

Perception of the esthetic impact of mandibular incisor extraction treatment on laypersons, dental professionals, and dental students

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ABSTRACT

Objective: To evaluate the degree of perception of laypersons, dental professionals, and dental students regarding dental esthetics in cases with mandibular central incisor extraction.

Materials and Methods: Using a smile photograph of a person with normal occlusion and all teeth, modifications were made to reflect the extraction of a mandibular incisor of various compositions and sizes. For this purpose a program specifically for image manipulation (Adobe Photoshop CS3, Adobe Systems Inc) was used. After manipulation the images were printed on photographic paper, attached to a questionnaire and distributed to laypersons, dental professionals, and dental students (n = 90) to evaluate the degree of perception and esthetic using a scale of attractiveness, where 0 = hardly attractive, 5 = attractive, and 10 = very attractive. The differences between examiners were checked by the Mann-Whitney test. All the statistics were performed with a confidence level of 95%.

Results: The results demonstrated the skill of the dental professionals and dental students in perceiving the difference between cases of normal occlusion and cases where an incisor was lacking ($P < .05$). The photograph in which the lateral incisors were shown to be larger than the central incisor was the one that obtained the highest value among the cases of extraction in all groups of evaluators.

Conclusions: It can be concluded that dental professionals and dental students are more skillful at identifying deviation from normality. In addition, central incisor extraction should always be discarded when there are other treatment options available. (*Angle Orthod.* 2012;82:732–738.)

KEY WORDS: Incisor; Tooth extraction; Orthodontic treatment

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INTRODUCTION

The purpose of orthodontic treatment is to optimize the functional relationship of occlusion and a harmonious dentition, with esthetics being an important factor within general scope of treatment and an imperative for the patient's satisfaction.^{1,2} A harmonious smile plays an important role in establishing a good relationship between physical and facial beauty,³ as the teeth are considered important components in the architecture of facial disposition.⁴ Because of this factor, studies have shown that the perception of facial esthetics, including self-perception, contributes significantly to reasons for seeking orthodontic treatment in 80% of patients.^{5–11}

Although the concepts that rule the parameters for qualifying and quantifying beauty are subjective in most cases,^{12,13} the orthodontics specialty follows guidelines that make it feasible to diagnose and plan orthodontic treatment.

Table 1. Demographic Data of Study Participants in Groups

| Characteristics | Dental Professionals (n = 30) | Dental Students (n = 30) | Laypersons (n = 30) |
|-----------------|-------------------------------|--------------------------|---------------------|
| Sex | | | |
| Male | 17 (57%) | 18 (60%) | 18 (60%) |
| Female | 13 (43%) | 12 (40%) | 12 (40%) |
| Age group | | | |
| 16–30 years | 16 (53%) | 30 (100%) | 23 (77%) |
| 31–45 years | 10 (33%) | 0 (0%) | 7 (23%) |
| >45 years | 4 (13%) | 0 (0%) | 0 (0%) |

Making a precise diagnosis and, consequently, correctly formulating a treatment plan present a high degree of difficulty and complexity.^{8,14} When defining the treatment plan, the presence of a significant percentage of malocclusions, including discrepancies between the sizes of teeth and maxilla and discrepancies between the bony bases, normally results in a therapy that includes extractions.¹⁵

The teeth routinely extracted are, in order, the first premolars, second premolars, and molars. Extraction of the mandibular incisor is a less common treatment option.^{16,17} It is most often done in patients who have a tooth-size discrepancy and a significant mandibular anterior tooth-size excess.^{18–21}

Because the mandibular incisor is an important component in anterior dental esthetics, esthetics may be compromised by its extraction. Therefore, the aim of this study was to evaluate the perception of laypersons, dental professionals, and dental students regarding the esthetics of the smile in patients in whom a mandibular central incisor was extracted. The extraction was simulated by altering the smile photograph of a patient with full occlusion.

MATERIALS AND METHODS

To conduct this study we used a smile photograph of a female patient aged 16 years and 10 months who had normal occlusion. The photograph was taken with a digital camera (Canon Rebel XTi, Canon, Japan), resulting in some images in which only the gingival tissue and the teeth could be visualized.

The real photograph was manipulated with the aid of Adobe Photoshop CS3 Software (Adobe Systems Inc, San Francisco, CA). However, the maxillary arch was maintained without any modification.

Changes in the photograph were made in the region of the anteroinferior arch of the image with various compositions of sizes. With the intention of simulating the extraction of the mandibular right central incisor, the crown and the gingival curvature were removed due to the presence of its respective root. Five images were obtained: (A) one with four incisors, (B) one image without any alteration to the width of the three remaining incisors, (C) one with increase in the three mandibular

incisors with the same proportion, (D) one with a mesiodistal increase in the central incisor and no alteration in the lateral incisors, and (E) one with a mesiodistal increase in the lateral incisors and the central incisor without any alteration. All the images presented the teeth with mandibular alignment. The images were numbered, randomly printed on photographic paper, and attached to a questionnaire and distributed to laypersons, dental professionals, and dental students (n = 90).

On a second sheet, the distribution of the same images was altered; they were renumbered and attached to the same questionnaire to evaluate the degree of reliability of the answers evaluated. On additional sheets, the images were individually printed so they could be evaluated individually using a scale of attractiveness in which 0 = hardly attractive, 5 = attractive, and 10 = very attractive. All the evaluators were advised not to compare the images on different sheets. The evaluation time for each image was limited to 60 seconds.

Statistical Procedures

The frequencies of the answers given by the dental professionals, dental students, and laypersons were compared by means of the chi-square test. In cases in which the expected frequency was less than five, Fisher’s exact test was used. The scores of grades awarded to each photograph were compared by means of the Kruskal-Wallis test, and comparisons between pairs were performed using the Mann-Whitney test. The means of grades awarded to each photograph were calculated in each group in to determine the Spearman correlation coefficients and to evaluate the similarity between the perceptions of the dental professionals, dental students, and laypersons. The level of significance adopted was 5% ($\alpha = .05$). The data were tabulated and analyzed in the statistical program BioEstat (version 5.0, Belém, Pará, Brazil).

RESULTS

Table 1 shows the demographic data of the study participants. Of the 90 participants, 59% were men and most (77%) was in the age range of 16 to 30 years.

Table 2. Perception of the Participants Regarding Differences between and Preferences for the Different Photographs Presented

| Answers | Image 1 | | | P Value |
|--------------------------------------|---------------------------------|----------------------------|-----------------------|---------|
| | Dental Professionals No. (%) | Dental Students No. (%) | Laypersons No. (%) | |
| Perceive differences | | | | |
| Yes | 26 (86.7%) | 22 (73.3%) | 11 (36.7%) | <.001** |
| No | 4 (13.3%) | 8 (26.7%) | 19 (63.3%) | |
| Photograph I like most ^a | | | | |
| A | 1 (3.8%) | 1 (4.5%) | 2 (18.2%) | .061*** |
| B | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | |
| C | 3 (11.5%) | 1 (4.5%) | 2 (18.2%) | |
| D | 1 (3.8%) | 0 (0.0%) | 2 (18.2%) | |
| E | 21 (80.8%) | 20 (90.9%) | 5 (45.5%) | |
| Photograph I like least ^a | | | | |
| A | 9 (34.6%) | 15 (68.2%) | 5 (45.5%) | .076*** |
| B | 11 (42.6%) | 4 (18.2%) | 1 (9.1%) | |
| C | 1 (3.8%) | 1 (4.5%) | 0 (0.0%) | |
| D | 3 (11.5%) | 2 (9.1%) | 3 (27.3%) | |
| E | 2 (7.7%) | 0 (0.0%) | 2 (18.2%) | |
| Image 2 | | | | |
| Perceive differences | | | | |
| Yes | 27 (90%) | 27 (90.0%) | 19 (63.3%) | .010** |
| No | 3 (10.0%) | 3 (10.0%) | 11 (36.7%) | |
| Photograph I like most ^a | | | | |
| A | 25 (92.6%) | 22 (81.5%) | 13 (68.4%) | .478*** |
| B | 1 (3.7%) | 1 (3.7%) | 1 (5.3%) | |
| C | 0 (0.0%) | 2 (7.4%) | 2 (10.5%) | |
| D | 0 (0.0%) | 0 (0.0%) | 1 (5.3%) | |
| E | 1 (3.7%) | 2 (7.4%) | 2 (10.5%) | |
| Photograph I like least ^a | | | | |
| A | 1 (3.7%) | 2 (7.4%) | 1 (5.3%) | .144*** |
| B | 1 (3.7%) | 3 (11.1%) | 3 (15.8%) | |
| C | 5 (18.5%) | 4 (14.8%) | 0 (0.0%) | |
| D | 11 (40.7%) | 5 (18.5%) | 3 (15.8%) | |
| E | 9 (33.3%) | 13 (48.1%) | 12 (63.2%) | |

^a Answered only by participants who perceived differences between the images.

** Chi-square test.

*** Exact Fisher test.

Table 2 presents the perception of the research participants with respect to the differences in and preferences for the photographs presented. The data show that there was a significant difference in the

perception of the differences in the photographs, and the largest number of persons who were able to note the lack of similarity between the photographs was observed in the group of dental professionals, followed by the group of dental students. Among the participants who were able to note differences between the photographs of image 1, there was no statistical difference in the groups regarding which photograph was most and least preferred. In the

Table 3. Mean Grades (standard deviations) of the Photographs Awarded by the Dental Professionals, Dental Students, and Laypersons

| Photograph | Dental Professionals | Dental Students | Laypersons | P Value |
|------------|--------------------------|--------------------------|--------------------------|---------|
| A** | 7.93 (1.85) ^a | 8.11 (1.86) ^a | 6.59 (1.99) ^b | .003 |
| B | 5.91 (1.85) | 5.70 (1.93) | 5.80 (2.34) | .888 |
| C | 5.55 (1.80) | 5.41 (1.85) | 5.42 (2.36) | .824 |
| D | 5.35 (1.87) | 4.99 (2.01) | 5.32 (2.41) | .745 |
| E | 5.24 (1.73) | 5.00 (2.00) | 5.49 (2.66) | .485 |

* Scores of grades were compared by means of the Kruskal-Wallis test.

** Values with different superscript letters are significantly different (Mann-Whitney test).

Table 4. Spearman's Coefficient of Correlation of the Mean Grades for the Photographs

| Group of Participants | r_{spearman} | r_{spearman} |
|-----------------------|-----------------------|-----------------------|
| | Dental Students | Laypersons |
| Dental professionals | 0.90* | 0.70 |
| Dental students | 1.00 | 0.90* |

* $P = .037$ (2-tailed).

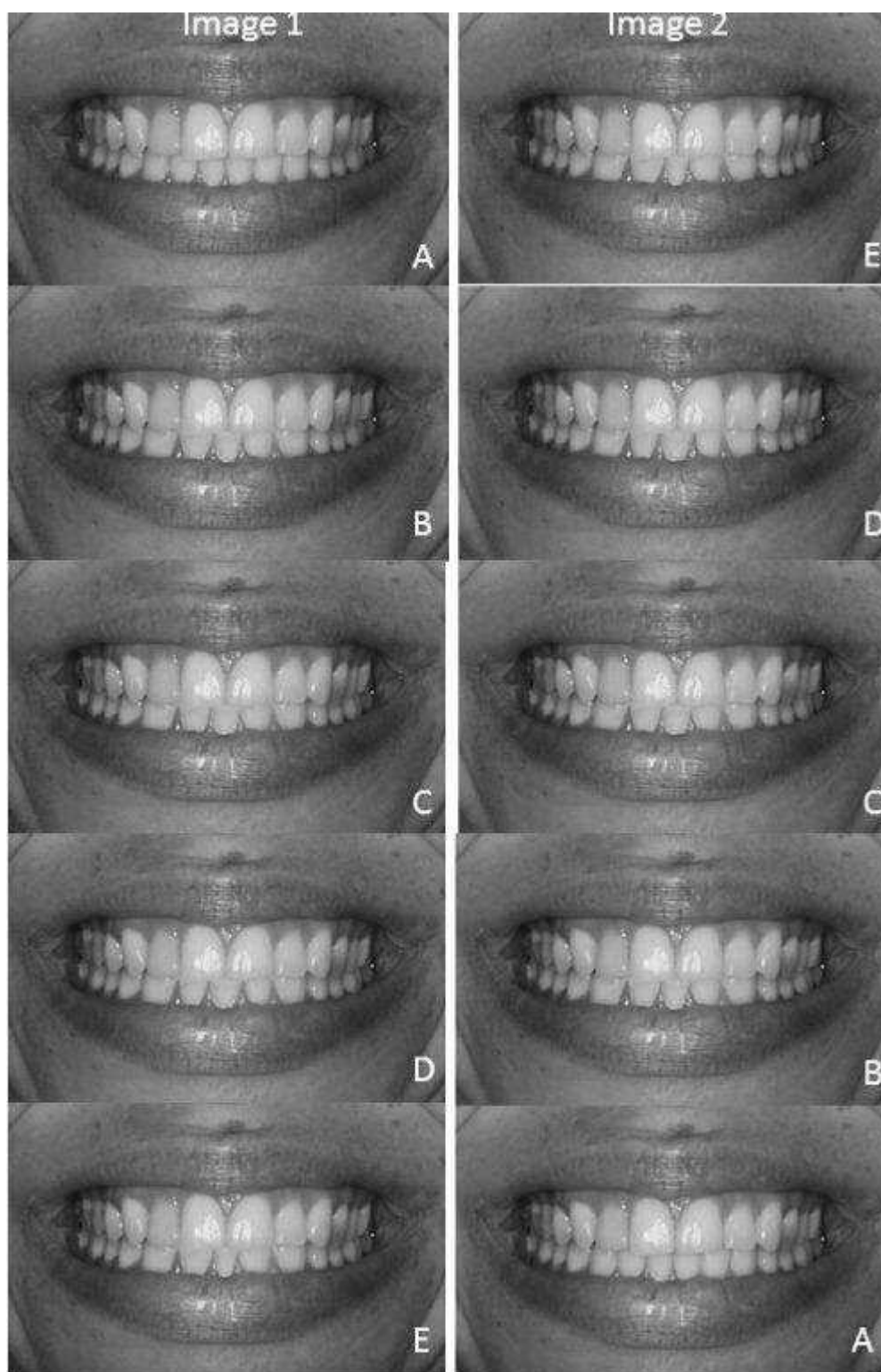


Figure 1. Modified images evaluated - Images 1 (A) With a four incisors. (B) Without any alteration as regards the width of the three remaining incisors. (C) With increase in the three mandibular incisors with the same proportion. (D) With a mesiodistal increase in the central incisor and no alteration in the lateral incisors. (E) Image with a mesiodistal increase in the lateral incisors and the central without any alteration; Images 2 (E) Image with a mesiodistal increase in the lateral incisors and the central without any alteration; (D) With a mesiodistal increase in the central incisor and no alteration in the lateral incisors; (C) With increase in the three mandibular incisors with the same proportion; (B) Without any alteration as regards the width of the three remaining incisors; (A) With four incisors.

case of image 2, the frequency of dental students who were able to note differences between the photographs was equal to that of the professional dentists (90%), and both groups differed significantly from the group of laypersons. As was the case with image 1, no statistical difference was found among the groups regarding which photograph was most and least preferred.

The means of grades awarded to each photograph are shown in Table 3. Photograph A was scored the most attractive by the three groups. Photograph E was ranked the least attractive by the dental professionals, whereas the dental students and laypersons scored D as the least attractive photograph. Only the grades awarded to photograph A presented significant differences among the groups. Comparisons between pairs showed that dental professionals ($P = .009$) and dental students ($P = .001$) awarded better grades to photograph A than laypersons did.

Positive and high correlations between the mean grades awarded to photographs are shown in Table 4. Significant correlations were found for the grades between dental professionals and dental students and between dental students and laypersons.

DISCUSSION

Over the course of time, tooth extraction has been adopted as an alternative for solving problems of tooth crowding; conventionally, premolars have been chosen as the best teeth to extract.²² However, some authors suggest that the removal of a mandibular incisor could solve tooth-crowding problems, in addition to presenting superior posttreatment stability compared with premolar extractions.^{22–24}

Treatment with mandibular incisor extraction is not a popular technique in orthodontics because of its apparent disadvantages, such as an increase in overbite, increase in overlap, reopening of the extraction space, unsatisfactory posterior occlusion, recurrence of mandibular crowding, and loss of esthetics of the interdental papilla.^{19,25} On the other hand, some authors have indicated that this treatment option provides such advantages as maintenance of intercanine distance, considerable reduction in treatment time, and better possibility of achieving long-term stability.^{21,23,26}

Because it is a polemic subject in orthodontics, the proposal of the present study was to evaluate the esthetic perceptions of a patient in which mandibular incisors were extracted to correct a malocclusion compared with a patient in which all the incisors were present. No study with this proposal was found in the literature, so the results found here are unprecedented.

Our method was to use an image manipulation program to modify a frontal photograph of a patient with normal occlusion and all the teeth. The manipulated photographs were mounted in an album and attached to a questionnaire that was given to dentists, dental students, and laypersons.

The methodology of the research conducted in this study was based on previous studies found in the literature, in which the results of possible treatments with orthodontic intervention were evaluated in photographs that have been modified using an image editing programs.^{27–33}

The use of computer programs that enable manipulation of the structures that compose the face allows for analysis of the degree of influence of certain morphologic structures on facial and dental esthetic composition. However, identification of the problem and the form of treatment to choose so that there is correction of the disposition of teeth, presents some complex and difficult decisions.

It is worth pointing out that esthetic analysis of the smile includes evaluation of all its components, such as the arch of the smile, tooth positions and structures, peculiarity of gingival esthetics, buccal corridor space, and coincidence of the midline and proportionality of the teeth.³⁴

Recently, a great deal of attention has been paid to the perception of laypersons and dental professionals with regard to esthetic evaluations,^{4,27,31,34} which are of fundamental importance in deciding to seek treatment and determining which treatment to perform.

Our results indicate a remarkable difference in how the three groups evaluated the photographs analyzed. From the point of view of dental professionals and dental students, removing the mandibular incisor alters the esthetics of the smile, and of those surveyed, 86.7% and 73.3%, respectively, noted differences. In contrast, 63.3% of laypersons did not note any difference (see image 1 of Table 2). Our findings contradict previous studies that laypersons tend to attribute greater impact to the negative aspects of a smile when it is evaluated in an isolated manner.³⁵

Nevertheless, in image 2 the results demonstrated that 90% of the dental professionals and dental students were capable of identifying alterations made in the images in the period of evaluation, and there was a significant increase in perception among laypersons as well.

The instrument for measuring a subjective phenomenon used in this study—establishing fixed points with “hardly attractive,” “attractive,” and “very attractive”—served to demonstrate that there are differences in the evaluation of esthetics among professionals and dental students and laypersons. Photograph A was evaluated as the most attractive by the three groups with a mean score of 7.93 and 8.11 from the dental

professionals and dental students, respectively, and a score of 6.59 among laypersons. Photograph E was considered the least attractive by the dental professionals (mean score = 5.24), whereas dental students and laypersons scored D as the worst, with mean scores of 4.99 and 5.32, respectively. These results suggest that when one opts for treatment with mandibular incisor extraction, the ideal is to keep these without any alteration to the width of the three remaining incisors (Photograph B) or all three teeth with the same size (Photograph C). Discrepancies between the sizes of the remaining incisors results in perceptibly compromised esthetics.

However, the results demonstrated a significant correlation for the scores between dental professionals and dental students and between dental students and laypersons. This may be related to the studies of Wylie,³⁶ in which it was demonstrated that esthetic perception can be altered as the characteristics of a specific smile will influence how the observer perceives orthodontic alterations.

From this study, it can be shown that the three study groups perceived the absence of an incisor in the mandibular arch. This has implications for the choice of the procedure to be performed. The dental professional will want to opt for a treatment that does not alter the esthetics and harmony of the smile.

CONCLUSION

- Dental professionals and students are more skillful in identifying deviation from normality.
- Central incisor extraction should always be discarded when other treatment options are available.

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