on the HP Laptop, the photograph was manipulated to meet the ideal criteria with regards to size, shape and gingival display. This software was then used to manipulate dimensions by adjusting crown height, width and angulation of lateral incisor. A set of 34 photographs was generated with difference of 0.5 mm in length and width and 5 degrees change in mesial and distal angulation (Figs. 1-3).

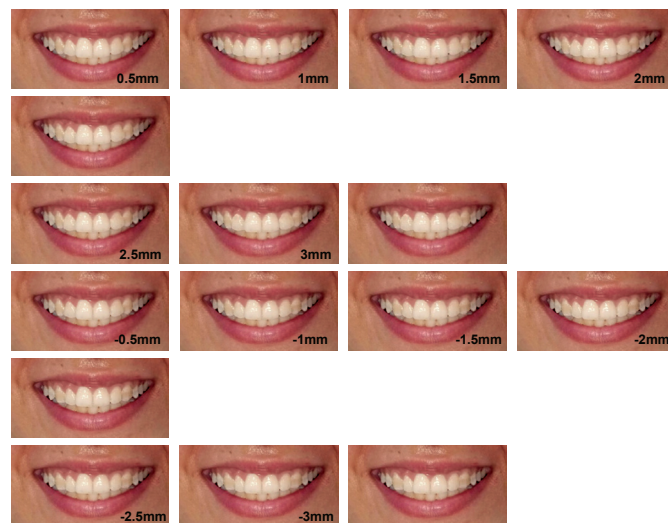
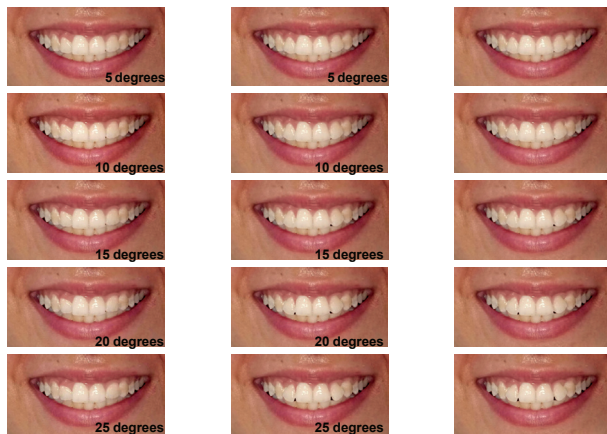


Fig. (2). Pictures of Variation in Crown Width of the Lateral Incisors (the Pictures were Presented to the Patients in the Form of a Power Point Slideshow with Variations of 0.5 mm).

Each photographic image (JPEG files) was saved and exported to prepare a photographic questionnaire with 34 photographs for presentation on a 10.5-inch tablet (Samsung Galaxy Tab A – Resolution 8.0 MP). The images were presented to the participants via Microsoft PowerPoint (Microsoft Corp., Microsoft Office 2016, NY, USA). The images were divided into three sets with 12 images in set 1, 12 images in set 2 and 10 images in set 3, respectively.

Questionnaires were distributed to the participants. The participants were asked to score the attractiveness of each smile image separately using a visual analog scale (VAS). A VAS score of 0, the lowest, indicated the least attractive smile, whereas a VAS score of 10, the highest, indicated the most attractive smile [6].



Variations in Mesial Angulation Variations in Distal Angulation

Fig. (3). Pictures of Variation in the crown Angulation of the Maxillary Lateral Incisors (the Pictures were Presented to the Patients in the Form of a Power Point Slideshow with Variations of 5 degrees).

Each photograph had to be scored within 10 seconds and returning to the previous photograph was not possible.

The questionnaire consisted of two parts: section one asked questions about socio-demographic characteristics (e.g. gender and age). A separate section was given after the demographic part where participants had to sign in order to have a written approval of their consent before moving on to the next section. In section two, participants were asked to assess esthetic smiles using a 10-point visual analogue scale (VAS), of which the right end of the scale is labeled “attractive smile” and represented by the number 10, and the left end of the scale is labeled “unattractive smile” and represented by the number 0. The total time to evaluate images was limited to 4-5 minutes.

In order to maintain confidentiality, following steps were taken which are as follows: -Taking the photographs into possession after survey by researcher and were not left unattended. Concealing of identity as only the image containing teeth in a smiling pose was shown to participants not the whole facial photograph. Photograph were discarded by paper shredding once research was conducted and was not be used for any other purpose. Other researchers will have access to data as long as they agree to preserve the confidentiality.

STATISTICAL ANALYSIS

Statistical analysis was done by using SPSS (statistical package for social sciences) version 21. The descriptive study was used to calculate mean and standard deviation of all VAS scores. Mean score for crown height, width and angulation changes were compared by applying Student T-test. P-value of less than 0.05 was considered for statistical significance.

RESULT

The participants in this study were comprised of 120 people

with 44 males and 76 females that was between 15 and 35 years of age.

Both males and females considered 2.5 mm increase in height as aesthetically less pleasing. Mean score of 2.5 mm increase in males was 5.66 ± 2.4 and mean score of females was 6.30 ± 1.99 . Mean score of 2.5 mm decrease in males was 5.41 ± 2.37 and mean score of females was 6.06 ± 2.47 as shown in Table 1. Highest score by males was given to lateral incisor whose length was increased by 1mm and in females highest score was given to lateral incisor which is modified by adding 0.5 mm increment.

After analyzing the width of the incisor, it was observed that both males and females preferred narrow lateral incisor as esthetically pleasing. The mean highest scores given by males was 6.52 ± 2.52 and 6.8 ± 2.217 by the females as shown in Table 1.

When it comes to change in mesial and distal angulation of lateral incisors, both males and females preferred 10 degrees of mesial angulation of lateral incisor as more esthetically pleasing. As far as distal angulation is concerned, highest score was given to 5 degrees. This showed males and females are less tolerant towards distal angulation (Table 2).

Table 1. Esthetic Grade (mean \pm standard deviation) of Lateral Incisor Height and Width Changes by the Observers.

Study Parameters / Variables	mm	Overall Mean VAS Score Mean (SD)	Male Mean (SD)	Female Mean (SD)	P-value*
Increase in height of lateral incisor	0.5	6.94 (0.10)	6.87 (2.21)	7.02 (1.97)	0.71
	1	7.05 (0.09)	7.12 (2.07)	6.98 (1.05)	0.677
	1.5	6.63 (0.26)	6.45 (2.35)	6.82 (1.82)	0.371
	2	6.42 (0.48)	6.08 (2.43)	6.76 (1.917)	0.116
	2.5	5.98 (0.45)	5.66 (2.4)	6.30 (1.99)	0.139
Decrease in height of lateral incisor	0.5	6.28 (0.39)	6.0 (2.49)	6.56 (2.27)	0.224
	1	5.84 (0.48)	5.5 (2.71)	6.18 (2.25)	0.163
	1.5	6.17 (0.31)	5.95 (2.51)	6.39 (2.209)	0.337
	2	6.12 (0.17)	6 (2.58)	6.25 (2.3)	0.596
	2.5	5.73 (0.45)	5.41 (2.37)	6.06 (2.47)	0.157
Increase in width of lateral incisor	0.5	6.48 (0.32)	6.25 (2.65)	6.71 (2.19)	0.333
	1	6.27 (0.50)	5.91 (2.59)	6.63 (2.21)	0.126
	1.5	6.21 (0.37)	5.95 (2.59)	6.48 (1.84)	0.237
	2	6.05 (0.36)	5.79 (1.95)	6.31 (1.90)	0.159
Decrease in width of lateral incisor	2.5	6.10 (0.06)	6.06 (1.85)	6.15 (2.05)	0.806
	0.5	6.29 (0.07)	6.34 (2.05)	6.24 (1.98)	0.795
	1	6.28 (0.47)	5.95 (2.36)	6.62 (2.14)	0.125
	1.5	6.59 (0.09)	6.52 (2.52)	6.66 (2.204)	0.760
	2	6.66 (0.19)	6.52 (2.52)	6.8 (2.127)	0.537
Decrease in width of lateral incisor	2.5	6.66 (0.19)	6.52 (2.52)	6.8 (2.217)	0.537

*The P-values were based on Student T tests.

Table 2. Tolerance of the Male and Female Population for Changes in Angulation in the Lateral Incisor.

Study Parameters/ Variables	degrees	Overall Mean VAS Score Mean (SD)	Male Mean (SD)	Female Mean (SD)	P-value*s
Mesial deviation in degrees	5	6.29 (0.11)	6.21(2.34)	6.37(2.81)	0.738
	10	6.50 (0.19)	6.37(2.18)	6.64(1.81)	0.489
	15	6.13 (0.13)	6.04(2.11)	6.23(1.78)	0.617
	20	5.78 (0.63)	5.33(2.29)	6.23(1.81)	0.028
	25	5.48 (0.45)	5.16(1.90)	5.81(2.07)	0.084
Distal deviation in degrees	5	6.02 (0.02)	6.04(2.15)	6.00(1.99)	0.92
	10	5.66 (0.06)	5.62(1.92)	5.71(1.81)	0.801
	15	4.84 (0.26)	4.66(2.07)	5.03(2.81)	0.411
	20	4.46 (0.29)	4.25(2.65)	4.67(2.48)	0.394
	25	4.44 (0.24)	4.62(2.94)	4.27(2.79)	0.524

*The P-values were based on Student T tests.

There was no statistically significant difference between males and females regarding change in height, width and distal angulation of maxillary lateral incisor. Only significant difference from statistical standpoint between genders was observed in 20 degrees change in mesial angulation of lateral incisor.

DISCUSSION

In the kind of society, we are living, great preference is given to appearance due to the influence of social media. Facial expressions play an important role in the communication of emotions and smile plays a key role in delivering those emotions [13]. Nowadays, both personal and professional life success is greatly dependent on how one looks [14]. From dental smile aesthetics viewpoint; maxillary anterior teeth play a key role. As lateral incisor is a part of maxillary anterior teeth, the changes in its dimensions and angulations will have a profound impact on the smile [15, 16].

After the third molars, now lateral incisor is considered to be the most frequently congenitally missing tooth. Different treatment strategies are designed to treat missing lateral incisor which includes canine substitution or prosthetic replacement of missing lateral [5]. There is also a great frequency of anomalous lateral incisors; the most common is peg-shaped incisor [6]. Due to the above-mentioned variations; it was decided to conduct a study to find out the tolerance limits by changing the dimensions and angulation of lateral incisors on a set of PowerPoint slides among the participants. Only dental views were selected for this study instead of full-face view as research shows that smile assessment is superior in dental views rather than full-face views [16].

The VAS (Visual Analogue Scale) was used in the present study to objectively evaluate the attractiveness of a smile. It is most commonly used to score the intensity of pain in epidemiological studies. It is also considered to be a simple and reliable scoring

method for the assessment of smile aesthetics [16].

In one study done by Haerian, *et al.*, a direct correlation was found between changing the length of maxillary lateral incisors and its effects on the perception of both most and least attractive smiles. This shows that participants were more sensitive to changes in length [15]. These findings are consistent with our results.

Similarly, other studies conducted on maxillary central incisors showed statistically significant results when the length of the maxillary incisor was changed [16, 17].

Studies conducted by Daou, *et al.* and Almanea, *et al.* showed the consistent result that the perception of an ideal smile decreases when the length and width of the lateral incisor changed [18, 19].

The study conducted by Florez, *et al.* showed strong preference for wider lateral incisors [20]. This is in contrast to our findings where both males and females preferred narrower lateral incisors as compared to wider ones which clearly showed that these preferences are highly dependent on the aesthetic concerns of a specific population. The same study also conducted to determine the smile esthetics by changing the width of the maxillary lateral incisor and was analyzed by orthodontists and laypersons showed statistically significant results, orthodontist preferred 5.7:10 width ratio which was close to the “golden proportion” [18] while laypersons showed preference to 8:10 width ratio [20].

This knowledge regarding preference would be helpful in cases where restorative treatment on narrower lateral incisors is needed or not. If the discrepancy of the bilateral malformed lateral incisor is equal to or less than 2mm then restorative treatment is not needed but if the discrepancy is greater than 2mm, restoration of both malformed lateral incisors is required before the commencement of orthodontic treatment. And in the case of the unilateral malformed lateral incisor, restoration should be done according to its' counterpart dimension to get maximum esthetics [21, 22].

In the majority of cases where insufficient space is present for ideal restoration, orthodontic space opening is required before the placement of the restoration. In order to achieve smile esthetic, the central incisor and lateral incisor should be placed in close proximity rather than the canine so that restoration's emergence profile on the mesial surface is flat and is the same color as the central incisor [23].

LIMITATIONS

One of the limitations of the study is that the evaluation of smile esthetics was focused on the crown height, width and angulation; other variables like gingival margin, enamel color and torque were not considered which can also affect smile aesthetics. Another shortcoming is that the pictures displayed to participants in our study were two- dimensional while a smile is a three-dimensional phenomenon. Future studies are needed to

be done in a three-dimensional format like video graphic techniques so that smiles can be assessed more dynamically to overcome the above-mentioned limitations.

CONCLUSION

In this present study, the effects of modifications of the lateral incisor angular dimensions were also studied between males and females. Lateral incisor angulation is of grave importance when it comes to esthetics and Prosthodontic texts state that when the lateral incisor has a mesial angulation the face looks more feminine [24]. This in turn could explain why a significant number of females were found to be more sensitive to these changes.

With the advent of computer-aided treatment options, a patient can now view the outcome of the treatment beforehand [25]. This is considered to be the future tool in diagnosis and treatment planning that will facilitate the clinicians to come up or formulate a treatment plan according to the patient's desires and meet their expectations [26, 27].

AUTHORS' CONTRIBUTION

- **Hana Pervez:** Principle researcher, Study design and concept, Questionnaire design, Article writing, Data analysis and interpretation.
- **Anam Sattar:** Questionnaire design, Article writing, Data analysis and interpretation.
- **Marium Iqbal:** Literature research, Cross referencing and Proofreading.
- **Nasreen Iqbal Nagani:** Data analysis and data interpretation.
- **Sadia Shabbir and Hareem Sultan:** Article discussion, Study design and Concept.
- **Khadija Zafar and Zainab Javed :** Data collection and Data analysis

CONFLICT OF INTEREST

None

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