MAXILLARY DENTAL MIDLINE DEVIATION IN THE PATIENT PERSPECTIVE

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Palavras-chave: Estética Dental. Sorriso. Ortodontia.

RESUMO

Objetivo: O objetivo foi avaliar a percepção estética do desvio da linha média dentária por pacientes ortodônticos; influência de estruturas adjacentes ao sorriso na percepção de desvios; e diferença de percepção entre pacientes tratados em Universidade e consultório particular. **Métodos**: Neste estudo comparativo observacional transversal uma fotografia de mulher sorrindo foi modificada digitalmente com desvios da linha média para a esquerda em relação à face. Doze fotografias foram recortadas para obter o grupo LCN incluindo lábios, queixo e 2/3 nariz; e grupo L incluindo lábios. O teste não paramétrico de Friedman (α= 0.05), seguido pelo de Wilcoxon, corrigido pelo teste de Bonferroni (α = 0.0033) foram utilizados para comparações múltiplas. O teste de Mann-Whitney foi aplicado para comparar grupos LCN e L, verificando a influência das estruturas adjacentes ao sorriso. O coeficiente de Pearson foi usado para correlação e regressão dos desvios sobre a estética do sorriso, adotando nível de significância de 5%.**Resultados**: Desvios de 2 mm foram identificados. Comparando grupos LCN e L houve diferença estatisticamente significante nos desvios de 2 e 3 mm. Entre pacientes da universidade e do consultório houve diferença significativa ao comparar fotografias no grupo LCN, sem desvio e desvios de 2, 4 e 5 mm. **Conclusões**: pacientes ortodônticos são capazes de detectar desvio da linha média dentária maxilar de 2 mm. Estruturas adjacentes ao sorriso influenciaram na percepção do desvio para os pacientes privados. Os pacientes da Universidade foram mais críticos do que os de consultório particular.

Keywords: Dental Esthetics. Smiling. Orthodontics.

ABSTRACT

Objective: This study aimed to determine aesthetic perceptions of midline deviations by orthodontic patients; influence of adjacent structures to smile in the perception of deviations; and difference between patients treated in University and in private practice. **Methods:** In this observational comparative cross-sectional study a smiling woman photograph was digitally modified, producing left maxillary dental midline deviations relative to facial midline. Twelve photographs were cropped in Group LCN including lips, chin and 2/3 of the nose; and group L including the lips. Non-parametric Friedman test (α = 0.05), followed by Wilcoxon test corrected by Bonferroni test (α = 0.0033) were used for multiple comparisons. Pearson correlation coefficient was used to study of the correlation and regression of the degree of smile esthetics on the midline deviations, adopting a significance level of 5%. **Results:** Patients were able to identify deviations from 2 mm. Among the groups of photos there was statistically significant difference in deviations of 2 and 3 mm. Comparing patients from University and private there was significant difference when comparing the photos in group LCN, without deviation and deviation of 2, 4 and 5 mm. **Conclusions:** Orthodontic patients are able to detect maxillary dental midline deviation from 2 mm. There was influence of viewing structures adjacent to smile in the perception of deviation for the private patients. University patients were more critical than private patients.

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INTRODUCTION

The main individual motivation to seek orthodontic treatment is to improve smile esthetics, as currently, having good appearance is an important factor both in the professional and social field. Knowing this, orthodontists worldwide are increasingly committed to the expectations of their patients in relation to treatment.[1-3]

Scientific studies have shown reproducible and reliable methods to evaluate the smile esthetics´, allowing the evaluation of aspects considered subjective. Such studies intend to get an understanding of the factors that improve or worsen the attractiveness of the smile, and try to create norms from scientific data to guide orthodontists regarding diagnosis and treatment plan.[4,5]

An esthetically pleasing smile includes factors like symmetry, proportion of tooth size, small gingival exposure when smiling, moderate buccal corridor, smiling curve following the curvature of the lower lip, proper vertical overlap and absence of diastemas.[1,6-10]

One feature that contributes to facial and smile symmetry is the dental midline. Although a subtle asymmetry between the facial and tooth midlines is acceptable, a significant discrepancy can be harmful.[11,12] Often orthodontists encounter malocclusions where there is discrepancy between dental and facial midlines, and its main causes are mandibular displacement caused by crossbite, asymmetric arches, discrepancy in the size of the teeth, displacement of the upper incisors and/or lower, isolated mandibular displacement or combination of these factors.[13-15]

In some cases, the correction of the discrepancy between the dental and facial midline is not simple and may increase the complexity and duration of treatment.[15] Therefore studies have been conducted in order to evaluate the perception of lay individuals,[1,4-6,12,14,15] dentists[4-6] and orthodontists[1,4,5,14,15] in relation to the influence of the deviation of the maxillary dental midline in smile esthetics, so that treatment planning reach the expectations of the patient,[1,2] avoiding unnecessary measures that prolong its completion. Threfore, not many studies assessed the perception of dental midline deviation by orthodontic patients. In the Beyer and Lindauer[4] study, patients and their parents participated as evaluators. They found statistically significant differences between orthodontists, dentists, patients and parents, with the orthodontists being the most critical ones and the patients the less critical.

For our study, we felt that it was consistent to consider the difference in perception between patients treated in the University and patients from a private practice.

The aim of this research was to evaluate the esthetic perception of the upper midline deviation by undergoing orthodontic treatment; the influence of structures adjacent to smile in the perception of deviation; and the difference of perception between patients treated at the Federal Fluminense University (UFF) and in private practice.

MATERIALS AND METHODS

This comparative and observational cross-sectional research project was submitted to the Research Ethics Committee of the Faculty of Medicine of the Federal Fluminense University, Niterói, Rio de Janeiro, Brazil,[11] and was approved with the number 19883013.1.0000.5243, with the protocol number 422 820, and all participants signed a Consent and Informed form.

The digital photograph of a woman presenting well-aligned teeth was digitally modified with Adobe Photoshop Elements 2.0® software (Adobe Systems Inc., San Jose, California, USA) in order to produce progressive shifts of the maxillary dental midline in relation to facial midline 1 mm by 1 mm, from 0 to 5 mm. Adjacent tissue was kept in position once the entire upper arch was shifted to the left.[12]

To evaluate the influence of adjacent structures, the photos were cropped to obtain photographs in two configurations: Group LCN - including lips, chin and 2/3 of the nose; and Group L - including lips. We used [13] images for review, two of them without midline shift and [11] digitally altered. All photos were standardized reproducing the smile on the original patient´s size.[12]

The 12 photographs (6 from group LCN and 6 from group L) were coded, printed and arranged randomly in an album to be submitted for review by the evaluators. The first part was assembled with the photographs from group LCN and the second part with the photographs from group L.[12]

The group of evaluators was composed by 104 lay in dentistry individuals that were in any fase of their orthodontic treatment in the clinic of post-graduation in orthodontics at UFF (n= 53), or in a private office (n= 51), including only adults (inclusion criteria). The mean age of the University sample was 23,18 years (18-44,7y) and for the private practice patients was a mean of 33,92 years (18-74,8y). The type of sample was based on cluster randomization where the evaluators were approached by the researcher when they got in the University or the private office for their appointment. They had complete freedom to choose whether to participate or not.

Before the evaluation of photographs was performed, two leveling photographs were showed to the evaluators: the original, without midline shift and another featuring 6 mm of deviation to the left side. It was delivered to the evaluator the album with the coded pictures and a form with 12 visual analogue scales (VAS),[16,17] a scale for each picture, numbered from zero to one hundred, the lowest

value assigned to the least esthetic smile and the greatest value to more esthetic. The time limit for the observation of each photograph was 20 seconds with an interval of 10 seconds between observation of a photograph and another. It was advised to the evaluator not to return to the previous album page. The same operator (T.M.G.) approached the patients, gave the instructions, handed the album and controlled the time of each evaluation.

After marking the values on their respective scales, measurements were performed by a single operator (T.M.G.), with the aid of a digital caliper (Starrett Indústria e Comércio Ltda., Itu, São Paulo, serial number 001296) calibrated to VAS, positioned in the point equal to zero and extended to the mark made by the evaluator. The values were recorded in tables so they could be analyzed statistically.

The sample size calculation was based on data from a doctoral thesis in Orthodontics, Dental School, Federal University of Rio de Janeiro.[11,12] For a 90% in power and 95% confidence interval ($\alpha = 0.05$) and considering difference of 10 in the VAS estimated sample size was 92 evaluators.

For evaluation of the method error, 20 examiners were randomly selected and requested to repeat the evaluation with three weeks apart. For the analysis of intra-examiner systematic error we used Student's t-test for paired samples and to determine the random error was used the calculation of the proposed error by Dahlberg.[18]

The minimum, the maximum, median and interquartile range were used where for achieving descriptive statistical data in all evaluations proposed.

The normality of the data relating to the esthetic evaluation of the midline changes, and the comparison between patients from UFF and private practice was evaluated by the statistical test of Kolmogorov-Smirnov.

To evaluate the influence of the change of the dental midline in the perception of smile esthetics, we used the non-parametric Friedman test, at a significance level of 5% ($\alpha = 0.05$), followed by the Wilcoxon test considering the significance level corrected by Bonferroni test ($\alpha = 0.0033$) for multiple comparisons.

It was adopted a 5% significance level for all tests described below.

Interference from adjacent structures to smile was evaluated using the non-parametric Friedman test , followed by the Wilcoxon test.[19]

The study of the correlation and regression of the degree of smile esthetics on the midline deviations was done using the Pearson correlation coefficient.

Statistical analysis was performed using the Statistical Package Computer program for Social Science © (SPSS Inc. Chicago, Illinois, USA), belonging to the Department of Statistics at the Mathematics Faculty of the Federal Fluminense University.

RESULTS

The calculation result for intra-examiner error made by the Student test showed no statistically significant difference between the evaluations at a significance level of $p>0.05$, confirming the absence of systematic errors. According to the calculation results to random error assessment, acceptable values were obtained.

Table 1: *- The amount of manipulated shift, median and, interquartile range (iqr) of data assigned by the University patients evaluators (n= 53). Comparison of degrees of shift between photo LCN and photo L ($p < 0.05$).*

	Deviation	median	iqr
Group LCN	No shift	75.65	19.74
	1 mm	81.28	19.51
	2 mm	70.98	28.27
	3 mm	66.78	24.06
	4 mm	57.66	24.24
	5 mm	50.40	24.05
Group L	No shift	79.74	21.43
	1 mm	76.62	18.15
	2 mm	73.17	28.07
	3 mm	64.99	18.94
	4 mm	63.49	26.71
	5 mm	52.02	29.14
		Mann-Whitney Test	
			p-value
LCN x L		No shift	0.706 (ns)
		1 mm	0.257 (ns)
		2 mm	0.731 (ns)
		3 mm	0.598 (ns)
		4 mm	0.728 (ns)
		5 mm	0.765 (ns)

Note: (ns) = no statistically significant difference

Table 1 shows the central tendency and dispersion of the scores given by the evaluators from University. It can be seen that the highest grades were attributed to smiles without deviation and with 1 mm deviation, with the lowest scores awarded to the photos of smiles with 4 or 5 mm deviation, both in group LCN and group L. Mann-Whitney test was applied for comparisons between photos in group LCN and L, to verify the interference of adjacent structures to the smile. The results showed no statistically significant difference in valuation of University patients for both groups.

The Kolmogorov-Smirnov test was applied to verify the normality of the data and showed that they were not normal in some deviations in group LCN and in group L. The Wilcoxon test, at a significance level of 0.0033 after Bonferroni correction, indicates evidence of statistically significant difference between the deviation groups

Table 2: *- Application of the Wilcoxon test for multiple comparisons of the values assigned to each amount of shift of the groups LCN and L from University patients evaluators.*

	Deviation	1 mm	2 mm	3 mm	4 mm	5 mm
Group LCN	No shift	p = 0.501	p <0.0001*	p <0.0001*	p <0.0001*	p <0.0001*
	1 mm		p <0.0001*	p <0.0001*	p <0.0001*	p <0.0001*
	2 mm			p = 0.067	p <0.0001*	p <0.0001*
	3 mm				p <0.0001*	p <0.0001*
	4 mm					p <0.0001*
Group L	No shift	p = 0.789	p = 0.014	p = 0.0004*	p < 0.0001*	p < 0.0001*
	1 mm		p = 0.009	p < 0.0001*	p < 0.0001*	p < 0.0001*
	2 mm			p = 0.071	p < 0.0001*	p < 0.0001*
	3 mm				p = 0.015	p < 0.0001*
	4 mm					p = 0.0004*

*Note: * - Statistically significant (α = 0.05), adjusted by the Bonferroni test (α = 0.0033)*

Table 3: *- The amount of manipulated shift, median and interquartile range (iqr) of data private assigned by practice patients evaluators (n= 51). Comparison of degrees of shift between photo LCN and photo L (p < 0.05).*

	Deviation	median	iqr
Group LCN	No shift	84.17	20.16
	1 mm	82.63	16.02
	2 mm	80.61	13.64
	3 mm	75.60	18.27
	4 mm	71.42	21.84
	5 mm	61.88	15.08
Group L	No shift	85.07	15.18
	1 mm	76.69	19.06
	2 mm	75.00	23.4
	3 mm	68.04	19.29
	4 mm	66.38	28.14
	5 mm	60.12	18.91
		Mann-Whitney Test	
			p-value
LCN x L		No shift	0.621(ns)
		1 mm	0.556(ns)
		2 mm	0.490(ns)
		3 mm	0.070(ns)
		4 mm	0.366(ns)
		5 mm	0.926(ns)

Note: (ns) = no statistically significant difference

Table 4: *- Application of the Wilcoxon test for multiple comparisons of the values assigned to each branch of the groups LCN and L from private practice patients.*

	Deviation	1 mm	2 mm	3 mm	4 mm	5 mm
Group LCN	No shift	p = 0.689	p = 0.002*	p = 0.001*	p <0.0001*	p <0.0001*
	1 mm		p = 0.0033*	p <0.0001*	p <0.0001*	p <0.0001*
	2 mm			p = 0.164	p <0.0001*	p <0.0001*
	3 mm				p = 0.001*	p <0.0001*
	4 mm					p = 0.0005*
Group L	No shift	p = 0.009	p <0.0001*	p <0.0001*	p <0.0001*	p <0.0001*
	1 mm		p = 0.001*	p <0.0001*	p <0.0001*	p <0.0001*
	2 mm			p = 0.269	p <0.0001*	p <0.0001*
	3 mm				p = 0.005	p <0.0001*
	4 mm					p <0.0001*

Note: - Statistically significant (α= 0.05), adjusted by the Bonferroni test (α= 0.0033)*

Table 5: Comparison between the segments in each of the shifts of the images of the group LCN.

Deviation	Segment	Test Result
No deviation	University	p = 0.008*
	Private practice	
1 mm	University	p = 0.175
	Private practice	
2 mm	University	p = 0.002*
	Private practice	
3 mm	University	p = 0.123
	Private practice	
4 mm	University	p = 0.001*
	Private practice	
5 mm	University	p = 0.011*
	Private practice	

Note: - Statistically significant (α= 0.05)*

Table 6: *Comparison between the segments in each of the shifts of the images of the group L.*

Deviation	Segment	Test Result
No deviation	University	p = 0.109(ns)
	Private practice	
1 mm	University	p = 0.828(ns)
	Private practice	
2 mm	University	p = 0.904(ns)
	Private practice	
3 mm	University	p = 0.601(ns)
	Private practice	
4 mm	University	p = 0.344(ns)
	Private practice	
5 mm	University	p = 0.318(ns)
	Private practice	

Note: (ns) No statistically significant difference



Figure 1: *– Group LCN photographs. The number in each picture indicates the amount of the midline shift in millimeters.12*



Figure 2: *- Group L photographs. The number in each photograph indicates the amount of midline shift in millimeters.12*

The analysis of the correlation between the deviations shown on the images of group LCN and group L and average grades achieved by the evaluators found a strong correlation between the two variables, the Pearson correlation coefficient was r = 0.8663 and r = 0, 9777, respectively (Figure 1).

Table 3 presents the central tendency and dispersion of the scores given to the photographs by private patients. The highest grades were attributed to smiles without deviation, with 1 and 2 mm deviation of the maxillary dental midline, with the lowest scores awarded photos of smiles with 3, 4 or 5 mm deviation, both in group LCN and in group L. Mann-Whitney test was applied to comparisons between group LCN and Group L to verify the interference of adjacent structures to smile. The results showed no statistically significant difference in the evaluation of private patients for any deviation of the maxillary dental midline.

Kolmogorov-Smirnov test was applied to verify the normality of the data and showed that they were not normal

in some deviations. Wilcoxon test, at a significance level of 0.0033 after Bonferroni correction, indicates evidence of statistically significant difference between the groups deviation (Table 4).

The analysis of the correlation between the deviations shown on the image of photos LCN and L and average grades achieved by the evaluators found a strong correlation between the two variables, the Pearson correlation coefficient was r = 0.9751 and r = 0, 9891, respectively (Figure 2).

Comparisons were made between the assessments made by patients of University and private practice. Student's t test was used when there was normality of the data and the Mann-Whitney test was used when there was no normality. There was significant difference when comparing the photos in group LCN, without deviation and deviation of 2, 4 and 5 mm (Table 5).

Again, comparisons were made between the assessments made by patients of University and private practice. Mann-Whitney test was used and there are no differences when comparing all photos in group L (Table 6).

DISCUSSION

Although the correction of functional and esthetic dental problems is the goal of orthodontic treatment, it is also important to consider the expectations of the patient. Therefore the evaluation of the perception of different individuals about smile features is subject of studies.[1,3-8,13,14] From this work, it was possible to qualify the perception of individuals in orthodontic treatment of the deviation of the maxillary dental midline in smile esthetics.

The evaluators were anable to detect 1 mm deviation, since there was no statistically significant difference between the values awarded to smiles without deviation and with 1 mm deviation, but there was difference in the comparison of smiles without deviation and deviation of 2 mm. All deviations greater than 2 mm were considered statistically significant when compared to photos without deviation.

It was not adopted here the use of full-face photographs, especially for the chance of confusing and dispersing the reviewer.[15]

In addition, it was planned to select only the smile feature related to the maxillary dental midline. The validity and reliability of the use of photographs and VAS as a methodological resource for the evaluation of dental and facial esthetics were proven in other studies.[17,18,20,21]

The concept of what can be a beautiful smile is personal, however, the perception of beauty for orthodontists, dentists and patients is essential to provide scientific data suitable for diagnosis and orthodontic planning.

Most studies used orthodontists, dentists and laypeople as evaluators in research on the midline shifts,[5,6,14,15] however it is wise to know the opinion of the patients[4], since they are the recipients of the benefits of treatment. It is known that the perception of the esthetic by dentists, in particular, the orthodontists is more accurate than the one from laypeople[1,4-,6] but it is believed that patients with the course of treatment, repair increasingly in smile details and supposedly become more critical then laypeople.

The research from Kokich et al[6] which used laypeople in dentistry as evaluators of smile esthetics, attested they were not able to detect midline deviations of up to 4 mm, Pinho et al[5] concluded that the laypeople were not able to notice any deviation in the midline.

On the other hand, An et al[22] compared the esthetic perception of laypeople with no orthodontic treatment history, laypeople with orthodontic treatment history and dentists on aspects that influence the esthetics of the smile and concluded that laypeople with previous experience had the most critical esthetic perception than those who have never been treated orthodontically, agreeing with our hypothesis.

Our results showed no statistically significant difference in evaluation of University patients of group LCN and group L . However there was statistically significant difference in the evaluation of private patients when the deviation of the maxillary dental midline was 2 mm and when the deviation was 3 mm between the photos of group LCN and group L. The photos of group L, received lower scores on average, indicating that the closer the smile appears in the image, the more critical will be the evaluation. The research of Normando et al[14] meets our study when only shows a small difference, but statisticallysignificant, between photos more or less approximate, on the other hand in this case the photos including the nose and the lip philtrum, scored lower values.

Evaluations performed by patients from University and private practice were compared. All the average scores of University evaluators were lower than the average of private practice patients. In addition, there was a statistically significant difference when comparing the photos in group LCN, without deviation and deviation of 2, 4 and 5 mm. This result can be explained by the amount of information received during their queries. Patients from an educational institution regularly hear the instructions of teachers to students during treatment and can absorb more knowledge than a private practice patient

CONCLUSIONS

According to the methodology used and the results obtained:

Lay in dentistry individuals who are undergoing orthodontic treatment are able to detect the maxillary dental midline deviation from 2 mm;

Viewing structures adjacent to smile affected the perception of deviation of the midline by the private practice patients;

Orthodontic patients from University were more critical then private practice patients.

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