



Smile components and facial biotype according to sex in patients with malocclusion

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ABSTRACT

Introduction: achieving a balanced smile requires consideration of its constituent elements together with facial biotype, all of which should create a harmonious appearance.

Objective: to determine the relationship between smile components and facial biotype according to sex in patients aged 14 to 18 years with malocclusions.

Methods: a correlational, prospective longitudinal study was conducted at the Eduardo Agramonte Piña Pediatric Hospital in Camagüey from April 2023 to December 2024. The sample consisted of 46 adolescents who underwent lateral cephalometric radiographs, corresponding cephalometric tracings, and posed smile photographs before and after orthodontic treatment.

Results: a significant relationship was found between smile components and sex, particularly regarding buccal corridors, frontal occlusal plane, dental component, and gingival component ($p < 0,05$) in both sexes before and after orthodontic treatment. Smile arc and smile symmetry were significant only in females following aesthetic treatment. No relevant differences were observed between sexes. Prior to treatment, common characteristics included high lip line, consonant smile arc, and asymmetric occlusal plane. Regarding facial biotype, no significant differences were found ($*p* > 0,05$); the mesofacial type predominated, followed by brachyfacial, with dolichofacial being the least frequent.

Conclusions: a highly significant relationship exists between smile components and sex after orthodontic treatment. No association was found between facial biotype and sex before or after orthodontic treatment.

Keywords: Esthetics, Dental; Smiling; Orthodontics.

INTRODUCTION

Facial appearance exerts a significant influence on social acceptance and psychological well-being. Numerous studies have shown that aesthetic motivation outweighs functional concerns when patients seek orthodontic treatment.^(1,2,3,4)

Currently, there is growing interest in achieving an attractive smile—concerns now extend beyond oral function to include beauty and harmony during smiling.⁽⁵⁾ To attain an aesthetically pleasing smile, its components must be in balance and harmony. This involves not only dental alignment but also the interrelationship among skeletal components, musculature, and the oral structures.⁽⁶⁾

Facial analysis is a crucial element in orthodontic diagnosis. Facial biotype determines not only physical characteristics but also craniofacial complex traits that can guide orthodontic movement planning, help understand growth patterns, and assist in patient-specific diagnosis. Accurate biotype determination is particularly important in orofacial myology, as each facial type exhibits distinct features reflected in craniofacial structures, dental occlusion, and facial muscle harmony.⁽⁷⁾

International literature includes numerous studies describing the relationship between smile components and facial biotype in patients with normal occlusion or prior to orthodontic treatment. Most of these studies propose similar facial models across different populations, yet report significant differences due to ethnic, nutritional, and environmental variability.

In Cuba, no prior studies have examined the relationship between these variables, and few investigations have addressed aesthetic smile analysis. Consequently, reliable, objective tools for aesthetic diagnosis are scarce or absent in clinical practice. Given the high demand for aesthetic solutions in orthodontics, this study aims to establish reliable diagnostic criteria by determining the relationship between smile components and facial biotype according to sex in patients aged 14 to 18 years with malocclusions.

METHODS

A correlational study was conducted among patients aged 14 to 18 years attending the Orthodontics Clinic of the Department of Stomatology at the Eduardo Agramonte Piña Pediatric Hospital in Camagüey, Cuba, from April 2023 to December 2024. The research was carried out by a First-Degree Orthodontics Specialist, supervised by a Second-Degree Orthodontics Specialist and Assistant Professor. The study population consisted of 46 adolescents selected based on inclusion and exclusion criteria.

The variables assessed were: sex; smile line (low, medium, high); smile arc (consonant or non-consonant); upper lip curvature (high, straight, or low); negative spaces (present or absent); smile symmetry (high, straight, or low); negative spaces (present or absent); frontal occlusal plane (symmetric or asymmetric); dental component (acceptable or unacceptable); gingival component (acceptable or unacceptable); and facial biotype (classified via cephalometric analysis as dolichofacial, mesofacial, or brachyfacial).

Each adolescent underwent a standardized lateral cephalometric radiograph, processed to ensure optimal density, contrast, definition, and detail, as well as an extraoral frontal photograph in posed smile—taken both before and after orthodontic treatment.

Cephalometric radiographs were placed on a viewbox on a worktable, and all necessary cranial and facial structures were traced onto acetate paper for cephalometric analysis. Facial biotype was then determined for each patient.

Smile components were assessed through manual measurements performed on printed 5×7 photographs.

Data were processed using SPSS 25,0 for Windows. Statistical significance was set at $p < 0.05$ with 95 % confidence. The sign test and McNemar's test were applied according to variable type to address the study objectives.

Informed consent was obtained from all patients. The study adhered to the ethical principles of the Declaration of Helsinki from its inception and upheld the principle of beneficence (doing good).

RESULTS

Table 1 shows the relationship between smile components and sex. Buccal corridors, frontal occlusal plane, dental component, and gingival component showed a statistically significant association ($p < 0.05$) using McNemar's test in both females and males, before and after orthodontic treatment. Smile arc and smile symmetry were significantly associated only in females after aesthetic treatment. However, no statistically significant differences were observed between sexes overall. Prior to treatment, predominant characteristics included high lip line, consonant smile arc, low upper lip curvature, present buccal corridors, symmetrical smile, asymmetric frontal occlusal plane, unacceptable dental component, and acceptable gingival component.

Table 1. Patients before and after orthodontic treatment according to smile components and sex.

Smile Component		Male				Femenino			
		Before		After		Before		After	
		No.	%	No.	%	No.	%	No.	%
Lip line	High	10	21,7	3	6,5	12	26,1	2	4,3
	Medium	3	6,5	12	26,1	10	21,7	23	50,0
	Low	3	6,5	1	2,2	8	17,4	5	10,9
<i>Sign test (p)</i>		0,344				0,092			
Smile arc	Consonant	10	21,7	13	28,3	18	39,1	28	60,9
	Non-consonant	6	13,0	3	6,5	12	26,1	2	4,3
<i>McNemar test (p)</i>		0,250				0,002			
Upper lip curvature	High	2	4,3	0	0,0	9	19,6	5	10,9
	Straight	4	8,7	11	23,9	10	21,7	23	50,0
	Low	10	21,7	5	10,9	11	23,9	2	4,3
<i>Sign test (p)</i>		0,453				0,267			
Buccal corridors	Present	15	32,6	1	2,2	16	34,8	3	6,5
	Absent	1	2,2	15	32,6	14	30,4	27	58,7
<i>McNemar test (p)</i>		<0,001				<0,001			
Smile symmetry	Symmetric	15	32,6	16	34,8	17	37,0	25	54,3
	Asymmetric	1	2,2	0	0,0	13	28,3	5	10,9
<i>McNemar test (p)</i>		0,901				0,021			
Frontal occlusal plane	Symmetric	6	13,0	16	34,8	14	30,4	30	65,2
	Asymmetric	10	21,7	0	0,0	16	34,8	0	0,0
<i>McNemar test (p)</i>		0,002				<0,001			
Dental component	Acceptable	4	8,7	16	34,8	7	15,2	30	65,2
	Unacceptable	12	26,1	0	0,0	23	50,0	0	0,0
<i>McNemar test (p)</i>		<0,001				<0,001			
Gingival component	Acceptable	16	34,8	16	34,8	24	52,2	30	65,2
	Unacceptable	0	0,0	0	0,0	6	13,0	0	0,0
<i>McNemar test (p)</i>		<0,001				0,031			

Table 2 shows that there are no statistically significant differences in facial biotype according to sex before and after orthodontic treatment ($p > 0,05$; 95 % CI). The mesofacial biotype was the most frequent at both time points (51,4 % before and 6,4 % after), followed by the brachyfacial (28,3 % before and 17,3 % after), while the dolichofacial type was the least represented (17,4 % before and 15,2 % after). Overall, these findings confirm the predominance of the mesofacial biotype and the absence of significant sex-related variations following treatment.

Table 2. Patients before and after orthodontic treatment according to facial biotype and sex.

Sex	Time	Facial biotype						p-value
		Mesofacial		Dolichofacial		Brachyfacial		
		No.	%	No.	%	No.	%	
Male	Before	8	17,4	3	6,5	5	10,9	0,125
	After	12	26,1	2	4,3	2	4,3	
Female	Before	17	37,0	5	10,9	8	17,4	0,500
	After	19	41,3	5	10,9	6	13,0	

DISCUSSION

The results obtained coincide with the study by Melo et al.,⁽⁸⁾ which aimed to determine the frequency of different aesthetic smile parameters and explore possible gender differences. They found no significant differences between females and males regarding the studied aesthetic smile parameters. Both studies also agree on the presence of a consonant smile arc; however, they differ from the present study in reporting a medium smile line, high upper lip curvature, and acceptable dental component. It should be noted that Melo et al.,⁽⁸⁾ evaluated the dental component considering only the coincidence of dental and facial midlines and tooth shape, whereas the present study included tooth size, shape, color, alignment, crown angulation, midline, and arch symmetry.

The research partially agrees with the results obtained by Espejo,⁽⁹⁾ in a study conducted in Peru to determine the relationship between six smile components among dental students at the Central Military Hospital. Espejo found no significant differences between smile components and sex, and also reported consonant arcs, acceptable gingival component, and asymmetric smile—findings consistent with ours. However, Espejo reported a medium lip line, straight upper lip curvature, and acceptable dental component, which differ from the present investigation.

Cunha et al.,⁽¹⁰⁾ in a study conducted in Portugal to evaluate the influence of age and sex on six aesthetic smile parameters, found a direct correlation between upper lip curvature ($p = 0,049$ and $p = 0,032$) and smile arc ($p = 0,001$ and $p = 0,007$) with gender and age. Straight upper lip curvature was more predominant in females (44,1 %), while low curvature prevailed in males (47 %); the consonant smile arc predominated in both sexes. These results do not agree with those of the present study, as our statistical test shows an associated probability greater than 0,05 for the upper lip curvature component in both females and males, leading to the conclusion that there is insufficient evidence to assert sex-related differences in this variable before and after treatment with 95 % confidence. However, the smile arc showed a significant relationship with sex in females, but only after orthodontic treatment.

Tenorio Chávez et al.,⁽¹¹⁾ in a study to determine the relationship between Roy Sabri's smile components and sex among dental students at Norbert Wiener University in Lima, Peru, found no association between smile components and sex ($p > 0,05$)—results that differ from the present study, where four smile components showed a relationship with sex. They found no significant differences regarding lip line, upper lip curvature, frontal occlusal plane, and gingival component in relation to sex, which contrasts with our findings.

Tanjun Nacarino et al.,⁽¹²⁾ in a study to determine the frequency of aesthetic smile parameters in young adults of Huanuco descent, obtained results similar to the present study regarding the significant association of buccal corridors and acceptable gingival component. However, they differed regarding smile arc, upper lip curvature, and acceptable dental component.

It is important to mention that no studies relating these variables after orthodontic treatment were found during the research process. Therefore, the referenced studies only applied their investigations to patients with normal occlusion or no prior orthodontic treatment, which means the following results are not compared with other investigations.

After aesthetic orthodontic treatment, no statistically significant differences were observed between sexes, with the following features predominating: medium lip line, consonant smile arc, medium upper lip curvature, absent buccal corridors, symmetrical smile, symmetric frontal occlusal plane, and acceptable dental and gingival components.

Regarding facial biotype in relation to sex, Calizana,⁽¹³⁾ found results consistent with the present study, reporting a mesofacial biotype in 36,5 % of patients, brachyfacial in 34,2 %, and dolichofacial in 29,3 %. By sex, mesofacial predominated in both males (37 %) and females (36,1 %).

The results obtained by Lipe K et al.,⁽¹⁴⁾ in a study associating smile line photographs and facial biotype among patients in Juliaca, coincide with the present study regarding the predominant facial biotype—mesofacial in both females and males (56 %), followed by dolichofacial (28 %) and brachyfacial (16 %). However, these latter results differ from those presented in our investigation.

Nieto Montecillo et al.,⁽¹⁵⁾ aiming to determine the relationship between smile components and facial morphology in patients at dental clinics in Huánuco, Peru, found the brachyfacial biotype to be most frequent (48 %), followed by mesofacial (40 %), with dolichofacial least frequent (12 %). These results partially agree with the present study, as both found dolichofacial to be the least frequent; however, they differ from the study by Díaz Mendoza,⁽¹⁶⁾ which sought to determine the relationship between facial biotype and smile types in patients attending the "Familydent" dental clinic in Lima, Peru, where 94,3 % of examined individuals presented a dolichofacial biotype.

The results of the present investigation also differ from those reported by Abad Rujel et al.,⁽¹⁷⁾ in a study to determine the relationship between aesthetic smile characteristics and facial patterns among students at a national university in Piura, Peru, where the dolichofacial pattern was most dominant in 43,8 % of men, while 43,8 % of women presented a mesofacial biotype. However, García Martínez et al.,⁽¹⁸⁾ in a study to determine the association between facial biotype and the shape of upper central incisors in patients treated at a private dental clinic in Huacho, found the mesofacial biotype to be most frequent in males (35,3 %) and the brachyfacial biotype in females (15,3 %).

CONCLUSIONS

There is a highly significant relationship between smile components and sex after orthodontic treatment, yet no statistically significant differences are observed between sexes. No relationship was found between facial biotype and sex, and no statistically significant differences were observed between sexes.

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