Universidade Estadual Paulista

"Júlio de Mesquita Filho"

Faculdade de Odontologia de Araraquara

ANDRÉ WILSON LIMA MACHADO

Percepção estética de parâmetros ortodônticos por diferentes grupos de indivíduos

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Orientador: Prof. Dr. Luiz Gonzaga Gandini Júnior (FOAr-UNESP)

Co-Orientador: Prof. Dr. Kang Ting (UCLA-EUA)

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Araraquara, 12 de Dezembro 2011

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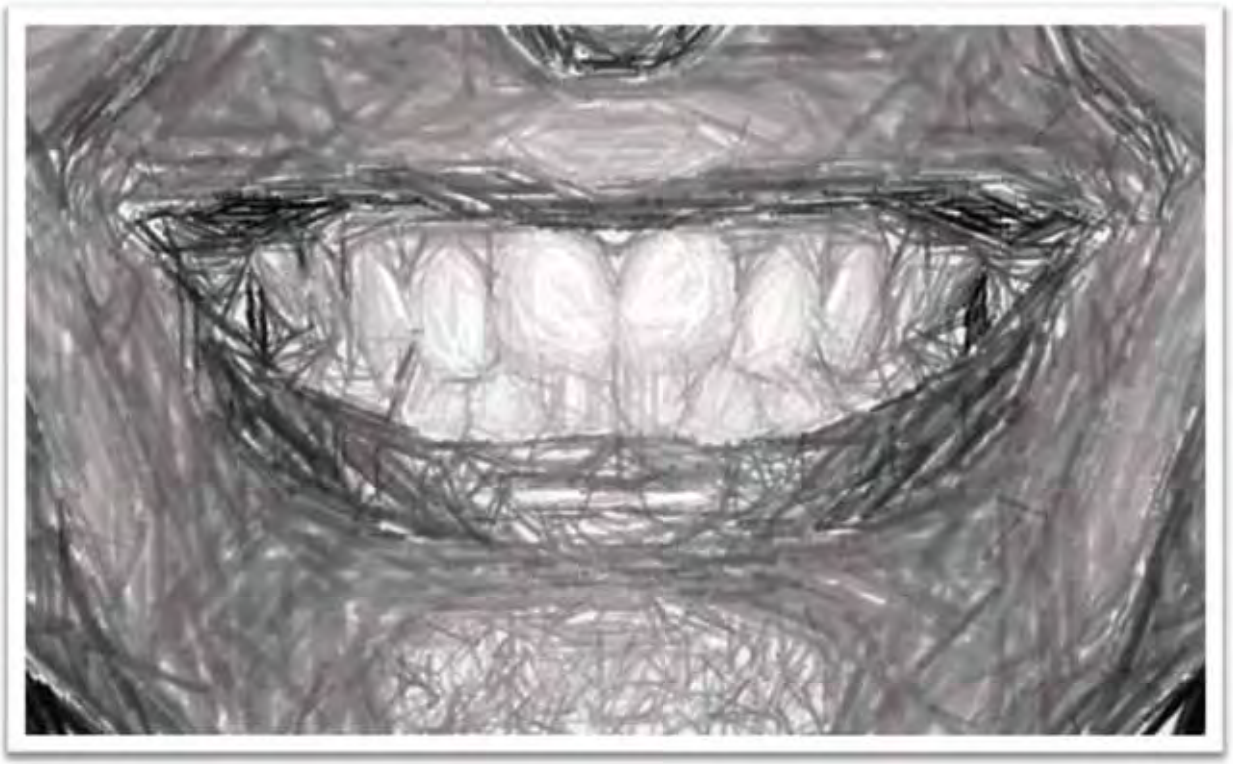

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Sumário

SUMÁRIO

Resumo

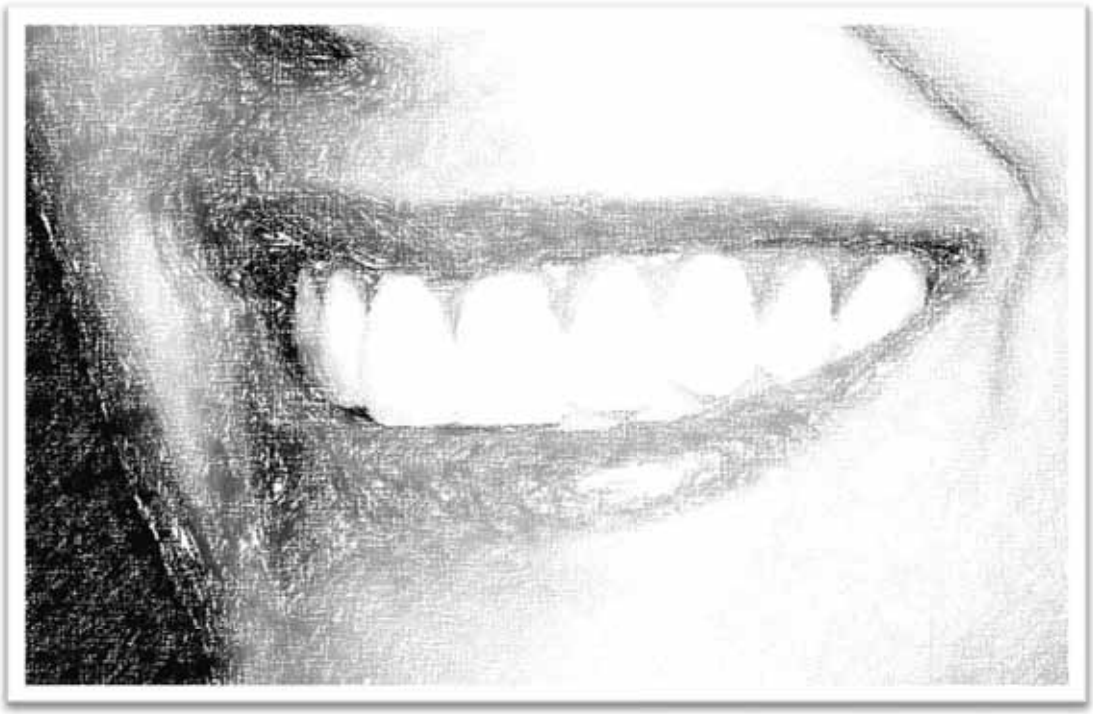
Machado AWL. Percepção estética de parâmetros ortodônticos por diferentes grupos de indivíduos [Tese de Doutorado]. Araraquara: Faculdade de Odontologia da UNESP; 2011.

RESUMO

Objetivo: Comparar a percepção estética de ortodontistas e leigos frente a três parâmetros: (1) a posição vertical da margem gengival e da borda incisal dos incisivos centrais superiores; (2) a presença de diastemas na região dos incisivos laterais superiores e (3) a presença de assimetrias nas bordas incisais dos incisivos centrais e laterais superiores. **Materiais e Métodos**: três artigos científicos foram redigidos e utilizados para a avaliação dos propósitos apresentados. **Resultados:** Os posicionamentos verticais dos centrais superiores considerado mais estético, por ortodontistas e leigos, foi aquele no qual as margens gengivais dos centrais estão ou no mesmo nível da dos caninos ou 0.5mm abaixo. Quando as bordas incisais foram avaliadas, o degrau de 1.0 e 1.5mm entre centrais e laterais foram os mais atrativos. A presença de diastemas na região de incisivos laterais foi considerada anti-estética por ortodontistas e leigos, brasileiros e norte-americanos. Em geral, os sorrisos seguiram o seguinte padrão: quanto maior os diastemas e quanto mais mesialmente posicionados, menor o nível de atratividade do sorriso. O sorriso com diastema de 0.5mm na face distal dos incisivos laterais não diferiu do sorriso sem diastemas na avaliação dos ortodontistas e leigos norte-americanos, bem como os leigos brasileiros. Assimetrias na bordas incisais de centrais e laterais foi considerada, em geral, uma característica anti-estética.

Os sorrisos avaliados seguiram o seguinte padrão: quanto maior as assimetrias menos atrativos eram os sorrisos e, assimetrias em laterais foram mais aceitáveis esteticamente do que em centrais. A presença de pequena assimetria, de 0.5mm, em centrais foi considerada anti-estética para ortodontistas e leigos. Por outro lado, assimetrias em laterais foram mais toleradas, sendo o limite do aceitável para ortodontistas de 0.5mm e, leigos, de 1.0mm.

Palavras-chave: Ortodontia; Estética; Sorriso.



Abstract

Machado AWL. Influence of different parameters on smile esthetics perception as perceived by orthodontists and laypeople. [Tese de Doutorado]. Araraquara: Faculdade de Odontologia da UNESP; 2011.

ABSTRACT

Objective: Determine the smile esthetics perception from orthodontists and laypeople of three smile parameters: (1) vertical upper central incisor positioning; (2) presence of diastemas in upper lateral incisors area and (3) presence of asymmetries in the upper incisor edges. **Material and Methods:** in order to accomplished our objective three scientific articles were written. **Results:** The most attractive smile were the one with two major characteristics: the central incisors gingival margins matching the laterals and both 0.5 mm below the line of the canines' gingival margins and the central-to-lateral incisal step of 1.5 mm. This smile type did not differ statistically to the one with the centrals gingiva margins matching the canines and the central-to-lateral incisal step of 1.5 mm. Brazilian and US orthodontists and laypersons considered the presence of spacing in the upper lateral incisor area unattractive. Generally, the bigger the diastemas and the more mesial, the less attractive was the smile. For the US orthodontists, US laypeople, and Brazilian laypeople the presence of a 0.5 mm diastema in the distal surface of the lateral incisor did not influence the evaluation process, and thus, was not recognized as unattractive. Generally, tooth wear was considered unattractive following a pattern: the greater the tooth wear the more unattractive the smile; tooth wear in the central incisor was considered more unattractive than tooth wear in the lateral. For both group of

raters the presence of a 0.5 mm wear in the central incisor was considered unattractive while the threshold for lateral incisors discrepancies was 0.5 mm for orthodontists and 1.0 mm for laypersons.

Keywords: Orthodontics; Esthetics; Smile.

1 Introdução e Revisão de Literatura

1 INTRODUÇÃO E REVISÃO DE LITERATURA

Atualmente, a demanda de pacientes adultos que buscam tratamentos estéticos é alta. Muitas vezes inspirados pelos belos sorrisos e pelo padrão de lábios volumosos de artistas da mídia, pacientes mostram-se cada vez mais interessados em reparos que envolvem o sorriso. Nesse sentido, a Ortodontia desempenha fundamental importância na obtenção de estética facial por meio do tratamento das más oclusões.

Para a obtenção da excelência nos resultados ortodônticos é importante a existência de referenciais estéticos ideais para auxiliar o ortodontista no planejamento e finalização dos casos. Há vários parâmetros para a avaliação estética dos pacientes, porém, a maioria deles foi baseada em opiniões clínicas subjetivas de profissionais renomados[3,5,10,11,19] ou, por meio de algumas pesquisas científicas conduzidas fora do Brasil[2,6-9,12,13,15,17,18], enquanto poucos trabalhos foram conduzidos no país[14,16,21].

A partir do pioneiro trabalho de Kokich[8], alguns profissionais buscaram a tecnologia digital, por meio da manipulação de imagens, para criar referenciais mais consistentes cientificamente. Nesse sentido, diversas variáveis do sorriso foram pesquisadas: a dimensão do corredor bucal[12,15], a linha do sorriso[7], a proporção ideal entre os seis dentes anteriores[2,17,18,22], dentre outras.

Do ponto de vista da estética do sorriso, especial atenção tem sido direcionada ao arranjo dos dentes anteriores (canino a canino), chamado na literatura de “zona estética”[3,19,20]. Nessa região, os incisivos centrais superiores são chamados de “elemento chave” e, a terminologia “dominância dos incisivos centrais” também vem sendo utilizada[2,3,6,18,20,22,23].

Assim, algumas características relacionadas a essa área foram pesquisadas. A ausência de exposição gengival durante o sorriso ou a presença desta até 2,0mm é aceitável esteticamente[8,9,21]. A proporção largura/altura dos incisivos centrais superiores parece ser fator decisivo na estética do sorriso e valores entre 75 a 85% foram considerados os mais atrativos[8,18,23]. Para complementar esses dados, alterações da simetria do contorno gengival desses dentes também foram investigadas e, alguns trabalhos mostraram que discrepâncias gengivais maiores do que 2,0mm foram consideradas antiestéticas o que resultaria em proporções largura/altura maiores do que 85%[7-9]. Assimetrias incisais também foram pesquisadas e quando 2,0mm de desgaste incisal assimétrico ocorre em um canino superior este aspecto não é visto como antiestético por ortodontistas e leigos[14]. Outro dado importante encontrado foi que desvios da linha média superior até 2,0mm não possuem efeitos negativos na atratividade dos sorrisos[6,8,14]. Outra variável estudada foi a possibilidade de diastemas medianos influenciarem na estética do sorriso e, observou-se que espaços maiores do que 2,0mm possuem impacto estético negativo[9,16].

Embora diversos referenciais estéticos já tenham sido pesquisados e testados, até a presente data, algumas convenções clínicas encontradas na literatura odontológica ainda não foram elucidados cientificamente. Dentre esses, alguns temas tem despertado a atenção dos profissionais da Odontologia, como: (1) o posicionamento vertical dos incisivos centrais superiores, levando em consideração suas margens gengivais, bem como suas bordas incisais; (2) a presença de diastemas na área dos incisivos laterais

superiores e (3) a presença de assimetrias nas bordas incisais de incisivos centrais e laterais superiores.

O posicionamento vertical dos incisivos centrais superiores é uma característica fundamental na estética do sorriso. Esta característica possui relação direta com diversos procedimentos odontológicos como: restaurações e reabilitações estéticas na região anterosuperior, montagem de próteses parciais e/ou totais e, no posicionamento de bráquetes ortodônticos e/ou dobras em fios ortodônticos na fase de finalização dos casos. Segundo um referencial estético odontológico, consagrado e recomendado em livros-texto e publicações, procura-se nivelar as margens gengivais dos incisivos centrais com os caninos e a dos laterais abaixo desses[3,5,10,11,19]. Embora ortodontistas, bem como profissionais de outras especialidades, utilizem esse parâmetro, o questionamento se este padrão é realmente o mais estético ainda existe.

O impacto da presença de diastemas medianos também é uma característica que já foi estudada[9,16,17]. Outro detalhe interessante é que esses trabalhos testaram a percepção estética avaliando o sorriso numa visão frontal aproximada. De fato, a avaliação frontal aproximada do sorriso é importante, porém, ressalta-se que essa análise estática é limitada e não corresponde à avaliação dinâmica do sorriso na vida real[1,14]. Para contornar esse viés uma estratégia utilizada na literatura foi à utilização da vista lateral do sorriso, em 45º, que também deve ser pesquisada[1]. O aspecto lateral do sorriso deve ser considerado, pois, nessa visão as pessoas avaliam a estética de um ângulo diferente daquele visto numa análise frontal. Assim, aspecto bastante interessante na finalização de casos tratados ortodonticamente é a presença de diastemas na região dos incisivos laterais superiores (nas faces distal ou

mesial). Nesse sentido, estratégia comum adotada pelos ortodontistas é encaminhar os pacientes para a reanatomização estética com resinas compostas. Embora esse procedimento seja consagrado na literatura, do ponto de vista estético, será que ele é necessário? Em outras palavras, da mesma forma que a literatura demonstra que diastemas medianos de até 2,0mm não são antiestéticos[9], será que os espaços na região dos incisivos laterais também não o são?

O impacto estético da presença de assimetrias gengivais na zona estética foi bem documentado na literatura. Quando existe uma assimetria entre centrais e laterais de 2.0mm, ortodontistas e leigos não consideram anti-estético[7,8]. Porém, quando a assimetria ocorre entre centrais, discrepâncias de 0.5mm e 1.5mm são consideradas anti-estéticas por ortodontistas e leigos, respectivamente[9,14]. Embora esses dados ressaltem a importância da presença de simetria entre incisivos centrais, uma interessante pergunta surge: se pequenas assimetrias gengivais são imperceptíveis aos olhos dos leigos, é necessário corrigí-las?

A mesma pergunta pode ser realizada para a presença de assimetrias incisais nos dentes anterosuperiores, que provavelmente, é a maior causa de assimetrias na zona estética. Qual é o limite de aceitação de ortodontistas e leigos frente a essas assimetrias?

De fato, a elucidação desses parâmetros estéticos é fundamental para a condução dos casos clínicos de forma mais objetiva e segura. Porém, faz-se necessário, não somente pesquisar todos esses aspectos, mas também, comparar a opinião técnica dos ortodontistas com outros profissionais e, principalmente com os leigos para criar parâmetros estéticos que estejam em

sintonia com as expectativas dos pacientes. Embora a literatura demonstre que o julgamento dos ortodontistas, na maioria das vezes, seja muito mais crítico que o dos leigos[2,8,9,14,21,23], frente a dificuldades e limitações clínicas, os resultados alcançados pelos primeiros podem satisfazer as expectativas estéticas dos pacientes.

Por fim, torna-se fundamental ainda, comparar a percepção estética de pessoas de diferentes regiões, países e, talvez, continentes. Como exemplo desse assunto, em um trabalho multi-centro[13], seis diferentes grupos raciais (americanos afro-descendentes, caucasianos, chineses, hispânicos, japoneses e coreanos) foram avaliados e diferentes características estéticas foram encontradas nessas populações, como grau de exposição gengival e largura dos incisivos centrais superiores. Sendo assim e, levando em consideração que as populações possuem características diferentes, será que o julgamento estético de diferentes populações é semelhante? Por exemplo, a percepção estética de leigos e ortodontistas americanos é similar aos mesmos grupos de brasileiros? De fato, se os padrões estéticos são influenciados pela cultura, moda, mídia e outras correntes, hipoteticamente, o questionamento se existe concordância entre a percepção estética de pessoas de diferentes países é uma realidade. Esse aspecto torna-se fundamental, pois alguns parâmetros estéticos baseados em normas sustentadas por evidências científicas foram realizadas fora do Brasil e, consequentemente, gerado pela opinião de pessoas de outros países. Sendo assim, esses achados podem não corroborar a percepção estética dos brasileiros invalidando a aplicação de alguns parâmetros estéticos criados em populações estrangeiras.

Por isso, ressalta-se a necessidade da realização de estudos com o objetivo de determinar o padrão ideal de alguns parâmetros estéticos como: (1) a posição vertical da margem gengival e da borda incisal dos incisivos centrais superiores; (2) a presença de diastemas na região dos incisivos laterais superiores e (3) a presença de assimetrias nas bordas incisais dos incisivos centrais e laterais superiores. Além disso, torna-se fundamental a comparação desses achados entre grupos de ortodontistas e leigos e, também, entre pessoas de diferentes países.

2 Proposição

2 PROPOSIÇÃO

Objetivo Geral

Avaliar a influência de variáveis na região anterosuperior na percepção da estética do sorriso por ortodontistas e leigos.

Objetivos Específicos

2.1. Avaliar a influência de modificações no posicionamento vertical dos incisivos centrais superiores, na percepção da estética do sorriso, por ortodontistas e leigos, numa análise fotográfica frontal aproximada do sorriso.

2.2. Avaliar a influência de diastemas na região dos incisivos laterais superiores, na percepção da estética do sorriso, por ortodontistas e leigos (brasileiros e norte-americanos), numa análise fotográfica frontal aproximada do sorriso.

2.3. Avaliar a influência de assimetrias nas bordas incisais de incisivos centrais e laterais superiores na percepção da estética do sorriso, por ortodontistas e leigos, numa análise fotográfica frontal aproximada do sorriso.

Artigo 1

INFLUENCE OF MAXILLARY CENTRAL INCISORS VERTICAL POSITIONING ON SMILE ESTHETICS PERCEPTION *

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ABSTRACT

Objective: determine the smile esthetics perceptions of orthodontists and laypeople to different upper central vertical positions in a frontal smile analysis. **Material and Methods:** a frontal close-up smile photo of a 27 years old Caucasian adult woman was selected for this study. The smile selected had unworn, unrestored and healthy upper anterior teeth and had not undertaken orthodontic treatment. Images were digitally altered in order to create six different central incisors vertical positions in 0.5mm increments. Since vertical modifications in the central incisors affect the gingival margins and also the incisal edges relationships, every image was assessed in three different views: full smile, gingiva close-up and incisal close-up. Final images were randomly assembled in a photo album, which was given to 60 judges, 30 orthodontists and 30 laypersons. Each rater was asked to evaluate the attractiveness of the images in visual analog scales. The data collected was submitted to ANOVA and student t test for statistical analysis. **Results:** generally, the most attractive smiles were the one with the central incisors gingival margins matching the laterals and both 0.5mm below the line of the canines' gingival margins and the one with the centrals gingiva margins matching the canine's. The least attractive smile was the one with the central incisors gingival margins 1.0mm above the canines' gingival margins. When the central-to-lateral incisal step was assessed the most attractive design was the 1.0 and 1.5mm while the least attractive smile was the one without a step. The analysis from the three types of images views indicates that gingival margins has a weak correlation with the overall smile esthetics while the incisal edges relationship plays an important role in the overall smile esthetic analysis. **Conclusion**: The result of this study indicates

that more extruded upper centrals incisors are more esthetically preferred than intruded. Due to the subjectivity of smile esthetics, it is also important to incorporate to the decision-making process patient's opinion and expectations.

Key-words: Esthetics, Smile, Perception, Facial Attractiveness.

INTRODUCTION

In order to accomplish optimal dental esthetic results it is of paramount importance for the clinician to follow esthetic guidelines. For many years these parameters were only based on authors' opinions rather than on evidence based literature.[1-9] These guidelines could be biased since the concept of beauty is tied to great subjectivity and is strongly influenced by the opinions of others.[10-12] For instance, orthodontics and laypeople had showed different perceptions of smile esthetics in a variety of characteristics whereas the first group is more sensitive in detecting deviations from ideal than the latter.[13-18]

In order to provide scientific contributions regarding the evaluation of esthetic guidelines more objectively some studies were undertaken with digital imaging manipulations.[13-27] Thereby, some smile characteristics were better elucidated such as: the smile arc;[13,19-22] the amount of gingival display;[14,15,19,23] the position of the buccal corridors;[13,19,20] the presence of dental and gingival asymmetries;[14-16,19] the influence of a midline diastema;[15,21,24] the impact of midline and long axes deviations[14,16,19] and; upper anterior incisors size, proportion, anatomy and angulation.[17,18,24-27]

Although a great number of smile esthetics guidelines was published, some parameters used as clinical references has not yet been scientific

validated. For instance, upper central incisor vertical positioning, taking into account its gingival margins and also its incisal edges, has been focus of great attention recently. According to a devoted and ubiquitous reference it is recommended in textbooks and clinical articles that the gingival margins of the centrals should match the cuspids and the laterals gently below that line.[1-3,5-8] Although a great number of orthodontists and professionals from other specialties based their esthetic treatment plans in this guideline the question whether this is indeed the most pleasing pattern still remains.

Based in recent papers if one strictly follows this reference can end up creating a smile in which the upper central edges are above than those of the canines which might create an unpleasant smile line so-called flat, reverse or nonconsonant.[8,13,20,28] This aspect becomes even more important because youthful smiles show more upper incisors while older smiles shows less[29]. Therefore, it is clinically recommend that the incisal edges of the maxillary central incisors should appear to be below the tips of the canines, creating a convex appearance which is the so-called convex or consonant smile line.[2]

Although this confirms why the upper central incisors are the key determinant in evaluating smile esthetics[1-3,5,6,9] it also highlights a question: what is the most attractive vertical position of the upper centrals in the smile analysis? The methodology to clarify this question is difficult because when the vertical position of the upper centrals is altered one is not only evaluating the positions of the gingival margins but also the incisal edges. Kokich et al.[14] found that laypeople could not recognize as unattractive a smile in which the gingival margins of the upper centrals were 1.5mm below the line of the canines. When the incisal edges were evaluated the majority of studies that assessed this

variable found that a smile in which the centrals edges are above the canines cusps, creating a reverse smile arc, are considered unattractive.

Although these studies assessed the position of the gingival margins and incisor edges, they were biased because when vertically changing the positions of these lines it results in a modification of the crown length. After analyzing this information, couple of questions can be made. What is the most attractive vertical position of the upper central incisors' gingival margins related to the canine margins? What is the most pleasing vertical position of the upper central incisors' edges related to the lateral edges? In other words, what is the threshold for orthodontists and laypeople when evaluating different vertical positions of central incisors? This information is of paramount importance because it can ultimately assist the clinician to optimize smile esthetics during brackets positioning in the esthetic zone and also during finishing and detailing phases.

Those questions were explored in this study and the objective was to determine the esthetics perceptions of orthodontics and laypersons to different vertical positions of upper central incisors in a frontal smile analysis and also to assess the role of gingival margins and incisal edges in this evaluation. The null hypothesis tested was that different vertical positions are equally ratted as attractive by orthodontists and laypeople.

MATERIAL AND METHODS

A frontal close-up smile photo of a 27 years-old Caucasian adult woman was selected for this study. The smile selected had unworn, unrestored and healthy upper anterior teeth, had not undertaken orthodontic treatment and was

considered highly attractive following some of the subjective principles of an ideal smile described in the literature[1-6], namely: an adequate width/length proportion of the esthetic zone; a 1.0mm gingival display; gingival line of the central incisors matching the canines and the laterals 0.5mm below; upper and lower dental midline even and; central-to-lateral incisal step of 1.0mm.

After selecting the photo, it was digitally altered by using Adobe Photoshop CS3 (Adobe Systems Inc, San Jose, Calif). The photo was manipulated to produce a symmetrical image (left to right) and then, was retouched to adjust color, brightness and contrast and to remove any discoloration in the lips and skin. Then, the image was condensed to achieve an image size that represented the real situation, thus each mm in the image was equivalent to each mm in the patient. In order to do this, measurement of the upper incisor central crown length was considered representative to check the 1:1 magnification. Furthermore, following literature recommendation, a great part of the nose and chin was removed to reduce the number of variables on the images.[14-17,25]

The smile produced was altered in 0.5mm increments and the upper centrals were intruded or extruded, creating six smiles, which was part of a group of images called “full smile” (Table 1) (Figure 1). Then, these images were cropped in the level of the lateral incisor edges creating a group called “gingiva close-up” (Figure 2). Finally, the “full smile” images were also cropped in the level of the lateral incisors gingiva margins creating a group called “incisal close-up” (Figure 3).

Table 1: Characteristics of the smiles used in this study.

Altered Vertical Positions	Central Gingiva Margins	Central incisor edges
A - 0	Matching the canines	1.0mm below the laterals
B - 0.5 down	0.5mm below the canines	1.5mm below the laterals
C - 1.0 down	1.0mm below the canines	2.0mm below the laterals
D - 1.5 down	1.5mm below the canines	2.5mm below the laterals
E - 0.5 up	0.5mm above the canines	0.5mm below the laterals
F - 1.0 up	1.0mm above the canines	Matching the laterals

Final images were digital files with 300 dpi (dots per inch) resolution. They were professionally printed in specialized digital equipment (Minilab Digital Frontier 570, Fuji Film, Manaus, AM, Brazil) on standard A4 size format (29.7cm x 42cm) Kodak Edge Generations paper (Kodak do Brasil, Manaus, AM, Brazil). Then, a photo album was assembled containing all images from each group randomly organized.

The album was given to 60 judges, 30 Brazilian orthodontists, members of the Brazilian Association of Orthodontics and 30 Brazilian laypersons with an university level without dental backgrounds. Each rater was given brief information about the study and was asked to evaluate the attractiveness of the images. Along with the album, each judge received a questionnaire with 100-mm visual analog scales printed for each image, as in previous studies.[10,13-17,21-23,28] In each scale it was labeled on the left-most position “very unattractive” and, on the right-most position, “very attractive.” A slight line was also printed at the middle of each scale to provide an idea of an average level of attractiveness. All judges marked a point along the scale according to their perceptions of smile esthetics. The scores were then measured in millimeters by the first author with an electronic digital caliper (Starrett, Suzhou, China) to determine the respondent’s score.

The data were submitted to statistical analyses with the software SPSS 16.0 (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL, USA). Central tendency and dispersion were calculated and the normal distribution was tested (k-s test). Descriptive statistics were reported as means and standard deviations and data were analyzed by using 1-way analysis of variance (ANOVA) with the Tukey post-hoc test and “t” student test. The level of significance was established at 5%.

RESULTS

From the orthodontist’s standpoint the most attractive smiles was the 0.5mm down (mean 85.13) and the zero position (mean 76.58). The least attractive was the 1.0mm up. According to the laypersons ‘opinion the most attractive smile was the 0.5mm down (mean 86.27), the zero position (mean 80.2) and the 1.0mm down (mean 77.1), while the least attractive was the 1.0mm up (mean 12.61) (Table 2).

Table 2: Orthodontists’ and laypersons’ perception in the ”full smile”.

*Smiles with the same letter did not differ from each other.

Altered Vertical Positions “Full Smile”	Orthodontists			Laypersons			Difference
	Mean	SD	Results	Mean	SD	Results	
0	76.58	12.92	A	80.2	13.2	A	
0.5 Down	85.13	6.93	A	86.27	9.79	A	
1.0 Down	66.83	16.34	B	77.1	13.3	A	
1.5 Down	46.56	15.56	C	61.18	15.56	B	
0.5 Up	34.23	15.87	C	60.91	14.9	B	*
1.0 Up	19.9	14.76	D	39.6	12.61	C	*

The analysis of the “incisal close-up” smiles revealed that for the ortho’s opinion the most attractive was the 0.5mm down (mean 84.54), the zero position (mean 79.53) and the 1.0mm down (mean 73.28). The least attractive was the 1.0 up (mean 22.72). Following the same tendency the group of

laypersons considered the zero position, 0.5mm down and 1.0mm down the most attractive and the 1.0mm up the least (Table 3).

Table 3: Orthodontists' and laypersons' perception in the "incisal close-up "smile. *Smiles with the same letter did not differ from each other.

Altered Vertical Positions "Incisal close-up"	Orthodontists			Laypersons			Difference
	Mean	SD	Results	Mean	SD	Results	
0	79.53	14.07	A	74.15	18.23	A,B	
0.5 Down	84.54	9.83	A	84.63	12.45	A	
1.0 Down	73.28	15.69	A	76.02	12.46	A,B	
1.5 Down	46.5	14.28	B	59.62	23.33	B,C	*
0.5 Up	43.57	16.92	B	70.27	14.88	B	*
1.0 Up	22.72	16.64	C	51.12	17.52	C	*

The assessment from the "gingiva close-up" smiles displayed a different tendency. For the ortho's opinion the most attractive was the 0.5mm down, the zero position and the 1.0mm down, while the least attractive was the 1.0 up. On the other hand, in the layperson's viewpoint no statistical difference was found among all smiles (Table 4).

Table 4: Orthodontists' and laypersons' perception in the "gingival close-up" smile. *Smiles with the same letter did not differ from each other.

Altered Vertical Positions "Gingiva close-up"	Orthodontists			Laypersons			Difference
	Mean	SD	Results	Mean	SD	Results	
0	77.56	16.23	A	78.55	15.87	A	
0.5 Down	76.1	11.97	A	75.01	16.26	A	
1.0 Down	73.4	11.47	A	72.32	19.76	A	
1.5 Down	39.89	15.48	B	63.74	22.71	A	*
0.5 Up	40.32	14.92	B	63.61	21.69	A	*
1.0 Up	23.86	15.05	C	66.57	19.01	A	*

The comparison between both groups of raters showed statistical differences in some situations where laypersons were more tolerant ranking the smiles with higher scores (Tables 1, 2 and 3).

A comparison between males and females was also performed. In the "full smile" evaluation both group's agreed that the most attractive smiles was

the 0.5mm down and the zero position. The least attractive, however, was the 1.5mm down and 1.0mm up for the males and the 1.0mm up the females (Table 5).

Table 5: Males and Female's perception in the "full smile".

*Smiles with the same letter did not differ from each other.

Altered Vertical Positions "Full Smile"	Male			Female			Difference
	Mean	SD	Results	Mean	SD	Results	
0	80.21	13.21	A,B	72.92	12.93	A,B	
0.5 Down	83.72	9.83	A	85.14	6.93	A	
1.0 Down	71.04	11.5	B	69.83	13.35	B	
1.5 Down	55.19	12.95	C	46.56	15.57	C	
0.5 Up	68.58	17.97	B	40.9	16.61	C	*
1.0 Up	39.61	12.62	C	19.9	14.76	D	*

The analysis of the "incisal close-up" smiles revealed that for the males' opinion four smiles was equally rated as most attractive with no statistical difference among them: 0.5mm down, zero position, 1.0mm down and 0.5mm up. The least attractive was the 1.5mm down and the 1.0mm up. On the other hand, females' most attractive ratings was for the 0.5mm down and zero, while the least attractive was the 1.0mm up (Table 6).

Table 6: Males' and females' perception in the "incisal close-up "smile.

*Smiles with the same letter did not differ from each other.

Altered Vertical Positions "Incisal close-up"	Male			Female			Difference
	Mean	SD	Results	Mean	SD	Results	
0	74.15	18.23	A	74.2	19.55	A	
0.5 Down	80.21	13.31	A	84.54	9.83	A	
1.0 Down	72.27	10.1	A	73.28	15.69	A	
1.5 Down	59.62	23.33	B	46.5	14.28	B	
0.5 Up	70.27	14.88	A	43.57	16.9	B	*
1.0 Up	51.12	17.52	B	22.72	16.64	C	*

Similar to the comparison between orthodontists and laypersons the ratings from the “gingiva close-up” smiles displayed a different behavior. For the females‘ opinion the most attractive was the 0.5mm down and zero, while three types of smiles was considered the least attractive: 1.5mm down, 0.5mm up and 1.0mm up. (Table 7).

Table 7: Male’ and Females’ perception in the ”gingival close-up“ smile.

*Smiles with the same letter did not differ from each other.

Altered Vertical Positions “Gingiva close-up”	Male			Female			Difference
	Mean	SD	Results	Mean	SD	Results	
0	80.22	16.21	A	77.56	16.23	A,B	
0.5 Down	75.01	16.26	A	82.77	11.33	A	
1.0 Down	72.32	19.76	A	68.4	13.66	B	
1.5 Down	63.74	22.71	A	39.89	15.48	C	*
0.5 Up	63.61	21.69	A	40.32	14.92	C	*
1.0 Up	66.57	19.01	A	33.86	15.05	C	*

The comparison between males and females’ ratings showed statistical differences in some situations where females were more critical ranking the smiles with lower scores (Tables 4, 5 and 6).

DISCUSSION

The upper central incisors are the key determinant in evaluating smile esthetics and thus, their vertical positioning is an aspect of paramount importance.[1-3,5,6,9] Their vertical placement has implications on different areas such as anterior esthetic restorations; anterior veneer placements; setting of dentures and, orthodontic bracket positioning. Based on the importance of the upper centrals in the smile esthetics it is recommended that an esthetic treatment plan must begin at the upper central incisor area.[1,3,6]

With this in mind, according to a ubiquitous guideline it is recommended that the gingival margins of the centrals should match the canines with the

laterals margins gently below that line.[1-3,5-8] Although a great number of esthetics treatments are based in this clinical assumption no evidence based study was found to support this clinical suggestion.

The methodology to clarify this issue is somewhat difficult because when the vertical position of the upper centrals is altered one is not only evaluating the positions of the gingival margins but also the incisal edges. Some studies was conducted to evaluate the threshold for the presence of gingival asymmetries between centrals and laterals[14-16,19] and also to determine the ideal central-to-lateral incisal step.[19,27] These studies are questionable because during the manipulation of the gingival margins and incisal edges one is not only evaluation these parameters but also altered tooth proportions. Ideally, in order to determine the smile esthetics perception of a characteristic it is necessary to isolate only this aspect during the evaluation process. Thus, we separated the analysis of the “full smile”, “incisal close-up” and “gingiva close-up” in order to quantify the role of gingiva margins and incisor edges to the overall smile assessment.

The analysis of the data from our study showed that in the “full smile” analysis, the smile that had the highest score was the one in which the central incisors gingival margins matched the lateral incisor margins and both were 0.5mm below the canines margins (0.5mm down position). This condition also displayed no statistical difference from the zero position smile, which is the guideline described before. Besides, the most preferred central-to-lateral incisal step was the 1.0-1.5mm. It was also found that the least attractive smile in the “full smile” appraisal was the 1.0mm up. This information shows that a reverse smile line with the central incisors gingiva margins above the canine’s in

conjunction with the absence of a step between central and lateral was a very unpleasant characteristic.

The evaluation of the cropped images showing the incisal edges arrangement had a similar behavior from the “full smile” images. This similarity highlights the role of the incisal edges in the overall smile esthetics. For both groups of raters, the most attractive central-to-lateral incisal steps were the 1.0, 1.5 and 2.0mm with no statistical difference among them. The least attractive incisal edges relationship was the one with no step. The preference for greater steps between centrals and laterals is corroborated by Ker et al.[19] who found an ideal step to be 1.4mm. On the other hand, King et al.[27] found that the most attractive central-to-lateral incisal step was 0.6mm. Since there is a great range of acceptability of this variable, communication to the patient is essential when undertaking treatment planning.

On the contrary, the evaluation of the cropped images showing the gingival margins arrangement had different behavior from the other types of viewing. For the laypersons no statistical difference was found among all smiles showing that gingival margins plays a small role in the overall smile esthetics perception. Our findings are corroborated by the literature that found large thresholds for gingival margins discrepancies.[14-16,19] Some studies have shown that when there is a gingival margin discrepancy between central and lateral incisors, neither laypersons nor dental professionals considered a 2mm discrepancy unesthetic[15,19]. Others complemented that when the gingival margin discrepancy was between the central incisors, a discrepancy of 0.5mm and 1.5mm was considered unattractive by orthodontists and laypersons, respectively.[15,16]

The comparison of the role of gingival margins and incisal edges in the overall smile esthetics perception has a profound clinical relevance. According to our findings the first aspect has a weak correlation while the latter has a strong correlation with the smile esthetic analysis. Ultimately, the contour of the incisal edges is the isolated most important variable in the smile esthetics.[15]

With this in mind, in a clinical situation to decide what is the ideal vertical position of the upper centrals, the clinician should give more priority to correcting the incisal discrepancies instead of the gingival asymmetries. Based on the data of our paper and previous studies,[14-16,19] orthodontists and laypeople are more tolerant to gingival asymmetries than incisal edge discrepancies. Thus, since the threshold for gingival asymmetry is large, it makes more sense to guarantee an ideal central-to-lateral incisal step. This finding corroborates the platinum rule that states that the incisal edges sets the gingival levels.[6]

In this way, if an orthodontists strictly follows the reference that states that the centrals gingiva margins should match the canines, can end up creating a smile in which the upper central incisal edges are above than those of the canines which may create an unpleasant smile line so-called flat, reverse or nonconsonant.[8,13,20,28] On the other hand, if proper vertical position of the upper centrals is achieved with their incisal edges appearing to be below the tips of the canines, a convex smile appearance is accomplished, which is the so-called convex or consonant smile line.[2] Clinically, the positions of the incisors edges should follow the lower lip[1-3,6] and thus, this aspect needs to be evaluated to assist in the placement of the upper centrals edges.

The results of this study disclosed a paramount clinical importance for the orthodontist. During brackets placement small differences in the position of the upper centrals can generate a great impact in the smile esthetics. A variety of brackets prescriptions recommendations suggest that upper centrals brackets position (X) should be identical to the canine (X)[30] or gently above the position of the canines (X + 0.25; X + 0.5; X + 1.0)[31,32,33]. Interesting, if we use the same brackets height for centrals and canines and consider that they have the same anatomical crown length, after proper aligning and leveling phases, their gingival margins will be even. According to our results, if central margins match the canines' or are 0.5-1.0mm below smile esthetics are considered very attractive. However, if central margins are above the canines' in even a small deviation (0.5mm) the smile was considered very unattractive. Therefore, we suggest that since placement of upper centrals has a profound clinical relevance in the smiles esthetics the clinician carefully evaluate this aspect before bonding brackets in the esthetic zone. Ultimately, upper centrals incisors should appear more extruded than intruded in order to guarantee youthful smiles.

In this study, we surveyed orthodontists and laypeople. The first group was selected because previous studies showed that they are the most sensitive group in detecting deviations from ideal.[13-18,20,23] The latter was chosen because they are the primary consumers of dental services, instead of practitioners, who are providers of care.[19] Following the tendency of the literature, these examiners showed different esthetics perceptions.[13-18] In most situations, orthodontists were more critical in their evaluations. However, for the most attractive smiles, both groups displayed no statistical difference. It can be

hypothesized that an ideal smile arrangement can easily be recognized by any group of raters, but when smaller deviations are included, they start to show differences in their judgments.

The main differences between orthodontists and laypersons were their thresholds for gingival margins and incisal edges altered positions. For the orthodontists, in the “full smile“ appraisal, a 0.5mm gingival margin deviation was considered accepted whereas for the laypersons the threshold was 1.0mm. At the same time, the orthodontists’ threshold for centrals-to-laterals incisal step was 0.5mm and 1.0mm for laypersons. Those results suggest that the treatment of minor vertical position discrepancies might reflect an exaggerated concern by dental specialists rather than an esthetic need.[13]

Another aspect tested was a possible difference between the judgments of men and women. This issue is somewhat controversial with a study showing that female evaluators gave statistically significant higher scores than males[34] while another paper concluded that males were less critical than females when evaluating smile esthetics.[35] It seems that this debate is related to the smile characteristics evaluated. In our study, the comparison between males and females was similar to the one between orthodontists and laypersons. In most situations, females were more critical in their evaluations. However, for the most attractive smiles, both groups displayed no statistical difference while they differ statistically for the least attractive smiles. In those situations, male evaluators gave statistically significant higher scores than female.

Interestingly, the comparison between males and females showed two major differences in their esthetics preferences. The first aspect is that in the “full smile” and ”incisal close-up” assessment, males were more tolerant to a

small central-to-lateral incisal step (0.5mm up smiles). In other words, it can be stated that men's level of acceptability for a flat smile is larger than women. The second point is that male raters were not able to differentiate any type of smiles in the "gingival close-up". Thus, it can be hypothesized that female raters are more sensitive in detecting gingiva margins deviations than male. This finding indicates that esthetics preferences for central incisors vertical positions could be influenced by sex. Therefore, as stated before, dental professionals should enhance their communication with patients to guarantee more accurate results.

This study was conducted with manipulated computer digital images to try to simulate clinical situations. In this way smile images were manipulated in 0.5mm increments because presentation of large incremental differences between images may obscure the true threshold of acceptability.[19] The reason for using small increments is also related to the human visual acuity. According to the literature at a normal viewing distance (18 inch – 45 cm) the normal human eye can resolve features that are 1/200 of an inch in size.[36,37] In other words, one can distinguish two objects that are separated by 0.12mm.[36,37] This information explains and justify why both groups of raters could notice a 0.5mm asymmetric smile, even though with different judgments and level of acceptability.

Finally, it is important to remember that since this study used computer manipulated smile images from one patient, and the opinion of specific groups of individuals, the results should be carefully analyzed. As stated by Kokich et al.[15], since the results and conclusions are based on averages, it is difficult to customize this information to a patient due to the subjectivity of smile esthetics evaluation. In addition, upper central incisors ideal positioning may be a very

sensitive approach and could be related to age, sex, tooth anatomy, upper and lower design, etc. Therefore, we support their suggestion to discuss the results of this study with patients then, decide what is the most attractive central incisors vertical position.

CONCLUSION

- The most attractive smile were the one with two major characteristics: the central incisors gingival margins matching the laterals and both 0.5mm below the line of the canines' gingival margins and the central-to-lateral incisal step of 1.5mm. This smile type did not differ statistically to the one with the centrals gingiva margins matching the canines and the central-to-lateral incisal step of 1.5mm.
- The least attractive smile was the one with the central incisors gingival margins 1.0mm above the canines' gingival margins and no step between centrals and laterals.
- The analysis of the three types of image views indicates that gingival margins has a weak correlation with the overall smile esthetics while the incisal edges relationship plays an important role in the overall smile esthetic analysis.
- In the most unattractive smiles, orthodontists gave statistically lower scores than laypersons. However, for the most attractive smiles, both groups displayed no statistical difference.
- It can be hypothesized that an ideal smile arrangement can easily be recognized by any group of raters, but when smaller deviations are included, they start to show differences in their judgments.

- Male raters were more tolerant to reverse gingival line (0.5mm up) and small central-to-lateral incisal step (0.5mm). They also were not capable in detecting gingival deviations ranking all smiles equally.

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FIGURES AND LEGENDS

Figure 1: Full smile view in 0.5-mm altered vertical positions increments.

Figure 2: Incisal close-up view in 0.5-mm altered vertical positions increments.

Figure 3: Gingiva close-up view in 0.5-mm altered vertical positions increments.

Artigo 2

INFLUENCE OF SPACING IN THE UPPER LATERAL INCISOR AREA ON SMILE ESTHETICS PERCEPTION *

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ABSTRACT

Objective: Determine the esthetic perceptions of orthodontists and laypeople from different countries (US and Brazil) when analyzing the presence of diastemas in the upper lateral incisor in the mesial, distal, and both surfaces using an oblique smile analysis. **Material and Methods:** Two standardized oblique photos of pleasant smiles from adult white women, between 25 and 30 years old, were selected for this study. Both women had undergone orthodontic treatment, one nonextraction, and the other with four first bicuspid extractions. Images were digitally altered in order to create diastemas adjacent to the lateral incisor area in 0.5mm increments in the mesial, distal or both sides of the laterals. Final images were randomly assembled in a photo album, which was given to 120 judges: 30 Brazilian orthodontists, 30 US orthodontists, 30 laypeople from Brazil, and 30 from the US. Each rater was asked to evaluate the attractiveness of the images in visual analog scales. The data collected was submitted to ANOVA and t student test for statistical analysis. **Results:** The most attractive smile in both types of images (extraction and nonextraction) was the one without spacing and presence of diastemas were considered unattractive by all groups of raters following a pattern: the bigger and the more mesial located, the more unattractive was the smile. For US orthodontists, US laypeople, and Brazilian laypeople, the presence of a 0.5mm diastema in the distal surface of the lateral incisor did not influence the evaluation process, and thus, was not recognized as unattractive. **Conclusion:** The results of this study suggest that if a diastema is to be present in the esthetic zone, the distal aspect of the lateral incisor should be taken as the first choice. It is also important to

incorporate the patient's opinion and expectations in the decision-making process.

INTRODUCTION

In recent years, facial esthetics has become a major focus for the public worldwide. Among patients primary concerns, the pursuit of beautiful and youthful smiles are routine in dental offices. Some studies have shown that an improvement in dental aesthetics provides a significant enhancement in adult patients' quality of life, highlighting the psychosocial importance and significance of an attractive smile.[1-3] Therefore, it is of paramount importance for the clinician to follow esthetic guidelines for the optimal treatment result. Previously, theses esthetic parameters were only based on authors' opinions rather than on evidence based literature.[4-8]

The concept of beauty is still very subjective, and is not only strongly influenced by the opinions of others, but also the cultural preferences related to smile characteristics.[1,9,10] For instance, in comparing a variety of characteristics, orthodontists and laypeople showed differing perceptions of smile esthetics, whereas the first group was more sensitive to detect deviations from ideal.[11,15-17,19,20]

In order to provide scientific contributions regarding the evaluation of esthetic guidelines, more objective studies were conducted with digital imaging manipulations.[11-24] Thereby, some smile characteristics were better elucidated such as: the smile arc;[11-14] the amount of gingival display;[12,15,16,24] the type of buccal corridors;[11-13] the presence of dental and gingival asymmetries;[12,15-17] the presence of a midline diastema;[14,16,18] the influence of midline and long axes

deviations;[12,15-17] and; upper anterior incisors size, proportion, anatomy and angulation.[18-22]

For the constitution of a harmonic and pleasant smile, the presence or absence of spacing in the esthetic zone is of fundamental importance. Some authors have studied the impact of a midline diastema on smile esthetics. Kokich et al.[16] encountered that a small midline diastema between 1.0 and 1.5mm was not rated as unattractive by orthodontists, dentists and laypeople. On the contrary, Rosenstiel and Rashid[18] found that a smile with no midline diastema was preferred in 96.6% of the judges when compared to a smile with a 0.5mm diastema. To support this idea, a similar study digitally created four different unpleasant characteristics in a smile and found that among all variables, the least attractive smile was one with a 1.0mm midline diastema.[14]

Interestingly, all studies conducted regarding the esthetic effect of a midline diastema used smile photographs in the frontal view.[14,16,18] This evaluation is indeed important, but in some cases it doesn't provide a full view and dynamic evaluation of the smile.[23,25] A different strategy suggested in the literature was to use an oblique or a profile view of the smile.[22,23] In the finishing of orthodontic cases, the presence of diastemas, not at the midline, but at mesial and distal surfaces of upper laterals is of paramount importance. At the end of treatment, when minor spaces are present, a very common approach is to restore them with composite resins. In those situations, an interesting question arises: Esthetically, are those spaces going to be recognized? In other words, since literature has shown that small midline diastemas are not considered unattractive[16], does spacing in the upper lateral area follow the same pattern? Furthermore, if a clinician needs to leave a space in that area,

what is the least attractive area, mesial or distal? Finally, another important question that could also be addressed is if individuals from different countries have varying opinions on smile characteristics.

The previous questions were explored in this paper, and the objective of this collaborative multicenter study was to determine the esthetic perceptions of orthodontists and laypeople from two countries (US an Brazil) regarding the presence of diastemas at mesial, distal and both surfaces of the upper lateral incisor in an oblique smile analysis. The null hypothesis is that the perception of attractiveness with or without the diastema, is rated similarly by US and Brazilian orthodontists and laypeople.

MATERIAL AND METHODS

Two standardized oblique photos displaying pleasant smiles of adult white women, between 25 and 30 years old, were selected for this study. Both women had undergone orthodontic treatment, one with no extractions and the other with four first bicuspid extractions. The smiles used in this study were considered highly attractive, and followed many of the principles of an ideal smile described in the literature[4-6,8], namely: an adequate width/length proportion of the esthetic zone; a consonant smile arc; gingival display less than 1.0mm; gingival line of the central incisor matching the canine and the lateral slightly below and; progressive increase in depth of teeth embrasures from the central to the canine.

After selecting the photos, they were digitally altered by using Adobe Photoshop CS3 (Adobe Systems Inc, San Jose, Calif). The images were retouched to adjust color, brightness and contrast and to remove any

discoloration in the lips and skin. Next, both images were condensed to achieve an image size that represented the real situation, thus each mm in the image was equivalent to each mm in the patient. In order to do this, measurement of the lateral crown length was considered representative to check the 1:1 magnification. Furthermore, following the recommendation of the literature, the nose and chin were removed to reduce the number of variables on the images.[15-17, 19-21]

In order to create the diastemas, the lateral incisor was unaltered, and the anterior and posterior segments were manipulated. Each new image created was altered in 0.5mm increments in the mesial, distal or both sides of the laterals. The reference points for these measurements in both mesial and distal surfaces were the middle point of the lateral incisors height. In all images, the gingival margins, papillary heights, and the incisal edges were not altered. Finally, for both photos 10 new images were created (Figs 1 and 2).

Final images were digital files with 300 dpi (dots per inch) resolution. They were professionally printed in specialized digital equipment (Minilab Digital Frontier 570, Fuji Film, Manus, AM, Brazil) on standard A4 size format (29.7cm x 42cm) Kodak Edge Generations paper (Kodak do Brasil, Manaus, AM, Brazil). Then, a photo album was assembled containing all images randomly grouped.

The album was given to 120 judges: 30 Brazilian and 30 US orthodontists, 30 Brazilian and 30 US laypersons at university level without dental backgrounds. Each rater was given brief information about the study and was asked to evaluate the attractiveness of the images. Along with the album, each judge received a questionnaire with 100-mm visual analog scales printed for each image, as in previous studies.[11,13-17,19] In each scale it was labeled on

the left-most position “very unattractive” and, on the right-most position, “very attractive.” A slight line was also printed in the middle of each scale to provide an idea of an average level of attractiveness. All judges marked a point along the scale according to their perceptions of smile esthetics. The scores were then measured in millimeters by the first author with an electronic digital caliper (Starrett, Suzhou, China) to determine the respondent’s score.

The data was submitted for statistical analyses with the software SPSS 16.0 (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL). Central tendency and dispersion were calculated and the normal distribution was tested with Kolmogorov-Smirnov test. Descriptive statistics were reported as means and standard deviations and data were analyzed by using 1-way analysis of variance (ANOVA) with the Tukey post-hoc test and “t” student test. The level of significance was established at 5%.

RESULTS

From the Brazilian orthodontist’s standpoint the most attractive images in the “nonextraction” smile was the one with no spacing (mean 92.72) followed by the 0.5mm at the distal incisor group (mean 74.01). The least attractive was the group with 1.5mm spacing at the distal and mesial surfaces (mean 6.37). According to the US orthodontist’s opinion the most attractive smile was the one with no spacing (mean 92.27) and the 0.5mm distal (mean 86.71), while the least attractive was the 1.5mm mesial (mean 15.41) and 1.5mm mesial and distal (7.59) (Table 1).

Table 1: Brazilian and US Orthodontists' perception in the nonextraction smile.

*Smiles with the same letter did not differ from each other.

Nonextraction smile							
Spacing	Brazilian Orthodontists			US Orthodontists			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No spacing	92.72	6.26	A	92.27	7.08	A	
0.5 Distal (D)	74.01	11.58	B	86.71	11.92	A	**
1.0 Distal (D)	37.8	12.09	D	53.52	17.61	B	**
1.5 Distal (D)	25.32	13.35	E	32.42	13.72	C	**
0.5 Mesial (M)	49.49	12.42	C	55.19	15.73	B	
1.0 Mesial (M)	19.34	11.27	E,F	21.47	12.80	D	
1.5 Mesial (M)	15.71	10.10	F	15.41	8.49	D,E	
0.5 M and D	43.95	12.17	C,D	47.77	13.19	B	
1.0 M and D	18.06	10.41	E,F	22.57	10.20	D	
1.5 M and D	6.37	5.51	G	7.59	10.19	E	

Table 2: Brazilian and US Orthodontists' perception in the nextraction smile.

*Smiles with the same letter did not differ from each other.

4 premolars extraction smile							
Spacing	Brazilian Orthodontists			US Orthodontists			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No spacing	92.64	5.78	A	91.42	4.09	A	
0.5 Distal (D)	71.92	8.55	B	85.86	10.67	A	**
1.0 Distal (D)	40.53	17.9	C	53.24	13.46	B	**
1.5 Distal (D)	25.45	15.37	D	33.00	13.82	C	**
0.5 Mesial (M)	46.09	7.64	C	49.08	10.98	B	
1.0 Mesial (M)	18.54	14.32	D,E	22.85	13.95	C,D	
1.5 Mesial (M)	14.08	8.64	E,F	14.08	8.65	E	
0.5 M and D	40.01	10.79	C	49.26	12.54	B	
1.0 M and D	25.13	9.55	D	23.76	9.14	D,E	
1.5 M and D	6.86	7.17	F	7.92	10.69	F	

A similar result was found in the "extraction" smiles. For the Brazilian ortho's opinion the most attractive was the smile without spacing (mean 92.64) followed by the 0.5mm distal group (mean 71.92) and the least attractive was the 1.5mm mesial and 1.5mm mesial and distal (mean 6.86). However, for the US orthodontists the 0.5mm distal smiles ratings had no statistical difference compared to the no spacing smile (Table 2).

The perception between Brazilian and US orthodontists showed some statistical differences in certain situations. In both types of smiles the Brazilian orthodontists were more critical giving lower scores in the 0.5mm distal, 1.0mm distal and 1.5mm distal (Tables 1 and 2).

From the Layperson's opinion, the group of Brazilian and US displayed similar behavior in the majority of situations. For both groups the most attractive images in the "nonextraction" smile was the one with no spacing and the 0.5mm distal and the least attractive was the 1.5mm mesial and distal. In the evaluation of the 1.0mm distal smile these groups differed statistically, with the US laypersons being less critical (Table 3).

Table 3: Brazilian and US Laypersons' perception in the nonextraction smile.

*Smiles with the same letter did not differ from each other.

Nonextraction smile							
Spacing	Brazilian Laypersons			US Laypersons			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No spacing	90.45	7.37	A	91.99	7.31	A	
0.5 Distal (D)	87.13	5.15	A	89.86	7.16	A	
1.0 Distal (D)	44.45	15.97	C	57.88	16.79	B,C	**
1.5 Distal (D)	34.41	10.59	D	36.21	13.67	D	
0.5 Mesial (M)	61.45	12.27	B	61.73	9.89	B	
1.0 Mesial (M)	27.51	14.18	D,E	29.06	13.14	D,E	
1.5 Mesial (M)	26.98	14.73	D,E	26.62	10.92	E	
0.5 M and D	54.28	14.5	B	51.82	13.91	C	
1.0 M and D	24.68	10.05	E	24.77	9.44	E	
1.5 M and D	14.96	7.73	F	11.64	7.47	F	

The same tendency was found in the US and Brazilian laypersons' ratings from the "extraction" smile. The most attractive was the smile with no spacing and the 0.5mm distal, while the least attractive was the 1.5mm mesial and distal. However, these groups of raters differed statistically in three situations, 1.0mm distal, 1.5mm distal and 0.5mm mesial. Again, the US laypersons 'scores were lower than the Brazilian laypersons (Table 4).

Table 4: Brazilian and US Laypersons' perception in the extraction smile.

*Smiles with the same letter did not differ from each other.

4 premolars extraction smile							
Spacing	Brazilian Laypersons			US Laypersons			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No spacing	90.33	6.42	A	92.31	4.9	A	
0.5 Distal (D)	87.25	4.79	A	88.13	5.19	A	
1.0 Distal (D)	41.75	11.59	C	59.61	15.26	B	**
1.5 Distal (D)	26.7	13.52	D	35.15	10.34	C	**
0.5 Mesial (M)	57.72	7.26	B	59.37	10.51	B	
1.0 Mesial (M)	27.29	13.88	D	30.67	17.55	C,D	
1.5 Mesial (M)	20.61	11.93	D	25.11	11.28	D,E	
0.5 M and D	41.86	9.41	C	50.98	16.26	B	**
1.0 M and D	26.11	9.92	D	20.88	8.39	E	
1.5 M and D	10.62	4.51	E	8.54	4.37	F	

The behavior of the US orthodontists were statistically similar to the US laypeople in the majority of situations ($p > 0.05$) except for the 1.0mm mesial and 1.5mm mesial for the smile without extractions, and the 0.5mm mesial and 1.5mm mesial for the smile with extractions ($p < 0.05$).

On the contrary, the judgment of the Brazilian orthodontists were statistically different from the Brazilian laypeople group in the majority of the situations with the first evaluating the images with lower scores ($p < .05$). The few situations where no statistical difference was displayed were in the no spacing and 1.0mm distal images for the smile without extractions ($p > .05$). In the images from the smile with extractions they showed no statistical difference in half of the images ($p > .05$).

DISCUSSION

The presence or absence of spaces in the esthetic zone plays an important role in the perception of smile esthetics. The results of this study indicate that in the orthodontists and laypeople's opinion, spaces in the upper

lateral area (mesial, distal or both surfaces) are considered unesthetic, and the most attractive image for all groups of raters was the smile without spacing.

This result is corroborated by Rosenstiel and Rashid[18], who found in a web-based study that 96.6% of the judges preferred a smile without spacing compared to a smile with a 0.5mm midline diastema. Rodrigues et al.[14] also found that among four esthetics variables tested, the presence of a 1.0mm midline diastema had a negative influence on smile evaluation.

The amount and location of the diastemas was also important information regarding the perception of esthetics. When the three areas with spaces were analyzed (mesial, distal and both), it was found that the bigger the space the least attractive the image was rated. Depending on the group of raters, the only smile that had no statistical difference compared to the smile without spacing was the 0.5mm in the distal surface. In other words, for US orthodontists, US laypeople and Brazilian laypeople the presence of a 0.5mm diastema in the distal surface of the lateral incisor did not influence the evaluation process, and thus, was not recognized as unattractive. On the other hand, this 0.5mm threshold was not corroborated by Kokich et al.[16], who found a 1.0-1.5mm threshold for orthodontists and 2.0mm for laypeople when evaluating the presence of a midline diastema in the perception of smile esthetics.

Based on the data from this study, the clinician should first measure the amount of space and then decide if a restoration is necessary. Kokich et al.[16] noted that in some situations; if smaller deviations are not recognized as unattractive, why refer the patient for cosmetic restorations that would eventually need to be replaced? In addition, literature shows that a composite

restoration accumulates more biofilm than natural enamel and also is more prone to discolorations with time.[26-29]

Another aspect that can assist the clinician is the question, if a space is to be left, which area is the least attractive: mesial, distal or both? From a clinical standpoint, one would decide to leave the space in the distal because it is farther from the midline and thus more difficult to see. This clinic assumption was corroborated in this study. Generally, for all groups of raters, the smiles with spaces in both surfaces (mesial and distal) were the least attractive, followed by the mesial surfaces and distal surfaces. Therefore, from the esthetic point of view, the data from this study recommends the distal surface of the upper lateral incisor as the best area to leave spaces for future restorations. In this way, Kokich et al.[16] corroborated this idea and pointed out that if a restoration is to be performed in the distal surface, the most overcontouring will be in this area, which will be less noticeable[16].

In this study, we surveyed orthodontists and laypeople. The first group was selected because previous studies showed that they are the most sensitive group in detecting deviations from ideal.[11,13,15-17,24] The latter group was chosen because they are the primary consumers of dental services, instead of practitioners, who are providers of care.[12] This strategy was very important because literature shows that orthodontists have different opinions from laypeople. Another issue that has been discussed recently in the literature is that possible cultural differences may exist related to smile characteristics preferences.[1,9,10] For this reason we used two different groups of raters, orthodontists and laypeople, from different countries.

Generally, when Brazilian orthodontists opinion was compared to Brazilian laypersons', the first group was more critical than the latter, rating the smiles with lower scores. This result corroborates the literature stating that orthodontists are more sensitive in detecting deviations from ideal.[11,15-17,19,20] On the other hand, the US orthodontists group displayed similar behavior compared to US laypeople on the majority of situations.

The comparison between inter-continental groups of raters showed different behaviors. In both types of smiles (with and without extraction) the groups of US and Brazilian orthodontists showed statistical differences in the evaluation of the images with spaces (0.5, 1 and 1.5mm) at the distal surface of the lateral incisor. In those situations, US orthodontists group rated the images with higher scores. Since this kind of comparison was not found in the literature, it is difficult to explain this result. However, It is important to rationalize this data because it does not indicate that Brazilian orthodontists are more critical than US orthodontists. It only showed that in this study the US orthodontists were more acceptable to the presence of diastemas in the distal surface of the upper lateral incisor compared to Brazilian orthodontists. On the other hand, from the laypeople viewpoint, the US and Brazilian group showed similar perception in the majority of situations. This result is in contrast to McLeod et al.[9], which found that Canadian laypersons, on average, were more discriminating to deviations from ideal than the US laypersons group.

It is important to highlight that the key aspect of this discussion is not which group is more or less critical, but to consider that different patients from different countries, may have different expectations about what is the ideal

smile arrangement. Therefore, it is vital to customize the smile esthetic guidelines to each patient in order to guarantee more acceptable clinical results.

This study was conducted with manipulated computer digital images to try to simulate clinical situations. In this way smile images were manipulated in 0.5mm increments because presentation of large incremental differences between images may obscure the true threshold of acceptability.[12] The reason for using small increments is also related to the human visual acuity. According to the literature at a normal viewing distance (18 inch – 45 cm) the normal human eye can resolve features that are 1/200 of an inch in size.[30,31] In other words, one can distinguish two objects that are separated by 0.12mm.[30,31] This information explains and justify why all groups of raters could notice the presence of minor diastemas (0.5mm), even though, depending on the location and amount, with different judgments and level of acceptability.

In order to simulate clinical ortho conditions, we used close-up photos of orthodontically treated attractive smiles from 2 very common clinical situations, a nonextraction and a 4-bicuspid extraction case. Since we only used one smile of a nonextraction and one of an extraction case from different patients, the establishment of a comparison between those images was not possible. The primary objective was to survey the impact of the presence of diastemas in the upper lateral incisor area in two clinical situations: extraction and nonextraction cases. Although this was not the purpose of this study, literature shows no smile esthetic differences between extraction and nonextraction cases.[32,33]

Even though one might argue that the evaluation of the smile level of attractiveness should consider the overall facial analysis (such as nose, hair, eyes), we used only a close-up assessment because literature showed no

difference between the two types of smile evaluations, the close-up and the facial smile photo.[14, 24]

Interestingly, previous studies evaluating the effect of spaces in the esthetic zone (i.e. midline diastema) used smile photographs in the frontal view.[14,16,18] This study used an oblique view because it provides a more dynamic evaluation of the smile and a similar view to that at some moments of interpersonal daily interactions.[23] In addition, since the presence of spaces surveyed was in both the mesial, distal, and both surfaces, a frontal assessment would have compromised the evaluation process of the distal spaces.

Finally, it is important to remember that since this study used computer manipulated images from two patients, and the opinion of specific groups of individuals, results should be carefully analyzed. As stated by Kokich et al.[16], since the results and conclusions are based on averages, it is difficult to customize this information to a patient due to the subjectivity of smile esthetics evaluation. Therefore, we corroborates their suggestion to discuss the result of this study with patients in which spaces are to be left at the lateral area and then, decide whether to close it orthodontically, leave it or refer for a cosmetic restoration.

CONCLUSIONS

1. Generally, the most attractive smile in both types of images (extraction and nonextraction) was the one without spacing, and the presence of spaces in the upper lateral area (mesial, distal or both surfaces) was considered unattractive by all groups of raters.

2. For US orthodontists, US laypeople, and Brazilian laypeople the presence of a 0.5mm diastema in the distal surface of the lateral incisor did not influence the evaluation process, and thus, was not recognized as unattractive.
3. Generally, Brazilian orthodontists were more critical than Brazilian laypersons, rating the smiles with lower scores. On the other hand, the group of US orthodontists displayed similar behavior compared to the US laypeople on the majority of situations.
4. US and Brazilian orthodontists showed statistical differences in the evaluation of the smiles (in both extraction and nonextraction cases) with spaces (0.5, 1 and 1.5mm) at the distal surface of the lateral incisor, where the first group rated the images with higher scores. On the contrary, from the laypeople viewpoint, US and Brazilians showed similar perception in the majority of situations.

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FIGURES AND LEGENDS:

Figure 1: Nonextraction smile diastemas in 0.5-mm increments (**A,** control; **B,** 0.5 mm mesial; **C,** 1.0 mm mesial; **D,** 1.5 mm mesial; **E,** 0.5 mm distal; **F,** 1.0mm distal; **G,** 1.5 mm distal; **H,** 0.5 mm mesial and distal; **I,** 1.0 mm mesial and distal, **J,** 1.5 mm mesial and distal.

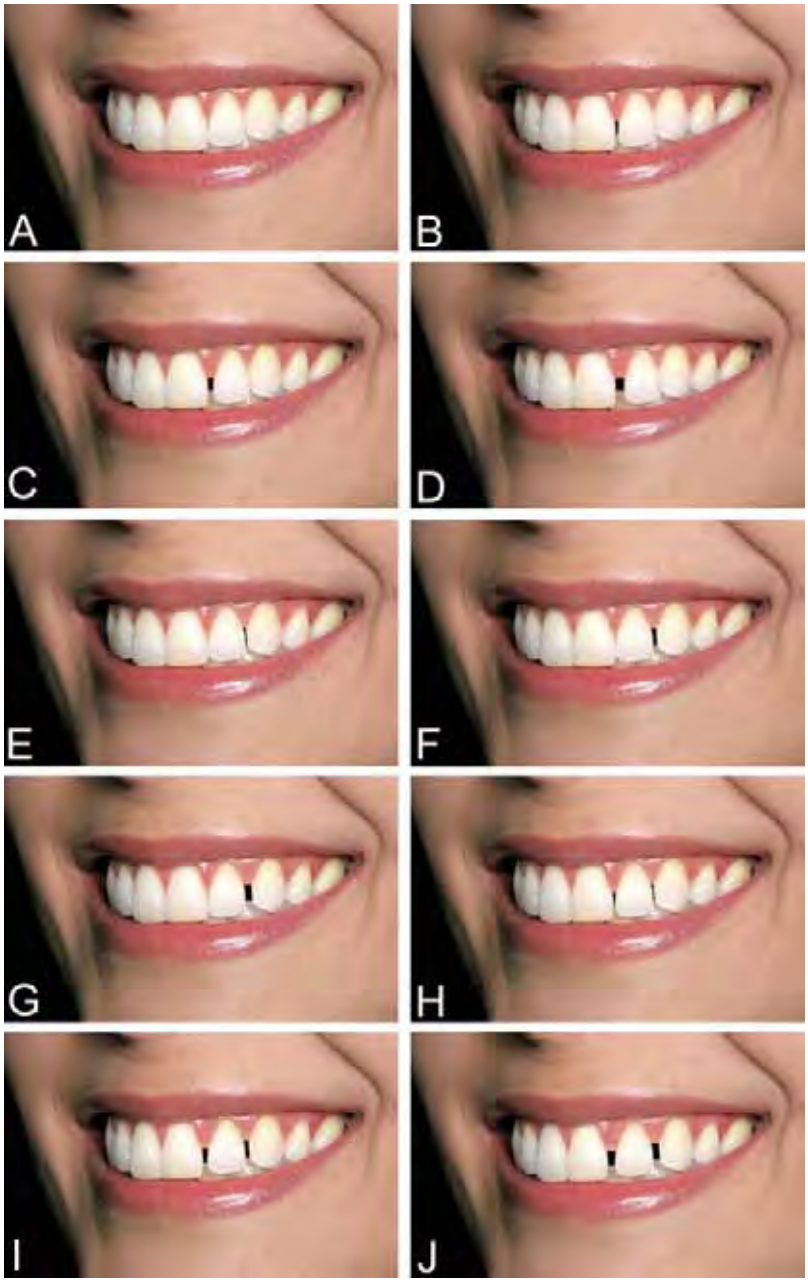

Figure 2: Extraction smile diastemas in 0.5-mm increments (**A,** control; **B,** 0.5 mm mesial; **C,** 1.0 mm mesial; **D,** 1.5 mm mesial; **E,** 0.5 mm distal; **F,** 1.0mm distal; **G,** 1.5 mm distal; **H,** 0.5 mm mesial and distal; **I,** 1.0 mm mesial and distal, **J,** 1.5 mm mesial and distal.

Artigo 3

INFLUENCE OF UPPER INCISOR EDGES ASYMMETRIES ON SMILE ESTHETICS PERCEPTION *

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ABSTRACT

Objective: compare the smile esthetics perceptions of orthodontists and laypeople regarding the presence of asymmetries in the upper incisors edges in a frontal smile analysis. **Material and Methods:** two standardized frontal photos of pleasant smiles of two adult women, one white and one afro-brazilian, between 25 and 30 years old, were selected for this study. Both women had unworn, unrestored and healthy upper incisors and had not undertaken orthodontic treatment. Images were digitally altered to create tooth wear in the upper left incisors in 0.5mm increments. Final images were randomly assembled in a photo album, which was given to 60 judges, 30 orthodontists and 30 laypersons. Each rater was asked to evaluate the attractiveness of the images in visual analog scales. The data collected was submitted to ANOVA and student t tests for statistical analysis. **Results:** the most attractive smiles in both types of images white and afro-brazilian was the one without asymmetries and the 0.5mm in the lateral incisor. Generally, tooth wear was considered unattractive by all groups of raters following a pattern: the more tooth wear the more unattractive the smile; tooth wear in the central incisor was considered more unattractive than tooth wear in the lateral. For both group of raters the presence of a 0.5mm wear in the central incisor was considered unattractive while the threshold for lateral incisors discrepancies was 0.5mm for orthodontists and 1.0mm for laypersons. **Conclusion**: The result of this study corroborates the clinical assumption that the presence of symmetry between upper central incisors is a paramount goal for esthetic treatments. It is also important to incorporate in the decision-making process patient's opinion and expectations.

Clinical Significance: The result of this study showed that for laypeople and orthodontists the presence of a slight asymmetry (0.5mm) between the central incisors edges was considered unattractive. This finding corroborates the clinical assumption that the presence of symmetry between upper central incisors is a paramount goal for esthetic treatments.

INTRODUCTION

If optimal esthetic results is desired in a treatment planning it is of paramount importance for the clinician to follow esthetic guidelines. For many years these parameters were only based on authors' opinions rather than on evidence based literature.[1-6] These guidelines could be biased since the concept of beauty is tied to great subjectivity and is strongly influenced by the opinions of others.[7-9] For instance, orthodontists and laypeople have shown different perceptions of smile esthetics in a variety of characteristics where the first group tends to be more sensitive in detecting deviations from ideal lay people.[10-15]

In order to provide scientific contributions regarding the evaluation of esthetic guidelines more objectively some studies were undertaken with digital imaging manipulations.[10-22] Thereby, some smile characteristics were better elucidated such as: the smile arc;[10,16-28] the amount of gingival display;[11,12,16,19] the type of buccal corridors;[10,16,17] the presence of dental and gingival asymmetries;[11-13,16] the presence of a midline diastema;[12,18,20] the influence of midline and long axes deviations[11,13-16] and; upper anterior incisors size, proportion, anatomy and angulation[14,15,20-22].

Although a great number of smile preferences have been published, the most important region in the smiles analysis is the arrangement of the six upper anterior teeth, the so-called “esthetic zone”. In this way, an esthetic treatment plan must begin at the upper central incisor area[1,3,6] and thus, the presence of dental and gingival asymmetries must be carefully analyzed[11-13,16].

The impact of gingival asymmetries in the smile esthetics perception is well documented in the literature. When there is a gingival margin discrepancy between the central and lateral incisors, neither laypersons nor dental professionals considered a 2mm discrepancy unesthetic[12,16]. However, when the gingival margin discrepancy was between the central incisors, a discrepancy of only 0.5mm and 1.5mm was considered unattractive by orthodontists and laypersons, respectively[12, 13]. Although this confirms that the presence of symmetry between upper central incisors is an important aspect it also highlights a question: if small gingival asymmetries are not recognize by laypeople as unattractive is it necessary to treat?

The same question could be addressed to the presence of crown length discrepancies related to tooth wear, which is probably the most common etiology of asymmetries in the esthetic zone. This topic was not very well documented in the literature. Pinho et al.[13] found that the presence of a 2.0mm tooth wear of a canine cusp had no impact in the smile esthetic perception. This result corroborates a clinical assumption that the closer to the midline the more the need of symmetry and the further away from the midline gentle asymmetries are acceptable[6].

After analyzing this information, a couple of questions arise. If the presence of incisor edges discrepancies occurs in the central and lateral

incisors what is the laypeople and orthodontist perception? In other words, what is the threshold for this group of people when evaluating uneven central and laterals incisors due to tooth wear? This information is of paramount importance because it can assist the clinician in deciding whether to restore those discrepancies or not. For instance, Kokich et al.[12] stated that if a dental asymmetry is not recognized as unesthetic it may not be necessary to commit the patient to restorations.

Those questions were explored in this study and the objective was to determine the esthetics perception of orthodontists and laypersons in regards the presence of asymmetries in the upper central and lateral incisors edges in a frontal smile analysis. The null hypothesis tested was that the presence of these asymmetries is equally rated as attractive by orthodontists and laypeople.

MATERIAL AND METHODS

Two standardized frontal photos of pleasant smiles of a white and an afro-brazilian adult white women, between 25 and 30 years old, were selected for this study. Both women had unworn, unrestored and healthy upper incisors and had not undertaken orthodontic treatment. The smiles used in this study were considered highly attractive and followed some of the principles of an ideal smile described in the literature[1-6], namely: an adequate width/length proportion of the esthetic zone; a convex smile arc; gingival display less than 1.0mm; gingival line of the central incisor matching the canine and the lateral slightly below and; progressive increase in depth of teeth embrasures from the central to the canine.

After selecting the photos, they were digitally altered using Adobe Photoshop (CS3 Adobe Systems Inc, San Jose, Calif). The photos were manipulated to produce symmetrical images left to right and then, were retouched to adjust color, brightness and contrast and to remove any discoloration in the lips and skin. Then, both images were condensed to achieve an image size that represented the real situation, thus each mm in the image was equivalent to each mm in the patient. In order to do this, measurement of the upper incisor central crown length was considered representative to check the 1:1 magnification. Furthermore, following the literature recommendation the nose and chin were deleted to reduce the number of variables on the images [11-13,14,15-21].

Each new image created was altered in 0.5mm increments in the incisor edges of the upper left central and lateral incisors. In all images, the gingival margins, the papillary heights as well as the right side of the image were not altered. At the end, for both photos used, 7 new images were created (Figures 1 and 2).

Final images were digital files with 300 dpi (dots per inch resolution). They were professionally printed in specialized digital equipment (Minilab Digital Frontier 570, Fuji Film, Manus, AM, Brazil) on standard A4 size format 29.7cm x 42cm (Kodak Edge Generations paper Kodak do Brasil, Manaus, AM, Brazil). Then, a photo album was assembled containing all images randomly grouped.

The album was given to 60 judges, 30 Brazilian orthodontists, members of the Brazilian Association of Orthodontics (15 women and 15 men) and 30 Brazilian laypersons (14 women and 16 men) at university level without dental backgrounds. Each rater was given brief information about the study and was

asked to evaluate the attractiveness of the images. Along with the album, each judge received a questionnaire with 100-mm visual analog scales printed for each image, as in previous studies [10-14,17-29]. In each scale it was labeled on the left-most position “very unattractive” and, on the right-most position, “very attractive.” A slight line was also printed in the middle of each scale to provide an idea of an average level of attractiveness. All judges marked a point along the scale according to their perceptions of smile esthetics. The scores were then measured in millimeters by the first author with an electronic digital caliper (Starrett, Suzhou, China) to determine the respondent’s score.

The data were submitted to statistical analyses with the software SPSS 16.0 (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL, USA). Central tendency and dispersion were calculated and the normal distribution was tested with the Kolmogorov-Smirnov test. Descriptive statistics were reported as means and standard deviations and data were analyzed by using 1-way analysis of variance (ANOVA) with the Tukey post-hoc test and “t” student test. The level of significance was established at 5%.

RESULTS

From the orthodontist’s standpoint, the most attractive smiles in the “white female” images were the symmetrical smile mean 86.0 and the 0.5mm asymmetry in the lateral incisor (mean 78.20) and the least attractive was the 1.5mm wear at the central incisor (mean 9.27). From the Laypeople’s opinion, the most attractive smiles were the symmetrical smile (mean 87.26), the 0.5mm lateral wear (mean 87.15) and the 1.0mm lateral wear (mean 80.43) while the

least attractive was the 1.0mm and 1.5mm central wear (mean 29.34 and 22.36, respectively) (Table 1).

Table 1: Orthodontists's and Layperson's perception in the white female smile.

*Smiles with the same letter did not differ from each other.

White-brazilian smile							
Altered Asymmetries	Orthodontists			Laypersons			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No asymmetry	86.00	9.99	A	87.26	9.71	A	
0.5 Lateral	78.20	8.45	A	87.15	8.31	A	**
1.0 Lateral	51.64	16.2	B	80.43	13.89	A,B	**
1.5 Lateral	37.04	16.05	C	61.91	10.92	C	**
0.5 Central	51.49	13.33	B	72.44	9.25	B	**
1.0 Central	22.35	10.82	D	29.34	14.29	D	**
1.5 Central	9.21	3.7	E	22.36	12.21	D	**

Similar results were found in the "afro-brazilian female" images. For the group of orthodontists, the most attractive smile was the symmetrical smile (mean 83.41) and the 0.5mm lateral wear (mean 80.40) and the least was the 1.0mm and 1.5mm central incisor wear (mean 24.04 and 16.05, respectively). For the laypersons, the most attractive smile was the symmetrical (mean 87.61), the 0.5mm lateral wear (mean 86.16) and the 1.0mm lateral wear (mean 80.32); while the least attractive was the 1.0mm and 1.5mm central wear (mean 29.18 and 23.98, respectively) (Table 2).

Table 1: Orthodontists's and Layperson's perception in the afro-brazilian female smile.

*Smiles with the same letter did not differ from each other.

Afro-brazilian smile							
Altered Asymmetries	Orthodontists			Laypersons			Difference
	Mean	SD	Results*	Mean	SD	Results*	
No asymmetry	83.41	11.20	A	87.61	8.74	A	
0.5 Lateral	80.40	9.92	A	86.16	7.26	A	**
1.0 Lateral	55.72	10.64	B	80.32	8.79	AB	**
1.5 Lateral	30.11	13.70	C	50.38	12.61	C	**
0.5 Central	57.66	16.17	B	72.52	11.35	B	**
1.0 Central	24.04	14.45	CD	29.18	14.32	D	
1.5 Central	16.05	12.89	D	23.98	15.00	D	**

When comparing the perception from the Orthodontists and Laypersons, they showed statistical differences in the majority of the situations with the latter group giving higher scores ($p < .05$). Generally, both groups had similar behavior in the most attractive smile, which was the symmetrical (Tables 1 and 2).

The comparison between the group of men and women judges showed no statistical difference in all situations for the afro-brazilian smile ($p>.05$). The same tendency was found in the white Brazilian, with the exception of the 1.0 mm and 1.5 mm central incisor asymmetric smiles where the group of women was more critical rating the images with lower scores ($p<.05$).

DISCUSSION

The presence of symmetry between upper central incisors is a guideline of paramount importance in the cosmetic dentistry field.[1,3,6] There is also a clinical assumption that the closer to the midline the more the need of symmetry and, the further away from the midline, gentle asymmetries are acceptable.[6]

The presence of dental and gingival asymmetries in the esthetic zone is a very common problem in the adult patient. Those situations are mainly caused by tooth wear or abrasion of incisors causing unequal crown lengths. Because an active incisor eruption can be followed by uneven tooth wear, a gingival asymmetry might also occur. According to the literature, the treatment of dental asymmetries is a simple procedure and, depending on the location and severity of the problem, it can be accomplished by enamel reshaping, composite restorations and/or porcelain veneers.[6,23,24] If, after restoring the tooth anatomy, a gingival asymmetry is still present, it can be corrected by periodontal surgery

or orthodontic movement intrusion or extrusion complemented by composite restorations or tooth enamel reshaping.[25-28]

Although those treatment strategies are very well documented in the literature, from an esthetic standpoint, an intriguing question can be made: is it necessary to correct? In other words, if laypeople cannot recognize a dental or gingival asymmetry as unattractive, why should dental specialists need to treat it? Literature has shown that a 2mm gingival margin discrepancy between the central and lateral incisors, cannot be recognized as unesthetic by laypersons nor by dental professionals.[12,16] When the gingival margin discrepancy is between the central incisors, a discrepancy of only 0.5mm and 1.5mm is considered unesthetic by orthodontists and laypersons, respectively.[12,13] Those results suggest that the treatment of minor gingival discrepancies might reflect an exaggerated concern by dental specialists rather than an esthetic need.[13] It can also be stated that the threshold depends not only on the group of raters but also on the location of the asymmetry. Gingival discrepancies further from the midline are more tolerated than those closer to the midline.

The methodology used by those authors to assess the influence of crown length discrepancies, in the smile esthetic perceptions, modified the position of gingival margins.[11-13,16] In this way, the main variable studied was the impact of gingival asymmetries in the smile esthetics perception. On the other hand, in our study, the variable studied was not the influence of gingival asymmetries but the impact of incisal discrepancies in the smile esthetic perception.

The results of our study showed that even a minor incisal discrepancy 0.5mm between the upper central incisors was rated as unattractive by laypeople and orthodontists. This finding supports the clinical assumption that

the presence of symmetry between upper central incisors is an aspect of paramount importance and also that these teeth are the key determinant in evaluating smile esthetics. It is also important to consider that laypeople were very sensitive in detecting dental asymmetries in our study compared to gingival asymmetries previous published in the literature.[11-13,16] From the laypeople's perception, a correction of a 1.5-2.0mm gingival asymmetry between the upper centrals might not be necessary, but only 0.5mm incisal discrepancy may be. Therefore, the clinician should restore uneven central incisors not only to reestablish anterior guidance and avoid active incisor eruption, but also to optimize smile esthetics.

Although the threshold for orthodontists and laypeople was similar in the evaluation of asymmetries in the upper central incisors, their behavior for the presence of discrepancies in the lateral incisors was statistically different. The threshold was 0.5mm for orthodontists and 1.0mm for laypeople. Following the same idea addressed before, a correction of a 1.0mm incisal discrepancy between upper laterals might reflect an excessive concern by dental specialists rather than an esthetic need.

Even though a review of the literature did not produce a study that assessed the same aspect, Pinho and colleagues[13] found that the presence of an asymmetrical 2.0mm tooth wear of a canine cusp had no impact in the smile esthetic perception. In this way, it can be hypothesized that the presence of incisal asymmetries in the upper canines is more tolerated by orthodontists and laypeople, followed by upper laterals and upper centrals. This finding corroborates the clinical assumption that the closer to the midline, the more the

need of symmetry, and the further from the midline, the more gentle asymmetries are acceptable.[6]

Therefore, the clinician should first locate and measure the amount of tooth wear, and then decide if a restoration is necessary. Kokich et al.[12] noted that in some situations if smaller deviations are not recognized as unattractive, why refer the patient for cosmetic restorations that would eventually need to be replaced? In addition, literature shows that a composite restoration accumulates more biofilm than natural enamel, and also is more prone to discolorations with time[29-32].

With this in mind, in a clinical situation of a crown length discrepancy, the clinician should give more priority to correcting the incisal discrepancy instead of the gingival asymmetries. Based on the data of our paper and previous studies, orthodontists and laypeople are more tolerant to gingival asymmetries than incisal edges discrepancies. Thus, if a gingival asymmetry is within the patient's threshold, it makes more sense to match the incisal edges by simple procedures such as enamel reshaping and restorations than commit the patient for a periodontal surgery or even a multi-disciplinary approach involving orthodontics and periodontics. This finding corroborates the platinum rule that states that the incisal edges sets the gingival levels.[6]

In this study, we surveyed orthodontists and laypeople. The first group was selected because previous studies showed that they are the most sensitive group in detecting deviations from ideal.[10-15,17,19] The latter group was chosen because they are the primary consumers of dental services, instead of practitioners, who are providers of care.[16] Following the tendency of the literature, these groups of raters showed different esthetics perceptions.[10-15] In

most situations, orthodontists were more critical in their evaluations. However, for the symmetrical smiles, both groups displayed no statistical difference. It can be hypothesized that an ideal smile arrangement can easily be recognized by any group of raters, but when smaller deviations are included, they start to show differences in their judgments.

Another aspect tested was a possible difference between the judgments of men and women. This issue is somewhat controversial with a study showing that female evaluators gave statistically significant higher scores than males[33] while another paper concluded that males were less critical than females when evaluating smile esthetics[34]. It seems that this debate is related to the smile characteristics evaluated. In our study, in the majority of situations, there was no statistical difference between men and women ratings. However, in two situations 1.0 and 1.5mm central asymmetry in the white smile, male evaluators gave statistically significant higher scores than female.

This study was conducted with manipulated computer digital images to try to simulate clinical situations. In this way smile images were manipulated in 0.5mm increments because presentation of large incremental differences between images may obscure the true threshold of acceptability.[16] The reason for using small increments is also related to the human visual acuity. According to the literature at a normal viewing distance 18 inch – 45 cm the normal human eye can resolve features that are 1/200 of an inch in size.[34,35] In other words, one can distinguish two objects that are separated by 0.12mm.[34,35] This information explains and justify why both groups of raters could notice a 0.5mm asymmetric smile, even though with different judgments and level of acceptability.

In previous studies the smile used for evaluation was from white patients. For this reason, we used close-up photos of smiles from two adult women, one white and another afro-brazilian. The main reason for including an afro-brazilian smile in the study was to survey possible differences in the influence of asymmetries in the esthetic perception. The results of our study suggest that the behavior of orthodontists and laypeople was similar when the white and afro-brazilian smiles were compared. Although the objective was not to compare those types of smiles, it can be stated that the impact of dental asymmetries in both situations was very similar.

Even though one might argue that the evaluation of smile attractiveness should consider the overall facial analysis[36], we used only a close-up assessment because literature showed no difference between the two types of smile evaluations, the close-up and the facial smile photo.[18,19]

Finally, it is important to remember that since this study used computer manipulated images from two patients, and the opinion of specific groups of individuals, the results should be carefully analyzed. As stated by Kokich et al.[12], since the results and conclusions are based on averages, it is difficult to customize this information to a patient due to the subjectivity of smile esthetics evaluation. Therefore, we support their suggestion to discuss the results of this study with patients who have dental asymmetries and then, decide whether to restore it or leave it.

CONCLUSION

1. The most attractive smiles in both types of images (white and afro-brazilian females) were the ones without asymmetries and the 0.5mm in the lateral incisor.
2. Tooth wear was considered unattractive following a pattern: the greater the tooth wear the more unattractive the smile; tooth wear at the central incisor was considered more unattractive than tooth wear at the lateral.
3. For both group of raters the presence of a 0.5mm wear in the central incisor was considered unattractive while the threshold for lateral incisors discrepancies was 0.5mm for orthodontists and 1.0mm for laypersons.

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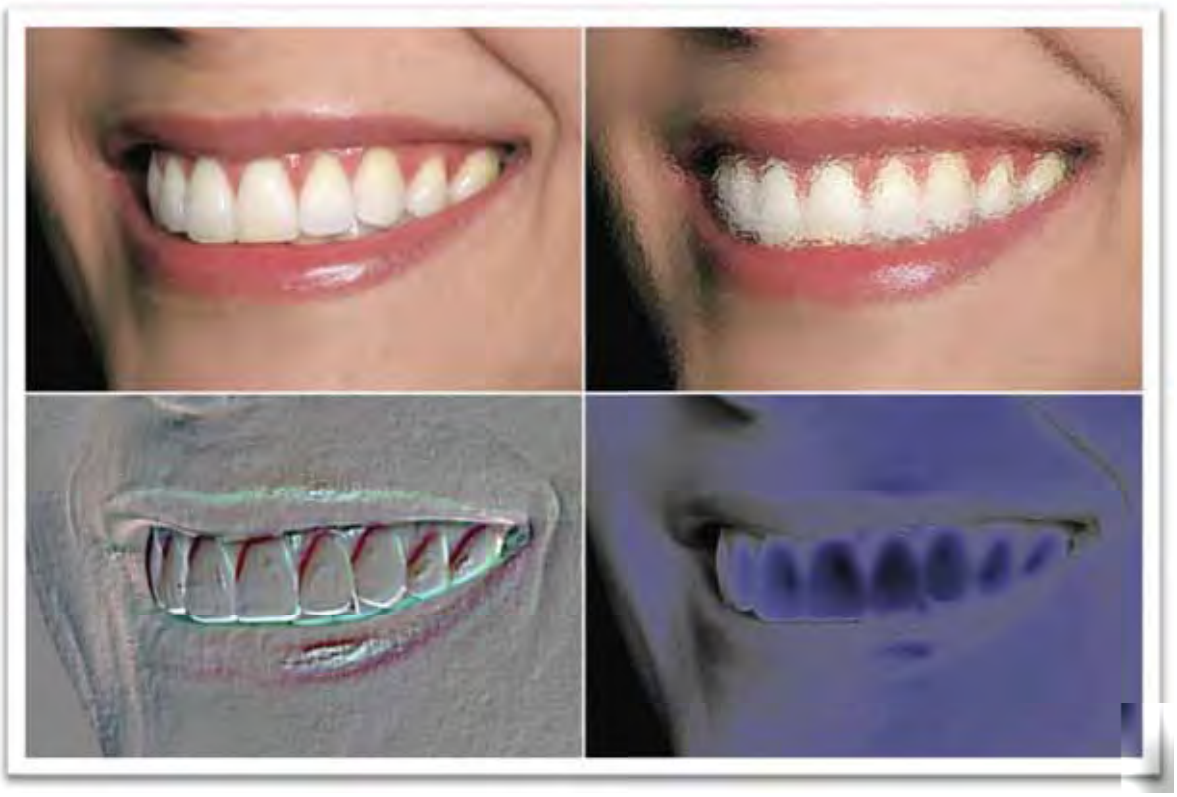
FIGURES AND LEGENDS

Figure 1: White female tooth wear in 0.5-mm increments (**A,** control; **B,** 0.5 mm lateral; **C,** 1.0 mm lateral; **D,** 1.5 mm lateral; **E,** 0.5 mm central; **F,** 1.0mm central; **G,** 1.5 mm central.

Figure 2: Afro-brazilian female tooth wear in 0.5-mm increments (**A,** control; **B,** 0.5 mm lateral; **C,** 1.0 mm lateral; **D,** 1.5 mm lateral; **E,** 0.5 mm central; **F,** 1.0mm central; **G,** 1.5 mm central.



3 Considerações Finais

3 CONSIDERAÇÕES FINAIS

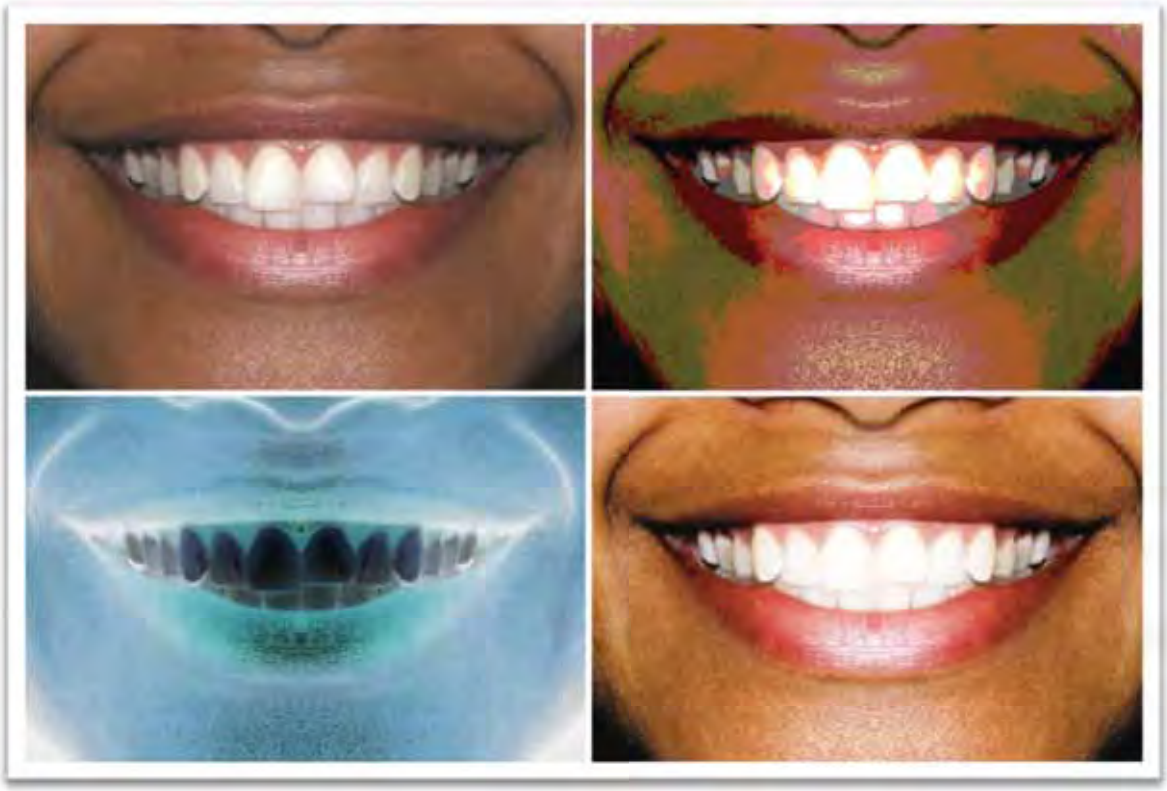
Baseado nos resultados e conclusões apresentados pelos artigos podemos tecer as seguintes considerações finais:

3.1. Os posicionamentos verticais dos centrais superiores considerado mais estético, por ortodontistas e leigos, foi aquele no qual as margens gengivais dos centrais estão ou no mesmo nível da dos caninos ou 0.5mm abaixo. Quando as bordas incisais foram avaliadas, o degrau de 1.0 e 1.5mm entre centrais e laterais foram os mais atrativos. Quando as bordas incisais foram avaliadas, o degrau de 1.0 e 1.5mm entre incisivos centrais e laterais foram os mais atrativos.

3.2. A presença de diastemas na região de incisivos laterais foi considerada anti-estética por ortodontistas e leigos, brasileiros e norte-americanos. Em geral, os sorrisos seguiram o seguinte padrão: quanto maior os diastemas e quanto mais mesialmente posicionados, menor o nível de atratividade do sorriso. O sorriso com diastema de 0.5mm na face distal dos incisivos laterais não diferiu do sorriso sem diastemas na avaliação dos ortodontistas e leigos norte-americanos, bem como os leigos brasileiros.

3.3. Assimetrias nas bordas incisais de centrais e laterais foi considerada, em geral, uma característica anti-estética. Os sorrisos avaliados seguiram o seguinte padrão: quanto maior as assimetrias menos atrativos eram os sorrisos e, assimetrias em laterais foram mais aceitáveis esteticamente do que em centrais. A presença de pequena assimetria entre centrais (0.5mm) foi

considerada anti-estética por ortodontistas e leigos, enquanto assimetrias em laterais foram mais aceitas, sendo o limite para os ortodontistas de 0.5mm e, para os leigos, de 1.0mm.



4 Referências

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5 Apêndice

5 APÊNDICE

Materiais e Métodos dos Artigos 1, 2 e 3

Uso da Escala Analógica Visual

Cada examinador recebeu um formulário contendo simulações impressas de réguas (escala visual analógica), sendo uma para cada tipo de imagem. Nestas réguas, os examinadores foram solicitados a marcar um ponto correspondente ao grau de atratividade associado a cada imagem. A escala foi configurada apresentando uma ordem crescente de qualidade da esquerda para a direita. A cada avaliador foi explicado que era possível marcar o ponto em qualquer região da régua. A escala visual analógica possuía 10cm, estando escrito, em seu extremo esquerdo “MUITO RUIM”, e, no direito, “MUITO BOM”. O centro da régua foi demarcado com um traço para que a percepção de regular fosse dada ao avaliador (Figura 1).

A distância entre a marca feita pelo avaliador e o ponto da extrema esquerda foi medida com um paquímetro digital (Starrett, Suzhou, China) e serviu como medida, em milímetros, do grau de atratividade da imagem avaliada, equivalendo à nota de cada examinador.

Figura 1: Exemplo da escala analógica visual utilizada nessa pesquisa.

Araraquara, 12 de dezembro de 2011

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