



**UNIVERSIDADE FEDERAL FLUMINENSE
FACULDADE DE ODONTOLOGIA**

**SORRISOS AGRADÁVEIS: MÉTODOS DE AVALIAÇÃO, PERCEPÇÃO DE
LEIGOS E PRINCIPAIS CARACTERÍSTICAS**

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LEIGOS E PRINCIPAIS CARACTERÍSTICAS**

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Dissertação apresentada à Faculdade de Odontologia da Universidade Federal Fluminense, como parte dos requisitos para obtenção do título de Mestre, pelo Programa de Pós-Graduação em Odontologia.

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DEDICATÓRIA

Dedico aos meus pais e todos
aqueles que acreditam em mim.

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RESUMO

Oliveira PLE. Sorrisos agradáveis: métodos de avaliação, percepção de leigos e principais características [dissertação]. Niterói: Universidade Federal Fluminense, Faculdade de Odontologia; 2016.

Objetivo: Pretendeu-se com este estudo: (1) comparar a confiabilidade entre as técnicas EVA e Q-sort simplificado, na avaliação dos sorrisos; (2) estabelecer ordem hierárquica dos detalhes dos sorrisos mais agradáveis pela percepção de leigos e; (3) determinar os sorrisos mais atraentes e menos atraentes de uma amostra de brasileiros, e correlacionar com as características anatômicas quando avaliados por dentistas, ortodontistas e leigos. **Material e Método:** (1) Fotografias (258) provenientes de 86 indivíduos, obtidas com os lábios em repouso, sorriso leve e sorriso amplo, foram avaliadas quanto à atratividade dentária e do sorriso por meio da EVA e do Q-sort simplificado por cirurgiões-dentistas, ortodontistas e leigos. As concordâncias interavaliadores foram calculadas pelo Coeficiente de Correlação Intraclasse (ICC). (2) Foi realizada revisão sistemática, em bases de dados eletrônicas: Medline, Scopus, Web of Science, BVS e a literatura cinza até janeiro de 2016. Foram selecionadas pesquisas com leigos, com pelo menos 2 avaliadores adultos que julgaram visualmente, as características dentárias e/ou gengivais da estética do sorriso, em fotografia de vista frontal. A fim de determinar o risco de viés, foram avaliados: a descrição da amostra, o cálculo do tamanho da amostra, a análise estatística, os fatores de confusão e validação do método. (3) Fotografias de 86 estudantes, 66 do sexo feminino e 20 masculino, de idade entre 19-30 anos, foram avaliadas por ortodontistas, dentistas e leigos pela EVA. Foram eleitas as oito imagens com a maior pontuação e oito com menor para o sexo feminino, duas com maior pontuação e duas com menor para o masculino. A composição estética dos sorrisos mais e menos atraentes foi mensurada por um avaliador cego, e foram calculadas as médias e desvios-padrões para análise descritiva. **Resultados:** (1) O método Q-sort simplificado apresentou valores ligeiramente superiores em comparação com a EVA, ainda assim, ambas as escalas foram consideradas confiáveis. (2) Foram encontrados 1393 artigos, 20 preencheram os critérios de inclusão, sendo 3 classificados com alto risco de viés. Dados de 17 artigos foram extraídos, organizados em tabelas e ordenados hierarquicamente por percepção (3)

No total, 42 detalhes anatômicos do sorriso foram identificados e descritos, obtendo-se as médias das características mais e menos agradáveis. **Conclusões:** (1) O Q-sort simplificado é discretamente mais confiável do que a EVA; (2) Foi possível estabelecer ordem hierárquica das características de acordo com a percepção de leigos, sendo classificadas em alta, moderada e baixa relevância clínica. (3) Nos melhores sorrisos foram observados: Ausência de: assimetrias; diastemas; espaços triangulares negros; inclinação do plano incisal e; exposição gengival anterior. Arco do sorriso paralelo; Incisivos arredondados com bordas reta-arredondadas; Aumento das ameias e diminuição dos conectores em progressão distal; Exposição de incisivos superiores e mínima dos inferiores; Margem gengival dos centrais 0,5mm coronal aos caninos e 0,8mm apical aos laterais; Exposição gengival posterior de 1,5mm; Menos de 20% de corredor bucal e 12 dentes expostos e caninos verticais.

Palavras-chave: Ortodontia; Estética dentária; Sorriso; Escala Visual Analógica; Q-sort.

ABSTRACT

Oliveira PLE. Attractive smiles: evaluation methods, perception of laypersons and main characteristics [dissertation]. Niterói: Universidade Federal Fluminense, Faculdade de Odontologia; 2016.

Objective: The aim of this study was: (1) compare the reliability between VAS and Q-sort simplified on smiles evaluation; (2) rank the details of pleasant smiles by laypersons perception and; (3) determine the most attractive and least attractive smiles from a Brazilian sample and correlate the anatomical characteristics identified in these smiles when evaluated by dentists, orthodontists and laypersons. **Material and methods:** (1) An album containing 258 photos of 86 individuals with their lips at rest, a slight and broad smile, was assessed by dentists, orthodontists and laypersons with regard to smile and dental attractiveness. To this end, both VAS and simplified Q-sort method were used. Agreements were calculated by intraclass correlation coefficient (ICC). (2) Systematic review in electronic databases: Medline, Scopus, Web of Science, VHL and grey literature until January 2016. Studies were selected which used laypersons and included at least 2 adult evaluators who judged visually the dental and/or gingival characteristics of smile aesthetics in frontal view photographs. In order to determine the risk of bias the sample description, sample size calculation, statistical analysis, confounding factors, and method validation were assessed. (3) Photos of 86 students, 66 female and 20 male, aged between 19-30 years, were evaluated by orthodontists, dentists and laypersons by the VAS. Eight images with the highest score and eight lowest were elected for females, two with the highest score and two lowest for males. The aesthetic composition of the most and least attractive smiles was measured by a blinded evaluator, and were calculated the average and standard deviation for descriptive analysis. **Results:** (1) The Q-sort simplified method showed slightly higher values compared to the EVA, nevertheless both scales were considered reliable. (2) 1393 articles were found, 20 met the inclusion criteria being 3 classified as high risk for bias. Seventeen articles data were extracted, organized into tables and ranked by perception. (3) In total, 42 smiling anatomical details have been identified and described, obtaining average values for the characteristics. **Conclusions:** (1) The simplified Q-sort is slightly more reliable than the EVA; (2) It was possible to rank the smile features according to the

perception of laypersons, being classified into high, moderate and low clinical relevance. (3) From the most attractive smiles were observed: Absence of: asymmetries; diastemas; black spaces; incisal plane inclination and anterior gingival display. Parallel smile arc; oval-shaped incisors with square-rounded edges; increase of the incisal embrasure and reduction of connectors space in distal progression; display of upper incisors and minimum display of lower teeth; gingival margin of central incisors 0.5mm coronal to the canines and 0.8mm apical to the lateral incisors; posterior gingival display of 1.5mm; less than 20% of buccal corridor and display of 12 teeth; and canines with -2 degrees of inclination.

Key-words: Ortodontics; Esthetics, dental; Smiling; Visual Analog Scale; Q-sort.

SUMÁRIO

1- Introdução.....	11
2- Artigos produzidos.....	13
2.1- Artigo 1: Comparison of two scales for evaluation of smile and dental attractiveness.....	13
2.2- Artigo 2: Laypersons' perceptions regarding dental features of the smile: A systematic review.....	20
2.3- Artigo 3: Details of pleasing smiles.....	43
3- Discussão.....	66
4- Conclusões.....	68
5- Referências.....	71
6- Anexos.....	75

1- INTRODUÇÃO

Um sorriso atraente tem papel importante na auto-estima e nas interações sociais individuais.¹ A compreensão das preferências estéticas são essenciais para apreciar plenamente as principais preocupações dos pacientes, suas percepções da necessidade de tratamento e as suas expectativas.²

Nos estudos clínicos e experimentais, busca-se definir um guia para o tratamento ortodôntico corretivo atingir sorrisos esteticamente agradáveis,³ mas percepção estética é algo subjetivo e influenciado por fatores: culturais, status social e nível educacional.⁴ Algumas características dentárias são mais facilmente percebidas do que outras e podem causar menor ou maior interferência na percepção estética do sorriso.⁵ Contudo, para obter ótimos resultados estéticos, é indispensável seguir normas estéticas baseadas em evidências científicas.⁶

Duas das ferramentas de avaliação conhecidas na tentativa de se assegurar uma avaliação confiável de preferências estéticas das estruturas dentofaciais são: Escala Visual Analógica (EVA),^{3,4,6-18} e o método Q-sort.¹⁹⁻²⁵ Entretanto, somente um estudo comparou a confiabilidade entre EVA e Q-sort na avaliação estética do sorriso.²⁰

EVA e Q-sort possuem diferenças importantes. As pontuações na EVA são absolutas, onde os avaliadores pontuam cada objeto de forma independente. É amplamente utilizada em pesquisas de opinião, e além disso, é conveniente, simples, econômica e rápida.²⁶⁻²⁸ O Q-sort propõe, originalmente, categorizar a amostra em nove possibilidades, de forma progressiva, distribuindo entre menos atraentes e mais atraentes. Todos os objetos são avaliados em conjunto, sendo a avaliação sobre a amostra total.²⁰

As características do sorriso podem ser compreendidas pelos componentes: (1) Miniestética: analisa, por exemplo, exposição de gengiva e incisivos, apinhamento, linha média e arco do sorriso; e (2) Microestética: avalia, por exemplo, forma dentária, proporção e espaços triangulares negros²⁹. Apesar das revisões sistemáticas indicarem níveis de aceitação para algumas destas normas

estéticas,^{2,30,31} não existe uma hierarquia de influência das características na percepção estética.³²

O entendimento dos fatores que harmonizam o sorriso para o planejamento e tratamento é importante para a criação de sorrisos atraentes.³³ Entretanto, apenas um estudo elegeu os melhores e piores sorrisos naturais de uma amostra, avaliando sete características dos eleitos,³⁴ e nenhum adotou como metodologia analisar o máximo de características possíveis nos sorrisos considerados mais e menos atraentes.

Assim, os principais objetivos deste estudo foram determinar:

- (1) Entre Q-sort simplificado e a EVA, a ferramenta mais confiável ao avaliar a atratividade de fotos em um álbum de indivíduos com lábios em repouso, sorriso leve e sorriso amplo.
- (2) Por uma ordem hierárquica, a preferência dos componentes dentários e gengivais do sorriso sob a percepção de leigos.
- (3) As características e preferências dos sorrisos, masculino e feminino, mais atraentes e menos atraentes.

2 - ARTIGOS PRODUZIDOS

Artigo 1:

original article

Comparison of two scales for evaluation of smile and dental attractiveness

Pedro Lima Emmerich Oliveira¹, Andrea Fonseca Jardim da Motta², Clarice Julia Guerra³, José Nelson Mucha⁴
 DOI: <http://dx.doi.org/10.1590/2176-9451.20.2.042-048.oar>

Objective: To compare the visual analogue scale (VAS) and the simplified Q-sort method used to investigate the highest level of agreement among dentists, orthodontists and laypeople when assessing smile and dental attractiveness. **Material and Methods:** An album containing 258 photos of 86 individuals with their lips at rest, a slight and broad smile, was assessed by 25 dentists (general clinicians and various specialties), 23 orthodontists and 27 laypeople with regard to smile and dental attractiveness. To this end, both VAS and simplified Q-sort method were used. Agreements were calculated by intraclass correlation coefficient (ICC). **Results:** For the single measurement between the VAS method and the simplified Q-sort method, all simplified Q-sort rates were higher in all groups. The simplified Q-sort method results ranged between 0.42 and 0.49 while those of the VAS method varied between 0.37 and 0.42. The simplified Q-sort method also presented higher mean measurement values (0.95 and 0.96) in comparison to VAS (0.94 and 0.95). **Conclusions:** Both scales may be considered reliable for evaluating smile and dental attractiveness; however, the simplified Q-Sort method presented slightly higher values than the VAS method.

Keywords: Dental esthetics. Smile. Q-sort. Corrective Orthodontics. Visual analogue scale.

Objetivo: comparar a escala visual analógica (EVA) e o método Q-sort simplificado quanto à maior concordância nas avaliações entre cirurgiões-dentistas, ortodontistas e leigos em atratividade dentária e do sorriso. **Métodos:** 258 fotografias, provenientes de 86 indivíduos, fotografados com os lábios em repouso, sorriso leve e sorriso amplo, foram avaliadas quanto à atratividade dentária e do sorriso por meio da EVA e do Q-sort simplificado por 25 cirurgiões-dentistas (clínicos gerais e especialidades diversas), 23 Ortodontistas e 27 leigos. As concordâncias foram calculadas pelo Coeficiente de Correlação Intraclassa (ICC). **Resultados:** para medida única entre a EVA e o método Q-sort simplificado, todas as taxas do Q-sort simplificado foram maiores em todos os grupos. O resultado do Q-sort simplificado variou entre 0,42 e 0,49, e da EVA entre 0,37 e 0,42. O Q-sort simplificado também apresentou valores de medida média superiores (0,95 e 0,96) em relação à EVA (0,94 e 0,95). **Conclusão:** pode-se considerar que ambas as escalas são confiáveis para avaliação da atratividade dentária e do sorriso; porém, o método Q-sort simplificado apresentou valores ligeiramente maiores que os da EVA.

Palavras-chave: Estética dentária. Sorriso. Q-sort. Ortodontia Corretiva. Escala Visual Analógica.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

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INTRODUCTION

One of the main objectives of orthodontic treatment is to improve the smile appearance.¹ For this purpose, it is important to know the perception of orthodontists, dentists and mainly laypeople with regard to the ideal smile, in addition to bearing in mind that the definitive source of esthetic values must be related to the perceptions of the overall population, and not only to those of orthodontists and dentists.^{2,3}

Thus, it is important to assess the perceptions of the overall population as well as professionals in Dentistry in order to determine some peculiarities common to all, or even reformulate some concepts about smiling, which would be more relevant.

Investigators have proposed different methods to assess esthetic concepts, each method with its advantages or limitations. The visual analogue scale (VAS) is one of the most popular and widely used method, probably because it is simple and inexpensive.⁴⁻⁹ It is used for esthetic evaluations of patient's profile,⁹ face,⁸ tooth positioning^{4,5,6} and post-treatment evaluations.⁸

The Q-sort method, developed by Stephenson in 1953,¹⁰ has been used in psychological and behavioral sciences,¹¹ as well as to assess the esthetics of the smile^{8,12,13} and profile.¹⁴ In addition, there are methods based on scales of scores or ordinal categorization, such as the 10-point scale.¹⁵⁻¹⁸

Considering the availability of a high number of instruments of study, it is necessary to validate, compare and establish a gold standard for the methods of evaluating dentolabial attractiveness. The VAS method scores each object in an independent manner, while in the Q-sort method, the objects are evaluated in conjunction.⁸

Challenged by the question of which method should be used to assess the attractiveness of lip/tooth interrelationship and smile, this article aimed to compare the scores assigned while assessing the attractiveness of photographs in an album from individuals with lips at rest, a slight and broad smile, by means of VAS and simplified Q-sort methods, and determine which types of evaluation presented the greatest reliability or less dispersive results.

MATERIAL AND METHODS

The study was approved by the Institutional Review Board of the School of Dentistry of Universidade Federal Fluminense (UFF) under protocol #337193.

To conduct this study, a photograph album belonging to the Department of Orthodontics from Universidade Federal Fluminense (UFF) was used. The album comprised 258 color facial photographs of patients with lips at rest, a slight and broad smile. The photographs were obtained from 86 students enrolled in the undergraduate course in Dentistry at UFF, of whom 66 were females and 20 were males with an age-range from 19 to 30 years old.

In order to be included in the study sample, individuals should present complete permanent dentition from second molar to second molar, Angle Class I molar relationship, normal overjet and overbite, good facial profile tending to straight, no previous orthodontic treatment and could show teeth misalignment. From a total of 350 students enrolled in the dental school, 86 were selected and sex distribution is the real proportion of male and female students at that time.

Three photographs were obtained from each patient and standardized in the following manner: lips at rest, a slight and broad smile. A Minolta photographic camera with 100-mm macro lens was used. A Kodak 100 photographic film was used. The object-film distance was 1.0 m, with the head of each individual being positioned at the Frankfort plane parallel to the ground when the front view photograph was taken.

Images were digitized with an HP Scanjet G4050 scanner. Subsequently, Photoshop software (Adobe CS4, San Jose, California, USA) was used to diminish potential confounding factors. Cropping was done to limit the photographs to a restricted perioral area, excluding the nose,^{3,15-24} cheeks and chin. Potential rotations were corrected.

To assess the photograph album in terms of attractiveness, a website was set up with the help of a programmer, and an online questionnaire was prepared. The participants were drawn from a list of dentists and orthodontists working in the city of Vitória, ES, Brazil. The laypeople had no specific knowledge about oral esthetics, or any education in sciences connected with the study of the face or art, such as plastic surgeons, estheticians and architects.⁷ They were post-graduate students attending public and private universities who were invited as volunteers.

Sample size was calculated on the basis of population estimations. The same parameters were used for the three groups (orthodontists, dentists and

article

laypeople), and were as follows: 90% of confidence, error of 10% of the proportion in order to detect differences of 10% between groups. Thus, for a population of 140 orthodontists, we arrived at a sample of 23. For the population of 1643 dentists, the total number was 25, and as we had no population of lay-people, the sample was calculated without the factor of correction for the finite population, thereby arriving at a sample of 27.

Table 1 presents the distribution of the number and percentage of individuals in each group (dentists, laypeople and orthodontists). All individuals were instructed to take into consideration the set of three photos: at rest, with a slight and a broad smile (Fig 1).

Each examiner assessed the photos twice, once by means of a visual analogue scale (VAS) and then again by means of the simplified Q-sort method. For the VAS method, a bar with a slider was developed on the website which the examiners used to position the point on the scale that represented the score in his/ her judgment. Score “0” being the least imaginable level of attractiveness and “100” the most attractive level imaginable (Fig 2).

Stephenson¹⁰ proposed the Q-sort method with a ranked ordinal distribution into nine categories of a sample of 96 items evaluated, and Schabel et al⁸ applied the method to a sample reduced to 48 items. In this study, the simplified Q-sort method was used, in which the concept of ranked ordinal distribution was maintained with the arrangement changed from nine to five categories. The number of images evaluated was not pre-determined and could differ from 96 and 48.

For the simplified Q-sort method, the examiners received the following instructions adapted from the method performed by Schabel et al:⁸

- 1) Of the 86 images, select the 5 most and the 5 least attractive;
- 2) Of the remaining 76, select the 10 most attractive and the 10 least attractive;

Table 1 - Descriptive analysis and percentage of individuals in each group.

	n	%
Dentists	25	33.3
Laypeople	27	36.0
Orthodontists	23	30.7



Figure 1 - Illustration of 3 photos to be evaluated in the 3 categories.



Figure 2 - Illustration of the sliding bar (from 0 to 100) available on the website used to assess the value of attractiveness of the photos.

3) The remaining 56 photos were automatically selected and considered as intermediate level of attractiveness.

The following scores were established: (0) 5 least attractive; (1) 10 least attractive; (2) 56 intermediate; (3) 10 most attractive; and (4) 5 most attractive. After

the photographs were assessed by the three groups of examiners in an independent manner, agreements between the VAS method and the simplified Q-sort method were calculated. To this end, the intraclass correlation coefficient (ICC)²⁵ was used and evaluated as follows:

(a) Single measurement: one single measurement that evaluated the probability of an examiner generating the same scores for VAS and simplified Q-sort to be reproduced;

(b) Mean measurement: evaluated the probability of a group of examiners generating the same scores for VAS and simplified Q-sort to be reproduced;

Reproducibility, which measures the level of agreement between observations under the same circumstances, was assessed by means of analysis of variance (ANOVA) for the continuous scale (VAS), and the alternative non-parametric method to ANOVA, Kruskal-Wallis test, was used for the ordinal scale (Q-Sort), so as to verify the equality of means of scores in the two scales. The reproducibility assessed in this study was of the interobserver type; that is, by different evaluators, since the photos were not evaluated at two distinct time intervals.

The level of significance adopted in the test was 5% with a confidence interval of 95%. The software IBM SPSS Statistics version 19 performed the analyses.

RESULTS

Means, standard deviation and maximum and minimum scores for VAS and simplified Q-sort methods are shown in Table 2. The means of VAS and simplified Q-sort scores were obtained by combining the results of the evaluators of each photo with its respective standard deviation. Score limits represent the minimum and maximum of a single evaluator.

When the VAS method was assessed, it was possible to observe that the group of laypeople was more critical towards the scores (37.18). In the general evaluation, the group attributing the highest scores were the dentists (45.34) followed by the orthodontists (44.94).

The evaluation between agreements is presented in Table 3. The ICC of the single measurement is an index used to demonstrate the confidence of the score in VAS and in the simplified Q-sort of one evaluator; whereas the ICC of the mean measurement determines the confidence by the mean of the score of a group of evaluators.

In the ICC (Table 3) of the single measurement for VAS, dentists (0.42) showed a higher level of agreement than orthodontists (0.40) followed by laypeople (0.37). In the simplified Q-sort, orthodontists showed the highest level of agreement (0.49), followed by dentists (0.47) and laypeople (0.42). In the ICC of the mean measurement evaluated by VAS, dentists (0.96) presented a higher level of agreement than orthodontists and laypeople (0.94). In the evaluation by Q-sort, dentists and orthodontists (0.96) obtained greater reproducibility than laypeople (0.95).

When observing only the single measurements between the VAS method and the simplified Q-sort method, all simplified Q-sort rates were higher for all individuals (dentists, laypeople and orthodontists). In this method, values ranged between 0.42 and 0.49, while VAS values ranged between 0.37 and 0.42. Therefore, results suggest that the simplified

Table 2 - Descriptive analysis of scores stratified by categories of evaluators.

		Mean ± SD	Minimum	Maximum
VAS method (0 - 100)	Dentists	45.34 ± 14.68	0	100
	Laypeople	37.18 ± 13.44	0	100
	Orthodontists	44.94 ± 11.78	0	100
Simplified Q-sort (0 - 4)	Dentist	2.00 ± 0.57	0	4
	Laypeople	2.00 ± 0.56	0	4
	Orthodontists	2.00 ± 0.58	0	4

Table 3 - Single measurement and mean measurement of the intraclass correlation coefficient (ICC) used to evaluate which of the two instruments (VAS and Q-sort) has the most robust scale or the one with the best reproducibility.

	Single measurement ICC		Mean measurement ICC	
	VAS	Simplified Q-sort	VAS	Simplified Q-sort
Dentists (n = 25)	0.42	0.47	0.95	0.96
Laypeople (n = 27)	0.37	0.42	0.94	0.95
Orthodontists (n = 23)	0.40	0.49	0.94	0.96

Table 4 - Interobserver reproducibility of scores.

	P value	
	VAS ¹	Q-sort ²
Dentists (n = 25)	0.145	0.888
Laypeople (n = 27)	0.201	0.902
Orthodontists (n = 23)	0.120	0.805

¹ANOVA. ²Kruska-Wallis.

Q-sort method presents with more similar responses; that is, the method would be more reliable than VAS if evaluations were to be repeated.

The mean measurement, which is an index for a group of evaluators, ranged between 0.94 and 0.95 for VAS, and 0.95 and 0.96 for the simplified Q-sort method (Table 3), with equal variations in amplitudes, but of different magnitudes. Thus, the simplified Q-sort method would be considered slightly more reliable than VAS, if new measurements were to be made.

ANOVA and Kruskal-Wallis tests (Table 4) demonstrated that there were no statistically significant differences between the means of scores awarded by the evaluators in the three groups, which demonstrates good interobserver reproducibility. However, p values of the Q-Sort method were higher; thus, its reproducibility is considered better when compared to VAS.

DISCUSSION

Mean values were lower than 50 for all groups (Table 2). Howells and Shaw²⁶ and Schabel et al⁸ found mean VAS values near 50, which is in the center of the scale. This difference may be justified by the characteristics of the sample. The current sample did not include individuals who had undergone orthodontic treatment, unlike the sample from Schabel et al.⁸ However, the values obtained corroborate the affirmative finding that evaluators tend to attribute scores that remain distant from the extremity of the scale.⁸

Based on the mean values obtained in VAS, we observed that dentists and orthodontists attributed higher scores in comparison to laypeople. Zange et al⁴ also found laypeople to be more critical than orthodontists when VAS was used. Guo et al²³ found that oral and maxillofacial surgeons were stricter than laypeople when evaluating gingival smile; and Elham et al²⁷ found that laypeople were

less demanding than dentists and orthodontists. These differences in mean values may be justified by two reasons: firstly, the differences in study designs, since digitally modified sequential images were used in those studies; secondly, laypeople may have evaluated facial characteristics other than smile and dental attractiveness, even though images had been cropped to a specific and restricted area.

Although laypeople have a lower average score that indicates higher criticism in assessment, they also have less agreement, particularly in the single ICC measurement. Even with a small difference, orthodontists and dentists were more consistent.

By means of Q-sort, it was not possible for the mean value of the evaluation to differ from four.⁸ In this study, due to the simplification and modification of the scale, scores between 2.05 and 1.83 were attributed because the subjects were not normally distributed, as they would have been in the original method.

The limited aspect of the study is related to the absence of socioeconomic inclusion or exclusion criteria and the selection of the sample of laypeople with no randomization. However, these factors do not invalidate the results, especially in the selection of laypeople, since the ICC had values similar to orthodontists and dentists.

The purpose of the ICC was to evaluate whether the scales presented confidence for studies with regard to perception of dentolabial esthetics, in addition to showing which scale would be superior to be used in future studies. The VAS method has been used in other investigations and is a tool of proven scientific validity. The results of the mean measurements were 0.94 and 0.95 in a maximum coefficient of one; therefore, the reliability of the scale was confirmed. Schabel et al⁸ proved the reliability of the Q-sort method and also found higher agreement than the VAS method when it was used in a single ICC measurement and in the mean measurement. Moreover, the values obtained for the mean measurements in clinical photographs were the same as those found in the present study (0.95 and 0.96). The simplified Q-sort method (0.95 and 0.96) of the present study also proved reliable and presented a slightly higher ICC for both single and mean measurements than those found for VAS.

When assessing agreement in each professional group, as shown in Table 3, dentists presented a higher

level of agreement in the ICC of the single measurement of VAS (0.42), mean measurement of VAS (0.95) and simplified Q-sort (0.96). Orthodontists obtained higher scores of the ICC single (0.49) and mean (0.96) measurements in the simplified Q-sort. Laypeople presented a lower level of agreement in comparison to the other groups in all methods; nevertheless, with an excellent ICC score for the mean measurement (0.94 and 0.95). Although in a different esthetic and statistical context, Gehrke et al²⁸ found a higher level of agreement between orthodontists and a lower level of agreement between laypeople. In an experiment with ICC for profile evaluation, Sloss et al²⁹ also found strong agreement between residents in Orthodontics and laypeople.

The force of the mean measurement values found for ICC may be justified by the number of evaluators ($n = 75$),⁸ since the ICC tends to increase as more evaluators are added.²⁶ Single measurement scores are lower than those of the mean measurement because they refer to a pair of data collected, while the mean measurement refers to the entire group.

Although the Q-sort method applied in this study was simplified and modified, it still presented similarity to the original: a ranking mechanism alternating

with pre-established scores. The ranking mechanism represents the greatest distinction between VAS and Q-sort, and this is probably the reason why minor differences in confidence were found between scales. The results and the difference in values found do not invalidate any scales, but corroborate the studies using them. Both can be displayed or interpreted for clinical practice. In spite of being executed in a different manner in comparison to VAS, the Q-sort or simplified Q-sort method is understandable and uncomplicated. Additionally, because they present a slightly higher level of agreement between evaluators, they could be considered the first choice as a method of scientific evaluation with regard to dentofacial attractiveness.

CONCLUSIONS

When dentists, orthodontists and laypeople evaluated the attractiveness of photographs with lips at rest, slight and broad smile by means of VAS and the simplified Q-sort method, both scales proved to be reliable. However, the simplified Q-sort method presented a slightly higher level of interobserver reliability in comparison to VAS, and should, therefore, be preferred as a method for evaluation of smile and dental attractiveness.

article

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Artigo 2:**Laypersons' perceptions regarding dental features of the smile: A systematic review**

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ABSTRACT

Objective: To determine the dental features most noticeable by laypersons with the purpose of performing agreeable smiles in cosmetic treatments. **Material and methods:** Systematic review in electronic databases: Medline, Scopus, Web of Science, VHL and grey literature until January 2016. Studies were selected which used laypersons and included at least 2 adult evaluators who judged visually the dental and/or gingival characteristics of smile aesthetics in frontal view photographs. In order to determine the risk of bias the sample description, sample size calculation, statistical analysis, confounding factors, and method validation were assessed. **Results:** 1393 articles were found, and after a process of screening to determine eligibility 20 articles met the inclusion and exclusion criteria. Of these 20 articles, five were classified as low risk of bias, with 12 exhibiting medium risk, and 3 high risk. Data from 17 articles were extracted and organized into tables. **Conclusions:** Highly rated in descending order were: (1) Step absence between centrals; (2) One to 1.5 mm step between central and lateral; (3) Maxillary edges contouring the lower lip; (3) Absence of a diastemas; (4) Height symmetry between lateral; (5) Maxillary incisors square-rounded for men and rounded for women; (6) Up to 1 mm gingival display; (7) Flat or pointed canine for men and flat or rounded for women; (8) Centrals gingival margin 0.5 mm below the canines; (9) Absence of incisal plane inclination; (10) Centrals with symmetrical gingival margin; (11) Absence of black space; (12) Width/height ratio of 80% to 75% for the central incisor.

Keywords: Esthetics, dental; smile; orthodontics.

INTRODUCTION

Considerable attention has been given to dental and facial features in seeking to achieve optimal facial aesthetics.¹ For patients smile aesthetics is a major concern, often constituting their chief complaint,² since it is a well known fact that for 48.3% of the individuals seeking orthodontic treatment aesthetics is the key motivator.³

An ideal smile reaches beyond personal satisfaction and increased self-esteem since people with attractive smiles are considered smarter and stand a better chance of landing a job.⁴ Therefore, orthodontic treatment should focus on both an ideal occlusion and an ideal appearance.⁵

Orthodontists' opinions may diverge from those of laypersons given the former's professional training. Moreover, laypersons can be less discerning than orthodontists when it comes to evaluating the components of dentolabial aesthetics.^{6,7} Nevertheless, since the majority of the population undergoing orthodontic treatment is comprised of laypersons, the patient's perception is paramount at the start of a corrective treatment.⁷

Even when the restorative and functional goals of treatment are achieved, if the patient's smile aesthetics expectations are not met, this factor alone will exert a remarkable impact on the treatment's success rate.⁸

Some of the smile aesthetics components that can influence the perception and judgment of the attractiveness held by orthodontists or by laypersons are: gingival display,^{7,9-16} gingival margin, midline, incisal edges, buccal corridor, arch form, diastemas, incisal plane, tooth shape, tooth size, tooth inclinations and black space (gaps).

There are in the literature some articles about the dental esthetic. Although systematic review has been performed,¹⁷⁻¹⁹ there is no published any article about the opinion, exclusively, of laypersons and which present a ranking of the most important characteristics notable by them.

The aim of this study was to rank in hierarchical order the most noticeable dental and gingival components of an attractive smile as verified by laypersons, and thereby determine their ideal values and acceptable limits.

MATERIAL AND METHODS

A systematic review was conducted and the following electronic databases were consulted: Medline (<http://www.ncbi.nlm.nih.gov/pubmed/>), Scopus (<http://www.scopus.com/>), Web of Science (<http://apps.webofknowledge.com/>), Lilacs and BBO (Virtual Health Library, VHL, www.bvs.br), and grey literature (<http://www.opengrey.eu/>), in a search for articles addressing the subject in order to list in descending order the dental and gingival features most noticeable in smiles, as assessed by laypersons.

This systematic review was registered at the Centre of Reviews and Dissemination, University of York, under submission nº CRD42015023369, and was based on the guidelines of the Preferred Reporting Items for Systematic reviews and Meta-Analyses, as known as PRISMA Statement (<http://www.prisma-statement.org>)..²⁰

During the electronic searches, the articles selected should respond to PICO (Table 1). No restrictions whatsoever were established in terms of language, and searches were carried out until January 27, 2016. Table 2 describes the search strategies developed for each database with guidance of an experience library

Inclusion criteria were: studies of opinion survey with laypersons, with at least two evaluators, and adults over age 18 years who visually analyzed the dental and/or gingival smile aesthetics in frontal view photographs. Once evaluated, the images could be digitally manipulated; any changes in the smile components should be duly described, as well as both dental arches and any perioral structure that might be present (not including eyes, in close-up view). The assessment tool used in the study was a visual analogue scale (VAS), cited in the text, and the numerical data (mean and/or standard deviation) resulting from the laypersons' evaluation which had to be presented in the text or tables, and separated by rater groups.

Table 1 - PICO

P - Population/Research	Layperson`s opinion about smile esthetics
I - Intervention	Images of smiles with variations of smile components evaluated by Visual Analog Scales
C - Comparison	Among the maximum and minimum values assigned to each smile components
O – Outcome / Expected Results	Rank in hierarchical order the most noticeable smile components as assessed by laypersons
Question	What are the most noticeable features for laypersons when assessing smile aesthetics?
Null hypothesis	Unable to establish a hierarchical order of importance in the aesthetic perception of the smile by laypersons

The articles were excluded which assessed: color and brightness of the teeth, light reflection zone, dental implants, dentures, smiles with appliances, fluorosis, mixed dentition, crowding, anterior open bite, dental protrusion, skeletal deformities, missing teeth, gingival recession, gender influence, evaluator age or gender; studies with cleft palate patients, congenital absence of teeth or anomalies in tooth shape and size; research on profile evaluation, full-face photographs, videos, and a comparison of assessment methods, or between different methods to obtain photographs.

Two reviewers (PLEO and IOC) analyzed independently the title and summary of the articles initially found. After this screening phase the articles, once selected, were read in full by the same two reviewers and found eligible if in accordance with the criteria described above. Disagreements were resolved by consensus meeting and, where necessary, a third reviewer was consulted (J.N.M.).

Table 2 – Search strategies

Databases	Search strategy and keywords	Results
Medline, via PubMed	((Esthetics, Dental[MeSH Terms] OR Smiling[MeSH Terms] OR "dental esthetic"[Tiab] OR "dental esthetics"[Tiab] OR "dental aesthetic"[Tiab] OR "dental aesthetics"[Tiab] OR smil*[Tiab] OR "dental appearance"[Tiab] OR "dental attractiveness"[Tiab] OR "buccal corridors"[Tiab] OR "dental midlines"[Tiab] OR "diastema"[Tiab] OR "gingival exposure"[Tiab] OR "gingival exposure"[Tiab] OR "gummy smile"[Tiab] OR "dental exposure"[Tiab] OR "incisor position"[Tiab] OR "smile arc"[Tiab] OR "dental proportion"[Tiab] OR "tooth shape" [Tiab] OR "tooth form"[Tiab] OR "tooth morphology"[Tiab] OR "dental morphology"[Tiab] OR "papilla height"[Tiab] OR "tooth exposure"[Tiab] OR "black space"[Tiab] OR "dental asymmetry"[Tiab] OR "dental asymmetries"[Tiab]) AND ("general public"[Tiab] OR layman[Tiab] OR laymen[Tiab] OR "lay person"[Tiab] or layperson*[Tiab] OR "lay people"[Tiab] OR laypersons*[Tiab] OR "lay public"[Tiab] OR "lay opinion"[Tiab] OR "lay perception"[Tiab] OR "lay perceptions"[Tiab] OR generalists[Tiab] OR "peer assessment"[Tiab] OR nonprofessional*[Tiab] OR non-professional*[Tiab] OR "patient perceptions"[Tiab] OR "patient satisfaction"[Tiab] OR nondental[Tiab] OR non-dental[Tiab] OR untrained[Tiab] OR inexpert[Tiab]))	470
Scopus	(TITLE-ABS-KEY("Smiling" OR "dental esthetic" OR "dental esthetics" OR "dental aesthetic" OR "dental aesthetics" OR smil* OR "dental appearance" OR "dental attractiveness" OR "buccal corridors" OR "dental midlines" OR "diastema" OR "gingival exposure" OR "gingival exposure" OR "gummy smile" OR "dental exposure" OR "incisor position" OR "smile arc" OR "dental proportion" OR "tooth shape" OR "tooth form" OR "tooth morphology" OR "dental morphology" OR "papilla height" OR "tooth exposure" OR "black space" OR "dental asymmetry" OR "dental asymmetries")) AND (TITLE-ABS-KEY("general public" OR "layman" OR "laymen" OR "lay person" or layperson* OR "lay people" OR laypersons* OR "lay public" OR "lay opinion" OR "lay perception" OR "lay perceptions" OR "generalists" OR "peer assessment" OR nonprofessional* OR non-professional* OR "patient perceptions" OR "patient satisfaction" OR "nondental" OR "non-dental" OR "untrained" OR "inexpert"))	575
Web of Science	#1) TS=("Smiling" OR "dental esthetic" OR "dental esthetics" OR "dental aesthetic" OR "dental aesthetics" OR smil* OR "dental appearance" OR "dental attractiveness" OR "buccal corridors" OR "dental midlines" OR "diastema" OR "gingival exposure" OR "gingival exposure" OR "gummy smile" OR "dental exposure" OR "incisor position" OR "smile arc" OR "dental proportion" OR "tooth shape" OR "tooth form" OR "tooth morphology" OR "dental morphology" OR "papilla height" OR "tooth exposure" OR "black space" OR "dental asymmetry" OR "dental asymmetries") #2) TS=("general public" OR "layman" OR "laymen" OR "lay person" or layperson* OR "lay people" OR laypersons* OR "lay public" OR "lay opinion" OR "lay perception" OR "lay perceptions" OR "generalists" OR "peer assessment" OR nonprofessional* OR non-professional* OR "patient perceptions" OR "patient satisfaction" OR "nondental" OR "non-dental" OR "untrained" OR "inexpert") #3) #1 AND #2	251
Lilacs and BBO, via BVS	(tw:(("Smiling"(mh) or "sorriso"(mh) or "sonrisa"(mh) OR "esthetics, dental"(mh) OR "estética dentária"(mh) OR "estética dental"(mh) OR "dental esthetics" OR "estética dentária" OR "estética dental" OR "smil*" OR "sorriso" OR "sonrisa" OR "dental aesthetic" OR "dental aesthetics" OR "dental appearance" OR "aparência dentária" OR "dental attractiveness" OR "atratividade dentária" OR "buccal corridors" OR "corredores bucais" OR "corredores bucles" OR "dental midlines" OR "linhas médias dentárias" OR "líneas medias dentales" OR "diastema" OR "gengival exposure" OR "gengival exposure" OR "exposição gengival" OR "exposición gengival" OR "pantanal gengival" OR "gummy smile" OR "sorriso gengival" OR "dental exposure" OR "exposição dental" OR "exposición dental" OR "tooth shape" OR "forma do dente" OR "forma del diente" OR "tooth form" OR "tooth morphology" OR "morfologia dental" OR "morfología dental" OR "dental morphology" OR "morfologia dentária" OR "papila heigh" OR "altura de papilas" OR "altura de la papila" OR "tooth exposure" OR "exposição de dentes" OR "black space" OR "espaço negro" OR "buracos negros" OR "espacio negro" OR "dental asymmetry" OR "assimetria dentária" OR "assimetria dental" OR "dental asymmetries" OR "assimetrias dentárias" OR "asimetría dentales") AND ("general public" OR "lay person" OR "layperson" OR "layman" OR "leigo" OR "lego" OR "lay people" OR "laypersons*" OR "laymen" OR "leigos" OR "legos" OR "lay public" OR "lay opinion" OR "opinião leiga" OR "opinión laica" OR "lay perception" OR "lay perceptions" OR "percepção leiga" OR "la percepción laica" OR "generalists" OR "generalistas" OR "peer assessment" OR "non-professional*" OR "nonprofessional*" OR "não profissional" OR "pateia perceptions" OR "percepções do paciente" OR "percepciones del paciente" OR "patient satisfaction" OR "satisfação do paciente" OR "satisfacción del paciente" OR "nondental" OR "non-dental" OR "untrained" OR "inexpert" OR "inexperiente" OR "inexperto" OR "inexperta")))	62
Grey Literature, via Open Grey	(smil* OR dental) AND (esthetic OR aesthetic)	35

Whenever the information was not clear or available in the articles an attempt was made to contact the authors by email or through a social network (www.researchgate.com) for further information and clarification of the scale used in the study, and for additional details of the assessment tool.

An analysis of the risk of bias in the pre-selected studies was performed based on the parameters described by Janson et al.¹⁹ and Witt, and Flores-Mir,¹⁸ and the following criteria were evaluated: sample, sample size calculation, statistical analysis, confounding factors and method validation (Table 3). In each one of these items the study could receive up to two points. Studies with scores lower than or equal to five were considered at high risk of bias; with a score greater than or equal to six and less than or equal to eight the studies were considered of medium risk of bias, and those with a score greater than or equal to nine were considered at low risk of bias. Studies at high risk of bias were excluded. Data from selected articles were extracted and organized into tables.

Table 3 – Criteria for analyzing the risk of bias

1- Sample: description of gender, age and origin of the participants.	Full description - 2 points	Partial description - 1 point	No description of the sample - 0 point
2- Sample calculation: presence of the calculation for determining the sample size	Sample calculation performed - 2 points	Sample based on previous pilot studies - 1 point	Absence of sample calculation - 0 points
3- Statistical analysis: whether or not statistical analysis was performed to evaluate the data	Statistical analysis performed - 2 points	-	Absence of statistical analysis - 0 points
4- Confounding factors: structures around the smile eliminated or minimized so as not to affect assessment (eyes, hair, nose, cheeks, stains or others that might cause distraction)	Confounding factors eliminated - 2 points	Confounding factors partially eliminated - 1 point	No concern for confounding factors - 0 point
5- Method validation: image manipulation showed natural modification of smile features and standardized images	Proper method validation - 2 points	-	Improper method validation - 0 points

For comparison among the VAS, scores were standardized and whenever necessary, converted to the 100 scale.

For each smile feature of each article the difference between the maximum and minimum scores was calculated, and when more than one article evaluated regarding the same features, the mean difference was calculated. The means of the scores were calculated for the men and women whose smiles were evaluated,²¹⁻²³ for the scores of the African-Brazilian and Caucasian women's smiles,²⁴ for ages 35 to 44, and 65 to 74 years,^{11,25,26} for the patients who were evaluated,²⁷ and for those undergoing (or not) orthodontic treatment.²⁸

Fifteen percent differences in evaluation using the VAS scale were considered the minimum necessary to be clinically significant.²⁹ Furthermore, a difference between 15% and 30% was defined as of moderate clinical relevance, and above 30% as of high clinical relevance.

The differences or mean difference of dental and gingival components related to smile aesthetics were listed and presented in descending order of acceptance (from more to less noticeable) by the lay evaluators.

A meta-analysis was not performed because the data extracted and calculated from the articles were the mean difference, therefore, without the standard deviation, the comparison is not possible.

RESULTS

During the process of selecting the articles (Figure 1), 1393 articles were found by electronic search (Table 2), and only 20 was considered eligible. After assessing the risk of bias three studies were excluded due to high risk (Table 4),^{6,8,30} twelve were classified as medium risk, and five with low risk of bias. The data gleaned from the 17 included studies are shown in Table 5.

In order to evaluate the crown length,¹⁴ the height of the gingival margin of the central incisors was also taken into account since certain changes significantly distort the gingival height.

The vertical position of the maxillary central incisors³¹ was divided into an incisal step of the central incisors relative to the lateral incisors. Moreover, the height of the gingival margin of the central incisors was also compared to the lateral incisors. The length of the central incisors difference was done with the gingival margin of central incisors.¹⁴

The influence of dental and gingival features in smile attractiveness in the selected articles was assessed by laypersons using a VAS with 10mm,^{7,11,23,25,27,32} 80mm,¹² 100mm,^{14,16,24,28,31-34} and percentages.³⁵

Certain articles deserved further consideration. The data from evaluators aged 15-25 years, and 15-19 years²³ were excluded.^{11,25,26} In the study of Borges et al.²⁷ only the data containing mandibular incisors were considered, and in the study of Machado et al.³¹, only full smile data were taken into account.

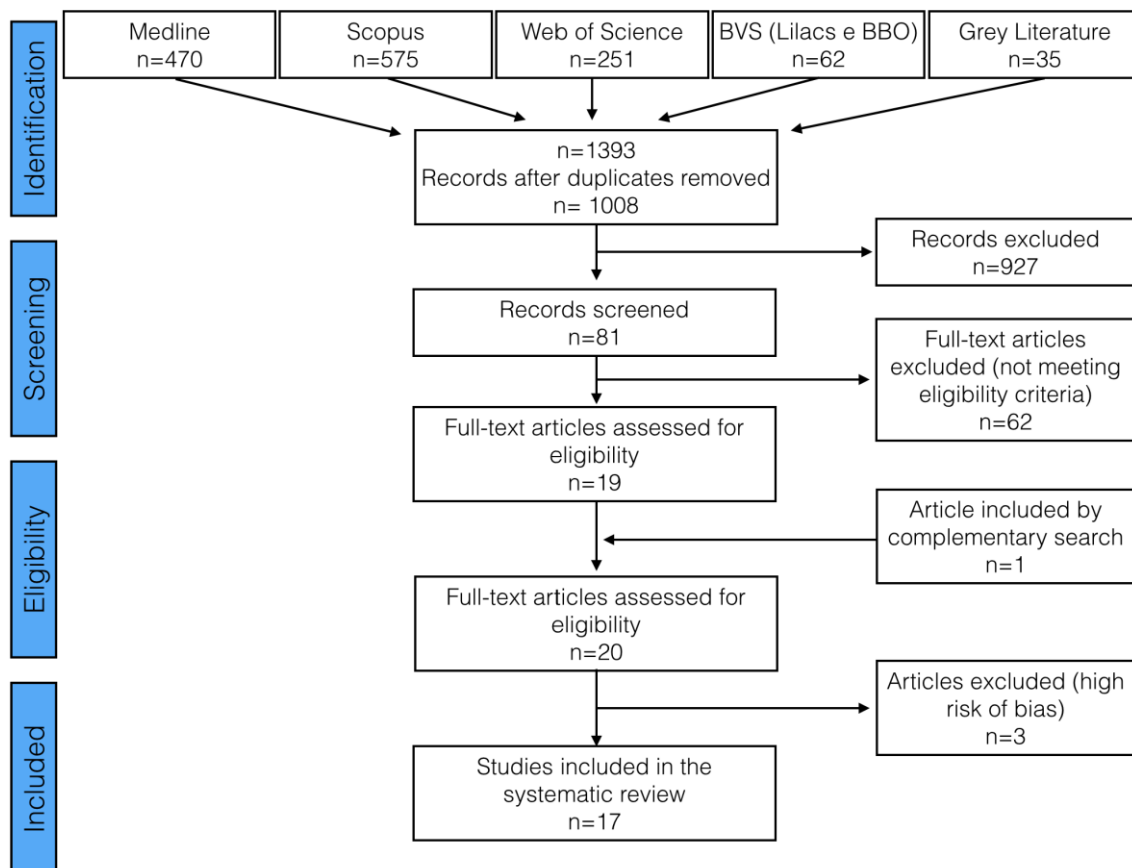


Figure 1 – Flow diagram

Table 4 – Risk of bias assessment

Author / Year	Sample description	Sample calculation	Statistical Analysis	Confounding factors	Method validation	Total	Risk of bias
Borges et al. 2012 ²⁷	0	0	2	2	2	6	medium
Kokich Jr et al. 1999 ⁶	1	0	2	2	0	5	high
Kumar et al. 2012 ⁷	2	0	2	2	2	8	medium
Machado et al. 2013 ²⁴	1	2	2	2	2	9	low
Machado et al. 2013 ³¹	1	2	2	1	2	8	medium
Pithon et al. 2013 ²⁵	1	0	2	2	2	7	medium
Pithon et al. 2015 ¹¹	1	2	2	2	2	9	low
Talic et al. 2013 ¹⁴	1	0	2	2	2	7	medium
Thomas et al. 2011 ³⁰	1	0	2	2	0	5	high
An et al. 2014 ²⁸	2	0	2	2	2	8	medium
Anderson et al. 2005 ²²	2	1	2	2	2	9	low
Heravi et al. 2011 ²³	2	0	2	2	2	8	medium
Kaya and Uyar 2013 ¹²	2	2	2	1	2	9	low
Martin et al. 2007 ³⁴	2	0	2	2	2	8	medium
Parekh et al. 2007 ³⁵	1	2	2	2	2	9	low
Pinho et al. 2007 ³³	1	0	2	2	2	7	medium
Roden-Johnson et al. 2005 ³²	1	0	2	2	2	7	medium
Silva et al. 2013 ⁸	1	0	2	0	0	3	high
Suzuki et al. 2009 ¹⁶	0	0	2	2	2	6	medium
Pithon et al. 2015 ²⁶	2	0	2	2	0	6	Medium

Tabela 5 – Data gleaned from the included studies.

Author/ Year	Scale	N: Lay evaluators - Ages, Gender	Material Assessed	Smile component / changes made	Results/ Conclusions / Laypersons
1 Anderson et al. 2005 ²²	VAS%	102 (21M, 80W). Ages: 21-30 years; 31-40 years; 41-50 years; 51-60 years	18 photographs of men's and women's smiles	Incisal edge angle shape: square, square-rounded and rounded. Three canine cusp shapes: pointy, rounded and flat.	No preference for women's incisor shape. The square-rounded was preferred for men. Canine shape is less important than incisor shape. Laypersons are less critical than dentists, and men are less critical than women.
2 Rodon Johnson et al. 2005 ³²	VAS 10cm	N: 20, between 26 and 64 years.	60 black and white perioral photos, without changes.	Images of patients without the buccal corridor had the teeth near the lateral commissure digitally removed.	Orthodontists, dentists and laypersons evaluate the smile differently. The buccal corridor does not influence the assessment of the smile according to the three groups of evaluators, be it present or absent.
3 Parekh et al. 2007 ³⁵	VAS%	115 (60M, 55W) had higher education	36 photos of randomized smiles	Consecutive images were created with changes in the buccal corridor and in the smile arc.	A flat smile arc is not acceptable to laypersons. Although excessive buccal corridors received the worst possible score, they are still acceptable in 70% of cases. Evaluator gender, and the image did not influence the acceptability of the smile arc and buccal corridor.
4 Martin et al. 2007 ³⁴	VAS 100mm	94 – 40M 54W 18-29 years – 23, 30-39 years - 22, 40-49 – 18, and above 50 - 31	18 photos: 9 being symmetrical, seven asymmetrical, and two repeated	Buccal corridor: Ratio of the width of the visible teeth by the width of the mouth. Changes: (1) Bilaterally, increasing the width of the maxillary arch; (2) Bilaterally, reducing the number of posterior teeth and applying the first method; and (3) asymmetrical buccal corridors.	Preference for smiles without a buccal corridor, or with a small corridor; and smiles with 10 teeth (5 to 5). Buccal corridor proportionality is more important than mild asymmetry.
5 Pinho et al. 2007 ¹⁸	VAS 100mm	50 - Law, Administration and Tourism undergraduates	16 photos: 13 digitally modified, and 3 original	Changes: (1) Height of the gingival margin of the maxillary centrals, with 0.5 mm to 2.5 mm increases; (2) Wear of the upper canine cusp, with increases of 0.5mm to 2 mm; and (3) Midline deviation, with 1 mm to 4 mm increases.	Asymmetry limit of the gingival margin of the centrals for laypersons was 2 mm. Canine cusp wear had no aesthetic impact. Laypersons failed to notice midline deviations of up to 4 mm.
6 Suzuki et al. 2009 ¹⁶	VAS 10cm	20, 18 years old and above	20 photographs of men and women	Original images manipulated on the computer generating gingival display of 0 to 7 mm.	Laypersons were statistically more receptive to displays of 3 mm, 5 mm and 7 mm than orthodontists.
7 Heravi et al. 2011 ²³	VAS 10- cell	50 – 25M 25W 40-50 years old	18 photos organized on two pamphlets	Pointy canine cusps, with edges of the centrals and laterals square, square-rounded and rounded. Rounded canine cusps, with edges of the centrals and laterals	Laypersons' gender and age do not affect the aesthetic perception of maxillary anterior teeth. For both men and women square-rounded and rounded incisors were

					square, square-rounded and rounded. Flat canine cusps, with incisors modified in the same manner.	preferred over square Rounded. The canine shape has no remarkable effect on the perception of laypersons.
8	Borges et al. 2012 ²⁷	VAS 10cm	30 had higher education	18 photos of 3 patients	Different widths and heights of the maxillary anterior teeth, based on the central incisors. Digitally modified images showing different height/width ratios of the maxillary teeth: 65%, 70%, 75%, 80%, 85% and 90%.	The width ratios with the best scores were 75%, 80% and 85%, and the worst score, 65%. The presence or absence of mandibular teeth showed no statistically significant difference.
9	Kumar et al. 2012 ⁷	VAS 0-10	40, 20M and 20W Patients visiting the University Mean Age: 31.3 years old	25 3.5 "x 5" photo prints in photo album Digital modification	Diastemata of up to 2 mm between centrals (0.5 mm variations). Gingival display of up to 4 mm (1 mm). Asymmetry of the gingival margin between centrals of up to 2 mm, reducing the left crown length (0.5mm). Reduction of up to 2 mm (0.5 mm) in the crown width of the laterals.	Asymmetrical changes are most noticeable to orthodontists, but not to dentists and laypersons. Moderate changes in dental aesthetics are acceptable to laypersons, and this perception should be regarded as relevant prior to treatment.
10	Kaya and Uyar 2013 ¹²	VAS 80	70 – 25M and 45W Mean age 31.3 +/- 11.6 years	Total of 28 different images for evaluation	Smile arc and gingival display were evaluated together. Seven images were created with different incisal curvatures of the maxillary teeth combined with gingival displays of -4, -2, 0, and 2 mm.	The smile arc and gingival display affect perception. Arched archwires are preferred with excessive gingival display, while straightened out archwires are suitable for insufficient gingival display. Gingival display negatively influenced the aesthetic perception of evaluators.
11	Machado et al. 2013 ²⁴	VAS 100mm	60 – 32M and 28W. With higher education and no knowledge of dentistry	2 photos of women: one Caucasian and one Afro-Brazilian Total: 14 images	Each image was modified in increments of 0.5 mm of the incisal edge of the upper left central incisor and left lateral.	The most attractive were those without asymmetries or up to 0.5 mm on the laterals. Tooth wear was considered less attractive as it increased. Wear on the centrals was rated worse than on the laterals; a 0.5 mm wear on the centrals and 1 mm wear on the laterals were considered unattractive.
12	Machado et al. 2013 ³¹	VAS 100mm	60 – 32M and 28W. Had higher education with no knowledge of dentistry	1 photo of a 27-year-old Caucasian woman, resulting in 6 full smile images	The vertical position of the centrals had been modified by extruding 0.5mm, 1.5 mm and 1 mm, and intruding 0.5 mm and 1 mm. The incisal step of the central incisors was modified relative to the laterals, and the height of the gingival margin of the central incisors was also altered.	1.5 mm incisal step between central and lateral received a better rating. Less attractive: no step, and with the cervical margin of the centrals 1 mm above the canines The gingival margin exerts minimal influence on perception, unlike the level of the incisal edge, which is of paramount importance.
13	Pithon et al. 2013 ²⁵	VAS 0-10	150. Three groups: 15-19 years (21M and 28W), 35-44 years (16M and 35W), and 65-74 years (22M and	1 photo of a 30-year-old woman altered into 8 photos.	Black space (gaps). 1 image without spaces, and 1 with increasing sizes of 0.5, 1, 1.5, 2, 2.5, 3 and 3.5 mm between the maxillary central incisors.	The aesthetic perception of the smile decreases with age, and critical thinking is more evident in younger individuals

			28H).			
14	Talic et al. 2013 ¹⁴	VAS 100mm	30, 20-40 years old	36 images showing digital manipulation of the smile components	Central incisors' crown length modified from 0.5 to 3 mm. Modified central incisors' gingival margin. Lateral incisors' gingival margin modified with respect to the centrals from 1 to 5 mm. Gingival display modified from 1 to 5 mm. Width of the lateral incisors' crowns modified from 1 to 4 mm. Midline deviation modified from 1 to 5 mm; upper diastema from 0.5 to 2.5 mm.	Differences perceived in the length of crowns larger than 2 mm. Gingival margin of the laterals unchanged received the highest score, and a 5 mm change at its worst. Gingival display from 0 to 1 mm at its best, and 5 mm at its worst. Reduction of 2 mm in crown width at its best evaluation, and 4 mm at its worst. No midline deviation; or those changes of up to 1 mm were given the best evaluation, but 4 and 5 mm, the worst. No diastema received the best evaluation, while the worst evaluation was at 2.5 mm.
15	An et al. 2014 ²⁸	VAS 100mm	50 undergoing orthodontic treatment, 12M and 38W (22 years), and 50 not undergoing, 6M and 44W (23.8 years)	Photo of young Korean woman smiling, yielding 20 images for evaluation	Reduction of the gingival margin of the right central incisor from 0.5 to 2 mm. Reduction of the width and length of the left lateral incisor from 1 to 4 mm. Incisal plane inclination: left segment moved downwards, and the right upwards, from 1 to 4 mm. Upper and lower midline deviation: upper midline moved to the right, and lower to the left, from 1 to 4 mm.	1.5 mm discrepancy perceived in the gingival margin between centrals. Less attractive when changes in length and width of the lateral incisors reached 3mm. Untreated laypersons perceived a 3 mm inclination of the incisal plane, and 2 mm when treated. 3 mm midline deviation was perceived by treated laypersons. The orthodontic treatment experience improved perception.
16	Pithon et al. 2015 ¹¹	VAS 0-10	150, three groups: 15-19 years (23M and 27W), 35-44 years (15M and 35W), and 65-74 years (24M and 26W)	1 smile: 30-year-old woman - 16 images	Gradual gingival reduction of maxillary incisors in 1 mm increments. Range from +2 mm to -13 mm.	Age is an important factor in the perception of the smile. Younger evaluators preferred smiles with substantial tooth display while older evaluators preferred less tooth display.
17	Pithon et al. 2015 ²⁶	VAS 0-10	150, three groups: 15-19 years (13M and 37W), 35-44 years (22M 28W), and 65-74 (27M 23W).	1 smile: 30-year-old woman - 6 images	Black spaces. One image without spaces, and 1 with increasing sizes, i.e., 0.5, 1, 1.5, 2, 2.5, 3, and 3.5 mm between the maxillary central incisors.	The larger the black spaces, the worse the smile was rated. Black space were noticed more readily by younger evaluators.

VAS = visual analog scale / M = men / F = women

Table 6. Ranking of the layperson's perception about smile components

Order	Smile component	Authors	Highest	Lowest	Difference	Mean	
Major difference	1	Central incisor edges	Machado et al. 2013 ²⁴	87.43	23.17	64.2	64.2
	2	Step between centrals and laterals	Machado et al. 2013 ³¹	86.27	39.6	46.67	46.67
	3	Smile arc	Parekh et al. 2007 ³⁵ Kaya e Uyar 2013 ¹²	91.9 85.12	60 28.5	31.9 56.62	44.26
	4	Diastema between centrals	Kumar et al. 2012 ⁷ Talic et al. 2013 ¹⁴	68.5 60	32.5 26.5	36 33.5	34.75
	5	Symmetry between laterals edges	Machado et al. 2013 ²⁴	87.43	56.14	31.29	31.29
	6	Incisors shape	Anderson et al. 2005 ²² Heravi et al. 2011 ²³	70.05 95	59 45	11.05 50	30.52
Medium differences	7	Gingival display and dental exposure	Suzuki et al. 2009 ¹⁶ Kumar et al. 2012 ⁷ Talic et al. 2013 ¹⁴ Kaya e Uyar 2013 ¹² Pithon et al. 2015 ¹¹	70.77 64 63.1 85.12 72.05	34.08 47.5 54.3 28.5 43.05	36.69 16.5 8.8 56.62 29	29.52
	8	Canines shape	Anderson et al. 2005 ²² Heravi et al. 2011 ²³	66.55 95	57.5 45	9.05 50	29.52
	9	Gingival margin of central incisors	Talic et al. 2013 ¹⁴ Machado et al. 2013 ³¹	60.5 86.27	48.4 39.6	12.1 46.67	29.38
	10	Black spaces	Pithon et al. 2013 ²⁵ Pithon et al. 2015 ²⁶	71.45 90.3	59 47.7	12.45 42.6	27.52
	11	Incisal plane inclination	An et al. 2014 ²⁸	73.52	50.87	22.65	22.65
	12	Gingival margin of central incisors (asymmetry)	Pinho et al. 2007 ³³ Kumar et al. 2012 ⁷ An et al. 2014 ²⁸	41.5 63 71.51	20.9 48 45.1	20.6 15 26.41	20.67
13	Central Width/Height ratio	Borges et al. 2012 ²⁷	51.39	32.29	19.1	19.1	
Minor differences	14	Lateral incisor length (asymmetry)	An et al. 2014 ²⁸	68.89	53.95	14.94	14.94
	15	Lateral incisor gingival margin	Talic et al. 2013 ¹⁴	64	49.8	14.2	12.95
	16	Central incisor crown length	Talic et al. 2013 ¹⁴	60.5	48.4	12.1	12.1
	17	Buccal corridor	Roden-Johnson et al. 05 ³² Parekh et al. 2007 ³⁵ Martin et al. 2007 ³⁴	50.8 82.3 60.45	50.6 71.9 36.11	0.2 10.4 24.34	11.63
	18	Upper and lower midlines	Pinho et al. 2007 ³³ An et al. 2014 ²⁸	54.5 55.03	46.8 42.44	7.7 12.59	10.14
	19	Lateral incisor width (asymmetry)	Kumar et al. 2012 ⁷ An et al. 2014 ²⁸	83.5 68.89	80.5 53.95	3 14.94	8.97
	20	Upper midline	Talic et al. 2013 ¹⁴	57.4	48.9	8.5	8.5
	21	Lateral incisor width	Kumar et al. 2012 ⁷ Talic et al. 2013 ¹⁴	82.5 52.4	75.5 42.6	7 9.8	8.4
	22	Canine step (asymmetry)	Pinho et al. 2007 ³³	52.8	48.5	4.3	4.3

Table 6 shows the components of the smile ranked according to the calculated difference or mean difference, from the largest to the smallest. The higher the value of the difference or mean difference represent the greater the perception of the evaluator regarding the changes, which points to lower acceptability by laypersons, and therefore a more relevant smile component.

The smile components were ranked as follows: (1) Those ranked from 1st to 6th, with a difference or mean higher than 30; these were classified as of high clinical relevance; (2) Components classified from the 7th to the 13th position, with a difference or mean from the 15 to the 30; these were considered as of moderate clinical relevance; (3) Those classified from the 14th to the 22nd position, with a difference or mean lower than 15, were classified as of low clinical relevance.

DISCUSSION

The present systematic review established a ranking of the smile components most perceived for laypersons in the analysis of the smile esthetic.

Studies that evaluated more than one component made it possible to establish their own hierarchy in accordance with the differences between the highest and lowest scores (Table 6).

In the study of An et al.²⁸ the following order, i.e., from the greatest to the smallest difference, was found between the evaluators: (1) Gingival margin of the central incisors; (2) Incisal plane; (3) Length and width of the lateral incisors; and (4) Upper and lower midline deviation. This sequence showed only minor changes compared with the order described in this study, but it could be said that they are nonetheless very similar (Table 6).

The study by Kumar et al.⁷ also showed a unique hierarchy: (1) Diastema between maxillary central incisors; (2) Gum and tooth display; (3) Gingival margin of the central incisors (asymmetry); (4) Width of the lateral incisors; and (5) Width of the lateral incisors (asymmetry). There were changes in ranking position in terms of asymmetry of the lateral incisors vis-à-vis the width of the lateral incisors. However,

the mean discrepancy found in this study was very similar.

Given the results of the article from Talic et al.¹⁴ the following ranking could be established: (1) Diastema between the maxillary central incisors; (2) Gingival margin of the lateral incisors; (3) Gingival margin of the central incisors; (4) Crown length; (5) Width of the lateral incisors; (6) Gum and tooth display; (7) Upper midline deviation.

Pine et al.³³ faithfully follow the ranking and scoring of the average discrepancies found in the total sample: (1) Gingival margin of the central incisors (asymmetry); (2) Upper and lower midline deviation; (3) Canine step (asymmetry).

One can assert that the closer to the midline is a component, the more noticeable it becomes since the average difference in height between the edges of the central incisors is greater than between the lateral incisors, and even higher compared to the canines.

The worst score for a step between the incisal edges, between the centrals, was 1.5 mm, while the best was with no unevenness whatsoever (0 mm).²⁴ The step between the incisal edges of the centrals was considered unsightly by laypersons starting from a distance of 0.5 mm, and a 1 mm step between the incisal edges of the laterals. It was considered progressively less attractive as the wear (difference) increased.²⁴ Regarding the asymmetric wear of the canine cusp, the lay evaluators found no aesthetic repercussion thereof.³³

The changes in vertical position of the central incisors resulted in changes in the step from the central incisors to the laterals, and the best score for a given step was 1.5 mm.³¹ Similarly, Springer et al.³⁶ found a step of 1.2 mm, and Ker et al.³⁷ a step of 1.4 mm in the most attractive smiles. Flores-Mir and Witt¹⁸, a systematic literature review, recommend the same 1.4mm, being 2.9mm the limit.

As for the gingival margin, the height of the gingival margin of the centrals showed a mean difference greater than the height of the asymmetric gingival margin between the central incisors. This is most likely due to the work of Machado et al.,³¹ which changed the height of the gingival margin in conjunction with the step of the incisal edges, observing that the height of the gingival margin has minimal impact on the aesthetic perception of laypersons, while the height of the incisal edge has a more important role.

It was reported that laypersons perceived an unevenness (discrepancy) consisting of a 2 mm height difference of the gingival margins of central incisors.³⁷ Machado et al.³¹ perceived as more attractive the gingival margin of the central incisors at the same level of the laterals, and 0.5 mm below the margin of the canines, although it did not differ statistically from a smile with its gingival margin at the same level as the canines. Flores-Mir and Witt,¹⁷ concluded that 0.5mm coronal margin in relation to the lateral incisor would be ideal. One can therefore infer from the articles included in this study that the ideal would be an absence of asymmetries in the gingival margins of the incisors, a gingival margin of the central incisors about 0 to 1 mm above the laterals, and 0 to 0.5 mm below the canines. Nevertheless, the gingival margin exerts minimal influence on aesthetic perception whereas the incisal edges play a more important role in smile aesthetics.³¹

Heravi et al.²³ concluded that rounded and square-rounded shapes are preferred over the incisors for both men and women, and that the cusp of the canine has no effect on smile aesthetics. To confirm, the Anderson et al.²² noted that the shape of the canine is less important than the shape of the incisors, the highest scores were for square-round incisors for men and round for women, and canines, pointed or flat for men and flat or round for women, the last, under judgment of laypersons, without significant difference. For Marunick et al.³⁸ the preference was for the square shape for men and oval shape for women. Flores-Mir and Witt¹⁸ concluded that laymen do not discriminate form of incisors and canines for women, and men preferred square-round incisors and flat canines.

All components related to tooth size^{7,14,28} were considered of low clinical relevance. Laypersons classified as less attractive the asymmetric changes in length and width of the lateral incisor, but only when they reached 3 mm.²⁸ Changes in the crown length of the central incisors were only perceived when greater than 2 mm.¹⁴ The lowest score was assigned only in cases where the lateral width was reduced symmetrically by 1.5 mm, and asymmetrically by 0.5 mm.⁷

Laypersons rated progressive changes in the width/height ratio of the upper central incisors between 65% and 90%; the best ratings were 75%, 80% and 85%, and the worst, 65%.²⁷ The preferred ratio was 80%.^{18,39} Reducing the width of the lateral incisors, with a resulting change in tooth ratio, had a negative aesthetic impact.^{6,28}

The smile arc^{12,35} and incisal plane²⁸ were considered of high and moderate clinical relevance respectively. In a systematic review, the consonants smile were preferred,¹⁷ however, in another paper, was observed that does not influence the attractiveness.¹⁹ A flat smile arc reduces the attractiveness of the smile.³⁵ The most attractive smiles show a coincidence (match) between the curve formed by the incisal edges of the anterior teeth and the curvature of the lower lip, i.e., a parallel smile arc.^{36,37,40}

The canting of the incisal plane, laypersons evaluators were sensitive to 3mm.²⁸ Four degrees^{37,41} and 3 degree of inclination negatively impacted the aesthetics,⁸ and the maximum tolerated was 2.8 degrees.³⁶

Although gum and tooth display was the most evaluated smile component, with the inclusion of five articles, it was ranked seventh place, with moderate clinical relevance.^{7,11,12,14,16} This is probably due to the fact that the group of lay evaluators was more sensitive to 3 mm, 5 mm and 7 mm gingival display than other groups of evaluators.¹⁶ Additionally, in assessing 0 to 5 mm gingival display the maximum difference between the scores was found to be only 8.8.⁷

A 0 to 1 mm gingival display was described as more acceptable,^{7,14,16} and it was found that starting at 2 mm and above a smile would not be considered attractive.⁴² Kaya and Uyar¹² concluded that gingival display negatively influences the aesthetic perception of evaluators, while Springer et al.³⁶ reported that ideally the upper lip should overlap the centrals by 2.3 mm. Pithon et al.¹⁰ noted that the most attractive images only showed the teeth and gingival papillae. A full exposure of the incisors in men, and a 2 mm gum display in women were considered as more attractive.^{43,44} Younger evaluators preferred smiles with substantial tooth display while older evaluators preferred less tooth display.¹¹ Flores-Mir and Witt, demonstrated laypersons preference for no gum exhibition, with the upper lip on the gingival margin of the maxillary incisors.¹⁷

About midline diastema, not even a small 0.5 mm space managed to surpass the scores assigned to smiles with no diastema,^{7,14} leading to the conclusion that laypersons are highly sensitive to diastema. The worst sizes for diastema were 1.5 mm¹⁵, 2 mm,⁷ and 2.5 mm..¹⁴ Even the smallest diastema is considered a smile component of clinical relevance. Furthermore, all diastema are considered

unsightly.⁴² Absence of black space was considered more attractive, but 2.5 mm³¹ and 3.5 mm²⁵ of space were seen as the worst.

An excessive buccal corridor was rated as less attractive,^{17,32,34,35} was preferred smiles without a buccal corridor, or just a small corridor, exposing the region from second premolar to second premolar.³⁴ Some studies have concluded that the buccal corridor is a component that does not interfere with the aesthetic evaluation of the smile,^{19,32,47} so that there is no justification for expanding the dental arches to eliminate the black spaces formed by buccal corridors.

Maxillary and mandibular midline deviations were perceived at 3 mm.²⁸ According to Pinho et al.³³ even a 4 mm deviation was not perceived. Dental midline deviations were considered of low clinical relevance from an aesthetic point of view. However, maxillary and/or mandibular midline deviation plays a pivotal role as a diagnostic element in malocclusions with subdivisions.

CONCLUSIONS

The smile components most noticeable by laypersons were, in descending order:

I- High clinical relevance:

1. Absence of a step (discrepancy) between central incisors - Leveled edges;
2. One to 1.5 mm step between central and lateral incisors.
3. Maxillary incisal edges contouring the lower lip.
4. Absence of a diastema between maxillary central incisors.
5. Height symmetry between lateral incisors.
6. Shape of the maxillary incisors: square-rounded for men and rounded for women.

II- Moderate clinical relevance:

7. Gingival display of 0 mm to 1 mm, or slightly covering the incisors.
8. Flat or pointed canine cusp for men, and flat or rounded for women.
9. Gingival margin of the centrals 0.5 mm below the canines.
10. Absence of incisal plane inclination.
11. Symmetrical gingival margin of the central incisors.
12. Absence of black space.

13. Width / height ratio of 80% to 75% for the maxillary central incisor.

III- Low clinical relevance

14. Length symmetry between lateral incisors.
15. Gingival margin of the lateral incisors matching the central incisors.
16. Length of the central incisors in accordance with the dental ratio.
17. Small or absent buccal corridor.
18. Maxillary midline coinciding with the mandibular midline.
19. Width symmetry between lateral incisors.
20. Maxillary dental midline coinciding with the midline of the face.
21. Width of the lateral incisors in accordance with the dental ratio.
22. Height symmetry between canines.

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Artigo 3:**Details of pleasing smiles**

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ABSTRACT

Objectives: To determine the most and least attractive smiles from a Brazilian sample and correlate the anatomical characteristics identified in these smiles.

Materials and method: Orthodontists, dentists and laypersons assessed photographs of 86 students, 66 women and 20 men aged between 19-30 years, using the visual analog scale. The esthetic composition of the most and least attractive smiles was measured by an evaluator blinded to the results, and the mean and standard deviations were calculated for the descriptive analysis.

Results: At the end, eight photographs with the highest and eight with the lowest ratings for women and the two highest and two lowest ratings for men were elected. A total of 42 anatomical smile details were identified and described, obtaining the means of the characteristics. **Conclusion:** From the most attractive smiles were observed: Absence of: asymmetries; diastemas; black spaces; incisal plane inclination and anterior gingival display. Parallel smile arc; oval-shaped incisors with square-rounded edges; increase of the incisal embrasure and reduction of connectors space in distal progression; display of upper incisors and minimum display of lower teeth; gingival margin of central incisors 0.5mm coronal to the canines and 0.8mm apical to the lateral incisors; posterior gingival display of 1.5mm; less than 20% of buccal corridor and display of 12 teeth; and canines with -2 degrees of inclination.

Key-words: Smiling; Esthetics, Dental; Visual analog Scale; Orthodontics

INTRODUCTION

Dental treatment has a great influence on smile attractiveness¹ and this is a criterion that lay persons, orthodontists and dentists use to judge a successful treatment from an unsuccessful one.² Even if malocclusion has greater psychological impact on a specific case,³ understanding the factors that help or hinder the attractiveness of a smile is an important step in creating attractive smiles and achieving professional success.⁴

In patients undergoing orthodontic treatment, the harmonic esthetics of the smile can be related to⁵: the height of the incisal edges,^{6,7} type of smile arch,^{5,8,9} absence of diastemas;^{4,10,11} shape of incisors and canines;^{12,13} amount of gingival exposure;^{5,9-11,14-16} absence of black spaces;^{16,17} height of the gingival margin;^{7,10,17-19} incisal plane inclination^{16,17} as well as the ratio of tooth size.^{20,21} These are some characteristics known to affect the esthetic result of orthodontic treatment.²²

To determine more precisely the details to be enhanced when finishing orthodontic treatments, it is important to understand the judgment of dentists, orthodontists and lay people to measure the attractiveness of smiles. However, the preference among different groups of evaluators may differ in terms of rating^{10,16,20,23-26} due to orthodontic experience,^{17,27} but the average score of different groups should be taken into account in determining the most pleasing smile. As an assessment tool, such observational studies, the visual analogue scale (VAS) has shown to be reliable²⁸ and, in addition, a score of 100 is widely used in many studies assessing esthetic preferences.^{6,7,11,15,17,19,25,29}

Therefore, to achieve optimal esthetic results, it is imperative that clinical orthodontists follow esthetic guidelines⁶ and studies on standards and norms related to the attractiveness of smiles to ensure the "golden smile",⁴ but there are no specific studies in the literature that evaluated in natural smile, the maximum smile characteristics.

Some studies on the esthetic perception of the smile have focused on digital manipulation of image details,^{6,10-12,16,19,23,24,30-40} while others have adopted natural

images without any digital manipulation.^{5,41-43} Durgekar et al.⁴⁴ elected five smiles with the highest and lowest scores to assess seven features. However, no research has adopted as the objective of the study the election of the most and least assessed smiles with a significant sample of smiles, and used it as a guide to determine the maximum details to be obtained from orthodontic treatment.

Thus, the aim of the present study was to determine, from a representative sample of smiles, the most attractive and least attractive smiles in both males and females, according to the assessment of orthodontists, dentists and lay people using the Visual Analogue Scale and consequently correlate the anatomical characteristics identified in these smiles.

MATERIAL AND METHODS

To conduct the study of qualitative and quantitative assessment of smiles, an album with 258 colored photographs of smiles obtained from 86 students enrolled in the course of Dentistry at UFF was used, 66 females and 20 males, aged 19 to 30 years. The photographs belong to the Specialization Course in Orthodontics, Fluminense Federal University, Niterói, RJ (UFF).³⁰

The study was approved by the Institutional Review Board of the School of Dentistry of the Fluminense Federal University (UFF) under protocol #337193.

To be included in the total sample of photographs, individuals/dental students has to meet the following inclusion criteria: complete permanent dentition from second molar to second molar, Angle Class I molar relationship, normal overbite, good facial profile tending to straight, no previous orthodontic treatment, and minor dental misalignments.

Three standardized photographs were taken of individual, as follows: (1) with lips at rest, (2) slight smile and (3) broad smile. The Minolta camera equipped with a 100 mm macro-lens was used to take the photographs. Kodak-100 photographic film was used and the object-film distance was 1.0 meter. To take the frontal photograph, the position of the head of each individual was maintained with Frankfurt horizontal plane parallel to the ground.

The images were scanned using a HP Scanjet G4050 scanner. Once they were digitalized, the Photoshop software (Adobe CS4, San Jose, California, USA) was used to reduce confounding factors such as possible rotations. The photographs were cropped to show the focused area of interest (perioral area), excluding the nose, cheeks and chin.^{36,45,46}

A website was developed with the help of a programmer (G.B.) for the album of photographs and an online questionnaire for the dentists, orthodontists and lay people to assess the attractiveness of the smiles.

The evaluators were drawn from a list of dentists and orthodontists working in the city of Vitória, Brazil. The lay persons had no specific knowledge on oral esthetics or any education in sciences related to the study of faces or art, such as plastic surgeons, estheticians or architects.²⁶ The lay persons were graduate students attending public and private universities who were randomly invited as volunteers.

The sample size of the evaluators was calculated based on population estimates, with the same parameters for the three groups (orthodontists, dentists and lay people), i.e. 90% confidence, 10% error of proportion in order to detect 10% differences among the groups. Thus, for a population of 140 orthodontists, the sample consisted of 23 orthodontists. For the population of 1643 dentists, the total number consisted of 25, and as there was no accurate estimate of the population of lay people, the sample was calculated without the correction factor for the finite population, thus reaching a sample of 27 individuals.

Each evaluator rated the photographs using a visual analogue scale (VAS): a bar with a slider was developed on the website and the evaluators placed the score on the scale that represented the scores for their judgment. Score "0" being the lowest level imaginable of attractiveness and "100" the most attractive level imaginable.

The number of students enrolled in the School of Dentistry was 350. Thus, was decided to conduct a sample calculation in two scenarios. The first sample consisted of a simple random sample with a 95% confidence level, maximum expected error of 9%, ratio of 50%, which resulted in the highest possible value for the sample, maximizing variability and the correction factor for finite population. Therefore, the sample established was composed of 86 students. As this is a

heterogeneous population, we decided to divide it into sub-populations.⁴⁷ The technique used for the calculation was the stratified sampling with proportional allocation, establishing a sample of 66 female and 20 male students.

When evaluating the smile of each of the 86 students, ratings attributed to their esthetics were given by dentists, students and lay persons. Thus, for the second stage of sample calculation, but at this time for the mean scores, the following parameters were used: 95% confidence level, maximum expected error of 10%, and population standard deviation of 26.37. Therefore, the sample size was 20. Again, was used the stratified sampling with proportional allocation and were obtained 16 photographs for the women and 4 for men.

The esthetic composition of the smile of the 16 broad smile photographs of women, the eight most voted and eight least voted, and four men, following the same criteria, elected by the 3 groups of evaluators were assessed by a blinded evaluator (V.L.B.M.) and on two occasions to assess intra-evaluator error.

The most frequently judged smile components by articles published on this subject were assessed,^{5-17,19-21,24,29,33,36,39,40,44,46,48-59,61,62} as shown in Table 1. The connector is above the contact points, where teeth appear to touch, and its proportion in relation to the central incisor were calculated. Buccal corridor proportion in relation to the intercommissural distance were calculated. Smile index were calculated dividing intercommissure width by interlabial gap. A total of 42 smile variables were found, of which 36 were numerical and eight were categorical.

Table 1. An evaluation chart of the details of the smiles selected and appropriate variations according to previous studies.

N		Characteristics	Variations		
Tooth position	1	Step between CI edges ⁶	() 0mm () 0,25mm () 0,5mm () 0,75mm	() 1mm () 1,25mm () 1,5mm () 1,75mm	() 2mm () 2,25mm () _____
	2	CI-to-LI incisal step ⁷	() 0 mm () 0,5mm () 1mm	() 1,5mm () 2mm () 2,5mm	() 3mm () _____
	3	Step between LI edges ⁶	() 0mm () 0,5mm	() 1,5mm () 1mm	() 2mm () _____

	4	Step between the cusps of the canines ¹⁹	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm	<input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> _____
	5	Disposition of the upper incisors incisal edges and the lower lip ^{46,50,51}	<input type="checkbox"/> Parallel <input type="checkbox"/> Straight	<input type="checkbox"/> Inverted <input type="checkbox"/> _____	
Tooth shape	6	Incisal edges shape ^{12,13}	<input type="checkbox"/> Square <input type="checkbox"/> Round	<input type="checkbox"/> Square-rounded <input type="checkbox"/> _____	
	7	Incisors shape ⁵⁶	<input type="checkbox"/> Oval <input type="checkbox"/> Square	<input type="checkbox"/> Triangular <input type="checkbox"/> _____	
	8	Canines shape ^{12,13}	<input type="checkbox"/> Flat <input type="checkbox"/> Pointed	<input type="checkbox"/> Round <input type="checkbox"/> NA	
Interdental spaces	9	CI incisal embrasure ^{56,57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> NA <input type="checkbox"/> _____
	10	CI and LI incisal embrasure ^{56,57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> NA <input type="checkbox"/> _____
	11	LI and canine embrasure ^{56,57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> NA <input type="checkbox"/> _____
	12	Diastema between CI ^{10,11,24,36}	<input type="checkbox"/> Absence <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> _____
	13	Diastemas between CI and LI ⁵²	<input type="checkbox"/> Absence <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> _____
	14	Black spaces ^{16,48,49}	<input type="checkbox"/> Absence <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> _____
Gingival and dental display	15	Gingival display above CI ^{9,10,15,36,46}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> 5mm <input type="checkbox"/> _____
	16	Posterior canine gingival display ⁵⁴	<input type="checkbox"/> 0mm <input type="checkbox"/> 1mm <input type="checkbox"/> 2mm	<input type="checkbox"/> 3mm <input type="checkbox"/> 4mm <input type="checkbox"/> 5mm	<input type="checkbox"/> 6mm <input type="checkbox"/> 7mm <input type="checkbox"/> _____
	17	Upper CI display ^{14,53,56,61}	<input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm <input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> 5mm <input type="checkbox"/> 5,5mm	<input type="checkbox"/> 6mm <input type="checkbox"/> 6,5mm <input type="checkbox"/> 7mm <input type="checkbox"/> 7,5mm <input type="checkbox"/> 8mm <input type="checkbox"/> 8,5mm <input type="checkbox"/> 9mm	<input type="checkbox"/> 9,5mm <input type="checkbox"/> 10mm <input type="checkbox"/> 10,5mm <input type="checkbox"/> 11mm <input type="checkbox"/> 11,5mm <input type="checkbox"/> 12mm <input type="checkbox"/> _____
	18	Lower CI display ⁵³	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4,5mm <input type="checkbox"/> 5mm <input type="checkbox"/> 5,5mm <input type="checkbox"/> _____
Periodontal esthetics	19	CI-to-canine gingival margin ⁷	<input type="checkbox"/> 1mm above <input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm below	<input type="checkbox"/> 1mm below <input type="checkbox"/> 1,5mm below	<input type="checkbox"/> 2mm below <input type="checkbox"/> _____ <input type="checkbox"/> NA
	20	CI-to-LI gingival margin ¹¹	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm below <input type="checkbox"/> 1mm below	<input type="checkbox"/> 1,5mm below <input type="checkbox"/> 2mm below <input type="checkbox"/> 2,5mm below	<input type="checkbox"/> 3mm below <input type="checkbox"/> _____ <input type="checkbox"/> NA
	21	Asymmetry between gingival margin of CI ^{17,19,36}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm	<input type="checkbox"/> 1,5mm <input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm	<input type="checkbox"/> 3mm <input type="checkbox"/> _____ <input type="checkbox"/> NA
	22	Papillae height ^{24,36}	<input type="checkbox"/> Symmetric <input type="checkbox"/> Asymmetric	<input type="checkbox"/> Unexposed	

Tooth size and proportion	23	CI connector height ^{57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> _____ <input type="checkbox"/> NA
	24	CI connector height ratio ^{57,59}	<input type="checkbox"/> 15% <input type="checkbox"/> 20% <input type="checkbox"/> 25%	<input type="checkbox"/> 30% <input type="checkbox"/> 35% <input type="checkbox"/> 40%	<input type="checkbox"/> 45% <input type="checkbox"/> _____ <input type="checkbox"/> NA
	25	CI and LI connector height ^{57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> _____ <input type="checkbox"/> NA
	26	CI and LI connector height ratio ^{57,59}	<input type="checkbox"/> 15% <input type="checkbox"/> 20% <input type="checkbox"/> 25%	<input type="checkbox"/> 30% <input type="checkbox"/> 35% <input type="checkbox"/> 40%	<input type="checkbox"/> 45% <input type="checkbox"/> _____ <input type="checkbox"/> NA
	27	LI and canine connector height ^{57,59}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> _____ <input type="checkbox"/> NA
	28	LI and canine connector height ratio ^{57,59}	<input type="checkbox"/> 15% <input type="checkbox"/> 20% <input type="checkbox"/> 25%	<input type="checkbox"/> 30% <input type="checkbox"/> 35% <input type="checkbox"/> 40%	<input type="checkbox"/> 45% <input type="checkbox"/> _____ <input type="checkbox"/> NA
	29	Comparação da largura entre os incisivos laterais ^{10,11,17,36}	<input type="checkbox"/> Symmetric <input type="checkbox"/> Asymmetric	<input type="checkbox"/> NA <input type="checkbox"/> _____	
	30	CI width/height ratio ^{5,20,57,61}	<input type="checkbox"/> 60% <input type="checkbox"/> 65% <input type="checkbox"/> 70% <input type="checkbox"/> 75%	<input type="checkbox"/> 80% <input type="checkbox"/> 85% <input type="checkbox"/> 90%	<input type="checkbox"/> 95% <input type="checkbox"/> 100% <input type="checkbox"/> _____
	31	LI to CI width ratio ²¹	<input type="checkbox"/> 30% <input type="checkbox"/> 35% <input type="checkbox"/> 40% <input type="checkbox"/> 45%	<input type="checkbox"/> 50% <input type="checkbox"/> 55% <input type="checkbox"/> 60% <input type="checkbox"/> 65%	<input type="checkbox"/> 70% <input type="checkbox"/> 75% <input type="checkbox"/> 80% <input type="checkbox"/> NA
	32	Canines to LI width ratio ²¹	<input type="checkbox"/> 30% <input type="checkbox"/> 35% <input type="checkbox"/> 40% <input type="checkbox"/> 45%	<input type="checkbox"/> 50% <input type="checkbox"/> 55% <input type="checkbox"/> 60% <input type="checkbox"/> 65%	<input type="checkbox"/> 70% <input type="checkbox"/> 75% <input type="checkbox"/> 80% <input type="checkbox"/> NA
Width and extent of smile	33	Smile height (interlabial gap) ^{44,46}	<input type="checkbox"/> 3,5mm <input type="checkbox"/> 4mm <input type="checkbox"/> 4,5mm <input type="checkbox"/> 5mm <input type="checkbox"/> 5,5mm	<input type="checkbox"/> 6mm <input type="checkbox"/> 6,5mm <input type="checkbox"/> 7mm <input type="checkbox"/> 7,5mm <input type="checkbox"/> 8mm	<input type="checkbox"/> 8,5mm <input type="checkbox"/> 9mm <input type="checkbox"/> 9,5mm <input type="checkbox"/> 10mm <input type="checkbox"/> _____
	34	Smile index (intercomissure width divided by interlabial gap) ^{44,58,62}	<input type="checkbox"/> 4mm <input type="checkbox"/> 5mm <input type="checkbox"/> 6mm	<input type="checkbox"/> 7mm <input type="checkbox"/> 8mm <input type="checkbox"/> 9mm	<input type="checkbox"/> 10mm <input type="checkbox"/> 11mm <input type="checkbox"/> _____
	35	Buccal corridor ^{8,33,39}	<input type="checkbox"/> 0mm <input type="checkbox"/> 0,5mm <input type="checkbox"/> 1mm <input type="checkbox"/> 1,5mm	<input type="checkbox"/> 2mm <input type="checkbox"/> 2,5mm <input type="checkbox"/> 3mm <input type="checkbox"/> 3,5mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 4,5 mm <input type="checkbox"/> 5mm <input type="checkbox"/> _____
	36	Buccal corridor ratio ^{39,44}	<input type="checkbox"/> 0% <input type="checkbox"/> 5% <input type="checkbox"/> 10%	<input type="checkbox"/> 15% <input type="checkbox"/> 20% <input type="checkbox"/> 25%	<input type="checkbox"/> 30% <input type="checkbox"/> _____ <input type="checkbox"/> NA
	37	Teeth displayed ²⁵	<input type="checkbox"/> 6 teeeth <input type="checkbox"/> 8 teeth <input type="checkbox"/> 10 teeth	<input type="checkbox"/> 12 teeth <input type="checkbox"/> 14 teeth <input type="checkbox"/> _____	
Tooth inclinations	38	Incisal plane inclination ^{39,40}	<input type="checkbox"/> 0 degrees <input type="checkbox"/> 0,5 degrees <input type="checkbox"/> 1 degrees <input type="checkbox"/> 1,5 degrees	<input type="checkbox"/> 2 degrees <input type="checkbox"/> 2,5degrees <input type="checkbox"/> 3 degrees <input type="checkbox"/> 3,5degrees	<input type="checkbox"/> 4 degrees <input type="checkbox"/> 4,5 degrees <input type="checkbox"/> 5 degrees <input type="checkbox"/> _____
	39	Canines buccolingual inclination ²⁹	<input type="checkbox"/> -15 degrees <input type="checkbox"/> -10 degrees <input type="checkbox"/> -7 degrees <input type="checkbox"/> -5 degrees	<input type="checkbox"/> -3 degrees <input type="checkbox"/> 0 degrees <input type="checkbox"/> +5 degrees <input type="checkbox"/> +7 degrees	<input type="checkbox"/> +10 degrees <input type="checkbox"/> +15 degrees <input type="checkbox"/> NA <input type="checkbox"/> _____

Dental midline	40	Upper midline and face ^{11,17,19}	() Coincident () 0,5 () 1mm () 1,5mm	() 2mm () 2,5mm () 3mm () 3,5mm	() 4mm () 4,5mm () 5mm () _____
	41	Lower midline and face ⁴⁰	() Coincident () 0,5 () 1mm () 1,5mm	() 2mm () 2,5mm () 3mm () 3,5mm	() 4mm () 4,5mm () NA () _____
	42	Upper and lower midline ^{50,55}	() Coincident () 0,5 () 1mm () 1,5mm	() 2mm () 2,5mm () 3mm () 3,5mm	() 4mm () 4,5mm () NA () _____

CI= Central incisor / LI= Lateral incisor / NA= Not able to evaluate

The 20 most and least voted photographs, 4 of men and 16 of women, elected by the three groups of evaluators, were corrected to a 1:1 ratio related to the real size. The correction factor was 0.995 and the 1:1 ratio was considered.

The blinded evaluator (V.L.B.M.) was a dentist, 30 years old, calibrated for the features assessed and used a millimeter screen (Velopex, London, UK) and protractor to assess the photographs and, in cases of doubt, the help of a digital caliper (Starrett, Athol, MA, USA). The measurement observed was noted in the column for variations (Table 1). When the measurements of the characteristics on the right and left sides differed, the mean values were used. Finally, the evaluator noted the features as “not able to evaluate” = NA if they were not fully visible or impossible to measure. The data that differed from the table was noted when the situation occurred. The evaluator performed the same measurements in two stages, with an interval of one week between them.

To verify the intra-rater agreement of the measurements for the continuous variables, the intraclass correlation coefficient (ICC) was suggested. Measurements of central trend (mean and standard deviation) were used to summarize and describe the data obtained from the VAS scales. Comparisons were stratified by scales, gender and group (dentists, orthodontists and lay people). The means of the 42 features for the eight highest and eight lowest mean values for the women obtained by the VAS scale were calculated. The same was done for the higher and lower values for men.

RESULTS

The means and standard deviations of the scores for each gender assigned by dentists, orthodontists and lay people in the VAS are shown in Table 2. Among 66 female images, eight images with the highest score and eight with the lowest were elected. For the male images, they were elected four, two with the highest scores and two with the lowest. Figure 1 is the best smile elected by the three groups of evaluators.

Tabela 2. Descriptive analysis of the images according to sex and group of evaluators.

Evaluation Sex	Image	Dentists		Laypersons		Ortodontists		Mean
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Feminine highest score	1	62.6	18.3	56.4	23	62.6	17.5	60.3
	15	65.5	21.3	62.6	23.8	62.5	17.5	63.5
	19	61.1	24.2	49.1	27.8	60	18.8	56.4
	25	80.4	16.2	77.9	23.3	69.6	20.7	76.2
	27	65.8	18.7	55.4	25.5	62.6	21	61.1
	29	70.4	19.5	57	23.9	68.5	18.2	65.0
	39	71.7	14.6	52.4	25	55	19.4	59.6
	53	56.2	25	56.6	27.4	59.7	28.1	57.4
Feminine lowest score	2	27.1	19.3	25	12.8	33	16.3	28.5
	8	15	14.1	15.8	11.7	22	15	17.4
	16	25.2	18.6	25.8	18.6	27.8	14.5	26.2
	18	19.7	18.9	14.1	12	19.3	11.3	17.5
	23	14.8	16.5	9.8	6.9	19.9	14.1	14.6
	44	20.1	15.5	14.3	12.6	25.8	15.7	19.7
	46	34.4	19.5	20.1	16.1	35.3	17.2	29.5
	48	34	23.6	25.1	15.9	29.7	18.7	29.5
Male highest score	69	78.6	12.8	60.4	19.5	69.4	26.5	69.46
	75	66.9	19.2	60.1	18.9	62.5	20	63.1
Male lowest scored	82	19.1	18	19.7	13.2	20.4	15.4	19.7
	84	16.2	16.9	15.6	10.6	20.4	16.9	17.4



Figure 1 – Image of best smile elected by three groups of evaluators.

The 42 variables were divided into continuous and categorical. The means and standard deviations for the 36 continuous variables (most and least attractive male and female smile) for each group are shown in Table 3 and the six categorical variables in Table 4. All variables showed significant ICC, i.e., there was agreement between the two measurements, which confirms the reliability of the method. The variables "diastemas between central and lateral incisors" and "incisal plane inclination" showed maximum coefficients (1.00), so there was complete agreement on the two measurements for the same photograph. The variable "gingival margin of the central incisors" and "width proportion of lateral incisors and central incisors" showed the lowest coefficient (0.63), but satisfactory. All other variables were satisfactory ($0.40 \leq \text{ICC} < 0.75$) and optimum ($\text{ICC} \geq 0.75$) according to Szklo and Nieto⁶³, resulting in similar measurements at the two time intervals.

Table 3. Means with standard deviation of the continuous variables per group of photographs.

Characteristics	Highest Fem.		Lowest Fem.		Highest male		Lowest Male	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1 Step between CI edges (mm)	0.07	0.19	0.29	0.49	0.13	0.18	0.00	-
2 CI-to- LI incisal step (mm)	1.21	0.64	1.17	0.61	2.25	0.35	-0.25	-
3 Step between LI edges (mm)	0.44	0.50	0.50	0.55	0.75	1.06	0.13	0.18
4 Step between the cusps of the canines (mm)	0.54	0.85	0.83	0.98	1.00	-	1.00	-
5 CI incisal embrasure (mm)	0.47	0.39	0.64	0.38	0.50	0.00	0.00	-
6 CI and LI incisal embrasure (mm)	0.53	0.41	0.89	0.61	1.00	0.00	0.00	-
7 Canines and LI embrasure (mm)	0.88	0.27	0.97	0.57	1.50	0.71	1.00	-
8 Diastema between CI (mm)	0.00	0.00	0.25	0.71	0.00	0.00	0.50	0.71
9 Diastema between CI and LI (mm)	0.00	0.00	0.25	0.46	0.00	0.00	0.00	0.00
10 Black spaces (mm)	0.03	0.09	0.06	0.18	0.00	0.00	0.00	-
11 Gingival display above CI (mm)	0.13	0.35	1.38	1.77	0.00	0.00	0.00	0.00
12 Posterior gingival display (mm)	1.44	1.18	1.25	1.58	1.75	0.35	0.50	0.71
13 Upper CI display (mm)	9.00	1.07	7.50	1.58	11.13	0.18	5.63	4.07

14	Lower CI display (mm)	1.88	1.46	1.38	1.51	1.00	1.41	3.00	4.24
15	CI-to-canine gingival margin (mm)	0.50	1.00	-0.50	0.58	-	-	-	-
16	CI-to-LI gingival margin (mm)	0.83	0.29	0.88	0.63	-	-	-	-
17	Asymmetry between gingival margin of CI (mm)	0.17	0.29	0.00	0.00	-	-	-	-
18	CI connector height (mm)	3.50	1.31	2.83	0.75	4.00	1.41	4.00	-
19	CI connector height (%)	39.60	15.26	38.42	5.61	-	-	-	-
20	CI and LI connector height (mm)	3.31	0.96	2.70	0.57	3.50	0.71	-	-
21	CI and LI connector height (%)	38.20	9.34	25.00	3.92	-	-	-	-
22	Canine and LI connector height (mm)	2.56	0.73	2.57	1.10	3.50	0.71	3.00	-
23	Canine and LI connector height (%)	29.80	6.57	24.30	11.42	-	-	-	-
24	CI width/height ratio (%)	79.20	11.34	79.38	10.84	-	-	-	-
25	LI to CI width ratio (%)	67.69	7.04	66.61	6.48	75.00	0.00	-	-
26	Canine to LI width ratio (%)	85.38	14.03	86.07	15.40	78.75	18.03	-	-
27	Smile height (mm)	10.25	2.19	9.75	2.12	12.50	0.71	9.00	8.49
28	Smile index (mm)	6.15	1.33	5.78	1.15	5.50	0.71	12.00	11.31
29	Buccal corridor (mm)	10.63	2.26	12.38	6.35	12.50	3.54	13.50	2.12
30	Buccal corridor (%)	17.36	3.50	21.62	9.38	18.11	3.85	22.50	3.54
31	Teeth displayed	12.00	0.00	10.25	1.16	12.00	0.00	11.00	1.41
32	Incisal plane inclination (°)	0.00	0.00	0.06	0.18	0.00	0.00	0.00	-
33	Canine buccolingual inclination (°)	-2.14	2.67	-0.93	1.88	0.00	0.00	-1.00	-
34	Upper midline and face (mm)	0.00	0.00	0.31	0.70	0.50	0.71	0.00	0.00
35	Lower midline and face (mm)	0.80	0.84	1.50	1.00	0.00	-	2.00	-
36	Upper and lower midline (mm)	0.80	0.84	1.50	1.00	0.00	-	2.00	-

CI= Central incisor/ LI= Lateral incisor/ (-) Not able to evaluate/ (*) ICC single measurement/ (SD) Standard deviation

For the most and least attractive male smiles, the covering of the upper incisors made it impossible to calculate the gingival margin difference between the central incisors and canines, gingival margin difference between the lateral and central incisors, gingival margin between the central incisors, height of contact point of central incisors (%), height of the contact point of the central incisor and lateral incisor (%), height of contact point of the lateral incisor with canine (%), width/height proportion of central incisors. Neither the width proportion between the lateral incisors and central incisors among the least attractive male smiles nor the incisal edges between the central and lateral incisors among the most attractive smiles were assessed because there were only two cases in the sample.

Table 4. Characterization of categorical variables per groups assessed.

		Melhores femininos		Piores femininos		Melhores masculinos		Piores masculinos		
		n	%	n	%	n	%	n	%	
1	Incisal edges and inferior lip	Inverted	0	0.0	0	0.0	0	0.0	1	50.0
		Parallel	6	75.0	1	12.5	2	100.0	0	0.0
		Straight	1	12.5	6	75.0	0	0.0	0	0.0
		NA	1	12.5	1	12.5	0	0.0	1	50.0
2	Incisal edges shape	Round	0	0.0	1	12.5	0	0.0	0	0.0
		Square-round	8	100.0	7	87.5	2	100.0	1	50.0
		Square	0	0.0	0	0.0	0	0.0	0	0.0

	NA	0	0.0	0	0.0	0	0.0	1	50.0
3	Oval	7	87.5	6	75	2	100.0	0	0.0
	Square	1	12.5	2	25.0	0	0.0	0	0.0
	Triangular	0	0.0	0	0.0	0	0.0	1	50.0
	NA	0	0.0	0	0.0	0	0.0	1	50.0
4	Round	4	50.0	3	37.5	0	0.0	0	0.0
	Flat	0	0.0	1	12.5	0	0.0	1	50.0
	Pointed	3	37.5	4	50.0	1	50.0	0	0.0
	NA	1	12.5	0	0.0	1	50.0	1	50.0
5	Asymmetric	0	0.0	1	12.5	0	0.0	0	0.0
	Unexposed	0	0.0	1	12.5	0	0.0	1	50.0
	Symmetric	8	100.0	6	75.0	2	100.0	1	50.0
	NA	0	0.0	0	0.0	0	0.0	0	0.0
6	Symmetric	8	100.0	5	62.5	2	100.0	0	0.0
	Asymmetric	0	0.0	0	0.0	0	0.0	0	0.0
	NA	0	0.0	3	37.5	0	0.0	2	100.0

NA = Not able to evaluate

DISCUSSÃO

The present study selected the most and least attractive male and female smiles. We compared the norms and values of the smile details with those in the literature, as follows:

Tooth position

The best rated male and female smile showed no step between the maxillary central incisors, corresponding to the ideal standard.⁶ There should be no difference between the incisal edges of the lateral incisors, 1mm being the limit accepted by laypersons.⁶ Nevertheless, the group of the best rated male smile presented 0.75mm.

Between the central and lateral incisor the mean step in the best rated female smile was 1.2 mm (\pm 0.64), close to 1.2mm,⁴⁰ 1.4mm,^{39,65} 1.5mm.⁷ For males, 2.25mm (\pm 0.35mm) indicates that other details defined these as the best smiles, but still within the acceptable limit of 2.9mm.⁶⁵ The difference between the cusp heights of the canine was between 0.5 and 1 mm in all the groups assessed, corroborating that cusp wear has no esthetic impact.¹⁹

Incisal edges parallel to the lower lip was the preferred shape in the most attractive smiles, which is in agreement with most studies.^{39,40,51,66} The inverted

shape is considered less attractive⁵¹ and it was observed in the least attractive male smile. Flat smiles also decrease the attractiveness⁸ and it was observed in 75% of the least attractive female smiles.

Tooth shape

Square-rounded incisal edges were observed predominantly in all the groups assessed and they were the ones preferred in other studies.^{12,13} Oval-shaped incisors were the most frequently observed in the groups, except among the least attractive male smiles. Similarly, in other studies, oval-shaped incisors are more pleasing in women, while square incisors are more pleasing in men.^{41,56} Round canine cusps were observed in the most attractive female smiles, pointed canines were rated least attractive in women and more attractive in men, and flat canines were rated least attractive in men. However, this feature has little influence on the esthetic perception.^{12,13}

Interdental spaces

Incisal embrasure increased in distal progression of the central incisors in all groups, being in agreement with most studies.^{56,57,59} One of the worst rated male smiles had no space between upper central incisors and central to lateral incisors, causing a negative esthetic impact.⁵⁹

Smile without a diastema is always preferred than with a diastema, even if it is only 0.5mm.^{10,11} Diastemas between the central incisors of 0.25mm in women and 0.5mm in men were rated as the least attractive smiles. The least attractive female smiles presented a diastema of 0.25mm between the central incisor and lateral incisor, causing a negative esthetic impact.⁵²

Black spaces also negatively affected the smile,^{48,49} but were not observed in either group (max 0.06 mm).

Gingival and dental display

No gingival display above the central incisors was observed in the most attractive smiles (up to 0.13mm in women), which is in agreement with other

studies.^{9,40,66} The best rated smile presented posterior gingival display of 1.44mm in women and 1.75mm in men.⁵⁴

Upper incisors with greater vertical exposure was found in the best rated smiles, 9mm in female smiles and 11mm in male smiles. These values are similar to those of other studies^{56,61} and correspond to the natural size of these teeth.⁵⁶ The least attractive male smiles displayed lower incisors up to 3 mm, greater than individuals at rest above the age of 50.⁵³

Periodontal esthetics

The gingival margins of the central incisors should be at the same level,^{19,39,40} 0.5mm coronal to the canines, which is in agreement with other studies,^{7,66} and central 0.83mm apical to the lateral incisors. When the central incisor margin is coronal to the lateral incisor, the esthetic influence is negative.¹¹

The height of the interdental papillae should be symmetrical, which is in agreement with other studies.^{24,36}

Tooth size and proportion

The central incisors connector height was 39.60% of the length of the central incisors, 38.2% between the central incisor and lateral incisor and 29.8% between the lateral incisor and canine. These values are close to the 50-40-30% rule.^{56,57} In millimeters, 3.5-3.3-2.5mm was observed.

The width/height proportion of the central incisor in the female smile was 79%, being in agreement with most studies^{20,56,57,61} and symmetrical lateral incisors were present in the best rated smiles.^{10,11,17,36} The width proportion between the lateral incisor and central incisor in the best rated smiles were 67 and 75%, and 78 and 85% between the canines and lateral incisors, values slightly above the golden proportion when converted.^{56,60}

Width and extent of smile

The distance between the upper and lower lip in the best rated smiles was 10.25 and 12.5 mm, which can be estimated as average smile height.^{44,46} Smile

index for the best rated smiles was 5.5 to 6.15mm, similar to those found by Durgekar et al.⁴⁴

The buccal corridor was between 10.6 and 12.5mm and 17.36 and 18.11% in the best rated male and female smiles, respectively. These values were similar to those of some authors,^{39,67,68} but different from other authors^{44,50,51} probably because the characteristic has little esthetic influence.^{1,33,69}

The best rated smiles displayed 12 teeth, but according to Martin et al.²⁵ 10 teeth are preferred.

Tooth inclinations

No incisal plane inclination was found in the best rated smiles, which is in agreement with other studies.^{17,39,40,70} The buccolingual inclinations of canines was 0 and -2 degrees in the best rated smiles, similar to those of other studies.^{29,71}

Dental midline

Deviations of up to 0.5 mm from the upper midline were found in the best rated male smiles, a value that is not detectable.^{17,19,50} Deviations of 2mm from the lower midline were observed in the worst rated male smiles, not detectable in relation with the face,⁴⁰ but detectable in relation to the upper midline.⁵⁰

CONCLUSION

The smile characteristics according to the preferences of dentists, orthodontists and lay people were as follows:

I. Most attractive smiles

- a. Edges of central incisors at the same level, 1.2mm below the lateral incisors in women;
- b. No differences between the edges of the lateral incisors;
- c. No differences between the cusps of canines;

- d. Incisors incisal edges parallel to the lower lip;
- e. Oval-shaped incisors with square-rounded edges;
- f. Round canines for women and pointed for men;
- g. Increase of the incisal embrasure in distal progression;
- h. Absence of diastema and black spaces;
- i. No anterior gingival display and approximately 1.5 mm for posterior display;
- j. Vertical exposure of upper incisor of 9mm in women and 11mm in men;
- k. Gingival margin of central incisors at the same level, 0.5 mm coronal to the canines and 0.8 mm apical to the lateral incisors;
- l. Reduced connector height in distal progression;
- m. Symmetrical papillae height;
- n. LI symmetrical in width;
- o. Height/width proportion of central incisor of 79%;
- p. Width proportion between lateral incisor and central incisor of 68% in women and 75% in men;
- q. Width proportion between canines and lateral incisor of 85% in women and 79% in men;
- r. Smile height between 10.5 and 12.5 mm;
- s. Buccal corridor below 20% and 12 teeth displayed;
- t. Absence of incisal plane inclination;
- u. Canines with -2 degrees of inclination;
- v. Absence of dental midline deviation.

II. Least attractive smiles

- a. Straight arch smile in women and inverted in men;
- b. Triangular male incisors;
- c. Pointed canines in women and flat canines in men;
- d. Presence of diastema;
- e. Display of upper incisors up to 7.5 mm in women and 5.6 mm in men, and greater display of lower teeth;
- f. Smile width and extent: height lower than 10mm and smile index of 12mm in men;

- g. Buccal corridor above 20% and less than 12 teeth displayed;
- h. Deviation of 2 mm from the lower dental midline in relation with the face and upper dental midline.

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3- DISCUSSÃO

Existem poucos estudos sobre a validade de métodos de avaliação da estética dentofacial, e as informações são insuficientes no que diz respeito à confiança de medições subjetivas da atratividade do sorriso.²⁰ Este trabalho primeiramente esclareceu a confiabilidade de duas ferramentas de avaliação da atratividade do sorriso.

O método Q-sort simplificado apresentou levemente maior confiança do que a EVA, concordando com estudo anterior.²⁰ Mesmo assim, foi comprovado que a EVA é um método confiável para avaliação da atratividade do sorriso, o que está de acordo com a maioria dos estudos.^{20,35,36} A EVA é a ferramenta de avaliação utilizada na percepção estética do sorriso na maioria dos estudos,^{8,18,37-39} o que fez dela critério de inclusão para a revisão sistemática do presente trabalho.

A organização de uma hierarquia de normas estéticas auxilia na escolha de tratamento e aumentam as chances de sucesso clínico.³² Na revisão sistemática deste estudo a hipótese testada foi confirmada e, pela primeira vez, os componentes dentários e gengivais do sorriso foram hierarquizados.

A variabilidade metodológica entre alguns dos estudos selecionados na revisão sistemática foi um fator limitante. Degrau entre incisivos centrais e laterais e altura da margem gengival dos incisivos centrais receberam pontuações idênticas e foram avaliadas em conjunto de acordo com a posição vertical dos incisivos.⁹ Comprimento dos incisivos centrais e altura da margem gengival, por convenção, foram avaliados em conjunto.¹¹ Forma de incisivos e caninos^{4,40} apresentaram diferenças muito desiguais entre os artigos, sendo necessários mais estudos para se estabelecer às normas ideais.

A maioria da população em tratamento ortodôntico é compreendida de pessoas leigas, conseqüentemente, para obter os melhores resultados, o tratamento deve ser direcionado à percepção estética individual do paciente.¹³ Em futuros trabalhos sobre a atratividade do sorriso, recomenda-se a avaliação das características identificadas na revisão sistemática como mais perceptíveis sob a avaliação de leigos.

Coerente ao presente estudo, outras investigações relataram que ortodontistas e dentistas tendem a avaliar a atratividade do sorriso com pontuações

mais altas do que pessoas leigas,^{18,20,26,41} mas diferentes de outros.^{11,16,42,43} Entende-se que mais importante do que a valor numérico atribuído, é a escolha dos sorrisos mais/menos atraentes, que muitas vezes foram os mesmos nos três grupos de avaliadores (ANEXO B).

Um estudo avaliou características do sorriso em imagens eleitas como mais e menos atraente.³⁴ No entanto, somente o presente trabalho identificou e estabeleceu normas para 42 variáveis que influenciam a atratividade do sorriso. As normas ideais para as características extraídas dos sorrisos mais atraentes, e as que deve ser evitadas, observadas nos menos atraentes, podem ser parâmetros clínicos e auxiliar na obtenção do desejável “golden smile”.³²

Novos estudos são necessários para reforçar as evidências científicas da atratividade do sorriso; as revisões sistemáticas sobre o tema não englobam todas as características identificadas por este estudo.^{2,30,31} Além disso, a percepção estética da população pode ser temporal se considerarmos a influência externa da mídia.^{20,44}

Devido à limitação imposta pelo cálculo amostral proporcional deste estudo, as duas fotografias mais atraentes e duas menos atraentes do sexo masculino foram insuficientes para avaliação completa das variáveis do sorriso. Sugere-se às futuras pesquisas, uma amostra com mais casos para definir com precisão a média das características dos sorrisos melhores e piores avaliados.

4- CONCLUSÕES

A partir das pesquisas realizadas foi concluído:

(1) O método Q-sort apresentou um nível de confiabilidade interobservador ligeiramente mais elevado em comparação com a VAS. Entretanto, ambas ferramentas são confiáveis na avaliação da atratividade de fotografias de lábio em repouso, sorriso moderado e amplo por dentistas, ortodontistas e leigos.

(2) Os componentes dentários e gengivais do sorriso ao serem avaliados por leigos, foram hierarquizados por percepção com seus respectivos valores ideais:

I- Alta relevância clínica:

1. Ausência de degrau entre incisivos centrais - Bordas niveladas;
2. Degrau de 1 a 1,5 mm entre incisivos centrais e laterais;
3. Bordas incisais superiores contornando o lábio inferior;
4. Ausência de diastema entre incisivos centrais superiores;
5. Simetria de altura entre os incisivos laterais;
6. Forma dos incisivos superiores, quadrado-arredondado para homens e arredondado para mulheres.

II- Moderada relevância clínica:

7. Exposição gengival de 0mm a 1mm, ou recobrir levemente os incisivos;
8. Cúspide dos caninos plana ou pontiaguda para homens e plana ou arredondada para mulheres;
9. Margem gengival dos centrais 0.5mm abaixo dos caninos;
10. Ausência de inclinação do plano incisal;
11. Margem gengival simétrica dos incisivos centrais;
12. Ausência de espaços triangulares negros;
13. Proporção largura/altura de 80% a 75% para os anteriores superiores.

III- Baixa relevância clínica

14. Simetria de comprimento entre os incisivos laterais.
15. Margem gengival simétrica dos incisivos laterais.
16. Comprimento dos incisivos centrais obedecendo a proporção dentária.
17. Corredor bucal pequeno ou ausente.
18. Linha média dentária superior coincidente com a inferior;
19. Simetria de largura entre os incisivos laterais;

20. Linha média dentária superior coincidente com a linha média da face.
21. Largura dos incisivos laterais obedecendo a proporção dentária;
22. Simetria de altura entre os caninos.

(3) As características do sorriso nas escolhas dos dentistas, ortodontistas e leigos foram indentificadas nos sorrisos mais atraentes:

- a. Bordas dos incisivos centrais niveladas entre si, 1,2mm abaixo dos incisivos laterais nas mulheres;
- b. Ausência de diferença entre as bordas dos incisivos laterais;
- c. Ausência de diferença entre as cúspides dos caninos;
- d. Bordas incisais paralelas ao lábio inferior;
- e. Incisivos ovóides com bordas reta-arredondadas;
- f. Caninos arredondados nas mulheres e pontiagudos nos homens;
- g. Aumento das ameias em progressão distal;
- h. Ausência de diastemas e espaços triangulares negros;
- i. Sem exposição gengival anterior e aproximadamente 1,5mm posterior;
- j. Exposição vertical dos incisivos superiores de 9mm nas mulheres e 11mm nos homens;
- k. Margem gengival dos incisivos centrais niveladas entre si, 0,5mm coronal aos caninos e 0,8mm apical aos laterais;
- l. Diminuição dos conectores (pontos de contato) em progressão distal;
- m. Altura de papilas simétricas
- n. Incisivos laterais simétricos em largura;
- o. Proporção altura/largura dos incisivos centrais em 79%;
- p. Proporção largura laterais para centrais de 68% nas mulheres e nos 75% homens;
- q. Proporção largura caninos para laterais de 85% nas mulheres e 79% nos homens;
- r. Altura do sorriso entre 10,5 e 12,5mm;
- s. Corredor bucal abaixo de 20% e 12 dentes expostos;
- t. Ausência de inclinação do plano incisal;
- u. Caninos com -2 graus de inclinação;
- v. Ausência de qualquer desvio de linha média.

Foram identificadas nos sorrisos menos atraentes:

- a. Arco do sorriso reto nas mulheres e invertido nos homens;
- b. Incisivos masculinos triangulares,
- c. Caninos pontiagudos nas mulheres e planos nos homens;
- d. Presença de diastema;
- e. Exposição de até de 7,5mm nas mulheres e 5,6mm nos homens dos incisivos superiores, e maior exposição dos inferiores.
- f. Menor amplitude do sorriso: altura menor do que 10mm e smile index de 12mm nos homens;
- g. Corredor bucal acima de 20% e menos de 12 dentes expostos;
- h. Desvio de 2mm da linha média inferior em relação à face e à superior.

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6- ANEXOS

ANEXO A – Certificado de aprovação do comitê de ética em pesquisa.

FACULDADE DE MEDICINA DA
UNIVERSIDADE FEDERAL
FLUMINENSE/ FM/ UFF/ HU



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Características agradáveis no sorriso identificadas por cirurgiões-dentistas, ortodontistas e leigos

Pesquisador: Jose Nelson Mucha

Área Temática:

Versão: 2

CAAE: 18000413.3.0000.5243

Instituição Proponente: Faculdade de odontologia

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 337.193

Data da Relatoria: 02/08/2013

Apresentação do Projeto:

Estudo descritivo, comparativo que visa determinar os sorrisos mais agradáveis e os menos agradáveis em um álbum na internet de jovens adultos, por meio de atribuições de valores em uma escala visual analógica (VAS) e uma adaptação do método Q-sort, por Cirurgiões-Dentistas, Ortodontistas e Leigos na Região Sudeste do Brasil. Para realização deste estudo, será utilizado um álbum fotográfico com 258 fotografias coloridas, obtidas de 86 estudantes de Curso de Graduação em Odontologia da Universidade Federal Fluminense, Niterói, RJ., sendo 66 do gênero feminino e 20 do gênero masculino, com idade variando de 19 e 30 anos, que pertencem aos arquivos da disciplina de Ortodontia da Universidade Federal Fluminense. Serão feitos cálculos de médias aritméticas, desvios padrões, medianas, valor mínimo e valor máximo para os valores tabulados das escalas visuais analógicas (VAS) e o método Q-sort, obtidos nas respostas dos questionários. Os sorrisos serão classificados como os 5 mais atraentes entre homens, 10 mais atraentes entre mulheres, 5 menos atraentes entre homens e os 10 menos atraentes entre mulheres, pelo método de julgamento que apresentar estatisticamente maior concordância. A partir desta seleção cada sorriso será individualmente avaliado, considerando-se a relação entre os lábios e os dentes e a relação dos dentes entre si em doze características específicas do sorriso. Resultados esperados: Determinar

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Continuação do Parecer: 337.193

as características preferidas para cada grupo de avaliadores bem como as características comuns a todos os avaliadores para auxiliar no diagnóstico e tomada de decisões nos procedimentos de planejamento e tratamento odontológico reabilitadores do sorriso. Determinar qual das escalas, VAS ou método Q-sort, apresenta maior concordância entre os avaliadores.

Objetivo da Pesquisa:

Primário:

Determinar por meio de atribuições de valores em uma escala visual analógica (VAS) virtual e em uma adaptação e simplificação do método Q-sort, ao serem analisados sorrisos obtidos de jovens adultos organizados em um álbum, os mais agradáveis e os menos agradáveis e as diferenças como as concordâncias entre Cirurgiões-Dentistas, Ortodontistas e Leigos na Região Sudeste do Brasil.

Secundário:

Determinar entre a escala VAS e o método Q-sort simplificado, qual apresenta maior concordância nas avaliações. Identificar as características mais presentes nos sorrisos considerados mais agradáveis, por cirurgiões-dentistas, ortodontistas e leigos. Identificar as características mais presentes nos sorrisos considerados menos agradáveis, por cirurgiões-dentistas, ortodontistas e leigos. Determinar uma ordem hierarquizada das características mais frequentes nos sorrisos mais agradáveis. Auxiliar com esta lista de prioridades nas tomadas de decisões nos procedimentos de reabilitação estética tanto por ortodontistas como cirurgiões dentistas das diversas especialidades.

Avaliação dos Riscos e Benefícios:

Segundo o pesquisador haverá risco mínimo aos entrevistados, pois não será realizada nenhuma intervenção ou modificação intencional nas variáveis fisiológicas ou psicológicas e sociais dos indivíduos que participarem no estudo. Será empregado um questionário online para avaliação de fotografias.

Como benefício, esta pesquisa trará maior conhecimento sobre o tema abordado, sendo um benefício indireto ao sujeito participante.

Comentários e Considerações sobre a Pesquisa:

Pesquisador atendeu à todas as solicitações do CEP.

Considerações sobre os Termos de apresentação obrigatória:

Dentro das conformidades.

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Continuação do Parecer: 337.193

Recomendações:

Nenhuma. Todas as pendências foram sanadas.

Conclusões ou Pendências e Lista de Inadequações:

Versão atual do projeto atende aos requisitos emanados do CEP, com descrição clara do que foi solicitado.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

NITEROI, 19 de Julho de 2013

Assinador por:
ROSANGELA ARRABAL THOMAZ
(Coordenador)

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ANEXO B – Análise descritiva das imagens por sexo e grupo de avaliador

Imagem	Dentistas		Leigos		Ortodontistas		Geral	
	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão
1	62.6	18.3	56.4	23	62.6	17.5	60.3	19.9
2	27.1	19.3	25	12.8	33	16.3	28.5	16.1
3	59.6	20.2	57.7	25.6	47	19	55.1	22.3
4	60.7	25.2	49.1	23.3	55.2	16.4	54.8	22.4
5	54.5	24.2	43	23.1	52.3	16	49.7	21.9
6	44.9	24.3	38.6	22.9	41.8	17.5	41.7	21.8
7	45.7	23.4	35.7	26.8	46.2	18.2	42.2	23.5
8	15	14.1	15.8	11.7	22	15	17.4	13.7
9	57.8	28.1	59.3	24.2	59.1	20.5	58.8	24.2
10	32.6	19.7	31.6	20	41.9	15.1	35.1	18.9
11	46.9	22	47.4	28.4	44.8	16.3	46.4	22.8
12	55.7	22.2	49.5	27.6	51.1	16.9	52.1	22.8
13	55.1	22	54.1	25.2	55.9	15.1	55.0	21.2
14	45.4	20.7	40.6	25.5	43.5	16.4	43.1	21.2
15	65.5	21.3	62.6	23.8	62.5	17.5	63.5	20.9
16	25.2	18.6	25.8	18.6	27.8	14.5	26.2	17.3
17	48.5	24.3	40.6	23.8	53.7	17.4	47.3	22.6
18	19.7	18.9	14.1	12	19.3	11.3	17.5	14.5
19	61.1	24.2	49.1	27.8	60	18.8	56.4	24.5
20	41.7	23	32.7	20.5	49.1	19.9	40.7	22.0
21	37.1	22.3	28.4	14.7	40.4	17.9	35.0	19.0
22	46.4	21.5	41.3	26.2	43.6	20.4	43.7	22.8
23	14.8	16.5	9.8	6.9	19.9	14.1	14.6	13.5
24	40.7	22.6	36.9	21.8	45.2	20.6	40.7	21.7

ANEXO B – Análise descritiva das imagens por sexo e grupo de avaliador

(Continuação)

Imagem	Dentistas		Leigos		Ortodontistas		Geral	
	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão
25	80.4	16.2	77.9	23.3	69.6	20.7	76.2	20.6
26	59.8	21.1	42	24.2	53	18	51.3	22.4
27	65.8	18.7	55.4	25.5	62.6	21	61.1	22.2
28	40.2	19.2	32.6	20.6	44.7	17.4	38.9	19.6
29	70.4	19.5	57	23.9	68.5	18.2	65.0	21.4
30	54	20.8	35.1	20.5	54.7	22.4	47.4	22.9
31	56.4	25.4	49.7	21.3	56.9	19.6	54.2	22.2
32	55.1	27.2	41.1	21.8	57.6	20.8	50.8	24.3
33	60.4	22.9	49.8	24.9	57.7	21.7	55.8	23.4
34	59	24.3	41.6	21.8	53.3	19.6	51.0	23.0
35	56.2	24.3	48	28	53.3	22.4	52.3	25.1
36	57.7	17.2	46.3	22.8	56.9	16.8	53.3	19.7
37	52.2	23.2	47.3	23.6	50.1	17.1	49.8	21.5
38	40.5	19.4	26.9	18.5	41.3	17.3	35.9	19.4
39	71.7	14.6	52.4	25	55	19.4	59.6	21.8
40	44.3	21.2	32.6	19.3	39.8	13.7	38.7	18.9
41	54.1	19.6	52	27.3	52.7	19.6	52.9	22.4
42	50	18.7	43.7	20.9	55	20.5	49.3	20.3
43	43.4	22.9	32.7	19.5	44.3	16.1	39.8	20.3
44	20.1	15.5	14.3	12.6	25.8	15.7	19.7	15.2
45	63.6	20.6	43.8	25.8	54.2	20.6	53.6	23.8
46	34.4	19.5	20.1	16.1	35.3	17.2	29.5	18.8
47	52.1	22.3	35	19.1	47.3	20.6	44.5	21.7
48	34	23.6	25.1	15.9	29.7	18.7	29.5	19.7

ANEXO B – Análise descritiva das imagens por sexo e grupo de avaliador

(Continuação)

Imagem	Dentistas		Leigos		Ortodontistas		Geral	
	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão
49	53.9	22	48.7	26.7	47.3	24.1	50.0	24.2
50	48.4	25	39.5	20.9	46.8	22.7	44.7	22.9
51	45	22.4	28.9	21.2	43.4	22.5	38.7	22.9
52	31.6	21.8	36	23	34.5	18.7	34.1	21.2
53	56.2	25	56.6	27.4	59.7	28.1	57.4	26.5
54	41.7	22	34.9	20.2	43.4	22.3	39.8	21.5
55	45	22.2	38.6	25.9	43	21.2	42.1	23.2
56	36	20.6	24.1	15.3	36.1	20	31.7	19.3
57	42.9	23.6	45.3	22.9	45	23.4	44.4	23.0
58	42.4	21.4	37.3	21	44.6	18.8	41.2	20.4
59	31.4	18.7	24.6	17.7	37.7	17.4	30.9	18.5
60	42.4	18.1	29.2	19.3	44.1	20.1	38.2	20.1
61	48.2	19.6	37.6	17.7	44.7	24.9	43.3	21.0
62	31.5	18.9	19.2	13.3	35	19.5	28.2	18.4
63	37.2	17.8	22.2	13	35.4	21.3	31.3	18.6
64	41.2	19.8	25.4	16.2	36.4	18.2	34.0	19.1
65	54.8	19.2	36.9	21.2	44.3	22.4	45.2	22.0
66	47.9	21.9	39.5	21.1	41.6	22.9	43.0	21.9
67	35.2	22.4	28.4	19.3	38.2	18.6	33.7	20.3
68	27.5	19.7	19.6	13.6	31.2	17.9	25.7	17.6
69	78.6	12.8	60.4	19.5	69.4	26.5	69.2	21.3
70	37.7	20.2	28.2	17.4	39	16.4	34.7	18.5
71	61.7	22.3	46.4	23.6	56.4	22.3	54.6	23.4
72	40	18	29.9	16.6	40.2	17.1	36.4	17.7

ANEXO B – Análise descritiva das imagens por sexo e grupo de avaliador

		(Conclusão)							
Imagem	Dentistas		Leigos		Ortodontistas		Geral		
	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão	Média	Desvio padrão	
Masculino	73	64.3	20.3	43	22.1	52.7	21.3	53.1	22.8
	74	43.6	20	36	19.8	48.1	24.9	42.2	21.8
	75	66.9	19.2	60.1	18.9	62.5	20	63.1	19.3
	76	35.5	22.3	26.9	17.6	35.5	18	32.4	19.6
	77	43.9	23.7	37	23.2	46.4	23.8	42.2	23.6
	78	29.2	18	21.1	16.5	39.4	19.3	29.4	19.1
	79	33.7	20.8	24.3	17.3	42.2	23.3	32.9	21.5
	80	24.5	19.5	21	16.1	25.8	17.9	23.6	17.7
	81	41.8	19.6	39.1	21.9	43.3	22.7	41.3	21.2
	82	19.1	18	19.7	13.2	20.4	15.4	19.7	15.4
	83	33.2	19.2	24.4	17.2	38.4	23.4	31.6	20.5
	84	16.2	16.9	15.6	10.6	20.4	16.9	17.3	14.9
	85	26	21.3	24.4	17.7	29.2	17.4	26.4	18.7
	86	22.3	20.5	20	16	24	17	22.0	17.8

ANEXO C – Coeficientes de Correlação Intraclasse das variáveis contínuas para avaliar a concordância entre as duas medições.

	Medida única			Medida média			Valor p
	ICC	Limite inferior	Limite superior	ICC	Limite inferior	Limite superior	
Bordas incisais entre os incisivos centrais superiores	0.88	0.71	0.96	0.94	0.83	0.98	< 0.001
Bordas incisais entre os incisivos centrais e laterais	0.78	0.44	0.92	0.87	0.61	0.96	< 0.001
Diferença entre as bordas dos incisivos laterais	0.71	0.38	0.88	0.83	0.55	0.94	< 0.001
Diferença entre as cúspides dos caninos	0.73	0.37	0.90	0.85	0.54	0.95	< 0.001
Ameias incisais dos IC superiores	0.83	0.59	0.93	0.90	0.74	0.96	< 0.001
Ameias incisais dos IC com IL superiores	0.71	0.38	0.88	0.83	0.55	0.94	< 0.001
Ameias incisais dos IL com caninos superiores	0.80	0.55	0.92	0.89	0.71	0.96	< 0.001
Diastema entre incisivos centrais superiores	0.92	0.81	0.97	0.96	0.89	0.98	< 0.001
Diastemas entre incisivos centrais e laterais	1.00	1.00	1.00	1.00	1.00	1.00	< 0.001
Espaços triangulares negros	0.81	0.58	0.92	0.90	0.73	0.96	< 0.001
Quantidade de exposição gengival acima dos centrais	1.00	0.99	1.00	1.00	1.00	1.00	< 0.001
Quantidade de exposição gengival dos caninos para posterior	0.95	0.87	0.98	0.97	0.93	0.99	< 0.001
Quantidade da exposição vertical das coroas dos incisivos superiores	0.98	0.96	0.99	0.99	0.98	1.00	< 0.001
Quantidade da exposição vertical das coroas dos incisivos inferiores	0.97	0.94	0.99	0.99	0.97	0.99	< 0.001
Diferença margem gengival dos centrais para os caninos	0.86	0.45	0.97	0.93	0.62	0.98	< 0.001
Diferença margem gengival dos laterais para os centrais	0.80	0.21	0.96	0.89	0.35	0.98	< 0.001
Margem gengival dos incisivos centrais entre si	0.63	-0.15	0.92	0.77	-0.34	0.96	0.049
Altura do ponto de contato dos IC	0.71	0.37	0.89	0.83	0.54	0.94	< 0.001
Altura do ponto de contato do IC com IL	0.78	0.24	0.95	0.88	0.39	0.98	< 0.001
Altura do ponto de contato do IC com IL	0.80	0.50	0.93	0.89	0.66	0.96	< 0.001
Altura do ponto de contato do IC com IL	0.77	0.13	0.96	0.87	0.23	0.98	0.013
Altura do ponto de contato do IL com canino	0.80	0.53	0.92	0.89	0.69	0.96	< 0.001
Altura do ponto de contato do IL com canino	0.71	0.14	0.93	0.83	0.25	0.96	0.011
Proporção largura/altura centrais	0.79	0.32	0.95	0.88	0.48	0.97	< 0.001

ANEXO C – Coeficientes de Correlação Intraclasse das variáveis contínuas para avaliar a concordância entre as duas medições.

	(Conclusão)						
Proporção da largura incisivos laterais para os centrais	0.63	0.22	0.85	0.77	0.36	0.92	< 0.001
Proporção da largura caninos para os laterais	0.68	0.32	0.87	0.81	0.48	0.93	< 0.001
Altura do sorriso	0.70	0.38	0.87	0.82	0.55	0.93	< 0.001
Smile index	0.94	0.85	0.98	0.97	0.92	0.99	< 0.001
Corredor bucal	0.67	0.33	0.85	0.80	0.49	0.92	< 0.001
Corredor Bucal	0.66	0.32	0.85	0.80	0.49	0.92	< 0.001
Dentes expostos	0.98	0.95	0.99	0.99	0.97	1.00	< 0.001
Inclinação do plano incisal	1.00	1.00	1.00	1.00	1.00	1.00	< 0.001
Inclinações bucolinguais de Caninos	0.70	0.35	0.88	0.83	0.52	0.94	< 0.001
Linha média – Superior e face	0.98	0.94	0.99	0.99	0.97	1.00	< 0.001
Linha média – Inferior e face	0.80	0.42	0.94	0.89	0.59	0.97	< 0.001
Linha média – Superior e inferior	0.80	0.42	0.94	0.89	0.59	0.97	< 0.001