

Evaluation of the Outcome of Removable Orthodontic Treatment Performed by Dental Undergraduate Students

SM. Abtahi*

*Assistant Professor, Department of Orthodontics, Faculty of Dentistry, Mashad University of Medical Sciences, Mashad, Iran

ABSTRACT

Statement of problem: Comprehensive diagnosis is regarded as an important base for orthodontic treatment. An effective way to reach a correct diagnosis is to compare the craniofacial skeleton of patients with normal cases in the same race through lateral cephalograms.

Purpose: The present study was designed to determine the cephalometric standards of senior high school students in the city of Hamadan and compare with results of other studies.

Material & Methods: According to the normal occlusion definition, 25 girls and 27 boys aged 17-20 years were selected. They did not have any facial malformation and history of orthodontic treatment. Lateral cephalograms were obtained in Natural Head Position. Twenty two cephalometric variables were measured three times. Student t -test used in order to analyze the results.

Results: The length of anterior cranial base of girls and boys (72.5 ± 3.7 , 76.8 ± 3.7) were significantly less than Michigan standards for girls and boys (76.9 ± 3.9 , 83.3 ± 3.8) ($p < 0.005$). There was a significant tendency to more straight profile and forward rotation of mandible (88.3 ± 4.6 , 89.6 ± 2.7) in this study vs. Cook's (80.8 ± 3.1 , 82.1 ± 2.2) ($p < 0.005$). Linear measurements of boys were generally greater than of girls.

Conclusion: It is important to consider ethnic and racial variations and sex differences in preparing problem list and treatment planning.

Key words: Cephalometry, Occlusion, Orthodontic treatment.

INTRODUCTION

Orthodontic treatment includes controlled operation of mechanical forces on the teeth and periodontium to create biological response, which will eventually lead to dental movement. These treatments are classified into two groups of fixed and removable. Removable treatments are in general dentists' field of work and are taught in dentistry faculties. Removable orthodontic appliances have a limited control on dental movement, for instance through canine retraction, most of these teeth deviate buccally or rotate. Excessive tipping of the teeth is also common

in removable treatment, there fore, in the correction of an occlusal anomaly by removable appliances; a result less than ideal is usually achieved.⁽¹⁾

In order to survey the quality of treatment, it is inevitable to evaluate the results of treatments. To achieve this goal, we need a proper indicator to evaluate the occlusion and the positions of teeth in the mandibular arch completely. Peer Assessment Rating (PAR) is a standard tool to assess orthodontic treatments results. This index was provided by Shaw, with the help of 10 experienced orthodontists to achieve a score for all occlusal anomalies, which may be found in a malocclusion in England in 1987.⁽²⁾ In this index, the score before and after treatment are calculated. The difference between these

Corresponding Author: SM. Abtahi
Adress: Department of Orthodontics, Faculty of Dentistry, Mashad University of Medical Sciences, Park Square, Mashad, Iran
Tel: +985118829501-15 E-mail:abtahi@umsha.ac.ir

scores shows improvement rate and orthodontic interference results.

In 1992, Richmond and colleagues performed a study titled: "Evaluation of Validity and Reliability of PAR Index". In this study, 74 examiners randomly selected 272 treated and untreated casts. In order to evaluate reliability, 4 examiners gave score to 38 samples of casts again with an eight-week interval. In order to determine validity of the data, Pearson correlation coefficient method was used. In this method, the relationship of 'PAR index' scores in each case with average score of board of judges was compared and analyzed. The final result showed that 'PAR index' demonstrates a high level of reliability ($R > 0.91$) and a high level of validity ($r = 0.85$).⁽¹⁾

In 1992, Richmond and colleagues performed a study titled "Methods to Determine Orthodontic Treatment Success from Standard and Improvement Grade Point of View". In this study, 74 examiners examined 128 dental casts before & after treatment as well as 32 pairs of casts from untreated cases. On the basis of the results of these calculations, a 30 percent decrease in PAR score shows "improvement" grade, and a decrease less than 30 percent shows "with no difference or worse" grade.

If standard deviation of "PAR" before and after treatment is at least 22, it shows "complete improvement" grade. The authors suggested that if we want to consider the performed treatment as a standard treatment, the average PAR score decrease should be about 70 percent.⁽²⁾

In 1993, a study with the title of "Using PAR Index in Evaluating Removable Appliances' Efficiency" was done by Kerr and colleagues. In this study, dental casts of 150 patients (whose treatments had been done by removable appliances) were evaluated by PAR index before and after treatment. The result showed that 89 percent of patients had "improvement" grade and 16 percent had "with no difference or worse" grade.⁽³⁾

The purpose of this study is to evaluate the results of removable orthodontic treatments performed by dentistry students in the Dentistry Faculty of Hamadan University of Medical Sciences, on the basis of PAR index.

MATERIAL&METHODS

In this analytical study, 70 pairs of dental casts were examined before and after treatment in treated patients (48 girls, 22 boys) of Orthodontic Department of Dentistry Faculty of Hamadan University of Medical Sciences. Occlusion parts were evaluated before and after treatment on the basis of PAR index. PAR index has 11 parts which include: anterior mandibular segment, right and left posterior mandibular segments, overjet, overbite, midline, right and left buccal occlusion. For each part, a specific scoring has been determined.⁽²⁾ After measurements and giving a specific score to each part, the scores were added to each other and raw scores before and after treatment on the basis of PAR index were achieved. But since the total scores were not sufficient for evaluating of occlusion improvement and standard treatment, the other points had been considered as well.

Therefore, specific coefficients had been given to different segments on the basis of Richmond study which are as follows:⁽²⁾

Right and left buccal segment: 0, anterior mandibular segment and right and left buccal occlusion: 1, over jet: 6, overbite: 2 and midline: 4.

The grades achieved for each segment of occlusion were multiplied by the related coefficient and the final result is found for each segment. These figures were added together and called weighted PAR criteria.

After 4 weeks, measurements on 15 patients, who had been selected randomly, were repeated. Another survey was done again by the examiner to achieve intra-examiner error coefficient. Also, another examiner measured again so that we could find inter-examiner error coefficient. In order to achieve these coefficients, "Pearson correlation test" was used.

At the end, data were analyzed on the basis of specific goals in order to evaluate treatment success. Data extraction was done by means of SPSS software. The applied test for analysis was "Willcoxon" non-parametric test for pair comparisons.

RESULTS

The coefficient of assessments contingency fluctuated between 90% and 95% for intra-

examiner errors and between 85% and 90% for inter-examiner. On the basis of weighted

PAR criteria, the difference between scores before and after treatment was significant for

Table 1: Evaluation of removable orthodontic treatment according to Peer Assessment Rating indexes

Components of PAR indexes	Rough Score of PAR			Weighted PAR			P Value
	(before orthodontic treatment) degree Mean (SD)	(after orthodontic treatment) degree Mean (SD)	Scores	(before orthodontic treatment) degree Mean (SD)	(after orthodontic treatment) degree Mean (SD)		
Anterior maxillary segment	1.94 (1.1)	2.15 (1.03)	1	1.94 (1.1)	2.15 (1.03)		0.14
Anterior mandibular segment	2.41 (0.83)	2.29 (0.85)	1	2.41 (0.83)	2.29(0.85)		0.039*
Right buccal occlusion	1.30 (1.32)	0.89(0.96)	1	1.30 (1.32)	0.96(0.89)		0.037*
Overjet	1.36 (1.33)	0.37 (0.71)	6	8.14 (7.98)	2.22 (4.22)		0.001*
Overbite	1.09 (0.97)	0.81 (0.71)	2	2.17 (1.94)	1.62 (141)		0.004*
Midline	0.30 (0.52)	0.27 (0.56)	4	1.20 (2.08)	1.08 (2.25)		0.56
Left buccal occlusion	1.14 (1.25)	1.0 (1.05)	1	1.14 (1.25)	1.0 (1.05)		0.43
Right posterior maxillary segments	0.68 (0.88)	0.46 (0.79)	0				
Left posterior maxillary segments	0.69 (0.90)	0.43 (0.75)	0				
Right posterior mandibular segments	0.64 (0.96)	0.56 (1.12)	0				
Left posterior mandibular segments	0.64 (0.96)	0.60 (1.10)	0				
Total score of PAR	12.41 (4.05)	9.58 (3.89)		0.94 (18.20)	10.80 (.68)		0.001*

*: Significant

anterior mandibular segment ($P=0.039$), right buccal occlusion ($P=0.037$), overjet ($P=0.001$), overbite ($P=0.004$) but was not significant for anterior maxillary segment ($P=0.14$), midline ($P=0.56$) and left buccal occlusion ($P=0.43$) (Table 1).

The difference between the total scores of PAR index before and after treatment was significant ($P=0.001$) and the total average of decrease percentage of PAR index was calculated as 34.07% (Table 2).

Also, on the basis of the current study, 38.6% of samples had "with no difference or worse" grades, 57.1% had "improvement" grade and 4.3% had "complete improvement" grade. On the basis of the current study, the average of PAR index decrease percentage were 42.39% for girls and 30.25% for boys.

Table 2: Amount of decreased percentage of Weighted PAR index after removable orthodontic treatment

Components of PAR indexes	Amount of decrease percentage Mean (SD)
Anterior maxillary segment	9.76 (3.1)
Anterior mandibular segment	4.97(2)
Right buccal occlusion	32.57 (26.15)
Overjet	72.72 (47)
Overbite	27.31(25.34)
Midline	10 (8.17)
Left buccal occlusion	16(12.28)
Total score of PAR	34.07(27.65)

DISCUSSION

Occlusion survey is the most common way of examining orthodontic treatment results. For this reason, there are many occlusal indices. Among these "PAR index", which has been introduced by Show, has been widely used in Britain and Europe.

In order to evaluate treatment results, we can use Index of Treatment Need (IOTN) and occlusal index as well.

IOTN is an epidemiologic index and is based on the need to treatment for society individuals. Since this index is applied for epidemiologic studies with high sample volumes, occlusion details are ignored. PAR index is more accurate and compares

different occlusion segments with ideal conditions.⁽⁵⁾

Another index is "Occlusal Index". PAR index is more general, but it has obvious definitions, using a special ruler (PAR ruler) can also help this more, while some other definitions in occlusal index differ from common definitions in orthodontics, so they need to be learned again.⁽⁶⁾

Regarding the fact that PAR index gives a specific score to any parameter in occlusion; it can be applied to evaluate different kinds of malocclusion and different treatments.

In addition, it has been shown a high level of reliability ($R>0.91$) and validity ($r=0.85$).⁽¹⁾

Improvement grade and treatment success rate is determined by comparing PAR index scores before and after orthodontic treatment (fixed or removable).

In the current study, different occlusion segments of 70 orthodontic patients (48 girls and 22 boys) were examined before and after treatment using PAR index. The results showed that there was a significant difference in PAR scores of anterior mandibular segment, right buccal occlusion, overjet and overbite before and after treatment, and PAR scores had no significant difference in the cases of left buccal occlusion, anterior maxillary segment, and midline before and after treatment. According to Dicken's study (2001), a significant difference was observed in PAR scores between anterior mandibular and maxillary segments, overjet and overbite before and after treatment. While PAR scores in right and left buccal occlusion and midline had no significant difference before and after treatment.⁽⁵⁾

Despite the fact that the performed treatment in Dicken's study was fixed type and the performed treatment in the current study was removable type, overjet and overbite changes were in significant in both studies. The possible reason for this contingency between the two studies were the high number of Class II treated patients. In the current study, total PAR indices showed a significant difference before and after removable orthodontic treatment ($P=0.001$) and weighted PAR index decrease percentage was 34.07%. In this study, treatment of patients has been done by dental students by using removable orthodontic appliances; therefore achieving lower percentage for

PAR index decrease was expected. Richmond did a survey on orthodontic treatments results in general dentistry services in England and Wales in 1990. He achieved these results by using weighted PAR index: Weighted PAR index decrease percentage average was 49.3% for removable treatment of maxilla, 50.4% for removable treatment orthodontic of both jaws 54.6% , 71.4% for fixed orthodontic treatment of both jaws.⁽²⁾

Richmond achieved this result through a research on 220 samples from Norwegian specialists, patients in 1992 that almost all performed orthodontic treatments by orthodontic specialists have been better than performed treatments by general English dentists from standard point of view, and they have higher standards. Weighted PAR decrease average in this sample was 78%. It is interesting to know that only 4% of those patients are placed in “with no difference of worse” group.⁽²⁾ In Alyami’s research(1998), weighted PAR index decrease was 68.9% in the case of fixed treatment of patients in an academic clinic.⁽⁴⁾

In Dicken’s study(2001), which the patients had received fixed orthodontic treatments, the results showed an 81.7% decrease in weighted PAR index among specialty course students and an 87.9% decrease among American board approved group.⁽⁵⁾

According to the current study, 38.6% of samples had “with no difference or worse” grade, 57.1% had “improvement” grade, and 4.3% had “complete improvement” grade. But for patients who have complicated problems and were treated by dental students, we should expect less than ideal results at the end of treatment. In Kerr’s study (1993), in which removable appliances were used for treatments, 89% of samples had “improvement” grade and 16% had “with no difference or worse” grade.⁽³⁾ It seems that in this study , patient selection was done properly. The case with complicated problems had not been treated by removable

appliances. In Alyami’s research (1998), in which patients had received fixed orthodontic treatment by specialists, 42.6% of patients had “complete improvement” grade, 49.1% had “improvement” grade, and 8.3% had “with no difference or worse” grade. It seems the difference between two studies was due to different treatment methods (fixed versus removable) and the examiner education levels (orthodontic specialist versus dental student).

In the current study, PAR index decrease percentage for girls and boys were $42.39 \pm 34.7\%$ and $54.2 \pm 19.38\%$ respectively. In Alyami’s study, PAR index decrease percentage was $69.4 \pm 25.9\%$ for girls and $68.2 \pm 26.31\%$ for boys. This difference can be due to the difference of devices used in these studies.

CONCLUSION

The average of PAR index reduction was higher in girls than in boys.

REFERENCES

1. Richmond S, Shaw C, O’Brien D, Buchanan IB, Jones R. The development of the Index (Peer Assessment Rating):reliability and validity. *Eur J Orthod* 1992; 14:125-39.
2. Richmond S, Shaw W.C, Robert C.T and Andrews M. The PAR Index (Peer Assessment Rating): methods to determine outcome of orthodontic treatment in terms of improvement and standards. *Eur J Orthod* 1992; 14:180-187.
3. Kerr WJ, Buchanan IB, Mc Coll JH. Use of the PAR Index in assessing the effectiveness of removable appliance treatment. *Br J Orthod* 1993; 20:351-7.
4. Alyami EA, Kuijpers-jagtman AM, Martin A, van’t Hof. Occlusal outcome of orthodontic treatment. *Angle Orthod* 1998;68:439-44.
5. Dyken RA, Sadowsky PL, Hurst D. Orthodontic outcomes assessment using the PAR Index. *Angle Orthod* 2001; 71:164-9.
6. Soltani MK. Quality of final occlusion in orthodontically treated patients according to ABO grading system. Thesis Faculty of Dentistry, Hamadan University of Medical Sciences 2002.