

A Comparative Study of Anxiety Levels among Patients Before and After Dental Treatment in Kerala

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Abstract: Dental anxiety is a common psychological barrier that can influence dental attendance, acceptance of treatment, and patient experience. This study was conducted to compare anxiety levels in patients before and after dental treatment and to determine factors associated with dental anxiety in Kerala. A total of 101 participants (33 males and 68 females) were assessed with the Modified Dental Anxiety Scale (MDAS) and procedure-specific anxiety responses. The mean pre-treatment MDAS score was 10.54 ± 4.22 , without significant gender difference (males: 11.58 ± 4.11 ; females: 10.04 ± 4.21 ; $p = 0.09$). However, females scored significantly higher on all five MDAS items with statistically significant differences ($p < 0.05$). Females also reported significantly higher anxiety in relation to expected treatment, waiting for treatment, tooth drilling, scaling and polishing and local anaesthesia. Current anxiety did not significantly differ by gender ($p = 0.056$). The clinical environment and duration of treatment were most often described as anxiety-related factors, whereas the prominent dentist-related factors were interpersonal skills and clinical ability of the dentist. These findings emphasise the necessity of early detection and tailored management of dental anxiety through effective communication, reassurance, pain control and a supportive clinical environment.

Keywords: Anxiety, Dental fear, Dental treatment, Pre-treatment, Post-treatment

1. Introduction

Dental anxiety is a common psychological condition common across the lifespan characterized by apprehension, fear, nervousness, or distress related to dental treatment or the dental care setting. It represents as a barrier to proper oral health behaviors and outcomes. It can occur in anticipation of a dental visit or sensory over-responsivity or during certain procedures, such as administration of local anesthesia, tooth preparation, scaling, extraction, or other invasive interventions (Chauca-Bajaña et al., 2025; Piechal et al., 2026; Stein Duker et al., 2022). Dental anxiety varies between individuals and may be influenced by previous dental experiences, anticipated pain, fear of dental equipment, perceived lack of control, treatment complexity, and interactions with dental professionals. Although mild anxiety is common, severe dental anxiety can significantly affect an individual's willingness to seek and complete dental care (Appukuttan, 2016; Winkler et al., 2023).

Dental anxiety has important implications for oral health because anxious individuals may delay or avoid dental appointments. Such avoidance can result in delayed diagnosis and treatment, progression of dental diseases, and the subsequent need for more complex or invasive procedures. The experience of extensive treatment may reinforce fear and anxiety, thereby creating a cycle of anxiety, avoidance, deterioration of oral health, and increased treatment needs (Armfield et al., 2007). Thus, dental anxiety is not only a psychological concern but also an important barrier to the utilization of oral health care services (Winkler et al., 2023).

Anticipation of pain, uncertainty about the procedure, fear of complications, and unfamiliarity with the clinical environment can contribute to increased anxiety before treatment. In addition, personal characteristics such as age,

sex, educational status, socioeconomic background, and previous dental experiences may influence anxiety levels (Chauca-Bajaña et al., 2025; Piechal et al., 2026). Therefore, assessment of anxiety before treatment provides useful information about the psychological state of patients and may assist dental professionals in identifying individuals who require additional reassurance or anxiety management interventions.

The experience of dental treatment may subsequently influence the level of anxiety experienced by patients. Apprehension may be reduced and confidence in future dental visits enhanced through effective communication, clear explanations of procedures, appropriate pain management, a comfortable and positive treatment experience, and a trusting relationship with the dental professional (Appukuttan, 2016). In contrast, pain, discomfort, poor communication, or an unpleasant treatment experience may maintain or increase dental anxiety. Therefore, evaluation at both pre- and post-treatment stages may provide a more comprehensive understanding of the influence of the dental treatment experience on anxiety within the same individual (Alsakr et al., 2023).

Although there is extensive research on the prevalence, etiology, and associated factors of dental anxiety, relatively less attention has been given to changes in anxiety levels following dental treatment, particularly within specific regional populations. Pre- and post-treatment assessment of anxiety may indicate whether the treatment experience is associated with a reduction in anxiety and may also identify patients who remain substantially anxious after completing treatment (Alsakr et al., 2023). Such evidence may assist clinicians in developing individualized approaches to anxiety management and improving patient comfort, satisfaction, treatment acceptance, and future dental attendance.

Dental patients in Kerala represent a wide range of demographic and socioeconomic backgrounds. Examining dental anxiety within this population may provide useful evidence for strengthening patient-centered dental services. A better dental experience may be achieved through appropriate communication and behavioral approaches, reassurance, and pain-management strategies tailored to patients' anxiety levels (Appukuttan, 2016). Evidence regarding the utilization of dental health services among adults in Kerala also highlights the importance of understanding factors influencing access to and use of dental care (Sidharthan et al., 2024). Hence, the present study was conducted to compare anxiety levels among patients before and after dental treatment in Kerala, evaluate changes in anxiety associated with the dental treatment experience, and generate evidence to support improved anxiety management and patient-centered dental care.

2. Materials and Methods

A cross-sectional study was conducted to examine dental anxiety among clinic patients seeking treatment. The study included 101 dental patients from dental clinics and hospitals in Kerala who met the eligibility criteria. The inclusion criteria were patients aged 18–65 years, who were willing to participate and provide consent for the study. The exclusion criteria were patients with any systemic illness, cognitive impairments, those taking anti-anxiety drugs, pregnant patients, and psychiatric patients.

A purposeful non-probability sampling technique was utilized. The Modified Dental Anxiety Scale (MDAS) and Structured Questionnaire were used. These are standardized tools with proven validity and reliability (Cronbach's alpha > 0.7 in previous research). After gaining ethical clearance from

the institutional ethics committee and permission from dental clinics and hospitals, the study was carried out with the patients' informed consent. Participants' responses were kept confidential and anonymous.

The degree of anxiety was used to grade answers on a scale of one to five. "Extremely anxious" received five points, while "not anxious" received one. The maximum score that could be obtained was 25 after adding the scores from each question. To distinguish between high-level and low-level anxiety, a cut-off score of 19 was established. High-level anxiety is defined as a MDAS score of 19 or more, while low-level anxiety is defined as a score of less than 19 (Caltabiano et al., 2018).

Statistical analysis

All statistical analyses were carried out using IBM SPSS version 27.0 (IBM, Armonk, NY, USA). Descriptive data were evaluated using frequency distributions. The Shapiro-Wilk test was used to determine whether the data were normal. Pre-treatment dental anxiety between genders was analysed using the independent-samples t-test. The chi-square test was used to determine the distribution of pre-treatment and post-treatment questionnaire responses by gender.

3. Results

The study included 101 participants: 33 (32.7%) males and 68 (67.3%) females. The mean age of participants was 30.87 ± 10.90 years, ranging from 17 to 70 years. The mean age of males was 33.67 ± 13.10 years, and that of females was 29.51 ± 9.48 years. The age distribution of the males and females was found to be statistically insignificant ($p=0.07$) (Table 1).

Table 1: Descriptive statistics of mean age of males and females

Age	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Z-test	p-value
Males	33 (32.7)	18	70	33.6667	2.27996	13.09739	1.81	0.07
Females	68 (67.3)	17	64	29.5147	1.1494	9.47816		
Total	101 (100)	17	70	30.8713	1.08506	10.90474		

$p>0.05$ statistically insignificant

The descriptive statistics of pretreatment dental anxiety assessed using the Modified Dental Anxiety Scale (MDAS) are presented in Table 2. Among the 101 participants, the overall mean pretreatment MDAS score was 10.54 ± 4.22 .

Males had a mean score of 11.58 ± 4.11 , while females had a mean score of 10.04 ± 4.21 . The difference in overall pretreatment MDAS scores between males and females was not statistically significant ($Z = 1.73$, $p = 0.09$).

Table 2: Descriptive statistics of pretreatment MDAS among males and females

Pretreatment MDAS	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Z-test	p-value
Males	33	5	21	11.5758	0.71514	4.10815	1.73	0.09
Females	68	5	25	10.0441	0.51083	4.2124		
Total	101	5	25	10.5446	0.41993	4.22025		

$p>0.05$ statistically insignificant

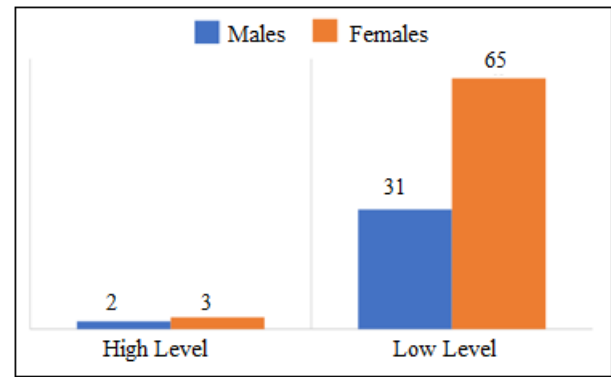
Table 3 presents the gender-wise comparison of individual MDAS items. Females demonstrated significantly higher mean scores than males across all five MDAS items. Significant differences were observed for Q1 (1.94 ± 0.89 vs. 1.39 ± 0.83 ; $Z = -2.98$, $p = 0.004$), Q2 (2.06 ± 0.99 vs. 1.27 ± 0.52 ; $Z = -4.30$, $p < 0.001$), Q3 (2.85 ± 1.28 vs. 1.79 ± 0.93 ; $Z = -4.24$, $p < 0.001$), Q4 (1.93 ± 0.98 vs. 1.33 ± 0.64 ; $Z =$

-3.20 , $p = 0.002$), and Q5 (3.04 ± 1.19 vs. 2.12 ± 1.19 ; $Z = -3.64$, $p < 0.001$).

Table 3: Comparison of pre-treatment dental anxiety between genders

MDAS	Gender	N	Score	Mean $\pm$ SD	Z-test	p-value
Q1	Males	33	46	1.39 $\pm$ 0.83	-2.98	0.004**
	Females	68	132	1.94 $\pm$ 0.89		
Q2	Males	33	42	1.27 $\pm$ 0.52	-4.3	<0.001**
	Females	68	140	2.06 $\pm$ 0.99		
Q3	Males	33	59	1.79 $\pm$ 0.93	-4.24	<0.001**
	Females	68	194	2.85 $\pm$ 1.28		
Q4	Males	33	44	1.33 $\pm$ 0.64	-3.2	0.002**
	Females	68	131	1.93 $\pm$ 0.98		
Q5	Males	33	70	2.12 $\pm$ 1.19	-3.64	<0.001**
	Females	68	207	3.04 $\pm$ 1.19		

**p<0.01 statistically highly significant

**Figure 1:** Comparison of high and low MDAS levels among males and female

The distribution of participants according to type of dental treatment (Table 4) showed that the most common treatment received was teeth cleaning (44.6%), followed by multiple treatments (24, 23.8%), filling (13, 12.9%), root canal treatment (9.9%), tooth removal (7, 6.9%), and tooth replacement (2, 2.0%). There was a significant association between sex and treatment type (Fisher's exact test = 11.327, p = 0.031).

Table 4: Comparison of treatment types among males of females

	Treatment type						Total	Fisher's exact test	p-value
	Teeth cleaning	RCT	Filling	Tooth removal	Tooth replacement	Multiple treatment			
Males	20 (60.6)	1 (3.0)	2 (6.1)	0 (0.0)	0 (0.0)	10 (30.3)	33 (32.7)	11.327	0.031*
Females	25 (36.8)	9 (13.2)	11 (16.2)	7 (10.3)	2 (2.9)	14 (36.4)	68 (67.3)		
Total	45 (44.6)	10 (9.9)	13 (12.9)	7 (6.9)	2 (2.0)	24 (23.8)	101 (100)		

*p<0.05 statistically significant

There was a significant difference between males and females in the reported level of anxiety (p = 0.001) for anticipated dental treatment (Table 5). Of the males, 24 (72.7%) stated that they were not anxious, compared to 22 (32.4%) females.

Mild anxiety was reported in 7 (21.2%) males and 34 (50.0%) females. Fair, very and extreme anxiety was reported by 1 (3.0%), 0 and 1 (3.0%) males, respectively, compared to 7 (10.3%), 4 (5.9%) and 1 (1.5%) females.

Table 5: Comparison of anxiety levels among males of females before appointment

	If you went to your dentist for treatment tomorrow, how would you feel?					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	24 (72.7)	7 (21.2)	1 (3.0)	0 (0.0)	1 (3.0)	33 (32.7)	15.512	0.001**
Females	22 (32.4)	34 (50.0)	7 (10.3)	4 (5.9)	1 (1.5)	68 (67.3)		
Total	46 (45.5)	41 (40.6)	8 (7.9)	4 (4.0)	2 (2.0)	101 (100)		

*p<0.05 statistically highly significant

There was also a significant gender-wise difference noted (Table 6) among the participants who were waiting for treatment in the dental clinic (p < 0.001). Most males (75.8%) reported no anxiety, while 21 (30.9%) females reported no

anxiety. Mild anxiety was reported by 7 (21.2%) of the males and 31 (45.6 %) of the females. The females reported fair, very and extreme anxiety more often: 8 (11.8%), 7 (10.3%) and 1 (1.5%), respectively.

Table 6: Comparison of anxiety levels among males of females while sitting in the waiting room before treatment

	If you were sitting in the waiting room (waiting for treatment), how would you feel?					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	25 (75.8)	7 (21.2)	1 (3.0)	0 (0.0)	0 (0.0)	33 (32.7)	18.165	0.000**
Females	21 (30.9)	31 (45.6)	8 (11.8)	7 (10.3)	1 (1.5)	68 (67.3)		
Total	46 (45.5)	38 (37.6)	9 (8.9)	7 (6.9)	1 (1.0)	101 (100)		

*p<0.01 statistically highly significant

Anxiety related to tooth drilling was also significantly different (Table 7) between males and females ($p = 0.001$). Of the males, 15 (45.5%) were not anxious, and 13 (39.4%) were slightly anxious. In comparison, 10 (14.7%) females reported

no anxiety, whereas 22 (32.4%) reported slight anxiety. Fair, very and extreme anxiety were reported by 13 (19.1%), 14 (20.6%) and 9 (13.2%) females, respectively.

Table 7: Comparison of anxiety levels among males of females before getting tooth drilled

	If you were about to have a tooth drilled, how would you feel?					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	15 (45.5)	13 (39.4)	2 (6.1)	3 (9.1)	0 (0.0)	33 (32.7)	16.917	0.001**
Females	10 (14.7)	22 (32.4)	13 (19.1)	14 (20.6)	9 (13.2)	68 (67.3)		
Total	25 (24.8)	35 (34.7)	15 (14.9)	17 (16.8)	9 (8.9)	101 (100)		

* $p < 0.01$ statistically highly significant

There was a significant difference between males and females for teeth scaling and polishing ($p = 0.001$). Most males, 25 (75.8%), reported no anxiety compared to 27 (39.7%) females. Slight anxiety was reported by 5 (15.2%) males and

26 (38.2%) females. 3 males (9.1%) and 14 females (20.5%) reported that they were fair to very anxious, and 1 female (1.5%) reported extreme anxiety (Table 8).

Table 8: Comparison of anxiety levels among males and females before getting the teeth scaled and polished

	If you were about to have your teeth scaled and polished, how would you feel?					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	25 (75.8)	5 (15.2)	3 (9.1)	0 (0.0)	0 (0.0)	33 (32.7)	12.055	0.009**
Females	27 (39.7)	26 (38.2)	9 (13.2)	5 (7.3)	1 (1.5)	68 (67.3)		
Total	52 (51.5)	31 (30.7)	12 (11.9)	5 (5.0)	1 (1.0)	101 (100)		

** $p < 0.01$ statistically highly significant

A significant difference ($p = 0.004$) was observed in the distribution of anxiety between males and females concerning the local anaesthesia (Table 9). Among males, 12 (36.4%) were non-anxious, and another 12 (36.4%) were mildly

anxious. In females 6 (8.8%) were not anxious and 18 (26.5%) were slightly anxious. 21 (30.9%) females reported fair anxiety, 13 (19.1%) females reported very anxious, and 10 (14.7%) females reported extreme anxiety.

Table 9: Comparison of anxiety levels among males and females before getting local anaesthesia done

	Local Anaesthesia					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	12 (36.4)	12 (36.4)	4 (12.1)	3 (9.1)	2 (6.1)	33 (32.7)	15.105	0.004**
Females	6 (8.8)	18 (26.5)	21 (30.9)	13 (19.1)	10 (14.7)	68 (67.3)		
Total	18 (17.8)	30 (29.7)	25 (24.8)	16 (15.8)	12 (11.9)	101 (100)		

* $p < 0.01$ statistically highly significant

No statistically significant difference was found between males and females on current anxiety levels ($p = 0.056$). Most participants were not anxious at the time of assessment, including 30 (90.9%) males and 44 (64.7%) females (Table

10). Three (9.1%) males and 15 (22.1%) females reported slight anxiety, whereas fairly anxious, very anxious and extremely anxious were reported only by females.

Table 10: Comparison of anxiety levels among males and females immediately after treatment

	How anxious are you feeling at the moment?					Total	Fisher's exact test	p-value
	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious			
Males	30 (90.9)	3 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	33 (32.7)	7.725	0.056
Females	44 (64.7)	15 (22.1)	6 (8.8)	2 (2.9)	1 (1.5)	68 (67.3)		
Total	74 (73.3)	18 (17.8)	6 (5.9)	2 (2.0)	1 (1.0)	101 (100)		

$p > 0.05$ statistically insignificant

The most common post-treatment factor (Table 11) was the clinical environment that affected anxiety during the appointment (41.6%), followed by the treatment duration (30.7%), not having specific factors (21.8%), and knowledge

of an additional appointment (5.9%). There was no significant association between sex and these factors ($\chi^2 = 1.063$, $p = 0.837$).

Table 11: Comparison of post-treatment factors among males and females that make you feel more or less anxious during the appointment

	What are the post-treatment factors, which make you more or less anxious during the appointment				Total	Fisher's exact test	p-value
	None	Clinical environment	Time length of treatment	Knowledge of additional appointment			
Males	9 (27.3)	13 (39.4)	9 (27.3)	2 (6.1)	33 (32.7)	1.063	0.837
Females	13 (19.1)	29 (42.6)	22 (32.3)	4 (5.9)	68 (67.3)		
Total	22 (21.8)	42 (41.6)	31 (30.7)	6 (5.9)	101 (100)		

$p > 0.05$ statistically insignificant

Factors related to the treating dentist (Table 12) were most commonly identified as interpersonal skills (33.7%) followed by clinical ability of the dentist (31.7%), presence of a senior

dentist (21.8%) and absence of any specific factor (12.9%). There was no statistical association between gender and dentist-related factors ($\chi^2 = 3.918$, $p = 0.270$).

Table 12: Comparison of factors related to treating dentist among males and females that make you feel more or less anxious during the appointment

	Factors related to the Treating dentist that make you more or less anxious during the appointment?				Total	Chi-square test	p-value
	None	Presence of Senior Dentist	Clinical ability of Dentist	Interpersonal skills of Dentist			
Males	6 (18.2)	10 (30.3)	8 (24.2)	9 (27.3)	33 (32.7)	3.918	0.270
Females	7 (10.3)	12 (17.6)	24 (35.3)	25 (36.8)	68 (67.3)		
Total	13 (12.9)	22 (21.8)	32 (31.7)	34 (33.7)	101 (100)		

$p > 0.05$ statistically insignificant

In terms of type of treatment received during the first dental appointment (Table 13), the most common treatment was periodontic treatment (40.6%) followed by operative treatment (23.8%), multiple treatments (10.9%), endodontic

treatment (9.9%), oral surgery (9.9%) and prosthodontic treatment (5.0%). There was no statistically significant association between sex and treatment category ($\chi^2 = 3.689$, $p = 0.617$).

Table 13: Comparison of the type of treatment received among the males and females during the first appointment

	The type of treatment received during their first appointment with the dentist.						Total	Fisher's exact test	p-value
	Operative	Periodontics	Endodontics	Oral surgery	Prosthodontics	Multiple treatments			
Males	7 (21.2)	13 (39.4)	2 (6.1)	4 (12.1)	1 (3.0)	6 (18.2)	33 (32.7)	3.689	0.617
Females	17 (25.0)	28 (41.2)	8 (11.8)	6 (8.8)	4 (5.9)	5 (7.3)	68 (67.3)		
Total	24 (23.8)	41 (40.6)	10 (9.9)	10 (9.9)	5 (5.0)	11 (10.9)	101 (100)		

$p > 0.05$ statistically insignificant

The analysis of comments from the participants' post-treatment revealed that the majority of the participants, 61 (60.4%), had no specific comment (Table 14). Of the reported comments, 19 (18.8%) participants reported that the treatment was time-consuming, and 10 (9.9%) were satisfied. Other responses included discomfort after treatment (2.0%), advance information about procedures being helpful (2.0%),

less anxious after treatment (1.0%), concern regarding pain after the effect of local anaesthesia subsided (1.0%), anxiety related to cavity preparation (1.0%), anxiety during tooth extraction (1.0%) and reporting no anxiety (1.0%). No statistically significant association was found between sex and post-treatment comments ($\chi^2 = 7.947$, $p = 0.663$).

Table 14: Comparison of the various other comments specified among the males and females after the treatment

	Other comments											Total	Fisher's exact test	p-value
	None	Discomfort after treatment	Satisfied	Giving a heads up on the procedures and what to expect is helpful.	Good	Less anxious after treatment	Time consuming	Tensed about pain after effect of local anesthetic is over	Most anxious treatment involves cavity preparation and it feels better if done completely under local anesthesia	Most anxious during tooth extraction	Not anxious			
Males	19 (57.6)	1 (3.0)	3 (9.1)	0 (0.0)	8 (24.2)	0 (0.0)	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.0)	33 (32.7)	7.947	0.663
Females	42 (61.8)	1 (1.5)	7 (10.3)	2 (2.9)	11 (16.2)	1 (1.5)	0 (0.0)	1 (1.5)	1 (1.5)	2 (2.9)	0 (0.0)	68 (67.3)		
Total	61 (60.4)	2 (2.0)	10 (9.9)	2 (2.0)	19 (18.8)	1 (1.0)	1 (1.0)	1 (1.0)	1 (1.0)	2 (2.0)	1 (1.0)	101 (100)		

$p > 0.05$ statistically insignificant

Overall, the findings suggest that females had significantly higher anxiety scores than males in relation to anticipated dental treatment, waiting for treatment, drilling of the teeth, scaling and polishing and anxiety related to local anaesthesia. However, the difference in anxiety levels was not statistically significant at the time of assessment. Clinical setting and length of treatment were the most frequently reported post-treatment factors influencing anxiety; dentist-related factors included interpersonal skills and the treating dentist's clinical proficiency.

4. Discussion

Dental anxiety is an important psychological factor affecting patients' perceptions regarding dental treatment, treatment acceptance, cooperation and subsequent dental attendance. The present study investigated anxiety in various dental situations and factors related to anxiety in the course of treatment. Females represented 67.3% of the study population and males 32.7% among the 101 participants. The mean age was 30.87 ± 10.90 years. The sex-related differences observed in the study should be interpreted considering the unequal representation of males and females. There was a statistically significant association between sex and type of dental treatment received ($p = 0.031$). The most frequently reported treatments were cleaning of teeth, followed by multiple treatments, filling, root canal treatment, extraction of teeth, and replacement of teeth. In the majority of treatment categories, most of the patients were female. The current findings cannot ascertain whether the type of treatment was responsible for the differences in anxiety found. Dental anxiety can be caused by the complexity of treatment, previous dental experiences, anticipated pain, and individual psychological characteristics. Previous studies have indicated that many demographic, experiential and treatment-related factors can influence dental anxiety, not one single factor (Appukuttan et al., 2015; Dhanapriyanka et al., 2024). In a large South Indian study, age, sex, previous dental experience and postponement of dental visits were significantly associated with dental anxiety (Appukuttan et al., 2015).

One of the most important findings of the present study was that females reported significantly more anxiety in several dental situations. Females were more anxious than males when thinking about a dental visit the next day ($p = 0.001$), waiting for treatment ($p < 0.001$), tooth drilling ($p = 0.001$), scaling and polishing ($p = 0.009$) and local anaesthesia ($p = 0.004$). These results are consistent with other Indian studies in general. A study carried out on adults in South India showed that females and younger participants had significantly higher dental anxiety scores (Appukuttan et al., 2015). Likewise, a study of young adults in Lucknow revealed that females experienced significantly higher anxiety than males in situations such as sitting in the waiting room, having a tooth drilled and receiving local anaesthesia (Singh et al., 2024).

The higher anxiety reported by females in the current study may be a reflection of the difference between perception and expression of fear and anxiety, but these differences should not be interpreted as a universal feature of female patients. Epidemiological studies have repeatedly reported an association between gender and dental anxiety, but individual experiences, cultural factors, previous dental experiences and expectations of pain also play an important role (Appukuttan et al., 2015; Singh et al., 2024). Therefore, sex should be viewed as a potential marker to identify patients who could benefit from a more detailed anxiety assessment rather than a determinant of anxiety itself.

Particular dental procedures appeared to be particularly anxiety-provoking. Sex was significantly different for tooth drilling, with 20.6% of females reporting being very anxious and 13.2% reporting extreme anxiety. In contrast, none of the males reported extreme anxiety. Moderate to extreme anxiety responses were significantly more likely to be associated with females for local anaesthesia. Our findings are in line with previous studies in India which reported tooth drilling and local anaesthetic injections as some of the major triggers of dental anxiety (Kumar et al., 2019). In a large sample of South Indians, extraction was reported to be an especially anxiety-provoking procedure, followed by drilling and administration

of local anaesthetic (Appukuttan et al., 2015). Similarly, a study of adults attending a dental institution in Central India reported high levels of anxiety associated with dental extraction. Injection of local anaesthetic and drilling were also identified as important sources of anxiety (Deogade & Suresan, 2016).

Another interesting point is the marked difference in the waiting period for treatment. Waiting room anxiety is anticipatory anxiety and can occur before the dental procedure has even begun. In the present study, 75.8% of males reported no anxiety while waiting compared to only 30.9% of females. This waiting period may enable patients to anticipate pain, recall previous negative experiences, or worry about the upcoming procedure. Armfield and Heaton stressed that identifying dental fear and understanding the reasons for it were key components in managing anxiety (Armfield & Heaton, 2013). Consequently, anxiety assessment should preferably begin before the patient enters the treatment phase.

Unlike the marked sex differences in some expected dental situations, the difference in present anxiety levels between males and females was not statistically significant ($p = 0.056$). Most of the participants stated that they were not anxious at the time of assessment. This finding suggests that anticipatory anxiety about particular procedures may not always be associated with high levels of immediate anxiety. Reassurance, communication, familiarity with the clinical environment, or completion of the procedure may also be related to lower immediate anxiety. However, the present data do not include a direct continuous pre-treatment versus post-treatment anxiety score, and it would be inappropriate to conclude that dental treatment in itself caused an anxiety reduction.

The most identified post-treatment factor that affected anxiety was the clinical environment (41.6%), followed by duration of treatment (30.7%). This finding underlines the importance of the wider dental context on the way in which patients experience dental treatment. A supportive and comfortable clinical setting may reduce uncertainty and anxiety, while long-term treatment or waiting may increase distress. Earlier studies have highlighted the significance of comprehending the causes and constituents of dental fear and using a structured patient-centred approach to management (Armfield & Heaton, 2013).

Dentist-related factors were also important factors. The most frequent factors were the interpersonal skills of the dentist (33.7%), followed by clinical ability (31.7%) and the presence of a senior dentist (21.8%). The correlation between sex and dentist-related factors was not statistically significant ($p = 0.270$), but the frequency of the interpersonal skills identified demonstrates the significance of dentist-patient communication. Effective communication, rapport, empathy and providing the patient with sufficient information can help to build trust and enhance the patient's sense of control. Armfield and Heaton found that good communication, rapport building and a phased approach to treatment were important components in the management of dental fear and anxiety (Armfield & Heaton, 2013).

The comments after treatment give additional insight into the experiences of the patients. Most of the participants (60.4%) did not specify a comment. Of those who did, the most common concern cited was treatment duration. Some participants reported being happy with the treatment. A few reported feeling less anxious after treatment, while others described feeling uncomfortable, concerned about pain after the local anaesthetic wore off, anxious about cavity preparation or anxious during the tooth extraction. These answers show that patients may feel different types of anxiety depending on the procedure and their expectations of treatment.

The findings are of considerable clinical interest. Local anaesthesia or environmental anxiety in the waiting room should be identified early, especially in patients showing marked apprehension to drilling. Providing information on the procedure, allowing the patient to express concerns, establishing a stop signal, providing adequate pain control and maintaining effective dentist-patient communication may improve the treatment experience. Systematic reviews have shown that behavioural and psychological interventions can reduce dental anxiety, but the strength of the evidence for the different interventions varies (Wide Boman et al., 2013; Lu et al., 2023). More recent evidence also supports matching anxiety-management strategies to the nature of anxiety, distinguishing acute anxiety during treatment from persistent dental anxiety and dental phobia (Steenen et al., 2024).

In general, the present study shows that dental anxiety depends on the dental situation and is significantly higher in females for several anticipated procedures. Tooth drilling, local anaesthesia and waiting for treatment were particularly anxiety-provoking situations. At the same time, the lack of a statistically significant difference between the sexes in current anxiety suggests that anticipatory anxiety and immediate anxiety may represent different components of the dental experience. Common factors identified as influencing anxiety were clinical environment, treatment duration and dentist-related interpersonal factors. The results underscore the importance of routinely identifying anxious patients and integrating effective communication, reassurance, pain-control measures and individualised behavioural approaches into routine dental practice.

5. Conclusion

The present study demonstrated that the degree of dental anxiety differs greatly depending on the dental situation and treatment procedure. Women reported significantly more anxiety than men in the anticipation of a dental visit, while waiting for treatment, during tooth drilling, scaling and polishing and local anaesthesia. However, no significant sex difference was found for current anxiety. The most frequently reported factors that influenced anxiety were the clinical environment and the duration of treatment, while dentist-related factors were the interpersonal skills and clinical ability of the treating dentist. Frequent evaluation of dental anxiety, good communication, reassurance, adequate pain control, and tailored anxiety management strategies may improve the comfort and experience of patients undergoing dental treatment.

6. Clinical Significance

The findings emphasise the need to routinely identify and manage dental anxiety as part of patient-centred dental care. Women patients and those facing procedures such as local anaesthesia and dental drilling may benefit from early assessment of anxiety, reassurance, clear explanation of procedures and effective pain control measures. Further improvements in patient comfort and trust may be possible by paying attention to the clinical environment, treatment duration, and the dentist's interpersonal skills with the patient. Simple anxiety-management strategies used in routine dental practice can improve treatment acceptance, co-operation and satisfaction and may reduce avoidance of dental care and promote regular dental attendance.

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