

Impact of brackets on smile esthetics: Laypersons and orthodontists perception

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Objective: This study evaluated the influence of orthodontic appliances on smile esthetics assessed by lay adolescents, lay adults and orthodontists. **Methods:** A facial photograph of a smiling young woman was used under the following conditions: With metal orthodontic brackets ligated by different elastic ligature colors (green, red and gray), with ceramic bracket brackets (transparent elastic ligature) and without brackets, totaling five 15 x 20 cm pictures. For the photograph assessment, 16 lay adolescents, 16 lay adults and 16 orthodontists were randomly selected. The photographs were randomly arranged in an album, followed by a visual analog scale (VAS) for the scores registration. Scores in both evaluations of each group of evaluators (adolescents, adults and orthodontists) were submitted to error analysis by WILCOXON test and multiple comparison among groups performed by Kruskal – Wallis at 5% significance. **Results:** Orthodontists, adults and adolescents agreed in their opinions, although the orthodontists gave lower scores in their assessments. It could be observed that ceramic brackets were more acceptable concerning the smile esthetics, whereas the metal brackets received the lowest scores. **Conclusion:** Orthodontists, adults and even adolescents seem to prefer esthetic solutions during orthodontic treatment.

Keywords: Esthetics. Dental. Visual perception. Orthodontic brackets.

Objetivo: esse estudo analisou a influência dos aparelhos ortodônticos na estética do sorriso em avaliação por adolescentes, adultos e ortodontistas. **Métodos:** foram utilizadas fotografias faciais do sorriso de uma jovem mulher, usando-se as seguintes combinações: aparelho ortodôntico de metal com ligaduras de diferentes cores (verde, vermelho e cinza); aparelho ortodôntico cerâmico (ligadura transparente); e sem aparelho — resultando em cinco fotografias de 15x20cm. Para a avaliação das fotografias, 16 adolescentes leigos, 16 adultos leigos e 16 ortodontistas foram selecionados de forma randômica. As fotografias foram aleatoriamente organizadas em um álbum, acompanhadas de uma escala visual analógica (EVA) para o registro das notas. As notas das duas avaliações de cada grupo (adolescentes, adultos e ortodontistas) foram submetidas à análise de erro (teste pareado de Wilcoxon) e comparação múltipla de grupos pelo teste de Kruskal-Wallis com significância de 5%. **Resultados:** ortodontistas, adultos e adolescentes concordaram em suas opiniões, porém, os ortodontistas deram notas menores em suas avaliações. Pôde ser observado que os braquetes cerâmicos foram mais aceitos, considerando-se a estética do sorriso, uma vez que os braquetes metálicos tiveram as menores notas. **Conclusão:** ortodontistas, adultos e adolescentes parecem preferir soluções estéticas durante o tratamento ortodôntico.

Palavras-chave: Percepção visual. Braquetes ortodônticos. Estética dentária.

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

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INTRODUCTION

One of the main reasons that motivate patients to start an orthodontic treatment is the esthetic factor,¹⁻³ as well as joint dysfunction and improvement of dental health as a whole.⁴ Patients that look for orthodontic treatment present a more critical self-perception, both of the face, as well as the teeth, than those who do not look for treatment. This fact suggests that patients that look for orthodontic treatment, in general, are more demanding about esthetic looks.⁵

The smile can have an important influence once that faces with better looking smiles are considered to be more acceptable esthetically^{6,7} and it can be associated with psychological characteristics.^{8,9}

Even considering that beauty is quite subjective and is associated with many factors, the professional has the responsibility to capture the patients' desires that is the main goal of treatment. Once the patient starts an orthodontic treatment for esthetic reasons, it is consistent to assert that during the treatment he is also concerned about his esthetics. The use of orthodontic brackets can harm the appearance, even if it is temporary.

Long term treatment and non-esthetic appearance of metal brackets are the main reasons for adult patients declining to start orthodontic treatment⁴. Facing that, the industry for dental materials has been looking to offer alternatives so the treatment becomes more esthetic, developing specific treatment techniques and technology, such as lingual orthodontics, transparent aligners, and use of esthetic brackets.¹⁰ A recent study concluded that adult patients would pay more to use alternative appliances and ceramic brackets, once they were considered to be more acceptable and attractive than the metallic conventional ones.¹¹

A German survey shows that 97% of the patients (comprised mainly by females) wishes to have their malocclusions corrected for esthetic reasons, but 62% rejected treatment with a visible appliance.¹² In Sweden, a survey showed that 67% would probably wear visible brackets if needed. However, based on appearance of the brackets alone, 33% of the adults would be unwilling to wear visible brackets if needed. The same group additionally responded that 84% would probably or definitely

treated with visible brackets during adolescence if needed.¹³ These responses suggest a dichotomy between acceptability of orthodontic appliance for adolescents and adults.

However, to date no studies have been published on the real impact of this kind of orthodontic accessories on smile esthetics perceived by adolescents in comparison with adults or orthodontists, even with metal brackets, being used in a larger scale in orthodontic clinics. A previous investigation¹⁴ examining 18 years old youngsters found that orthodontic appliance attractiveness varies significantly by the following hierarchy of appliance types: Alternative appliances > ceramic appliances > all stainless steel and self-ligating appliances.¹⁴ Recently, the impact of orthodontic brackets on the esthetics of the face when smiling, with and without premolar extraction was evaluated by lay adults and orthodontists. This investigation concluded that metal orthodontic brackets did not affect facial esthetics. On the other hand, they found that ceramic brackets were significantly less pleasant to lay adults. To orthodontists, ceramic brackets had no negative influence on facial esthetics. The authors also concluded that perception of lay adults and orthodontists was different.¹⁵

Facing the lack of studies about the impact of orthodontic brackets on smile esthetics, particularly among adolescents, it is difficult for orthodontists to inform their patients which brackets to choose based on scientific evidence. This lack of information also becomes relevant when considering the high investments done by industries of dental materials in an effort to develop and commercialize orthodontic brackets more imperceptible to human eyes.

MATERIAL AND METHODS

A female volunteer with a pleasant smile was photographed in the frontal aspect, with a CANON 30 D 8.0 megapixel camera, with a 100 mm macro lens in a distance of one meter. The metal orthodontic brackets (Abzil/3M-Brazil) and the ceramic ones (Inspire – Ice – ORMCO, California, – United States) were temporarily bonded (with easy removal and only to perform the pictures) on the volunteer's upper teeth with a cheek retractor

and no acid etching. Adhesive and Transbond® XT composite (3M Unitek, California, EUA) were used and cured for 10 seconds to this sample of brackets. A stainless steel arch 0.018-in was used as reference to level bracket position and fixed with ligatures (Morelli, São Paulo, Brazil). Photos of volunteer smiling were obtained in three conditions: Without brackets, with ceramic brackets ligated by transparent elastic ligatures and with metal brackets ligated by different ligature colors (green, red and gray).

One of the photographs in which the patient is smiling was selected as the matrix, which was used as reference to obtain smile standardization. Close up photographs were taken with metal and ceramic orthodontic brackets, which were transferred to the matrix photo, with a digital simulation using the *software* Adobe Photoshop CS2.

The teeth and orthodontic bracket images of the other photos were transferred to the matrix photo in order to maintain the same relation between lips and teeth in the smile and the same head positioning at all result photos, so that the only difference between the simulated photos was the orthodontic brackets.

The photos were: A matrix photograph (Fig 1) and four manipulated photographs with images of all kinds of brackets and elastic ligature used (Fig 2).

Color prints with picture quality in size 15 x 20 cm were obtained and randomly grouped in an album. The evaluators were randomly selected and distributed in the following groups: 16 adolescents between 13 and 17 years old (8 males and 8 females), 16 graduate adults between 25 and 50 years old (8 males and 8 females) and 16 orthodontists, aged 26-48 years old (8 males and 8 females).

Each evaluator received an album with five photos, an instruction sheet and five evaluation sheets with visual analogue scales (VAS)¹⁶ with 10 cm each and a sheet to collect data (age, schooling level and address). On the left end of the scale was written “Very unpleasant” and on the right end “Very pleasant” (Fig 3).

The raters were instructed not to compare the smiles of the album. They had around 20 seconds to evaluate each photo. The VAS scale sheet was fulfilled in the researcher presence, without any

interference. After two weeks a second evaluation was performed similar to the first one, in order to evaluate the error of method.

Statistical analysis

Scores in both evaluations of each group (adolescents, adults and orthodontists) were submitted to

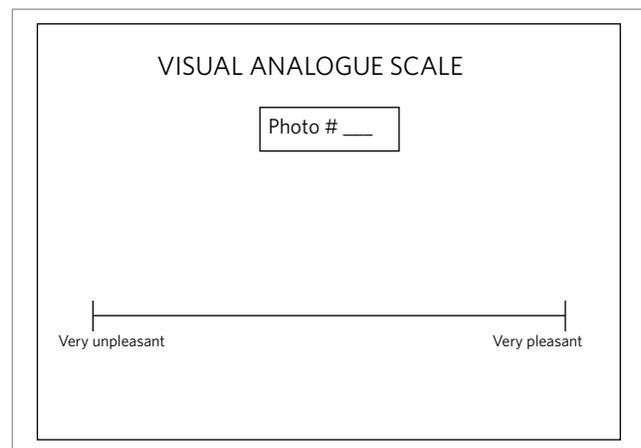


Figure 1 - Visual Analogue Scale.



Figure 2 - Smile without brackets (NB).

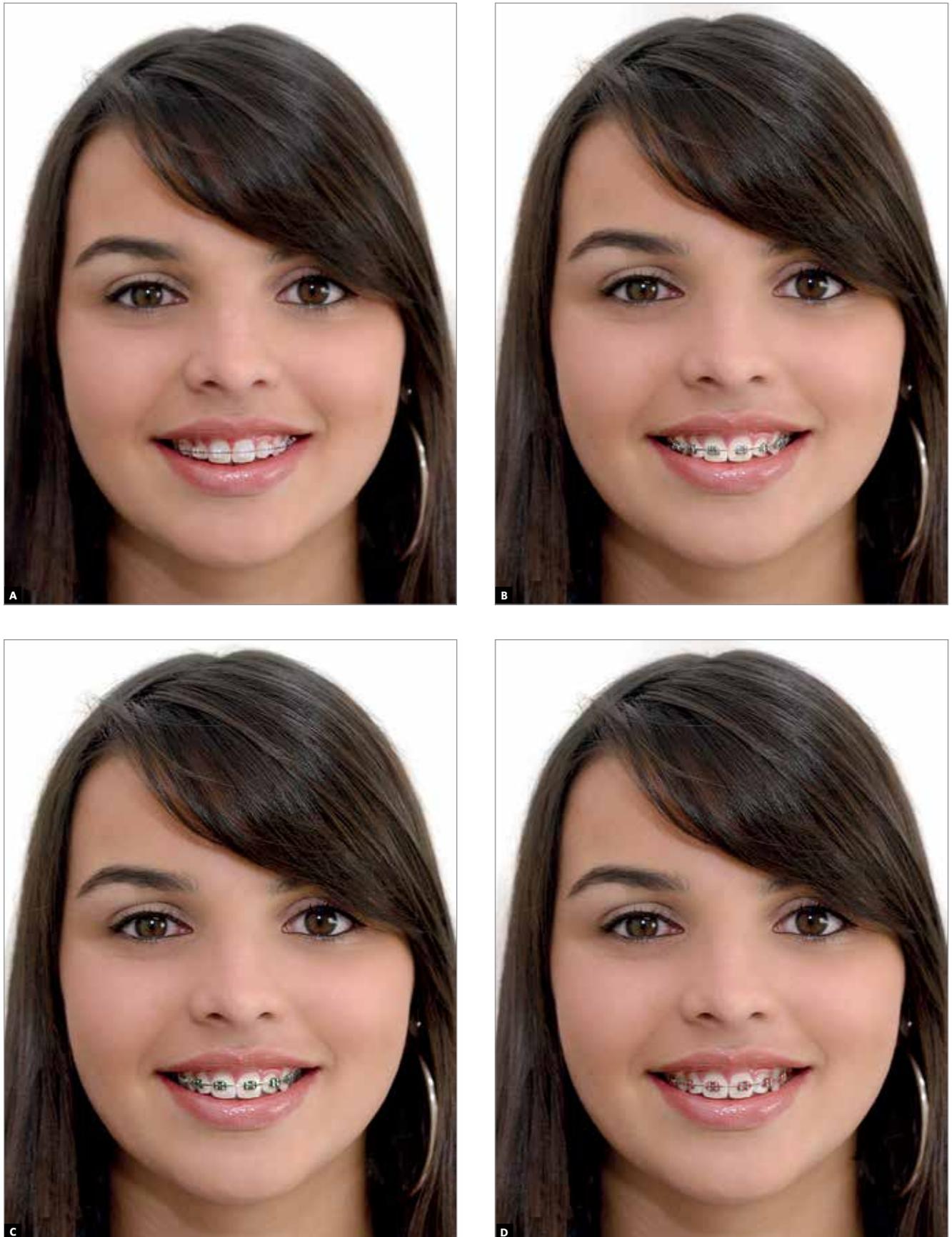


Figure 3 - A) Smile with ceramic brackets (CB). **B)** Metal brackets + gray ligatures (MB + GY). **C)** Metal brackets + green ligatures (MB + GN). **D)** Metal brackets + red ligatures (MB + R).

Table 1 - Descriptive data of the scores obtained by VAS.

Group	Treatment	Mean	Standard Deviation	n	95% confidence interval	
					Lower Limit	Upper Limit
Adolescents	CB	70.47	21.41	32	62.750	78.187
	MB+GN	55.81	19.98	32	48.610	63.015
	MB+R	61.56	14.84	32	56.213	66.912
	MB+GY	60.28	17.26	32	54.060	66.503
	NB	74.81	12.79	32	70.202	79.423
Adults	CB	80.56	13.46	32	75.709	85.416
	MB+GN	64.72	21.07	32	57.123	72.314
	MB+R	65.88	18.38	32	59.247	72.503
	MB+GY	66.72	19.24	32	59.782	73.655
	NB	78.63	15.01	32	73.214	84.036
Orthodontists	CB	70.34	16.30	32	64.468	76.219
	MB+GN	50.72	19.21	32	43.793	57.645
	MB+R	56.09	17.07	32	49.939	62.248
	MB+GY	57.06	20.29	32	49.748	64.377
	NM	66.50	19.84	32	59.348	73.652

an error analysis using of Wilcoxon signed-rank test. Multiple comparisons among groups were performed using Kruskal-Wallis test. All the statistics were performed using two-tailed distribution at $p > 0.05$.

RESULTS

Table 1 presents intra-group comparisons. It can be observed that all groups presented similar behaviors, scoring smiles with ceramic brackets as well as smiles without brackets as more esthetical.

The averages were tested between genders and presented on table 2. There was no significant difference between genders, except on the MB+GN combination (metal bracket+ green ligature), where the female gender presented a smaller average in comparison to the male evaluators ($p < 0.05$).

The intergroup analysis showed that orthodontists presented higher esthetic levels especially to the combinations MB+R, MB+GN, NB. For the CB and CB+ GY the lay adolescent group showed to be as demanding as orthodontists. The lay adult group showed to be less demanding than the other groups for all proposed combinations (Table 3, Fig 4), marking higher scores in general.

Figure 4 illustrates the scores behavior of all groups of evaluators. A clear similarity was found on the behavior of the curves, especially differing the lay adult's scores, as well as the best grades for the smile without brackets or with ceramic brackets.

Table 2 - Multiple comparison (Kruskal-Wallis) to the average comparison of the two genders for each combination.

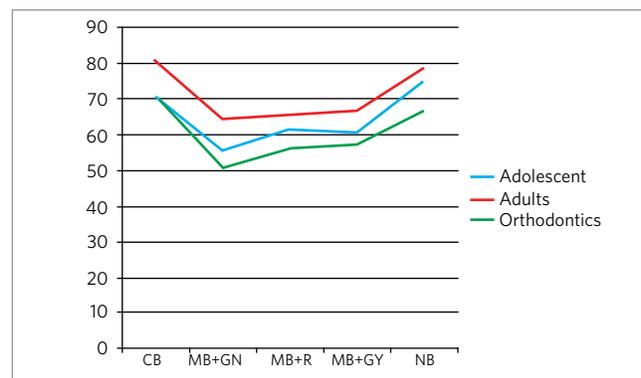
Group	Average Score Treatment				
	CB	MB+GN	MB+R	MB+GY	NB
Male	74.25 ^a	61.29 ^a	64.08 ^a	62.35 ^a	73.48 ^a
Female	73.33 ^a	52.87 ^b	58.27 ^a	60.35 ^a	73.14 ^a

* Averages on the columns with different letters are statistically different on the 5% level of significance (p value < 0.05).

Table 3 - Multiple comparison (Kruskal Wallis) between score averages for each group of evaluators.

Group	Average score				
	CB	MB+GN	MB+R	MB+GY	NB
Adolescents	70.47 ^a	55.81 ^a	61.56 ^a	60.28 ^a	74.81 ^a
Adults	80.56 ^b	64.72 ^b	65.88 ^a	66.72 ^a	78.63 ^a
Orthodontists	70.34 ^a	50.72 ^a	56.09 ^b	57.06 ^b	66.50 ^b

* Averages on the columns with different letters are statistically different on the 5% level of significance (p value < 0.05).

**Figure 4** - Average scores for the three evaluators groups.

DISCUSSION

The adult demand for orthodontic treatment increased, in most cases for esthetic reasons.^{3,10} Because of this, it would be reasonable to assume that patients, especially adults, would not only be concerned about the esthetics in the end of the treatment, but also during the whole process. Although this affirmation is confirmed for adults,¹²⁻¹⁵ no study had been conducted on adolescents' attractiveness perception when using brackets, maybe because it is presumed that adolescents are used to a "metallic smile".

Our results showed that adolescents recorded similar scores between the smiles with or without ceramic brackets. On the other hand, smiles with metal brackets, regardless of the ligature color used, were considered less pleasant. In fact, adolescents were more demanding in esthetic reasons than the adult evaluator group, contradicting the idea that adolescents tend to feel better with a "metallic smile". This can suggest that the esthetic requirement is very updated, even in young patients and not only restricted to the adult public. Maybe this is due to the influence of the media, the increased number of patients under orthodontic treatment, or by cultural and socio-economic aspects.^{3,10,15}

Considering that orthodontic treatment requires time to be accomplished, it would be acceptable that, even adolescents would choose brackets that interfere the minimum possible on their appearance, being discrete or even non perceivable.^{10,11} Thus, orthodontists should concern about the population requests. Although clear aligners, lingual and ceramic brackets are most commonly used in adults,¹²⁻¹⁵ we can expect an increasing demand for these esthetic options among adolescents.

It is appropriate to emphasize that metal brackets ligated by green elastomers, which were the less scored, presented an average of 55.81 mm in VAS scale by adolescents, 64.72 mm by adults and 50.72 mm by orthodontist (Table 3). Thus, it can be considered that the metal brackets were not negatively scored (as VAS measurements were above 50 mm), but had a higher impact on the smile esthetics than the ceramic brackets. Although it is a

value and an appearance question for patients.^{11,14} the appliances should be selected on the efficiency basis. In fact, less attractive appliances are most commonly used in orthodontic practice.²¹ It was pointed that ceramic brackets could be less efficient than metallic in terms of fracture resistance and sliding quality.^{11,14} Furthermore, to date, it was reported that clear aligners still need improvements to achieve clinical performance compared to conventional brackets.²²

Although there was homogeneity in respect to smile esthetics, the orthodontic group showed to be more demanding for all proposed combinations, with smaller scores in general. Other perception studies showed similar judgment behavior between orthodontists and lay people.¹⁷⁻²⁰

Many studies have evaluated characteristics of both dental and facial esthetics, rating photographic records with a visual analog scale (VAS), which has been shown to be a valid method of assessing dental attractiveness.^{1,6,11,14,15,17-20,23} Two evaluations with two weeks interval in this study showed no significant differences in all groups. When genders of evaluators were compared, metallic brackets with green ligation were the only significant different measurement found in female group, who scored less attractive than males.

In this study, evaluators judged photographs of the whole face and not by limited dental frameworks of the smile. In this way smiles are evaluated as a part of the whole esthetics of the face. In photos with guidelines about the smile, there is overvaluing of certain characteristics of the smile in question, particularly negative characteristics.²⁰ Despite of different evaluation methods, our results agree with Rosvall et al¹¹ and Ziuchkovski et al¹⁴ where both orthodontists and lay people classified the devices in a hierarchy where the attractiveness decreased with increasing amount of metal present. In opposite, Berto et al¹⁵ found that lay people prefer metallic brackets than ceramic, however an extraction site was present in their photographs, which could affected perception.

It is suitable to say that in the present study all brackets were temporarily bonded, then photographed and lately removed. This way, they were not allowed to pass through the environmental

conditions caused by time and the actual orthodontic treatment, which would be more significant, once they could change, mainly on the bracket/ transparent ligature, which could affect their esthetic perception. This fact suggests that more studies should be conducted with the objective of evaluating the perception of the esthetic of these devices, in long-term.

CONCLUSIONS

- » Considering the esthetic aspect, smiles with metal brackets presented smaller scores than smiles without brackets and with ceramic brackets.
- » Adolescents, adults and orthodontists showed similar perceptions on the evaluation of the impact of brackets on smile esthetics.

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