Original Article

PAR Evaluation of Treated Class I Extraction Patients

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ABSTRACT

Objective: To evaluate treatment changes and quality of finishing occlusion in Class I patients treated with four premolar extractions.

Material and Methods: Dental casts of 94 subjects (50 males and 44 females) were evaluated. Mean pretreatment age was 13.46 years, and mean treatment time was 2.09 years. The peer assessment rating (PAR) index was obtained from pretreatment and posttreatment dental casts.

Results: The mean pretreatment PAR index of 29.46 was reduced to 6.32 at posttreatment stage, achieving a reduction of 78.54% with treatment. There was correlation between the initial PAR and correction during treatment, that is, the more severe the malocclusion the greater the treatment changes.

Conclusion: The cases evaluated showed a high-standard orthodontic finishing.

KEY WORDS: Occlusal index; Orthodontic treatment outcomes

INTRODUCTION

Assessment of orthodontic treatment outcomes has traditionally been accomplished using the subjective opinion and experience of clinicians. Several indices have been devised in an attempt to provide more objective assessment of malocclusion severity.[1–4] Otuyemi and Jones[2] recently reviewed different methods of assessing malocclusion and divided the indices into five groups: diagnostic, epidemiologic, treatment need, treatment success, and treatment complexity.

The peer assessment rating (PAR) index[5] was specifically designed to provide a more objective assessment of treatment success. The PAR index has been shown to have good intra- and interexaminer reliability,[3,6] and it has been used in several studies.[2,7–11]

O'Brien et al[12] evaluated 250 patients with Class II, division 1 malocclusions treated by various treatment modalities. PAR scores for the sample were reduced by a mean of 75.4%. Further study using the PAR Index on different samples would be useful to report on values that orthodontists can use as a method of self-audit and/or comparison with others.

Richmond and Andrews[13] reported that orthodontic treatment conducted by a specialist corrects the malocclusion by a mean of 78% (PAR index). Richmond et al[5] proposed some criteria for a high-standard orthodontic treatment: the mean PAR reduction with treatment should be greater than 70%, the number of cases without any improvement should be irrelevant, and the number of cases considered to have had "excellent improvement" should be above 40%.

A trustworthy evaluation of orthodontic treatment outcomes without using an occlusal index is difficult. The PAR index is capable of objectively assessing treatment changes. This way, the present work aimed to evaluate treatment changes and quality of finishing occlusion in patients treated with four premolar extractions.

MATERIAL AND METHODS

The sample consisted of 94 subjects who were selected by means of a retrospective record review of patients treated by graduate students at Bauru Dental School, University of São Paulo, Brazil. Subjects were chosen for the sample according to the following criteria:

—Class I malocclusion was present at the beginning of orthodontic treatment;

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—Treatment protocol included extraction of the four first premolars;
—The subject completed a complete course of orthodontic treatment with full maxillary and mandibular fixed appliances (slot 0.022-inch × 0.025-inch) and Edgewise mechanics;
—All permanent teeth had erupted up to the first molars at the pretreatment stage;
—Tooth agenesis and anomalies were absent; and
—Pretreatment (T1) dental casts, obtained at the beginning of orthodontic treatment, and posttreatment (T2) dental casts, obtained immediately after appliances were removed, were available at the time of the study.

Ninety-four subjects of both sexes (50 male; 44 female) were selected. Mean pretreatment age was 13.46 years (SD = 1.80). Mean treatment time was 2.09 years (SD = 0.58). All patients wore a cervical headgear as anchorage in the maxillary arch and a lip bumper in the mandibular arch during the alignment and anterior retraction phases. In some patients, incisors did not need to be retracted due to severe crowding. In these cases, the cervical headgear and lip bumper were used to maintain Class I molar relationship during the canine retraction and alignment phases. After the end of active treatment, all patients wore a Hawley maxillary retainer and a bonded canine-to-canine mandibular retainer.

Pretreatment (T1) and posttreatment (T2) dental casts of each patient were used. All dental cast measurements were performed with a 0.01-mm precision digital caliper (Mitutoyo America, Aurora, Ill) by one calibrated examiner. The assessed variable was the PAR index, as described by Richmond et al[3] and scored with the American weight.[14]

The difference between posttreatment and pretreatment PAR index values (PAR T2-1) and the percentage of PAR value reduction were calculated to express the amount of correction with treatment using the following formula:

$$\%PAR = \frac{PAR\ T2\text{-}1 \times 100}{PAR\ T1}$$

Error Study

After a 1-month interval from the first measurement, 50 randomly selected dental casts (25 from pretreatment and 25 posttreatment stages) were remeasured by the same examiner. The same dental casts were also measured by an experienced examiner; the interexaminer correlation ranged from 0.91 to 0.99, indicating a high level of reliability. The casual error was calculated according to Dahlberg's formula[15] ($Se^2 = \Sigma\ d^2/2n$), where Se^2 is the error variance and d is the difference between the two determinations of the same variable, and the systematic error with dependent *t*-tests,[16] for $P < .05$.

Table 1. Results of Descriptive Statistics of the Whole Sample for All Variables Evaluated

Variables[a]	Mean	SD	N
Age T1	13.46	1.80	94
Treatment time	2.09	0.58	94
PAR T1	29.46	8.79	94
PAR T2	6.32	3.48	94
PAR T2-1	−23.14	9.51	94

[a] PAR indicates peer assessment rating; PAR T1, pretreatment PAR; PAR T2, posttreatment PAR; PAR T2-1, difference in PAR between posttreatment and pretreatment stages.

Statistical Analysis

Descriptive statistics (mean, standard deviation, and N) of the whole sample were determined for the following variables: pretreatment age, treatment time, pretreatment PAR (PAR T1), posttreatment PAR (PAR T2), and differences between posttreatment and pretreatment stages (PAR T2-1), characterizing treatment changes.

Multiple regression analysis was used to verify possible factors correlated to the PAR index in the pretreatment and posttreatment stages. For this, the unweighted PAR index was used. This analysis allowed researchers to evaluate the influence of each PAR component in the total sum of scores. Pearson correlation coefficient was used to assess the degree of correlation between the PAR index values in the stages evaluated (PAR T1 × PAR T2 and PAR T1 × PAR T2-1).

All statistical analyses were performed using Statistica software (Statistica for Windows 6.0; Statsoft, Tulsa, Okla). Results were considered statistically significant for $P < .05$.

RESULTS

No systematic errors were detected, and casual errors were considered acceptable and within the normal range. Descriptive statistics are shown in Table 1. Mean pretreatment PAR was 29.46 (SD = 9.79), mean posttreatment PAR was 6.32 (SD = 3.48), and mean PAR reduction with treatment was 78.54%.

Table 2 shows results of multiple regression analysis considering the pretreatment PAR. Variations in pretreatment PAR values were attributable to variations in the following components: crowding, posterior occlusion, and overbite. The overjet and midline components were not significantly responsible for PAR index values variations.

Table 3 shows results of multiple regression analy-

Table 2. Results of Multiple Regression Analysis Considering Pretreatment Peer Assessment Rating as the Dependent Variable

Variables[a]	*r*	*P*
Overjet T1	0.013	.846
Overbite T1	0.241	.001*
Posterior occlusion T1	0.381	.001*
Crowding T1	0.468	.000*
Midline T1	0.085	.240

* Statistically significant at $P < .05$.
[a] T1 indicates pretreatment stage.

Table 3. Results of Multiple Regression Analysis Considering Posttreatment Peer Assessment Rating as the Dependent Variable

Variables[a]	*r*	*P*
Overjet T2	.175	.011*
Overbite T2	.136	.048*
Posterior occlusion T2	.375	.000*
Crowding T2	.691	.000*
Midline T2	.101	.140

* Statistically significant at $P < .05$.
[a] T2 indicates posttreatment stage.

Table 4. Results of Pearson Correlation Coefficient

Variables[a]	*r*	*P*
PAR T1 × PAR T2	−.090	.384
PAR T1 × PAR T2-1	.918	.000*

* Statistically significant at $P < .05$.
[a] PAR indicates peer assessment rating; PAR T1, pretreatment PAR; PAR T2, posttreatment PAR; PAR T2-1, difference in PAR between posttreatment and pretreatment stages.

sis considering the posttreatment PAR. Variations in pretreatment PAR values were determined by variations in the following components: crowding, posterior occlusion, overjet, and overbite. The midline component was not significantly responsible for PAR variations.

Table 4 shows Pearson correlation coefficient results. Significant correlation was found between the pretreatment PAR and correction during treatment.

DISCUSSION

Sample and Methodology

The sample selection criteria aimed to eliminate or minimize some factors that could influence the results. Thus, sample subjects had the same malocclusion type (Class I), treatment protocol (extraction of the four first premolars), and the same appliance and mechanics (fixed Edgewise mechanics).

The fact that sample subjects were treated by orthodontic graduate students could raise some doubts regarding treatment quality. However, it has been demonstrated that there is no significant difference in standard of quality of orthodontic treatment between subjects treated by specialists or orthodontics students.[9]

The literature is unanimous in emphasizing the role of patient compliance in final results where success is based on the standard of finishing and treatment length.[17–19] In the present study, some factors that could influence the results, such as patient compliance and treatment time, were eliminated by including only Class I malocclusion cases and treatment with the same protocol, appliances, and mechanotherapy. This way, none of the patients needed to use extraoral appliances extensively, because molar relation did not need to be corrected.

As we proposed to evaluate occlusal treatment results, the best method to assess orthodontic finishing is on dental casts because they assemble most information regarding diagnosis and treatment planning.[20] Besides, a poor association has been demonstrated between occlusal characteristics and morphology obtained from lateral cephalograms, and a greater prediction of orthodontic results has been shown using occlusal indexes rather than cephalometrics.[21,22] Important occlusal features, like severity of crowding and transversal relationship of dental arches, cannot be evaluated using cephalometrics.

Treatment Results

The PAR index is recognized worldwide and accepted as a method of recording occlusal characteristics.[23] The index was specifically developed to objectively assess orthodontic treatment success.[9] In the present study, results of the statistical analysis showed a mean pretreatment PAR index of 29.46 (SD = 8.79), which was reduced to a mean of 6.32 (SD = 3.48) in the posttreatment stage (Table 1).

It was previously suggested that a good standard orthodontic treatment should result in a mean PAR index reduction of 70% or above.[5] The present results showed a 78.54% mean PAR reduction, and treatment showed a good standard of orthodontic finishing. This seems to be what would be subjectively called ''clinically acceptable.''[5,23] Results are similar to mean percentages of PAR reduction with treatment (between 75.4% and 78%) found in most previous studies in the literature.[8,10,12,13,24]

Our results are better than others published in literature,[7,12,23,25,26] but comparison must be made cautiously, and differences in sample and methodology need to be considered. Linklater and Fox[23] found a 68.6% PAR reduction after treatment, but they evaluated cases treated with fixed and removable appliances, and this could explain the difference with our results. Dyken et al[9] found reductions in mean PAR val-

ues during treatment: 79.5% for patients treated by specialists certified by the American Board of Orthodontists and 68.6% for patients treated by orthodontic graduate students. Because all of our cases were treated by students, the results demonstrated a high standard of orthodontic finishing.

Even though few studies have reported better percentage results than ours,[2,27] differences in methodology, sample selection, and evaluation of results can be observed. Woods et al[27] found a mean PAR reduction of 85.6% with treatment; they evaluated 65 patients who presented with several types of malocclusion types and were treated with various treatment protocols. We speculate that this divergence from our results is because treatment was performed by a single specialist in that study, while in our study treatment was performed by many orthodontic students. Besides, when the 65 patients were subdivided,[27] the extraction subgroup, treated with the same protocol as our sample, presented a mean PAR correction of 82.2%, which is closer to our results. Otuyemi and Jones[2] found a posttreatment PAR correction of 82.5% in their study of 50 Class II patients treated with several protocols. In addition to the malocclusion difference, the mean pretreatment PAR index of their subjects was less than the initial malocclusion severity in the present study, and this could justify the divergence of the results.

Occlusal Characteristics

Although the PAR index provides a reliable evaluation of occlusal condition and treatment results, the absolute value of PAR index does not allow one to determine which characteristics contribute most to the changes observed, because the index is a sum of scores of different occlusal components.[3] In addition, components receive different weights; thus, it is still more difficult to detect the real contribution of each component in the final score.[3]

Multiple regression analysis allows evaluation of the influence of several factors that could possibly be correlated to a determined variable. Thus, weights were removed from each PAR component, and multiple regression analysis was performed to verify if they are correlated to the final score in the pretreatment and posttreatment stages.

When pretreatment PAR was considered as dependent variable, results of multiple regression analysis showed that variations in this score were attributable to crowding, posterior occlusion, and overbite components. The overjet and midline components were not significantly responsible for pretreatment variations in PAR index values (Table 2). When considering posttreatment PAR as a dependent variable, alterations in index score were determined by variations in crowding, posterior occlusion, overjet, and overbite components. The midline component was not significantly responsible for posttreatment PAR variations (Table 3).

Correlations

Significant correlation was found between the pretreatment PAR (PAR T1) and correction during treatment (PAR T2-1) (Table 4); in other words, the more severe the malocclusion, the greater will be the treatment changes.

Diverging from our results, Woods et al[27] found neither clinical nor statistically significant correlations between pretreatment PAR and corrections obtained in the posttreatment stage. However, this absence of correlation can be partly explained by the fact that they evaluated several malocclusion types and included different treatment plans and protocols.[27]

CONCLUSIONS

- The mean pretreatment PAR index was reduced from 29.46 to 6.32 at the posttreatment stage, representing a reduction of 78.54% during treatment and demonstrating a high-standard orthodontic finishing.
- Correlation was found between the pretreatment PAR and correction with treatment. Specifically, the more severe the malocclusion the greater will be the treatment changes.

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