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Orthodontic treatment outcome with PAR Assessment rating



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An Analysis of Orthodontic Treatment Outcomes at the Lagos University Teaching Hospital using the Peer Assessment Rating Index

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Abstract

Background: There is a correlation between the demand and need for orthodontic treatment. Other factors may be responsible for the rising orthodontic demand rather than the actual need for treatment. An objective assessment is important to justify orthodontic treatment as well as evaluate treatment outcomes. The Peer Assessment Rating (PAR) Index was designed to objectively assess malocclusion and quantify the efficacy of treatment. The aim of this study was to assess malocclusion and evaluate treatment outcomes in Orthodontic patients at the Lagos University Teaching Hospital using the PAR Index.

Methods: This study was a retrospective cross-sectional study of patients treated at the Lagos University Teaching Hospital, Idi-Araba Lagos. A total of 43 pre and post-treatment study casts of patients treated over a period of one year were recruited for the study. This was obtained from the archives of the Orthodontics unit, LUTH. One principal investigator was calibrated for the PAR Index measurement. Selected casts were subsequently measured and scored using the PAR ruler and the UK weighting system of the PAR Index.

Results: A total of 43 pre and post-treatment study casts were analysed. A total of 31 (72.1%) out of the 43 treated cases showed great improvement with a 95% mean percentage reduction (mean reduction of 18.9) in malocclusion using the PAR Index. However, 11.6% of the subjects showed improvement and little improvement each, with a mean percentage reduction of 64.3% and 44.9% respectively. About 5% of the treated cases showed no improvement.

Conclusion: In this study, 72 % of patients managed at the orthodontics unit of the Lagos University Teaching Hospital showed great improvement in their occlusion.

Keywords: PAR, malocclusion, study casts, pre-treatment, post-treatment.

ORIGINAL ARTICLE

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Introduction

The demand for orthodontic treatment has notably increased all over the world, with waiting lists for treatment increasing, including in Nigeria[1,2,3]. Several factors such as differences in the cultural perception of dental aesthetics, improvements in treatment modalities, and advances in technology have been attributed to this[4,5]. As a result, the science of the different mechanics involved in orthodontic treatment is always advancing. Even though there is a correlation between the demand and need for orthodontic treatment[6], it is often seen that other factors might be responsible for orthodontic demand, instead of the need for treatment. One-third of over 150 people, who presented at the Lagos University Teaching Hospital for orthodontic treatment, did not need treatment[7]. This observation makes it difficult to determine how successful a treatment outcome is, where the objective need for treatment is low. It is therefore important to quantify the amount of

improvement achieved for every orthodontic treatment, including how much overall difference in malocclusion was achieved.

The Aesthetic Component (AC) and Dental Health Component (DHC) of the Index of orthodontic treatment needs (IOTN) are scientific methods of assessing the need for orthodontic treatment, while the Dental Aesthetic Index (DAI) is based on the social standard of dental aesthetics[8]. These indices help to determine patients who require orthodontic treatment and to what extent such care is needed. They however cannot determine the percentage change achieved following orthodontic treatment. Most orthodontic indices put into consideration three main areas: psychosocial limitations, oral function, and the effect on dental health or injury. Other indexes used include the NOTI, the Treatment Priority Index (TPI), and the Handicapping Malocclusion Assessment Record (HMAR).[9] While the IOTN is mostly used in Great Britain, the NOTI is used by the National Health Insurance System to reimburse the cost of orthodontic treatment.[9] Despite the difficulties encountered when assessing occlusal relationships and patients' satisfaction with treatment outcomes, the objective assessment of treatment outcomes in orthodontics is very important.[10] Several methods have been proposed to assess orthodontic treatment outcomes, despite being mostly limited to occlusal assessment only.[11,12,13] The Ideal Tooth Relationship Index (ITRI) was developed to overcome that limitation. However, it involves cumbersome measurements of iatrogenic or photographic changes, as well as skeletal, dental, and soft tissue changes between pre-treatment and post-treatment cephalometric and panoramic radiographs[10].

The Peer Assessment Rating (PAR) Index was designed in 1992 by Richmond S. et al[14] who made a panel of 74 examiners to characterize the degree of orthodontic improvement. The goal was to ensure that objective and quantitative measures are used to simultaneously assess malocclusion and efficacy of treatment of the same case. The PAR index was designed such that one summarized score is assigned to depict the severity of the malocclusion. The difference in scores assigned before and after treatment recorded on a scoring sheet indicates the extent of improvement in treatment. Opinions differ among orthodontists about what constitutes an improvement in orthodontic treatment, hence, PAR Index provides an avenue for standardization and uniformity in interpreting the outcome.[9] The index uses the PAR ruler to measure specific components of the treatment outcome, and residual malocclusion is weighted. Orthodontic treatment carried out under high standards is judged by each clinician's mean percentage reduction in weighted PAR score.

As the demand for orthodontic treatment increases in Nigeria, it is important to examine the standard of practice among orthodontists in Nigeria and compare the outcome to other practices abroad. This study aimed to assess the outcome of orthodontic treatment provided at a Nigerian orthodontic training institution, using the PAR index.

Materials and methods

The study was carried out on the study casts, retrieved from the archives of patients who had orthodontic treatment using fixed orthodontic appliance therapy, at the Lagos University Teaching Hospital (LUTH), one of the foremost tertiary referral centres for orthodontic care in Nigeria. Ethical approval was obtained from the Health and Research Ethics Committee (HREC) of LUTH.

Study design: A retrospective cross-sectional study, where a total of 35 study casts were randomly retrieved from the archive of completed cases at the Orthodontics Unit of LUTH. The study was based on the population of orthodontic cases treated by consultant orthodontists and senior orthodontics residents. Subjects were selected according to

specified inclusion and exclusion criteria.

Inclusion criteria for selection:

Cases with complete pretreatment and post-treatment records.

Cases that had documented study models.

Exclusion criteria:

Cases in which treatment was incomplete.

Cases managed with removable appliances.

A simple random sample of study models that met the inclusion criteria was selected. The materials used were the study models, PAR scoring sheets, and the PAR Index ruler. The calibration of the principal investigator for the PAR Index was done by a specialist orthodontist. Selected casts were blinded and randomly scored by the principal investigator using the UK weighting system of PAR Index on both pre-treatment and post-treatment models. A dedicated PAR Index Ruler was used to increase scoring reliability and ease of measurement. Five out of the 35 measurements were repeated to assess inter-examiner reliability. A total of 43 pairs (pre-treatment and post-treatment) of study casts that met the inclusion and exclusion criteria were retrieved

Statistical analysis: The analysis was done using IBM SPSS 26.0. Descriptive statistics included the calculation of overall mean PAR scores, pre and post-treatment, PAR scores reduction, weighted PAR scores reduction, and mean percentage PAR scores reduction. The Independent sample t-test was used to assess inter-examiner and intra-examiner reliability.



PAR SCORING SHEET

Name

CASE NUMBER		Pre-Treatment		Date								
PAR COMPONENTS	RIGHT									LEFT	UN-WEIGHTED TOTAL	WEIGHTED TOTAL
Upper anterior segments	3-2		2-1		1-1		1-2		2-3			X1
Lower anterior segments	3-2		2-1		1-1		1-2		2-3			X1
Buccal occlusion	Antero-posterior			Right			Left					X1
	Transverse			Right			Left					X1
	Vertical			Right			Left					X1
Overjet	Positive				Negative							X6
Overbite	Overbite				Openbite							X2
Centre line												X4
										TOTAL		

CASE NUMBER		Post-Treatment		Date								
PAR COMPONENTS	RIGHT									LEFT	UN-WEIGHTED TOTAL	WEIGHTED TOTAL
Upper anterior segments	3-2		2-1		1-1		1-2		2-3			X1
Lower anterior segments	3-2		2-1		1-1		1-2		2-3			X1
Buccal occlusion	Antero-posterior			Right			Left					X1
	Transverse			Right			Left					X1
	Vertical			Right			Left					X1
Overjet	Positive				Negative							X6
Overbite	Overbite				Openbite							X2
Centre line												X4
										TOTAL		

ASSESSMENT OF OUTCOME

PAR SCORE		IMPROVEMENT	
Change in PAR score		Greatly improved	
% change in PAR score		Improved	
		Worse or no different	

Results

The results showed a mean reduction of 15.86 since the mean PAR of subjects' occlusion before treatment reduced significantly from 18.76 to 2.91 after treatment. A mean percentage change of 81.14% indicates a great improvement (70%-100%) in occlusion following orthodontic treatment. (Table 1)

Out of the 43 casts assessed, 31 patients showed great improvement, at a mean percentage reduction of 95%. Five subjects each showed little improvement within the mean percentage reduction range of 44.9%-64.3%, and only 2 showed no improvement at all. The negative mean percentage reduction of the patients who showed no improvement indicates the patient became worse following treatment. (Table 2)

Figure 1 shows a nomogram showing all pre-treatment and post-treatment scores of all study models.

Two subjects who showed no improvement are represented by two dots on the far left of the above nomogram. The middle frame represents subjects who showed improvement following treatment, while all 31 subjects who had great improvement are represented on the far right of the monogram. Each dot represents one participant, except in cases where PAR scores between subjects are the same.

Descriptive Statistics

Table 1: Mean and Standard Deviation

Variables	Mean	SD
Mean Pre-treatment Score	18.76	8.31
Mean Post-Treatment Score	2.91	3.73
Mean Reduction	15.86	9.25
Mean Percentage Change	81.14	27.03

Table 2: Mean percentage reduction in PAR and the category of improvement

Improvement	Number of Patients	Mean Reduction	Mean Percentage Reduction
No Improvement	2	1	-1.39 %
Little Improvement	5	5.6	44.9 %
Improvement	5	13	64.3 %
Great Improvement	31	18.9	95.0 %

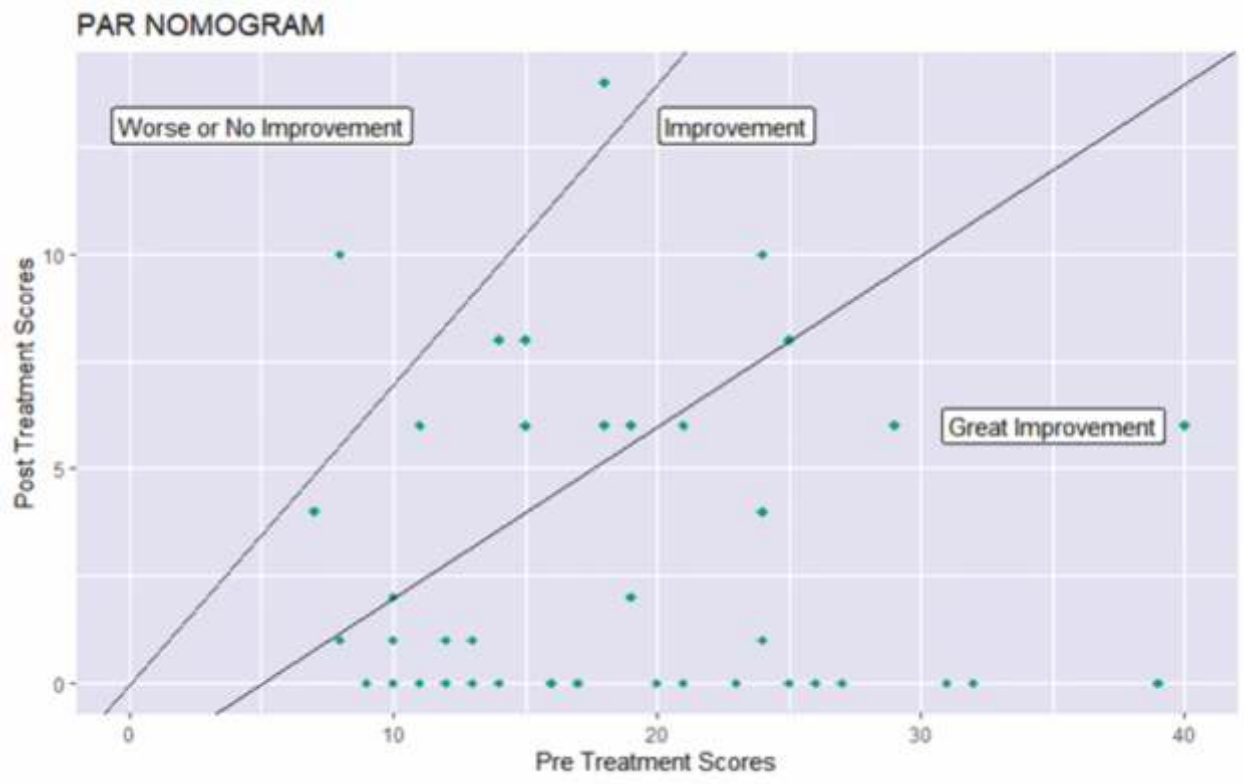


Figure 1: A nomogram showing all pre-treatment scores on the x-axis and post-treatment scores on the y-axis.

Table 3: The number of examined casts with an orthodontic need or optional need for treatment.

Treatment Need	Number of Patients
Treatment Needed	23
Treatment Optional	20

Independent Sample T-test

Group Statistics					
Examiner		N	Mean	Std. Deviation	Std. Error Mean
Pre-treatment Score	1	5	21.60	10.945	4.895
	2	5	26.80	9.338	4.176
Post Treatment score	1	5	0.20	0.447	0.200
	2	5	2.40	3.286	1.470

Independent Samples Test

t-test for Equality of Means

	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
Pre-Treatment Score	-0.808	7.806	0.443	-5.200	6.434	-20.102	9.702
Post-Treatment Score	-1.483	8	0.176	-2.200	1.483	-5.620	1.220

The difference between the mean pre-treatment scores of Examiners 1 and 2, was not statistically significant t(7.806) = -0.808, p = 0.443.

The difference between the mean pre-treatment scores of Examiners 1 and 2, was not statistically significant. t(8) = -1.483, p = 0.176.

Discussion

Orthodontic graduate institutions all over the world are expected to adhere to standard training ethics. Therefore, a significant improvement in the outcome of treatment is expected. A high standard of treatment is revealed in each case mean percentage reduction in PAR.

This study revealed 72%, 11.6%, and 4.7% of patients managed at the Orthodontics unit of the Lagos University Teaching Hospital showed a mean percentage reduction of 95% in PAR scores (suggesting great improvement), improvement, and no improvement respectively. This percentage is significantly higher than a similar study carried out by Onyeaso and BeGole at an accredited graduate school in the US where the result was 50%, 47%, and 3% suggested great improvement, improvement, and worse or no improvement respectively.[15] Grossly 33% of the PAR scores qualified as greatly improved, according to the criteria of at least a score of 22 cut off for pre-treatment score according to Kerr[16]. This is higher than none qualified as great improvement seen in the study carried out by Onyeaso and BeGole. [15] This difference suggests that more cases managed at LUTH had greater orthodontic treatment needs compared to graduate school in the US. A total of 95.3% of cases studied had improvement in treatment outcome (>30% PAR reduction). This is also higher than 80% of cases with improvement in a similar study carried out by Adeleke et al at another graduate training institution in Nigeria.[17] In this study, the overall mean pretreatment-weighted PAR score in this study was 18.8, while the mean post-treatment-weighted PAR was 2.9, and the overall mean percentage change was 81.1%. This value is lower than the weighted scores reported by Onyeaso, being 23.83, and a mean percentage reduction of 86%.[15]

A random sampling of cases managed with removable or fixed appliances in GDS of England and Wales showed a mean percentage reduction of 55%, which is expected given the limitations of treatment outcomes using removable appliances. The overall mean reduction in this study is close to 82.6% mean percentage reduction in cases evaluated by OD Otuyemi's personal clinical audit of orthodontic

treatment outcomes.[18] However, only 2% of cases examined in this study showed no improvement.

Conclusion

Based on PAR criteria by Richmond,[14] it can be concluded that a high standard of treatment is adhered to in managing orthodontic patients at the Lagos University Teaching Hospital, Nigeria. An overall mean percentage reduction shows the standard maintained in orthodontic treatment at LUTH is high.

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