Original Research

Outcome Quality and Treatment Efficacy of Early Class II elastics compared to Late Class II elastics: A Retrospective Clinical Investigation

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ABSTRACT

Introduction: Class II elastics are widely used treatment modalities in correction of class II malocclusion. Class II elastics are traditionally used in combination with multibracket appliances after completion of the initial leveling phase. The use of early short and light class II elastics on initial leveling wires has been advocated to reduce the treatment time and increase the treatment efficiency. However, there is a lack of sufficient evidence in the literature. Therefore, the aim of this retrospective study was to investigate the outcome quality and treatment efficiency of early class II elastics compared to late class II elastics using the PAR index.

Materials and Methods: Records of patients treated between September 2005 and April 2017 were retrieved from the archive of the university of Frankfurt have been sighted to generate data for the present study. Patients with class II malocclusion undergoing a treatment with multibracket appliance after their peak of growth were included in the study. 16 Patients were included in the group IEA (early class II elastics) and 21 were allocated to the group IEL (late class II elastics). The peer assessment rating index (PAR) was used to assess the treatment outcome in each group.

Results: Both early and late class II elastics showed great improvement of the occlusal traits in the patients. However, the treatment duration was significantly shorter in group IEA, showing the higher efficiency of early class II elastics. Conclusion: Incorporation of early class II elastics on the initial leveling arch wires can increase the treatment efficiency without compromising the occlusal outcome of the treatment.

Keywords: Class II malocclusion, early Class II elastics, late class II elastics, PAR index.

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INTRODUCTION

Class II malocclusions are considered to be among the most common malocclusions with a high prevalence in European populations.[1] Treatment of Class II malocclusion remains a controversial topic in orthodontics due to varying treatment modalities.[2] The primary goal of Class II treatment is to achieve skeletal effects with minimal dentoalveolar side effects in a short period. However, existing Class II appliances correct malocclusion through a combination of skeletal and dental components. However, the existing class II appliances are shown to correct the malocclusion through various combination of both skeletal and dental components.[3-5] Class II elastics are effective, inexpensive, popular and compliance-dependent on treatment auxiliaries with mainly dentoalveolar effects similar to long term effects of fixed functional appliances.[6] Several studies have shown that the continuing growth and development wipe out the skeletal short-term effects of the treatment with fixed functional appliances, making their results comparable to those of class II elastics.[6-8] Class II elastics are compliance dependent auxiliaries that are mainly used in combination with multibracket system for class II correction. If these elastics are combined with highly elastic or round wires, they can lead to several dentoalveolar side effects such as palatal tipping of the upper incisors as well as lingual tipping of lower molars.[7] Therefore, they are commonly used as late class II elastics after the initial aligning and leveling stage. This stage typically occurs after the growth peak, as bonding the multibracket appliance is usually done following the full eruption of the second molars, which occurs around the age of 11-13 years, surpassing the maximum growth velocity. On the other hand, early class II elastics were introduced in the recent years and are employed directly after placing the multibracket appliance in combination with the initial round copper NiTi arch wires.[9] However, there is a lack of scientific studies, evaluating the effects of the early class II elastics.

Therefore, the present study aimed to investigate the treatment outcome and treatment efficacy of the early class II elastics compared to late class II elastics using PAR Index.

MATERIALS AND METHODS

The ethics approval of this retrospective clinical study was obtained from the ethics committee of university of J.W. Goethe University Frankfurt under number 181/17.

Study groups and sample size calculation

Our study groups consisted of 2 groups: a group treated with early class II elastics (group IEA) and another group. Our study sample comprised of two groups, patients treated with early class II elastics (group IEA) and patients treated with late class II elastics (group IEL).

Calculation of the sample size was done using the Van-Elteren-Test. By assuming an error probability of 5% and a test-relevant probability of $P(X1<X2) = 0.76$, which roughly corresponds to one standard deviation in the Gaussian model, for a test power of 80% a minimum of would mean a number of at least ten patients per group was required. Therefore, the sample size of 10 patients in each group was calculated.

Data collection from archive of the university

The archive of the orthodontic department of J. W. Goethe University Frankfurt was searched for records of patients with class II malocclusions and the following inclusion and exclusion criteria were applied.

Inclusion criteria

- Patients, who had completed their entire orthodontic treatment at the orthodontic department of **** university between September 2005 and April 2017 with diagnosis of skeletal class II malocclusion (ANB angle > 4°)
- Patients after their peak of growth (CVS staging of above 4 on the T0 lateral cephalogram)
- Patients with at least ½ cusp distal occlusion on one side
- Patients in treatment with Damon Q self-ligate multibracket system (Ormco Corporation, Orange, California, USA)
- Begin of the multibracket treatment latest in April 2015
- The use of class II elastics
- Patients with available, intact study models at both pre- and posttreatment (T0 and T1) stages.
- Patients with available T0 lateral cephalograms

Exclusion criteria:

- Severe skeletal class II patients, who required an orthognathic surgery
- Patients with craniofacial syndromes
- Patients with less than ½ cusp distal occlusion on one side
- Patients with skeletal class I and dental class II malocclusions
- Patients with a phase of therapy using removable functional appliances
- Patients with hypoplasia or oligodontia
- Low- and non-compliant patients as recorded in their records
- Patients with extraction therapy

Since the German insurance system does not include the orthodontic treatment of patients above 18 years old, these patients could not be included in the study sample of the present study.

Patient allocation and Data availability

37 patients (17 male and 20 female) met die inclusion criteria. All the patients had the T0 and T1 study models as well as T0 lateral cephalograms. Therefore, diagnosis of a skeletal class II malocclusion and estimation of skeletal maturity at the beginning of the treatment were possible for all the patients. 16 patients were treated with early class II elastics (group IEA) and 21 patients with late class II elastics (group IEL).

Data analysis

All the diagnostic records (study models and lateral cephalograms) were analyzed by a senior attending at the orthodontic department of J. W. Goethe University Frankfurt. The skeletal maturity of all patients was determined using the Baccetti cervical vertebrae maturation (CVM) method.[10] Lateral cephalogram analysis of the available data were performed on T0 images. OnyxCeph³™ software, version 3.2.32 (Image Instruments, Germany) was used for the cephalometric diagnosis. Model analysis was made on study models of all the patients obtained up to 3 months before placement and up to 15 months after removal of multibracket system. The measurements were made using manual caliper to the nearest 0.5 mm. PAR index with the weighting system according to Richmond et al. was assessed using a PAR ruler.[11] Occlusal traits of PAR score were measured, summed, and multiplied by

their weight according to both weighting systems at T0 and T1. Reduction and percentage reduction of the weighted PAR scores between T0 and T1 were also calculated for each patient. Furthermore, numerical and percentage reductions of PAR scores per year were additionally measured for all the samples.

Statistics

Nonparametric van Elteren Test was used to measure the sole effect of the different therapy methods on the treatment result. Hodges–Lehmann estimator and Rosenthal effect size estimator were used to compare the difference between the median value of 2 groups and assess the superiority of one group against the other. The BiAS software version 11.0 was used for all the statistical measurements.

RESULTS

PAR score analysis

Comparing the weighted PAR scores of the groups at T0, no statistically significant differences were found between the groups (P <0.001). The groups were also harmonious after the treatment, as no statistically significant differences were found between their PAR scores at T1. According to Richmond et al.[11] a reduction of above 22 points of PAR Index as well as a percentage reduction of above 70% are considered to be great improvement of the malocclusion. Since a reduction of above 22 points of PAR Index as well as a reduction of above 80% were recorded in all groups at T1, both treatment modalities are considered to have greatly improved the patients' malocclusion. The median values of Richmond's weighted PAR index in IEA and IEL groups were respectively 25 and 28 at T0, and 2 and 3 at T1 (Figure 1).
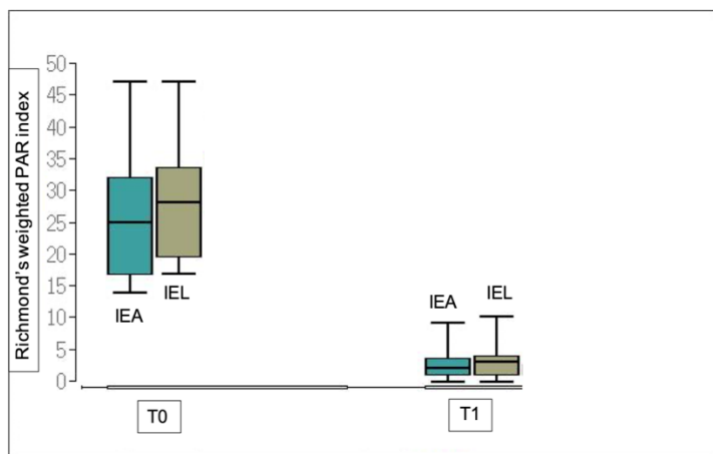

Figure 1: The median values of Richmond´s weighted PAR index in IEA and IEL groups at T0 and T1.

Therefore, great improvement of the patients´ malocclusion was achieved in both groups. No statistically significant differenced were found between two groups using the Wilcoxon matched paired test at T0 and T1. However, the numerical reduction and percentage reduction of PAR score per year was significantly higher in the IEA group compared to IEL group (P< 0.05) (Table 1).

Table 1: The numerical reduction and percentage reduction of Richmond weighted PAR score (median value) per year in groups IEA and IEL.

	IEA	IEL	P Value
Numerical reduction of PAR value per year	16,0	10,2	0.016
Percentual reduction of PAR value per year	65,3	36,4	0.001

Treatment duration

Statistically significant differences were recorded between the groups regarding the duration of the active treatment. The average active treatment duration of 16,5 months of group IEA was significantly shorter than 28 months in group IEL (P < 0.05).

DISCUSSION

The present investigation evaluated the occlusal outcome and treatment efficacy of early vs late class II elastics using weighted PAR scorings. Class II elastics are compliance depended on auxiliaries, which are commonly used in combination with fixed orthodontic appliances. Class II elastics are shown to correct the class II malocclusion by dental movements; however, Long-term studies have shown the results of class II elastics to be comparable to those of fixed functional appliances.[6-8]

The use of early light elastics on initial leveling wires in combination with bite turbos has been advocated to improve the efficiency of Damon system treatment.[12,13] The bite correction stage by traditional class II elastics is initiated after completion of the leveling and aligning stage, which takes a bout several months. To increase the efficiency of treatment, several treatment protocols have been devised to employ early light elastics (3/16" or 5/16" with maximal 2 oz). Several case reports have shown the efficiency of shorty class II elastics in combination with bite turbos in low-angle class II cases. These elastics can have multiple configurations (such as posterior vertical box, posterior triangle or posterior check with class II vector), but should have reduced horizontal pull to minimize the detrimental effects on the arch form and the overbite. [12,13] Despite promising results of the preliminary case reports, the research on the occlusal effects of early class II elastics is scares. Our results show that the annual reduction of the weighted PAR score was significantly higher in the IEA group compared to IEL group (P< 0.05). This effect could be attributed to the significantly shorter treatment duration in the IEA group. By applying the class II elastics from the beginning of the treatment, we were able to start the bite correction during the leveling stage and shorten the treatment duration.

CONCLUSION

The authors recommend the use of short and light elastics in the initial stages of the treatment. Since early class II elastics were first described scientifically in our study, further studies and especially prospective ones should be performed.

LIMITATIONS AND FURTHER RESEARCH

Our sample consisted of young post pubertal patients. So, the effects of pubertal growth peak on the treatment were not investigated in our study. Further research is required to determine the effects of pubertal growth peak on the efficacy and outcome of treatment with class II elastics.

SOURCE OF FUNDING

No funding was received for the study.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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LEGENDS:

Figure 1: The median values of Richmond's weighted PAR index in IEA and IEL groups at T0 and T1.

Table 1: The numerical reduction and percentage reduction of Richmond weighted PAR score (median value) per year in groups IEA and IEL.