Objective Grading System Scores After the Use of a New Finishing Protocol. A Clinical Study

Puntajes del Objective Grading System (OGS) luego de usar un nuevo protocolo de finalización de tratamiento. Un estudio clínico

Pontuações do sistema de classificação objetiva após o uso de um novo acabamento protocolo. Um estudo clínico

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Abstract

Objective: This non-randomized controlled clinical trial compared a new finishing protocol UDEA2 with the UDEA1 finishing protocol, according to the Objective Grading System (OGS).

Methods: Forty-one patients treated in the postgraduate orthodontics clinic were included. Twenty patients served as intervention group (IG) with whom was used the UDEA2 protocol which includes dental positioners, and were compared to twenty-one patients that served as control group (CG) with whom was used the UDEA1 finishing protocol. An orthodontist (gold standard) determined the required movements with positioners used in the UDEA2 protocol. Eight OGS variables were measured by a calibrated clinician.

Results: Both groups were comparable in gender, age and severity, but not in type of treatment applied. The total OGS for GC was 28.9±10.0, for IG at T1 (before the positioner) was 20.4±6.0 and the score for IG at T2 (after the positioner) was 19.2±6.0, with statistically significant differences (P≤0.05). The OGS score was principally increased for "alignment" in GC and IG-T1 groups. This variable decreased significantly in the IG-T2 group. There were no patients with more than 30 points in the IG-T2. The regression analysis showed an association (P=0.002) between the finishing protocol applied and the final OGS score. Possibility of belonging to the IG-T2 decreases as the OGS score increases (odds ratio [OR] 0.83; 95% confidence interval [CI] 0.738, 0.933).

Conclusions: The implementation of the UDEA2 finishing protocol, which includes an orthodontics student's constant training, a Finishing Protocol Guide application, and a dental positioner in the finishing phase, showed an improvement in quality of orthodontic treatments.

Keywords: Orthodontics, Outcome of treatment, Clinical protocols, Dental aligners

Resumen

Objetivo: este ensayo clínico controlado no aleatorio comparó el nuevo protocolo de finalización de tratamiento UDEA2 con el protocolo UDEA1, de acuerdo con el OGS.

Métodos: se incluyeron 41 pacientes tratados en la clínica de posgrados en Ortodoncia. 21 pacientes sirvieron como grupo de intervención (IG) con quienes se usó el protocolo UDEA2 que incluye posicionadores dentales, y se comparó con 21 pacientes que sirvieron como grupo de control (GC) con quienes se usó el protocolo UDEA1. Un ortodoncista (gold standard) determinó cuáles eran los movimientos requeridos con los posicionadores en el protocolo UDEA2. Se midieron ocho variables OGS, que fueron calibradas por el clínico.

Resultados: ambos grupos fueron comparados por género, edad y severidad, pero no en el tipo de tratamiento aplicado. El OGS total para el GC fue 28.9±10.0. Para el GI en T1 (antes del posicionador) fue 20.4±6.0 y el puntaje para GI en T2 (luego del posicionador) fue 19.2±6.0, con diferencias estadísticamente significativas (P≤0.05). El puntaje de OGS incrementó en "alineación" en GC y en IG-T1. Esta variable decrementó significativamente en IG-T2. No hubo pacientes con más de 30 puntos en IG-T2. El análisis de regresión mostró una sociación (P=0.002) entre el protocolo de finalización aplicado y puntaje OGS final. La posibilidad de pertenecer al IG-T2 decrementa a medida que el puntaje OGS incrementa (OR 0.83; 95% CI 0.738, 0.933).

Conclusiones: la implementación del protocolo de finalización UDEA2, que incluye el entrenamiento constante de un estudiante de Ortodoncia, una guía de aplicación, y un posicionador dental en la fase de finalización mostró una mejora en la calidad del tratamiento ortodóncico.

Palabras clave: Ortodoncia, Resultado del tratamiento, Protocolos clínicos, Alineadores dentales.

Resumo

Objetivo: Este ensaio clínico controlado, não randomizado, comparou o novo protocolo de término do tratamento UDEA2 com o protocolo UDEA1, de acordo com o OGS.

Métodos: Foram incluídos 41 pacientes atendidos na clínica de pós-graduação em Ortodontia. 21 pacientes serviram como grupo de intervenção (GI) com quem o protocolo UDEA2 foi usado, que inclui posicionadores dentários, e foram comparados com 21 pacientes que serviram como grupo controle (GC) com quem o protocolo UDEA1 foi usado. Um ortodontista (padrão-ouro) determinou quais movimentos eram necessários com os posicionadores no protocolo UDEA2. Oito variáveis OGS foram medidas e calibradas pelo clínico.

Resultados: os dois grupos foram comparados por sexo, idade e gravidade, mas não no tipo de tratamento aplicado. O OGS total para o GC foi de 28,9 ± 10,0. Para o GI em T1 (antes do posicionador) foi de 20,4 ± 6,0 e o escore para o GI em T2 (após o posicionador) foi de 19,2 ± 6,0, com diferenças estatisticamente significantes (P≤0,05). A pontuação OGS aumentou no "alinhamento" no GC e IG-T1. Essa variável diminuiu significativamente no IG-T2. Não houve pacientes com mais de 30 pontos IG-T2. A análise de regressão mostrou uma associação (P = 0,002) entre o protocolo de conclusão aplicado e o escore final do OGS. A possibilidade de pertencer ao IG-T2 diminui à medida que o escore OGS aumenta (OR 0,83; IC 95% 0,738, 0,933).

Conclusões: a implementação do protocolo de conclusão da UDEA2, que inclui o treinamento constante de um aluno de Ortodontia, um guia de aplicação e um posicionador dentário na fase de conclusão, mostrou uma melhora na qualidade do tratamento ortodôntico.

Palavras-chave: Ortodontia, Resultado do tratamento, Protocolos clínicos, Alinhadores dentários

Introduction

Orthodontic treatment is comprised of three phases: 1) alignment and leveling, 2) correction of molar relationships and the closing of spaces, and 3) finishing (1). The latter phase is oriented to achieve an adequate occlusion, alignment and aesthetic smile (2). It is cataloged as one of the most complex, needs greater detail, and defines, to a great extent, the quality of the professional who performs it (1). Because it is important that orthodontic treatments end optimally and improve the training and clinical performance of students and professionals, it is essential to measure the final results in an objective and standardized manner that allows comparison, self-assessment, and strategy development aimed at maintaining or improving clinical practices (3).

For this purpose, different methods or indices have been used (4) (5), one of the most known is the Objective Grading System (OGS), also called Cast/Radiographic Evaluation (CRE), proposed by the American Board of Orthodontics (ABO), which is performed in dental models and panoramic radiography, evaluating eight criteria. Their values can yield excellent, acceptable and/or less than acceptable results (6) (7).

The Faculty of Dentistry (FdeO) of the University of Antioquia (UdeA) has carried out different studies on the quality of orthodontic results, where patients who had

finished treatment were evaluated and an average OGS of 31.7 ± 8.4 was found, a score less than acceptable (8), but similar to the averages reported by other national and international universities (9)-(12). Later, in order to improve scores, Carvajal et al. (13) implemented a Finishing Protocol (UDEA1 protocol) for evaluating the results under the same criteria and comparing them to the first research. This research provided evidence of a decrease in some variables, but with the persistence of high scores. Therefore, it was necessary to modify the existing protocol and provide additional academic assistance in order to improve the quality of treatments.

The use of a thermoformed positioner or aligner after the removal of orthodontic appliances is reported as finishing strategy in orthodontic treatments (14). It allows for the correction of dental alignment, slight inclinations, anterior intrusion, and minor discrepancies. They also avoid the occurrence of clinical emergencies and favor aesthetics, oral hygiene and comfort, good periodontal health, and the reduction of soft tissue irritation (15)-(18). These positioners can be used when the occlusion of a patient is almost ideal but requires slight movements that, when introducing changes in the wires or repositioning brackets, can create new problems in the neighboring teeth, or can exhaust the patient's interest and cooperation (19). These positioners were introduced in the UDEA2 Finishing Protocol.

The aim of this research was to compare the effect of the implementation of a new UDEA2 finishing protocol with the traditional UDEA1 finishing protocol, using the OGS criteria.

Materials and methods

This nonrandomized controlled clinical trial evaluated the cast models and panoramic radiographs of 41 patients. The sample was taken for convenience and was distributed in two groups, one historical or control group (GC) (n = 21) to which the UDEA1 finishing protocol was applied, and one intervention group (IG) (n = 20), on whom the finishing protocol UDEA2 was implemented. In turn, the IG was evaluated twice: once before the placement of the dental thermoforming positioners (PDT) T1, and after the use of positioners T2 (Figure 1). The groups were selected according to the inclusion and exclusion criteria (8) (13).

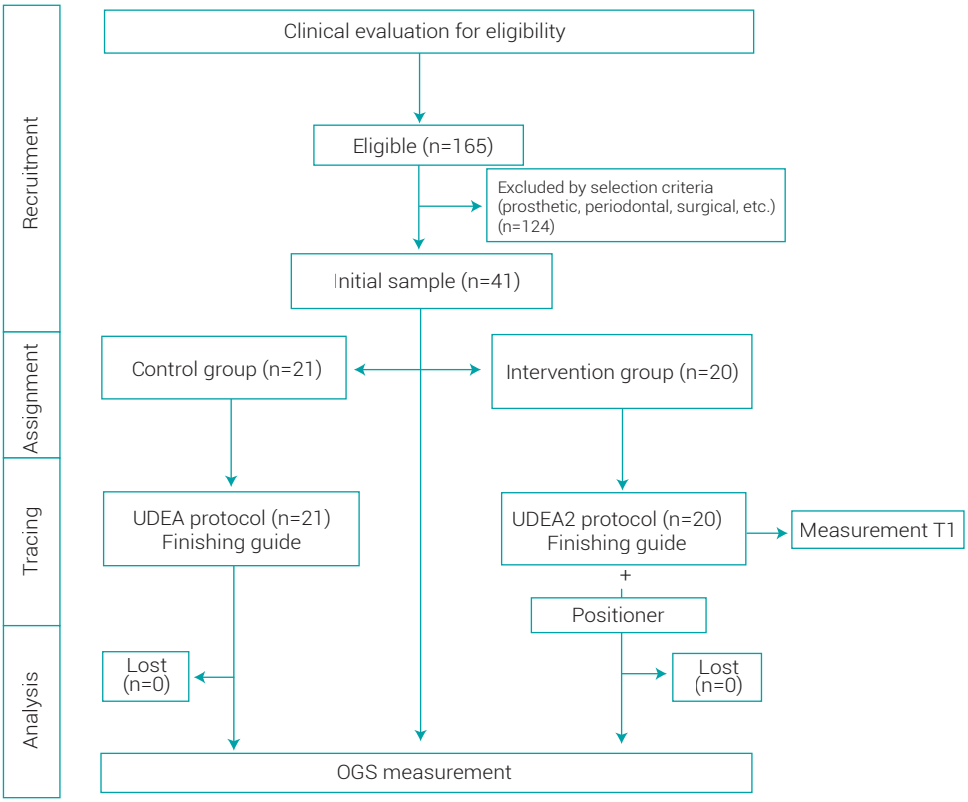

Figure 1. Flowchart.
Source: Own elaboration.

The patients who finished their treatments by the criterion of the treating clinician in the Postgraduate Program in Orthodontics at the Faculty of Dentistry of the University of Antioquia (UDEA) in the period 2014-2018 were included. All were analyzed with the standardized diagnostic records at the end of the finishing phase (cast models and panoramic radiography) and were deemed acceptable to participate in the study. The exclusion criteria included patients who required prosthetic, periodontal, and/or surgical treatments, or possessed systemic compromise that could have influenced the outcome of orthodontic treatment.

This study was done according to the ethical principles established in the Declaration of Helsinki, and to Resolution 008430 of the Ministry of Health of Colombia. This research was classified as a risk greater than the minimum category. The Ethics Committee of the Faculty of Dentistry of the University of Antioquia authorized this project on the record #1 of 2016. The Committee ordered that some benefits from intervention is theoretically expected, the Finishing Protocol UDEA2 should be applied to all patients treated between 2017-2018 (IG), as well as the use of a group of patients

who have completed treatment between 2014 -2016, when the UDEA protocol without PDT was applied, as CG. In addition, patients signed a voluntary informed consent form to participate in the study.

The UDEA1 protocol included (13): 1) information and training for students and teachers of the postgraduate course, 2) filling in of the finishing guide, 3) replacement of brackets or bends according to discrepancies found in the guide, and 4) supervision by teachers of the execution of finishing guide. It also evaluated the OGS criteria: alignment, marginal ridges, bucco-lingual inclination, occlusal relations, occlusal contacts, interproximal contacts, and root angulation. Additionally, it evaluated the line and the smile arch. The sociodemographic variables (age, sex, malocclusion compromise and type of treatment) were evaluated according to the medical records of each patient.

Intervention

The UDEA2 Finishing Protocol adopted the 4 points of the UDEA1 Finishing Protocol, and the use of PDT was added, similar to that described by Stock et al (14). Once the orthodontic appliances were removed, impressions were taken with Orthoprint-Zhermack alginate. An experienced orthodontist from the research group (gold standard) defined set-up movements of the cast models. These positioners were made in acetate ACE Dentsply of 0.40" caliber by an expert laboratory technician and in coordination with the gold standard using a Biostar IV pressure machine (figure 2).

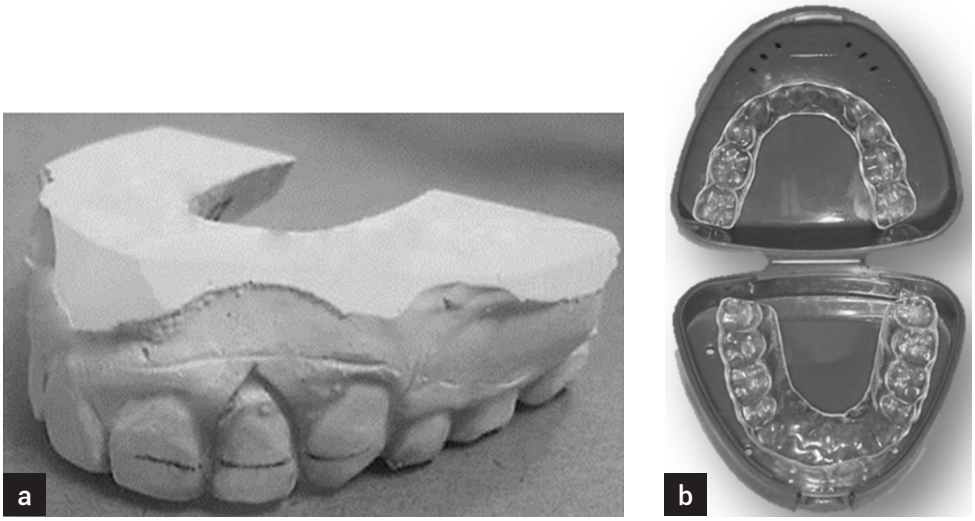

Figure 2. a. Set-up in models, b. Positioners.
Source: Own elaboration.

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At this time, the cast models and the panoramic X-Ray were taken in a diagnostic center with standardized processes (T1). Subsequently, the upper and lower PDT'S were installed and patients were instructed to use them full time for 3 weeks. Patient's compliance to the instructions of professional was verified weekly with phone calls. At the end of this period the final records (T2) were taken. Panoramic radiograph was not included since no significant changes in root angulation were expected (20), so a second radiograph was not justified at that time.

The occlusal criteria were measured in the cast models previously scanned with the Ortho Insight 3D Laser and using Motion View Software Design LLC software. The root parallelism and marginal ridges were measured manually following the protocol described by Carvajal et al (13). The evaluators were calibrated for all digital and manual variables with a kappa>0.8 for qualitative and an ICC>80% for quantitative variables.

The final score value of the OGS (FS-OGS) was the sum of the values obtained from the occlusal parameters and the root parallelism, according to the OGS of the ABO (7) (6). The method described by Barbosa et al (8) was followed to evaluate the initial compromise of the malocclusion and guarantee the comparability of the groups.

Statistical analysis

The information obtained was digitized in an Excel® database. Later, an IBM SPSS Statistics version 23.0 program was used in the data processing. When the Shapiro-Wilk test was applied to the groups, a normal distribution was found for most of the variables, so parametric tests were used. The univariate analysis included means and standard deviations for the quantitative variables, while distributions of frequency, percentages for qualitative ones. The bivariate analysis was performed by student t-tests for independent samples between CG vs IG-T1 and CG vs IG-T2, and a paired t-test was used for the comparison of IG-T1 vs IG-T2. Chi square (X^2) test were used for the comparison for qualitative variables.

Additionally, two regression models were carried out:

1. A multiple linear regression model to evaluate the influence of sociodemographic, clinical variables and two of the finishing protocols (CG and IG-T2) with the variable FS-OGS (Final Score OGS), removing variables to leave the most significant by a backward stepwise selection procedure (the IG-T1 group was not taken into account in this regression in order to avoid collinearity because they are the same patients in the IG-T2).

2. An ordinal multinomial logistic regression model that evaluated the association between the type of Finishing Protocol used (CG, IG-T1 and IG-T2) with the FS-OGS, age and sex. The quality of the model's adjustment was analyzed by the log of the likelihood ratio and the Akaike Information Criterion (AIC). The model with the lowest value of the log-likelihood ratio and AIC was selected.

For all the analysis, the level of significance was set at 5% .

Results

Table 1 shows the demographic characteristics of 41 patients (21 CG and 20 IG). The average age of the CG (9 men and 12 women) was 21.7 ± 9 years. The average age of the IG (10 men and 10 women) was 19.1 ± 4 years. The groups were comparable in age, gender, and malocclusion severity (P> 0.05). The most common treatment type in the CG was without extractions, and in the IG, with extractions.

Table 1. Demographic characteristics of control and intervention group

Variable		GROUP				
		Control		Intervention		Significance
		n (%)	Mean (SD)	n (%)	Mean (SD)	P
Gender	Male	9 (42.9)		10 (50)		0.86‡
	Female	12 (57.1)		10 (50)		
	Total	21 (100)		20 (100)		
Age			21.7 (9)		19.1 (4)	0.23¥
Compromise	Low compromise	4 (19)		5 (25)		0.88‡
	Compromise	9 (42.9)		10 (50)		
	High compromise	8 (38.1)		5 (25)		
	Total	21 (100)		20 (100)		
Type of treatment	Extraction	5 (23.8)		12 (60)		0.02*‡
	Non-extraction	16 (76.2)		8 (40)		
	Total	21 (100)		20 (100)		

¥ Chi-square

‡ Student's t-test

*Statistically significant difference ($P < 0.05$)

Source: Own elaboration.

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The OGS average score for the CG was 28.9 ± 10.0. The points added to the OGS total score for Alignment variable were the highest (5.9 ± 3.2), while interproximal contacts added the lowest (0.1 ± 0.0). However, the IG obtained a final total OGS score of 19.2 ± 6.0 with Occlusal Relations variable adding the highest score (4.8 ± 3.0) and interproximal contact adding the lowest, the same as in the CG.

Statistically significant differences between IG-T1 and IG-T2 were observed in alignment variables (4.0 and 3.1 points) and in total OGS score (20.4 and 19.2 points) (table 2).

Table 2. Description and comparison of OGS score and components for control and intervention groups

Variable	GROUP											
	Control n=21		Intervention n=20				Confidence interval 95%			Significance *P* value		
			T1		T2							
	Mean	± SD	Mean	± SD	Mean	± SD	C-T1	T1-T2	C-T2	C-T1 ¥	T1-T2 ‡	C-T2¥
Alignment	5.9	3.2	4.0	2.2	3.1	1.7	(0.20,3.70)	(0.31,1.48)	(1.20,4.50)	0.029*	0.005*	0.001*
Marginal ridges	3.3	2.0	2.6	2.0	2.6	2.0	(-0.50,1.97)	(-0.05,0.15)	(-0.47,2.04)	0.238	0.330	0.214
Buccolingual Inclination	4.8	4.0	3.9	3.0	3.9	3.0	(-1.17,3.00)	--	(-1.17,3.00)	0.384	--	0.385
Occlusal Relationships	5.4	3.0	4.8	3.0	4.8	3.0	(-1.45,2.71)	--	(-1.45,2.71)	0.546	--	0.546
Occlusal Contacts	2.0	3.0	0.6	1.0	0.5	1.0	(0.08,2.80)	(-0.02,0.32)	(0.24,2.95)	0.038*	0.083	0.023*
Overjet	3.0	3.3	1.8	2.1	1.7	2.1	(-0.53,2.73)	(-0.07,0.37)	(-0.36,2.87)	0.182	0.186	0.127
Interproximal contacts	0.1	0	0.1	0.0	0.1	0.0	(-0.12,0.21)	--	(-0.12,0.21)	0.589	--	0.589
Root Angulation	4.4	3.0	2.7	2.0	2.7	2.0	(0.25,3.21)	--	(0.25,3.21)	0.022*	--	0.022*
OGS score	28.9	10.0	20.4	6.0	19.2	6.0	(3.27,13.83)	(0.46,1.83)	(4.39,15.0)	0.002*	0.002*	0.001*

¥ Independent t- test
‡ Paired t- test
* Statistically significant difference (*P* < 0.05)
-- There were no changes between T1 and T2 therefore the t test could not be performed

Source: Own elaboration.

The OGS distribution by groups showed that in the CG, almost half of the patients were classified as less than acceptable and in the IG, none qualified for this category. Additionally, the percentage of patients in the excellent category increased from 19.05% in the GC to 50% in the IG (table 3).

Table 3. Distribution of OGS group score in control and intervention group

			Group OGS			Total
			Excellent	Acceptable	Less than acceptable	
Group	Control	Count	4	7	10	21
		% within the OGS group	16.7%	25.9%	100.0%	34.4%
	T1	Count	10	10	0	20
		% within the OGS group	41.7%	37.0%	0.0%	32.8%
	T2	Count	10	10	0	20
		% within the OGS group	41.7%	37.0%	0.0%	32.8%
Total		Count	24	27	10	61
		% within the OGS group	100.0%	100.0%	100.0%	100.0%

Note: Since two boxes have values less than 0, the chi^2 test cannot be performed.

Source: Own elaboration.

The multiple linear regression model showed a significant association (P <0.0001, R^2: 0.36, constant: 38.82) between the OGS score and the Finishing Protocol type with the age variable in the model. After adjusting the model with the other variables, the average decrease of the OGS score was as follows: finishing protocol and PDT 10.90 points (95% Confidence Interval (CI): -15.98, -5.81). For every increasing year of age, the OGS score decreases on average of 0.46 (95% CI: -0.82, -0.087) (P = 0.049) (table 4).

Table 4. Multiple linear regression model with OGS score as dependent variable

OGS score (Dependent Variable)	Coefficient	95%IC	Value *P*
Age	-0.46	-.8261 -.0872	0.017*
Group			
Control group	0	-	
Group T2	-10.90	-15.983 -5.814	<0.0001****
Constant	38.82		
R^2	0.364		
Statistically significant to * *P*=.05; ** *P*=.01; ***P=.001; ****P=.0001			

Source: Own elaboration.

Table 5 shows the multinomial logistic regression model, which can be interpreted to mean that for each unit of change in the predictor variable (OGS score), the odds ratio (OR) of belonging to a certain group of finishing protocol (IG) -T1, IG-T2) with

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respect to the reference group (CG) is given by a factor of the respective parameter. According to the results, if a subject increases a unit in the OGS score, the possibility of being in the IG-T1 compared to being in the CG is decreased significantly (P = 0.006) by a factor of 0.86 (OR = 0.86; 95% CI 0.768, 0.956). Additionally, for a subject increases a unit in the OGS score, the possibility of being in the IG-T2, compared to being in the CG, is significantly reduced (P = 0.002) by a factor of 0.83 (OR = 0.83, 95% CI 0.738, 0.933).

Table 5. Multinomial logistic regression model with the control group as the basis

Name of the Variable	OR (95% IC)	*Value P*
Group T1		
Score OGS	0.8577	0.006***
Group T2		
Score OGS	0.8305	0.002***
Statistically significant to * *P*=.05; ** *P*=.01; ***P=.001; ****P=.0001		

Source: Own elaboration.

Discussion

This clinical trial evaluated the effect of the implementation of a new finishing protocol UDEA2 (IG: T1-T2) compared to the UDEA1 Protocol (CG). These protocols were implemented during the years 2014-2018 in the Postgraduate Orthodontics Program of the FdeO of UdeA, using the OGS score as an evaluation method. The use of a PDT for 3 weeks in the UDEA2 protocol was the main difference between the two protocols, once the orthodontic appliances were removed, similarly to how it was used at the University of Michigan by Stock et al. (14)

The statistical evaluation indicated that the groups: intervention group (IG) and control group (CG) were comparable in age, malocclusion complexity, and gender at the beginning of the intervention. It is very important that the initial complexity of the cases is comparable, because Campbell et al (11) reported that the more complex patients tend to finish the treatments with higher OGS scores.

However, there were differences in the treatment performed in both groups. For example, there were more cases with extractions in the IG to which the UDEA2 protocol was applied. As to this, the literature is controversial regarding whether treatment with or without extractions affects OGS scores. The study by Anthopoulou et al (21)

did not find significant differences in the total score (27.04 ±6.3 for extractions treatment and 29.07 ± 7.1 for non-extraction treatment). Further, Akinci et al (22) reported that most of the OGS variables are not affected by treatments with 4, 2, or no extractions. It seems, then, that dental extractions do not affect the final result. However, Janson et al (23) found better occlusal characteristics in class II patients treated with extractions of 2 premolars than with 4 extractions of premolars. The present study evaluated the initial malocclusion complexity and the type of treatment of the patients, but did not take into account the sagittal classification of the patients, which could be a limiting factor.

This study indicated a statistically significant difference between the CG with a value of 28.9 ± 10.0 with the IG at T1 value of 20.4 ± 6.0 in the OGS total scores. Although the protocols used with both groups before treatment were equal, the experience in the finishing protocol application was different. The OGS results showing an improvement in the T1 group could be associated with this aspect, given that in the Postgraduate Program in Orthodontics of UdeA, theoretical aspects of the finishing treatment phase have been used, and checklists of clinical aspects of the treatments and continuous measurements of the results have been done since 2012. At the University of Detroit (24) it was shown that with continuous measurements of the scores, a progressive improvement of the results is evident. Likewise, at the University of Indiana (3), a decrease was seen in the OGS total score from 28.6 in 2001 to 22.4 in 2003, applying three basic strategies on a frequent basis from the direction program: pre-finishing records evaluation, continued education on previous treatment outcomes, and evaluation of the student's practical skills.

Our study obtained similar results respect to how the constant and ongoing training of both teachers and students improves OGS scores, an aspect that should be considered in orthodontic programs.

Additionally, in the present study a PDT was used between T1 and T2 in the UDEA2 finishing protocol. This introduced statistically significant differences, decreasing the total OGS score from 20.4 ± 6.0 to 19.2 ± 6.0. Park et al (25) reported similar results using a positioner in the finishing phase and decreased the OGS scores from 19.9 ± 6.9 to 16.7 ± 7.0. Equally, Stock et al (14) changed their total OGS from 21.29 ± 6.8 to 14.68 ± 7.28.

Alignment was the OGS variable that showed a significant decrease between IG-T1 (4.0 ± 2.2) and IG-T2 (3.1 ± 1.7; p = 0.005). Similar findings were found at the University of Michigan (14) where a positioner at the end of the orthodontic treatment decreased the alignment variable from 2.47 ± 1.42 to 1.53 ± 0.96. Park et al (25) also varied their scores from 2.8 ± 1.6 to 2.3 ± 1.7 (P = 0.030). This study showed that

before using the PDT, the alignment variable contributed the most to the OGS total score. Carvajal et al (13) reported a similar finding, but also noted that alignment is the principal variable in the decrease of the OGS total score at the end of the use of PDT.

Regarding the length of time of use of the positioners, it was established that 3 weeks was appropriate since it has been reported that a minimum of 2 weeks is required to produce appreciable movements (26) and, at the same time, not generate undesired vertical changes. These findings are similar to those of Stock et al (14) who used the positioner for between 2 and 4 weeks without showing significant changes in the variable overjet. Park et al (25) used the positioner for 31 days and did not present significant differences in the Occlusal Contacts variable, changing from 3.5 to 3.1. This suggests then that the use of PDT for this period of time does not negatively affect vertical occlusal relationships.

Variable root angulation was not measured in IG-T2 and was recorded with the same value of IG-T1, given that, according to studies, this variable does not show statistically significant differences with the use of a positioner at the end of treatment. Additionally, the duration of use of the positioner is too short to indicate root changes and involves exposure to unnecessary additional radiation (14) (25) (20).

To our knowledge, we are the first to report a regression analysis that allows us to predict the behavior of the OGS according to the protocol used. These linear and multinomial regression analysis showed that implementing a finishing protocol is a protective factor against the high scores of the OGS, and when the PDT is added, the protection is greater.

Only a manual set-up was used for the PDT, and it was not developed with tools like the CAD-CAM, nor were additional attachments used to improve the predictability of the movements (27) (28). Perhaps this is the reason why only significant changes were found between IG-T1 and IG-T2 in one of the 8 OGS variables (alignment).

Conclusion

The implementation of the finishing protocol UDEA2, which included constant training, application of a finishing guide, and use of a PDT in the final phase of orthodontic treatment, showed improvement in the quality of the treatments, decreasing the total scores based on the OGS of the ABO. The results from the multinomial regression analysis suggest that implementing a finishing protocol in the last phase of orthodontic treatment, is a protective factor against the high scores of the OGS, and when the PDT is added, the protection is greater.

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