

# The Psychosocial Impact of Dental Esthetics and Its Association with Self-Esteem among Dental Students: A Cross-sectional Study

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## ABSTRACT

**Background:** Dental aesthetics can influence psychological well-being and self-esteem, especially in professional dentistry students. This study examined these relationships in Erbil, Kurdistan, Iraq.

**Methods:** This cross-sectional study included 271 students (153 females, 118 men; mean age 21.1 ± 1.8) from Tishk International University, Hawler Medical University, and Cihan University. The Rosenberg Self-Esteem Scale (RSES) measured self-esteem, while the PIDAQ measured psychosocial impact. Spearman correlation, ordinal regression, and nonparametric tests were used.

**Results:** The mean RSES was 26.7 ± 6.8 (median 27 [22-32]) and the mean PIDAQ was 2.33 ± 0.80 (median 2.26 [1.55-2.97]), indicating minimal psychological impact. There was a moderate negative correlation between RSES and PIDAQ ( $\rho = -0.433$ ,  $p < 0.001$ ). Gender and academic year have minimal effect on scores. HMU students were 68% more likely than TIU to experience heightened psychosocial effect (OR = 1.68, 95% CI 1.05-2.69,  $p = 0.031$ ). Dental alignment or lip morphology dissatisfaction, desires for orthodontic or prosthetic treatments, and financial restrictions or fear were linked to higher psychological consequences and worse self-esteem ( $p < 0.001$ ).

**Conclusion:** Higher self-esteem is associated with lower psychosocial impact. Unmet treatment needs, dissatisfaction with dental appearance, and institutional affiliation contribute to psychosocial distress, highlighting the need for targeted support.

**Keywords:** Dental esthetics, Oral Health-Related Quality of Life, Self-esteem, Dental students, Erbil, Iraq

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## INTRODUCTION

Health encompasses physical, mental, and social impact, as defined by the World Health Organization (WHO).<sup>1</sup> In contemporary healthcare, the concept of dental health has progressed beyond the mere absence of disease to include its influence on self-esteem, interpersonal relationships, and overall quality of life.<sup>2,3</sup> Dental appearance, particularly the color, shape, and alignment of teeth, is a central component of facial attractiveness and social communication.<sup>4,5</sup> Even minor dental irregularities can negatively influence an individual's confidence, leading to psychosocial distress and reduced oral health-related quality of life (OHRQoL).<sup>6,7</sup>

Many research have explored the psychosocial impact of dental esthetics in adolescents or the general population,<sup>8</sup> few have focused on dental students a group whose professional identity and future patient interactions are closely tied to their own dental appearance. Dental students are unique in that they not only acquire technical skills but also internalize professional standards of oral presentation and self-care. Their perceptions of dental esthetics may therefore influence their clinical empathy, patient communication, and eventual practice behaviors.<sup>5,9</sup>

Despite increasing global attention to dental esthetics, research in the Kurdistan Region of Iraq remains scarce. Cultural perceptions of beauty, professional expectations, and social values in this region differ significantly from those reported in Western and Asian populations, where most of the existing data originate.<sup>10-12</sup> Investigating this topic among dental students in Erbil offers region-specific insight into how cultural norms and professional demands intersect to shape psychosocial impact.

Moreover, most previous studies have examined either self-esteem or oral health-related quality of life independently, providing partial understanding of psychosocial effects of dental appearance. However, little is known about how dental esthetics affects both self-esteem and psychosocial well-being specifically among dental students in the Kurdistan Region of Iraq, where cultural norms and professional expectations may differ from those in other populations. This gap underscores the need for an integrated, region-specific investigation.

Therefore, the present study aims to examine the psychosocial effect of dental aesthetics and its association with self-esteem within dental students in Erbil. The results will contribute regionally novel data from Iraqi Kurdistan and provide actionable insights to support both students' psychosocial well-being and the development of holistic, patient-centered dental education programs.

## METHODOLOGY

**Study Design and Setting:** This cross-sectional anal-

ytical study was performed from October to December 2024 among undergraduate dental students from three universities in Erbil City, Kurdistan Region, Iraq: Hawler Medical University (public), Tishk International University (private), and Cihan University-Erbil (private). These institutions collectively represent the major dental education centers in the region, encompassing students from diverse academic and socioeconomic backgrounds.

**Study Population and Sampling:** The target population consisted of all undergraduate dentistry students registered in the 2024-2025 academic year.

The criteria for inclusion were: enrollment in any year of a dental program and provision of informed consent.

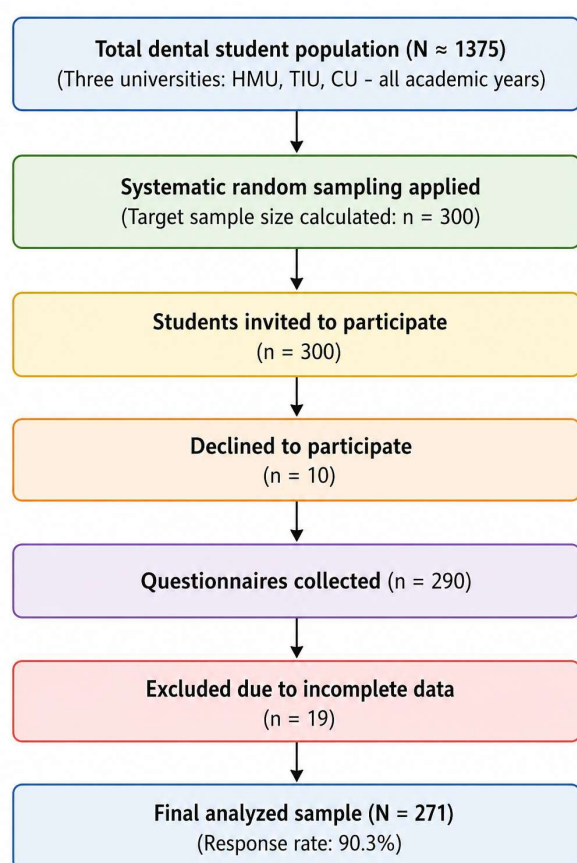
Exclusion criteria were: students with systemic or psychiatric disorders, or those taking medications that could affect oral or psychological health.

At the time of data collection (October-December 2024), first-year dental students had not yet commenced their academic year due to administrative procedures and were therefore unavailable to participate. Consequently, the study population was limited to students in their second through fifth years.

To minimize potential bias, questionnaires were completed anonymously and in a private setting.

**Sampling procedure:** The minimum required sample size was calculated for a correlation-based analytic study using the formula based on Fisher's Z transformation (Hulley et al.<sup>13</sup>, 2013). Assuming a conservative moderate correlation of  $r = 0.30$  between PIDAQ and RSES scores (based on prior literature), with 80% power and  $\alpha = 0.05$  (two-tailed), the required sample size was 85 participants. To account for potential non-response and incomplete questionnaires, we aimed to recruit 300 students. A systematic random sampling technique was applied. To ensure a replicable systematic random sampling procedure, we obtained complete lists of eligible undergraduate dental students (years 2-5) from the registrar's office of each university, using the order provided by the registrar's office (typically by student ID). The total sampling frame (N) across the three universities was 1,375 students. The target sample size was 300, so the sampling interval was calculated as  $k = N/n = 1,375 / 300 \approx 4.58$ , which was rounded down to 4. A random starting point between 1 and 4 was selected using a random number generator (starting point = 2). We then combined the lists from all three universities into a single master list (ordered by university, then by student ID). Every 4th student from the starting point was invited to participate until the target of 300 was reached. Out of 300 distributed questionnaires, 271 valid responses were collected (response rate: 90.3%), exceeding the minimum requirement.

**Instruments for Data Collection:** Data were gathered by a structured, self-administered questionnaire consisting of three sections:



**Figure 1: STROBE-compliant flow diagram of participant selection**

**Sociodemographic Data:** This section recorded age, gender, academic year, university type, and perceived satisfaction with dental appearance.

**Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ):**<sup>14</sup> The PIDAQ comprises four domains: Dental Self-Confidence (DSC, 6 items), Social Impact (SI, 8 items), Psychological Impact (PI, 6 items), and Aesthetic Concern (AC, 3 items). In the original scoring, higher DSC scores indicate greater dental self-confidence, while higher SI, PI, and AC scores indicate greater negative psychosocial impact. All items are rated on a 5-point Likert scale from 1 ("not at all") to 5 ("very strongly"). For the purpose of calculating a total PIDAQ score that uniformly reflects negative impact, the DSC domain was reverse-coded (so that higher reverse-coded DSC scores indicate lower confidence). The total PIDAQ score was then computed as the mean of all 23 items after reverse-coding DSC. Thus, higher total PIDAQ scores indicate greater overall negative psychosocial impact and lower dental self-confidence. Domain-specific scores (DSC, SI, PI, AC) are reported in Table 2 in their original orientation (i.e., DSC: higher = more confidence; SI, PI, AC: higher = more negative impact). Internal consistency for the reverse-coded DSC was Cronbach's  $\alpha = 0.95$  (identical to the original DSC).

**Rosenberg Self-Esteem Scale (RSES):**<sup>15</sup> This 10-item scale assessed dental students' self-esteem and in-

cludes both positively and negatively worded statements. In this study, items were rated from 0 ("strongly disagree") to 4 ("strongly agree"), yielding a total possible score range of 0-40. Negatively worded items were reverse-coded so that higher total scores represent higher self-esteem. While the original RSES was developed using a 4-point scale (Rosenberg, 1965),<sup>15</sup> the 0-4 scoring adaptation used in this study has been validated in cross-cultural research (Schmitt & Allik, 2005).<sup>16</sup>

**Instrument Validity and Reliability:** Instrument validity and reliability were found to be strong for both scales used in the study. The Rosenberg Self-Esteem Scale (RSES) demonstrated good internal consistency with a Cronbach's  $\alpha$  of 0.82, while the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) showed excellent reliability with a Cronbach's  $\alpha$  of 0.94. The domain-specific Cronbach's alpha values for the PIDAQ were also high, including Dental Self-Confidence (DSC)  $\alpha = 0.95$ , Social Impact (SI)  $\alpha = 0.89$ , Psychological Impact (PI)  $\alpha = 0.84$ , and Aesthetic Concern (AC)  $\alpha = 0.90$ .

Construct validity was supported by prior psychometric evaluations and verified in this study through exploratory factor analysis (EFA) using principal component analysis with Varimax rotation. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.922, exceeding the recommended threshold of 0.60, and Bartlett's test of sphericity was significant ( $\chi^2 = 4227.296$ ,  $df = 253$ ,  $p < 0.001$ ), confirming the suitability of the data for factor analysis. A four-factor solution with eigenvalues greater than 1 emerged, accounting for 66.44% of the total variance. The rotated component matrix revealed factor loadings ranging from 0.491 to 0.840 across all items, with items loading onto their respective domains (Dental Self-Confidence, Social Impact, Psychological Impact, and Aesthetic Concern) consistent with the original PIDAQ structure. The overall Content Validity Index (CVI) was 0.94, confirming strong item relevance and internal structure.

**Ethical Considerations:** Ethical permission was obtained from the Kurdistan Higher Council of Medical Specialties (Approval No. 1612; Dated: July 3, 2024). The study followed the principles of the Declaration of Helsinki (2013 revision). After giving a full explanation of the study's goals and privacy, all participants gave their written informed consent. Participation was voluntary, and respondents were made aware of their freedom to withdraw at any moment without consequences.

**Data Analysis:** IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA) was used to enter and analyze the data. All data were screened for completeness, accuracy, and coding consistency prior to analysis. Normality of continuous variables (RSES and PIDAQ scores) was evaluated using the Shapiro-Wilk test, histograms, and Q-Q plots. As both scales deviated from normal distribution, nonparametric statistical methods were applied throughout. Incomplete

questionnaires (n = 20) and invalid responses (n = 9) were excluded from the analysis. No missing data were present among the 271 included responses.

**Descriptive Analysis:** Categorical variables (e.g., gender, college, academic year, reasons for dissatisfaction, desired interventions) were summed up as frequencies and percentages. Continuous variables were characterized by medians accompanied by interquartile ranges (IQRs) and means  $\pm$  standard deviations (SD) for interpretability. Internal consistency reliability was assessed using Cronbach's alpha ( $\alpha$ ) for both PIDAQ and RSES scales and their subdomains.

**Inferential Analysis:** Inferential analysis was performed using nonparametric statistical methods to explore group differences and associations. The Mann-Whitney U test was used to compare median Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) and Rosenberg Self-Esteem Scale (RSES) scores between two categories, such as gender, while the Kruskal-Wallis H test assessed differences in PIDAQ and RSES scores across more than two groups, including academic year, causes of dissatisfaction, desired dental interventions, and reasons for not undergoing treatment. Following significant Kruskal-Wallis test results, post-hoc pairwise comparisons were conducted using the Mann-Whitney U test with Bonferroni correction to identify differences between specific groups. In addition, Spearman's rank correlation coefficient ( $\rho$ ) was used to measure the strength and direction of correlations between total PIDAQ and RSES scores, as well as between RSES scores and the PIDAQ subdomains, namely dental self-confidence, social impact, psychological impact, and aesthetic concern.

**Predictive Analysis:** Identifying independent predictors for psychosocial impact and for self-esteem, binary logistic regression models were performed.

**Model 1 (Psychosocial impact Model):** PIDAQ Total (categorized into low, moderate, and high impact) was entered as the dependent variable, with age, gender, academic year, college type, and dissatisfaction/ intervention variables (Q1-Q3) as independent predictors.

**Model 2 (Self-Esteem Model):** RSES Total (categorized into low, moderate, and high self-esteem) served as the dependent variable, with the same predictors as above, including overall PIDAQ category to evaluate the influence of psychosocial distress on self-esteem. Thus, the RSES model included age, gender, academic year, college type, dissatisfaction/intervention variables, and PIDAQ category (low, moderate, high) as independent predictors.

Because of high intercorrelations among PIDAQ subdomains ( $\rho$  ranging from 0.418 to 0.909), only the total PIDAQ score was entered as a predictor in regression models to avoid multicollinearity. Subdomains were analyzed separately only in bivariate correlation analyses.

Model adequacy was evaluated using the likelihood ratio chi-square test, pseudo- $R^2$  statistics (Nagelkerke  $R^2$ ), and the test of parallel lines to confirm proportional odds assumptions. The outcomes were presented as odds ratios (Exp(B)) accompanied by 95% confidence intervals (CIs). There were two-tailed statistical tests, and significance was set at  $p < 0.05$ . For nonparametric tests, effect sizes were calculated as  $r = Z / \sqrt{N}$  to indicate the magnitude of group differences.

## RESULTS

Table 1 outlines the sociodemographic and academic features of the 271 dental students who participated in this cross-sectional survey. The sample comprised 153 females (56.5%) and 118 males (43.5%), with ages ranging from 17 to 36 years (mean  $\pm$  SD = 21.07  $\pm$  1.76, median [IQR] = 21 [20-22]). Participants were recruited from three dental colleges in Erbil: Tishk International University (50.9%, n = 138), Hawler Medical University (39.5%, n = 107), and Cihan University-Erbil (9.6%, n = 26). The distribution across academic years was relatively balanced, with the largest proportions of students in the second and fourth years (each 27.3%, n = 74), followed by the third year (24.7%) and fifth year (20.7%).

DSC domain scores are presented in original orientation (higher = greater dental self-confidence). The total PIDAQ score was calculated after reverse-coding DSC, so higher total scores indicate greater negative psychosocial impact. SI, PI, and AC scores are also in original orientation (higher = greater negative impact).

Table 2 presents the reliability and descriptive statistics of the RSES and the PIDAQ among 271 dental students. The RSES, which assessed self-esteem, showed strong internal consistency (Cronbach's  $\alpha$  = 0.82), while the PIDAQ, which assessed psychosocial impact related to dental esthetics, exhibited excellent reliability (Cronbach's  $\alpha$  = 0.94). Domain-specific reliability for the PIDAQ was high: DSC ( $\alpha$  = 0.95), SI ( $\alpha$  = 0.89), PI ( $\alpha$  = 0.84), and AC ( $\alpha$  = 0.90).

**Table 1: Sociodemographic and Academic Characteristics of Dental Students (N = 271)**

Characteristic	Participants (%)
<b>Gender</b>	
Male	118 (43.5)
Female	153 (56.5)
<b>Age (Years)*</b>	21(20-22)/ 21.07 $\pm$ 1.76
<b>College of Dentistry</b>	
Tishk International University	138 (50.9)
Hawler Medical University	107 (39.5)
Cihan University	26 (9.6)
<b>Academic Year</b>	
Second Year	74 (27.3)
Fourth Year	74 (27.3)
Third Year	67 (24.7)
Fifth Year	56 (20.7)

\* Median (IQR) /Mean  $\pm$  SD

**Table 2: Reliability and descriptive statistics of RSES and PIDAQ among dental students (N = 271)**

Scale / Domain	Number of Items	Cronbach's $\alpha$	Range	Mean $\pm$ SD	Median (IQR)
RSES Total	10	0.82	0 - 40	26.72 $\pm$ 6.78	27 (22 - 32)
PIDAQ Total	23	0.94	1.00 - 4.24	2.33 $\pm$ 0.80	2.26 (1.55 - 2.97)
DSC	6	0.95	1 - 5	2.92 $\pm$ 0.95	3.00 (2.25 - 3.75)
SI	8	0.89	1 - 5	2.04 $\pm$ 0.91	1.88 (1.13 - 2.63)
PI	6	0.84	1 - 5	2.29 $\pm$ 0.87	2.33 (1.58 - 2.83)
AC	3	0.90	1 - 5	2.08 $\pm$ 1.17	1.67 (1.00 - 3.00)

Note: PIDAQ: Psychosocial Impact of Dental Esthetics Questionnaire; RSES: Rosenberg Self-Esteem Scale; DSC: Dental Self-Confidence; SI: Social Impact; PI: Psychological Impact; AC: Aesthetic Concern.

**Table 3: Association of demographic and academic variables with self-esteem (RSES) and psychosocial impact (PIDAQ) of dental students' total scores (N = 271)**

Variable	Students (n=271)	RSES Total Score Median (IQR)	p-value	PIDAQ Total Score Median (IQR)	p-value
<b>Gender</b>					
Male	118	26.00 (9.25)	0.329	2.39 (1.29)	0.066
Female	153	28.00 (11.50)		2.16 (1.47)	
<b>Academic Year</b>					
Second Year	74	28.50 (12.25)	0.166	2.30 (1.41)	0.847
Third Year	67	28.00 (10.00)		2.22 (1.47)	
Fourth Year	74	24.00 (9.00)		2.36 (1.33)	
Fifth Year	56	28.00 (8.75)		2.25 (1.33)	
<b>College of Dentistry</b>					
HMU	107	25.00 (9.00)	0.107	2.33 (1.26)	0.743
CU	26	29.00 (11.00)		2.33 (1.28)	
TIU	138	28.00 (11.00)		2.22 (1.47)	

Note: HMU: Hawler Medical University; CU= Cihan University; TIU: Tishk International University

RSES: Rosenberg Self-Esteem Scale; PIDAQ: Psychosocial Impact of Dental Esthetics Questionnaire; IQR: Interquartile Range.

p-values were derived from the Mann-Whitney U test (for Gender) and the Kruskal-Wallis H test (for Academic Year and College).

**Table 4: Spearman's rank-order correlation between overall self-esteem (RSES), the total psychosocial impact (PIDAQ) of dental students' total scores (N = 271)**

Variable	PIDAQ Total	DSC	SI	PI	AC
RSES Total	-0.433**	-0.336**	-0.400**	-0.354**	-0.396**
PIDAQ Total		0.693**	0.856**	0.870**	0.909**
DSC			0.418**	0.454**	0.564**
SI				0.773**	0.732**
PI					0.720**

Note. Spearman's rank correlation coefficients ( $\rho$ ) are shown.

All correlations are statistically significant at  $p < 0.001$ .

Higher RSES scores indicate greater self-esteem; higher PIDAQ scores indicate greater psychosocial impact of dental esthetics.

DSC = Dental Self-Confidence; SI = Social Impact; PI = Psychological Impact; AC = Aesthetic Concern.

The mean self-esteem score was  $26.72 \pm 6.78$  (median [IQR] = 27 [22-32]; range 0-40), reflecting moderate to high self-esteem. The mean psychosocial impact score was  $2.33 \pm 0.80$  (median [IQR] = 2.26 [1.55-2.97]; range 1.00-4.24), indicating a generally mild psychosocial impact of dental esthetics. Among psychosocial impact domains, the highest mean score was observed for DSC ( $2.92 \pm 0.95$ ), followed by PI ( $2.29 \pm 0.89$ ), AC ( $2.08 \pm 1.17$ ), and SI ( $2.04 \pm 0.91$ ).

Higher RSES scores indicate higher self-esteem. Higher total PIDAQ scores (calculated after reverse-coding the DSC domain) indicate greater psychosocial impact. For the domain-specific PIDAQ scores presented in Table 2, higher DSC scores indicate greater dental self-confidence, while higher SI, PI, and AC scores indicate greater negative psychosocial impact.

The associations between demographic and academ-

ic variables with self-esteem (RSES) and psychosocial impact (PIDAQ) were examined using nonparametric tests (Table 3). The Mann-Whitney U test showed no statistically significant difference in self-esteem scores between males (Median = 26.00, IQR = 9.25) and females (Median = 28.00, IQR = 11.50;  $p = 0.329$ ). Similarly, psychosocial impact scores did not differ significantly between genders (Median = 2.39, IQR = 1.29 vs. 2.16, IQR = 1.47;  $p = 0.066$ ). Using the Kruskal-Wallis H test, no significant differences were identified in self-esteem or psychosocial impact scores across academic years ( $p = 0.166$  and  $p = 0.847$ , respectively) or across the three dental colleges ( $p = 0.107$  and  $p = 0.743$ , respectively).

Regardless, there was no statistically significant relationship between any of these variables. Descriptively, fourth-year students and those from Hawler Medical University (HMU) appeared to report lower self-esteem levels compared with their peers.

**Table 5: Comparison of psychosocial impact (PIDAQ) and self-esteem (RSES) scores according to causes of dissatisfaction, desired interventions, and reasons for not undergoing treatment of dental students' total scores (N = 271)**

Variable	Median RSES	Median PIDAQ	p-value RSES	p-value PIDAQ
<b>Cause of dissatisfaction</b>				
Tooth color	25.00	2.45	0.007	<0.001
Tooth size	20.50	2.84		
Gum color / position	26.50	2.47		
Arrangement / positioning	26.00	2.70		
Lip shape	26.50	2.95		
Satisfied with teeth	30.00	1.58		
Bruxism	24.50	2.71		
<b>Desired dental intervention</b>				
Orthodontic therapy	26.00	2.64	0.075	<0.001
Gum position correction	26.50	2.47		
Scaling / whitening	27.50	1.97		
Restorative therapy	28.50	1.83		
Prosthetic therapy	24.00	2.82		
Nothing	34.00	1.50		
Lip filler	25.00	2.82		
<b>Reason for not doing intervention</b>				
Financial reason	23.50	2.78	0.022	<0.001
Concern about outcome	28.00	2.50		
Lack of time	27.00	1.85		
Fear of dentist	30.00	3.07		
Did it before	26.00	2.07		
Negligence	22.00	2.02		
Graduation pictures	26.00	2.33		
Don't need treatment	35.00	1.32		

Note: Kruskal-Wallis H test was used to compare median scores across multiple categories for each variable. Statistically significant results ( $p < 0.05$ ) indicate group differences in self-esteem (RSES) or psychosocial impact (PIDAQ) scores. Higher PIDAQ values reflect greater psychosocial impact, while higher RSES values indicate greater self-esteem.

**Table 6: Ordinal Regression Results for Predictors of Psychosocial Impact (PIDAQ) and Self-Esteem (RSES) Categories**

Predictor	PIDAQ Model		RSES Model	
	OR (95% CI)	p-value	OR (95% CI)	p-value
<b>Gender (ref: Male)</b>				
Female	1.25 (0.85-1.84)	0.254	0.95 (0.59-1.53)†	0.832
<b>Academic Year (ref: Fifth Year)</b>				
Second Year	0.88 (0.52-1.49)	0.634	0.71 (0.35-1.42)	0.327
Third Year	0.95 (0.56-1.61)	0.851	0.73 (0.35-1.49)	0.388
Fourth Year	1.42 (0.84-2.41)	0.192	0.66 (0.32-1.37)	0.267
<b>College (ref: TIU)</b>				
HMU	1.68 (1.05-2.69)	0.031*	0.71 (0.41-1.24)	0.228
CU	1.12 (0.69-1.82)	0.643	0.89 (0.38-2.07)	0.782
<b>PIDAQ Category (ref: Low impact)</b>				
Moderate impact			0.50 (0.27-0.92)	0.026*
High impact			0.16 (0.09-0.27)	<0.001*
<b>Model Fit Statistics</b>				
-2 Log Likelihood	485.32		267.31	
$\chi^2$ (df)	25.18 (6)	0.001*	53.02 (8)	<0.001*
Nagelkerke R <sup>2</sup>	0.089		0.202	

Note: OR = Odds Ratio; CI = Confidence Interval; ref = reference category; † OR for Gender in RSES model calculated as  $\text{Exp}(-0.052) = 0.95$   $p < 0.05$  (Significant). TIU = Tishk International University; HMU = Hawler Medical University; CU = Cihan University.

**Table 7: Comparison of RSES and PIDAQ scores between public and private university dental students**

Variables	Public (HMU) n = 107	Private (TIU + CU) n = 164	Test Statistic	p-value	Effect Size (r)
RSES Median (IQR)	25.00 (9.00)†	28.00 (11.00)†	U = 7452.50, Z = -2.098	0.036*	0.127
PIDAQ Median (IQR)	2.33 (1.26)†	2.24 (1.44)†	U = 8316.50, Z = -0.725	0.468	0.044

Note: HMU = Hawler Medical University; TIU = Tishk International University; CU = Cihan University; RSES = Rosenberg Self-Esteem Scale (higher scores indicate higher self-esteem); PIDAQ = Psychosocial Impact of Dental Aesthetics Questionnaire (higher scores indicate greater psychosocial impact); IQR = Interquartile Range (Q3 - Q1).

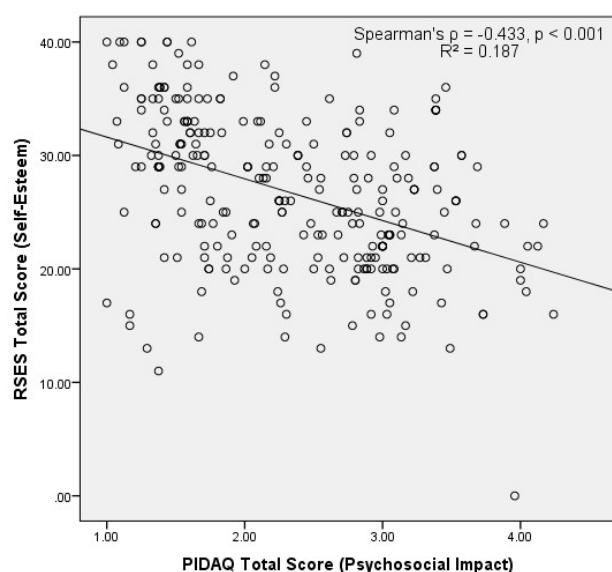
† Median (IQR) reported as median (interquartile range value).

$p < 0.05$  (statistically significant).

Table 4 shows the Spearman correlation coefficients between self-esteem (RSES) and psychosocial impact (PIDAQ) scores. A significant moderate negative correlation was observed between the self-esteem and total psychosocial impact scores ( $\rho = -0.43$ ,  $p < 0.001$ ), indicating that higher self-esteem was associated with lower psychosocial impact of dental esthetics.

Among the psychosocial impact domains, the strongest positive intercorrelations were observed between *PI* and *AC* ( $\rho = 0.72$ ) and between *SI* and *PI* ( $\rho = 0.77$ ), all  $p < 0.001$ . The DSC domain (after reverse-coding) correlated negatively with self-esteem ( $\rho = -0.336$ ,  $p < 0.001$ ) and positively with the other psychosocial impact domains (*SI*:  $\rho = 0.418$ ; *PI*:  $\rho = 0.454$ ; *AC*:  $\rho = 0.564$ ; all  $p < 0.001$ ), consistent with the scoring direction where higher DSC scores indicate greater dental self-confidence (i.e., less psychosocial impact).

Scatter plot showing the association between psychosocial impact of dental aesthetics (PIDAQ total score) and self-esteem (RSES total score) among dental students ( $N = 271$ ). Each point represents one participant. The line is shown for visual reference only. Spearman's rank correlation coefficient was  $\rho = -0.433$  ( $p < 0.001$ ), indicating a statistically significant moderate negative association between higher psychosocial impact and lower self-esteem.



Note: The linear regression line is shown for visual reference only; statistical inference was based on Spearman's rank correlation ( $\rho = -0.433$ ,  $p < 0.001$ ).

**Figure 2: Scatter plot of PIDAQ total score versus RSES total score among dental students ( $N = 271$ )**

Table 5 presents the comparison of self-esteem (RSES) and psychosocial impact (PIDAQ) scores according to students perceived causes of dissatisfaction, desired dental interventions, and reasons for not undergoing treatment.

A statistically significant difference in psychosocial impact scores was observed across different causes of dissatisfaction ( $p < 0.001$ ). Students who reported dissatisfaction with the arrangement or positioning of their teeth and those dissatisfied with their lip shape had the highest psychosocial impact scores, while students who were satisfied with their teeth had the lowest psychosocial impact and the highest self-esteem scores.

Similarly, desired dental interventions were significantly associated with psychosocial impact scores ( $p < 0.001$ ), but not with self-esteem scores ( $p = 0.075$ ). Students who expressed a need for orthodontic or prosthetic therapy showed higher levels of psychosocial impact than those who reported no need for treatment.

Regarding reasons for not undergoing treatment, significant differences were found for both self-esteem ( $p = 0.022$ ) and psychosocial impact ( $p < 0.001$ ) scores. Students who cited financial constraints or fear of dental procedures reported higher psychosocial burden and lower self-esteem compared with those who indicated that they did not need treatment.

Overall, these results suggest that dissatisfaction with dental appearance and unmet desire for aesthetic interventions are linked to lower self-esteem and greater psychosocial impact among dental students.

Post-hoc pairwise comparisons using Mann-Whitney U tests with Bonferroni correction, following significant Kruskal-Wallis H results, identified specific significant relationships (Supplementary Table S1.). Students dissatisfied due to tooth arrangement or tooth color reported significantly higher psychosocial distress compared with those satisfied with their teeth ( $p < 0.001$ ). Dissatisfaction related to tooth arrangement also produced higher distress than dissatisfaction due to tooth color ( $p = 0.002$ ). Participants satisfied with their dental appearance demonstrated significantly higher self-esteem than those dissatisfied with tooth size ( $p = 0.002$ ).

Regarding desired dental interventions, students expressing the need for orthodontic, restorative, prosthetic, or scaling/whitening treatments had significantly higher psychosocial impact scores compared to those who reported needing no intervention (all  $p < 0.001$ ). Students desiring orthodontic correction also showed greater psychosocial impact than those indicating restorative or scaling needs ( $p < 0.01$ ).

For reasons for not performing treatment, participants citing financial limitations, concerns about treatment outcomes, or lack of time had significantly higher psychosocial impact scores than those who reported no need for treatment ( $p < 0.001$ ).

At the item level, the statement "I am pleased when I see my teeth in the mirror" revealed significant differences across both psychosocial impact and self-esteem. Participants who responded "not at all"

showed markedly higher psychosocial distress ( $p < 0.001$ ) and lower self-esteem ( $p = 0.001$ ) than individuals expressing higher satisfaction.

Supplementary Table S1.

Table 6 presents the findings from ordinal regression analyses investigating demographic and institutional predictors of categorized psychosocial impact (PIDAQ) and self-esteem (RSES) levels among dental students. The results indicate that both overall models achieved statistical significance (psychosocial impact:  $\chi^2(6) = 25.18, p = 0.001$ ; self-esteem:  $\chi^2(8) = 53.02, p < 0.001$ ), explaining approximately 8.9% and 20.2% of the variance in their respective outcomes according to Nagelkerke's  $R^2$ . Notably, institutional affiliation emerged as a significant predictor, with students from HMU demonstrating 68% higher odds of reporting elevated psychosocial distress categories in comparison to their equivalents at TIU (OR = 1.68, 95% CI [1.05, 2.69],  $p = 0.031$ ). Conversely, academic progression status and gender identification failed to demonstrate statistically significant associations with either psychosocial distress or self-esteem categories in the multivariate analyses.

The proportional odds assumption was met for both ordinal regression models (psychosocial impact model: test of parallel lines  $\chi^2 = 15.32, df = 12, p = 0.225$ ; self-esteem model:  $\chi^2 = 18.76, df = 12, p = 0.095$ ), confirming the appropriateness of the ordinal logistic regression approach.

For nonparametric comparisons, effect sizes ( $r$ ) ranged from 0.05 to 0.42. The largest effects were observed for dissatisfaction with tooth arrangement vs. satisfaction ( $r = 0.42$ ) and for orthodontic need vs. no treatment need ( $r = 0.38$ ).

A subgroup analysis was conducted to compare self-esteem (RSES) and psychosocial impact (PIDAQ) scores between students from public (Hawler Medical University,  $n = 107$ ) and private (Tishk International University and Cihan University combined,  $n = 164$ ) dental schools. As shown in Table 7, students from private universities reported significantly higher self-esteem scores (median = 28.00, IQR = 11.00) compared to their peers from the public university (median = 25.00, IQR = 9.00; Mann-Whitney  $U = 7452.500, Z = -2.098, p = 0.036, r = 0.127$ ). However, no statistically significant difference was observed in psychosocial impact scores between the two groups (public: median = 2.33, IQR = 1.26; private: median = 2.24, IQR = 1.44; Mann-Whitney  $U = 8316.500, Z = -0.725, p = 0.468, r = 0.044$ ). These findings suggest that institutional affiliation may influence self-esteem but not the overall psychosocial impact of dental esthetics among dental students in Erbil.

## DISCUSSION

This study investigated the psychosocial effect of dental esthetics and its relationship with self-esteem amongst dental students in Erbil, Kurdistan Region

of Iraq, using two validated instruments the RSES and the PIDAQ. The findings revealed a statistically significant, moderate negative correlation between total PIDAQ and RSES scores ( $\rho = -0.433, p < 0.001$ ), indicating that students who experienced a stronger psychosocial impact related to their dental appearance tended to report lower self-esteem. This result supports previous evidence indicating that dissatisfaction with dental appearance is negatively associated with psychological impact and self-esteem.<sup>17-19</sup>

Consistent with studies from other regions,<sup>20-22</sup> tooth color and arrangement were the most frequently cited and powerful sources of dissatisfaction among Erbil dental students. The high psychosocial impact associated with dissatisfaction in these areas underscores a universal desire for a bright, well-aligned smile. Such a smile is often culturally associated with health, youth, and success. Post-hoc analyses further revealed that dissatisfaction with tooth arrangement generated an even greater psychosocial impact than dissatisfaction with color alone. This aligns with research on dental students in Saudi Arabia. In that research, malocclusion and tooth crowding were found to be significant predictors of psychosocial impact. These findings emphasize that deviations from an idealized dental arch are associated with profound changes in self-perception.<sup>21,22</sup>

Compared to the Serbian study by Stojilković et al. (2024)<sup>22</sup>, our sample reported higher PIDAQ scores (2.33 vs. 1.84) and a stronger negative correlation with self-esteem ( $\rho = -0.433$  vs.  $-0.38$ ), despite similar age and tooth color/alignment concerns. These differences may reflect regional variations in dental aesthetics awareness or healthcare access.

A pivotal insight from this study is the powerful influence of the perceived need for treatment, which emerged as a stronger predictor of psychosocial impact than any demographic factor examined. Students who expressed a perceived need for orthodontic, prosthetic, or whitening procedures reported significantly higher PIDAQ scores than peers with no such need. This treatment need gap reflects a form of psychological dissonance. Specifically, an individual's esthetic ideal conflicts with their current dental appearance. That conflict corresponds to intensified emotional distress.<sup>23,24</sup>

Financial constraints emerged as a major barrier, linking socioeconomic factors directly to the psychological impact on future dentists. This finding is consistent with previous research indicating that unmet need for esthetic dental treatment and limited access to care are associated with reduced patient satisfaction and poorer oral health-related quality of life.<sup>20,23,24</sup>

Furthermore, fear of dental procedures was also associated with higher psychosocial impact, suggesting that dental anxiety is not exclusive to patients but may also be reported by dental students, thus creating a paradoxical barrier to self-care.<sup>25</sup> These behavioral and psychological interconnections highlight

that the inability to act on a desired esthetic improvement whether due to financial limitations or fear is as strongly related to lower self-esteem as the esthetic concern itself.

Beyond individual factors, institutional affiliation also showed a contextual influence. Although bivariate comparisons revealed no significant differences, multivariate ordinal regression (controlling for gender and academic year) indicated that students from HMU had higher odds of reporting psychosocial impact compared with students from TIU. Possible explanations include variations in institutional culture, academic pressure, and clinical exposure. The contrast between public (HMU) and private (TIU) environments may also play a role and warrants exploration in future qualitative research. Few studies have examined institutional affiliation as a predictor of psychosocial impact from dental aesthetics. However, our finding is consistent with reports from other Middle Eastern settings where socioeconomic and institutional factors (e.g., public vs. private education) influenced dental self-perception and treatment seeking.<sup>23,26</sup>

Students who cited financial constraints or fear as reasons for avoiding esthetic treatment exhibited greater psychosocial distress and lower self-esteem. This finding suggests that barriers to treatment are associated with greater emotional strain and lower confidence.<sup>20,22</sup> Particularly, students who were “not at all pleased” when seeing their teeth in the mirror displayed the lowest self-esteem, underscoring the deep emotional significance of dental appearance.

Culturally, these findings contribute novel insights from the Kurdish academic context, where personal appearance and professional image are closely intertwined. For dental students, dental aesthetics represent not only personal satisfaction but also professional competence and trustworthiness.<sup>22,27</sup>

Neither gender nor academic year significantly predicted psychosocial impact or self-esteem in any analysis. This aligns with previous findings among dental students.<sup>28</sup> The absence of these effects may reflect the homogeneous cultural and professional context of our sample, or that dental aesthetics concerns remain stable across training years. Future longitudinal studies could detect subtle shifts with clinical progression.

These findings hold important educational implications. Dental students are future oral health professionals whose perceptions of their own dental aesthetics may influence clinical empathy, communication with patients, and professional confidence.<sup>17-19</sup> The association between unmet esthetic needs and reduced self-esteem suggests that dental curricula may be overlooking a key component of student well-being. Incorporating modules on esthetic self-awareness, providing psychological support services, and offering counseling to help students manage esthetic concerns might be associated with greater resilience and professional confidence.<sup>19,22,27</sup> Building

this emotional competence is essential for developing dentists who are not only technically proficient but also psychologically attuned to their patients' needs.

Finally, this study provides regionally specific data from the Kurdish context of Iraq, a population underrepresented in dental aesthetics research. The demonstration of a clear behavioral-psychological linkage where specific dissatisfactions and treatment barriers predict psychosocial impact and self-esteem has not been previously documented among Iraqi dental students. In a collectivist society like Kurdistan, social appearance and family honor carry high value. Therefore, the pressure to present an esthetically pleasing smile may be particularly intense. For dental students, who are expected to embody oral health, this pressure may be magnified, making these findings both culturally significant and educationally urgent.

## LIMITATIONS AND FUTURE RESEARCH

This study has several limitations. First, the cross-sectional design prevents causal inference between dental aesthetics and self-esteem. Second, self-reported data may have introduced response or social desirability bias. Third, data were collected from three universities within a single city, limiting generalizability. Fourth, reasons for non-participation were not recorded for the 29 students who did not complete the questionnaire (10 declined to participate, 19 had incomplete data), which may introduce non-response bias. Finally, future research should employ longitudinal or mixed-method designs to explore changes in perception over time and clarify causal mechanisms.

Subsequent studies should employ longitudinal or mixed-methodological frameworks to examine changes over time and clarify causal relationships. Expanding the study to multiple regions or countries would allow cross-cultural comparisons, and qualitative studies could provide deeper insight into how students connect personal appearance with professional identity and psychological well-being.

## CONCLUSION

Within the limitations of this study, perceived dental aesthetics and unmet esthetic treatment needs were identified as significant predictors of psychosocial impact and self-esteem among dental students in Erbil. The observed negative correlation between PIDAQ and RSES scores highlights the inverse relationship between dissatisfaction with dental appearance and self-esteem.

From an educational perspective, integrating psychosocial education and counseling within dental curricula may enhance students' emotional resilience and professional confidence. From a cultural per-

spective, these findings provide region-specific evidence from the Kurdish context, contributing to a more globally representative understanding of how sociocultural and institutional factors shape dental esthetic self-perception among future dental practitioners.

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**Availability of Data:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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