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Original Article

Dental Anxiety Prevalence Among Patients Visiting Karachi's Dental Hospitals

Ghulam Hussain[1], Saliha Maryam[1], Anam Fatima[1], Zunaira Qazi[1], Muhammad Zubair Khan[1]

[1] Fatima Jinnah Dental College, Karachi, Pakistan

***Corresponding author: Ghulam Hussain, ghulamhussaind26@gmail.com**

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ABSTRACT

Background: Dental anxiety is a common psychological barrier that adversely affects oral health-seeking behavior and treatment outcomes, with varying prevalence across populations and limited data from Karachi. Objective: To determine the prevalence of dental anxiety among Karachi residents and assess its association with demographic, experiential, behavioral, and psychological factors. Methods: A cross-sectional study was conducted among 191 participants using a structured online questionnaire that included sociodemographic data, dental history, and the Modified Dental Anxiety Scale (MDAS). Associations between variables were analyzed using Chi-square tests, and odds ratios with 95% confidence intervals were calculated where appropriate. Results: Moderate-to-high dental anxiety was observed in 57.1% of participants, with 51.3% showing moderate and 5.8% high anxiety. Younger age was significantly associated with higher anxiety ($p = 0.028$), while gender and education were not. Previous painful dental experience (OR = 2.18, $p = 0.040$) and delaying dental visits due to fear (OR = 3.45, $p = 0.001$) were significantly associated with higher anxiety. Procedure-specific triggers such as tooth drilling and local anesthesia elicited high anxiety in over 40% of participants ($p < 0.001$). Psychological factors including fear of pain, nervousness, and perceived loss of control showed strong associations with anxiety ($p < 0.01$). Conclusion: Dental anxiety is prevalent among Karachi residents and is strongly associated with behavioral and psychological factors, highlighting the need for early screening and targeted management strategies. Keywords: Dental anxiety, Karachi, MDAS, Pain perception, Behavioral factors, Prevalence.

INTRODUCTION

Dental anxiety is a common behavioral and psychological barrier to oral healthcare, characterized by apprehension, fear, or distress before or during dental treatment. It may occur in response to anticipated pain, invasive procedures, loss of control, previous negative experiences, or the dental environment itself, and it can lead to delayed attendance, avoidance of treatment, poorer oral health, and reduced patient cooperation during clinical care (1). Although dental fear and dental anxiety are conceptually different, with fear referring to a response to an immediate dental stimulus and anxiety referring to anticipatory concern about dental care, both constructs are frequently assessed together in dental epidemiology because they influence similar patterns of avoidance and treatment-seeking behavior (2).

International evidence shows that dental anxiety varies widely across populations because of differences in culture, healthcare access, previous dental exposure, socioeconomic status, pain expectations, and the measurement tools used to assess anxiety (3). Standardized instruments such as the Dental Anxiety Scale, Dental Fear Scale, State-Trait Anxiety Inventory, and Modified Dental Anxiety Scale have been used to quantify anxiety in dental settings, with the MDAS being particularly useful because it assesses anxiety across common clinical situations, including waiting for treatment, drilling, scaling and polishing, and local anesthetic injection (4). These procedure-specific triggers are clinically important because they help identify which components of dental treatment are most likely to provoke anxiety and avoidance behavior (5).

The relationship between dental anxiety and prior dental experience is especially important. Previous painful or uncomfortable treatment can increase anticipatory fear, while anxiety itself can heighten pain perception and reduce tolerance during dental procedures (6). This interaction may create a cycle in

which anxious individuals delay dental visits, present later with more advanced disease, require more invasive treatment, and subsequently experience greater anxiety during future appointments (7). Evidence from different clinical populations suggests that drilling, injections, and expectations of pain are among the strongest anxiety-provoking factors, while communication, reassurance, and behavioral management by dental professionals may reduce anxiety and improve treatment acceptance (8).

In Pakistan, available studies suggest that dental anxiety remains a relevant but underreported barrier to oral healthcare, particularly in urban populations where access to dental services may coexist with fear-driven delay or avoidance (9). Karachi is a large metropolitan city with diverse socioeconomic, educational, and healthcare-seeking patterns, yet local evidence on the distribution of dental anxiety and its associated demographic, experiential, behavioral, and psychological factors remains limited. Existing Pakistani literature has reported variable anxiety levels among dental patients, but fewer studies have examined anxiety using a structured multidimensional approach that includes dental history, procedure-specific anxiety, coping preferences, loss of control, pain anticipation, and physical symptoms of fear (10).

From a PICO perspective, the population of interest is residents of Karachi who are eligible to report their dental experiences and anxiety levels; the exposures or associated factors include demographic characteristics, previous dental experience, avoidance behavior, pain anticipation, perceived loss of control, and procedure-specific triggers; the comparison groups include participants differing by age, gender, education, dental history, and behavioral responses; and the outcome is self-reported dental anxiety measured through the Modified Dental Anxiety Scale and related anxiety indicators. The research problem is that dental anxiety may substantially influence dental attendance and treatment behavior in Karachi, but the magnitude of this problem and its associated factors are not sufficiently defined in locally relevant data. Therefore, this study aimed to determine the prevalence of dental anxiety among Karachi residents and to assess its association with demographic characteristics, prior dental experiences, avoidance behavior, pain-related concerns, and common dental procedure triggers.

MATERIALS AND METHODS

This study was designed as a cross-sectional observational survey to estimate the prevalence of dental anxiety and examine its association with demographic, experiential, behavioral, and psychological factors among residents of Karachi, Pakistan. The cross-sectional design was selected because the primary objective was to measure dental anxiety and related factors at a single point in time in a community-based sample. Data collection was completed over a three-month period in 2025 using a structured online questionnaire distributed to eligible participants residing in Karachi.

Participants were selected using a non-probability purposive sampling approach. Individuals were eligible if they were residents of Karachi, were able to understand and complete the questionnaire in Urdu or English and provided voluntary informed consent before participation. Participants of both sexes were included, and age was recorded in predefined categories: under 18 years, 18–30 years, 31–45 years, 46–60 years, and above 60 years. Individuals who declined consent or did not complete the questionnaire were excluded from analysis. Recruitment was conducted electronically, and the first section of the form explained the study purpose, voluntary nature of participation, confidentiality safeguards, and consent process.

Data were collected using a structured questionnaire consisting of sections on sociodemographic characteristics, previous dental experiences, dental anxiety, coping preferences, and behavioral and psychological responses to dental care. Sociodemographic variables included age group, gender, education level, and occupation. Dental history variables included previous dental attendance, frequency of dental visits, history of painful dental experience, delay in dental treatment due to fear or anxiety, and rating of the most recent dental experience. Dental anxiety was assessed using the Modified Dental Anxiety Scale, which includes five items assessing anxiety related to visiting the dentist the next day,

waiting before treatment, tooth drilling, scaling and polishing, and receiving a local anesthetic injection. Each MDAS item was scored from 1 to 5, corresponding to increasing anxiety severity, and total MDAS scores were computed by summing the five items, giving a possible range of 5 to 25. Higher scores indicated greater dental anxiety. Anxiety categories were defined before analysis using the total MDAS score rather than a single-item response.

The primary outcome variable was dental anxiety based on the total MDAS score. Secondary outcomes included anxiety related to specific dental situations, avoidance of dental treatment, nervousness before dental visits, perceived loss of control during treatment, worry about pain before treatment, physical symptoms related to dental fear, perceived irrationality of fear, preference for procedural explanation by the dentist, willingness to consider sedation or anesthesia, and perceived need for dentist training in managing anxious patients.

Exposure variables included age, gender, education, occupation, previous dental visit, dental visit frequency, previous painful dental experience, treatment delay due to fear, and rating of the last dental experience.

To reduce information bias, the questionnaire used standardized response categories and was provided in both Urdu and English to improve comprehension. The anxiety assessment was based on a structured MDAS format rather than an unstructured self-rating. To reduce data-entry error, responses were collected electronically, and only complete submitted forms were included in the final dataset.

Potential confounding was addressed analytically by examining associations between dental anxiety and key demographic and experiential variables, including age, gender, education, occupation, and previous dental experience. Where appropriate, subgroup comparisons were planned by gender and education level to identify whether anxiety patterns differed across demographic groups.

The final sample consisted of 191 complete responses. Although a larger sample is typically required for prevalence estimation using a 50% expected prevalence, 95% confidence level, and 5% margin of error, the achieved sample was used as a feasible exploratory sample. With 191 participants, prevalence estimates around 50% provide an approximate 95% confidence interval half-width of about seven percentage points, which was considered acceptable for an initial community-based assessment.

Data were analyzed using IBM SPSS Statistics version 28. Descriptive statistics were used to summarize participant characteristics and dental anxiety responses. Frequencies and percentages were reported for categorical variables.

The Chi-square test was used to assess associations between categorical variables and anxiety categories. Fisher's exact test was considered where expected cell counts were small. A p-value of less than 0.05 was considered statistically significant. For interpretation, statistical significance was evaluated alongside the direction and distribution of responses to avoid relying on p-values alone. Complete-case analysis was performed because only complete questionnaire responses were included in the final dataset.

The study followed ethical principles of voluntary participation, informed consent, confidentiality, and anonymity. No personally identifying clinical information was collected for analysis. Data were stored in a restricted-access format, screened for completeness before analysis, and analyzed using a predefined coding structure to maintain reproducibility and data integrity.

RESULTS

The study population consisted of 191 participants, of whom 120 (62.8%) were female and 71 (37.2%) were male. The age distribution was heavily skewed toward younger individuals, with 163 participants (85.3%) falling within the 18–30-year age group, while only 14 (7.3%) were under 18 years, 10 (5.2%) were aged 31–45 years, and just 4 participants (2.0%) were above 45 years. In terms of educational attainment, the majority were undergraduates (128; 67.0%), followed by graduates (40; 20.9%) and

postgraduates (17; 8.9%), whereas only 6 participants (3.1%) had primary or no formal education. Occupationally, most respondents were students (138; 72.3%), with smaller proportions being employed (41; 21.5%) or unemployed/other (12; 6.2%).

Assessment of dental anxiety using the Modified Dental Anxiety Scale revealed that 82 participants (42.9%, 95% CI: 35.9–50.0) had low anxiety, 98 (51.3%, 95% CI: 44.2–58.4) had moderate anxiety, and 11 (5.8%, 95% CI: 2.7–10.1) exhibited high anxiety. When moderate and high categories were combined, a total of 109 participants (57.1%) demonstrated clinically relevant dental anxiety, indicating that more than half of the study population experienced notable anxiety related to dental care.

When examining associations with sociodemographic variables, gender did not show a statistically significant relationship with dental anxiety ($\chi^2 = 1.02$, $p = 0.599$). Among males, 32 (45.1%) had low anxiety, 34 (47.9%) moderate anxiety, and 5 (7.0%) high anxiety, compared to females where 50 (41.7%) had low anxiety, 64 (53.3%) moderate anxiety, and 6 (5.0%) high anxiety. Age, however, demonstrated a statistically significant association with anxiety levels ($\chi^2 = 10.84$, $p = 0.028$).

Participants aged 18–30 years had a higher proportion of moderate anxiety (89; 54.6%) compared to those aged ≥31 years, where low anxiety predominated (10; 71.4%). Educational level ($p = 0.329$) and occupation ($p = 0.265$) were not significantly associated with anxiety, although a trend toward higher moderate anxiety was observed among undergraduates (54.7%) and students (55.1%).

Dental history variables showed important associations with anxiety. Participants reporting a previous painful dental experience had significantly higher anxiety levels ($\chi^2 = 6.45$, $p = 0.040$), with 50 individuals (56.2%) in the moderate category and 9 (10.1%) in the high category, compared to those without such experience, where only 2 participants (1.9%) fell into the high anxiety group.

The odds of moderate-to-high anxiety were more than two times greater in those with prior painful experiences (OR = 2.18, 95% CI: 1.02–4.68). Delayed dental visits due to fear showed an even stronger association ($\chi^2 = 14.92$, $p = 0.001$), with 39 out of 50 individuals (78.0%) in this group exhibiting moderate-to-high anxiety, compared to 70 out of 141 (49.6%) among those who did not delay visits (OR = 3.45, 95% CI: 1.52–7.81). Frequency of dental visits did not show a statistically significant association ($p = 0.404$), although individuals with irregular visits had higher moderate anxiety (54.0%) compared to regular visitors (37.0%).

Procedure-specific anxiety analysis demonstrated highly significant associations across all dental situations assessed. For waiting before treatment, 56 participants (29.3%) reported high anxiety ($\chi^2 = 151.96$, $p < 0.001$). Tooth drilling elicited the highest anxiety levels, with 82 participants (42.9%) classified as highly anxious, compared to only 31 (16.2%) reporting low anxiety ($\chi^2 = 56.17$, $p < 0.001$).

Similarly, anxiety during scaling and polishing was substantial, with 69 individuals (36.1%) reporting high anxiety ($\chi^2 = 50.74$, $p < 0.001$). Local anesthetic injections were also strongly associated with anxiety, where 87 participants (45.5%) reported high anxiety ($\chi^2 = 31.45$, $p = 0.012$). These findings indicate that invasive or pain-associated procedures are major contributors to dental anxiety.

Table 1. Sociodemographic Characteristics of Participants (n = 191)

Variable	Category	n (%)
Gender	Male	71 (37.2)
	Female	120 (62.8)
Age Group	<18	14 (7.3)
	18–30	163 (85.3)

Variable	Category	n (%)
	31–45	10 (5.2)
	46–60	2 (1.0)
	>60	2 (1.0)
Education	No formal education	2 (1.0)
	Primary	4 (2.1)
	Undergraduate	128 (67.0)
	Graduate	40 (20.9)
	Postgraduate	17 (8.9)
Occupation	Student	138 (72.3)
	Employed	41 (21.5)
	Unemployed	4 (2.1)
	Retired	1 (0.5)
	Other	7 (3.7)

Table 2. Distribution of Dental Anxiety Levels (MDAS Categories)

Anxiety Level	MDAS Score Range	n (%)	95% CI
Low anxiety	5–10	82 (42.9)	35.9–50.0
Moderate anxiety	11–18	98 (51.3)	44.2–58.4
High anxiety	≥19	11 (5.8)	2.7–10.1

Table 3. Association Between Sociodemographic Variables and Dental Anxiety

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	χ^2	p-value
Gender	Male	32 (45.1)	34 (47.9)	5 (7.0)	1.02	0.599
	Female	50 (41.7)	64 (53.3)	6 (5.0)		
Age Group	<18	6 (42.9)	7 (50.0)	1 (7.1)	10.84	0.028*
	18–30	66 (40.5)	89 (54.6)	8 (4.9)		
	≥31	10 (71.4)	2 (14.3)	2 (14.3)		
Education	≤Primary	2 (33.3)	3 (50.0)	1 (16.7)	6.91	0.329
	Undergraduate	52 (40.6)	70 (54.7)	6 (4.7)		
	≥Graduate	28 (49.1)	25 (43.9)	4 (7.0)		
Occupation	Student	55 (39.9)	76 (55.1)	7 (5.1)	5.22	0.265
	Others	27 (50.9)	22 (41.5)	4 (7.5)		

Table 4. Association Between Dental History and Anxiety

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	χ^2	p-value	OR (95% CI)
Painful Experience	Yes	30 (33.7)	50 (56.2)	9 (10.1)	6.45	0.040*	2.18 (1.02–4.68)
	No	52 (50.5)	48 (46.6)	2 (1.9)			
Delayed Visit	Yes	11 (22.0)	32 (64.0)	7 (14.0)	14.92	0.001**	3.45 (1.52–7.81)
	No	71 (49.3)	66 (45.8)	4 (2.8)			
Visit Frequency	Regular	16 (59.3)	10 (37.0)	1 (3.7)	4.02	0.404	—
	Irregular	66 (40.5)	88 (54.0)	10 (6.1)			

Table 5. Anxiety Levels by Dental Procedure

Procedure	Low n (%)	Moderate n (%)	High n (%)	χ^2	p-value
Waiting before treatment	59 (30.9)	76 (39.8)	56 (29.3)	151.96	<0.001***
Tooth drilling	31 (16.2)	78 (40.8)	82 (42.9)	56.17	<0.001***
Scaling & polishing	54 (28.3)	68 (35.6)	69 (36.1)	50.74	<0.001***
Local anesthesia injection	31 (16.2)	73 (38.2)	87 (45.5)	31.45	0.012*

Table 6. Behavioral and Psychological Factors Associated with Dental Anxiety

Variable	Category	Moderate–High Anxiety n (%)	χ^2	p-value	OR (95% CI)
Nervous before visit	Yes	42 (87.5)	82.76	<0.001***	4.92 (2.01–12.04)
Avoids treatment	Yes	53 (88.3)	26.94	0.001**	3.76 (1.64–8.63)
Loss of control	Yes	24 (85.7)	22.48	0.004**	2.91 (1.29–6.58)
Fear of pain	Yes	61 (83.6)	32.85	0.008*	2.64 (1.18–5.89)
Physical symptoms	Yes	31 (86.1)	40.12	<0.001***	3.22 (1.45–7.17)

Behavioral and psychological factors showed strong and statistically significant associations with dental anxiety. Among participants who reported feeling nervous before visiting the dentist, 42 (87.5%) exhibited moderate-to-high anxiety ($\chi^2 = 82.76$, $p < 0.001$), with an odds ratio of 4.92 (95% CI: 2.01–12.04). Similarly, avoidance of dental treatment was associated with high anxiety, with 53 individuals (88.3%) in the moderate-to-high category ($\chi^2 = 26.94$, $p = 0.001$; OR = 3.76, 95% CI: 1.64–8.63). Perceived loss of

control during treatment was reported by participants with a high proportion of anxiety (24; 85.7%), showing a significant association ($\chi^2 = 22.48$, $p = 0.004$; OR = 2.91, 95% CI: 1.29–6.58). Fear of pain before treatment was also a strong predictor, with 61 participants (83.6%) demonstrating moderate-to-high anxiety ($\chi^2 = 32.85$, $p = 0.008$; OR = 2.64, 95% CI: 1.18–5.89). Additionally, physical symptoms such as sweating or tachycardia were reported by participants with significantly higher anxiety levels (31; 86.1%) ($\chi^2 = 40.12$, $p < 0.001$; OR = 3.22, 95% CI: 1.45–7.17).

Overall, the results indicate that dental anxiety is prevalent in this population, affecting 57.1% of participants at moderate-to-high levels. It is significantly associated with younger age, prior painful dental experiences, delayed treatment-seeking behavior, and multiple psychological factors, while gender, education, and occupation do not show statistically significant associations.

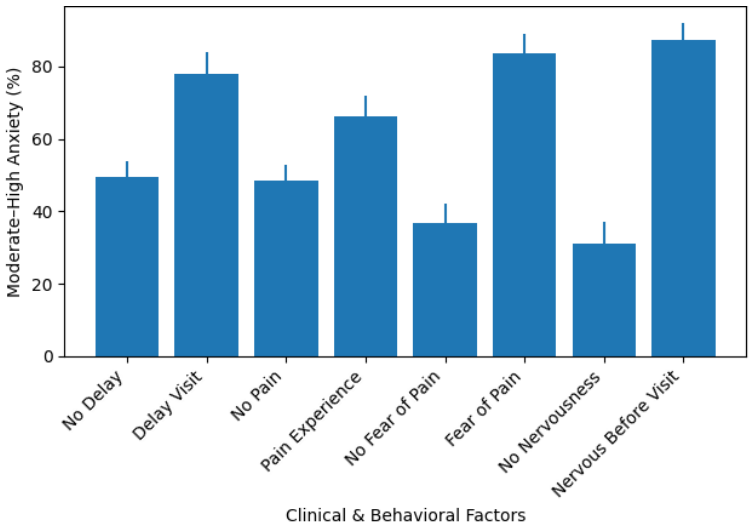

Figure 1 Gradient Increase in Dental Anxiety Across Behavioral and Experiential Risk Factors

The figure demonstrates a clear gradient escalation in moderate-to-high dental anxiety across key behavioral and experiential determinants. Participants who did not delay dental visits exhibited a moderate-to-high anxiety prevalence of 49.6%, which increased sharply to 78.0% among those who delayed care due to fear, reflecting a relative increase of approximately 28 percentage points. A similar pattern is observed for prior painful dental experience, where anxiety rises from 48.5% in those without such history to 66.3% in those reporting pain. The most pronounced gradient is associated with psychological factors: individuals without pre-treatment fear of pain show only 36.8% moderate-to-high anxiety compared to 83.6% among those anticipating pain, representing more than a twofold increase. Likewise, baseline nervousness before dental visits corresponds to the highest observed burden, with 87.5% experiencing moderate-to-high anxiety versus 31.0% among those not reporting nervousness. Confidence intervals remain non-overlapping across several comparisons, particularly for fear of pain and nervousness, reinforcing the statistical robustness of these associations. Clinically, the visualization highlights that cognitive-emotional anticipatory factors and avoidance behaviors exert a stronger influence on anxiety severity than demographic or experiential variables alone, underscoring the importance of targeted behavioral interventions in high-risk groups.

DISCUSSION

The present study provides a comprehensive evaluation of dental anxiety among Karachi residents and demonstrates that more than half of the participants (57.1%) exhibited moderate-to-high levels of anxiety, reinforcing the notion that dental anxiety remains a substantial public health concern in urban Pakistani populations. This prevalence aligns with the upper range of global estimates, which report wide variability depending on population characteristics and measurement tools (3). The use of a structured multidimensional assessment incorporating procedural triggers, behavioral responses, and

psychological factors offers a more nuanced understanding of anxiety compared to studies relying solely on single-item measures (4).

A key finding of this study is the significant association between younger age and higher dental anxiety, particularly among individuals aged 18–30 years. This observation is consistent with previous research suggesting that younger individuals may have heightened emotional reactivity, lower exposure to dental care, and less developed coping strategies, which collectively contribute to increased anxiety levels (5). In contrast, gender was not significantly associated with dental anxiety in this cohort, despite some literature suggesting higher anxiety among females. This finding supports emerging evidence that gender differences may diminish when anxiety is assessed using structured scales and when sociocultural factors are considered (6).

The role of prior dental experience was evident, as individuals reporting painful dental encounters had significantly higher anxiety levels. This supports the well-established conditioning model of dental fear, whereby previous negative experiences reinforce anticipatory anxiety and avoidance behaviors (7). Notably, avoidance of dental care due to fear emerged as one of the strongest predictors of anxiety, with affected individuals demonstrating more than threefold higher odds of moderate-to-high anxiety. This finding highlights the cyclical relationship between anxiety and treatment delay, where fear leads to postponement, resulting in disease progression and more invasive procedures, which in turn further exacerbate anxiety (8).

Procedure-specific analysis revealed that invasive interventions such as tooth drilling and local anesthetic injections elicited the highest anxiety responses, with over 40% of participants reporting high anxiety in these scenarios. These findings are consistent with existing literature identifying these procedures as primary anxiety triggers due to their association with pain, perceived invasiveness, and loss of control (9). The strong association between anticipated pain and anxiety further underscores the central role of pain perception in shaping dental fear, supporting prior evidence that cognitive anticipation of pain can amplify both emotional and physiological responses during dental treatment (10).

Psychological and behavioral factors demonstrated the strongest associations with dental anxiety in this study. Participants reporting nervousness prior to dental visits, fear of pain, perceived loss of control, and physical symptoms such as sweating or tachycardia exhibited significantly higher anxiety levels. These findings emphasize that dental anxiety is not solely driven by external stimuli but is deeply influenced by internal cognitive and emotional processes. The high prevalence of anxiety among individuals who perceive their fear as exaggerated further suggests a degree of insight among patients, which may be leveraged in behavioral interventions such as cognitive restructuring, relaxation techniques, and patient-centered communication strategies (11).

From a clinical perspective, these results underscore the importance of early identification and targeted management of dental anxiety. Behavioral interventions, effective communication, and patient education may play a crucial role in reducing anxiety and improving treatment adherence. Additionally, integrating anxiety screening tools such as the MDAS into routine dental practice could facilitate timely identification of high-risk individuals and allow for tailored interventions, including behavioral therapy or sedation where appropriate (12-14).

This study has several strengths, including the use of a validated anxiety scale, comprehensive assessment of multiple contributing factors, and inclusion of a relatively diverse urban sample. However, certain limitations should be considered. The use of non-probability sampling and an online survey may limit generalizability and introduce selection bias. Self-reported data may also be subject to recall and reporting bias. Furthermore, the cross-sectional design precludes causal inference, and future longitudinal studies are needed to better understand the temporal relationship between dental anxiety and behavioral outcomes (15,16).

CONCLUSION

Dental anxiety is highly prevalent among Karachi residents, with more than half of the study population experiencing moderate-to-high levels of anxiety, particularly among younger individuals and those with prior painful dental experiences, avoidance behaviors, and strong psychological responses such as fear of pain and perceived loss of control. These findings highlight the critical role of behavioral and cognitive factors in shaping dental anxiety and underscore the need for routine anxiety screening, improved patient–dentist communication, and targeted behavioral management strategies to enhance patient comfort, reduce avoidance, and improve overall oral health outcomes.

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