


Dental pain and oral health-related quality of life in individuals with severe dental anxiety

Lisa Svensson , Magnus Hakeberg and Ulla Wide

Department of Behavioral and Community Dentistry, Institute of Odontology, The Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

ABSTRACT

Objectives: To analyze the prevalence and level of dental pain among adult individuals with severe dental anxiety (DA), and the association between dental pain and oral health-related quality of life (OHRQoL).
Methods: The study was based on 170 adult individuals with DA referred to a specialized DA clinic. All patients answered a questionnaire including questions on DA (DAS, DFS), OHRQoL (OIDP) and dental pain. An adapted clinical examination and a panoramic radiograph revealed the present oral status.
Results: The prevalence of dental pain was high (77.6%) and among those reporting pain the intensity was high (49.0–61.0 on a VAS). One or more problems during the last 6 months with the mouth or teeth affecting the individual's daily activities were reported in 85.3% of the participants. Individuals who reported dental pain had lower OHRQoL compared with those who did not report dental pain ($p < .001$). Dental pain and number of decayed teeth were associated with the probability of poor OHRQoL (OR = 8.2, $p < .001$, OR = 3.8, $p = .008$).
Conclusion: This study revealed a high prevalence and a high level of dental pain among adult individuals with severe DA. Having dental pain was associated with poor OHRQoL.

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Introduction

Dental anxiety (DA) is a common health problem that affects a significant part of the population, both on an individual and community level. The prevalence of severe DA in the adult population of Sweden has recently been reported to be 4.7% [1], but in different countries and cultures, the prevalence has been reported to vary from 4 to 20% [2–7]. It is well-documented that DA is associated with poor oral health, functional impairment and avoidance of dental care [5,8–10], which are factors associated with three critical aspects of oral health-related quality of life (OHRQoL): pain, appearance and function. The association between DA and impaired OHRQoL has been reported in recent years [11–14], and the degree of impairment is related to the extent of the dental anxiety [15].



Dental pain is characterized as pain originating from the teeth and supporting tissues as a result from disease or injury to the teeth [16]. Locker et al. [17,18] found in an epidemiological study from 1987, that the most common dental and facial pain was pain in teeth exposed to hot and cold fluids (28.8%), while toothache was reported by 14.1% of the study participants. Around 50% of those reporting dental pain judged their pain intensity as moderately severe or severe. Lipton et al. [19] found that almost 22% of the general population in USA had experienced orofacial pain in the

previous 6 months. The most common type of orofacial pain was dental pain, which was reported in 12.2%. The prevalence of head, neck and mouth pain in Sweden has been estimated to be 14.6% among the general population; however, dental pain was not specified [20]. Dental pain is reported to affect everyday life. Adulyanon et al. [21] reported toothache as the major oral causative condition for almost all aspects of impairment of daily performance.

Several studies have reported of treatment-related dental pain i.e. procedural pain and they have shown that DA has a consistent impact on pain during dental treatment [22]. Less is known about the distribution of dental pain and its impact on everyday life among patients with severe DA and the association to OHRQoL.

Treatment of individuals with severe DA is a challenge for the dental profession with regard to the combination of severe anxiety triggered in the dental setting, poor oral health and the symptoms often associated with avoidance of dental care. Thus, a better understanding of how dental pain may be associated with everyday life and OHRQoL in individuals with DA is needed to improve the quality of dental care.

The aim of the study was to analyze the prevalence and level of dental pain among adult individuals with severe dental anxiety, and the association between dental pain and OHRQoL.

CONTACT Lisa Svensson  lisa.svensson@odontologi.gu.se  Department of Behavioral and Community Dentistry, Institute of Odontology, The Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

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Material and methods

Design and study population

This cross-sectional study was based on a consecutive sample of 219 adult patients referred for severe DA to the Clinic of Oral Medicine, the Public Dental Service, Gothenburg, Sweden. The study started in June 2012 and continued until February 2014. All patients meeting the inclusion criteria were asked to participate during the clinic's standard intake procedure. The inclusion criteria were age ≥ 20 years, suffering from severe DA (Dental Anxiety Scale score ≥ 13 or a Dental Fear Survey score ≥ 60), and refusal to undergo conventional dental treatment. The exclusion criteria were diagnosis of severe mental disorders (e.g. neuropsychiatric disorders, severe depression, psychosis, schizophrenia) and not speaking or understanding Swedish. Thirty-five individuals did not want to participate and another 14 individuals were excluded. The final study sample included 170 individuals, 110 (64.7%) women and 60 (35.3%) men, with a mean age of 42 years. The study was approved by the Regional Ethics Committee in Gothenburg (Reg. no. 395-10), and the participants provided informed consent.

Procedure

According to the clinic's standard intake procedure, all patients filled in questionnaires including background variables (age, gender, socioeconomic status, dental history) and DA status at their first appointment. If the patient agreed to participate, a dentist administered an additional questionnaire as a structured interview, including OHRQoL, self-rated oral and general health, and dental pain. Clinical variables were registered at the second and third visit to the clinic (panoramic radiography and an adapted clinical examination). Three dentists took part in the sampling procedure. Consensus was performed as to calibrate the examiners according to the variables from the adapted clinical examination and the panoramic radiograph to reduce the likelihood of diagnostic errors.

Measures

Dental anxiety (DA) was captured by the Dental Fear Survey (DFS) and the Dental Anxiety Scale (DAS). The DFS [23] is a self-report questionnaire consisting of 20 items covering anticipation anxiety, avoidance, physiological arousal and fear of specific stimuli. Each item is scored from one (no anxiety) to five (high intensity of anxiety), giving a total sum range between 20 and 100, with a higher score indicating more DA. A total score ≥ 60 is often used to indicate DA [24]. The DAS [25] is a self-report questionnaire that consists of four questions describing imagined dental situations. Each item is scored from one (no anxiety) to five (extreme anxiety). The sum of the test ranges from 4 (no anxiety) to 20 (extreme anxiety). A DAS score ≥ 13 indicates severe DA [26].

Dental pain experience data were collected using a questionnaire including eight questions about pain in different oro-facial regions. The questionnaire was completed as a

structured interview administered by the dentist. Three questions were used in the present study: Did you have toothache during the past month? Did you feel pain when eating or drinking hot and/or cold food/beverages during the past month? Did you feel pain when chewing food during the past month? The response options were 'yes' or 'no'. If the answer was yes, a further question about pain intensity was asked. Pain intensity was measured on a 100mm VAS graded from zero (no pain) to 100 (extreme pain). A dichotomous dental pain index was constructed, where individuals with an affirmative answer to at least one of the three pain questions were categorized as having dental pain. This dental pain index was used in further analyses.

OHRQoL was measured using the Oral Impacts on Daily Performance index (OIDP) [27]. The OIDP is a psychometric test including nine items that measure impairment in activities during the last 6 months due to problems with the mouth or teeth, in three domains: physical performance (eating and enjoying food, speaking and pronouncing words, going shopping or visiting someone, cleaning of teeth), psychological performance (sleeping and relaxing, smiling/laughing and showing your teeth without getting embarrassed, keeping your emotional state/not getting upset more easily than usual) and social performance (working/keeping up with your social life, enjoying contact with other people). Patients who answered yes to any item were asked about the frequency and severity using a five-point scale. The frequency score measures frequency (periodic pattern) and duration (period): 0 = never affected, 0 days; 1 = less than once a month, or up to 5 days in total; 2 = once or twice a month, or up to 15 days in total; 3 = once or twice a week, or up to 30 days in total; 4 = 3–4 times a week, or up to 3 months in total; and 5 = every or nearly every day, or over 3 months in total. Severity scores measure the impact of each item as an indication of how much trouble it causes for daily living: 0 = no impact, 1 = very minor impact, 2 = fairly minor impact, 3 = moderate impact, 4 = fairly severe impact, and 5 = very severe impact. The OIDP summary index score uses both frequency and severity scores to quantify the impact on each activity, and is calculated by multiplying the frequency score with the severity score for all activities, divided by the number of maximum possible score (9 activities \times 5 frequency score \times 5 severity score = 225) and multiplying with 100 to give a percentage score [27]. A dummy variable is constructed from summing up the OIDP prevalence score (0–9) and dichotomising this into 0 = no daily activity affected, and 1 = at least one daily activity affected. The OIDP prevalence score has been used previously [13,28].

Self-rated oral and general health were measured using single questions: 'How do you rate your overall oral health?' and 'How do you rate your overall general health?' with the answers given on a 100mm VAS, with the end points of 0 = worst possible, and 100 = best possible.

Socioeconomic status (SES) was captured by a question about the highest level of education achieved with the response options: elementary school, high school, and university.

Clinical status was registered as the number of missing teeth, root remnants, decayed, filled and root-filled teeth,

and the number of teeth with apical periodontitis. The clinical variables were registered as a number between 0 and 28 (third molars not counted) at the clinical examination and/or from a panoramic radiography. The number of decayed teeth were dichotomized into 0 (≤ 1) and 1 (> 1) and the number of missing teeth, root-filled teeth, and teeth with apical periodontitis were dichotomized into 0 (0) and 1 (≥ 1) to be used in further analysis.

Statistics

The statistical analysis consisted of descriptive statistics [means, medians, proportions, standard deviations (SD), 95% confidence intervals (CI)], and bivariate and multivariable analyses. Bivariate associations were tested for statistical significance using the *t*-test between continuous variables that showed a normal distribution, and the Mann–Whitney U-test and Spearman's correlations for ordinal variables and for variables with skewed distributions. Chi-square and logistic regression were used to analyze categorical variables. Variables that were significant in the bivariate analysis were included in the multivariable logistic regression analysis to investigate independent effects beyond the dental pain variable. Multivariable logistic regression was applied using the OIDP (dichotomized) as the dependent variable.

Results

Study group characteristics

Age, gender, DA, self-rated oral- and general health and clinical variables for the total study group and according to the dental pain index are presented in Table 1. Individuals reporting dental pain had higher level of dental anxiety according to DFS ($p = .030$) and poorer self-rated oral health ($p = .008$) than individuals not reporting dental pain.

Dental pain prevalence and intensity

The prevalence of dental pain (according to the index variable) in the total sample was high (77.6%), as shown in Table 2. Thirty-one individuals (18.2%) answered 'Yes, I have pain', to each of the three pain questions included in the dental pain index. Among those who reported pain, the pain intensity was high, with mean scores varying from 49.0 (SD 23.4, 'toothache when eating something hot/cold') to 61.0 (SD 27.7, 'toothache') for the total group.

Prevalence, frequency and severity of oral impact on daily performance and the relation to dental pain

The majority of the participants reported negative consequences on their everyday life activities due to their oral health problems: 85.3% ($n = 145$) reported negative

Table 1. Study sample characteristics according to dental pain and for the total group.

Characteristics	No dental pain ($n = 38$)	Dental pain ($n = 132$)	<i>p</i> value	Total ($n = 170$)
Age, M (SD)	44.1 (14.3)	41.4 (12.3)	NS ^a	42.0 (12.8)
Gender, % (<i>n</i>)			NS ^b	
Men	44.7 (17)	32.6 (43)		35.3 (60)
Women	55.3 (21)	67.4 (89)		64.7 (110)
Education, % (<i>n</i>)			NS ^b	
Elementary school	18.4 (7)	30.3 (44)		27.6 (47)
High school	47.4 (18)	45.5 (60)		45.9 (78)
University	31.6 (12)	23.5 (31)		25.3 (43)
Dental anxiety, M (SD)				
DAS	17.2 (2.2)	17.8 (2.0)	NS ^a	17.6 (2.1)
DFS	75.7 (12.0)	80.5 (11.8)	0.030 ^a	79.4 (12.0)
Self-rated oral health, M (SD)	31.1 (24.2)	19.8 (20.8)	0.008 ^c	22.3 (22.0)
Self-rated general health, M (SD)	69.3 (21.2)	67.4 (21.4)	NS ^c	67.9 (21.3)
Clinical variables, M (SD) Md				
Missing teeth	3.6 (4.9) 3.0	2.9 (4.0) 1.0	NS ^c	3.0 (4.2) 1.0
Root remnants	2.0 (3.2) 0.0	1.6 (3.5) 0.0	NS ^c	1.7 (3.4) 0.0
Decayed teeth	5.2 (6.3) 3.0	6.6 (6.6) 4.0	NS ^c	6.25 (6.6) 3.5
Filled teeth	7.1 (4.9) 7.5	7.2 (5.3) 6.0	NS ^c	7.1 (5.2) 6.0
Root-filled teeth	1.6 (2.5) 0.5	1.0 (1.5) 0.0	NS ^c	1.1 (1.8) 0.0
Apical periodontitis	1.9 (2.9) 0.0	2.0 (2.8) 1.0	NS ^c	2.0 (2.8) 1.0

^a*t*-test,

^bChi-squared test;

^cMann–Whitney U-test.

M: mean; SD: standard deviation; Md: median.

Table 2. Dental pain prevalence and pain intensity (100 mm VAS) according to gender and the total group.

	Prevalence % (<i>n</i>)			Intensity mean (SD)		
	Men, $n = 60$	Women, $n = 110$	Total, $n = 170$	Men	Women	Total
Toothache	40.0 (24)	43.6 (48)	42.4 (72)	63.2 (27.0)	59.8 (28.3)	61.0 (27.7)
Toothache when eating hot/cold food	46.7 (28)	56.4 (62)	52.9 (90)	45.5 (24.4)	50.6 (23.0)	49.0 (23.4)
Toothache when chewing	45.0 (27)	50.9 (56)	48.8 (83)	51.2 (28.0)	52.7 (27.2)	52.2 (27.3)
Dental pain index	71.7 (43)	80.9 (89)	77.6 (132)	–	–	–

No statistically significant differences between the groups.

consequences on one activity, and 70.6% ($n = 120$) on two or more activities. Individuals reporting one or more negative consequences were older [42.8 years (SD 12.3) versus 37.1 years (SD 14.9), $p = .024$], had more decayed teeth [6.8 (SD 6.8) versus 2.8 (SD 3.9), $p = .001$], more teeth with apical periodontitis [2.1 (SD 2.9) versus 1.0 (SD 2.3), $p = .002$] and a higher number of root-filled teeth [1.3 (SD 1.8) versus 0.6 (SD 1.5), $p = .002$].

Table 3 presents the prevalence, frequency and severity scores according to the oral impact on daily performance (OIDP). Individuals reporting dental pain had higher prevalence, i.e. reported more OHRQoL problems, on all the items of the OIPD, than individuals not reporting dental pain. Moreover, regardless of dental pain or no dental pain, the participants reported that they often were affected by all the situations measured by the OIDP, thus reporting an impaired OHRQoL.

The participants reporting problems on the OIDP items (prevalence), also reported how often they had encountered problems (frequency) and the severity of the problems experienced (severity). Irrespective of dental pain or not, the individuals scored very high on the frequency and severity dimensions. However, individuals reporting dental pain reported significantly higher frequency on problems with speaking/pronouncing word, and a higher level of severity on the item 'cleaning of teeth', as compared to individuals reporting no dental pain.

The mean OIDP summary index score was 27.0 (SD 25.6) for the total group and individuals who reported dental pain had a significantly higher mean score than those who did not report dental pain [31.3 (SD 25.3) versus 12.3 (SD 19.0), $p < .001$].

Multivariable analysis

Logistic regression was used to analyze the association of the dental pain index and the OIDP while controlling for other independent variables (Table 4). Age, number of decayed teeth, number of teeth with apical periodontitis and number of root-filled teeth were found to be significant in the bivariate analyses and were included in the multivariable analyses. Due to the small number of individuals without an impact on OIDP, we only included three independent variables in the equation, using the rule of thumb of at least 10 cases per independent variable related to the smallest group. Accordingly, the number of teeth with apical periodontitis and root-filled teeth were not included in the final model but showed similar predictive values as number of decayed teeth (data not shown). The final model (Table 4) revealed that the dental pain index (OR 8.21, CI 2.97–22.65, $p < .001$), and the number of decayed teeth (OR 5.87, CI 1.41–10.61, $p = .008$) were statistically significantly associated with the probability of having at least one impact on the OIDP. The overall model summary index was 0.31, as expressed by the Nagelkerke R^2 .

Table 3. Prevalence, frequency of and severity of OIDP scores according to dental pain and the total group.

	Prevalence % (N)		Frequency (0–5) of affected individuals, mean (SD)		Severity (0–5) in affected individuals, mean (SD)		Total	p Value ^b	Total	p Value ^b	Total		
	No dental pain, N = 38	Dental pain, N = 132	No dental pain	Dental pain	No dental pain	Dental pain						No dental pain	Dental pain
	Total, N = 170	p Value ^a	Total	Total	Total	Total						Total	Total
Physical performances													
Eating/enjoying food	38.8 (14)	75.8 (100)	67.1 (114)	4.5 (1.1)	4.7 (0.8)	3.1 (1.4)	4.7 (0.9)	NS	4.7 (0.9)	3.5 (1.2)	NS	3.4 (1.3)	
Speaking/pronouncing words	5.3 (2)	18.2 (24)	15.3 (26)	4.0 (1.4)	4.8 (0.8)	4.0 (1.4)	4.8 (0.9)	.029	4.8 (0.9)	4.0 (1.3)	NS	4.0 (1.2)	
Going shopping/meeting someone	7.9 (3)	18.9 (25)	16.5 (28)	5.0 (0.0)	4.7 (0.7)	4.0 (1.0)	4.8 (0.6)	NS	4.8 (0.6)	4.4 (0.9)	NS	4.3 (0.9)	
Cleaning of teeth	15.8 (6)	48.5 (64)	41.2 (70)	5.0 (0.0)	4.8 (0.8)	2.2 (1.7)	4.8 (0.8)	NS	4.8 (0.8)	3.6 (1.3)	.004	3.5 (1.4)	
Psychological performances													
Sleeping/relaxing	10.5 (4)	43.2 (57)	35.9 (61)	4.3 (1.5)	4.8 (0.7)	3.5 (1.0)	4.7 (0.8)	NS	4.7 (0.8)	3.9 (1.1)	NS	3.9 (1.1)	
Smiling/laughing/exposing teeth	39.5 (15)	60.6 (80)	55.9 (95)	4.9 (0.3)	4.9 (0.5)	3.8 (1.3)	4.9 (0.5)	NS	4.9 (0.5)	4.3 (1.0)	NS	4.2 (1.1)	
Keeping one's emotional state/not getting irritated	13.2 (5)	40.2 (53)	34.1 (58)	5.0 (0.0)	4.8 (0.5)	3.8 (1.8)	4.9 (0.5)	NS	4.9 (0.5)	3.9 (1.2)	NS	3.9 (1.2)	
Social performances													
Working/keeping up with social life	15.8 (6)	32.6 (43)	28.8 (49)	5.0 (0.0)	4.9 (0.5)	4.5 (0.5)	4.9 (0.4)	NS	4.9 (0.4)	4.3 (0.9)	NS	4.3 (0.8)	
Appreciating human contact	15.8 (6)	29.5 (39)	26.5 (45)	5.0 (0.0)	4.8 (0.7)	4.2 (1.0)	4.8 (0.7)	NS	4.8 (0.7)	4.1 (0.9)	NS	4.1 (0.9)	

^aChi-squared test;

^bMann-Whitney U-test.

Table 4. Multivariable logistic regression with the independent variables age, the dental pain index, and decayed teeth regressed on the dependent variable OIDP (dichotomized into no daily performance versus one or more daily performance reported).

Variable	Category	Referent category	OR	95% CI	<i>p</i> Value
Dental pain index	Pain	No pain	8.21	2.97–22.65	<.001
Age (years)			1.04	1.00–1.08	.76
Decayed teeth	>1	≤1	3.87	1.41–10.61	.008

Nagelkerke $R^2=0.31$. OR: odds ratio; CI: confidence interval.

Discussion

This study examined the association between dental pain and OHRQoL, in a clinical sample of highly dentally anxious adults referred to a specialized DA clinic. Reporting dental pain, and having decayed teeth, were predictive of poor OHRQoL.

In this clinical sample of severely dentally anxious individuals, the results indicated that they had poor oral health with regard to number of decayed teeth, number of teeth with apical periodontitis and number of root remnants. Similar results have been shown in several other studies, both in epidemiological and clinical studies [8,10,14,29–35]. Moreover, the association between DA and OHRQoL in the present study was strong irrespective of having dental pain or not, indicating other important dimensions than dental pain affecting OHRQoL. Other research groups have also revealed such findings [14,15,32].

Pain is a complex phenomenon captured by the individuals themselves. While being a self-reported dimension, pain may be described and experienced in many different ways, and illustrated by the often used McGill scale [36]. However, Newton concluded that the McGill scale might be lengthy for use in dental clinical practice [37]. In the present study, we chose to ask the participants exclusively about dental pain from the teeth, while not being associated with procedural pain during dental treatment. We used the questions described by Locker et al. [17,18] in their epidemiological survey, and we argue that these questions are tested for reliability and validity. By using these questions, it is possible to compare the present results with other studies.

The results in this study revealed that a large majority of the participants reported dental pain. The three pain questions used captured somewhat different types of dental pain, both related to provocation (chewing, hot/cold stimulation) or not (toothache), and almost one-fifth of the participants stated that they had all three types of dental pain. For this group of individuals with severe DA, having poor oral health, a high prevalence of dental pain would be expected. Population-based surveys concerning the prevalence of dental pain show figures of up to 30% of adults in the general population reporting dental pain [17–19]. However, to the best of our knowledge, there is a gap of knowledge about how common dental pain may be in groups of individuals with severe DA.

The present study revealed a clear association between dental pain and OHRQoL among individuals with severe DA. Participants reporting dental pain had poorer OHRQoL as

measured with the OIDP prevalence score and the OIDP summary index score. In addition, dental pain had the highest odds ratio of the independent variables included in the multivariable analysis model predicting poor OHRQoL. Dental pain was significantly associated to the majority of daily activities included in the OIDP instrument. Adulyanon et al. [21] reported on factors related to the OIDP in a low dental disease Thai population. Although different populations, there are similarities to the present study. Adulyanon et al. [21] showed that a high OIDP score was mainly associated with pain and discomfort. In the present study, dental pain was the main predictive factor of poor OHRQoL as measured with the OIDP. Thus, the results highlight the association between dental anxiety, pain and poor OHRQoL, and similar findings have been revealed in some other reports [11–13].

The results of the present study may be conceptualized in the vicious circle of DA reinforced by DA, avoidance of dental care, poor oral health and psychological consequences [8,38,39]. When dental pain is added, the consequences on OHRQoL gets worse. Another model that shows the relationship between oral conditions, functional impairment, and psychological disabilities is the conceptual framework of oral health by Locker [40]. An interpretation of the pathways in that model may be that poor oral health eventually can lead to different psychosocial effects e.g. decreased health-related quality of life, mediated by, for example, impairment such as pain.

The clinical consequences as interpreted from the results of this study may be that dental pain is prevalent and of significant intensity, and correlates with poor OHRQoL. Thus, it is of utmost importance to offer evidence based dental treatment based on principles for the dentally anxious individual in order to break a vicious circle, decrease the level of dental anxiety, reduce dental pain symptoms and eventually improve the OHRQoL.

This study has some strengths and limitations. It included a relatively large clinical sample of individuals with severe DA, and used both clinical measures of oral diseases and well-established questionnaires such as OIDP, DAS and DFS and previously used questions of dental pain. However, oral status was examined using panoramic radiograph and adapted clinical examinations, which may underestimate the amount of oral diseases. With the cross-sectional study design, the results can only be interpreted as associations, not as showing causal links. The project did not include a control group, which in some respects limits the interpretation of results.

In conclusion, this study revealed that dental pain was prevalent among adult individuals with severe DA. In addition, the individuals reported a high level of intensity of the dental pain and having dental pain was significantly associated with poor OHRQoL in patients with severe DA.

Disclosure statement

No potential conflict of interest was reported by the authors.

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ORCID

Lisa Svensson  <http://orcid.org/0000-0001-8389-4916>

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