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Gender-specific associations between the dimensions of alexithymia personality trait and dental anxiety in parents of the FinnBrain Birth Cohort Study

Max Karukivi[1,2,3] | **Auli Suominen**[4] | **Noora M. Scheinin**[1,3] | **Ru Li**[1,3] | **Hanna Ahrnberg**[1,3] | **Kari Rantavuori**[5] | **Hasse Karlsson**[1,2,3] | **Linnea Karlsson**[1,2,3] | **Satu Lahti**[2,3,4]

[1] Department of Psychiatry, University of Turku and Turku University Hospital, Turku, Finland

[2] Centre for Population Health Research, University of Turku, Turku, Finland

[3] FinnBrain Birth Cohort Study, Department of Clinical Medicine, Turku Brain and Mind Center, University of Turku, Turku, Finland

[4] Department of Community Dentistry, University of Turku, Turku, Finland

[5] Department of Oral Development and Orthodontics, University of Turku, Turku, Finland

Correspondence
Satu Lahti, Department of Community Dentistry, University of Turku, Turku 20014, Finland.
Email: satu.lahti@utu.fi

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Abstract

We evaluated gender-specific associations of two dimensions of dental anxiety (anticipatory and treatment-related dental anxiety) with three dimensions of alexithymia: difficulty in identifying feelings, difficulty in describing feelings, and externally oriented thinking. The sample comprised 2558 parents from the general population participating in the FinnBrain Birth Cohort Study. Dental anxiety was measured with the Modified Dental Anxiety Scale and alexithymia with the 20-item Toronto Alexithymia Scale. Associations between dental anxiety and alexithymia dimensions were modelled using linear regression analysis adjusting for general anxiety and depressive symptoms, age, and education. Structural equation modeling assessed their interrelationships. In women, anticipatory dental anxiety was associated only with difficulty in identifying feelings, but treatment-related dental anxiety was associated with difficulty in identifying feelings, difficulty in describing feelings, and externally oriented thinking. In men, anticipatory dental anxiety was associated with only externally oriented thinking, whereas treatment-related dental anxiety was associated with difficulty in describing feelings, and with externally oriented thinking. Structural equation modelling showed that difficulty in identifying feelings was associated with anticipatory and treatment-related dental anxiety in women, whereas in men, only difficulty in describing feelings was associated with both types of dental anxiety. Anticipatory and treatment-related dental anxiety have different associations with alexithymia dimensions.

KEYWORDS
affective symptoms, dental fear, emotions, personality

INTRODUCTION

Dental anxiety is a common problem, with every third adult reporting dental anxiety and up to 10% high dental anxiety, and women more often than men [1]. It often leads to non-habitual dental attendance, and consequently, to poor perceived and professionally assessed oral health [1–5]. Dental anxiety has been associated with mental disorders and symptoms, in particular, phobias and other anxiety disorders, mood disorders and substance use disorders [6–23]. Dental anxiety is suggested to originate from two sources, namely exogenous and endogenous [24,25]. Exogenous dental anxiety refers to external sources such as direct experiences, vicarious learning, or an informational pathway [26]. Endogenous dental anxiety refers to internal sources, such as personality traits or psychiatric symptoms (like anxiety or depression), which have been referred as 'constitutional vulnerability to (dental) anxiety disorders' [6,7,27,28]. The two dimensions of dental anxiety, anticipatory and treatment-related dental anxiety, have shown to be associated with anxiety and depression to different degrees [18,23], suggesting that these dimensions may capture dental anxiety originating from endogenous and exogenous sources [23].

Alexithymia is a personality trait characterized by difficulties in identifying and expressing emotions, a limited imagination and a concrete, externally oriented way of thinking [29]. According to population studies in Western countries, the prevalence of alexithymia in the adult population is approximately 10%, and it is to some extent more common in males [30,31]. Alexithymia has been associated with a wide variety of mental and somatic illnesses [e.g. 32–35].

The most commonly used alexithymia measure is the 20-item Toronto Alexithymia Scale (TAS-20), which measures three of the four core features of alexithymia: difficulty identifying feelings (DIF), difficulty describing feelings (DDF), and externally oriented thinking (EOT) [36]. These three subscales have been shown to markedly vary regarding their associations with different illnesses, and particularly the dimensions of difficulty identifying and describing feelings appear to be associated with mental illness symptoms, such as anxiety and depression [37]. This difference has mostly been explained by the weaker psychometric properties of the externally oriented thinking subscale [38]; however, recent findings have also made other explanations more likely. For example, it has been hypothesized that difficulty in identifying or describing feelings is associated with difficulties in the appraisal of emotions, whereas externally oriented thinking is related to a deficit of attention towards emotions [39]. The latter may also be conceptualized as lacking interoceptive sensibility, whereas difficulty in identifying or describing feelings is related to a deficit in interoceptive accuracy [40].

Dental anxiety has been associated with alexithymia in adults [41,42]. In a study conducted in a sample of public dental health patients, the total score for alexithymia and the scores for difficulty in identifying and describing feelings were associated with dental anxiety when adjusted for age and gender [41]. In another nationally representative adult population study, scores for difficulty in describing feelings were associated with dental anxiety in men and women, whereas the total score for alexithymia, and scores for difficulty in identifying feelings and for externally oriented thinking were linked to dental anxiety only in women [42]. In both of these studies, alexithymia was related to more severe anxiety symptoms. Taking into account the associations between dental anxiety and mental health disorders, and the reports repeatedly associating alexithymia with more adverse outcomes for the latter [e.g. 43], it is plausible that the relationship is also of clinical significance regarding dental anxiety.

Although dental anxiety and alexithymia have been associated on a general level, there is lack of knowledge as to whether the two dimensions of dental anxiety (anticipatory and treatment-related) are differently associated with the three dimensions of alexithymia (DIF, DDF, EOT). Thus, our aim was to study how the alexithymia dimensions are associated with the dimensions of dental anxiety while adjusting for general anxiety and depressive symptoms according to gender. Our hypothesis was that difficulties in identifying and describing feelings are more strongly associated with anticipatory dental anxiety, while externally oriented thinking is more strongly linked with treatment-related dental anxiety.

MATERIAL AND METHODS

This cross-sectional study used parental data from the multidisciplinary FinnBrain Birth Cohort Study (www.finnbrain.fi), which examines prospectively the effects of environmental and genetic factors on child brain development and health [44]. Participants were recruited after ultrasonography appointments, offered free of charge for every pregnant mother in Finland by municipal maternity clinics during the first trimester of the pregnancy (gestational week 12), in the Hospital District of Southwest Finland and the Åland Islands in Finland in 2011−2015. The Ethics Committee of the Hospital District of Southwest Finland has approved the study protocol (14.6.2011 ETMK:57/180/2011 §168). Of those informed about the study (N = 5790), a total of 3808 (66%) mothers and 2623 fathers or other partners of the mother, expecting 3837 children (twins included) agreed to participate, and of those, 3095 (81%) mothers and 2011 (77%) fathers returned the baseline questionnaire and started the study [44]. Written informed consent was obtained from all participants.

Parental data on dental anxiety was collected three months after delivery. Data on alexithymia was collected 6 months after delivery. For this study, those parents (1684 mothers and 873 fathers) from whom data on both dental anxiety as well as alexithymia were available, were included in the analyses. Of

the confounders, age and education data were collected at gestational week 14, and data on general anxiety and depressive symptoms were collected three months after delivery, that is, concurrently with data on dental anxiety.

Dental anxiety was measured with the Finnish translation of the Modified Dental Anxiety Scale (MDAS), which has shown concurrent and discriminant validity, and high internal consistency (Cronbach's alpha = 0.93) and reliability over time (intraclass correlation coefficient = 0.93) [45–47]. The questions in the MDAS are: (item 1) 'If you went to your dentist for treatment tomorrow, how would you feel?'; (item 2) 'If you were sitting in the waiting room (waiting for treatment), how would you feel?'; (item 3) 'If you were about to have a tooth drilled, how would you feel?'; (item 4) 'If you were about to have your teeth scaled and polished, how would you feel?'; and (item 5) 'If you were about to have a local anesthetic injection in your gum, above an upper back tooth, how would you feel?' Each item has five response options, ranging from 1 (not anxious) to 5 (extremely anxious), with the range for the total sum score being 5−25. For the dimensions of dental anxiety, two confirmed subscales, that is anticipatory dental anxiety (items 1 and 2; score range = 2−10) and treatment-related dental anxiety (items 3, 4, and 5; score range = 3−15) were calculated [23]. Established cut-off points were used for the MDAS total scores to categorize participants as having no to moderate dental anxiety (5−18) or high dental anxiety (19−25) [45]. If there were ≤30% missing items for the MDAS, they were imputed with the mean value of the answered items. Imputations were done for 13 mothers and 7 fathers.

Alexithymia was measured using the TAS-20 [36]. The TAS-20 comprises 20 items that are scored on a 5-point Likert scale from 1 to 5 (total score range from 20 to 100). The scale includes three subscales: DIF (seven items), DDF (five items), and EOT (eight items). The psychometric properties of the scale have been shown to be good for numerous versions in different languages [48], including its Finnish version (Cronbach's alpha for TAS-20 = 0.76−0.83, DIF = 0.77−0.81, DDF = 0.72−0.77, and EOT = 0.61−0.66) [49]. An established cut-off point was used for TAS-20 scores to categorize participants as having a low level of alexithymia (20−60) or a high level of alexithymia (61−100) [50]. Participants who had up to two missing items for DIF, one missing item for DDF, or two missing items for EOT were included in the sample. The missing values were imputed separately for each of the subscales, using the mean value of the items answered. Factor-wise imputations were done as follows: DIF, 35 mothers, 7 fathers; DDF, 17 mothers and 7 fathers; and EOT, 45 mothers and 25 fathers.

General anxiety symptoms were measured with the Finnish version of the Symptom Checklist − 90 (SCL-90, anxiety subscale with Cronbach's alpha = 0.89) [51–53]. The SCL-90 consists of 10 items scored on a 5-point Likert scale (from 0 to 4). Depressive symptoms were assessed with the Finnish version of the Edinburgh Postnatal Depression Scale (EPDS), which has shown varying but mostly high sensitivity and specificity, is valid for screening both pre- and postnatal depressive symptoms [54,55], and can be used among fathers as well [56,57]. The EPDS consists of 10 questions scored on a 4-point Likert scale (from 0 to 3). For the EPDS, the total sum score (range 0−30) was used. If there were ≤30% missing items for the SCL-90 or EPDS, they were imputed with the mean value of the answered items.

Education was trichotomized as low (high school/vocational ≤ 12 years), medium (polytechnics), and high (university degree or comparable). As women consistently report higher levels of dental anxiety [45,58], and men consistently report higher levels of alexithymia [30,31], analyses were stratified by gender.

The bivariate associations between dental anxiety, alexithymia and their dimensions, as well as general anxiety and depressive symptoms, were assessed with Spearman's correlation coefficients separately for women and men. The associations between dental anxiety and alexithymia, as well as their dimensions, were assessed with linear regression analysis adjusted for general anxiety and depressive symptoms, age, and education. Gender specific structural equation modeling (SEM) was used to assess the interrelationships among dental anxiety treatment-related and anticipatory factor scores and alexithymia DIF, DDF, and EOT subscale scores. The hypothetical model to be tested is presented in Figure 1. SEM was conducted to test the configural invariance (unconstrained model) and metric invariance (structural weights model). In the analysis, error terms of items were not allowed to correlate. The following fit indices were used: chi-square and its significance, normed chi-square (χ^2/df), normative fit index (NFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and Akaike's information criterion (AIC). The values of χ^2/df < 5, NFI > 0.90, CFI > 0.90, and RMSEA < 0.08 indicate reasonably good fit, while values of χ^2/df < 2, NFI > 0.95, CFI > 0.95, and RMSEA < 0.05 indicate very good fit, and the best model has the smallest AIC [59]. For loadings, standardized estimates (interpreted similarly as correlation coefficients) were calculated. All analyses were conducted using IBM SPSS Statistics 25 and SAS statistical software 9.4 (SAS Institute). Alpha was set at 0.05 (two-sided).

RESULTS

The sample characteristics are described in Table 1. Men were older and reported on average lower dental anxiety than women, for total as well as anticipatory and treatment-related dental anxiety. Regarding alexithymia, men reported higher scores for total alexithymia, and for difficulty in describing feelings and for externally oriented thinking, but lower scores than women for difficulty in identifying feelings.

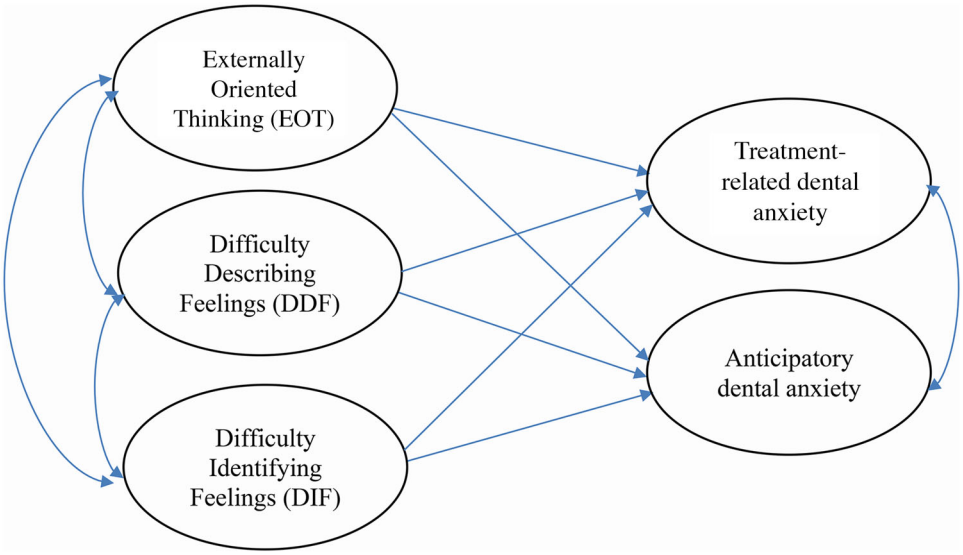

FIGURE 1 The hypothetical structural equation model for the interrelationships of the dental anxiety and alexithymia dimensions for men and women

TABLE 1 Description of the participants according to age, education, general anxiety, depressive symptoms, dental anxiety, and alexithymia as well as its dimensions, separately for women and men

	Women			Men		
Variable	**n**	**Mean**	**95% CI**	**n**	**Mean**	**95% CI**
Age	1684	30.7	(30.5, 30.9)	873	32.5	(32.2, 32.9)
MDAS Total score	1684	10.7	(10.5, 10.9)	874	9.1	(8.8, 9.4)
MDAS F1	1684	3.6	(3.5, 3.7)	874	3.2	(3.1, 3.3)
MDAS F2	1684	7.1	(6.9, 7.2)	874	5.9	(5.8, 6.1)
TAS-20 Total score	1684	39.8	(39.3, 40.2)	874	43.2	(42.6, 43.8)
DIF	1684	11.6	(11.4, 11.8)	874	10.9	(10.6, 11.2)
DDF	1684	9.5	(9.4, 9.7)	874	11.1	(10.8, 11.3)
EOT	1684	18.6	(18.4, 18.8)	874	21.3	(21.0, 21.5)
SCL-90	1684	2.5	(2.4, 2.7)	873	2.4	(2.2, 2.7)
EPDS	1684	4.2	(4.0, 4.4)	874	3.3	(3.0, 3.5)
Education	n (%)			n (%)		
Low	531 (31.8)			250 (29.2)		
Medium	504 (30.2)			269 (31.5)		
High	633 (38.0)			336 (39.3)		

Abbreviations: DDF = Difficulty Describing Feelings; DIF = Difficulty Identifying Feelings; EOT = Externally oriented thinking; EPDS = Edinburgh Postnatal Depression Scale.; MDAS F1 = anticipatory dental anxiety; MDAS F2 = treatment-related dental anxiety; MDAS = Modified Dental Anxiety Scale; SCL-90 = Symptom Checklist −90 (anxiety subscale); TAS-20 = 20-item Toronto Alexithymia Scale.
Categorization for Education: Low = high school/vocational ≤ 12 years, Medium = polytechnics, High = university degree or comparable.

Also, depressive symptom scores were lower among men, but general anxiety scores were in the same range as for women.

Among women, 9.3% reported high dental anxiety and 3.3 % had a high level of alexithymia. Corresponding percentages for men were 3.2% and 7.0%, respectively. Of those reporting high dental anxiety, 8.3% in women and 10.7% in men were categorized as having a high level of alexithymia. Of those with a high level of alexithymia, 23.6% in women and 4.9% in men reported high dental anxiety.

In bivariate analyses, all alexithymia scores showed weak correlations (r = 0.05−0.17) with all dental anxiety scores. Depressive symptoms showed weak correlations (r = 0.11−0.17) with all dental anxiety scores and moderate correlations (r = 0.31−0.44) with all alexithymia scores. General anxiety symptoms showed weak correlations

TABLE 2 Association between dental anxiety and alexithymia and its dimensions (multiple linear regression) adjusted for general anxiety (SCL-90 anxiety subscale) and depressive (EPDS) symptoms, age, and education

		Total MDAS			Anticipatory			Treatment related		
		β	95% CI	*p*	*β*	95% CI	*p*	*β*	95% CI	*p*
Women	TAS-20	0.045	(0.020, 0.070)	<0.001	0.010	(0.0002, 0.021)	0.038	0.035	(0.019, 0.051)	<0.001
	DIF	0.097	(0.039, 0.155)	<0.001	0.024	(0.002, 0.049)	0.041	0.074	(0.037, 0.110)	<0.001
	DDF	0.090	(0.024, 0.155)	0.005	0.020	(−0.009, 0.048)	0.147	0.070	(0.029, 0.111)	<0.001
	EOT	0.054	(0.001, 0.107)	0.013	0.012	(−0.011, 0.035)	0.211	0.035	(0.009, 0.076)	0.005
Men	TAS-20	0.046	(0.015, 0.076)	0.003	0.017	(0.004, 0.030)	0.012	0.029	(0.009, 0.049)	0.003
	DIF	0.070	(−0.004, 0.145)	0.067	0.026	(−0.006, 0.058)	0.075	0.006	(−0.002, 0.014)	0.073
	DDF	0.072	(0.002, 0.142)	0.027	0.023	(−0.007, 0.053)	0.114	0.049	(0.004, 0.095)	0.019
	EOT	0.081	(0.020, 0.143)	0.013	0.031	(0.005, 0.058)	0.013	0.050	(0.010, 0.090)	0.025

Abbreviations: MDAS = Modified Dental Anxiety Scale, TAS-20 = 20-item Toronto Alexithymia Scale, DIF = Difficulty Identifying Feelings, DDF = Difficulty Describing Feelings, EOT = Externally oriented thinking, SCL-90 = Symptom Checklist −90 (anxiety subscale), EPDS = Edinburgh Postnatal Depression Scale. Categorization for Education: Low = high school/vocational ≤ 12 years, Medium = polytechnics, High = university degree or comparable.

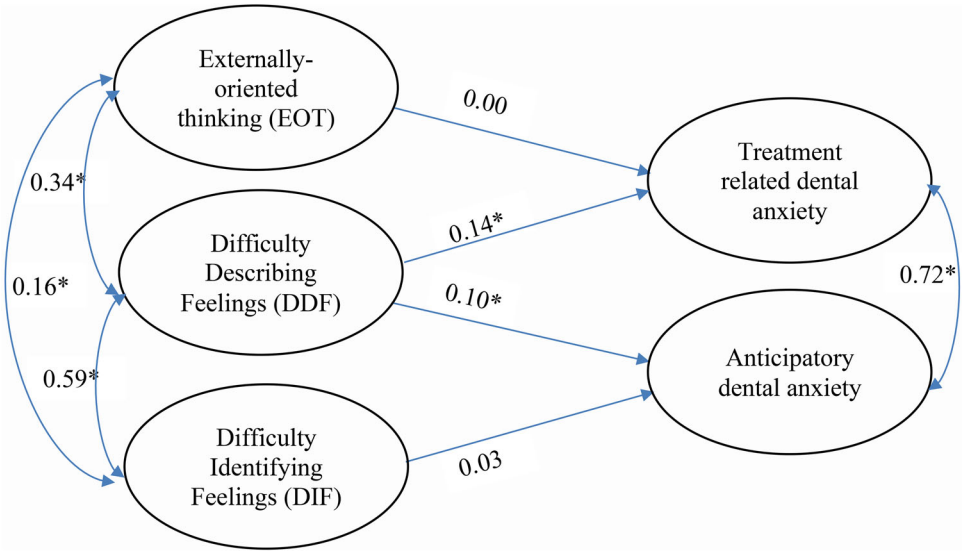

FIGURE 2 The estimated structural equation model with standardized coefficients for the interrelationships of the dental anxiety and alexithymia dimensions for men, with standardized covariances among dental anxiety and alexithymia dimensions. * $p < 0.05$

($r = 0.09–0.13$) with all dental anxiety scores and moderate correlations ($r = 0.27–0.42$) with all alexithymia scores.

When adjusting for general anxiety and depressive symptoms, men with higher total dental anxiety reported higher scores for total alexithymia, and for difficulty in describing feelings and for externally oriented thinking (Table 2). Men with higher anticipatory dental anxiety reported higher scores for total alexithymia and for externally oriented thinking, and those with higher treatment-related dental anxiety reported higher scores for total alexithymia, and for difficulty in describing feelings and for externally oriented thinking. In women, those with higher total or treatment-related dental anxiety had higher scores for total alexithymia and for all alexithymia dimensions. Women with higher anticipatory dental anxiety had higher scores for total alexithymia and only for difficulty in identifying feelings.

When looking at simultaneous associations between the dimensions of dental anxiety and alexithymia in men, only difficulty in describing feelings was associated with dental anxiety, the association being stronger with treatment-related dental anxiety than with anticipatory dental anxiety (Figure 2). In women, only difficulty in identifying feelings was associated with dental anxiety, the association being stronger with treatment-related dental anxiety than with anticipatory dental anxiety (Figure 3). In women, the estimated model showed very good fit, while in men the fit was reasonably good, except for the chi-square value. The hypothetical model showed poor fit (Table 3).

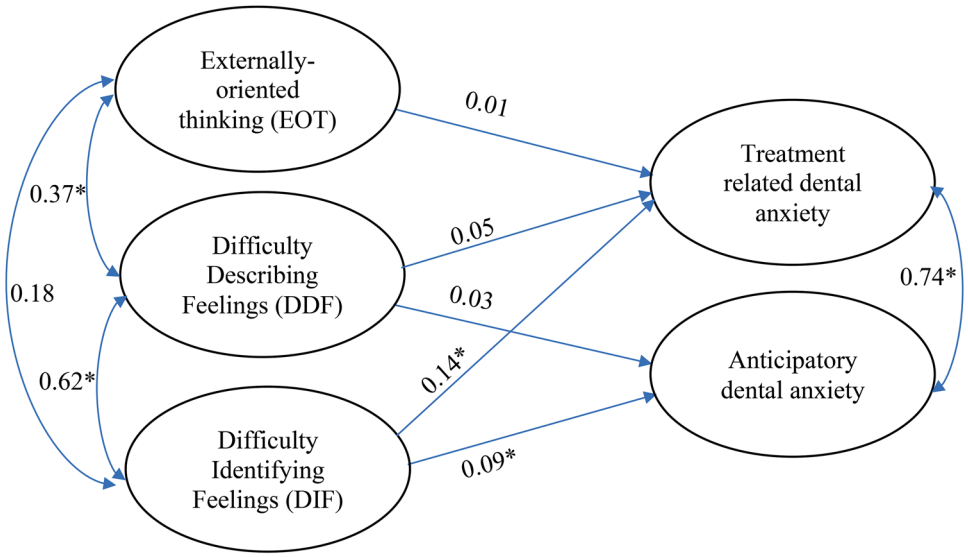

FIGURE 3 The estimated structural equation model with standardized coefficients for the interrelationships of the dental anxiety and alexithymia dimensions for women, with standardized covariances among dental anxiety and alexithymia dimensions. * $p < 0.05$

TABLE 3 Structural equation model (SEM) fit indices for the unconstrained model and models with constrained factor loadings/structural weights, on the Modified Dental Anxiety Scale (MDAS) two-factor structure for women and men

	Model	χ^2	df	χ^2/df	*p*	NFI	CFI	RMSEA	AIC
Women	Unconstrained	2597.42	10	259.7	<0.0001	0.440	0.438	0.890	1483.53
	Constrained structural weights	2.15	1	1.08	<0.0001	0.999	0.9996	0.026	30.15
	Difference	2595.27	9		0.001				
Men	Unconstrained	1178.85	10	117.9	<0.0001	0.449	0.445	0.862	678.03
	Constrained structural weights	12.88	2	6.44	0.002	0.991	0.993	0.079	34.69
	Difference	1165.95	8		<0.0001				

Abbreviations: NFI, normative fit index; CFI, comparative fit index; RMSEA, root mean square error of approximation; AIC, Akaike's information criterion.

DISCUSSION

Anticipatory and treatment-related dental anxiety differed regarding their associations with the three dimensions of alexithymia, and the associations were different according to gender when looking at the two dimensions at the same time. When looking at the associations between all dimensions simultaneously, only difficulty in identifying feelings was statistically significantly associated with both anticipatory and treatment-related dental anxiety in women, whereas in men, only the association of difficulty in describing feelings with both types of dental anxiety was statistically significant. Our results did not give support to our hypothesis that difficulty in identifying and describing feelings would be associated more strongly with anticipatory dental anxiety, and externally oriented thinking with treatment-related dental anxiety.

The prevalence of participants reporting both high dental anxiety and a high level of alexithymia was lower than in a sample of public dental health care patients (n = 823) and in the Finnish adult population [41,42]. In the patient sample, dental anxiety was associated with alexithymia globally (TAS-20 total score) and with its two dimensions of difficulty in identifying feelings and difficulty in describing feelings dimensions [41]. However, in our study, the association with difficulty in identifying feelings was observed only in women. In the patient sample study, dentally anxious men were underrepresented, which might partly explain this difference. This finding regarding the association of dental anxiety and difficulty in identifying feelings in women was also supported by a Finnish nationally representative study (n = 5241) among >30-year-old-adults [42]. The found women and men to differ regarding the association of dental anxiety with alexithymia. In women, dental anxiety was associated with the alexithymia total score, difficulty in identifying feelings, and externally oriented thinking, whereas in men, similar associations were not observed. In that study, dental anxiety was rated only with one question validated against MDAS

for the cut-off of high dental anxiety [45]. Interestingly, in our study as well, externally oriented thinking was significantly associated with higher total MDAS scores, not only in women, but also in men. In contrast, in the study by Pohjola et al. [42], belonging to the group with lowest dental anxiety was associated with higher externally oriented thinking scores.

The association of difficulty in identifying feelings with dental anxiety is not surprising taking into account the several previous studies linking anxiety and anxiety disorders to this particular alexithymia dimension [e.g. 37,61]. In the alexithymia literature, the associations of difficulty in identifying feelings and difficulty in describing feelings with mental health outcomes are often similar and accordingly, in our correlation analyses, both difficulty in identifying feelings and difficulty in describing feelings were strongly correlated with general anxiety and depressive symptoms. General anxiety was more strongly associated with anticipatory dental anxiety than treatment-related dental anxiety in the same population, while both dimensions were associated with depressive symptoms. This suggests that anticipatory and treatment-related factors may capture dental anxiety originating from different sources referred to as endogenous and exogenous [23]. However, as discussed in previous studies regarding dental anxiety, the links of difficulty in identifying feelings and difficulty in describing feelings have differed to some extent.

In the present study, the correlation coefficients for the association of difficulty in identifying feelings with general anxiety and depressive symptoms were higher than for difficulty in describing feelings, and in the multivariate analyses, their associations were partly different. Interestingly, externally oriented thinking correlated positively with the MDAS scores, whereas the correlation with general anxiety symptoms measured with the SCL-90 was also statistically significant ($p = 0.048$), but weak and negative ($r = -0.048$).

In order to formulate a model to explain the typically observed differences between difficulty in identifying and describing feelings and externally oriented thinking dimensions, an *attention-appraisal model of alexithymia* has been previously suggested [39]. The model proposes that externally oriented thinking is associated with a deficit in the attentional phase of emotions, whereas difficulty in identifying and describing feelings is linked to problems in the appraisal of emotions. Based on this, with regard to the different dimensions of dental anxiety, it may be hypothesized that anticipatory dental anxiety is related to appraisal of emotions, that is, to difficulty in identifying and describing feelings, while treatment-related dental anxiety is related to the attentional phase and thus, to externally oriented thinking. In women, difficulty in identifying feelings indeed was the only dimension associated with anticipatory dental anxiety in the regression analyses, while in men, a significant association was observed only for externally oriented thinking. However, when modelling all dimensions simultaneously, only difficulty in describing feelings was associated with anticipatory dental anxiety in men. In regression analyses, treatment-related related anxiety was associated with externally oriented thinking in both women and men, but associations were observed also for other dimensions (difficulty in identifying feelings and difficulty in describing feelings for women, and difficulty in describing feelings for men). When modelling all dimensions simultaneously, the association of externally oriented thinking with treatment-related dental anxiety was not statistically significant.

It is possible that the observed associations may be mediated or moderated also by other factors. It may be speculated that one such factor would be pain which was not measured in this study. Indeed, a link between pain sensitivity and both alexithymia and dental anxiety has been reported [62,63]. For alexithymia, this link is particularly with chronic pain [64], whereas pain related to dental anxiety is seldom chronic but acute. Additionally, it is important to acknowledge that pain is not the most important distressing experience behind dental anxiety [65], though fear of pain has been found the most significant predictor of dental anxiety among other non-dental fears [66]. However, a more plausible link existed between certain emotions and feelings, such as feeling of helplessness during dental treatment [65]. One possible factor may also be somatization, which has been associated with both dental fear and alexithymia [5,67]. Excessive focus on somatic symptoms may predispose to experiencing dental treatment as more traumatic, and thus increase dental anxiety. However, more research on these factors and how they are related to our current findings is needed.

The present study has some limitations. The studied population sample is quite large and representative of both genders, but as a birth cohort parental sample, represents a relatively healthy population [44]. This is reflected, for example, by the lower prevalence of participants with a high level of alexithymia in the cohort than in studies in the general population [37]. The population sample might have also affected the association between alexithymia and dental anxiety, which might have been different in other populations or subgroups of this population. However, the prevalence of high dental anxiety was rather similar to that of the Finnish population of the same age range [1]. Regarding the methods, both the MDAS and TAS-20 are self-report measures. Although alexithymia has been shown to be quite a stable feature, the three-month interval between the MDAS and TAS-20 measurements may be considered as a limitation as well. On the other hand, this may have decreased the common method variance, which is the systematic variance shared among the variables, usually introduced by the method of measurement rather than measures' theoretical construct [68], between the two self-report measures (MDAS and TAS-20) used. However, possible common method variance should be noted regarding

measures of depression, dental anxiety, and general anxiety, as these were inquired in this order. However, different formats for reply alternatives were used. Because questionnaires were administered at a time when respondents were taking care of small children, when they were often busy, this should be considered when interpreting the results, especially those relating to the prevalence of depression and anxiety.

To conclude, the present study sheds light on the previously reported association between dental anxiety and alexithymia. While our findings give further support for this link, and the clinically notable observation that alexithymia relates to higher dental anxiety, this is the first study to explore the separate alexithymia dimensions regarding their associations with different dimensions of dental anxiety. Based on our findings, anticipatory and treatment-related dental anxiety appear to differ in terms of their links with the alexithymia dimensions according to gender. This notion calls for further exploration of the psychological underpinnings, such as pain sensitivity or catastrophizing. Like dental anxiety, alexithymia may also have a negative effect on the dentist-patient relationship. Difficulties in identifying or describing feelings related to dental anxiety may lead to underestimation of or misinterpretations related to the patient's dental anxiety. Thus, exploring this connection hopefully leads to finding ways to better meet the needs of this challenging group.

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AUTHOR CONTRIBUTIONS

Conceptualization: MK, SL. **Methodology**: MK, SL, AS. Formal analysis: AS. **Investigation**: HK, LK. **Writing – original draft**: MK, SL, AS. **Writing – review and editing**: AS, NMS, RL, HA, KR, HK, LK. **Project administration**: HK, LK.

CONFLICTS OF INTEREST

The declare there are no conflicts of interest.

ORCID

Linnea Karlsson https://orcid.org/0000-0003-3457-4611

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