



Evaluation of Outcome of Orthodontic Treatment in Context to Posttreatment Stability: A Retrospective Analysis

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ABSTRACT

Introduction: One of the main aims of orthodontic treatment is the improvement of esthetics along with enhancement of functions of the orofacial regions. Complications are observed even after final completion of the orthodontic treatment due to relapse and loss of stability. Hence, we retrospectively analyzed angle class I malocclusion cases to study the correlation of outcome of orthodontic treatment and posttreatment stability.

Materials and methods: A total of 100 patients were included in this retrospective analysis, which accounted for the patients reporting to the department of orthodontics from 2013 to 2015 with angle class I malocclusion. Pretreatment, posttreatment, and postretention casts of the patients were made and analyzed. The Richmond et al criteria was used to evaluate peer assessment rating (PAR) index and Little irregularity index, followed by scoring with American weight. Measurement of Pearson's coefficient was done to calculate the p-value. p-value of less than 0.05 was considered as significant.

Results: No significant amount of alteration was seen in the systematic errors of Little index and PAR index, while casual

errors were also within the normal range. While comparing the PAR index at pretreatment and posttreatment phases, statistically significant results were obtained, whereas in case of Little index at same time intervals, scores showed nonsignificant results.

Conclusion: Even after delivering ideal orthodontic treatment, stability of the treatment is still not ensured until unless posttreatment follow-up is properly maintained.

Keywords: Little index, Peer assessment rating index, Relapse.

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INTRODUCTION

Enhancement of functions of orofacial regions along with improvement of esthetics forms the main target of orthodontic treatment.¹ The basic goal of orthodontic treatment along with treating orofacial problems is to maintain postretention stability. If proper retention forces are not given following treatment, relapse of the treatment is often observed.²⁻⁴ Change in the arch length and arch width along with crowding and other complications are observed postoperatively if proper follow-up is not done.⁵⁻⁸ Quality of the orthodontic treatment and adherence to the treatment can be increased by better understanding the consequences and posttreatment complications of the orthodontic treatment.^{9,10} Hence, we retrospectively analyzed angle class I malocclusion cases to study the correlation of outcome of orthodontic treatment and posttreatment stability.

MATERIALS AND METHODS

The present retrospective study was conducted by evaluating the records of patients from the Department of Orthodontics of the institution. A total of 100 patients

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who were treated in the department from June 2013 to July 2015 were selected on the basis of following inclusion protocols:

- Patients having angle class I malocclusion before the commencement of orthodontic treatment.
- Patients in which extraction of first premolars of all quadrants was indicated.
- Patients in which edgewise mechanics was used for fixing the brackets for treating the malocclusion.
- Patients with absence of ectopic erupted teeth, oligodontia, or any other dental anomaly.
- Patients in which before the starting of the treatment, all permanent teeth up to first molars have erupted.
- Patients in which maxillary and mandibular retainers were worn by the patients posttreatment for at least 1 year.

The mean age of the patients at the time of starting of orthodontic treatment was 13.52 ± 1.6 years, with 54 patients out of 100 being males and the rest females. Mean time of commencing orthodontic treatment, retainers used, and postretention assessment in patients were $2.11 \text{ years} \pm 0.60$, $1.71 \text{ years} \pm 0.82$, and $5.42 \text{ years} \pm 1.72$ respectively. Three types of dental casts were used, namely: T1 – Pretreatment, T2 – Posttreatment, and T3 – Postretention. Precision digital caliper was used for measuring all the values of the dental casts with 0.01 mm precision. The Richmond et al¹¹ criteria was used to evaluate peer assessment rating (PAR) index and Little irregularity index,¹² followed by scoring with American weight.¹³ Change in the both PAR and Little indices were evaluated and the alteration in scores of pretreatment and posttreatment phase (T1–2) and postretention and post-treatment phase (T3–2) were taken as standard to measure the amount of improvement by orthodontic treatment. All the results were analyzed by Statistical Package for the Social Sciences (SPSS) software. Calculation of mean and standard deviation (SD) was done along with measurement of PAR index¹¹ and the Little index¹² at various stages of treatment, after the treatment, change of treatment (T1–2), and change of postretention (T3–2). Measurement of Pearson’s coefficient was done to calculate the p-value. p-value of less than 0.05 was considered as significant.

RESULTS

Table 1 highlights the systematic and casual errors occurring in the samples included in the present study. Graph 1 shows the mean casual errors between first and second appointments. Although alteration in the scores of Little index and PAR index were observed, no significant error were seen, and casual errors, when evaluated, were also within the normal range. Results of descriptive analysis of the study are summarized in Table 2. Table 3 highlights the p-value while comparing the variables and parameters

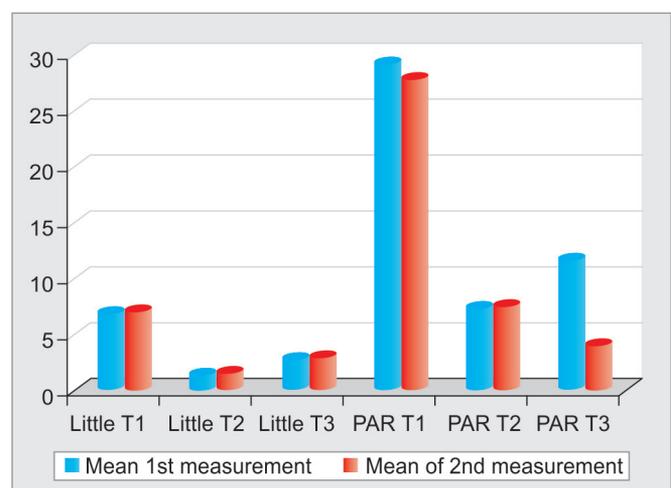
with different phases of treatment. Comparison of PAR index at initial time and at posttreatment phase showed statistically significant result, while comparison of Little index at same time intervals showed nonsignificant results, as shown in Table 3.

DISCUSSION

The primary goal of orthodontic treatment involves not only correction of malalignment, but also maintenance of results in the posttreatment phase. A morphologically stable, esthetic, and functionally normal occlusion is usually the desired result of orthodontic treatment. Several parameters are responsible for the variation in the

Table 1: Between first and second appointments, casual and systematic errors

| Parameters | Mean \pm SD of first measurement | Mean \pm SD of second measurement | No. of patients | p-value |
|------------|------------------------------------|-------------------------------------|-----------------|---------|
| Little T1 | 7.12 \pm 3.60 | 7.01 \pm 3.65 | 40 | 0.845 |
| Little T2 | 1.53 \pm 1.01 | 1.55 \pm 0.95 | 40 | 0.152 |
| Little T3 | 2.90 \pm 1.75 | 2.92 \pm 1.82 | 40 | 0.451 |
| PAR T1 | 29.41 \pm 7.14 | 27.81 \pm 7.10 | 40 | 0.986 |
| PAR T2 | 7.54 \pm 3.40 | 7.52 \pm 3.09 | 40 | 0.442 |
| PAR T3 | 11.81 \pm 3.85 | 4.01 \pm 3.83 | 40 | 0.135 |



Graph 1: Casual errors between first and second appointments

Table 2: Results of descriptive analysis of the parameters

| Parameter | Mean \pm SD | No. of patients |
|-------------|------------------|-----------------|
| PAR T1 | 30.20 \pm 8.91 | 100 |
| PAR T2 | 7.81 \pm 3.62 | 100 |
| PAR T3 | 10.81 \pm 5.37 | 100 |
| PAR T1-2 | 24.19 \pm 9.68 | 100 |
| PAR T3-2 | 4.21 \pm 5.71 | 100 |
| Little T1 | 7.11 \pm 3.94 | 100 |
| Little T2 | 1.38 \pm 1.08 | 100 |
| Little T3 | 2.97 \pm 1.49 | 100 |
| Little T1-2 | 5.89 \pm 3.81 | 100 |
| Little T3-2 | 1.59 \pm 1.81 | 100 |

Table 3: p-value (Pearson's correlation between PAR and Little indices evaluated at different times)

| Parameter | p-value |
|---------------------|----------|
| PAR T1×PAR T2 | 0.001 S |
| PAR T1×PAR T3 | 0.512 NS |
| PAR T1×PAR T1-2 | 0.001 S |
| PAR T1×PAR T3-2 | 0.001 S |
| PAR T2×PAR T3 | 0.001 S |
| PAR T2×PAR T1-2 | 0.001 S |
| PAR T2×PAR T3-2 | 0.001 S |
| PAR T3×PAR T1-2 | 0.251 NS |
| PAR T3×PAR T3-2 | 0.001 S |
| PAR T1-2×PAR T3-2 | 0.001 S |
| PAR T1×Little T3 | 0.845 NS |
| PAR T2×Little T3 | 0.545 NS |
| PAR T3×Little T3 | 0.846 NS |
| Little T1×Little T2 | 0.512 NS |
| Little T1×Little T3 | 0.001 S |
| Little T2×Little T3 | 0.001 S |

S: Significant; NS: Nonsignificant

results of the orthodontic treatment, namely: Difference in severity of orthognathic problem, type of malocclusion, difference in treatment protocols followed by the orthodontist, difference in the patient's behavior, and difference in patient's adaptability to the soft and hard tissue changes. Relapse of the treatment has been reported in a large number of studies due to lack of or improper wearing of retentive appliances by the patients.¹⁴⁻¹⁷ Various patient-dependent factors play a key role in maintaining the stability of posttreatment results of the orthodontic treatment, which includes patient's age, its periodontal status, amount of caries index present, quality and quantity of restorations present in the patient's oral cavity. Keeping all these factors in observation, a minimum of 5 years of follow-up of the patients posttreatment should be done in order to achieve and maintain successful orthodontic treatment.^{14,18} Hence, we retrospectively analyzed the success and stability of orthodontic treatment. Only those cases were selected in the present study in which comparable retention time was visible. The mean posttreatment retention time in this retrospective analysis was 1.71 years with SD of 0.82. Cases with comparable retention time were selected because literature quotes numerous studies which highlight that amount of retention period affects the stability of orthodontic treatment.^{17,19} As occlusal indices form an important parameter of orthodontic and oral research, PAR indexes were used in the present study as the mentioned index is specially formulated to analyze treatment outcomes, stability, and prognosis.²⁰⁻²²

Descriptive Analysis

Due to numerous advantages offered by the PAR index, it is used and accepted at the international level for

assessing dental casts of patients undergoing orthodontic treatment.^{11,23,24} At the initial time of commencing the orthodontic treatment (T1), the average PAR score of the total subjects included in the present study was 30.20. By the end of active treatment phase of the patient at T2 phase, the mean PAR score was 7.81, followed by rise in score to 10.81 at postretention time at T3 phase as shown in Table 2. On an average, reduction in PAR score of 70% or more is usually considered as gold standard for the outcome of orthodontic treatment as suggested by Richmond et al.²⁴ A good standard of orthodontic treatment was reflected in the present study in which in more than 75% of the cases, malocclusion were treated efficiently. Richmond et al.²⁴ and Birkeland et al.²² reported similar findings in their respective studies involving analysis of outcome of orthodontic treatments.^{25,26} In the present study, we observed a pretreatment score of 7.11 for Little's index, followed by a decline in value to 1.38 at the end of orthodontic treatment and again a rise in the value to 2.97 while evaluating at the postretention phase as shown in Table 2. It can be presented in this way that a mean correction of over 80% was provided by the orthodontic treatment in the present study while treating crowding in the mandibular anterior region. Meanwhile, after the postretention phase, the amount of correction seen in patients was reduced to approximately 60% owing to treatment loss by relapse due to lack of or improper retentive appliances used by the patients. Our results were in correlation with the results of previous studies in the literature, which also reported a fall in the amount of corrections seen in patients due to treatment relapse and further loss of stability.^{5,8,15,19,27}

Analysis of Correlation Coefficient

A statistically significant correlation was seen in the score of PAR index when compared at different stages of the treatment; at the initial time, at the postretention phase, at the time of correction of treatment, and further at time period of postretention phase as shown in Table 3. From the results, it can be interpreted that more severe is the type of malocclusion and orthognathic problem, more will be correction required in the treatment part and further, more chances of relapse of the treatment would be there. This further reinforces a value of PAR score at postretention phase. Our results were in correlation with the results of previous authors who observed that after the commencement of orthodontic treatment, settling does occur and even achievement of ideal and expected results after treatment does not guarantee a posttreatment stability.²⁸

No correlation was observed between Little's irregularity and PAR index at any of the phase of evaluation of scores as shown in Table 3. It can be presented in this way that a different characteristic behavior is shown

by relapse of treatment of crowding cases of anterior mandibular region when compared with other different occlusal characteristics. This can be hypothesized in a better way that in mandibular incisor crowding cases, there are more chances of relapse to occur.^{5,8,17,27} Burden et al²⁹ retrospectively analyzed the outcome of orthodontic treatment of class II division 1 malocclusion patients. They evaluated 264 patients who additionally had overjet of greater than 6 mm. From the results, they concluded that orthodontic treatment is highly successful in treating this type of malocclusion. Al Yami et al¹⁷ analyzed the stability of orthodontic treatment outcome by evaluating the casts of over 1,000 patients. They measured the PAR index at various patient stages: Pretreatment phase, post-treatment phase, retention phase, and 5 and 10 years after the retention phase. They found that most of the cases that were lost during follow-up, were of angle class II division 2. From the results, they concluded that such type of retrospective treatment studies helps the dentists to make their patient aware about the limitations and practical aspects of the dental treatments. Parka et al³⁰ evaluated the posttreatment age-related and arch-related changes occurring in patients seeking orthodontic treatment. They evaluated 96 patients reporting with angle class I or class I malocclusion. By analyzing the results, they observed that a significantly larger amount of irregularity of mandibular incisor and PAR index was seen in adolescents in comparison to adults. Also in comparison with class II malocclusion patients, class I patients exhibited lesser increase in overjet width and more amount of decrease in width of intermolar area in mandible.

CONCLUSION

From the aforementioned results, it can be concluded that stability of the treatment is not ensured even after delivering best of the treatment results. Therefore, treatment of the orthodontic patients is not finished after achieving the ideal occlusion, maintaining of the treatment in the posttreatment phase, i.e., retention, is also a part of full orthodontic treatment protocol.

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