

Evaluation of Incisor Inclination on Smile on Lateral Profile

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ABSTRACT

Background: Smile is the key that fits the lock of every heart. **Objective:** The aim of the study was to evaluate inclination of maxillary incisors on smile aesthetics in relation with the profile view and to evaluate the perception and awareness of dentists, orthodontists, lay people and students towards smile attractiveness. **Methods:** A right smiling lateral profile photographs of a 21-year-old female subject were taken and then altered. Five final images were obtained which were printed separately and randomly distributed to four groups of evaluators (50 orthodontists, 50 dentists, 50 lay people and 50 students). A Visual Analogue Scale (VAS) was distributed to them for judgment. The obtained data were subjected to statistical analysis using ANOVA and Fischer's test. **Results:** The results showed significant variation in the perception of smile based on the incisor inclination among different professionals (Wilk's Lambda, $F = 2.825$, $P = <0.001$). The original profile smile had the highest score among all professions (58% of dentists, 94% of orthodontists, 36% of students and 28% of layman). **Conclusion:** Orthodontists preferred inclination labially; dentists and laypeople did not appreciate excessive incisor inclination in either the lingual or the labial directions.

Key words: Aesthetic, Facial Attractiveness, Pleasant Smile, Smile Dynamics

A smile is a dynamic facial expression with sprinkling eyes characterized by a curving of the corners of the mouth in an upward direction and indication of pleasure and amusement. A smile is an important feature and seems to have a favorable influence on others and makes one likeable and more approachable. A smile is the prettiest thing, a person can wear. People with beautiful teeth and smile are often considered more attractive, more intelligent and popular among the opposite gender [1, 2].

Smile aesthetics is perceived best by the orthodontists and least by the laypeople as their perceptions and expectations about aesthetics are not good [3]. There are many factors which influence smile aesthetics. During

orthodontic treatment, the buccal-corridor ratio and philtrum to commissural height ratio are considered as guidelines for smile enhancement [3]. Different types of malocclusion have different smile characteristics and are influenced by skeletal pattern, dental procumbency, or facial type [4].

In order to attain facial attractiveness, the smile and the teeth should be in harmonious relation with each other. A balanced smile is an indication of social success, confidence and a better health of an individual [5]. The size of the teeth, lip position, extent of the gingival display and the position of the teeth in relation with the upper vermillion border plays an important role in rendering smile attractiveness [6].

There are numerous studies in Orthodontic literature concerned about the frontal views of smile and their effect on smile aesthetics but there is a scarcity of the literature on the lateral view. Ghaleb *et al.* [7] stated that upper incisor inclination affects smile aesthetics in the profile view. Sarver and Ackerman [8] noted that the incisor inclination is necessary in profile view for best smile aesthetics. Kerns *et al.* [9] compared between the frontal and the profile views of the smile and it was found that the profile view was rated more than the frontal view of the smile. Sarver and Proffit [10] further suggested that orthodontists should take into consideration both the frontal and the profile views before planning the orthodontic treatment.

The present study was undertaken to evaluate the inclination of the maxillary incisors on smile aesthetics in relation with the profile view and to determine most acceptable maxillary incisor inclination as perceived by dentists, orthodontists, lay people and dental residents.

METHODS

The present study was conducted at Faculty of Dentistry at School of Dental Sciences, Karad. The study sample included a 21-years-old female dental student, who was randomly chosen from the students of the college. The study protocol was reviewed by the Ethical committee of the Institutional Review Board and was granted ethical clearance. A signed informed consent form was obtained from the subject.

The subject was selected based on the clinical and radiographic examination criteria. It includes pleasant and balanced smile in profile as well as frontal views with maxillary incisors in relation with the facial features, adequate overjet and overbite. The subject should not have any facial scars or any facial deformity and had not undergone any orthodontic or cosmetic treatment at the time of commencement of the research.

A right smiling lateral profile photograph of the subject [Figure 1] was taken keeping in mind the natural head position. The Frankfort horizontal plane was approximately kept parallel to the floor. The photographs were captured with Nikon D5300 DSLR camera. The smiling photograph was altered using a commercially available image editing software programme (Adobe Photoshop CS, Version 3.0). The inclinations of the upper

incisors were changed. The inclination of incisors was altered to simulate four different images, each simulation in 5 degree increment with two modifications of +50 [Figure 2 (a)] and +100 [Figure 2(b)] in labial direction and two modifications of -50 [Figure 3(a)] and -100 [Figure 3(b)] in palatal direction. Incisal edge was considered as the centre of rotation. Editing was done wherever required to maintain a natural appearance. A total of five images were obtained (+10, +5, 0,-5,-10) and were printed separately on Kodak Digital Royal Paper with HP printer in 15X25 format.

The rating of the five photographs was done by 50 dentists, 50 orthodontists, 50 dental students and 50 laypeople. Convenience sampling technique was used to fulfil the desired sample size. The general dentist were selected from the college, the orthodontists were selected from the Orthodontic Department and Orthodontist practising in Karad, the students selected were undergoing internship programme from the respective college and the lay persons were randomly selected from those visiting the medical hospital attached to the institution. No gender control was observed in any group. Five photographs were labelled (A to E) and randomly placed in front of the evaluators. Each evaluator received a paper containing a visual analogue scale (VAS) [Figure 4]. The evaluators were asked to tick, his or her preference of smile attractiveness of the subject on the VAS. The VAS had ratings from 1 to 10 with specifications like 'Very Poor', 'Poor', 'Not Good', 'Below Average', 'Average', 'Better', 'Acceptable', 'Good', 'Very Good, and 'Excellent'. Specific instructions were given on the use of scale [11]. The evaluators were not allowed to compare between two photographs while evaluating. The data collected were sent for statistical analysis.

The data analysis was done using the Statistical Package for Social Sciences (Version 16.0) developed by IBM Corporation. The criteria for evaluation were the rating obtained which corresponded with the aesthetic inclination from a profile view of a smile. Mixed between-within-subjects ANOVA or split-plot ANOVA, was used for determination of differences in the mean scores on the visual analogue scale. Repeated ANOVA was carried out to find out two variables (profession and incisor inclination). Fisher's exact tests were conducted to determine significant differences in the evaluation of smile aesthetics by all the four groups of evaluators. The level of significance was set at 0.05 for all statistical tests.

RESULTS

The statistical analysis of scores using mean and standard deviations showed that the original photograph was scored that the original photograph was scored highest by all groups (58% of dentists, 94% of orthodontists, 36% of students and 28% of layman) [Table 1].

Table 1: Attractiveness rating scores [mean and standard deviation (SD)] of the four groups of the panelists in VAS of the five photographs.

Photograph (A to E)	Lay people (N = 50)		Students (N = 50)		Dentists (N = 50)		Orthodontists (N = 50)	
	Mean VAS	SD	Mean VAS	SD	Mean VAS	SD	Mean VAS	SD
Lingual inclination 10 ⁰	2.26	0.80	2.22	0.82	2.28	0.73	2.08	0.78
Lingual inclination 5 ⁰	3.20	0.67	3.44	0.64	3.06	0.77	2.80	0.57
Original	4.28	0.45	4.20	0.73	4.06	0.74	4.02	0.25
Labial Inclination 5 ⁰	2.84	0.58	3.02	0.68	2.68	0.74	2.84	0.51
Labial Inclination 10 ⁰	2.64	0.63	2.52	0.81	2.46	0.73	2.30	0.58

A profile plot of four groups of evaluators was drawn, in which the y-axis represents the scores in VAS and the x-axis represents the photographs. The graph of the interaction of this profile plots showed that the modification of incisor inclination can be differently perceived according to the evaluator's profession and a significant interaction effect was found between incisor inclination and evaluator profession (Wilk's Lambda, F = 2.825, P = <0.001) [Figure 5].

repeated measure ANOVA of variance followed by pair-wise comparisons using Dunn multiple comparison test. Appreciation of photographs by each profession was statistically found to be significant (P < 0.001). Among all the photographs, the original photograph was the most appreciated by orthodontists, dentists, student and lay persons (P < 0.001) [Figure 5].



Figure 1: Original Photograph of the subject

Follow-up tests to explore this relationship were carried out using analyses of simple effects. The intra-subject effect (photograph) for each group was tested using



Figure 2: Alteration of the photograph (a) Labial Inclination +5⁰; (b) Labial Inclination +10⁰

On the other hand, photographs -100, -50 and +100 degrees were not appreciated by an Orthodontist. The panel of dentists has the lowest scores for +50 and -50, while only -50 and +50 degrees were appreciated by students (with low-mean value). The initial image was aesthetically acceptable by all of them [Figure 6].



Figure 3: Alteration of the photograph (a) Lingual inclination -5° ; (b) Lingual Inclination -10°

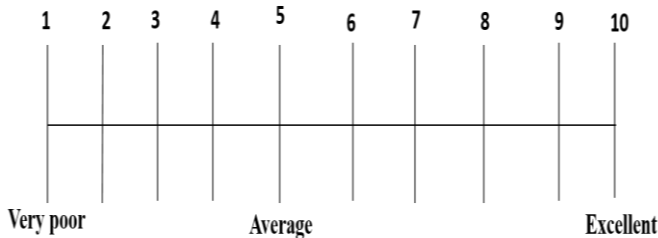


Figure 4: Visual analogue scale

When compared, the scores of statistically different inclinations between the four groups of judges; for inclination (-50), layman, dentists, orthodontists gave significantly lower scores than students ($P < 0.001$). For inclination ($+100$), no statistical difference was found between the four professions ($P > 0.05$). The difference in rating for the Photographs (initial, -100 and $+50$) were statistically non-significant [Figure 6].

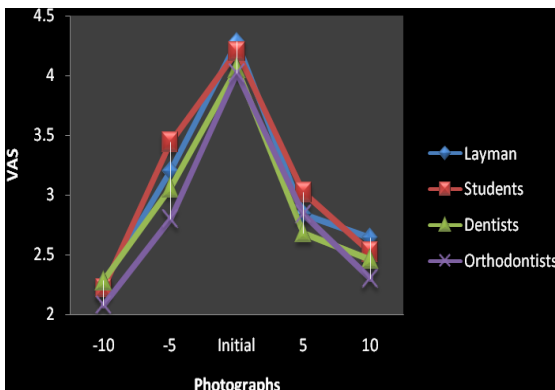


Figure 5: Profile plots of the VAS of the photograph for the four groups of panelists.

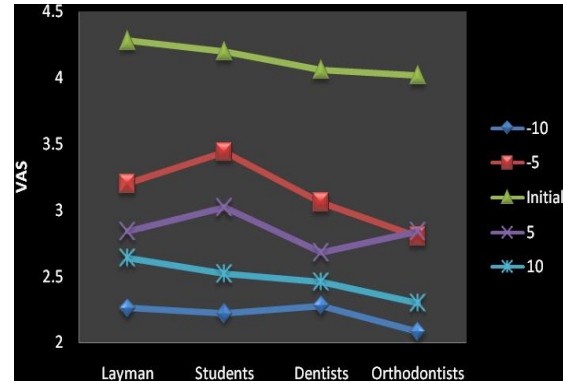


Figure 6: Profile plots of the sample mean for all photographs.

DISCUSSION

The attractiveness of a smile is a subjective factor that changes from person to person. In an attempt to reduce subjectivity and increase objectivity, many studies were done by implementing the judgement panel system. Alteration in the maxillary incisor position can surely make a smile more aesthetic and appealing [4]. Just by tipping or torquing the attractiveness of smile changes drastically. In order to establish the maxillary incisors in their most aesthetic position, it is important to take into consideration both the frontal and profile views [12]. Maxillary incisors should be positioned properly in relation to the smile line with adequate mesiodistal angulation and labiolingual inclination [13, 14].

The teeth should be arranged in harmonious relation with the facial features in both anteroposterior as well as a vertical view to ensure smile attractiveness [12]. The teeth should be aligned in a direct vector line, avoiding “round-tripping” as much as possible. A selective torquing method with an adequate amount of palatal root torque produces necessary intrusion of maxillary incisors [1]. Orthodontists often emphasize the importance of maintaining labial crown torque on anterior teeth during orthodontic treatment. Andrews [12] found that in order to achieve the most aesthetic outcome, the labial surface of the maxillary incisors should lie along a vertical line perpendicular to Frankfort horizontal passing through glabella. Ghaleb et al. [7] found that dentists considered 5° of labial proclination relative to a line drawn from subnasale to pogonion (Sn-Pg’) to be most aesthetic and that orthodontists preferred even more labial crown torque than both dentists and laypeople.

To evaluate the attractiveness of different positions and inclinations of incisors, the visual analogue scale score was used. The visual analogue scale used in this study used both the numerical ratings as well as descriptive ratings so that the judges could evaluate easily. Many

studies used the visual analogue scale as it is easy, reproducible, valid and reliable method to measure dental and facial attractiveness [7, 15]. Schlosser et al. [16] found that the maxillary incisors should be placed normally protrusive or slightly in the labial direction to attain a best aesthetic view of the smile.

The recent advances in the present study were to find the importance of incisor inclination in profile view on smile aesthetics and also the knowledge about the smile in the four groups of evaluators. Majority of the evaluators identified the changes in incisor inclination with the orthodontists being more precise. Smile aesthetics can negatively be influenced by the morphology of the lateral incisors, more commonly with labial modifications [7].

In this study, the original photograph was rated as highest by all the group of evaluators (58% of dentists, 94% of orthodontists, 36% of students and 28% of layman). Galeb et al. [7] study rated the smiling profile picture with 5° of lingual inclination relative to a vertical line drawn through glabella perpendicular to Frankfort horizontal to be the most aesthetic. While Li et al. [17] concluded that maxillary incisor lingual inclination and protrusion were more acceptable than labial inclination but when in retrusion.

In the present study, the lingual inclination of -10° was considered as the least appealing in terms of smile aesthetics. Slight protrusive and retrusive movement of incisors (-5, +5) were appreciated by almost all the evaluators. The labial inclination of +10 was considered less favourable compared to the slight inclination. While Schlosser et al. [11] proposed that even 1-4 mm protrusive inclination of the incisors followed by normal position. Retrusion even of about 1 mm onward resulted in less smile attractiveness in that study. Soh et al. [18] studied in Chinese people and found that normal profile or bimaxillary retrusion in females were the most attractive profile.

This study also took into consideration the maxillary incisor inclination in relation with the facial features. Incisor inclination directly influences the position of the lips, other factors such as lip thickness, tonicity, length, and lower lip proximity decrease the accuracy of predicting soft tissue changes post-orthodontic treatment [5, 6]. The lower edge of the upper incisors should touch the upper vermilion of the lower lip to attain aesthetic smile [19]. Some studies suggest that there should be a slight amount of gingival display to make it more appealing [13]. This states that while altering the incisors, a proper soft tissue analysis should be done as it enhances the attractiveness of the smile. Also, a slight amount of lower incisors should be visible so that the smile will look more appealing [20].

In this study, the ratings differed from different professionals. The orthodontists were very quick in determining even the slightest of alteration in the maxillary incisors. They preferred normal or slightly protrusive inclination to be more aesthetic. While the dentists and the dental students also preferred the same inclination but their perception was not exact as that of an orthodontist. The minor alteration of incisors had no influence on the layperson's perception. King et al. [21] also stated that altered maxillary central to lateral incisor edge levels had a smaller range of acceptability among orthodontists as compared to layperson's.

Further, the results suggested that, if the inclination of incisors has to be changed into retrusive or protrusive position, it is advised to alter the inclination to the normal or proclined position. Proclining or retroclining of upper incisors caused a significant reduction in smile aesthetics when compared to normal inclination. Therefore, when altering the inclination of incisors either in protrusive or retrusive direction, torquing control should be applied in order to keep the inclination as close to normal position as possible. The results also showed that all the four groups of panelists appreciated maxillary incisor inclination above normal standard values for enhancing the smile. Many factors determine the most aesthetic incisor inclination that can further enhance smile aesthetics. All the factors should be considered and further orthodontic treatment planning should be done. The orthodontists should take into consideration each factor before the commencement of the treatment.

Some limitations were present in the current study that should be recognised. The data was collected by evaluating the photographs of a single subject with relatively less number of evaluators and convenience sampling technique was used. Also, the four evaluators used in the study may not be representative of the entire population and the study subject was of only female population. Hence, further investigations can be done using multiple subjects or male subjects with an increase in the number of evaluators which could strengthen the results.

CONCLUSION

This study concludes that the maxillary incisor inclination affects smile aesthetics in lateral profile view and a majority of the evaluators preferred original incisor inclination or slight proclination of the incisors. There is a connection between appreciation of incisor inclination and the judge's profession. The lay people are the least educated about smile aesthetics while the orthodontics observed even the slightest change of inclination followed by dentists and dental students. The orthodontists preferred labial crown inclination than lingual crown inclination.

The preferred smile matched with an upper incisor angulated 89 degrees to the horizontal line.

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