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ARTICLE

ORTHODONTISTS' PREFERENCES IN THE USE AND TIMING OF APPLIANCES FOR THE CORRECTION OF MALOCCLUSIONS IN GROWING PATIENTS.

Preferencias de los ortodoncistas en el uso y momento oportuno de uso de aparatos para la corrección de maloclusiones en pacientes en crecimiento.

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ABSTRACT:

Objective: To evaluate orthodontists' preferences in the use and timing of appliances for the correction of Class II and Class III malocclusions in growing patients and the sociodemographic factors that influence these preferences.

Material and Methods: Active members of the Colombian Orthodontics Society (SCO) were invited to complete a previously validated survey on the use of Class II and Class III correctors in growing patients.

Results: 180 orthodontists responded (80 male, 100 female). The appliances used most frequently in the treatment of Class II malocclusion were Planas indirect tracks (32.78%) and Twin-blocks (30.56%). Facemasks (62.22%) and Progenie plates (25%) were the most prevalent appliances used in the treatment of Class III malocclusions. Regarding treatment timing, 52% of the orthodontists stated that Class II malocclusions must be treated during late mixed dentition or early permanent dentition, 42% stated that treatment for Class III malocclusions should occur during early mixed dentition. Appliance use and treatment timing were significantly associated with sex (p= 0.034), years of practice (p= 0.025), and area of work (private clinics or public institutions), (p= 0.039).

Conclusion: Twin-blocks and Facemask appliances were the preferred appliances for Class II and Class III treatment, respectively, in growing patients. Most of the orthodontists believed that Class II malocclusions must be treated during late mixed dentition and that Class III malocclusions must be treated during early mixed dentition. Sociodemographic variables are related factors that influence orthodontists' preferences in the use of these appliances.

KEYWORDS:

Malocclusion; Malocclusion, Angle Class II; Malocclusion, Angle Class III; Orthodontic Appliances, Functional; Treatment Outcome; Time Factors.

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RESUMEN:

Objetivo: Evaluar las preferencias de los ortodoncistas en el uso y momento oportuno de uso de aparatología para la corrección de maloclusiones Clase II y Clase III en pacientes en crecimiento y los factores sociodemográficos que influyen en estas preferencias.

Material y Métodos: Se invitó a miembros activos de la Sociedad Colombiana de Ortodoncia (SCO) a completar una encuesta previamente validada, sobre el uso de correctores para Clase II y Clase III en pacientes en crecimiento.

Resultados: Respondieron un total de 180 ortodoncistas (80 hombres, 100 mujeres). La aparatología más utilizada en el tratamiento de las maloclusiones de Clase II fueron pistas indirectas de Planas (32,78%) y bloques gemelos (30,56%). La máscara facial (62,22%) y las placas progenie (25%) fueron los aparatos más utilizados en el tratamiento de las maloclusiones de Clase III. En cuanto al momento oportuno del tratamiento, el 52% de los ortodoncistas afirmó que las maloclusiones de Clase II deben tratarse durante la dentición mixta tardía o la dentición permanente temprana, el 42% afirmó que el tratamiento para las maloclusiones de Clase III debe ocurrir durante la dentición mixta temprana. El uso de aparatos y el momento oportuno del tratamiento se asociaron significativamente con el sexo (p= 0,034), los años de práctica (p= 0,025) y el área de trabajo (clínicas privadas o instituciones públicas) (p= 0,039).

Conclusión: Los aparatos bloques gemelos y la máscara facial fueron los preferidos para el tratamiento de Clase II y Clase III, respectivamente, en pacientes en crecimiento. La mayoría de los ortodoncistas consideran que las maloclusiones de Clase II deben tratarse durante la dentición mixta tardía y que las maloclusiones de Clase III deben tratarse durante la dentición mixta temprana. Las variables sociodemográficas son factores relacionados que influyen en las preferencias de los ortodoncistas en el uso de estos aparatos.

PALABRAS CLAVE:

Maloclusión; Maloclusión de Angle Clase II; Maloclusión de Angle Clase III; Aparatos Ortodóncicos Funcionales; Resultado del Tratamiento; Factores de Tiempo.

INTRODUCTION.

Many authors have studied the clinical preferences of orthodontists with regard to the use of appliances to treat Class II and Class III malocclusions in growing patients, finding that factors such as clinical experience, training received during the graduate program, country/regional differences, academic level, years of practice, considerations about cost and laboratory facilities, and current trends are decisive in the choice of treatment type for orthodontists.[1–8]

The efficacy of orthopedic treatment to correct Class II and Class III malocclusions with different appliances in growing patients has been studied,[9–11] but the quality and level of evidence has been conside-red low according to systematic reviews of literature (SRL) due to the low number of primary studies and to flaws in design and methodology.[11,12]

Therefore, generally, the appliance used for treatment is determined more by individual preference than by evidence in the literature.[7]

In addition to the fact that there are individual preferences associated with socio-demographic characteristics and historical changes in approaches to treating malocclusions in growing patients, there is a persistent controversy regarding the ideal timing for treatment.[13–15] Batista *et al.*,[16] found that providing early treatment for Class II malocclusions (compared to treatment in adolescence) appears to have no advantage besides decreasing incisal trauma.

However, in the treatment of Class III malocclusions, Woon and Thiruvenkatachari[17] found a moderate amount of evidence that early treatment with a facemask results in positive improvement for both skeletal and dental effects in the short term. Only a few studies in Latin America have researched the current trends in orthodontists' preferences in the

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use of appliances for the treatment of Class II and Class III malocclusion in growing patients.[7]

Access to this information may help clinical orthodontists, orthodontic residency programs, and researchers in clinical decision-making, curriculum development, and specific research topics. Therefore, the aim of the present study was to determine Colombian orthodontists' preferences in the use and timing of appliances for the correction of Class II and Class III malocclusions in growing patients and the possible sociodemographic factors that influence these preferences.

MATERIALS AND METHODS.

This cross-sectional study was approved by the ethics committee of Fundación Universitaria CIEO-UniCIEO in Bogotá, Colombia. The research was conducted according to the principles of the World Medical Association Declaration of Helsinki.

All participants gave written informed consent for the use of their orthodontic data for research. Data on preferences regarding appliance use and treatment timing to correct Class II and Class III malocclusions in growing patients were obtained from a survey applied to 947 orthodontists, all active members of the Colombian Society of Orthodontics (SCO in Spanish) between September 2016 and May 2017.

The sample size required was calculated using OpenEpi software (Opensource Epidemiologic statistics for public health, version 3.01) from the data of a previous study[1] on the prevalence of usage of a Class II corrector (Forsus; 26%).

A total of 170 subjects was required to obtain a 90% confidence level and an estimate within ± 5% of error. The inclusion criteria were that the participants be certified orthodontists who agreed to conduct the survey. Incomplete surveys were excluded. The questionnaire was elaborated by the investigators and two epidemiologists, using the studies of Keim *et al.*,[1] as a foundation. Face validity (whether the instrument appears to be assessing the desired qualities) and content validity (whether the instrument samples all the relevant content) were evaluated by four experienced orthodontists in a preliminary fit test. The active members of the SCO were asked to participate in three e-mail messages and in personal interviews during academic events. The survey was self-administered and filled in paper during academic events or in a digital format when it was delivered electronically via an online Google Forms questionnaire.

The questionnaire included 15 items related to demographic data (sex, geographic location, years of professional practice, and area of professional work), as well as questions about use and indications of appliances to treat Class II and Class III malocclusions, ideal treatment timing, and which appliance should be used to treat maxillary transverse deficiency in growing patients. The frequency of use of the appliances was indicated on a Likert scale (never, occasionally, frequently, or very frequently), but for statistical analysis, these data were dichotomized to "no use" (never + occasionally) or "use" (frequently + very frequently), (Annex 1).

Statistical analysis

STATA14 software (version 14; StataCorp, College Station, TX) was used. To describe the variables, the absolute and relative frequencies for nominal variables and the median and Standard Deviations for quantitative variables were calculated. The qualitative variables were analyzed with Pearson's chi-squared test or Fisher's exact test when cells had frequencies <5. In all the tests, $p<0.05$ was considered an indication of statistical significance.

RESULTS.

Of the 947 active members of the SCO at the time of the study, 180 answered the survey (80 male and 100 female). The response rate for the survey was 19%. The sociodemographic description of the sample is summarized, (Table 1).

The three appliances most frequently used to treat Class II malocclusion were Planas indirect tracks (32.78%), twin blocks (30.56%), and Klammt activators (25%). Regarding treatment timing, 52% of the orthodontists believed that Class II malocclusions must be treated during late mixed dentition or early permanent dentition.

According to skeletal maturation, 49% preferred intervention during the pubertal growth spurt and 46% in the pre-pubertal growth spurt. The protocol of treatment preferred by 54% of the respondents was the 2-phase orthodontic treatment (Annex 2).

The three appliances most frequently used to treat Class III malocclusion were facemasks (62.22%), progenie plates (25%), and Planas indirect tracks (19.44%). The Class III treatment timing preferred by 42% of the orthodontists was during early mixed dentition, followed by 39% who preferred treatment during temporal dentition.

According to skeletal age, 78% preferred intervention in the pre-pubertal growth spurt and 16% during the pubertal growth spurt. The use of orthodontic fixed appliances for Class III patients was preferred by 40% after the pubertal growth spurt (Annex 3).

The three appliances most often used to treat transverse maxillary deficiencies exclusively were bonded hyrax (51.66%), banded hyrax (51.11%), and a functional appliance with an expansion screw (25%) (Annex 4).

Orthodontists with more than 20 years of clinical practice preferred to treat Class II malocclusion with an activator (59.38%; p=0.0001) or function regulator (18.75%; p=0.008), while those with 0 year to 5 year of clinical practice used Simoes Network (SNW) (44.44%; p=0.002).

Regarding area of work, there was a significant association (p=0.039) between private practice and the use of Planas indirect tracks (35.19%). The use of the Carriere Motion Appliance was associated with postgraduate faculty (10.91%; p= 0.038) and males (10%; p= 0.020) (Table 2).

In Class III, there was a significant association (p=0.034) between the indication of an activator and male orthodontists (12.5%). There were significant associations between the indication of SNW by orthodontists with 0–5 years of practice

Table 1. Descriptive sociodemographic statistics of the responders.

VARIABLES		n	(%)
Sex	Male	80	44
	Female	100	56
Geographic region	Andean	144	80
	Pacific	15	8
	Orinoco	3	2
	Amazon	2	1
	Caribbean	16	9
Years of practice	0 – 5	36	20
	6 – 10	52	29
	11 – 15	25	14
	16 – 20	35	19
	> 20	32	18
Area of work (orthodontist could select more than one option)	Undergraduate faculty	161	28
	Postgraduate faculty	125	22
	Private practice	18	3
	Public institution	171	30
	Private clinic	98	17

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Table 2. Association between Class II corrector's preferences and sociodemographic variables .

VARIABLE		CLASS II APPLIANCES						
		FFR n (%)	AC n (%)	BI n (%)	BIM n (%)	SN n (%)	TB n (%)	PIT n (%)
Sex	Male	5 (6,25)	23 (28.75)	12 (15.00)	4 (5.00)	13 (16.25)	24 (30.00)	23 (28.75)
	Female	8 (8.00)	22 (22.00)	9 (9.00)	7 (7.00)	27 (27.00)	31 (31.00)	36 (36.00)
p-value		0.652	0.299	0.213	0.578	0.085	0.885	0.303
Region	Caribbean	1 (6.25)	4 (25.00)	1 (6.25)	3 (18.75)	4 (25.00)	7 (43.75)	4 (25.00)
	Andean	12 (8.33)	37 (25.69)	17 (17.81)	7 (4.86)	32 (22.22)	41 (28.47)	47 (32.64)
	Pacific	0 (0.00)	1 (6.67)	3 (20.00)	0 (0.00)	2 (13.33)	6 (40.00)	5 (33.33)
	Orinoco	0 (0.00)	2 (66.67)	0 (0.00)	1 (33.33)	1 (33.33)	0 (0.00)	3 (100.00)
	Amazon	0 (0.00)	1 (50.00)	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)
p-value		0.764	0.187	0.712	0.043*	0.761	0.418	0.109
Years of practice	0-5	1 (2.78)	4 (11.11)	5 (13.89)	4 (11.11)	16 (44.44)	9 (25.00)	16 (44.44)
	6- 10	2 (3.85)	9 (17.31)	6 (11.54)	1 (1.92)	12 (23.08)	17 (32.69)	20 (38.46)
	11-15	4 (16.00)	5 (20.00)	2 (8.00)	1 (4.00)	4 (16.00)	11 (44.00)	8 (32.00)
	16-20	0 (0.00)	8 (22.86)	3 (8.57)	3 (8.57)	2 (5.71)	12 (34.29)	7 (20.00)
	>20	6 (18.75)	19 (59.38)	5 (15.62)	2 (6.25)	6 (18.75)	6 (18.75)	8 (25.00)
p-value		0.008*	0.0001***	0.859	0.445	0.002**	0.278	0.167
Undergraduate faculty		1 (5.26)	6 (31.58)	3 (15.79)	2 (10.53)	3 (15.79)	5 (26.32)	4 (21.05)
p-value		0.727	0.484	0.554	0.396	0.476	0.671	0.250
Postgraduate faculty		5 (9.09)	13 (23.64)	3 (5.45)	2 (3.64)	10 (18.18)	20 (36.36)	13 (23.64)
p-value		0.521	0.779	0.085	0.358	0.387	0.262	0.083
Private practice		12 (7.41)	43 (26.54)	20 (12.35)	11 (6.79)	37 (22.84)	52 (32.10)	57 (35.19)
p-value		0.773	0.151	0.395	0.254	0.550	0.178	0.039*
Public institution		1 (11.11)	2 (22.22)	0 (0.00)	1 (11.11)	2 (22.22)	2 (22.22)	3 (33.33)
p-value		0.644	0.843	0.263	0.521	1.000	0.578	0.971
Private clinic		6 (7.32)	21 (25.61)	11 (13.41)	4 (4.88)	18 (21.95)	21 (25.61)	29 (35.37)
p-value		0.964	0.863	0.504	0.528	0.936	0.188	0.499

VARIABLE		CLASS II APPLIANCES						
		H n (%)	Fs n (%)	Ps n (%)	Pd n (%)	DJ n (%)	MARA n (%)	CMA n (%)
Sex	Male	3 (3.75)	8 (10.00)	2 (2.50)	12 (15.00)	4 (5.00)	2 (2.50)	8 (10.00)
	Female	3 (3.00)	7 (7.00)	4 (4.00)	14 (14.00)	3 (3.00)	3 (3.00)	2 (2.00)
p-value		0.781	0.469	0.577	0.850	0.490	0.839	*0.020
Region	Caribbean	1 (6.25)	1 (6.25)	0 (0.00)	2 (12.50)	0 (0.00)	0 (0.00)	0 (0.00)
	Andean	4 (2.78)	14 (9.72)	6 (4.17)	23 (15.97)	7 (4.86)	5 (3.47)	10 (6.94)
	Pacific	1 (6.67)	0 (0.00)	0 (0.00)	1 (6.67)	0 (0.00)	0 (0.00)	0 (0.00)
	Orinoco	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
	Amazon	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
p-value		0.870	0.686	0.817	0.754	0.769	0.864	0.619
Years of practice	0-5	1 (2.78)	2 (5.56)	2 (5.56)	7 (19.44)	3 (8.33)	0 (0.00)	1 (2.78)
	6- 10	2 (3.85)	6 (11.54)	2 (3.85)	9 (17.31)	2 (3.85)	2 (3.85)	2 (3.85)
	11-15	2 (8.00)	0 (0.00)	0 (0.00)	6 (24.00)	0 (0.00)	2 (8.00)	2 (8.00)
	16-20	1 (2.86)	6 (17.14)	2 (5.71)	3 (8.57)	1 (2.86)	0 (0.00)	1 (2.86)
	>20	0 (0.00)	1 (3.12)	0 (0.00)	1 (3.12)	1 (3.12)	1 (3.12)	4 (12.50)
p-value		0.576	0.091	0.529	0.125	0.547	0.310	0.339
Undergraduate faculty		0 (0.00)	3 (15.79)	1 (5.26)	3 (15.79)	0 (0.00)	0 (0.00)	1 (5.26)
p-value		0.392	0.214	0.620	0.860	0.354	0.436	0.953
Postgraduate faculty		1 (1.82)	4 (7.27)	2 (3.64)	8 (14.55)	3 (5.45)	3 (5.45)	6 (10.91)
p-value		0.453	0.733	0.881	0.980	0.471	0.147	0.038*
Private practice		6 (3.70)	13 (8.02)	5 (3.09)	23 (14.20)	6 (3.70)	5 (3.09)	9 (5.56)
p-value		0.406	0.653	0.580	0.777	0.700	0.450	1.000
Public institution		0 (0.00)	1 (11.11)	1 (11.11)	1 (11.11)	0 (0.00)	0 (0.00)	0 (0.00)
p-value		0.568	0.757	0.182	0.770	0.536	0.603	0.455
Private clinic		2 (2.44)	9 (10.98)	5 (6.10)	14 (17.07)	5 (6.10)	2 (2.44)	7 (8.54)
p-value		0.541	0.241	0.059	0.359	0.161	0.800	0.110

Chi² test or Fisher exact test when cells had frequencies < 5. **Statistically significant at:** **p*<0.05; ***p*<0.01; ****p*<0.001; *****p*<0.0001. **FFR:** Frankel function regulator. **AC:** Activator. **BI:** Bionator. **BIM:** Bimler. **SN:** Simoes network. **TB:** Twin block. **PIT:** Planas indirect tracks. **H:** Herbst. **Fs:** Forsus. **Ps:** Power scope. **Pd:** Pendulum. **DJ:** Distal jet. **MARA:** MARA. **CMA:** Carriere Motion Appliance. Never/occasionally use was considered as no use and frequent/very frequent was considered as use.

Table 3. Association between Class III corrector's preferences and sociodemographic variables.

VARIABLE		CLASS III APPLIANCES						
		FFR	AC	BI	BIM	SN	TB	PIT
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sex	Male	8 (10.00)	10 (12.50)	3 (3.75)	4 (5.00)	12 (15.00)	6 (7.50)	17 (21.25)
	Female	6 (6.00)	4 (4.00)	5 (5.00)	3 (3.00)	14 (14.00)	3 (3.00)	18 (18.00)
p-value		0.319	0.034*	0.686	0.490	0.850	0.169	0.584
Region	Caribbean	2 (12.50)	3 (18.75)	0 (0.00)	1 (6.25)	2 (12.50)	1 (6.25)	4 (25.00)
	Andean	12 (8.33)	10 (6.94)	8 (5.56)	6 (4.17)	21 (14.58)	5 (3.47)	27 (18.75)
	Pacific	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (13.33)	2 (13.33)	3 (20.00)
	Orinoco	0 (0.00)	1 (33.33)	0 (0.00)	0 (0.00)	1 (33.33)	1 (33.33)	1 (33.33)
	Amazon	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (00.00)	0 (00.00)	0 (0.00)
p-value		0.691	0.136	0.719	0.898	0.866	0.087	0.876
Years of practice	0-5	0 (0.00)	2 (5.56)	3 (8.33)	1 (2.78)	10 (27.78)	1 (2.78)	6 (16.67)
	6- 10	3 (5.77)	3 (5.77)	2 (3.85)	2 (3.85)	10 (19.23)	4 (7.69)	13 (25.00)
	11-15	3 (12.00)	2 (8.00)	0 (0.00)	1 (4.00)	1 (4.00)	2 (8.00)	5 (20.00)
	16-20	2 (5.71)	1 (2.86)	1 (2.86)	1 (2.86)	2 (5.71)	1 (2.86)	6 (17.14)
	>20	6 (18.75)	6 (18.75)	2 (6.25)	2 (6.25)	3 (9.38)	1 (3.13)	5 (15.63)
p-value		0.051	0.131	0.568	0.952	0.025*	0.696	0.167
Undergraduate faculty		9 (5.59)	1 (5.26)	0 (0.00)	2 (10.53)	3 (15.79)	2 (10.53)	31 (19.25)
p-value		0.001***	0.665	0.320	0.114	0.860	0.243	0.250
Postgraduate faculty		6 (4.80)	2 (3.64)	1 (1.82)	1 (1.82)	6 (10.91)	4 (7.27)	11 (20.00)
p-value		0.025*	0.169	0.257	0.340	0.371	0.353	0.901
Private practice		3 (16.67)	14 (8.64)	8 (4.94)	7 (4.32)	25 (15.43)	8 (4.94)	2 (11.11)
p-value		0.138	0.194	0.335	0.368	0.258	0.909	0.346
Public institution		13 (7.60)	1 (11.11)	1 (11.11)	1 (11.11)	1 (11.11)	0 (0.00)	35 (20.47)
p-value		0.702	0.702	0.319	0.250	0.770	0.480	0.130
Private clinic		8 (8.16)	8 (9.76)	3 (3.66)	2 (2.44)	11 (13.41)	6 (7.32)	17 (17.35)
p-value		0.833	0.365	0.640	0.357	0.719	0.192	0.437

VARIABLE		CLASS III APPLIANCES					
		CMA	PIT	FM	CH	RH	BAMP
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sex	Male	2 (2.50)	18 (22.50)	46 (57.50)	9 (11.25)	4 (5.00)	4 (5.00)
	Female	2 (2.00)	27 (27.00)	66 (66.00)	9 (9.00)	4 (4.00)	2 (2.00)
p-value		0.821	0.488	0.242	0.617	0.746	0.265
Region	Caribbean	0 (0.00)	5 (31.25)	7 (43.75)	0 (0.00)	1 (6.25)	0 (0.00)
	Andean	4 (2.78)	39 (27.08)	92 (63.89)	17 (11.81)	7 (4.86)	5 (3.47)
	Pacific	0 (0.00)	0 (0.00)	9 (60.00)	1 (6.67)	0 (0.00)	1 (6.67)
	Orinoco	0 (0.00)	0 (0.00)	2 (66.67)	0 (0.00)	0 (0.00)	0 (0.00)
	Amazon	0 (0.00)	1 (50.00)	2 (100.00)	0 (0.00)	0 (0.00)	0 (0.00)
p-value		0.906	0.119	0.439	0.551	0.892	0.870
Years of practice	0-5	1 (2.78)	8 (22.22)	23 (63.89)	3 (8.33)	1 (2.78)	2 (5.56)
	6- 10	1 (1.92)	12 (23.08)	32 (61.54)	5 (9.62)	1 (1.92)	1 (1.92)
	11-15	0 (0.00)	6 (24.00)	18 (72.00)	4 (16.00)	3 (12.00)	1 (4.00)
	16-20	1 (2.86)	8 (22.86)	22 (62.86)	6 (17.14)	1 (2.86)	1 (2.86)
	>20	1 (3.13)	11 (34.38)	17 (53.13)	0 (0.00)	2 (6.25)	1 (3.13)
p-value		0.935	0.763	0.699	0.155	0.305	0.919
Undergraduate faculty		0 (0.00)	4 (21.05)	14 (73.68)	3 (15.79)	1 (5.26)	0 (0.00)
p-value		0.487	0.674	0.276	0.374	0.855	0.393
Postgraduate faculty		2 (3.64)	25 (25.45)	32 (58.18)	7 (12.73)	5 (9.09)	5 (5.09)
p-value		0.393	0.926	0.458	0.418	0.045	0.004
Private practice		4 (2.47)	42 (25.93)	105 (64.81)	17 (10.49)	7 (4.32)	6 (3.70)
p-value		0.500	0.389	0.031*	0.508	0.809	0.406
Public institution		0 (0.00)	2 (22.22)	5 (55.56)	1 (11.11)	1 (11.11)	0 (0.00)
p-value		0.643	0.843	0.672	0.909	0.319	0.568
Private clinic		3 (3.66)	23 (28.05)	48 (58.54)	9 (10.98)	3 (3.66)	2 (2.44)
p-value		0.232	0.388	0.351	0.690	0.640	0.541

Chi² test or Fisher exact test when cells had frequencies <5. **Statistically significant at:** *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001. **FFR:** Frankel function regulator; **AC:** Activator. **BI:** Bionator. **BIM:** Bimler. **SN:** Simoes network. **TB:** Twin-block. **PIT:** Planas indirect tracks. **CMA:** Carriere Motion Appliance. **FM:** Facemask. **CH:** Chincup; **RH:** Reverse Headgear. **BAMP:** De Clerck BAMP. Never/occasionally use was considered as no use and frequent/very frequent was considered as use.

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Table 4. Association between timing treatment preference for Class II malocclusion by dentition type and sociodemographic variables.

VARIABLE		TEMPORAL		EARLY MIXED		LATE MIXED OR EARLY PERMANENT		NO PREFERENCE		*p*-value
		n	%	n	%	n	%	n	%	
Sex	Male	6	7.50	33	1.25	36	45.00	5	6.25	0.381
	Female	5	5.00	32	2.00	58	58.00	5	5.00	
Region	Caribbean	0	0.00	4	25.00	9	56.25	3	18.75	0.234
	Andean	9	6.25	57	39.58	72	50.00	6	4.17	
	Pacific	1	6.67	4	26.67	9	60.00	1	6.67	
	Orinoco	1	33.33	0	0.00	2	66.67	0	0.00	
	Amazon	0	0.00	0	0.00	2	100.00	0	0.00	
Years of practice	0-5	7	19.44	14	38.89	11	30.56	4	11.11	0.007***
	6-10	0	0.00	19	36.54	30	57.69	3	5.77	
	11-15	1	4.00	10	40.00	14	56.00	0	0.00	
	16-20	1	2.86	8	22.86	23	65.71	3	8.57	
	> 20	2	6.25	14	43.75	16	50.00	0	0.00	
Undergraduate faculty		10	6.21	61	37.89	82	50.93	8	4.97	0.425
Postgraduate faculty		7	5.60	48	38.40	63	50.40	7	5.60	0.794
Private practice		4	4.08	29	29.59	57	58.16	8	8.16	0.045*
Public institution		11	6.43	62	36.26	89	52.05	9	5.26	0.766
Private clinic		2	11.11	4	22.22	12	66.67	0	0.00	0.284

Chi² test or Fisher exact test when cells had frequencies < 5. **Statistically significant at:** *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001.

Table 5. Association between timing treatment preference for Class II malocclusion by bone age and sociodemographic variables.

VARIABLE		PRE-PUBERTAL		PUBERTAL PEAK		POST-PUBERTAL		NO PREFERENCE		*p*-value
		n	%	n	%	n	%	N	%	
Sex	Male	37	46.25	36	45.00	1	1.25	6	7.50	0.319
	Female	45	45.00	52	52.00	1	1.00	2	2.00	
Region	Caribbean	7	43.75	8	50.00	1	6.25	0	0.00	0.204
	Andean	70	48.61	67	46.53	1	069	6	4.17	
	Pacific	4	26.67	10	66.67	0	0.00	1	6.67	
	Orinoco	1	33.33	1	33.33	0	0.00	1	33.33	
	Amazon	0	0.00	2	100.00	0	0.00	0	0.00	
Years of practice	0-5	21	58.33	13	36.11	0	0.00	2	5.56	0.213
	6-10	26	50.00	25	48.08	0	0.00	1	1.92	
	11-15	9	36.00	15	60.00	0	0.00	1	4.00	
	16-20	13	37.14	17	48.57	2	5.71	3	8.57	
	> 20	13	40.62	18	56.25	0	0.00	1	3.12	
Undergraduate faculty		77	47.83	75	46.58	1	0.62	8	4.97	0.054
Postgraduate faculty		57	45.60	59	47.20	2	1.60	7	5.60	0.503
Private practice		41	41.84	51	52.04	1	1.02	5	5.10	0.725
Public institution		77	45.03	86	50.29	1	0.58	7	4.09	0.011**
Private clinic		8	44.44	8	44.44	0	0.00	2	11.11	0.511

Chi² test or Fisher exact test when cells had frequencies < 5. **Statistically significant at:** *p<0.05; **p<0.01; ***p<0.001; ****p<0.0001.

Table 6. Association between timing treatment preference for Class III malocclusion by bone age and sociodemographic variables.

VARIABLE		PRE-PUBERTAL		PUBERTAL PEAK		POST-PUBERTAL		NO PREFERENCE		*p*-value
		n	%	n	%	n	%	n	%	
Sex	Male	58	72.50	16	20.00	3	3.75	3	3.75	0.389
	Female	83	83.00	12	12.00	2	2.00	3	3.00	
Years of practice	0-5	32	88.89	2	5.56	2	5.56	0	0.00	0.442
	0-5	32	88.89	2	5.56	2	5.56	0	0.00	
	6-10	38	73.08	12	23.08	0	0.00	2	3.85	
	11-15	20	80.00	4	16.00	0	0.00	1	4.00	
	16-20	28	80.00	4	11.43	2	5.71	1	2.86	
	> 20	23	71.88	6	18.75	1	3.12	2	6.25	
Region	Caribbean	10	62.50	3	18.75	1	6.25	2	12.50	0.517
	Andean	112	77.78	24	16.67	4	2.78	4	2.78	
	Pacific	15	100.00	0	0.00	0	0.00	0	0.00	
	Orinoco	2	66.67	1	33.33	0	0.00	0	0.00	
	Amazon	2	100.00	0	0.00	0	0.00	0	0.00	
Undergraduate faculty		128	79.50	23	14.29	5	3.11	5	3.11	0.445
Postgraduate faculty		96	76.80	19	15.20	5	4.00	5	4.00	0.407
Private practice		82	83.67	9	9.18	2	2.04	5	5.10	0.032*
Public institution		134	78.36	26	15.20	5	2.92	6	3.51	0.837
Private clinic		13	72.22	4	22.22	1	5.56	0	0.00	0.596

Chi^2 test or Fisher exact test when cells had frequencies < 5. **Statistically significant at:** **p*<0.05; ***p*<0.01; ****p*<0.001; *****p*<0.0001.

(27.78%; *p*=0.025) and the use of the Frankel function regulator (FFR) by undergraduate faculty (5.59%, *p*=0.001) and postgraduate faculty (4.80%, *p*=0.025); orthodontists in private practice preferred facemasks (64.81%; *p*=0.031), (Table 3).

There was evidence of an association (*p*=0.007) between years of practice and the ideal timing for treating Class II malocclusion.

Orthodontists with more than six years of clinical experience preferred treatment during late mixed dentition or early permanent dentition (57.69%). The association between timing of treatment and private practice (58.16%) was significant (*p*=0.045), and res-ponders preferred Class II treatment in late mixed or early permanent dentition, (Table 4).

An association (*p*=0.011) was found between work environment and treatment timing preference for Class II malocclusion based on bone age; orthodontists in public institutions preferred to treat Class II malocclusion in the puberal peak (50.29%), (Table 5).

An association was evidenced between a two-phase orthodontic treatment protocol for treating Class II malocclusion and private practice (42.86%; *p*=0.005) (Annex 5).

Regarding Class III malocclusion, there was no association between sociodemographic variables and treatment timing preference for Class III malocclusion based on dentition type (Annex 6). Private practice orthodontists preferred (*p*=0.032) to treat Class III malocclusion in the prepubertal period (83.67%), (Table 6).

DISCUSSION.

Orthodontist's preferences in the use of Class II and Class III correctors, treatment timing in growing patients, and the possible factors that influence these preferences were studied.

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We found that the appliances most frequently used by orthodontists in Colombia to treat Class II malocclusions were Planas indirect tracks (32.78%), twin blocks (30.56%), and Klammt appliances (25%).

Meanwhile, for Class III treatment, these were facemasks (62.22%), progenie plates (25%), and Planas indirect tracks (19.44%). These frequencies differ from those reported by other authors in diffe-rent countries. Keim *et al*.,[1] found that orthodontists in the USA prefer Forsus (26%) and twin blocks (2%) for Class II correction and facemasks (20%) and chin cups (2%) for Class III malocclusion.

Enver *et al*.,[18] observed that Turkish orthodontists tend to use activators (47%), Forsus (26.6%), and Herbst (7%) in Class II patients. The differe-nces in the preferred appliances for treating Class II and Class III malocclusions between studies could be due to differences in graduate training, the availability of attachments or devices, and/or costs.

Also, different methodologies or study designs could be responsible for the differences in the results. For transversal discrepancies, the present study found that the appliances most often used were bonded hyrax (51.66%) and banded hyrax (51.11%).

Similar results were found by Keim *et al*.,[3] who reported a preference for the use of hyrax (62%). On the contrary, Banks *et al*.,[19] found a preference for quad-helix (34.4%), and Enver *et al*.,[18] observed a higher prevalence of acrylic splints (60.9%).

In this study, evidence of an association was found between sociodemographic variables and preference for appliances for the treatment of Class II malocclusion. Orthodontists with more than 20 years of clinical practice preferred activators (p=0.0001) and function regulators (p=0.008), while those with 0 to 5 years of clinical practice preferred Simoes Network (SNW) (p=0.002).

Regarding the area of work, there was a significant association (p=0.039) between private practice and the use of Planas indirect tracks. The use of a Carriere Motion Appliance was associated with postgraduate faculty (p=0.038) and male orthodontists (p=0.020). In Class III, significant associations were found for the use of activators by male orthodontists (p=0.034), SNW by orthodontists with 0–5 years of practice (p=0.025), and Frankel function regulators (FFR) by undergraduate faculty (p=0.001) and postgraduate faculty (p=0.025); orthodontists in private practice preferred facemasks (p=0.031).

Similar results have been found by other authors, which suggests that the differences found in the preference for some appliances are related to the country and academic background,[3,4] academic training,[4,18–20] years of experience,[3] laboratory costs of appliance production, level of education, and scientific knowledge of the clinician.[7]

Turbill *et al*.,[21] observed that the age at treatment, the academic background of the clinician, the severity of the malocclusion, and the clinician's income are major factors influencing the selection of appliances.

Pietila *et al*.,[4] concluded that limited economic resources, lack of clinical experience, and the influence of national guides for treatment are important factors in selecting orthopedic treatment.

The results of the present study indicate strong evidence of an association (p=0.007) between years of practice and the ideal timing for treating Class II malocclusion. Orthodontists with more than six years of clinical experience preferred treatment during late mixed dentition or early permanent dentition. Similar results were reported by Yang *et al*.,[22] for USA orthodontists (58.2% treat Class II malocclusion in late mixed dentition, when the overjet is > 6mm).

This finding suggests that more experienced clinicians are more in line with the current evidence that recommends 1-phase treatment for Class II malocclusion. This may be because they are more in touch with updates from clinical practice, academia, and conferences than less experienced clinicians.

The association between treatment timing and kind of practice was significant (p<0.05), showing that, in private practice, 58.16% of orthodontists initiate Class II treatment in late mixed or permanent dentition, and 83.67% initiate Class III treatment before the pubertal peak of growth.

Almeida *et al*.,[7] found that orthodontists in private clinics tend to initiate Class II treatment at an earlier age, while orthodontists in academic settings tend

to perform treatment during the pubertal growth spurt, based on evidence provided by literature reports. Another important question is whether orthodontists' preferences in the use of different appliances and the timing for the treatment of malocclusions are in accordance with the actual scientific evidence.

Systematic reviews of the literature (SRL) are excellent tools to summarize information from primary studies and provide a high level of scientific evidence.[23] Batista *et al*.,[16] evaluated the effectiveness of dif-ferent appliances in a SRL. They found the use of the twin block in eight primary studies, Frankel in three, Bass in two, bionator in four, Harvold activator in one, Forsus in one, and extraoral traction in two, finding significant differences in overjet and ANB changes obtained with different appliances; they concluded that the twin block was the most effective for ANB changes.

In their SRL, Nucera *et al*.,[24] included one primary study with Frankel, four with the activator, one study with Sander's Bite Jumping, six with twin block, and three with bionator, finding some evidence that the functional appliances apparently inhibit sagittal growth of the maxilla when compared to non-treated controls. However, the evidence supporting their conclusions was of low quality and highly heterogeneous.

Santamaría *et al*.,[25] found the best results in the increment of mandibular length via Sander's Bite Jum-ping, followed by the twin block, bionator, Harvold Activator, and Frankel. When these results were compared with the reports obtained in the SCO survey (Planas indirect tracks, twin block, Klammt activator, and SNW, in decreasing order), there was agreement with the scientific literature for the use of twin block and activator, but not for Planas tracks and SNW. In two SRLs for Class III treatment,[17,26] the authors included ten primary studies evaluating facemasks, four using chin cups, one using a tandem traction appliance, one using a mandibular removable retractor, and one using a bionator.

The facemask was the most efficient in reducing negative overjet and increasing ANB, but the quality of evidence was low to moderate. There was agreement with the SCO survey concerning the use of facemasks, but the other appliances (progenie plate, Planas indirect tracks, and SNW) included in the SCO preferences had no evidence of use in the SRL.

The ideal treatment timing for Class II and Class III is still a subject of controversy, both in the literature and in the SCO survey.

Regarding Class II treatment, the literature[16,24,25,27] tends to favor treatment during the pubertal growth spurt as the most effective for stimulating mandibular growth. On the contrary, for Class III treatment, the studies[28,29] show better results for early treatment.

However, other authors[30] did not report differences in the results of Class III treatments associated with different timings. In clinical practice, there are several choices of appliances for the correction of Class II and Class III malocclusions in growing patients, but the indication of the ideal appliance for the treatment should be considered based on the evidence and determined by the individual diagnosis of the pa-tient and not only by the degree of appropriation of knowledge, the type of academic training, the current trend, or clinician preferences.

One of the limitations of this study could be the response rate of the survey (19%), which, although similar to the frequency reported by some authors,[1,7] was lower than that reported by others.[20] A small sample size decreases the power of the sample to find differences and could potentially lead to type II errors (errors that occur when one accepts a null hypothesis that is actually false).

However, Sinclair *et al*.,[31] found that, for internet surveys in health sciences, a percentage of response lower than 5% is expected due to the decrease in motivation for the responders because of the lack of personali-zation or the limitations of some of the responders with regard to access to the internet. Another limitation is the possible bias that can emerge from this type of survey as sampling bias, response or non-response bias, and answer option bias. In addition, the use of clear aligners was not investigated in our study.

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Aligners have been gaining wide acceptance among clinicians and patients due to their aesthetic advantages and good therapeutic results not only for adults but for early orthodontic treatment as well.[32,33] Future research in this area is recommended, as the increase in popularity of these appliances has led many clinicians to opt for this treatment.

CONCLUSION.

The orthodontists' preferred appliances for treating Class II malocclusions were Planas indirect tracks (32.78%) and twin blocks (30.56%), and for Class III malocclusions, the most popular appliances were facemasks (62.22%) and progenie plates (25%).

More than half (52%) of the orthodontists believed that Class II malocclusions must be treated during late mixed dentition or early permanent dentition, and 42% believed that Class III malocclusions must be treated during early mixed dentition.

The results of the present study support the hypothesis that the selection of appliances and treatment timing by clinicians is partially influenced by their sex, years of practice, and area of work (private or public institutions of health).

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The authors declare no conflict of interest.

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