

# Dimensions of Maxillary Lateral Incisor on the Esthetic Perception of Smile: A Comparative Study of Dental Professionals and the General Population

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## ABSTRACT

**Aim:** To evaluate the effect of the differences in the dimensions of maxillary lateral incisor on the esthetic perception of smile among dental professionals and the general population.

**Materials and methods:** Two sets of photographs where the maxillary incisor dimensions were modified using computer software (Adobe Photoshop) were created. In the first set, six images were included where the maxillary lateral incisor width was modified. The second set included five images where only the maxillary lateral incisor length was modified keeping the gingival margins same. Three groups of participants formed the sample. Hypodontia patients formed the first group, non-hypodontia patients formed the control group, while the dentists constituted to the third group. A total of 156 participants were recruited, 36 patients with radiographically confirmed hypodontia out of which 22 were female and 14 were male, 54 non-hypodontia "control" patients out of which 29 were female and 24 were male, and 66 dentists out of which 39 were female and 27 were male. Every participant had 15 seconds to view each photograph along with 30 seconds at the end for confirmation.

**Results:** The "most attractive smile" was the ones with 77% lateral incisor to central incisor width proportion according to 25.0% of the hypodontia group and 40.8% of the dentist's group, while only 4.2% of the control group agreed that it was the most attractive. However, the "least popular" was the 52% lateral incisor to central incisor width proportion according to 40.0% of patients who are hypodontic, 20.8% of participants from control group, and 49.0% of dentists.

**Conclusion:** The golden proportion was not considered as the most attractive among all groups. The esthetic perceptions of the patients might not be same as that of the dentists. In general, reductions in the maxillary lateral incisor width were not all acceptable.

**Clinical significance:** This study will help us understand the different perceptions of the patients and the dentists on esthetics, which would further help us in planning the treatment accordingly.

**Keywords:** Agensis, Esthetic perception, Golden proportion, Hypodontia, Maxillary lateral incisor.

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## INTRODUCTION

An individual's smile is considered a major asset in increasing the overall facial attractiveness.<sup>1</sup> Talic defined the smile as a "relationship of the dentition and supporting structures to the facial soft tissues that is dynamic and static in nature". Since the lateral incisor is located in the esthetic zone, its absence would lead to unpleasant smile.<sup>1</sup>

Hypodontia, which is the agenesis of teeth, is a developmental anomaly that is widespread among different populations around the globe. It is considered a major clinical issue in several dental specialties affecting function and esthetic at a young age.<sup>2</sup>

Other than the third molars, the agenesis prevalence in the permanent dentition lies within a range of 2.5% to 9.1%. Where the prevalence in female being higher than males (by 1.37 times).<sup>3-6</sup> It has been found that most agenesis in the maxillary arch is present in individuals with class III malocclusion.<sup>4</sup> Hence, it is less present in patients with skeletal class II.<sup>7</sup> There are differences in the views of the maxillary lateral incisor agenesis to be the most common occurring agenesis among different ethnic groups.<sup>4</sup> The maxillary lateral incisor agenesis prevalence is higher bilaterally than unilaterally.<sup>3</sup> Consequently, it is a significant issue that requires attention.

Unilateral or bilateral maxillary incisor agenesis can be managed by three treatment options, such as leaving the space untreated,

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relocating the canine to that space by reshaping it to resemble lateral incisor, and opening the space to replace the missing tooth with implant or prosthesis.<sup>8,9</sup> The most frequently used approach

in the replacement of missing teeth nowadays is a single tooth implants.<sup>10</sup>

It is revealed in the literature that each treatment approach has its own indication and limitation as well as advantages and disadvantages. Whatever approach is selected, it is of importance to take into consideration an interdisciplinary approach to result in the most predictable outcome.<sup>9-11</sup> Furthermore, the esthetic perception of a smile is affected by environmental factors along with personal experience. For this reason, the esthetic perception differs from person to person and from one clinician to another.<sup>12</sup> Therefore, dental clinicians' final decision should be based upon the least invasive approach that suits the patient's expectation and esthetic demands along with the functional objectives regardless of their esthetic point of view.<sup>2,11,12</sup>

Several congenitally missing lateral patients do not have enough space for restoration. When the decision of orthodontic space opening is taken, estimating how much space is required to accommodate the maxillary lateral incisor replacement can be critical.<sup>2,13</sup> Three methods exist to achieve that, first, considering it to be the case of unilateral agenesis where the contralateral maxillary incisor is of normal size, this kind of case becomes a perfect model to determine the needed space to replace the missing maxillary lateral incisor.<sup>13,14</sup> The second method is the application of Bolton's analysis.<sup>15</sup> The missing maxillary lateral incisor width can be calculated mathematically from this ratio. The third method is using the golden proportion to estimate the ideal measurements required to produce space for incisor substitution. It is a two-dimensional measurement which states that the ideal esthetic is achieved when the ratio of the mesiodistal width of the tooth is 1:0.618 with the one distal to it when viewed from the frontal aspect (the lateral incisor should have a width of 61.8% of the central incisor's). The exact dimensions of the lateral incisors are not accurately reproduced because from the frontal view the actual width of the teeth cannot be measured.<sup>13</sup> Some preferred that the golden proportion should be taken into consideration while restoring the anterior teeth.<sup>13</sup> On the contrary, several studies did not find the golden proportion to occur in most of the population.<sup>8,16,17</sup> Also, Pini et al. suggested that the golden proportion was not always present in what was perceived as an attractive smile.<sup>8</sup> Also, most of the normal dentitions lacked the ideal measurements of the golden proportion.<sup>8,16,17</sup>

The study aims to estimate the effect of the differences in the dimension of the maxillary lateral incisor on the esthetic perception of smiles among dental professionals and laypeople.

## MATERIALS AND METHODS

A computer software (Adobe Photoshop CS2 software; Adobe Systems Inc., San Jose, California, USA) was used to digitally modify the photograph of a smiling female that showed only the lips and teeth producing a standardized image, which was symmetrical bilaterally.<sup>14</sup>

The maxillary lateral incisor dimensions were photoshopped to create two sets of photographs: The first set included six images showing the maxillary lateral incisor's width modified by 5% difference in proportion with the maxillary central incisor in each photo, resulting in 52% to 77% where 62% was considered as golden proportion. The second set included five images where the lateral incisor width (66.7%) along with the level of the gingival margins remained the same while the maxillary lateral incisor length was adjusted. The maxillary lateral incisor edge in the original photograph was short by 1.5 mm compared to the central incisor

next to it and was referred to as (N), the other four images were produced by modifying the maxillary lateral incisor length each time by 0.5 mm resulting in (L1) (N + 0.5) which is short by 1 mm as compared to the maxillary central incisor (L2) (N + 1) which is short by 0.5 mm as compared to the maxillary central incisor, 2 mm (S1) (N - 0.5) which is shorter than the central incisor by 2 mm and (S2) (N - 1) which is short by 2.5 mm compared to the adjacent central incisor.

Each photograph was given a special letter on its back surface for identification after it was printed (4 × 6 inch) with a matt finish. The sample included three groups of participants. Hypodontia patients formed the first group, non-hypodontia patients formed the control group, while the dentists constituted to the third group. A total of 156 participants were recruited, 36 patients with radiographically confirmed hypodontia out of which 22 were female and 14 were male, 54 non-hypodontia "control" patients out of which 29 were female and 24 were male, and 66 dentists out of which 39 were female and 27 were male.

Ethical approval was obtained and all participants who volunteered willingly were unpaid and consented. They were interviewed separately and asked to arrange every set of photographs according to their level of attractiveness (most to least attractive). The order was recorded by the assigned symbol on the back of each photo which was shown while analyzing of the results was performed. Each participant had 15 seconds to view each photograph along with 30 seconds at the end for confirmation. Participants were free to move and reposition the pictures until the final arrangement was made within the allowed time frame.

Intra-observer reliability was determined if the participant could position a "duplicated image" which was randomly selected in every set of photos (width and length modification sets) either beside each other or placing it least one position apart, meaning that the median image is wider or narrower by only 5% than the duplicate images regarding the group modified in width, and 0.5 mm longer or shorter regarding the group modified in length. A decision on a minimum reliability level of 70% was made. This setting was originally obtained from Cronbach's alpha. This is considered as the most popular method used in cognitive tests confirming internal reliability to ensure the validity of this study.

Collection of data was performed on a data collection sheet (Appendix) and was transferred to a computer after that, the analysis was performed using "SPSS" software used for Windows (Version 20). Chi-square test for independent samples was performed for analyzing the data. The level of significance was set at  $p < 0.05$ .

## RESULTS

### Effect of Maxillary Lateral Incisors Width Changes on the Esthetic Perception of Smile

A comparison between the three different groups was made on the choices of "the most attractive" (Fig. 1). Analysis was completed in two steps using the Chi-square test. First, the overall perception of what was found to be the most attractive within each group. Second, a comparison between each combination of pairs, to define the most attractive in the width settings.

There was a statistically significant difference in the dentists and the control group ( $p = 0.019$ ). There is no difference in the perception of least attractive among and between groups (Figs 1 to 3).

The "most attractive smile" was the ones with 77% lateral incisor to central incisor width proportion according to 25.0% of the

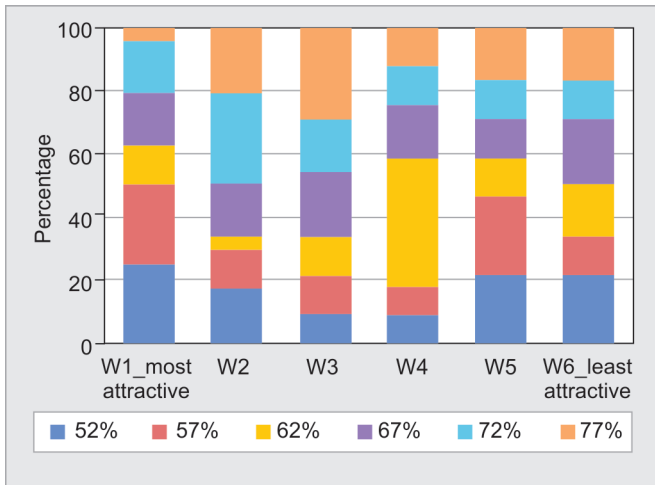


Fig. 1: Control in lateral incisor's changes

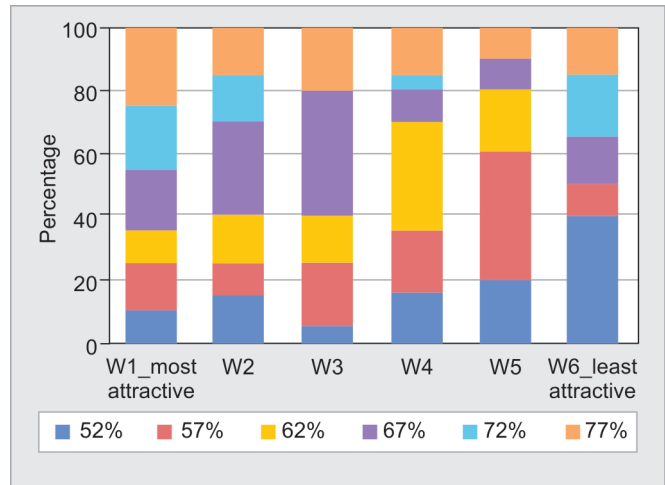


Fig. 2: Hypodontia in lateral incisor's changes

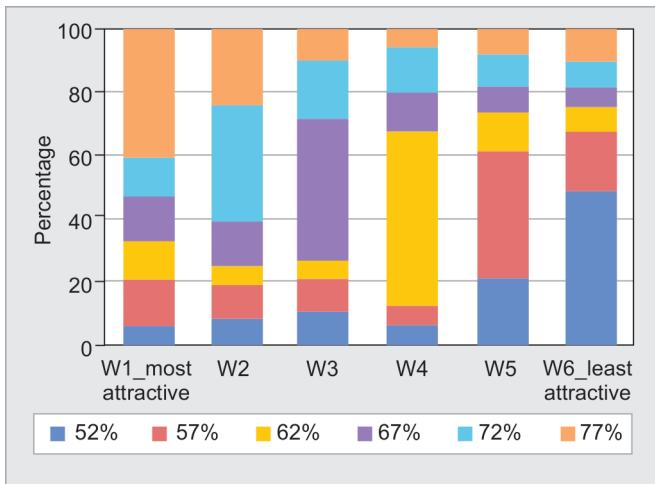


Fig. 3: Dentists' in lateral incisor's changes

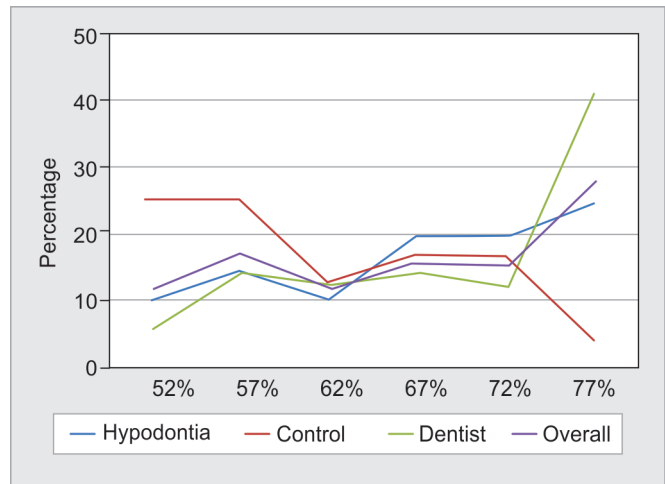


Fig. 4: Perception of "most attractive" smile following changes to width of maxillary lateral incisor

hypodontia group and 40.8% of the dentists' group, while only 4.2% of the control group agreed that it was the most attractive (Fig. 2). However, the "least popular" was the 52% lateral to central width proportion according to 40.0% of patients from the hypodontia group, 20.8% of patients from the control group, and 49.0% of the dentists (Figs 4 and 5). The reliability level of all the groups reached an acceptable degree. The hypodontia group revealed 62.5% reliability. Also, the control group showed a reliability of 55.8%. However, the dental professionals revealed a significantly higher reliability of 79.0%.

**Effect of Maxillary Lateral Incisors Length Changes on the Esthetic Perception of Smile**

Using the Chi-square test, results reveal that there is a remarkable difference in the perception of the changes in lateral incisors' length on the matter of most attractive ( $p = 0.006$ ). There was no statistically significant difference in all the three groups. No difference was found on the perception of least attractive among and between groups regarding the length changes. The maxillary lateral incisors that fall short by 0.5 mm in length as compared to the adjacent central incisor ( $N + 1$ ) were the "most attractive"

according to 35.0% of the hypodontic patients, 30.0% of control group, and 24.5% of the dentists.

On the contrary, 40.0% hypodontic patients, 56.7% of control participants, and 40.8% of dentists considered the lateral incisor which was short by 2.5 mm ( $N - 1$ ) as the "least attractive". The reliability level of all the groups reached an acceptable degree. The reliability of dentists was remarkably higher than hypodontia and control patients.

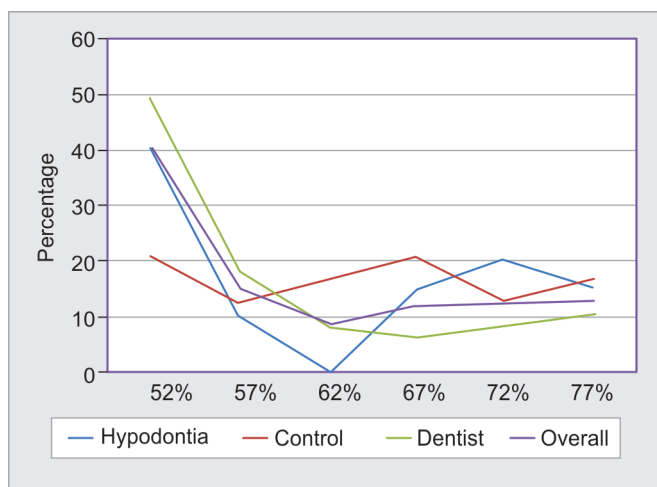
**Effect of Gender**

Using Chi-square test, results showed that there is no statistically significant difference in all the three groups ( $p = 0.038$ ), the dentists showed more reliability in both the genders as compared to the other groups.

**DISCUSSION**

Dentists, orthodontists, and maxillofacial surgeons carry out analysis of smile which is an important part of overall analysis of face.<sup>1</sup> Absent or malformed tooth highly compromises the esthetic smile subsequently affecting the personality, appearance, and





**Fig. 5:** Perception of "least attractive" smile following changes to width of maxillary lateral incisor

psychological well-being of an individual.<sup>18,19</sup> The maxillary lateral incisor which is congenitally missing presents a significant challenge in achieving an ideal smile.

The prevalence of dental agenesis varies from 0.3% to 36.5%. The etiology for dental agenesis is still unclear. Genetic factors and ethnic background are supposed to play an important role in dental agenesis.<sup>20–22</sup> The susceptibility rate of agenesis was more by 1.37 times in females as compared to males.<sup>23,24</sup>

The congenitally missing maxillary lateral incisor can be managed by three treatment options. The first option is to accept the space as it is, the second option is close the space and substitute it with canine, and third treatment option is to open up the space for tooth replacement.<sup>13</sup> There are differences in the views of the general population and hypodontia patients on the esthetic perception, which was one of the reasons for us to conduct this study.<sup>17,25,26</sup>

The lower range was set at 62% "golden proportion" as by few authors,<sup>17,25</sup> but in our study we have set 52% as the lower limit. The width of maxillary lateral incisor was performed by modifying it at 5% intervals. This was according to the study performed by Bukhary et al.<sup>14</sup>

A study performed by Preston confirmed the unrealistic characteristic of golden proportion.<sup>27</sup> According to his study, the maxillary anterior teeth did not follow golden proportion in 58 dental casts when frontally viewed. The anterior teeth arranged as same horizontal level was preferred by the patients according to the study performed by Brisman.<sup>28</sup>

Our results showed that the "most attractive smile" was the ones with 77% lateral incisor to central incisor width proportion according to 25.0% of the hypodontia group and 40.8% of the dentist's group, while only 4.2% of the control group agreed that it was the most attractive (Figs 1, 2 and 4) which were in accordance to the study by Rosenstiel et al.<sup>17</sup> However, the "least popular" was the 52% lateral incisor to central incisor width proportion.

The effects on gender were also studied. Although there was no statistically significant difference in all the three groups in both the genders, the dentists showed more reliability in both the genders as compared to the other groups.

## LIMITATIONS

It is of paramount importance for additional diagnostic setup. The patients understanding of dental esthetics and their appreciation

will be emphasized while planning the treatment. Computer-aided treatment planning system would be the future need which will help the patients to see the modifications before deciding on the final treatment plan.

## CLINICAL SIGNIFICANCE

This study will help us understand the different perceptions of the patients and the dentists on esthetics, which would further help us in planning the treatment accordingly.

## CONCLUSION

The golden proportion cannot be considered as the most attractive among all. The esthetic perceptions of smile by clinician might differ from that of patient. In general, reductions in the maxillary lateral incisor width was not all acceptable.

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