Original Article

EVALUATION OF LONG-TERM STABILITY OF EDGEWISE ORTHODONTIC TECHNIQUE

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ABSTRACT

The relapse of teeth after orthodontic treatment has been a topic of ongoing interest for practitioners. The instability of the orthodontic treatment depends on different variables, such as the normal developmental maturation process of the maxillofacial complex. It is common to use post-treatment retentions to avoid a relapse, permanent or removable, depending on the previous malocclusion. The casts of 15 subjects treated with the edgewise technique between 1985 and 2000 were selected to evaluate dental arch changes among 17 years post-treatment. Time points were pre-treatment (T1), post-treatment (T2) and follow-up (T3). The parameters considered were intercanine, interpremolar and intermolar width, dental arch length and crowding. The collected data were submitted for statistical analysis. The intercanine width outcome is the most significant, with the greater changes observed during the treatment among T1 and T2, maintained over time as the difference between T3 and T1 is statistically significant. The other parameter values were not statistically significant. Within the field of the edgewise technique, the intercanine width outcome is the most significant: greater changes from the pre-treatment to the post-treatment condition led to more significant relapse.

KEYWORDS: *relapse, stability, edgewise technique, intercanine width*

INTRODUCTION

The achievement of a good result was investigated over time and led to an improvement in materials, procedures, vestibular fixed appliance technique, and more esthetic treatments like aligners (1) and lingual orthodontics; this made possible even complex cases' treatments (2). However, a stable result over time is today a real challenge for the entire professional category. Therefore, different systems that could lead to the required results have been tested during these years, even applying light and continuous forces (3, 4).

Considering that less than 30% of treatment presents a satisfactory clinical alignment after 10 years from the end of the therapy, the percentage decreases to 10% after 20 years (5). Relapse after orthodontic treatment is defined as an undesired resurgence of a previously adjusted malocclusion, and this has been a topic of ongoing interest throughout most of this century (6, 7). Nowadays, we can relate several causes for relapsing: the skeletal growth (8-11), the neuromuscular forces (12, 13), the inferior incisors inclination variation (14), the variation of the inter canine's inferior width and the third molar eruption (7, 15, 16). In addition, it has been proved that the whole maxillo-facial complex is subject to physiological changes. Development of the arches affects intercanine and intermolar width, dental arch length (17-19)

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and crowding (20, 21). Several types of permanent or removable systems are used to avoid relapse risk. Depending on the previous malocclusion, they can be positioned in the lower arch, the upper arch, or both (22). Finally, the purpose of this study was to evaluate the stability of edgewise treatments over time through the examination of the changes in both arches over 17 years from the end of the treatment.

MATERIALS AND METHODS

Patient sample

For this study, 15 subjects treated with edgewise technique between 1985 and 2000 were selected from doctors Calderone's storage in Palermo and Cefalù (PA) in 2017. The inclusion criteria were:

- presence of pre-treatment (T1) and post-treatment (2) dental casts in optimal condition;
- possibility for the patient to come for dental impressions;
- arches conditions not affected by trauma or periodontal disease;
- post-treatment retention suspended for 3 years at least.

Of those patients, 12 females and 3 males were treated between 12-35 years old. In addition, 8 cases were treated with extractions and 7 without them. Regarding Angle's classification, 7 presented a bilateral class I, 6 presented a bilateral class II and 2 a bilateral class III. However, the sample is not homogeneous for malocclusion variability due to the complexity of recovering long-time records, the current presence of retention and the unavailability of patients to come for dental impressions after 17 years.

Analysis of dental casts

Patients came for alginate dental impressions. Casts obtained (T3), along with pre-treatment (T1) and post-treatment (T2) casts, were scanned with Sirona inEos X5. For every couple of casts, .stl files were obtained and used for software 3Shape Orthoanalyzer measurement. The focus was on intercanine, interpremolar and intermolar width, dental arch length and crowding. Also, overjet and overbite were calculated from casts in occlusion.

Statistical analysis

The collected data were submitted to statistical analysis with average values and standard deviation. Fisher's F ANOVA test was used to compare these values for every parameter of the three different time points. The level of statistical significance was predetermined as $p<0.05$. Finally, Bonferroni's post-hoc test was used to verify where were located the significant differences among average group values.

RESULTS

Upper intercanine width

Fig. 1 shows that the upper intercanine width average values increase along the second measurement and decrease along the third measurement. Blue circles represent average values that must be compared with those displayed on the left. Vertical lines represent the standard deviation. From Bonferroni's test, the ICD average upper at T2 (35.2) is significantly higher (p=0,001258) than the ICD upper average at T1 (33.2). Unlike this, there is no significant difference between the ICD upper average at T2 and T3.

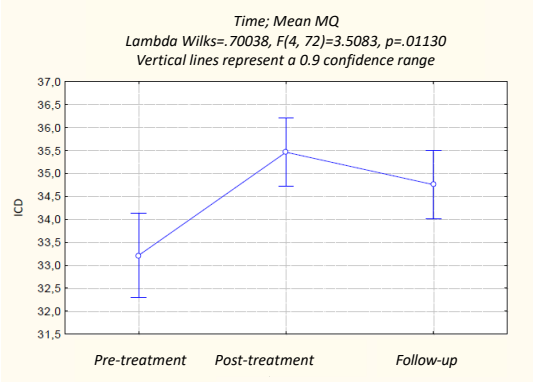

Fig. 1. *Upper intercanine width ICD average values comparison.*

Lower intercanine width

Fig. 2 shows that the average values increase along the second measurement and decrease along the third. The ICD lower average at T2 (27.0) is significantly higher (p= 0,001914) than the ICD average at T1 (25.2). Otherwise, there is no statistically significant difference between the ICD lower average at T2 and T3, as there is no significant difference between the ICD average at T1 and T3.

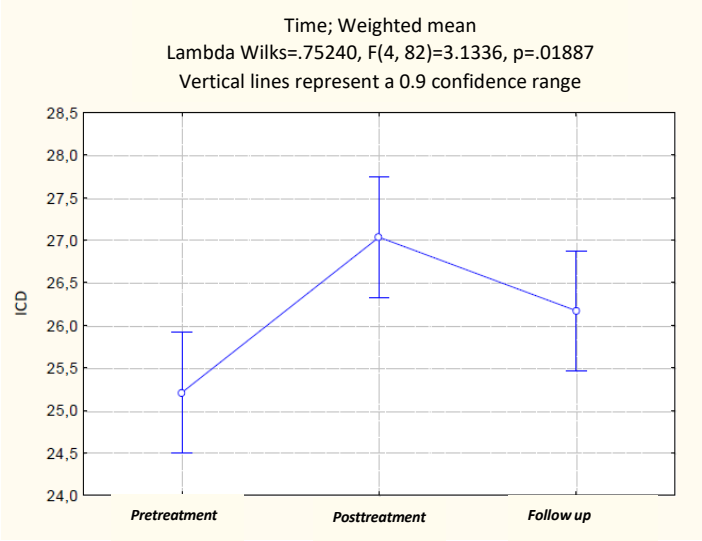

Fig. 2. *Lower intercanine width ICD average values comparison.*

Upper interpremolar width

The IPD upper average values increase from the T1 time point to T2 and decrease from T2 to T3. However, no significant differences were observed among the three time points ($p > 0.05$).

Lower interpremolar width

The IPD lower average values increase from T1 time point to T2 and decrease from T2 to T3. No significant differences were observed among the three time points ($p > 0.05$).

Upper intermolar width

The IMD upper average values increase from T1 to T2 and decrease from T2 to T3. No significant differences were observed among the three time points ($p > 0.05$).

Lower intermolar width

The IMD lower average values increase from T1 to T2 and decrease from T2 to T3. However, no significant differences were observed among the three time points ($p > 0.05$).

Dental arch length

The AL upper average values decrease from T1 to T2 but stay unvaried from T2 to T3; no significant differences were observed among the three time points ($p > 0.05$). The AL lower average values decrease from T1 to T2 but stay unvaried from T2 to T3; however, no significant differences were observed among the three time points ($p > 0.05$).

Upper crowding

The average values at T2 are significantly higher (p= 0.009958) than the T1 average. Otherwise, there is no significant difference between T1, T2 and T3 values; likewise, there is no significant difference between the T1 and T3 average values.

Lower crowding

The average values at T2 are significantly higher than those at T1. However, there is no significant difference between T2 and T3 average values, likewise between T1 and T3 average values. For what concerns *Overjet* and *Overbite* analysis, obtained results are not statistically significant.

DISCUSSION

Based on the results, intercanine width outcomes are the most significant, with the greater changes observed during the treatment among T1 and T2. These are maintained over time due to the statistical difference between T3 and T1. Lower intercanine width changed mainly during treatment, while changes due to the relapse were not considerable. In the same way, upper and lower crowding average values suggest that the main change was during treatment, without relevant results about relapse. Regarding the other parameters analyzed, the interpremolar and intermolar width results were not statistically significant. Both outcomes showed an increase from T1 to T2 and a slight decrease from T2 to T3. Both upper and lower dental arch length tends to decrease from T1 to T2 but remains stable from T2 to T3. At last, overjet and overbite outcomes contrast with previous studies due to the variety of the sample.

Obtained results are, therefore, comparable to the primary studies carried out by Little at Washington University (6). It is interesting to notice that there are no significant differences for every parameter between the end of the therapy (T2) and the control over time (T3). The analyzed cases present excellent stability over time, proven by the 17 years of follow-up with no retention for at least 3 years. Tweed's edgewise technique can be important in achieving such a treatment goal. The diagnosis is obtained through the characteristic diagnostic triangle, and the therapy is carried out respecting the anterior limit of the dentition and without manipulating the occlusal plane inclination.

Nowadays, the innovation and improvement of the techniques applied have brought the possibility to improve the quality of the treatment and many clinical advantages, such as reduced chair time, less compliance requirement, less discomfort for the patient, and a shortened treatment time.

In order to obtain a satisfactory and stable result, it is mandatory to consider the anterior limit of the dentition, as well as the preservation of the patient's initial dental arch width and the achievement of an occlusion balanced with neuromuscular forces. In addition, it is essential to avoid rapid movements that do not allow the reshaping of periodontal fibres, which generally takes 4-6 months. Therefore, the need for a retention phase is considered primary, especially in parafunctional patients with muscle hypertonia.

CONCLUSIONS

This study reveals that, in edgewise treatment, the intercanine width outcome is the most significant; the results show considerable changes from the pre-treatment to the post-treatment condition without a substantial relapse. These findings highlight the importance of the clinical practice of a correct diagnosis to plan a stable treatment in time. The intercanine width expansion, in most cases, leads to a recovery of the preexisting condition, which is why the clinician shall preserve the initial dimensions. Future research should investigate the range in which it is safe to expand without risking relapse, and guidelines should be drawn to help the clinician in the treatment planning.

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