Original Article

Is the Peer Assessment Rating index a valid measure for change in Oral Health-Related Quality of Life following orthodontic treatment? Results of a cohort study

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ABSTRACT

Objectives: To explore the relationship between changes in Peer Assessment Rating (PAR) score and Oral Health-Related Quality of Life (OHRQoL) following orthodontic treatment and to assess responsiveness of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) in a cohort of young adults.

Materials and Methods: Participants (n = 162) aged 18–25 years requiring comprehensive fixed orthodontic treatment were recruited. Changes in OHRQoL were measured using the PIDAQ, while malocclusion severity was assessed using the PAR index and Index of Orthodontic Treatment Need. Data were collected before treatment (T_0) and 1 month after treatment completion (T_1). Responsiveness of the PIDAQ was evaluated using standardized effect size, standardized response mean, and Global Transition Judgment.

Results: A positive, moderate overall correlation ($r = 0.417$, $P < .05$) was observed between changes in PAR and PIDAQ scores posttreatment, with significant improvements in OHRQoL reported by 88.1% of participants at T_1. Subgroup analysis revealed strong correlations in cases of crowding ($r = 0.711$) and increased overjet ($r = 0.703$), while Class III malocclusion showed a weaker correlation ($r = 0.263$). Multivariate regression analysis revealed that change in PAR score was independently associated ($R^2 = 0.652$) with change in OHRQoL score. The PIDAQ demonstrated responsiveness to treatment-associated changes, with a significant reduction in OHRQoL scores posttreatment.

Conclusions: While a positive correlation between the objective measure of malocclusion severity (PAR) and subjective OHRQoL was identified, the relationship was moderate. The PIDAQ was found to be a responsive scale for assessing OHRQoL in orthodontic patients. (*Angle Orthod*. 2025;95:438–444.)

KEY WORDS: PAR; Quality of life; OHRQoL; PIDAQ; Questionnaire; Responsiveness

INTRODUCTION

Recognition of the profound influence of orthodontic treatment on patient quality of life (QoL) has grown, extending beyond the traditional focus on dental esthetics and function. Central to this paradigm shift is the concept of Oral Health-Related Quality of Life (OHRQoL), which encompasses the multifaceted impact of oral health conditions on physical, psychological, and social well-being.[1] Understanding the interplay between orthodontic intervention and OHRQoL is essential for optimizing patient outcomes and refining treatment approaches.

Normative indices such as the Peer Assessment Rating (PAR) index and Index of Orthodontic Treatment Need (IOTN) serve as objective measures of malocclusion severity, primarily focusing on occlusal parameters. Conversely, OHRQoL scales represent subjective measures, reflecting an individual's perception of his or her oral health status in the context of overall well-being.[2] The assessment of OHRQoL might provide valuable insights into the long-term impact of orthodontic treatment beyond clinical endpoints.[3]

Improvement in PAR score and OHRQoL are generally anticipated to go hand in hand, yet this correlation is

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not always linear.[3] The exact nature of this relationship can be complex and individual specific, underscoring the need for better understanding to aid clinicians in treatment planning.

Most measures available to gauge OHRQoL are generic and adaptable to diverse dental conditions. These generic measures may fail to fully encapsulate the nuanced impacts of specific conditions.[4] Consequently, condition-specific instruments, such as the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), have been developed to provide a more tailored and comprehensive evaluation.[5] The scale has undergone translation and cross-sectional validation processes across a spectrum of languages.[6–9] However, longitudinal research to assess the responsiveness of the PIDAQ is limited.

In this study, therefore, we aimed to determine the relationship between change in PAR score and change in OHRQoL following orthodontic treatment and to test the responsiveness of the PIDAQ to changes associated with orthodontic treatment.

MATERIALS AND METHODS

Study Design and Setting

This research constituted a prospective longitudinal cohort investigation, carried out in the Department of Orthodontics & Dentofacial Orthopedics, Government Dental College, Kerala, India. The protocol was approved by the Institutional Ethics Committee (IEC/M/14/2017/DCK), and the study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[10]

Study Participants

All participants aged 18 years to 25 years requiring comprehensive fixed orthodontic treatment were invited to participate in the study. Enrollment was contingent upon willingness to participate and the provision of informed consent. Exclusion parameters were set to preclude individuals with a history of previous orthodontic intervention, those requiring surgical correction, or those unable to consent. Treatment was administered by one of the co-investigators (E.P.) and the Principal Investigator, supervised by the former.

The sample size estimation using G*Power software (G*Power Version 3.1.9.7., Heinrich Heine University, Düsseldorf, Germany) indicated a sample size of 135 to detect a moderate effect size at a 5% significance level and 90% power. Anticipating a high attrition rate (20%) by the end of treatment, the final sample size was increased to 162, consistent with previous studies.[3] Participants were recruited from May to December 2018.

OHRQoL Scale

The PIDAQ encompasses 23 items under four domains: Dental Self-Confidence (DSC) with 6 items, Social Impact having 8 items, Psychological Impact comprising 6 items, and the Aesthetic Concern domain with 3 items.[5] Each item was rated on a five-point Likert scale (0 = *not at all*, 1 = *a little*, 2 = *somewhat*, 3 = *strongly*, and 4 = *very strongly*).[5] Notably, the items in all domains, except those in DSC, are negatively worded. The version of the PIDAQ cross-culturally adapted for the study population was used.[9]

Methodology

Prior to the initiation of orthodontic intervention (T_0), participants were administered the cross-culturally adapted version of the PIDAQ and given sufficient time to complete the response sheet.[9] Objective assessment of malocclusion severity used the Dental Health Component of the IOTN (IOTN-DHC) and PAR index. The overall PAR score was computed using the weightings by Richmond et al.[11] Concurrently, participants' subjective perceptions were documented using the Aesthetic Component of the IOTN (IOTN-AC). The Principal Investigator, who underwent training and calibration under the co-investigator E.P., carried out the data collection process. Intraobserver reliability was ensured by repeating the pretreatment PAR evaluation of 30 randomly selected participants after a 2-week interval. The data collection process was reiterated 1 month following treatment completion (T_1).

The responsiveness assessment typically employs two methods: anchor based and distribution based.[12] The anchor-based approach correlates changes in the OHRQoL instrument with a recognizable anchor, providing insight into the significance of a particular level of change. Conversely, the distribution-based approach associates changes in treatment with specific measures of variability, such as standardized effect size (SES) and standardized response mean (SRM).[12] The following single-item measure, termed the Global Transition Judgment (GTJ), was employed for the anchor-based approach: "How would you rate the difference in your quality of life related to oral health following brace treatment?" The response options included *improved a lot*, *improved a little*, *remained the same*, *worsened a little*, and *worsened a lot*. The determination of minimally important difference (MID) was also carried out as part of responsiveness testing.[12]

Statistical Analysis

Data analysis was done with SPSS software, version 16.0 (SPSS, Chicago, Ill). The intraobserver reliability in PAR evaluation was confirmed by intraclass correlation

coefficient (ICC). The DSC domain items of the PIDAQ scale were reverse-scored, as they were positively worded, to ensure consistency in scoring direction across all domains.[9] The Shapiro-Wilk test was used to assess the normality of the data.

Relationship between PAR and OHRQoL Measure

The relation between the change in weighted PAR score and change in total PIDAQ score ($T_0 - T_1$) overall was assessed using Pearson's product moment correlation, both overall and within each GTJ group.

The dataset was stratified into six subgroups based on the malocclusion type, categorized using the IOTN-DHC and PAR index. The subgroups included crowding, spacing, bimaxillary proclination, anterior openbite, Class II–increased overjet, and Class III. The correlation between change in PIDAQ score and change in PAR score was assessed within each subgroup using Pearson's correlation.

A χ^2 analysis was performed to identify the relationship between sociodemographic factors (age, gender, and socioeconomic status), treatment duration, and OHRQoL. Multivariate regression analysis was subsequently undertaken to establish the relationship between significant independent variables and OHRQoL.

PIDAQ Responsiveness

Assessment of PIDAQ score change involved computing the difference between total baseline scores and total posttreatment PIDAQ scores. Improvement in OHRQoL would be interpreted as a positive change in scores and a deterioration in case of negative change. Responsiveness was gauged using SES and SRM, both quantifying the extent of change, categorized into small ($\leq$0.2), moderate (0.3–0.7), and large ($\geq$0.9).[13]

The significance of change in scores within subjects among those reporting improvement in OHRQoL and those reporting no improvement was evaluated using paired *t*-tests, as in existing research.[3] Significant changes in the improved group and insignificant changes in the no-improvement group is indicative of a responsive scale. To determine MID, the difference between the mean change scores of participants who reported minimal change and those who reported no change in their OHRQoL at T_1 was calculated.[14] The resultant value was used to compute Guyatt's responsiveness statistic, which is represented by the ratio of MID to the variability in participants who reported no change.[15]

Construct Validity of PIDAQ Over Time

In this study, we examined the relationship between changes in total PIDAQ scores and GTJ using one-way analyses of variance. Robust longitudinal construct validity was evidenced by positive mean score changes in participants reporting improvement in GTJ, negative changes for those reporting worsening, and negligible score differences for those indicating no change.[16]

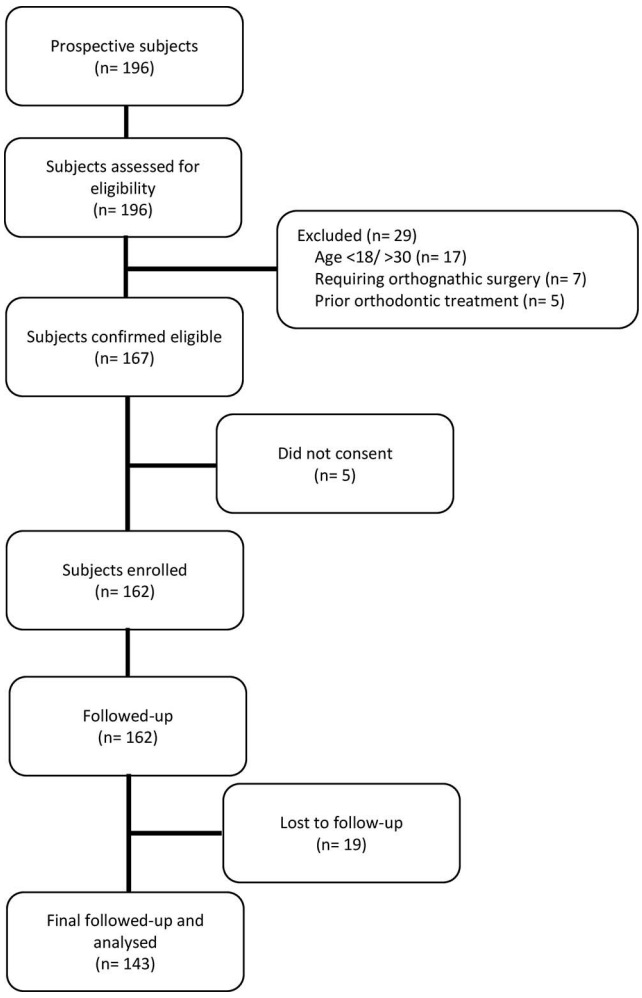

Figure 1. STROBE flowchart.

RESULTS

Participant and Clinician Characteristics

In this study, we enrolled 162 participants (48.7% males; 51.3% females) with a mean age of 20.9 $\pm$ 2.033 years who completed the questionnaire at T_0 (Figure 1; Table 1). It was conducted from May 2018 to December 2021, with an average treatment duration of 2.3 $\pm$ 1.2 years. Follow-up attrition resulted in a 12% dropout rate ($n = 19$), reducing the sample size to 143 (47.6% males, 52.4% females; mean age = 21.3 $\pm$ 1.8 years; Figure 1; Table 1). The data were found to be normally distributed ($P > .05$).

A larger proportion of participants (63.6%) was categorized as having a *definite need for treatment* according to the IOTN-DHC (Table 1). GTJs revealed that a substantial

Table 1. Sociodemographic and Clinical Characteristics of Participants[a]

Demographics	Followed Up (143)	Lost to Follow (19)	All (162)
Age, y, mean ± SD	21.3 ± 1.8	19.8 ± 1.4	20.9 ± 2.0
Gender			
Male	68 (47.6)	11 (57.9)	79 (48.7)
Female	75 (52.4)	8 (42.1)	83 (51.3)
Socioeconomic status			
BPL[b]	111 (77.6)	12 (63.2)	123 (76.0)
APL[b]	32 (22.4)	7 (36.8)	39 (24.0)
Incisor relation			
Class I	81 (56.6)	13 (68.4)	94 (58.0)
Class II	48 (33.6)	4 (21.1)	52 (32.1)
Class III	14 (9.8)	2 (10.5)	16 (9.9)
Type of malocclusion			
Bimaxillary proclination	39 (27.3)	7 (36.9)	46 (28.4)
Crowding	28 (19.6)	6 (31.6)	34 (21.0)
Spacing	21 (14.7)	1 (5.3)	22 (13.6)
Anterior openbite	15 (10.5)	1 (5.3)	16 (9.9)
Class II (increased overjet)	32 (22.4)	3 (15.8)	35 (21.6)
Class III	8 (5.5)	1 (5.3)	9 (5.6)
IOTN-DHC			
Little need (grades 1–2)	18 (12.6)	3 (15.8)	21 (13.0)
Moderate need (grade 3)	34 (23.8)	5 (26.3)	39 (24.0)
Definite need (grades 4–5)	91 (63.6)	11 (57.9)	102 (63.0)
Self-reported IOTN-AC			
Little need (grades 1–4)	10 (7.0)	2 (10.5)	12 (7.4)
Moderate need (grades 5–7)	42 (29.4)	5 (26.3)	47 (29.0)
Definite need (grades 8–10)	91 (63.6)	12 (63.2)	103 (63.6)

[a] Values are No. (%), except age. APL indicates above poverty line; BPL, below poverty line; IOTN-AC, Aesthetic Component of the Index of Orthodontic Treatment Need, and IOTN-DHC, Dental Health Component of the Index of Orthodontic Treatment Need.
[b] Government criteria for socioeconomic status in the study region.

majority of participants (88.1%) perceived an improvement in their OHRQoL at T_1 (Table 2).

The operators were orthodontic clinicians, with the supervisor (E.P.) having over 25 years of clinical experience. The ICC demonstrated a high intrarater reliability (0.982, 95% confidence interval = 0.977, 0.986).

Relationship Between PAR and OHRQoL Measure

A positive and statistically significant correlation ($P < .05$) was observed between change in total PIDAQ score and change in PAR score across all groups and subgroups tested (Table 3). The strength of correlation, overall, was moderate ($r = 0.417$), with moderate correlation in the GTJ 4 and 5 groups ($r = 0.524$ and 0.613, respectively) and weak in the GTJ 3 group ($r = 0.271$; Table 3).

Subgroup analysis revealed a strong correlation in participants with crowding ($r = 0.711$) and increased overjet ($r = 0.703$), a weak correlation in Class III ($r = 0.263$), and a moderate correlation in others (Table 3).

Chi-square analysis showed a statistically nonsignificant ($P > .05$) association between sociodemographic factors and change in OHRQoL following orthodontic treatment (Table 4). In contrast, treatment duration was found to have a statistically significant ($P < .05$) positive association with OHRQoL change (Table 4). The multivariate regression analysis model revealed that change

Table 2. Pretreatment and Posttreatment Total PIDAQ Scores, Change Scores, SES, and SRM for the Different GTJ Categories[a]

GTJ Category	Baseline PIDAQ Scores	Posttreatment PIDAQ Scores	*P* Value[b]	Change Scores	SES	SRM
Overall, n = 143	69.8 ± 10.8	3.7 ± 2.6	<.001	66.1 ± 7.8	6.1	8.5
GTJ 3 (no change), n = 17, 11.9%	53.0 ± 9.6	7.0 ± 2.4		46.0 ± 8.1	4.8	5.7
GTJ 4 (improved a little), n = 45, 31.5%	67.6 ± 9.7	2.1 ± 1.6		65.5 ± 8.8	6.8	7.4
GTJ 5 (improved a lot), n = 81, 56.6%	78.3 ± 9.0	1.5 ± 1.9		76.8 ± 7.9	8.5	9.7
P value[c]				<.001		

[a] Baseline and posttreatment PIDAQ and change score values are mean ± SD. GTJ indicates Global Transition Judgment; PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire; SES, Standardized Effect Size; and SRM, Standardized Response Mean.
[b] Paired *t*-test, significance level set at 5%.
[c] One-way analysis of variance, significance level set at 5%.

Table 3. Correlation Between Change in PAR Score and Change in PIDAQ Score[a]

	Pearson Correlation (*r*)	*P* Value
Overall	0.417	$<.05$[b]
GTJ 3	0.271	
GTJ 4	0.524	
GTJ 5	0.613	
Subgroups		
Bimaxillary proclination	0.462	$<.05$[b]
Crowding	0.711	
Spacing	0.513	
Anterior openbite	0.427	
Class II-increased overjet	0.703	
Class III	0.263	

[a] PAR indicates Peer Assessment Rating; PIDAQ, Psychosocial Impact of Dental Aesthetics Questionnaire.
[b] Pearson correlation test, significance level set at 5%.

in PAR score was independently associated ($R^2 = 0.652$) with change in OHRQoL score.

PIDAQ Responsiveness

Table 2 shows that both groups, those who improved (GTJ 4 and 5) and those who did not (GTJ 3), exhibited significant differences ($P < .05$) in total PIDAQ scores between pretreatment (T_0) and posttreatment (T_1). Based on the GTJ, a larger proportion of participants (n = 81, 56.6%) reported significant improvements in their OHRQoL. A smaller group (n = 17, 11.9%) indicated no change, and notably, none of the participants reported any deterioration (Table 2).

The effect size was large for participants who reported significant improvement (GTJ 5: 8.5) and small for those who reported no change (GTJ 3: 4.8; Table 2). The MID was determined to be 19.5, and Guyatt's responsiveness statistic was 2.4.

Construct Validity of PIDAQ Over Time

The mean difference ($T_0 - T_1$) in total PIDAQ scores was greatest (76.8) for participants who reported significant improvement (GTJ 5), moderate (65.5) for those reporting slight improvements (GTJ 4), and smallest (46.0) for those who experienced no change (GTJ 3; Table 2).

DISCUSSION

The PAR index provides a measurable, objective indicator of the need for orthodontic treatment as well as the effectiveness of interventions applied.[11] Over time, its validity and reliability have been well documented.[17–19] However, it is primarily limited to clinical viewpoints and does not always capture patient perceptions.[20]

Table 4. Bivariate and Multivariate Linear Regression for Change in OHRQoL Score[a]

Variable	Bivariate *P* Value	Multivariate B (Standard Error)	*P* Value
Age	.429		
Gender	.217		
Socioeconomic status	.091		
Treatment duration	$<.05$[b]	−0.026 (0.147)	.071
Change in PAR score	$<.05$[b]	3.138 (0.539)	$<.05$[b]

[a] OHRQoL indicates Oral Health-Related Quality of Life; PAR, Peer Assessment Rating.
[b] Significance level set at 5%.

PAR and OHRQoL

In this study, we confirmed a significant, albeit variable, association between the PAR index and OHRQoL. A positive and moderate overall correlation was observed between changes in PIDAQ and PAR scores. This implies that improved dental outcomes (lower PAR scores) are moderately associated with enhanced psychosocial well-being (lower PIDAQ scores). The Pearson correlation and effect size reflected a similar trend, with higher values in participants who reported improvement in OHRQoL following orthodontic treatment (GTJ 4 and 5) and lower in those who reported no change in OHRQoL (GTJ 3). However, the correlation was only moderate, as anticipated, given that they assess different constructs, one objective while the other subjective.[3]

Though treatment of malocclusion has been found to improve OHRQoL, the relationship is not always straightforward. Around 12% of participants reported no change in OHRQoL, despite definite improvements in their occlusal status. This was consistent with the findings of Peter et al.,[3] who reported a comparable rate of 15%. Chapman et al.[20] compared the impact of orthodontic treatment on OHRQoL of cleft lip and palate patients with a noncleft group. They found that the improvement in OHRQoL following treatment was similar in both cohorts, although the noncleft group achieved more favorable occlusal outcomes. These findings highlight the complex and sometimes divergent relationship between objective measures and patient-reported outcomes.

Considering the different malocclusion groups, the correlation was strong in participants with crowding and increased overjet, likely due to the higher incidence of teasing and bullying associated with these conditions.[21,22] Consequently, orthodontic interventions in these cases can yield substantial psychosocial benefits.[23] These findings were in agreement with previous studies, in which authors demonstrated that crowding and increased overjet significantly impacted the OHRQoL.[22,24] Conversely, Class III participants demonstrated a weak correlation. This could have been due to the inclusion of cases

amenable to nonsurgical correction only. Surgical intervention could have brought about a higher OHRQoL change, as reported by others.[25]

Bimaxillary proclination, spacing, and anterior open bite subgroups exhibited moderate correlations, indicating a noticeable, although less pronounced, relationship between dental improvements and psychosocial benefits. This was, partly, in agreement with the findings of Anthony et al.,[24] who reported anterior openbite to have no statistically significant impact on OHRQoL. However, they also reported that spacing was associated with a significant impact on OHRQoL, which contrasted with the current findings of only a moderate correlation.[24]

Multivariate regression analysis showed that change in PAR score independently influenced the change in OHRQoL following orthodontic treatment, as evidenced by an R^2 value of 0.652. This suggested that approximately 65% of the variability in OHRQoL score could be elucidated by this model.

PIDAQ Responsiveness

Responsiveness is the key attribute of a scale, defined by its ability to detect clinically significant changes over time.[15] A responsive OHRQoL scale is a valuable tool, as it aids in assessing the effectiveness of treatment, monitoring disease progression, and understanding the impact of oral health on overall QoL.[26]

The observed positive correlation between the change in OHRQoL and PAR scores indicated that the PIDAQ effectively captures dental changes following treatment. The mean PIDAQ scores decreased significantly following treatment, with no instance of an increase in scores. This finding reinforces the positive effect of orthodontic treatment on OHRQoL.

In evaluating the scale's longitudinal construct validity, patients who reported improvements and those who did not both demonstrated positive score changes. However, the degree of change followed a clear gradient across the three groups, categorized by the GTJ, as reported in the responsiveness assessment of the Malocclusion Impact Questionnaire.[3]

Limitations

Nineteen participants failed to complete treatment, primarily due to the COVID-19 pandemic. While an adequately increased sample size mitigated the potential loss of statistical power, a high dropout rate remains a concern in longitudinal studies such as this. Additionally, long-term follow-up over several years is necessary to confirm the stability of subjective treatment satisfaction, as measured by patient-reported outcome measures, and to confirm if it aligns with objective changes assessed using PAR.

CONCLUSIONS

- Though there was a positive correlation between objective assessment of malocclusion using the PAR index and subjective assessment using the PIDAQ, the association was only moderate.
- This highlights the importance of patient-reported outcome measures to capture patient perceptions.
- In the sample studied, crowding showed the maximum change in OHRQoL after orthodontic treatment, followed by an increase in overjet.
- The PIDAQ was found to be a valid and responsive measure in assessing OHRQoL following orthodontic treatment.

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