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SCIENTIFIC SECTION

Lay person's perception of smile aesthetics in dental and facial views

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Objective: To compare the aesthetic perception of different anterior visible occlusions in different facial and dental views (frontal view, lower facial third view and dental view) by lay persons.

Design: Cross-sectional survey, Lima, Perú, 2002.

Subjects: The different views were rated by 91 randomly selected adult lay persons.

Main outcome measurement: Visual Analogue Scale (VAS) ratings of aesthetic perception of the views.

Results: Anterior visible occlusion, photographed subject and view ($p<0.001$) had a significant effect on the aesthetic ratings. Also gender ($p=0.001$) and the interaction between gender and level of education ($p=0.046$) had a significant effect over the aesthetic rating.

Conclusions: A lay panel perceived that the aesthetic impact of the visible anterior occlusion was greater in a dental view compared with a full facial view. The anterior visible occlusion, photographed subject, view type are factors, which influence the aesthetic perception of smiles. In addition, gender and level of education had an influence.

Key words: Facial aesthetics, dental aesthetics, smiling, photography, lay persons

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Introduction

Physical attractiveness is an important social issue in our culture and the face is one of its key features. Several authors[1–3] have reported a hierarchy in the characteristics that determine the aesthetic perception of a person, with the face being the most important factor. Within the face, the mouth (31%) and eyes (34%) also appear to be important.[4] Since the patient's decision to undertake orthodontic treatment is based primarily on aesthetic considerations, the evaluation and understanding of the factors that influence their decision is of key importance to evaluate entry and completion of orthodontic treatment. As a result, a detailed aesthetic judgment of the face should be carried out using the patient's frontal face view, during conversation, their facial expressions and smiling.[5]

Aesthetic perception varies from person to person and is influenced by their personal experience and social environment. For this reason, professional opinions regarding evaluation of facial aesthetics may not coincide with the perceptions and expectations of patients or lay people.[6,7] For example, lay people have been shown to be more likely than general dentists, orthodontists or oral surgeons to assign normal ratings to profile drawings.[8] They were also less critical than general dentists and orthodontists regarding the aesthetics of photographs of the dentition.[9] In contrast, dental judges rated children seeking treatment as more attractive than did non-dental judges.[10]

When we consider smile aesthetics, one study reported that orthodontists and their patients did not agree in their evaluation of the aesthetic preference of frontal and profile views of the same smile. For this reason, it has been recommended that orthodontists should not only consider profile evaluation, but also the anterior evaluation of the smile.[3] Kokich, Kiyak and Shapiro provided a more comprehensive evaluation of the factors that determine the aesthetics of a smile from a frontal view.[11] They evaluated the effect of small variations in tooth position and the relationship of the teeth with their surrounding tissues. A definitive difference in the perception of smile aesthetics between orthodontists, general dentists and lay persons was reported.

In summary, it appears that lay people's appreciation of aesthetics seems different to that of dental professionals. However, neither anterior visible occlusion nor

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level of education of the evaluator has been evaluated in relation to the aesthetic perception of smiling views. This may be important to understand patient's perception when discussing aesthetic considerations of orthodontic treatment.

The objective of this study was to evaluate and compare the aesthetic perception of smiles in different facial and dental views by lay persons.

Material and methods

Construction of booklet of facial and dental views

Three standardized colour photographs (smiling frontal view, smiling lower facial third view and dental view) from 18 students from the University Dental Clinic presenting different anterior visible occlusions were taken at a reproduction ratio of 1 : 8, 1 : 3.5 and 1 : 1.5, respectively, with a Yashica Dental Eye I camera (Nyocera Co., Japan). Three cases for each representative anterior visible occlusion (open bite, deep bite, crossbite, end-to-end, crowded bite and ideal bite) were selected. The anterior teeth did not have any cavities, restorations or any other type of pathology in the surrounding tissues. The frontal view (FV) included the smiling face and neck of the subject. The lower facial third (LV) view included the tip of the nose and the soft tissue menton. The dental view (DV) included the anterior teeth and surrounding gingival tissues, and was taken with a lip retractor. An example of 3 photographic views of the same person is shown in Figures 1–3. The extra-oral photographs were taken with the individuals positioned in front of a neutral background with the instruction to moisten their lips and then to smile. No other instructions were given regarding their smile and the subjects were not permitted to look into a mirror prior to being photographed. We attempted to capture a smile that was spontaneous and natural. All photographs were developed to 4×6-inch prints and labeled with a code number. We then made a booklet that included 3 example photographs and 54 randomly ordered photographs all centred in a single page.

Data collection

The evaluators were selected randomly from persons accompanying patients to the University Dental Clinic and from the neighbourhood around the University Dental Clinic. They were approached and asked if they would voluntarily agree to participate in the study. All of them agreed and signed an informed consent letter. None of the evaluators had a Health Sciences or Artistic background. They were classified according to gender and level of education (elementary school, high school or college completed). The evaluators were asked to

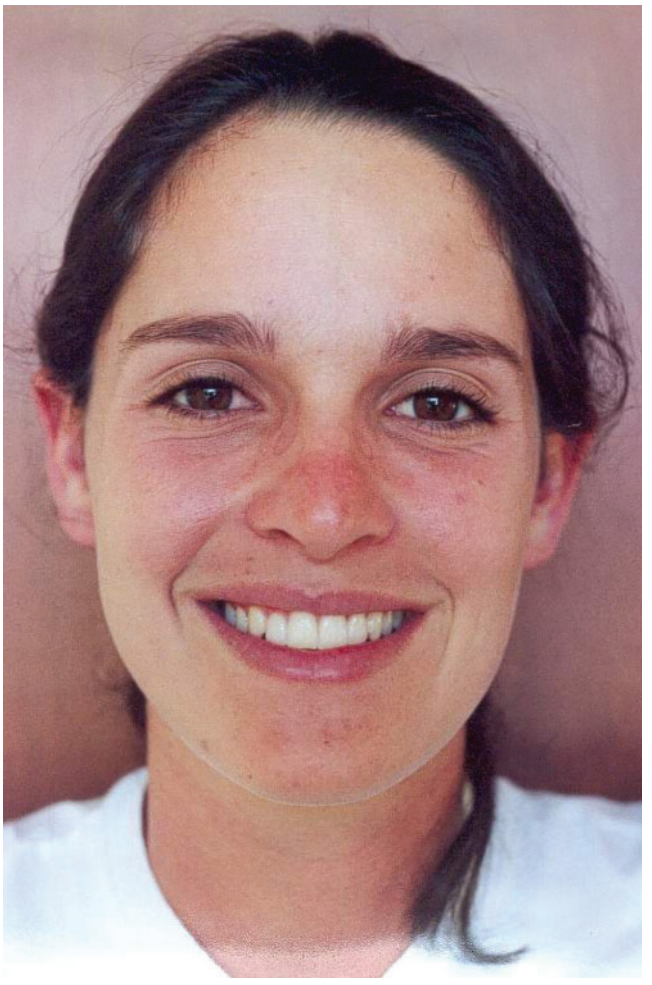

Figure 1 Smiling Frontal View example

Figure 2 Smiling Lower Facial Third View example

Figure 3 Dental View example

examine each view for a maximum of 20 seconds without being able to re-evaluate the previously seen photographs. They rated the aesthetic appeal of each view on a scale from 0 (least attractive imaginable) to 100 (most attractive imaginable) using a visual analogue scale. No other instructions were given.

Statistical analysis

Homogeneity of variances was evaluated with Levene Test and one-sample Kolmogorov–Smirnov Test was used to evaluate if the samples came from a normally distributed population. A one-way ANOVA with a Bonferroni Post Hoc test was used to evaluate the mean aesthetic scores between view types. Separate ANOVA's were used then to evaluate the effects of intra-photographed subject and inter-evaluators variables on the mean aesthetic scores grouped by view type. A MANOVA was used to evaluate all the variable effects simultaneously over the aesthetic ratings according to view type. Pearson partial correlation test was used to correlate the aesthetic perception of the 3 views controlled for bite type, photographed subject, gender and level of education.

Results

Eight randomly selected evaluators were approached for a second time after a week to rate the photographs again. Intra-class correlation reliability analysis was 0.994 for FV ratings, 0.996 for LV ratings and 0.994 for DV.

Descriptive data from the evaluators can be found on Table 1. After grouping the evaluators by level of education significant differences ($p<0.001$) in age according to gender were found, but no differences ($p=0.346$) in age according to gender were found in the photographed subjects. Regarding the photographed subjects, ten were male with a mean age of 25.9 (SD=2.33) and 8 were females with a mean age of 24.2 (SD=3.01).

Mean and standard deviation for the ratings from each view type are shown in Table 2. The best mean rating was for the FV and the worst for the DV. All the means were statistically different ($p<0.001$; ANOVA). The Bonferroni Post Hoc test also found significant differences between views compared by pairs. Rating variations were high in all view types (larger than 25%).

The data analysis revealed that:

- According to the repeated measurements ANOVA anterior bite type, photographed subject and view (all $p<0.001$) and several interactions ($p<0.005$) had a significant effect over the aesthetic ratings (Table 3).

Table 2 Mean and standard deviation of the VAS (100-mm scale) ratings from the different types of views

Views	Mean	SD
Frontal view	52.12	16.14
Lower facial third view	43.18	15.28
Dental view	30.53	15.01

All comparison by pairs with significant differences (Students' t, $p < 0.001$).

Table 1 Descriptive data from the evaluators

Level of education	Gender	No. evaluators	Mean age	SD	Range	*p*-value*
Elementary school	Male	10	47.30	9.58	32–64	0.000
	Female	10	30.80	5.83	24–42	
High school	Male	16	29.00	11.52	18–55	0.000
	Female	21	23.86	6.20	17–38	
College	Male	19	38.16	17.80	21–82	0.000
	Female	15	34.27	13.73	19–61	

*Students' t for independent samples.

Table 3 Significant findings of the effects of anterior bite type, photographed subject, view type, level of education, gender and their interactions on the aesthetic rating evaluated through the Pillai's Trace multivariate test (repeated measurements ANOVA)

Effect	Value	*F*	*p*-value
Bite type	0.769	53.864	<0.001
Photographed subject	0.578	57.589	<0.001
View type	0.761	133.996	<0.001
Bite type * gender	0.126	2.335	0.049
View type * level of education	0.156	3.602	0.008
Bite type * photographed subject	0.778	26.668	<0.001
Bite type * photographed subject * Gender	0.217	2.105	0.034
Bite type * view type	0.644	13.723	<0.001
Bite type * view type * level of education	0.431	2.117	0.006
Bite type * view type * level of education * gender	0.385	1.834	0.021
Photographed subject * view type	0.162	3.969	0.005
Bite type * photographed subject * view type	0.672	<0.001	<0.001

- Gender ($p<0.001$) and the interaction between gender and level of education ($p=0.046$) had also a significant effect over the aesthetic rating, but not level of education alone ($p=0.706$; Table 4).
- Bonferroni Post Hoc test did not reveal any significance between the different levels of education (Table 5).
- Partial correlations controlled for anterior bite type, photographed subject, gender and level of education between the aesthetic ratings of the different views were moderate (FV/LV $r=0.535$, LV/DV $r=0.478$ and FV/DV $r=0.385$; Table 6).

Discussion

The results of the present study highlight the importance for general dentists, orthodontists and dental surgeons to consider the patient's viewpoint when planning and assessing orthodontic treatment.

Table 4 ANOVA to evaluate the between-evaluator's effects of gender and level of education on the aesthetic ratings

Source	Type III sum of squares	df	Mean square	*F*	*p*-value
Intercept	8147262.187	1	8147262.187	855.505	0.000
Level of education	6429.048	2	3214.524	0.349	0.706
Gender	108369.720	1	108369.720	11.778	0.001
Level of education * gender	58638.223	2	28319.112	3.187	0.046
Error	782058.818	85	9200.692		

Table 5 Bonferroni Post Hoc test to evaluate the effects of different combination of levels of education over the aesthetic scores

(I) Level of education	(J) Level of education	Mean difference (I–J)	SE	Sig.	95% Confidence interval Lower bound	Upper bound
1	2	0.7	3.623	1.000	−8.15	9.55
	3	2.11	3.678	1.000	−6.87	11.1
2	1	−0.7	3.623	1.000	−9.55	8.15
	3	1.41	3.101	1.000	−6.16	8.98
3	1	−2.11	3.678	1.000	−11.1	6.87
	2	−1.41	3.101	1.000	−8.98	6.16

1, Elementary school completed; 2, High school completed; 3, college completed.

Table 6 Partial Pearson correlation test between the ratings of the different types of views controlled for anterior bite type, photographed subject, gender and level of education

	FV	LV	DV
FV	1.000	0.535**	0.385**
LV	0.535**	1.000	0.478**
DV	0.385**	0.478**	1.000

**Highly significant ($p < 0.001$).

It was particularly relevant that lay people appeared to be more aware of dental aesthetics when represented as a 'close up' view, rather than a full smiling face.

In addition, it appeared that the nature of anterior visible occlusion features had an effect. For example, there was no significant difference between the aesthetic scores for ideal bite and end-to-end, and between open bite, deep bite, crossbite and crowded bite cases. Nevertheless, between IB and EE cases, and the rest of the evaluated deviations (OB, DB, CB and CwB) we found differences. As a result we can conclude that the aesthetic deviations between near to ideal arrangements and unaesthetic arrangements were noted by our panel, but not the differences inside these categories. That has some implications because the present results show that lay persons did not differentiate between the morphology of malocclusions, they simply categorized them as unaesthetic. We should be aware of this in case discussions.

It was expected that variations between individual subject photographs were only significantly associated with FV, but not with LV and DV. When we considered the facial views this appeared to have an influence because specific features from the photographed subjects such as facial form, face and hair colour, gender, etc., may have influenced the aesthetic perception of the views. In closer views this possible influence disappears as lay persons focus their attention on dental features. We as professionals tend to evaluate the anterior occlusal features from an intra-oral point of view and perhaps not always as an integral part of the facial aesthetics. Lay people appear to evaluate their anterior dental arrangement from a full facial view in a mirror. That should also be taken into account when discussing aesthetic considerations.

When we consider the study variables, gender had an impact on aesthetic perception. Males were consistently less critical than females evaluating the same photograph. These results were similar to those previously reported on smile perceptions[3] and profile ratings on different aesthetic characteristics.[12–14]

Most previously published studies reported perceived aesthetics based on profile views through computer-animated programmes in different target groups from different backgrounds,[15–20] orthognathic surgery[21–24] or profile self-perception.[25] The problem with this is that people do not usually *see* their own profiles. They evaluate their facial, smile or dental aesthetics from a frontal view and, therefore, the usefulness of this approach is questionable. In contrast to the Kerns *et al.* study,[3] who compared the aesthetic perception of a frontal and a profile view of the smiles of the same person, the present study evaluated the aesthetics of facial smiles judged by lay people comparing the attractiveness of the same smile in different frontal views.

Level of education had no consistent impact on dental and facial aesthetic perception. This variable has not been previously considered in aesthetic evaluations.

One limitation in this study was the lack of homogeneity in racial origin in the photographed subjects. This is a difficult issue to overcome in Peru, since there is mixture of races, without a perfect definable race. For the same reason, lay people selected for the evaluation were not from pure race origin, but comply with Peruvian 'normal' people. Different authors,[7,14] have stated that differences in aesthetic perception exist according to ethnic origin. A second study limitation was the lack of standardization of socioeconomic status, as well as the cultural and religious status at the time of the surveys was almost impossible, but low level of education is mostly accompanied by low economic income in Peru.

The present study has evaluated, for the first time simultaneously, several variables that may influence the perception by lay persons of facial and dental aesthetics. Future research should be carried out with a larger and more significant sample of lay persons in different socio-cultural settings to evaluate if the present trends are repeated.

Conclusions

- The aesthetic impact of dental view decreased in a full facial smile view.
- Intra-photograph effects (bite type, photographed subject and view) influenced the aesthetic perception of smiles.
- Intra-evaluator effects (level of education and age) did not consistently influence the aesthetic perception of smiles, but gender did.
- Moderate correlations between the aesthetic ratings were found.

Contributors

C Flores-Mir was responsible for the study conception and design, analysis and interpretation of the data. He participated in the drafting and critical revision of the paper. E. Silva participated in the study conception and design. He also participated in the collection and interpretation of the data, drafting and critical revision of the paper. M. I. Barriga participated in the study conception and design. He also participated in the collection and interpretation of the data, drafting and critical revision of the paper. M. O. Lagravère participated in the study conception and design. He also participated in the collection and interpretation of the data, drafting and critical revision of the paper. P. W. Major participated in the study analysis and interpretation of the data. He participated in the drafting and critical revision of the paper.

All the listed authors approved the final version of the manuscript to be published.

Giseon Heo made the statistical analysis and Renzo H. Valverde provided some useful feedback in the analysis of the anterior visible occlusions.

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