Original Article

THE INFLUENCE OF FRÄNKEL-2 FUNCTION REGULATOR IN THE LOWER ANTERIOR TEETH CROWN LENGTH

INFLUÊNCIA DA UTILIZAÇÃO DO REGULADOR DE FUNÇÃO FRANKEL-2 NO COMPRIMENTO DA COROA CLÍNICA DOS DENTES ANTERIORES INFERIORES

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ABSTRACT: Functional orthopedic appliances used for Class II malocclusion treatment, usually work by guiding jaws growth and modifying dental positions. Among these dentoalveolar effects, it is the lower incisors buccal tipping, that helps to improve the overjet, but may cause gingival recessions, especially when associated with other etiological factors. The objective of this study was to evaluate the clinical crown length of the lower anterior teeth in individuals with Angle's Class II malocclusion, after treatment with Fränkel-2 function regulator appliance (RF-2). Fifty Class II-malocclusion individuals were divided into 2 groups: G1 – 14 male, and 11 female, treated with the Fränkel-2 function regulator appliance for 18 months, with average pre-treatment age (T1) of 11 years (sd=7 months) and average post-treatment age (T2) of 12 years and 7 months (sd=7 months); and G2 – a control group with 25 individuals (12 male and 13 female) with average age at T1 of 10 years and 3 months (sd=11 months) and at T2 of 12 years and 1 month (sd=11 months), which was part of a normal occlusion sample. The 100 dental cast models were analyzed at T1 and T2, with a digital caliper, measuring the distance from the incisal edge to the most concave portion of the gingival margin of lower incisors and canines. Data were checked by a Student's t-test and a paired t-test. Considering T2, the group 1 presented a significant increase in the crown length of all lower anterior teeth. On the other hand, in the group 2, this was observed only for the teeth 33, 42 and 43, suggesting that patients treated with RF-2 had more gingival recession than the control group.

KEYWORDS: Orthodontics. Gingival Recession. Functional Orthodontic Appliance.

INTRODUCTION

Treatment of Class II malocclusion with functional orthopedic appliances works in the anterior discrepancy of the jaws by guiding growth towards a more favorable direction. Dental positions are modified, as well as muscles and soft tissue, in order to prevent extractions (FRÄNKEL et al., 1969; CHADWICK et al., 2001; SCANAVINI et al., 2012, PARANHOS et al., 2013).

The literature shows promising results using Fränkel-2 (RF-2) function regulator appliance: increase in mandibular length, buccal inclination of the lower incisors, inclination of upper incisors to the lingual, restriction of maxillary growth, extrusion of upper molars, and increase in intercanine distance (MCNAMARA JÚNIOR et al., 1990; MARSICO et al., 2011). Fränkel-2 has been also related to expansion of the arches (maxillary and mandibular) and to reduction of crowding during teeth eruption – due to the action of vestibular shields (LITTLE et al., 1988).

Owing the trend of buccal inclination of lower incisors, it should be noted their bone support in relation to the limit of movement, because patients prone to vertical growth have a smaller thickness of the buccal bone at the symphysis, which may cause a gingival recession in the incisors region, once the gingiva accompanies bone support (ROTHE et al., 2006; VIECILLI et al., 2008). The lack of stability of the marginal gingiva of this region along with the poor hygiene may lead to increased clinical crown (DOLCE et al., 2007).

In this way, this study aimed to evaluate the length of the clinical crown of lower anterior teeth, on the buccal surface, in individuals with Angle Class II malocclusion treated with Fränkel-2 function regulator appliance.

MATERIAL AND METHODS

This study was previously approved by the ethics committee on Human Research (CEP: 289963-09, CAAE: 0077.0.214.000-09).

Received: 11/03/15
Accepted: 05/07/15

Fifty individuals with Class II malocclusion were divided into 2 groups. The group 1 (G1) was composed by 25 individuals treated with the Fränkel-2 function regulator appliance for 18 months, being 14 males and 11 females, with average pre-treatment age (T1) of 11 years (sd=7 months) and average post-treatment age (T2) of 12 years and 7 months (sd=7 months). Group 2 (G2) consisted of the control group, with 25 individuals, 12 male and 13 female, with average age at T1 of 10 years and 3 months (sd=11 months) and at T2 of 12 years and 1 month (sd=11months). The control group was part of a normal occlusion sample, present in the University, submitted to no orthodontic treatment.

One hundred lower dental cast models from the subjects were analyzed at T1 and T2. Using a digital caliper (Mitutoyo 500-144B/H12, Suzano, São Paulo State, Brazil) placed along the the facial axis of the anterior teeth clinical crown and, it was measured the distance from the incisal edge to the most concave portion of the gingival margin of lower incisors and canines. Only complete erupted teeth were considered in measurements. Criteria of exclusion were also gingival inflammation, when detected in annotations or at the photographs.

The measurements of the method error were done 30 days after the first measurement, considering 30% of the sample. Data were analyzed by a Student's t-test and a paired t-test ($p<0.05$).

RESULTS

The Table 1 lists the measures of the anterior teeth at T1 and T2 of the group treated with RF-2, including their variation at the two evaluated times. This tables shows that lower canines and incisors had their length increased during the treatment.

Table 2 shows the measures of the lower anterior teeth in the control group, at T1 and T2, demonstrating length increase in half of the analyzed teeth, even without treatment.

Table 1. Mean value and standard deviation at T1 and T2, result of paired t-test, in the group 1, treated with RF-2.

Tooth	n	T1		T2		T2 - T1	t	p
		Mean	sd	Mean	sd			
43	18	7.77	1.25	8.91	1.04	1.14	5.619	<0.001*
42	25	7.32	0.83	8.06	0.68	0.74	8.427	<0.001*
41	25	7.70	0.76	8.21	0.73	0.51	6.403	<0.001*
31	25	7.83	0.74	8.09	0.70	0.26	4.445	<0.001*
32	25	7.34	0.77	8.15	0.58	0.81	6.949	<0.001*
33	17	7.66	1.34	8.91	0.85	1.25	5.458	<0.001*

* - significant difference ($p<0.05$)

Table 2. Mean value and standard deviation at T1 and T2, result of paired t-test, in the control group (group 2).

Tooth	N	T1		T2		T2 - T1	t	p
		Mean	sd	Mean	sd			
43	15	6.82	1.67	7.88	0.70	1.06	3.001	0.010 *
42	25	7.54	0.63	7.78	0.51	0.23	3.711	0.001 *
41	25	8.02	0.68	8.07	0.52	0.05	0.607	0.549 ns
31	25	7.86	0.63	7.98	0.54	0.11	1.281	0.212 ns
32	25	7.46	0.62	7.60	0.59	0.13	1.513	0.143 ns
33	14	6.81	1.51	7.97	0.69	1.16	3.614	0.003 *

ns – non-significant difference; * - significant difference ($p<0.05$)

The comparison between the mean values of the lower anterior teeth of G1 and G2, at T1, is presented in Table 3, which shows no significant initial differences between the groups.

The Table 4 draws the comparison of the groups in the two treatment times. Lower incisors showed significant more length increase with the RF-2 treatment, when compared to the control group. Canines did not show significant differences.

Table 3. Comparison between G1 and G2 at T1, by the Student's t-test.

Tooth	Experimental			Control			Dif.	T	p
	Mean	sd	N	Mean	sd	N			
43	7.77	1.25	18	6.82	1.67	15	-0.95	1.875	0.070ns
42	7.32	0.83	25	7.54	0.63	25	0.22	-1.065	0.292ns
41	7.70	0.76	25	8.02	0.68	25	0.31	-1.537	0.131ns
31	7.83	0.74	25	7.86	0.63	25	0.03	-0.151	0.880ns
32	7.34	0.77	25	7.46	0.62	25	0.12	-0.616	0.541ns
33	7.66	1.34	17	6.81	1.51	14	-0.85	1.656	0.108ns

ns – non-significant difference

Table 4. Comparison between the Experimental and Control groups by the Student's t-test, considering the difference between T2 and T1.

Tooth	Experimental			Control			Dif.	T	p
	Mean	sd	N	Mean	sd	N			
43	1.14	0.86	18	1.06	1.37	15	-0.08	0.192	0.849ns
42	0.74	0.44	25	0.23	0.31	25	-0.50	4.662	<0.001*
41	0.51	0.40	25	0.05	0.45	25	-0.46	3.799	<0.001*
31	0.26	0.29	25	0.11	0.44	25	-0.14	1.366	0.178ns
32	0.81	0.58	25	0.13	0.44	25	-0.67	4.610	<0.001*
33	1.25	0.95	17	1.16	1.20	14	-0.10	0.250	0.804ns

ns – non-significant difference; * - significant difference ($p<0.05$)

DISCUSSION

Some studies have reported dental changes after the treatment with RF-2, however none of them compared the experimental group with a control one, considering crown length (OWEN, 1986; HIME; OWEN, 1990). The majority of the studies about RF-2 evaluate dental and skeletal effects that contribute to the Class II malocclusion correction (PERRILLO et al., 1996; RUSHFORTH et al., 1999).

The buccal positioning of the anterior teeth was not evaluated in this study, but this effect may be due to the presence of the RF-2 vestibular shields, which allow an alveolar expansion and remodeling, caused by the elimination of pressure on the adjacent soft tissue and the application of a stress of the periosteum on the bone tissue (FRÄNKEL, 1966; FRÄNKEL, 1974; FREELAND, 1979; FRÄNKEL; FRÄNKEL, 1990).

Thickness of the bone plate on the cervical and medium thirds of the root is very similar in the different facial types (FERREIRA et al., 2010), but the distance from the apex to the outer surface of the

buccal and lingual cortical is greater in the brachyfacial type, compared with the dolichofacial (TSUNORI et al., 1998). In this way, in patients with horizontal growth pattern, the orthodontic planning has fewer morphological limitations for the buccal-lingual movement of the lower incisors.

Therefore, the results of this study evidenced a significant increase of the clinical crown length of lower anterior teeth after treatment with RF-2. However, when compared to a non treated group, with similar characteristics, only half of the teeth showed significant differences, considering the clinical crown length increase. Literature diverges on this subject, with some authors suggesting a correlation between gingival recession and extrusion or facial flaring (PIKDOKEN et al., 2009), and other authors believing that one event is not dependent on the other (YARED et al., 2006; CLOSS et al., 2009). Many factors can influence gingival recession, as gingival quality, tooth brushing force and technique, dental trauma, bone thickness and, finally, buccal inclination of the teeth, which can be caused by orthopedic/orthodontic treatment or by muscular imbalance, specially by tongue interposition. Even patients not submitted to orthodontic treatment can experience of gingival recession, due to the factors cited above. This emphasizes the importance of a control group in this study.

Anyway, it is important to take care with the quality of periodontal support and protection in which the teeth are inserted, so the induced dental movement does not exceed healthy and safe limits. Other studies are necessary to verify a possible correlation between changes in gingival configuration and orthodontic/orthopedic treatment, cephalometric parameters, oral hygiene and other factors.

CONCLUSION

In conclusion, the clinical crown of the lower anterior teeth in the patients treated with Fränkel-2 function regulator appliance underwent an increase. Although canines did not presented significant differences, comparing to the control group, lower incisors showed more gingival recession with significant statistically difference.

RESUMO: Os aparelhos ortopédicos funcionais utilizados para o tratamento da má oclusão de Classe II normalmente atuam guiando o crescimento dos maxilares e modificando as posições dentais. Dentre esses efeitos dento alveolares está a inclinação dos incisivos inferiores para vestibular, o que auxilia na melhora do *overjet*, mas pode causar recessões gengivais, especialmente se associado a outros fatores etiológicos. O objetivo deste estudo foi avaliar o comprimento da coroa clínica dos dentes anteriores inferiores em indivíduos com má oclusão de Classe II, após o tratamento com o aparelho regulador de função Fränkel-2 (RF-2). Cinquenta indivíduos com Classe II foram divididos em dois grupos: G1 – 14 meninos e 11 meninas, tratados com o aparelho regulador de função Frankel-2, por 18 meses, com média de idade pré-tratamento (T1) de 11 anos (DP=7 meses) e média de idade pós-tratamento (T2) de 12 anos e 7 meses (DP=7 meses); e G2 – um grupo controle com 25 indivíduos (12 meninos e 13 meninas) com média de idade em T1 de 10 anos e 3 meses (DP=11 meses) e em T2 de 12 anos e 1 mês (DP=11 meses), que fazia parte de uma amostra de oclusão normal. Os 100 modelos de gesso foram avaliados em T1 e T2, com um paquímetro digital, medindo a distância da borda incisal à parte mais côncava da margem gengival dos incisivos e caninos inferiores. Os dados foram checados pelo teste t de *Student* e pelo teste t pareado. Considerando T2, o grupo 1 apresentou um aumento significante no comprimento das coroas de todos os dentes anteriores inferiores. Por outro lado, no grupo 2, isto foi observado somente para os dentes 33, 42 e 43, sugerindo que os pacientes tratados com o RF-2 apresentaram mais recessões gengivais do que o grupo controle.

PALAVRAS-CHAVE: Ortodontia. Recessão Gengival. Aparelho Ortodôntico Funcional.

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