Original Article

Is Herbst-Multibracket Appliance Treatment More Efficient in Adolescents than in Adults?

A Dental Cast Study

Julia von Bremen[a]; Niko Bock[a]; Sabine Ruf[b]

ABSTRACT

Objective: To determine whether Herbst treatment is more efficient in adolescent than in adult Class II division 1 subjects.

Materials and Methods: All Class II division 1 patients with a full secondary dentition who had been treated at the orthodontic department of the University of Giessen with a Herbst appliance between 1990 and 2000 were considered. The complete records of 77 patients were available. According to their skeletal maturity, as assessed on hand-wrist radiographs, the subjects were divided into an adolescent group (MP3-F to MP3-H; n = 49; mean age 13.5 years) and an adult group (R-IJ to R-J; n = 28; mean age 20.7 years). Pretreatment and posttreatment dental casts were evaluated using the Peer Assessment Rating (PAR) Index. The reductions in PAR scores of the two groups were compared.

Results: Before treatment, both groups had a severe Class II division 1 malocclusion. The average PAR score of the adolescent patients was slightly lower (27.8) than that of the adult patients (28.8). After treatment, good results were reached for both groups, and the average PAR scores of the two groups were comparable (adolescents: 4.5; adults: 4.8). The average reductions in PAR score were 82.7% (23.3 points) for the adolescent group and 82.9% (24.0 points) for the adults, indicating great improvement in both groups.

Conclusions: Because good treatment results were achieved, with substantial improvement of the pretreatment situation in both groups, Herbst treatment can be considered equally efficient in adolescent and in adult Class II division 1 subjects. (*Angle Orthod.* 2009;79:173–177.)

KEY WORDS: Efficiency; Herbst therapy; Adolescents; Adults

INTRODUCTION

Over the last decade, a trend in orthodontics, as in all areas of health care, has become not only to deliver high-quality treatment, but also to do so in the shortest time possible, increasing efficiency and reducing costs. Another trend that has developed over the past 25 years is the increasing number of adults demanding orthodontic therapy.[1,2]

For the adult Class II division 1 patient, however, treatment options are limited in comparison to the growing patient. The traditional options for adults are (1) multibracket appliances with Class II elastics, which are only indicated for mild Class II cases; (2) camouflage treatment, which involves the extraction of two maxillary first premolars and the retraction of the maxillary incisors; and (3) maxillofacial surgery for extreme skeletal discrepancies.

Recently, however, a fourth treatment alternative for adult Class II division 1 patients has been suggested. Herbst appliance treatment in young adults has been shown to correct the large overjet and the Class II molar relationship via a combination of skeletal and dental changes.[3–5] These skeletal changes are the result of a modeling of the condyle and the glenoid fossa as a result of a reactivation of temporomandibular joint growth.[6–10] Nevertheless, the degree of skeletal change will, on average, be less in adult Herbst patients.[11,12] It might thus be speculated that the quality

[a] Assistant Professor, Department of Orthodontics, University of Giessen, Giessen, Germany.

[b] Professor and Head, Department of Orthodontics, University of Giessen, Giessen, Germany.

Corresponding author: Dr Julia von Bremen, Department of Orthodontics, University of Giessen, Schlangenzahl 14, 35392 Giessen, Germany
(e-mail: Julia.v.bremen@dentist.med.uni-giessen.de)

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of treatment will be inferior in adults versus adolescents. Furthermore, as the length of the Herbst phase has been reported to be slightly longer[10,11] and tooth movements are slower because of a delay in the initial response[13,14] versus adolescents, adult Herbst treatment could be expected to be less efficient.

Thus the present study sought to analyze and compare the quality and efficiency of occlusal treatment results after Herbst-multibracket (MB) appliance therapy in adolescents and adults. The null hypothesis was that Herbst-MB appliance therapy is more efficient in adolescents than in adults.

MATERIALS AND METHODS

All Class II division 1 patients who had been consecutively treated with a Herbst appliance at the Orthodontic Department of the University of Giessen between 1990 and 2000 were screened. Those fulfilling the following criteria were selected:

- Treatment was begun in the full permanent dentition (with or without third molars erupted);
- Class II molar relationship of at least half a cusp width;
- Overjet of 5 mm or more; and
- Availability of complete records, including the 2-year follow-up exam.

According to pretreatment skeletal maturity, analyzed by means of hand-wrist radiographs according to the method described by Hägg and Taranger,[15] the subjects were divided into two groups. The adolescent group comprised all subjects with skeletal maturity of stages MP3-F to MP3-H, implying a prepeak to postpeak somatic maturity. In the adult group, only subjects with nearly or totally completed growth (skeletal maturity stages R-IJ to R-J) were included. Subjects with intermediate skeletal maturity stages (MP3-I and R-I) were excluded.

Seventy-seven subjects fulfilled the selection criteria; 49 were adolescents (25 women, 24 men) and 28 were adults (22 women, 6 men). The average pretreatment age of the adolescents was 13.5 years (range, 10.5 to 17.5 years) and that of the adults was 20.7 years (15.1 to 43.8 years). The same treatment protocol was used for all subjects. Upon insertion of the Herbst appliance, all subjects were jumped to an incisal edge-to-edge position and brackets were placed on the maxillary incisors and canines. After the Herbst appliance was removed, the remaining brackets were bonded. All patients had been treated by the department head, senior residents, or postgraduate students under senior supervision.

Pretreatment and postretention (2 years after removal of all fixed appliances) dental casts were evaluated using the Peer Assessment Rating (PAR) Index[16] with the weightings suggested by Richmond et al[17] applied. To exclude interexaminer differences, all dental cast evaluations were performed by one investigator with official PAR calibration, who was blinded for the treatment group during the analysis of PAR scores. Duration of treatment with the Herbst and MB appliances was calculated from the patients' records.

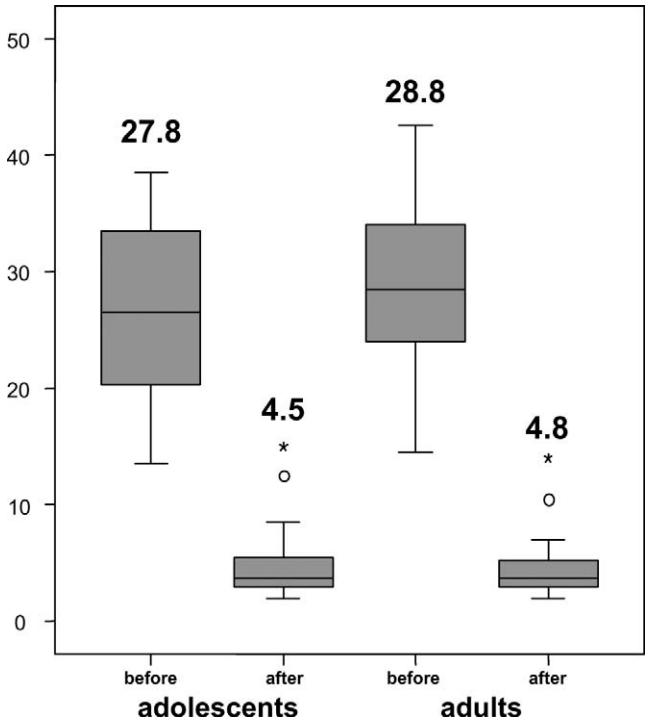

Figure 1. Pretreatment and posttreatment Peer Assessment Rating (PAR) scores of 49 adolescent and 28 adult Herbst-multibracket (MB) patients.

Statistical Analysis

Statistical analysis of the data was performed with SPSS 12.0 for MS Windows. Kolmogorov-Smirnov tests were applied to test for normal distribution, and Mann-Whitney *U* tests were applied to test for differences in PAR scores and treatment duration between adolescents and adults. The significance levels used were $P < .001$, $P < .01$, and $P < .05$. $P \geq .05$ was considered not significant.

RESULTS

Because no gender differences were found, men and women were pooled within their corresponding groups.

The average pretreatment PAR Index of the adolescent patients was 27.8, and that of the adults was 28.8 (Figure 1). Following Herbst-MB treatment, the average PAR Index was reduced to 4.5 in the adolescent

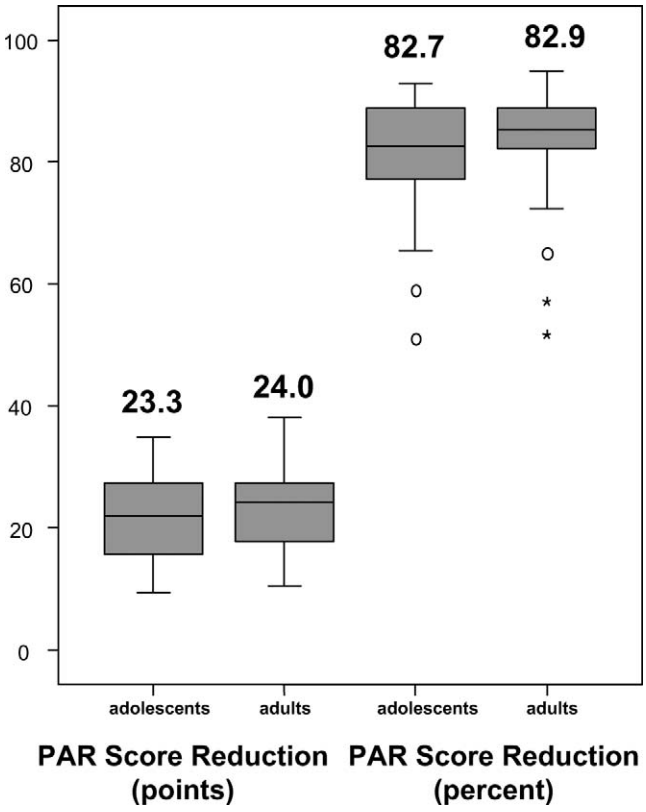

Figure 2. PAR score reductions of 49 adolescent and 28 adult Herbst-MB patients.

group and 4.8 in the adult group. There was no statistical difference between the groups, either before or after treatment.

The total reduction in PAR score can be assessed as either an absolute improvement (in points) or relative to the pretreatment situation (as a percentage). A comparison of adolescents and adults revealed that an average reduction in PAR score of 23.3 points was reached for adolescents, and adult PAR scores were reduced by 24.0 points. With regard to relative improvement, adolescents achieved an improvement of 82.7%; adults improved by 82.9% (Figure 2).

The improvements in PAR Index can be classified in three ways: ''great improvement,'' ''improvement,'' and ''worse or no difference.'' A PAR score reduction of at least 22 points is considered great improvement and can only be achieved if the pretreatment situation is severe (PAR Index $>$ 22 points). A PAR score reduction of at least 30% is considered improvement, and if a reduction of less than 30% in the PAR Index is achieved, the result is categorized as worse or no difference. In the present subject material, a great improvement was achieved in 53.1% of the adolescents and 60.7% of the adults ($P > .05$). Improvement was achieved in 46.9% of the adolescents and 39.3% of

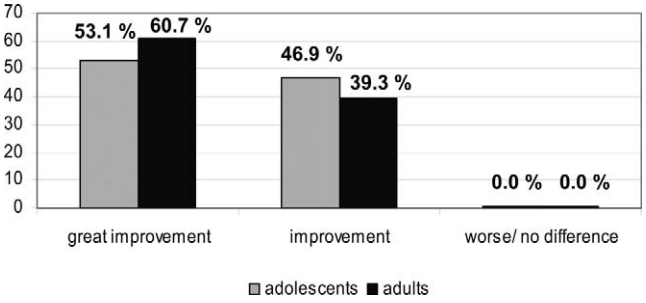

Figure 3. PAR score improvements of 49 adolescent and 28 adult Herbst-MB patients.

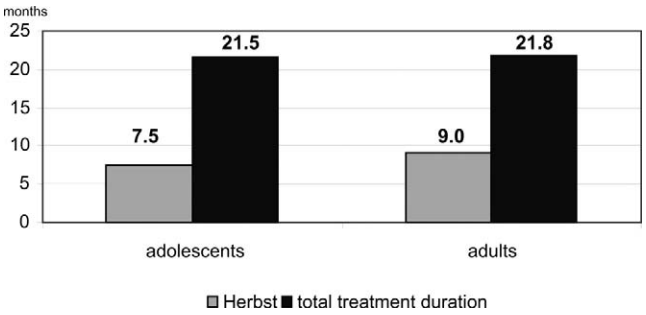

Figure 4. Duration of Herbst-MB treatment and total active treatment of 49 adolescent and 28 adult Herbst patients.

the adults. No subject of either age group fell into the category ''worse or no difference'' (Figure 3).

On average, adolescents wore their Herbst appliance for 7.5 months and adults wore them for 9.0 months. Thus, the Herbst phase was significantly shorter ($P < .001$) in the adolescent group. However, the total duration of active treatment (Herbst + MB) did not differ between adolescents (21.5 months) and adults (21.8 months) (Figure 4).

Regarding treatment efficiency, a treatment efficiency index, defined as PAR score reduction (points)/ treatment duration (months), was calculated. High scores imply high efficiency, and low scores imply low treatment efficiency. No statistical difference was found between the index for the two groups (1.18 for adolescents and 1.16 for adults).

DISCUSSION

Whereas the gender distribution in the adolescent group was balanced, in the adult group the number of women was significantly higher than that of men. This is in accordance with other studies on adult orthodontic patients, which found a clear overrepresentation of women.[18–22] The reason for this is not known, but it appears that, in general, women have a greater interest in improving their dental appearance than men do.

Before treatment, both groups had comparably severe malocclusions, with very high PAR scores (>27

points). Similarly high pretreatment PAR scores for Class II division 1 patients were described by Hamdan and Rock,[23] who found mean weighted PAR scores of 33.2 points. Much lower weighted pretreatment PAR scores (16 points) were described by Pangrazio-Kulbersh et al[24] and Firestone et al,[25] who did not assess Class II patients exclusively. Furthermore, both evaluated a much younger patient sample, with average pretreatment ages of 9.8 and 12 years, respectively. At this time, permanent canines and premolars might not have fully erupted and, consequently, are not considered in the PAR score calculation.

In a previous study[26] concerning the efficiency of early and late Class II division 1 treatment, it was described that patients treated in the early mixed dentition stage had significantly lower pretreatment scores (26 points) than those treated with late mixed dentition (29 points) or permanent dentition (32 points). This increase in PAR score values with increasing age was explained both by the disregard of primary teeth in the PAR Index and by the fact that, on average, untreated Class II division 1 malocclusions worsen over time.[27] Furthermore, it must be considered that in the present study the subject sample consisted exclusively of Class II division 1 patients with a large overjet, which is weighted strongly ($\times 6$) in the PAR Index, thus automatically resulting in high scores.

Richmond et al[16,17] remarked that PAR Index scores below 5 are close to perfect alignment and occlusion results. This implies that highly satisfactory results were achieved for both adolescents (4.5 points) and adults (4.8 points). A great improvement of the original malocclusion was achieved in more than half of the subjects (53.1% of the adolescents and 60.7% of the adults). Other authors reported "great improvement" in 18% to 50% of subjects with all types of malocclusions.[28–30] It also has to be noted that in the present study, no subject of either age group fell into the "worse or no difference" category, whereas in other studies 3% to 17% of the patients did.[28–31] This demonstrates the high reliability of Herbst appliance treatment, which, regardless of the patient's age, improved the initial malocclusion.

On average, adolescents had their Herbst appliance in place for a significantly ($P < .001$) shorter time (7.5 months) than adults (9.0 months). Two factors might explain this difference. First, it appears likely that, in adolescents, the temporomandibular joint adapts faster than in adults.[9,32] Second, when the Herbst appliance was first used in our department, it was routinely removed after half a year, after the patients had achieved a stable edge-to-edge incisal relationship. Since it has been demonstrated that later Herbst appliance removal results in greater skeletal treatment effects,[33] the appliances are now often left in situ for a longer time. Because most of the adult Herbst patients in the present study were treated in recent years, whereas adolescent Herbst treatment has been a routinely used therapy for many years, it could well be that the longer Herbst phase of the adults was not only a result of their slower reaction, but also partly a result of a slight change in treatment philosophy.

The total duration of active treatment with the Herbst-MB therapy was almost identical in adolescents (21.5 months) and adults (21.8 months), implying that the MB phase after Herbst was shorter for adults than it was for adolescents. Different studies have demonstrated that older patients generally cooperate better than younger ones,[34–36] thus explaining the shorter MB phase in the present adult subjects.

CONCLUSION

- Treating Class II division 1 patients with Herbst-MB appliances gives good occlusal treatment results for both adolescents and adults. The total treatment duration was independent of age. Thus, the null hypothesis had to be rejected; Herbst-MB therapy is equally efficient in adolescent and adult Class II division 1 treatment.

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