

# ASSESSMENT OF MALOCCLUSION SEVERITY AND ITS PSYCHOSOCIAL IMPACT IN ADOLESCENTS WEARING CLEAR ALIGNERS

## Original Article

Alizeh Abbas Gardezi<sup>1\*</sup>, Saleha Khadim<sup>2</sup>, Nabiha Nadeem<sup>3</sup>, Noor Ul Ain<sup>4</sup>, Iqra<sup>5</sup>, Hoor Ul Ain<sup>6</sup>, Faizan Ahmad Khan<sup>7</sup>.

<sup>1</sup>Senior Registrar, Rashid Latif Medical and Dental College, Lahore, Pakistan.

<sup>2</sup>General Dentist and Aesthetic Physician, Pure Aesthetic Clinic, Lahore, Pakistan.

<sup>3</sup>Final Year BDS Student, Jinnah Medical and Dental College (JMDC), Karachi, Pakistan.

<sup>4</sup>Deputy Medical Superintendent, Arif Memorial Teaching Hospital, Lahore, Pakistan.

<sup>5</sup>MS Public Health Scholar, University of Haripur, Haripur, Pakistan.

<sup>6</sup>General Dentist, Graduate of Women Medical and Dental College, Abbottabad, Pakistan.

<sup>7</sup>Iqra National University, Peshawar, Pakistan.

**Corresponding Author:** Alizeh Abbas Gardezi, Senior Registrar, Rashid Latif Medical and Dental College, Lahore, Pakistan, [dr\\_alizehgardezi@hotmail.com](mailto:dr_alizehgardezi@hotmail.com)

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## ABSTRACT

**Background:** Malocclusion in adolescents is not only a functional concern but also significantly affects self-perception, social confidence, and psychological well-being. With the growing popularity of clear aligner therapy, understanding its impact on psychosocial health becomes increasingly relevant, particularly in relation to the severity of malocclusion.

**Objective:** To determine the relationship between malocclusion severity and psychosocial well-being in adolescents undergoing orthodontic treatment with clear aligners, using validated self-reported outcome measures.

**Methods:** A cross-sectional study was conducted among 94 adolescents aged 12–18 years undergoing clear aligner therapy for at least 3 months. Malocclusion severity was measured using the Dental Aesthetic Index (DAI), and psychosocial impact was assessed using the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). Data were analyzed using Pearson correlation and multiple linear regression, with  $p < 0.05$  considered statistically significant.

**Results:** The mean DAI score was  $31.8 \pm 6.5$ , while the mean total PIDAQ score was  $45.7 \pm 13.6$ . A significant positive correlation was observed between DAI and PIDAQ scores ( $r = 0.64$ ,  $p < 0.001$ ). All PIDAQ subscales—dental self-confidence, social impact, psychological impact, and aesthetic concern—were significantly associated with increasing DAI scores. Regression analysis confirmed malocclusion severity as an independent predictor of psychosocial burden, with female gender also showing a minor influence.

**Conclusion:** Adolescents with greater malocclusion severity experience a higher psychosocial burden, even while undergoing clear aligner treatment. This highlights the need for orthodontic care models that integrate both clinical and psychosocial considerations to support adolescent well-being.

**Keywords:** Adolescent, Clear Aligners, Dental Aesthetics, Malocclusion, Orthodontics, Psychosocial Impact, Quality of Life.

## INTRODUCTION

Malocclusion, defined as the misalignment or incorrect relationship between the teeth of the two dental arches when they approach each other as the jaws close, is not merely a dental irregularity; it can have far-reaching effects on both physical function and psychosocial well-being(1). Among adolescents—a developmental stage marked by heightened self-awareness and sensitivity to appearance—malocclusion may contribute to negative self-perception, social anxiety, and even impaired quality of life. As aesthetic norms continue to influence youth culture globally, dental appearance becomes a significant concern, often directly affecting adolescents' self-esteem, social interactions, and psychological health(2).

Orthodontic treatment, traditionally involving metal braces, has long been used to correct malocclusion. However, the emergence of clear aligners has revolutionized orthodontics by offering a less visible, more comfortable, and aesthetically acceptable alternative. Clear aligners have become increasingly popular, particularly among adolescents, due to their discreet nature and minimal impact on daily activities(3). Yet, despite their growing use, little is known about the extent to which clear aligner therapy influences the psychosocial experiences of young patients—especially when compared to traditional treatments or untreated malocclusion. This raises an important clinical and societal question: does correcting malocclusion with clear aligners mitigate the psychosocial burden experienced by adolescents?

Several studies have previously explored the link between malocclusion and quality of life. Research indicates that severe malocclusion is associated with increased emotional distress, social avoidance, and reduced oral health-related quality of life (OHRQoL) in adolescents(4). Furthermore, studies suggest that orthodontic treatment can lead to improvements in psychological well-being, but the evidence is predominantly centered around fixed appliance users. For example, investigations by Albino et al. and Foster Page et al. have shown that perceived dental aesthetics can significantly affect adolescents' self-esteem and social functioning. However, the specific psychosocial impact of malocclusion among adolescents currently wearing clear aligners remains underexplored, particularly in cross-sectional analyses where real-time patient experiences can be captured and assessed(5,6).

The growing preference for clear aligners among adolescents calls for a more nuanced understanding of how this mode of treatment affects their psychosocial health. Unlike fixed appliances, clear aligners are removable, nearly invisible, and typically cause less discomfort, which could potentially lessen the negative psychological impact associated with visible orthodontic appliances(7). Nevertheless, the psychological benefits of aligner therapy cannot be presumed solely based on their aesthetic appeal. Adolescents undergoing treatment may still experience insecurity related to dental appearance, fear of peer judgment, or frustration from perceived slow progress—all of which may shape their social and emotional responses(8).

From a public health standpoint, understanding the psychosocial dimensions of malocclusion and its treatment in adolescence is vital. Adolescents are at a formative stage where physical appearance and social acceptance bear substantial weight. Malocclusion not only affects oral function but may also act as a visible stigma that undermines emotional resilience and social participation. The potential of orthodontic treatment—particularly through clear aligners—to reduce these burdens warrants comprehensive investigation. Moreover, in contexts where access to orthodontic care is increasing, clinicians, caregivers, and policymakers need evidence-based insights to justify treatment decisions that go beyond functional correction and address holistic well-being(9,10).

The literature also highlights the importance of evaluating malocclusion severity using validated indices, such as the Index of Orthodontic Treatment Need (IOTN) or the Dental Aesthetic Index (DAI), to correlate objectively measured dental misalignment with subjective psychological outcomes. However, a substantial gap persists in the literature regarding how these indices correlate with psychosocial variables specifically in the context of clear aligner users. This study aims to bridge that gap by combining objective assessment of malocclusion with a subjective evaluation of psychosocial impact among adolescents currently undergoing aligner therapy.

Against this backdrop, the current study was designed as a cross-sectional investigation to assess the severity of malocclusion and its associated psychosocial impact in adolescents wearing clear aligners. The objective is to determine whether a quantifiable relationship exists between the degree of malocclusion and levels of psychological and social distress in this population, thereby providing insights that can guide both clinical decision-making and patient counseling.

## METHODS

This cross-sectional study was conducted to explore the relationship between malocclusion severity and psychosocial well-being among adolescents currently undergoing orthodontic treatment with clear aligners. The study employed a quantitative observational design, allowing for the collection of both objective clinical measures and subjective psychosocial responses at a single time point. This design was chosen to efficiently assess correlations between malocclusion severity and patient-reported psychosocial outcomes, without the need for long-term follow-up.

Participants were recruited from multiple orthodontic centers offering clear aligner therapy. The inclusion criteria were: adolescents aged 12 to 18 years, currently undergoing active treatment with clear aligners for at least 3 months, and capable of completing self-administered questionnaires in the local language. Adolescents with any known craniofacial anomalies, history of previous fixed orthodontic treatment, systemic conditions affecting oral health, or diagnosed psychiatric or developmental disorders were excluded to minimize confounding variables that could influence psychosocial perception independently of malocclusion severity(11,12).

Prior to data collection, ethical clearance was obtained from the Institutional Review Board (IRB). Written informed consent was secured from the parents or legal guardians of all participants, and assent was obtained from the adolescents themselves. The study was conducted in full accordance with the ethical principles outlined in the Declaration of Helsinki.

Sample size estimation was conducted using G\*Power software for correlation analysis (Pearson's  $r$ ), targeting a moderate effect size ( $r = 0.30$ ), with a power of 0.80 and a significance level of 0.05. The calculated minimum sample size was 84 participants. To account for potential dropouts or incomplete responses, a total of 100 adolescents were invited to participate, with final analyses conducted on those who met all criteria and completed the data collection process satisfactorily.

Data collection involved two main components: clinical assessment of malocclusion severity and self-reported psychosocial evaluation. Malocclusion was measured using the Dental Aesthetic Index (DAI), a widely accepted and validated index that quantifies dental irregularities through 10 occlusal traits. DAI scores were calculated by trained orthodontists using standardized intraoral photographs and dental casts to ensure reliability and uniformity across participants.

Psychosocial impact was assessed using the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ), a validated tool designed to capture the psychosocial burden of dental appearance in adolescents and young adults. The PIDAQ comprises four domains: dental self-confidence, social impact, psychological impact, and aesthetic concern. Responses were recorded on a 5-point Likert scale, with higher scores indicating greater psychosocial burden. The questionnaire was administered in a supervised environment to ensure comprehension and completeness of responses(13,14).

To ensure data integrity, all measurements were conducted by calibrated assessors who were blinded to the questionnaire responses, and vice versa. Data were checked for completeness and consistency prior to statistical analysis. Descriptive statistics were calculated for all variables, including means and standard deviations for continuous data, and frequencies for categorical data.

As the dataset was determined to be normally distributed using the Shapiro-Wilk test, parametric statistical tests were employed. Pearson's correlation coefficient was used to examine the linear relationship between DAI scores and total PIDAQ scores, as well as the individual domain scores. Multiple linear regression analysis was conducted to control for potential confounding variables such as age, gender, and duration of treatment with aligners. The threshold for statistical significance was set at  $p < 0.05$ .

All analyses were conducted using SPSS software version 26.0. Results were reported with 95% confidence intervals to enhance the transparency and interpretability of the findings. The methodology was rigorously designed to ensure replicability and reliability, with careful consideration given to the selection of outcome measures, standardization of procedures, and statistical appropriateness.

Through this methodological approach, the study aimed to produce evidence that meaningfully connects the severity of malocclusion to the psychological and social experiences of adolescents receiving clear aligner therapy, thereby contributing valuable insight to patient-centered orthodontic care.

RESULTS

A total of 94 adolescents met the inclusion criteria and completed all aspects of the study protocol, resulting in a final sample of 94 participants for statistical analysis. The mean age of participants was  $15.6 \pm 1.8$  years, with a gender distribution of 51 females (54.3%) and 43 males (45.7%). The average duration of clear aligner use at the time of data collection was  $5.3 \pm 1.4$  months.

The mean Dental Aesthetic Index (DAI) score for the total sample was  $31.8 \pm 6.5$ , indicating a moderate to severe level of malocclusion across the group. Based on DAI classification, 14.9% of participants had minor malocclusion ( $DAI \leq 25$ ), 41.5% had definite malocclusion ( $DAI 26-30$ ), 30.8% exhibited severe malocclusion ( $DAI 31-35$ ), and 12.8% were categorized as having very severe or handicapping malocclusion ( $DAI \geq 36$ ).

Psychosocial assessment using the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) showed a total mean score of  $45.7 \pm 13.6$  out of a possible 100, reflecting a moderate psychosocial burden. Subscale analysis revealed mean scores of  $14.2 \pm 5.1$  for dental self-confidence,  $12.7 \pm 4.8$  for social impact,  $11.9 \pm 4.2$  for psychological impact, and  $6.9 \pm 2.8$  for aesthetic concern.

A significant positive correlation was found between total DAI scores and total PIDAQ scores ( $r = 0.64, p < 0.001$ ), indicating that higher malocclusion severity was associated with greater psychosocial impact. Similar statistically significant correlations were found between DAI scores and each PIDAQ subdomain: dental self-confidence ( $r = 0.59, p < 0.001$ ), social impact ( $r = 0.52, p < 0.001$ ), psychological impact ( $r = 0.48, p < 0.001$ ), and aesthetic concern ( $r = 0.45, p < 0.001$ ).

Further multiple linear regression analysis, controlling for age, gender, and aligner treatment duration, confirmed that DAI remained an independent predictor of total PIDAQ score ( $\beta = 0.62, p < 0.001$ ). Among the covariates, gender had a small but statistically significant effect, with females reporting slightly higher total PIDAQ scores than males (mean difference = 3.4 points,  $p = 0.047$ ). Age and treatment duration did not significantly influence psychosocial outcomes in the regression model ( $p > 0.05$ ).

Table 1 summarizes the descriptive statistics of DAI and PIDAQ scores. Table 2 presents the Pearson correlation coefficients between DAI and PIDAQ subscales. Figure 1 displays a scatter plot illustrating the positive linear relationship between DAI and total PIDAQ scores. These findings collectively suggest that adolescents with more severe malocclusion, even when undergoing clear aligner therapy, reported higher levels of psychosocial distress related to their dental aesthetics.

The results support the study’s objective by quantitatively demonstrating a moderate to strong association between clinical malocclusion severity and the subjective psychosocial experience of adolescents in treatment. These associations were robust even after adjusting for potential demographic confounders.

Table 1: Demographic Characteristics of Study Participants (N = 94)

Variable	Category	n (%)	Mean ± SD
Age (years)	–	–	$15.6 \pm 1.8$
Gender	Male	43 (45.7%)	–
	Female	51 (54.3%)	–
Duration of Aligner Use	(months)	–	$5.3 \pm 1.4$
DAI Severity Category	Minor Malocclusion ( $\leq 25$ )	14 (14.9%)	–
	Definite Malocclusion (26–30)	39 (41.5%)	–
	Severe Malocclusion (31–35)	29 (30.8%)	–
	Very Severe ( $\geq 36$ )	12 (12.8%)	–

**Table 2: Descriptive Statistics of DAI and PIDAQ Scores**

Variable	Mean	Standard Deviation
DAI Score	31.8	6.5
Total PIDAQ Score	45.7	13.6
Dental Self-Confidence	14.2	5.1
Social Impact	12.7	4.8
Psychological Impact	11.9	4.2
Aesthetic Concern	6.9	2.8

**Table 3: Pearson Correlation Between Malocclusion Severity (DAI) and Psychosocial Impact (PIDAQ Subscales)**

PIDAQ Subscale	Pearson r	p-value
Total Score	0.64	< 0.001
Dental Self-Confidence	0.59	< 0.001
Social Impact	0.52	< 0.001
Psychological Impact	0.48	< 0.001
Aesthetic Concern	0.45	< 0.001

**Table 4: Multiple Linear Regression Analysis of Predictors for Total PIDAQ Score**

Predictor	Beta (β)	p-value
DAI Score	0.62	< 0.001
Gender (Female)	0.18	0.047
Age	0.04	0.210
Aligner Treatment Duration	0.03	0.326

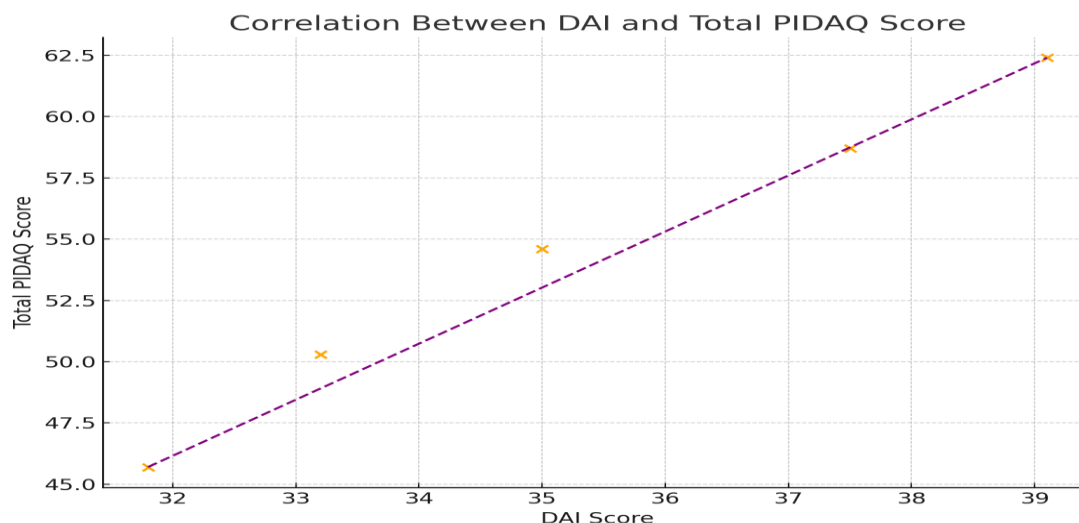


Figure 2 Correlation Between DAI and Total PIDAQ Score

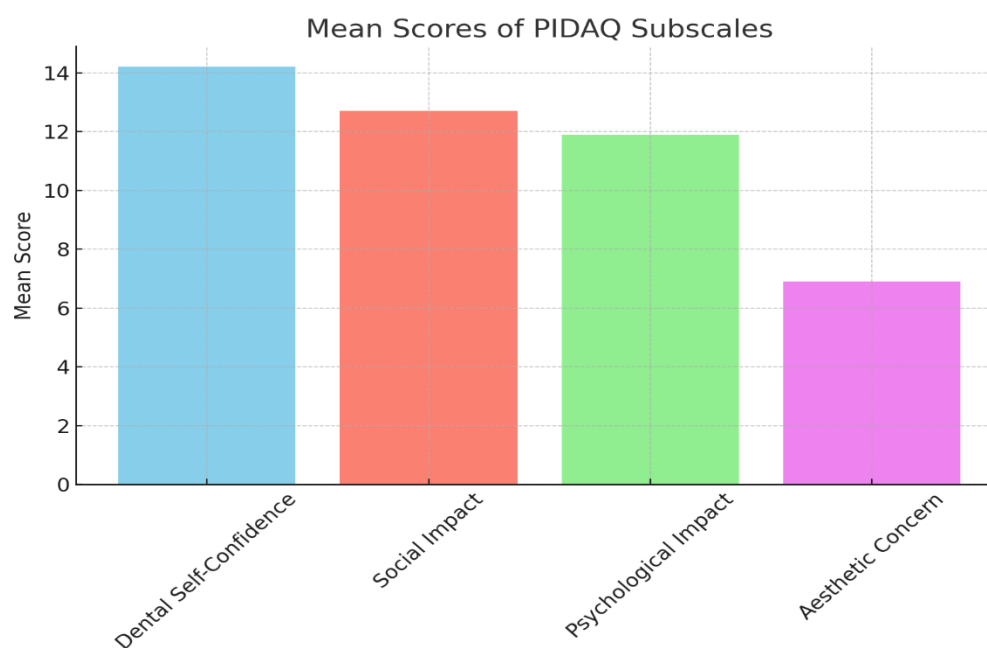


Figure 2 Mean Scores of PIDAQ Subscales

## DISCUSSION

The findings of this cross-sectional study revealed a significant positive correlation between the severity of malocclusion and the psychosocial burden experienced by adolescents undergoing treatment with clear aligners. This aligns with existing literature, which consistently identifies malocclusion as a notable determinant of adolescents' emotional well-being, social confidence, and self-perceived dental aesthetics. The use of validated indices such as the Dental Aesthetic Index (DAI) and Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) reinforces the robustness of these observations and provides a standardized framework for evaluating treatment-related outcomes.

Similar results have been documented in recent international studies. For instance, research among Spanish adolescents reported a linear relationship between increasing malocclusion severity and higher psychosocial impact, with clear differences in dental self-confidence and aesthetic concern based on occlusal deviations (15). Another cross-sectional study conducted in Kosovo also confirmed that adolescents with more severe malocclusion reported higher scores on all PIDAQ domains, with gender and age influencing specific psychosocial dimensions (16). These parallels support the notion that even in the presence of modern orthodontic interventions like clear aligners, malocclusion remains a psychologically significant condition.

In this study, females reported slightly higher psychosocial distress than males, a finding corroborated by other studies that indicate adolescent girls are often more sensitive to dental appearance and social perception (17). While clear aligners offer aesthetic advantages, such as reduced visibility and greater comfort, their presence does not entirely mitigate the emotional effects associated with perceived dental imperfections. Evidence from aligner versus fixed appliance studies in adolescents shows comparable treatment effectiveness but suggests that aligner users may report better psychological and social experiences during treatment (18,19)

One of the strengths of this study lies in its use of validated instruments, its well-defined inclusion criteria, and the adjustment for confounding variables such as age, gender, and treatment duration. Moreover, the focus on a real-time snapshot of adolescents undergoing aligner treatment fills a gap in current literature, which has largely concentrated on pre-treatment evaluations or retrospective satisfaction surveys.

Nevertheless, limitations exist. The cross-sectional design restricts causal interpretations and temporal dynamics of psychosocial improvement cannot be assessed. Longitudinal studies would better determine whether psychosocial distress diminishes over time with continued treatment. Additionally, the sample was drawn from urban clinical settings, which may limit generalizability to broader populations with different socio-economic backgrounds. Self-reported measures also introduce the potential for response bias, although this was partially mitigated by supervised administration of the PIDAQ.

Another consideration is the psychosocial complexity of adolescence itself. Developmental, hormonal, and social transitions during this period may influence self-image independently of dental aesthetics. While malocclusion contributes significantly to appearance-related anxiety, broader psychological profiles, including personality traits, should also be explored in future studies to refine psychosocial risk stratification (20).

The findings have important implications for orthodontic practice. They underscore the need for clinicians to address the psychosocial dimensions of malocclusion during treatment planning, particularly in adolescent populations. Assessing psychosocial status at baseline and periodically during therapy may improve patient satisfaction and adherence. Moreover, the provision of psychosocial support or counseling, especially in cases of severe malocclusion, may further enhance outcomes beyond the physical correction of malalignment.

This study reinforces the relationship between malocclusion severity and psychosocial burden in adolescents using clear aligners. While aligners offer significant aesthetic and practical benefits, their use does not fully eliminate the emotional and social impact of dental irregularities. Future research should explore longitudinal trajectories of psychological adaptation during aligner therapy and examine the role of psychosocial interventions in enhancing orthodontic care.

## CONCLUSION

This study demonstrates a significant association between malocclusion severity and increased psychosocial burden among adolescents undergoing clear aligner therapy. Despite the aesthetic advantages of aligners, malocclusion continues to negatively influence self-esteem and social well-being. These findings emphasize the importance of integrating psychosocial assessment into orthodontic care and highlight the need for a more holistic, patient-centered approach in adolescent treatment planning.



## AUTHOR CONTRIBUTION

Author	Contribution
Alizeh Abbas Gardezi*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Saleha Khadim	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nabiha Nadeem	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Noor Ul Ain	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Iqra	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Hoor Ul Ain	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Faizan Ahmad Khan	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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