Evaluation of changes in clinical crown length of lower anterior teeth after treatment with Frankel-2's appliance

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ABSTRACT

Purpose: The aim of this study was to test the null hypothesis that there is no change in the lower anterior teeth's crown size when measured just after the treatment with Frankel-2's orthopedic appliance and in a long-term posttreatment follow-up.

Materials and Methods: The sample was composed of 34 plaster models belonging to 9 male and 8 female individuals, treated at the College of Health, Methodist University of São Paulo, São Bernardo do Campo, São Paulo, Brazil, with mean age of 12 years and 6 months (standard deviation [SD] =7 months) at T1 (end of the treatment with Frankel-2's function regulator), and 19 years and 8 months (SD = 7 months) at T2 (7.11 years after the end of the treatment).

Results: The distance from the incisal edge to the most concave portion of the gingival margin of the lower incisors and canines was measured using a digital caliper. Data analysis was carried out by means of Student's t-test and paired-t test. Among the lower anterior teeth, the teeth 31, 33, 42 and 43 showed a statistically significant increase in their crown length, whereas the teeth 32 and 41 showed no changes.

Conclusion: It can be concluded that there is a tendency to increase the clinical crown of lower anterior teeth throughout the years after the mandibular advancement treatment by using functional devices, rejecting the null hypotheisis.

Key words: Orthodontic treatment, periodontics, removable, stability

The Angle's Class II malocclusion is characterized by a dental or skeletal interrelation between arches in sagittal norm, whose features are mandibular retrusion, maxillary protrusion, maxillary dentoalveolar protrusion, mandibular dentoalveolar retrusion or a combination of them,[1] mandibular retrognathia being the most prevalent feature.[2] The treatment of Class II can be accomplished by orthognathic surgery,[3-5] fixed orthopedic appliances[6-8] or by the use of functional orthopedic devices.[9-10]

In addition to the most appropriate treatment planning for each individual, it is up to the orthodontist to choose an adequate mechanics in order to achieve the goals of such a treatment as regards dental/periodontal health and aesthetics, dynamic and static occlusion, health of the temporomandibular joint, among others.[11-12]

Not less important than a proper completion of cases is the long-term stability of results;[13-14] among noteworthy items to be considered, periodontal health – particularly bone and gingival support – arouses attention.[12]

Given this, the aim of this study was to test the null hypothesis that there is no change in the lower anterior teeth's crown size when measured just after the treatment with Frankel-2's orthopedic appliance and after 7.11 years posttreatment.

SUBJECTS METHODS

This study was carried out after approval by the Research Ethics Committee at the Methodist University of São Paulo, São Bernardo do Campo, São Paulo, Brazil (protocol #289963–09).

The sample was composed of 34 plaster models (T1, $n = 17$; T2, $n = 17$) belonging to 9 male and 8 female individuals, with mean age of 12 years and 6 months (standard

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deviation [SD] =7 months), Caucasians, presenting with Class II malocclusion, Division 1, at T1 (end of the treatment with Frankel-2's function regulator), and 19 years and 8 months (SD = 7 months) at T2 (7.11 years after the end of the treatment) treated at the Orthodontic Department of The College of Health, Methodist University of São Paulo, São Bernardo do Campo, São Paulo, Brazil.

The following criteria were used for patient selection: Class II, Division 1 malocclusion with mandibular retrusion, no previous history of orthodontic treatment, absence of posterior cross bite, and no excessive inclination of the anterior teeth.

Patients were treated for 18 months with the Frankel-2's function regulator appliance, with daily use of 22 h, and removal only during cleaning and feeding. This was followed by night use for 6 months as a retention. Patients returned to the university to control appointment every 2 years or so, and 7.11 was the longest period this was performed. We expected that individuals returned every 2 years, but due to the school holiday period; the last control needed to be done just before 8 years.

In order to obtain the plaster models, patients were molded with fast-setting alginate Zhermarck (Hydrogume, Polesine Badia, Italy); then molds were poured in Asfer Type III plaster (Asfer, Curitiba, PR, Brazil).

A previously trained single operator performed the measurements on plaster models with a digital caliper (Mitutoyo 500–144B/H12, Suzano, SP, Brazil). By positioning the caliper parallel to the long axis of the teeth and its tips perpendicular to the buccal face, the distance from the incisal edge to the most concave portion of the gingival margin for all lower anterior teeth was measured [Figure 1]. We evaluated the plaster models corresponding to the final phase of the treatment with FR-2 (T1) and 7.11 years since the end of the treatment (T2).

Measurements of the casual or systematic method error were undertaken 30 days after the first measurement in 30% of the sample [Table 1]. For comparison between T1 and T2, we used a paired *t*-test with a significant level of 5% ($P < 0.05$). All the statistical procedures were performed on the software Statistica for Windows v. 5.1 (StatSoft Inc., Tulsa, USA).

RESULTS

Table 2 describes the measurements of clinical crown length of lower anterior teeth at T1 and T2.

DISCUSSION

Longitudinal clinical studies are extremely valuable in describing the effects of treatments on the population. However, given that these studies require patient follow-up
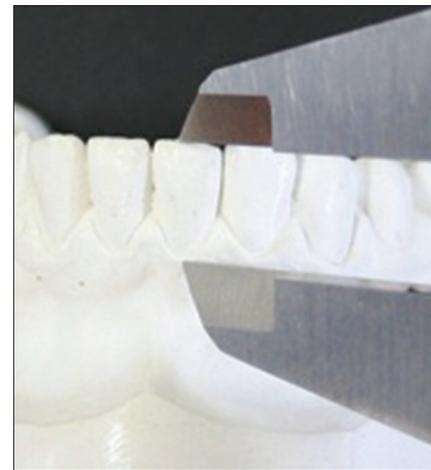

Figure 1: Measure of the distance from the incisal edge to the most concave portion of the gingival margin

Table 1: Mean and SD of two measurements, paired *t*-test and Dahlberg's error of the method to evaluate systematic and casual errors

Tooth	1st measurement		2nd measurement		T	P	Error
	Mean	SD	Mean	SD			
43	8.35	1.32	8.39	1.38	0.962	0.355[ns]	0.12
42	8.06	0.69	8.11	0.65	1.505	0.153[ns]	0.10
41	8.41	0.74	8.48	0.68	1.417	0.177[ns]	0.15
31	8.31	0.62	8.35	0.71	0.770	0.453[ns]	0.13
32	8.09	0.63	8.10	0.71	0.563	0.582[ns]	0.09
33	8.98	1.21	8.98	1.16	0.084	0.935[ns]	0.12

[ns]statistically nonsignificant difference. SD=Standard deviation

Table 2: Mean and SD at T1 and T2 and the results of the comparison according to paired *t*-test

Tooth	n	T1		T2		T2–T1	T	P
		Mean	SD	Mean	SD			
43	17	8.51	1.11	9.40	1.14	0.89	−3.675	0.002*
42	17	7.92	0.67	8.29	0.93	0.38	−2.661	0.017*
41	17	8.20	0.79	8.22	1.01	0.03	−0.202	0.842[ns]
31	17	7.97	0.75	8.37	1.00	0.40	−2.294	0.036*
32	17	8.11	0.53	8.28	0.84	0.16	−1.027	0.320[ns]
33	17	8.58	0.60	9.78	1.02	1.20	−5.284	<0.001*

*Statistically significant difference ($P<0.05$), [ns]statistically nonsignificant difference. SD=Standard deviation

as a function of time, they can be compromised by death/illness or drop out of the person studied. Hence, their samples are typically small. Another noteworthy factor is the impossibility of having a control group with growing patients since they would lose the proper time to be treated.

Mandibular protruding appliances have the potential to lean the lower incisors forward and the upper incisors backwards, in addition to changing to some extent mandibular and maxillary growth.[15]

After analyzing such protrusion in lower teeth, statistical results showed that 7.11 years after the end of the treatment with FR-2 there was a significant increase in clinical crown length of the teeth 31, 33, 42 and 43. This increase had

already been expected due to the natural development of occlusion, with alveolar bone growth, and particularly to the complete eruption of dental elements. Nevertheless, such difference between the clinical crown lengths of teeth was not observed for the teeth 32 and 41, requiring further studies in this regard. We can outline some cogitation concerning this fact. It is likely that the absence of statistically significant increase in the crowns size of the aforementioned teeth has not been established because these teeth might not be completely erupted. Moreover, it is also advocated the hypothesis that the teeth 32 and 41 are better positioned than the others, preserving the contour of the marginal gingiva and its firmer gingival tissue, and therefore less vulnerable to long-lasting adversities,[16] traumas during hygiene, recurrent gingivitis, gingival recession, etc.

Prospective studies of 10 years after treatment have indicated possible influence of bone characteristics on changes in the gingival margin,[17] and the major changes reported have been observed immediately after treatment with FR-2. Many alterations are related to bone effects, dental positioning and inter-canine distance, in addition to vertical growth, which can incur a lower thickness of the buccal bone of the mandible, favoring the recession in the anterior region of the incisors.[18]

Nonetheless, Djeu *et al.*[19] evaluated 67 patients treated at the Harvard School of Dental Medicine, in a 5 year period, and did not identify a relationship between proclination and gingival recession.

Authors[20,21] have warned that the stability of the marginal gingiva is also related to the degree of patient's dental hygiene, especially in the cervical-buccal region. The emergence of gingival recession may be related to the permanence of malocclusion, mainly in cases of buccal version and clinical crowns excessively long in the cervical-incisal direction.

Thus, the increase in the lower incisors crowns after using the Frankel-2's regulator, in general, may be a result of the natural process of development of occlusion, with consequent tooth extrusion, and may also be associated with factors such as persistence of malocclusion, poor oral care habits, or even traumatic oral hygiene.

It is up to the orthodontist to educate the patients on the importance of their active role in maintaining impeccable hygiene, as well as and to warn about the need for treatment of malocclusion in a timely manner.

CONCLUSIONS

A statistically significant increase in clinical crown length of most lower anterior teeth was observed after 7.11 years since the end of the treatment with FR-2, that means that the null hypothesis was rejected.

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