

## Knowledge of Dental Professionals, Dental Students, and Patients on Smile Design

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### Abstract

**Background:** Facial appearance often plays a vital role in forming an impression of others, especially during the initial stages of acquaintance. The impression one gets of the other person during this initial encounter is often a long lasting one and could be either positive or negative at different times. Looks, however, play an important role during this first impression. **Materials & Methods:** The attractiveness of different smile variables on the perception of smile esthetics was evaluated. The study consisted of 3 groups of evaluators: General dentists (100), dental students (100) and patients (100). 4 pleasant smile pictures of young females were selected and modified with one esthetic parameter each of midline diastema, crown length, gingival display, and midline shift. **Results:** A small amount of space between the maxillary central incisors was not rated as unattractive by any group. The general dentists and dental students were more critical than patients when evaluating midline diastema discrepancy. The general dentists and dental students did not perceive a change in attractiveness until the midline shift was 3mm. While the patients did not perceive any change in attractiveness even at the maximum of 4mm shift. A reduction of maxillary lateral incisor by 1.5mm was rated unattractive by the general dentists and the dental students while patients perception for attractive smile changed when the crown length was reduced to 2mm. **Conclusion:** The type and degree of deviation from the norm and the opinion of the patient need to be taken into consideration. Among all the four esthetic parameters, midline diastema was more unattractive for all the groups. So, correction of this parameter by the dental professional is of paramount importance for a better esthetic result.

**Keywords:** Dental Professionals, Dental Students, Smile Design.

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### INTRODUCTION

While it has been the desire of most individuals to look good and presentable, it has been their "smile" that often ends up either enhancing or spoiling the looks of that person [1]. Facial attractiveness and smile attractiveness appear to be strongly connected to each other [2]. Absence or malformed teeth of the anterior segment greatly affect the aesthetics of a smile, which itself affects the appearance, personality and psychological well being of an individual [3]. Sabri in 2005 described eight components of the balanced smile. An esthetically pleasing smile is not only dependent on components such as tooth position, size, shape, and color, but also on the amount of gingival display and the framing of

the lips. All of these components should form a harmonic and symmetric entity [4]. Esthetics is often the main complaint in the dental office and patients usually evaluate treatment results based on the positive changes in their smile [5]. Esthetic perception varies from person to person and is influenced by each person's personal experience and social environment. Miller in 1989 stated that the trained and observant eye readily detects asymmetry or what is out of balance and out of harmony with its environment [6]. For this reason, professional opinions regarding facial esthetics may not coincide with the perceptions and expectations of patients or laypeople [7]. Dental professionals have been sensitized to observe and evaluate features that do not seem to influence the general public. One of the

factors influencing the observer's perception is the symmetry of the smile. An asymmetric smile can be due to various factors, e.g., difference in tooth size, tooth shape (a central or lateral incisor that is shorter or narrower than the contralateral tooth), amount of gingival display, etc [8]. Individuals within a given culture or society embrace common definitions for facial and physical attractiveness [9]. It is also true that standards of beauty change over time and across cultures. The various cultures of the world, past and present, may differ widely in their standards of beauty. There may be unique cultural preferences that identify the attractive smile, and perception of smile esthetics may vary in different populations [10]. Research in the area of facial perception has identified many different factors that contribute to a face being considered attractive. One of the most important tasks in esthetic dentistry is the creation of harmonious proportions between the widths of maxillary anterior teeth when restoring or replacing them. Among these factors is the concept of "Golden proportion" or "Golden ratio" [11]. Lombardi was the first to suggest the application of the golden proportion in dentistry. He said that the golden proportion was too strong for use in determining tooth size [12]. One of the most important tasks in esthetic dentistry is the creation of harmonious proportions between the widths of maxillary anterior teeth when restoring or replacing them. 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 [13]. However, Preston reported that the golden proportion did not exist between the widths of the maxillary anterior teeth in individuals who have an esthetic smile [14]. Snow considered a bilateral analysis of apparent individual tooth width as a percentage of the total apparent width of the six anterior teeth. He proposed the golden percentage, wherein the proportional width of each tooth should be: canine 10%, lateral 15%, central 25%, central 25%, lateral 15%, and canine 10% of the total distance across the anterior segment, in order to achieve an esthetically pleasing Smile [15].

## MATERIALS AND METHODS

The attractiveness of different smile variables on the perception of smile esthetics was evaluated. The study consisted of 3 groups of evaluators: General dentists (100), dental students (100) and patients (100). 4 pleasant smile pictures of young females were selected and modified with one esthetic parameter each of midline diastema, crown length, gingival display, and midline shift. The smile images were modified using Adobe® Photoshop® (V7, Adobe Systems, San Jose, CA, USA). The nose and chin were digitally eliminated to remove any bias due to facial features.

These modifications were chosen based on their relatively high frequency in the population and their clinical significance to the smile. 4 groups were created based on the following variables: Group 1: Midline diastema- A midline diastema was created incrementally between the maxillary central incisors. It was widened progressively in 0.5-mm increments till 2mm. The measurements were made at the interproximal contact points between the central incisors and four images were created with .5mm, 1.0mm, 1.5mm and 2mm diastema gap. Group 2: Gingival display: Gingival exposure was altered to produce a 'gummy smile' by progressively moving the upper lip in 1-mm increments. The labial gingival margins of the maxillary central incisors were used as reference points for these measurements. Four images of 1mm, 2mm, 3mm and 4mm gingival display were created. Group 3: Crown Length: The most common variation in incisor crown length is usually associated with the size of the maxillary lateral incisors; hence the alterations were made to the maxillary lateral incisor. The crown length of the maxillary lateral incisors were altered by shortening the length, at the level of the incisal edge, by 0.5-mm till 2mm. Four images were created with .5mm, 1.0mm, 1.5mm and 2mm reduction in crown length. Group 4: Midline shift: The dental midline was altered by holding the entire adjacent tissue in position while the whole upper arch was gradually shifted to the right side with a increment of 1mm till 4mm. The lower central incisor midline was taken as the reference point. Four images with 1mm, 2mm, 3mm and 4mm midline shift towards right side were created. The scoring was done by the evaluators. The attractiveness of the smile in the original image and in each of the modified images was assessed by the three groups and scored using a 10-point visual analog scale (VAS) with '0' indicating the least attractive smile and '10' the most attractive smile. The images from each group were arranged randomly to avoid any biased scoring. The images which scored the highest were then analysed for golden proportion to check its relevance in esthetic smile design. The mean VAS scores were calculated for each photograph in the three groups. The paired t-test was used to determine the reproducibility of the test results. ANOVA was used to assess how the evaluator groups rated each level of alterations done in the photographs. The threshold levels of significant difference at which each group discriminated between aesthetic and less aesthetic dental features were determined by one-way ANOVA (F-test). A 5% level of significance was adopted ( $P < .05$ ).

## RESULTS

A small amount of space between the maxillary central incisors was not rated as unattractive by any group. The general dentists and dental students were more critical than patients when evaluating midline diastema discrepancy. The general dentist and dental students were most critical of changes between

1.0 and 1.5 mm ( $P < .001$ ). Patients did not rate a midline diastema as unattractive until the distance between the contacts of the central incisors was 1.5 mm ( $P < .001$ ). The general dentist perceived a change in attractiveness when the distance from gingiva to lip was 3.0 mm or greater ( $P < .05$ ). However, dental students and patients did not rate excess gingival display as unattractive even at the maximum 4.0 mm display ( $P < .05$ ). The general dentists and dental students did not perceive a change in attractiveness until the midline shift was 3mm. While the patients did not perceive any change in attractiveness even at the maximum of 4mm shift. A reduction of maxillary lateral incisor by 1.5mm was rated unattractive by the general dentists and the dental students while patients perception for attractive smile changed when the crown length was reduced to 2mm.

## DISCUSSION

The esthetics of the smile has an important influence in the perception about the individual appearance and personality [16]. The understanding of esthetic perception is extremely important because this approach can affect treatment decisions [17]. Since dentists are the care givers, in cases demanding of restoration of anterior smile segment, they often believe that the restoration provided is according to the ideal guideline and that is what is best for the patient. But occasionally what may be perfect and ideal in view of the dentist might not be ideal in the eyes of the general population. Expectation and perception of the patient plays a significant role in treatment planning [18]. In this present study 4 components of esthetic smile – midline diastema, crown length, gingival display and midline shift were altered to observe how these changes affected smile esthetics in the perception of General dentists, dental students and patients. These alterations were chosen based on the frequency and more easily perceived by the people. The intention was to know whether there is difference among the esthetic perception of these groups as well as which kind of alteration really matters for them. Facial features, such as hair color, face pattern, skin color and gender, are the factors that potentially affect the level of visual attention on the smile esthetic perception by laypersons [19]. Therefore, to eliminate any kind of bias these factors were removed from the study [20]. The digitally altered images were arranged randomly so that the evaluators could not compare the photographs at the same time which will eliminate any kind of bias. The evaluation was carried on a VAS scale of 1-10. The VAS has been widely used for purposes of evaluating subjective feelings and has demonstrated good levels of reproducibility and validity [21-23]. The presence of a large midline diastema negatively affects smile esthetics, and such persons are considered to be socially less successful [24]. Rodrigues *et al.*, reported that a large diastema may have a negative influence on the aesthetic evaluation of the smile. The tooth-size

discrepancies and excessive vertical overlap of the incisors are the most common factors in the development of diastemas. It may also be seen in orthodontic patients who experience some relapse or space reopening after the orthodontic appliances is removed. Possible therapeutic approaches include restorative orthodontics, prosthodontics, surgery, and various combinations of the above [25]. Treatment is mainly for esthetic and psychological reasons, rather than functional ones. When we improve anterior dental esthetics either orthodontically or restoratively, we probably unnecessarily sensitize our patients and make them more aware of minor esthetic problems [26]. In the present study, the general dentists and dental students rated the midline diastema unattractive when it was 1-1.5mm wide while the patients rated it unattractive when it was 1.5-2mm wide. Thus, from the results of present study, it appears that diastema may not be objectionable if it is less than 1 mm. The threshold for unattractiveness for midline diastema was found to be less in orthodontists and dentists compared to the layperson, which is in accord with the American populations. These results are in agreement with the findings of Kokich *et al.*, [26]. The results of this study show that laypeople accept a wider range of midline diastema deviation as compared to dentists. Therefore dentists must be careful that they do not impose their own beauty norms upon patients [2]. Brisman reported that patients were more inclined to have anterior dental arrangement at the same level in horizontal plane, whereas dentists were more in favour of anterior dental arrangement with radiating symmetry, with the incisal edge of the lateral incisor off the plane of the adjacent central incisor [18]. A lateral incisor 1-1.5 mm shorter than central incisor was thought to add a more natural look to the dental arrangement [27]. The results of the present study stated that reducing the crown length by more than 1.5 mm was perceived as unattractive equally by all the three groups. Laypeople did not detect asymmetric crown length unless one crown was 1.5–2.0 mm shorter than the other [28]. Supra-eruption, crowding, trauma, and severe bruxism may produce vertical discrepancy of the anterior teeth, which can compromise the anterior dental esthetics. The different treatment modalities available for this condition include crown lengthening, orthodontic extrusion or intrusion, and restoration of the shorter tooth [29]. When a patient has a unilateral discrepancy, the clinician should identify the cause so as to determine what treatment should be recommended. The present study results suggest that some therapeutic approaches to correct asymmetries of gingival margins of the maxillary central incisors of between 0.5 and 1.5 mm might reflect an exaggerated concern of the dental specialist rather than a real esthetic need. However, such procedures might be justifiable when fully discussed with the patient, because any treatment should respect the patient's self-image and wishes. An orthodontic treatment coupled with restorative procedures might

give better esthetic results than restorative procedures alone or other esthetic dental procedures [30, 31]. The extent of gingival display affecting smile esthetics is variable. In a normal smile, the entire maxillary incisor is visible and 1–2 mm of gingival exposure is considered as acceptable [32, 33]. Excessive display of the gingiva known as “gummy smile” can render a smile unattractive. The present study indicated that a display of up to 2mm was scored as attractive by the general dentist and dental students, whereas patient even rated a display of up to 4mm as attractive. These results suggest that dentists and dental students have been conditioned to see a ‘gummy smile’ as undesirable, although some gingival display is certainly acceptable to most people and even considered by some as giving a youthful appearance [34]. It is noteworthy that some marginal gingival display is not as objectionable to laypeople as dentists may imagine [35]. Medina et al in 2010 stated that the gummy smile is not accepted by specialists or patients when it is of 4mm or above with is in favour of our study [36]. On the other hand, Kokich *et al.*, found that asymmetric alterations make teeth more unattractive to, not only dental professionals but also, the lay public. Laypeople perceived a change in attractiveness when the distance from gingiva to lip was 3.0 mm or greater. However, dentists did not rate excess gingival display as unattractive, even with a maximum of 4.0 mm. The general dentists had a higher threshold [26]. According to Van der Geld and van Waas, it appears that the smile line is, on average, situated higher among women than among men. Colour of teeth and gingival display are critical factors in self-satisfaction with smile appearance. Smiles with disproportional gingival display are judged negatively and correlate with personality characteristics [36]. Geron and Atalia stated that gingival exposure above 1mm was an unaesthetic feature. With aging, there is loss of tonicity in the facial muscles, which reduces the lip movement. So, as the people get older, the gingival display decreases on smiling [37]. The amount of gingival display on smiling that is acceptable esthetically can vary widely; therefore, treatment of this esthetic issue should be performed judiciously. In broad terms, it is better to treat a ‘gummy smile’ less aggressively, because aging will naturally diminish this characteristic. A ‘gummy smile’ is often considered more esthetic than a smile with less tooth display [27]. In the present study the general dentists were less tolerant in their evaluation of dental midline discrepancy and rated 3.0-mm shifts as less attractive. Similarly, Kokich *et al.*, reported that orthodontists classified smiles as least attractive only when midline shifts reached 4.0 mm. In contrast to our findings Pinho *et al.*, [19] reported that orthodontists and prosthodontists were less tolerant of dental midline shifts, and rated 1.0 mm and 3.0 mm shifts as less attractive, respectively. The non-treated layperson group could not perceive dental midline shifts in this study, similar to the results of other studies. However,

some studies reported that midline shifts greater than 2.0 mm are perceived by most of the people, and 56% of laypersons noticed 2.0- mm midline shifts [30]. The lack of perception of dental midline asymmetries by patients in our study was similar to findings in other studies. These discrepant results might be explained by differences in the methodologies used for the digital manipulation of photographs, by different data collection instruments or different statistical tests, or different sociocultural aspects [38]. Although our results show that dental midline shifts less than 4.0 mm have no impact on the esthetic perceptions of laypersons, greater discrepancies might have other implications. The findings of the present study highlight the importance of a broader understanding of smile esthetics, since oral care providers tend to perceive esthetics differently from those who seek care. Since patients are the most important subjects to be considered in esthetic procedures, caution should be taken in order to offer procedures that might not be perceived as necessary by the patients.

## CONCLUSION

With the limitation of the study it can be concluded that dental professionals and patients express different perceptions about smile esthetics. It would be important for dental professionals to consider this fact when evaluating treatment needs of their patients and proposing treatment approaches. The findings of this study showed that patients accept a wider range of deviation compared with general dentists and dental students. Therefore, when aesthetic treatment to obtain a harmonious smile is performed, clinicians must be careful about imposing his/her own beauty norms upon patients. The type and degree of deviation from the norm and the opinion of the patient need to be taken into consideration. Among all the four esthetic parameters, midline diastema was more unattractive for all the groups. So, correction of this parameter by the dental professional is of paramount importance for a better esthetic result.

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