

THE IMPACT OF DENTAL ANXIETY ON PERIODONTAL DISEASE

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ABSTRACT

Aim of the study. Dental anxiety has an important role in the development of the periodontal disease. The aim of the current study is to investigate the relationship between dental anxiety and periodontal disease.

Material and methods: Data was collected between 2022 and 2023 using a self-reporting questionnaire created with the Google Forms platform. **Results:** High dental anxiety is correlated both with poor periodontal health ($p=2.11E-86$) and with strong psychosocial impact that dental aesthetics has on the quality of life ($p=4.46E-56$). These directly influence the frequency of visits to the dentist (P values: $4.89E-07$, $9.53E-17$ and $5.29E-07$), as well as the time elapsed since the last professional dental hygienization (P values: 0.0008 , $1.57E-17$ and $5.62E-10$). These three are also interconnected with general health (P values: 0.015 , $3.73E-09$ and $1.95E-05$) and stress (P values: $5.09E-10$, $1.64E-08$ and $9.87E-07$). In addition, BMI shows a direct relationship with dental anxiety ($p=0.020$), as well as with periodontal health, along with the quality of eating habits ($p=0.017$ and $p=0.001$). **Conclusion:** the results indicated that the severity of the periodontal disease is a result of dental anxiety, and vice versa. Therapy should be personalized for each individual following a comprehensive evaluation and should be based on the experience and expertise of the dentist, the intellectual capacity of the patient, age, cooperation, and clinical situation of the patient.

Key words: dental anxiety, questionnaire, periodontal disease, psychosocial impact

INTRODUCTION:

Periodontitis is a multifactorial chronic inflammatory disease that is associated with a dysbiotic biofilm and characterized by progressive destruction of the tooth-supporting apparatus, ultimately leading to tooth loss. Numerous diseases have been implicated in the development of periodontitis, including

cardiovascular diseases, coronary artery disease, diabetes, metabolic disorders, and rheumatic diseases. Dental plaque and inadequate oral hygiene are generally regarded as the foremost risk factors for periodontal disease [1]

Stress is another important factor in the etiology and maintenance of many

inflammatory diseases, including periodontal disease. Studies have demonstrated that periodontal disease is associated with a negative impact on the quality of life [2,3], as well as on nutrition [4], self-esteem, and overall well-being, which vary with the severity of periodontitis [3,5]. In addition to its social impact, periodontitis is strongly linked to systemic and inflammatory diseases [6]. The main psychophysiological symptoms of dental anxiety include perspiration (of the palms, forehead, upper lip), muscle tension, increased heart rate, restlessness, tachycardia, rigid posture, polyuria, strong startle response, facial flushing and xerostomia. Among the behavioral and emotional reactions to anxiety are hyperactivity, hurried walking, rapid and stuttered speech, panic, avoidance of interpersonal contact, poor memory, confusion, inattention, excessive worry, and emotional outbursts [7].

Dental anxiety can arise due to multiple factors, such as past negative or traumatic experiences (accidents, major injuries, severe pain, negative attitude or inappropriate remarks from the dentist), often starting in childhood. Another factor can be indirect learning from anxious family members or close individuals through the mechanism of social learning. Predisposing factors of dental anxiety include a low pain threshold as a genetic trait, as well as personality characteristics of the individual, such as inherent vulnerability to anxiety and temperament. Frightening portrayals of dentists in the media (movies, news), the vulnerable position of lying back in a dental chair, lack of control, predictability, and perception of danger all contribute to avoidance behavior and significant treatment delay. Anxiety can also be triggered by sensory factors, such as cold instruments, injections, drilling sounds, astringent odors

(eugenol, cut dentin), and high-frequency vibration sensations, all associated with the sight of white coats [7]. Furthermore, anxiety is associated with an exaggerated and prolonged perception of pain. Anxious patients tend to overestimate the intensity of pain and exhibit a heightened response to it. As a result, patients with dental anxiety may encounter difficulties in tolerating dental procedures, which can make it challenging for the dentist to perform an accurate examination and thorough oral hygiene [8].

MATERIAL AND METHODS:

The present study is a statistical study conducted in Romania and distributed through social media platforms such as WhatsApp, Facebook, and Reddit. Participants of all ages and socioeconomic groups were selected.

Inclusion criteria: >18 years old, ability to read and understand the Romanian language, and agreeing to participate in the study by checking the "Yes" box at the beginning. Data was collected between 2022 and 2023 using a self-reporting questionnaire created with the Google Forms platform. The questionnaire is divided into 9 sections, each interpreted separately with its own individual structure.

The first section focuses on the socio-demographic status of the participant, categorizing them into various groups based on age, gender, education level, place of residence, and marital status. The participants were divided into six age groups: Adolescent, Young Adult, Early Adult, Middle Adult, Late Adult and Elderly

Section 2: To measure the psychosocial impact of dental aesthetics, the PIDAQ (Psychosocial Impact of Dental Aesthetics Questionnaire) was used. Structurally, it consists of four domains:

aesthetic concern (2 items), psychological impact (4 items), social impact (6 items), and dental self-confidence (5 items). A 5-point Likert scale is utilized, ranging from 1 (no impact of dental aesthetics on quality of life) to 5 (maximum impact of dental aesthetics on quality of life) for each item. The response options are as follows: 1=Completely false; 2=Almost false; 3=Somewhat true; 4=True; 5=Completely true.

In **sections 3 and 4**, the modified Dental Fear Survey (DFS) (Kleinknecht's dental fear survey) was used to identify fears associated with specific dental treatment situations and stimuli and to measure the level of dental anxiety.

The two sections consist of 19 items with a 5-point scale, encompassing three dimensions: Avoidance of dental treatment and anticipatory anxiety with 7 items, questions 24 and 30-35, Physiological arousal during dental treatment with 5 items, questions 25-29, and Fear of specific dental stimuli or situations with 7 items, questions 36-42. The response options follow an evaluation scale ranging from "never" or "relaxed" (score = 1) to "always" or "very anxious" (score = 5). Avoidance scores can range from 7 to 35, physiological arousal scores from 5 to 25, and fear of specific stimuli/situations scores from 7 to 35. The total scores can range from 19 to 95, with higher scores indicating higher dental fear. The mean of each participant's response options will classify them into one of five categories: "Relaxed" for an average score below 1.49, "Anxious" for an average score between 1.5 and 2.49, "Tense" for an average score between 2.5 and 3.49, "Anxious" for an average score between 3.5 and 4.49, and "Very Anxious" for an average score above 4.5.

In **Section 5**, questions from the Dental Beliefs Survey (DBS) were used, but

the response format was simplified by participants checking the statements they consider to be true. This section aims to identify negative perceptions regarding the dentist associated with dental anxiety and low attendance for regular check-ups.

Section 6 serves as an informant about the participant's general health status, including relevant chronic conditions (diabetes, cardiovascular diseases, hypertension), their harmful habits (alcohol consumption and smoking) and the body mass index (BMI). In addition to these, the participant will self-assess their perceived level of stress on a scale from 1 to 5, the balance of their diet, and their overall self-rated health.

Section 7 focuses on the participant's periodontal health. This section relies on self-reporting, with the main indicators being the participant's oral hygiene habits, number of missing teeth, and subjective gingival symptoms.

Self-perceived periodontal disease was assessed using the validated periodontal disease surveillance questionnaire developed by the Centers for Disease Control and Prevention and the American Academy of Periodontology, represented by questions 57-64. To provide a comprehensive picture of periodontal status, additional questions were included regarding oral hygiene habits (frequency of tooth brushing, dental visits, and professional cleanings), degree of tooth loss and gingival recession, as well as bleeding and gingival pain.

Section 8 lists a series of popular myths in dentistry, most of which are misconceptions. This section aims to provide an indicative image of the participants' level of misinformation and the extent of the spread of these myths across various social classes.

The final section (**Section 9**) presents various strategies for managing dental anxiety, divided into three categories: methods related to the dental office environment, methods related to the attitude and organization of the medical staff during treatment, and relaxation and anxiety management techniques.

The data was processed using the Python programming language, utilizing the NumPy mathematical library and the Pandas library for data analysis and manipulation. Histograms and pie charts were created using Matplotlib and Google Forms.

RESULTS:

A total of 290 individuals completed the questionnaire. The majority of respondents were female (79%), totaling 229 participants. The highest proportion possessed a higher level of education (completed postgraduate university studies - 39.9%). Participant ages ranged from 18 to 73 years, with a mean age of 36.9 years. Among them, 87.2% resided in urban environments, and 55.2% were married.

In the context of this study, dental anxiety, psychosocial impact, and periodontal health did not exhibit significant variations based on gender, age, domicile, and marital status, as all P-values surpassed the reference alpha value (0.05).

Furthermore, the level of education did not directly influence periodontal health scores ($p=0.103$) and dental anxiety ($p=0.496$). However, it was found to be

correlated with the psychosocial impact of dental aesthetics ($p=0.015$). These two factors demonstrated an inverse proportionality, with individuals possessing higher education experiencing comparatively lesser impact on their lives.

Four of the subjects suffer from cardiovascular conditions, and 14 have diagnosed hypertension, numbers deemed insufficient for obtaining statistically relevant data. However, among the diabetic patients (10 subjects), deficient periodontal health was noted, particularly in those with poor glycemic control ($p=0.022$).

The quality of dietary habits, as well as the body mass index (BMI), correlate with periodontal health ($p=0.001$ and $p=0.017$, respectively). Furthermore, BMI exhibits a direct relationship with dental anxiety ($p=0.020$), indicating a direct proportionality between the two factors.

Diminished levels of overall health and heightened stress are correlated with heightened dental anxiety ($p=0.015$ and $p=5.09E-10$, respectively), deficient periodontal health ($p=3.73E-09$ and $p=1.64E-08$, respectively), and substantial psychosocial impact ($p=1.95E-05$ and $p=9.87E-07$, respectively) (**Table I,II**)

Stress and general health

Stress level	N (%)	Dental anxiety	Periodontal health	Psychosocial impact
1	24 (8.3%)	1,68	8.58	18.75
2	45 (15.5%)	1,89	8.11	25.31
3	110 (37.9%)	2,11	6.52	25.69
4	79 (27.2%)	2,44	5.08	28.89
5	32 (11%)	3,02	2.06	37.62
P value		5.09072E-10	1.64316E-08	9.87057E-07
Pearson correlation		0.354631956	-0.323954619	0.282733338
General health				
1	3 (1%)	2.05	-0.66	36.33
2	12 (4.1%)	2.17	5	34.33
3	82 (28.3%)	2.58	3.47	31.45
4	162 (55.9%)	2.09	6.96	25.59
5	31 (10.7%)	2.08	9.19	21.16
P value		0.015124616	3.73046E-09	1.95665E-05
Pearson correlation		-0.142544601	0.337457889	-0.247876827

Dental anxiety level

Dental anxiety level	N (%)	Periodontal health	Psychosocial impact
Relaxed	87 (30%)	8.79	22,36
Agitated	103 (35.51%)	6.15	25,60
Tense	62 (21.37%)	4.95	27,46
Anxious	34 (11.72%)	1.8	41,00
Very anxious	4 (1.37%)	-3	55,50
P value		2.11E-86	4.46E-56
Pearson correlation		-0.45136	-0.56088

Regarding dental office attendance, those who have never presented themselves, as well as those who only seek care when experiencing pain, exhibit significantly higher dental anxiety compared to those who attend the office occasionally for routine check-ups or

every six months (P value: 4.89E-07). Furthermore, the elapsed time since the last professional dental cleaning also appears to maintain a direct relationship with dental anxiety.(P value: 0.0008) **(Table III)**

Prophylactic habits

Last professional oral hygiene	N (%)	Dental anxiety	Periodontal health	Psychosocial impact
Never	24 (8.2%)	2,28	1	38.54
> 5 years	20 (6.9%)	2,91	0.15	40.35
1-5 years	66 (22.7%)	2,41	5.03	27.89
6 months -1year	89 (30.6%)	2,04	7.62	23.47
0-6 months	92 (31.6%)	2,12	7.90	24,59
P value		0.0008	1.57E-17	5.62E-10
Pearson corelation		-0.194	0.472	-0.353
Clinic attendance				
Never	5 (1.7%)	2,96	-0.6	41
Just when i have pain	40 (13.7%)	2,89	0.37	36.57
Occasionally, for a routine check-up.	160 (55%)	2,22	5.89	26.64
Every 6 months, for a routine check-up.	86 (29.6%)	1,90	9.43	23.18
P value		4.89E-07	9.53E-17	5.29E-07
Pearson correlation		-0.290	0.462	-0.289

A low frequency of brushing (occasional or never) is correlated with lower scores in periodontal health ($p=3.09E-05$) and psychosocial impact ($p=0.001$), but it does not influence the level of dental anxiety ($P=0.638$).

A total of 163 subjects (56%) declare using mouthwash 1-7 times per week. They exhibit superior periodontal health compared to non-users ($P<0.05$, $P=1.23E-07$), a lower level of dental anxiety ($P=0.017$), and reduced psychosocial impact ($p=0.004$). Similar findings were

observed for the 159 subjects (54.6%) who reported using dental floss 1-7 times per week (periodontal health: $p=3.09E-14$; psychosocial impact: $P=0.001$), except for the fact that the relationship between dental floss usage and dental anxiety is not significant ($P=0.062$).

There is a statistically significant correlation between the level of oral health perception and the level of dental anxiety, as well as between periodontal health and psychosocial impact ($P<0.05$) (**Table IV, V**)

Oral health

“Overall, how would you describe the health of your teeth and gums”	N (%)	Dental anxiety	Periodontal health	Psychosocial impact
Outstanding	5 (1.7%)	1.93	12	19.42
Very good	48 (16.5%)	1.82	11.04	26.79
Good	118 (40.5%)	1.93	7.92	36.64
Reasonable	83 (28.5%)	2.54	2.62	47.5
Deficient	37 (12.7%)	3.08	0.45	57.5
P value		6.15E-11	7.86E-38	7.91E-25
Pearson correlation		-0.371	0.661	-0.554

Gingival condition

„ Do you believe it is possible to have gingival conditions?”	Total number	Dental anxiety	Periodontal health	Psychosocial impact
Yes	134	2,48	2.78	31.78
No	103	2,01	9.80	21.65
Don't know	53	2,04	7.05	26.66
P value		0.0001	1.44E-28	5.24E-08
Pearson correlation		-0.219	0.589	-0.312

Table VI shows the number of subjects categorized under "Periodontitis" and "Gingivitis" based on response to the question "Do you believe it is possible to have gingival conditions?"

Number of subjects categorized under "Periodontitis" and "Gingivitis" based on response to the question "Do you believe it is possible to have gingival conditions?"

„ Do you believe it is possible to have gingival conditions??”	Periodontitis	Gingivitis
Yes	84 (62.68%)	19 (14.17%)
No	29 (28.15%)	4 (3.88%)
I do not know	21 (39.62%)	7 (13.20%)

A total of 76.86% of individuals who self-identified as having gingival issues were validated in their assessment.

The prevailing negative perceptions concerning dental practitioners that are linked to dental anxiety encompass (**Table VII**):

Negative Perceptions Regarding the Dental Practitioner Associated with Dental Anxiety

"They make me feel guilty about how I take care of my teeth."	66	22.8
"They don't provide enough information/explanations."	54	18.6
"I don't feel like I can ask for a break during the treatment to collect myself if needed"	45	15.5
"They are efficient, but they rush, and I feel hurried."	42	14.5
"I don't feel comfortable asking questions, and I believe the doctor would be bothered by it	40	13.8

Regarding the relationship between general health and oral health:

- 114 subjects (40%) do not believe that poor general health (chronic diseases, weakened immunity) can lead to dental issues.
- 67 (23.1%) do not think that poor oral health can contribute to overall health deterioration.
- 55 (19%) are not of the opinion that detrimental habits (dietary habits, smoking) affect oral health.
- 24 (8.3%) consider all of the above statements to be true.

Table VIII presents the most popular myths in dentistry:

The Most Popular Myths in Dentistry

- Dental treatments are painful.	78	26.90 %
Scaling damages enamel and causes dental sensitivity.	47	16.20 %
Removal of the calculus causes tooth mobility	23	7.90%
Using dental floss is unnecessary if brushing is done correctly.	19	6.60%
I don't need to see the dentist if my teeth do not hurt	16	5.50%

Table IX describes the most selected strategies for dental anxiety management:

Table IX. Most Selected Strategies for Dental Anxiety Management

Pleasant and relaxing music in the background.	23 2	80%
Patient education regarding all stages of treatment before its commencement	22 5	77.60%

Clear, honest, and direct responses from the dentist.	19 9	68.60%
A more caring and positive attitude from the dentist.	19 0	65.50%
Ambient scents to mask dental odors (e.g., lavender).	12 4	42.8%
Dedicated time for discussing my fears.	12 4	42.70%
Relaxation techniques involving breathing and muscle relaxation before treatment.	12 4	42.80%

DISCUSSIONS:

Although bacterial pathogens are necessary to initiate periodontal disease, their presence alone is not sufficient to cause tissue destruction. The etiological importance of biological and behavioral risk factors for periodontal diseases, such as smoking, alcohol consumption, socioeconomic status, advanced age, oral hygiene, and systemic conditions like diabetes mellitus, has already been established [9]

In the present study, the percentage of subjects with high and very high levels of dental anxiety was 11.74% and 1.37% respectively. Similar findings were found in a study conducted by Humphris et al. [10], which reported a percentage of high dental anxiety of 11%. Other similar studies that selected participants from dental clinic attendees had a lower percentage: Prathima et al. [11] with 4.4% and Locker et al. [12] with 4.4% high dental anxiety. In the current study, the prevalence of dental anxiety was higher in women than in men, but not significantly. However, in the literature [13], this difference between the two sexes has been demonstrated. For example, in the Chinese

population, Liu et al. [14] stated that women were considered more anxious than men. The difference in dental anxiety between women and men could be attributed to personality and psychological state, as women are more prone to expressing their fears than men [15], who may be more emotionally stoic and hide their anxieties [16].

Regarding other potential factors influencing periodontal disease, there is evidence that chronic stress, depression, and anxiety can negatively impact the progression of the disease [17]. In the present study, the level of stress reported by the subjects was directly proportional to dental anxiety and inversely proportional to self-reported periodontal health. Peruzzo et al. [18] conducted a systematic review of evidence on the influence of stress and psychological factors on periodontal disease, and the majority (57%) reported a positive relationship between stress/psychological factors and periodontal disease.

Self-reporting questionnaires have been developed and validated in various populations as useful tools for estimating the prevalence of periodontitis in

epidemiological studies. Studies have shown that dental anxiety is associated with self-reported poor oral health and clinically associated with more dental caries and missing teeth, fewer filled teeth, and poorer periodontal health [19], which may explain the higher prevalence observed among participants with higher dental anxiety in this study.

Subjects with lower periodontal health scores had significantly higher dental anxiety scores compared to those with self-reported good health. These findings were consistent with the studies by Yildirim [20] and Talo Yildirim et al. [21], which reported that periodontal status was better in participants with low to moderate dental fear compared to those with high dental fear scores.

On the other hand, Sezer et al. [22] and Ay et al. [23] did not find any statistically significant difference in dental anxiety levels in relation to periodontal status. The contradictory results between studies may be explained by the fact that the severity of periodontal disease among the subjects differed across studies.

Antilla and colleagues [24] found lower rates of tooth brushing and dental visits among anxious adults, even though these adults were aware of their need for dental treatment. Dental anxiety was associated with lower tooth brushing frequency and higher sugar consumption [25]. In the present study, individuals who were found to avoid dental visits had higher dental anxiety scores. However, no direct association was determined between oral hygiene frequency and dental anxiety. It is possible that the results may be biased by a certain sense of shame among the subjects.

In the present study, an inverse

proportional relationship between periodontal health and weight was observed, with participants classified in obesity categories having significantly lower periodontal health scores. Various cross-sectional and case-control studies have found a strong association between periodontal disease and obesity [26].

Several reports have proposed multiple mechanisms through which obesity can directly affect periodontal tissue. Obesity affects host immunity [27], and the relationship between adipose tissue and the immune system is believed to be linked to the secretion of numerous adipokines, including leptin, whose amount is correlated with adipose mass [28]. It has been demonstrated that human leptin is present in healthy and mildly inflamed gingiva, and its concentration decreases with increasing probing depth [29].

Linden et al. [30] investigated whether there is an association between obesity and periodontitis in a homogeneous group of male West European patients aged 60-70 years and showed that obesity was associated with a higher percentage of subjects with probing depth >5 mm and periodontitis.

Various self-report questionnaires with multiple and single items are available for assessing anxious and phobic patients. Some popularly used scales include Corah's Dental Anxiety Scale (CDAS) [31], Modified Dental Anxiety Scale (MDAS) [32], and Kleinknecht's Dental Fear Survey (DFS) [33]. These scales have been found to be reliable and valid in multiple languages [34, 35]. However, none of these existing instruments has been considered as a gold standard, as each has its own limitations.

The etiology of dental anxiety is multifactorial, and therefore, there is no one-size-fits-all therapy for its management. Adequate patient assessment and identification of the source and level of anxiety can enable the dentist to determine an appropriate treatment plan. Anxiety can be triggered even by the most harmless situations, such as meeting the receptionist to schedule an appointment or the ambiance of the dental clinic, so it is essential that every aspect of the dental office is accommodating. Additionally, it is important not to keep anxious patients waiting for too long [36].

The dental office atmosphere can be calm and non-threatening by playing soft music and avoiding bright lights. In a study conducted by Bare and Dundes [37], individuals preferred a slightly cooler dental office environment.

Aromatherapy is an alternative relaxation approach that involves the use of essential oils from aromatic plants to produce positive effects through the sense of smell. Inhaling pleasant scents, such as essential oils, has an anxiolytic effect and improves mood. Studies have shown that it is more effective in managing moderate anxiety than severe anxiety [38].

Techniques such as muscle relaxation and hypnotherapy can be extremely useful in cases of advanced anxiety. They can be used to induce relaxation as an adjunct to inhalation sedation, alleviate pain, anxiety, and stress, as well as reduce severe gag reflex. However, dentists require special training before they can practice these techniques [39]. Highly anxious or phobic patients most often require combined management approaches. However, offering the patient

a brief pause during a stressful procedure can be an effective option before considering more advanced techniques.

Limitationf of the study: Firstly, there is a potential for underreporting within self-reported surveys as participants may be subject to social biases. Moreover, the study was conducted on a limited and insufficiently diversified population, primarily due to a high percentage of highly educated women, which may not be representative of Romanian society. Multicenter studies with a larger number of participants from more diverse social groups are needed to reveal the prevalence and severity of dental anxiety in the Romanian population.

CONCLUSIONS:

1. Within the limitations of this study, the results indicated that the severity of periodontal disease may be a result of dental anxiety, and vice versa.
2. Therapy should be personalized for each individual following a comprehensive evaluation and should be based on the experience and expertise of the dentist, the intellectual capacity of the patient, age, cooperation, and clinical situation of the patient.
3. Efficient management of patient experiences will reduce the emotional, cognitive, behavioral, and physiological dimensions of dental anxiety, motivating them to seek dental care in the future, which should be the primary goal of the dental team.

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