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Received: 8 June 2023 | Accepted: 27 December 2023

DOI: 10.1111/eos.12973

European Journal of Oral Sciences NOF WILEY

ORIGINAL ARTICLE

Associations of sensory sensitivity, pain catastrophizing, and alexithymia with dental anxiety

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Funding information
Japan Society for the Promotion of Science, Grant/Award Number: 20K18817

Abstract

We aimed to reveal interrelationships between alexithymia, catastrophic thinking, sensory processing patterns, and dental anxiety among 460 participants who were registrants of a Japanese research company. Measures used were the Modified Dental Anxiety Scale, the Adult Sensory Profile, the Pain Catastrophizing Scale, and the 20-item Toronto Alexithymia Scale. The interrelationships among the constructs were analyzed using structural equation modeling, adjusting for age, gender, and negative dental treatment experience. Data from 428 participants were used in the analyses. Sensory sensitivity and pain catastrophizing were independently associated with anticipatory and treatment-related dental anxiety, while difficulty identifying feelings was not. In the mediation model, sensory sensitivity and pain catastrophizing served as full mediators between difficulty identifying feelings and the dimensions of dental anxiety (indirect effects were between 0.13 and 0.15). The strength of the associations was 0.55 from difficulty identifying feelings to both pain catastrophizing and sensory sensitivity, and between 0.24 and 0.26 to anticipatory and treatment-related dental anxiety. The association between trait-like phenomena, such as alexithymia, and dental anxiety may be mediated by neurophysiological and cognitive factors such as sensory sensitivity and pain catastrophizing. These findings could be crucial for new and innovative interventions for managing dental anxiety.

KEYWORDS
affective symptoms, dental fear, oral health

INTRODUCTION

Dental anxiety is a common global public health problem causing avoidance of dental treatment [1] and can further lead to a deterioration of oral health, along with poor oral health-related quality of life [2, 3]. Dental anxiety originates from endogenous and exogenous sources [4, 5]. Exogenous factors include conditioning through negative dental treatment experiences and indirect learning from family, peers, or media [6].

Temperament, personality, and other traits, such as neuroticism, negative affect, and alexithymia, are reported as endogenous sources for dental anxiety [7–11]. Alexithymia and its three dimensions (i.e., difficulties in identifying and describing feelings, and externally oriented thinking) have been associated with dental anxiety, but the associations have differed by study population, gender, and the two dimensions of dental anxiety (i.e., anticipatory and treatment-related dental anxiety) [7–9]. Alexithymia has also been reported to be associated with general anxiety and this is thought to be explained by its overlap with difficulties in expressing emotions [12, 13].

Alexithymia has also been shown to be associated with sensory processing patterns [14, 15], which are individual differences in sensitivity and response to stimuli other than pain, such as light, smell, and sound in everyday life. Dunn classified them into four patterns (sensory sensitivity, sensory avoidance, low registration, and sensation seeking) [16]. Those patterns are based on two continua: the neurological threshold and the behavioral response. The thresholds and response styles are thought to be modulated by genetic and environmental factors, and are related to individual mood, temperament, and psychiatric disorders [16, 17]. Certain sensory processing patterns, such as sensitivity to sound or light, might predispose an individual to develop dental anxiety from treatment experiences. Indeed, of the four sensory processing patterns, sensory sensitivity, sensory avoidance, and low registration (but not sensation seeking) have been shown to be associated with dental anxiety, even after adjustment for the effects of negative dental experiences and general anxiety [18].

Sensory processing patterns and alexithymia are also associated with pain catastrophizing [14, 19–22], which in turn is associated with dental anxiety [23, 24]. Catastrophic thinking is known to contribute to the experience of pain by negative ruminating, and by magnifying and capturing the experience of pain [23]. A literature review suggested that pain catastrophizing is associated with negative thought in dental settings [25]. Fear of pain is also associated with dental anxiety [26, 27].

These findings suggest that catastrophic thinking, sensory sensitivity, and alexithymia are associated with dental anxiety. They are also likely to be interrelated but, to our knowledge, no previous studies have examined their concurrent associations with dental anxiety. Thus, the main aim of the present study was to assess how alexithymia, catastrophic thinking, sensory processing patterns, and their dimensions are associated with dental anxiety, while adjusting for age, gender, and negative treatment experiences. The hypothesis was that sensory processing, alexithymia, and catastrophic thinking would be independently associated with both anticipatory and treatment-related dental anxiety, and that they are also associated with each other.

MATERIAL AND METHODS

Study design and sample

This cross-sectional study was approved by the Ethics Committee of Fukuoka Dental College (No. 517) in 2019 and was conducted in accordance with the Declaration of Helsinki. An online survey was conducted with registrants of VLC Inc., a private Japanese online survey company. The overall demographic characteristics of the registrants ($N = 3,077,222$) were 56% female, 55% over 40 years old, and 54% married; 42% were office workers, and 17% part-time employees. Participants ($N = 460$) were deliberately included from a randomly selected pool of 10,000 registrants to have equal distribution by gender and age groups of 10 years from 20 to 80 years. The inclusion criterion for possible registrants was an age of 20 years and over. There were no exclusion criteria. There is no consensus on sample size determination method for structural equation modeling (SEM) [28]. As a rule of thumb, a minimum sample size of 100–200 cases to conduct SEM and 100 cases per group is commonly used for multigroup SEM [28]. However, a study using Monte Carlo simulation analysis suggests complex models require a larger sample size than simple models to obtain sufficient statistical power and solution property [29]. The hypothetical model of this study described below was considered a relatively complex model. Thus, the target sample size was set at 400 for the group-specific SEM between genders. The first Internet screen of the survey explained the purpose of the study. Participants who agreed were asked to give informed consent by clicking a button at the bottom of the screen.

Measures

Dental anxiety was measured with the reliable and valid Japanese version of the Modified Dental Anxiety Scale (MDAS) [30–32], a five-item scale that assesses dental anxiety in five situations: going for treatment tomorrow, sitting in the waiting room, having one's tooth drilled, having one's teeth scaled and polished, and receiving local anesthetic injection. Responses are recorded on a 5-point Likert-type scale ranging from "not anxious" to "extremely anxious," and the scores are summed to give a total score (range 5–25). Higher scores indicate greater dental anxiety [30]. The two factors of the MDAS established in previous studies were calculated as anticipatory dental anxiety (items 1 and 2; range = 2–10) and treatment dental anxiety (items 3–5; range = 3–15) [33, 34], although a one-factor structure has been previously suggested in Japan [31, 32].

Sensory processing patterns were assessed with the Adolescent/Adult Sensory Profile [35, 36], a 60-item questionnaire measuring sensory responses to stimuli encountered in daily life. Each item was scored on a 5-point Likert scale (ranging from 1 = almost never to 5 = almost always). The 60 items were allocated equally across four dimensions: sensory sensitivity, sensory avoidance, low registration, and sensation seeking (range 15–75 for each quadrant). A higher score indicates more disturbed levels of sensory processing. The psychometric properties of the Japanese version have been

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shown to be good (Cronbach's alpha for sensory sensitivity = 0.76, sensory avoidance = 0.80, low registration = 0.80, and sensation seeking = 0.75; validity between with and without autism for sensory sensitivity, z = 1.99, $p < 0.05$, d = 0.30; sensory avoidance, z = 1.39, $p > 0.05$, d = 0.21; low registration, z = 2.91, $p < 0.01$, d = 0.43; sensory seeking, z = 3.61, $p < 0.01$, d = 0.54) [36].

The Pain Catastrophizing Scale (a valid and reliable Japanese 13-item self-report measure) was used to assess three components of catastrophizing: rumination, magnification, and helplessness [23, 37]. A three-factor structure has been supported, but unidimensionality has recently been reported [38]. Responses were measured with a 5-point Likert-scale ranging from "strongly disagree" to "strongly agree." Total scores range from 13 to 65. Higher scores indicate greater pain catastrophizing.

The valid and reliable Japanese version of the Toronto Alexithymia Scale, a 20-item self-report measure, was used to measure alexithymia [39, 40]. Responses were measured with a 5-point Likert-scale ranging from "strongly disagree" to "strongly agree." Total score (range 20–100) and three subscale scores (difficulty identifying feelings, difficulty describing feelings, externally oriented thinking) were calculated. Higher scores indicate a greater level of alexithymia.

Statistical analyses

Because the Shapiro–Wilk test did not show normality in the distribution of the dental anxiety scores ($p < 0.001$), nonparametric tests were mainly used. Spearman's correlation coefficients were used to explore bivariate associations between dental anxiety and other factors.

SEM was used to assess the interrelationships among dental anxiety, alexithymia, sensory processing patterns, and pain catastrophizing. SEM is a multivariate analysis method that can simultaneously perform correlation analysis and multiple regression analysis between latent variables [28]. The factors of the psychological scales were treated as latent variables and each item as an observed variable. The variables for SEM were selected from the results of previously reported models, exploratory and confirmatory factor analyses, and item response theory.

First, a confirmatory factor analysis was conducted to assess whether the two-factor model was acceptable for the Japanese MDAS. Second, the relationships between the dimensions of alexithymia and dental anxiety were examined according to an existing model [7]. A multigroup analysis was then conducted to examine whether there were gender differences because dental anxiety is consistently higher in women than in men [41, 42], and alexithymia higher in men [43, 44].

Third, we analyzed the subscales of the Adult Sensory Profile. Previous literature indicates that the Adult Sensory Profile does not have a clear four-factor structure [35].

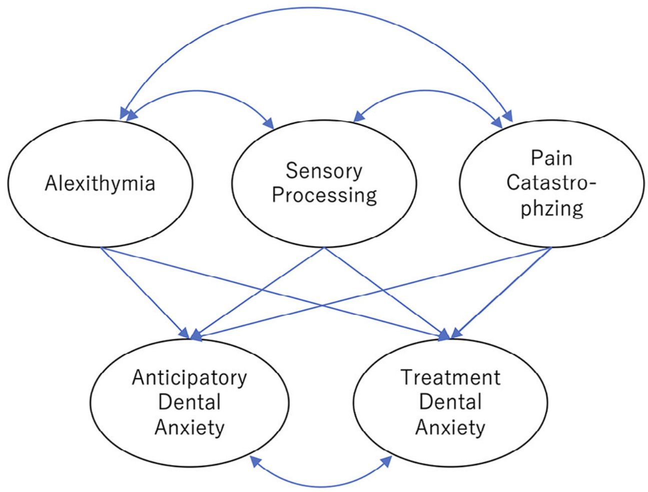

FIGURE 1 The hypothetical path diagram for structural equation modeling. Adjustments are also made for negative dental experiences, age, and gender. The observed variables, errors, and residuals for each factor are omitted.

Consistent with that finding, principal component analysis using this sample did not show a clear four-factor structure (Table S1). A prior correlation analysis showed that, among the four quadrants, sensory sensitivity correlated most strongly and positively with dental anxiety (sensory sensitivity: Spearman's r = 0.435; sensory avoidance: r = 0.352; low registration: r = 0.299; sensory seeking: r = −0.650). Based on these results and previous literature [18], sensory sensitivity was chosen for further analyses. To ensure the unidimensionality (i.e., the item response to a single latent variable of the sensory sensitivity subscale), item analysis was conducted using the polychoric correlation coefficient and item response theory (IRT). The graded response model was used to estimate item discrimination (α) and item difficulty (β), and to obtain test information curves to evaluate how well an assessment differentiates examinees, and at what ranges of ability [45, 46]. Prior to the main IRT analysis, categorical factor analysis and a preliminary IRT were conducted to remove items with a factor loading of less than 0.35, a discriminative power of less than 0.2, and a difficulty level of more than 4. The correlation coefficients for the association between the total score of the extracted items and the total score of the 15 items of the original scale were calculated to examine the validity of the shortened version.

Fourth, an exploratory factor analysis was conducted to determine the factor structure of the Pain Catastrophizing Scale based on the scree plot and the Guttman criterion.

Finally, based on the hypothetical model (Figure 1), SEM was performed assuming that sensory sensitivity, alexithymia, and catastrophic thinking were each associated with dental anxiety when considering negative dental experiences, age, and sex. Missing values were complemented using the full information maximum likelihood estimation method. The fit indices used were chi-square and its significance, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean square error of approximation (RMSEA). The values of χ^2/df < 5, CFI > 0.90, and RMSEA < 0.08 indicate reasonably good fit, and the best model has the smallest Akaike information criterion (AIC) [28].

Preliminary analyses were conducted using SPSS version 27 (IBM). SEM was conducted using MPLUS version 8 (Muthen & Muthen), and IRT was conducted using the ltm package in R version 4.0.0 (R Foundation for Statistical Computing) [47]. All tests were conducted at a significance level of 0.05.

RESULTS

Responses were obtained from all 460 participants, but 32 were excluded from the analysis because they did not meet the survey company's own data quality check criteria. Thereby, data from 428 individuals (93.0%) were used in the analysis. The sample demographic characteristics are shown in Table 1. The gender distribution was almost equal. Women had significantly higher mean MDAS scores than men. Almost every third participant had had negative dental experiences.

Table 2 shows correlations among variables using Spearman's correlation coefficient. Alexithymia total and subscale scores (excluding externally oriented thinking), pain catastrophizing, and three sensory processing dimensions (excluding sensation seeking) correlated positively with dental anxiety and its two factors. Sensory sensitivity showed the strongest positive correlation with dental anxiety.

In the confirmatory factor analysis, the Japanese version of the MDAS showed a better fit for the two-factor than the one-factor structure (Table S2), and so the two factors were used in further analyses.

Figure 2 shows the SEM findings of the associations between the dimensions of dental anxiety and alexithymia. Of the fit indices, CFI and TLI were slightly below baseline, probably due to the large number of observed variables, but the χ^2/df and RMSEA values indicated a relatively good fit. Only the subscale of difficulty identifying feelings

TABLE 1 Participant demographic and psychological characteristics by gender.

	Men (*n* = 216)			Women (*n* = 212)			Total (*n* = 428)		
	n	Mean or %	SD	*n*	Mean or %	S.D.	*n*	Mean or %	SD
Age	216	54.8	14.9	212	46.6	15.8	428	50.8	15.9
Education									
Up to university	55	25.6		90	42.7		145	34.0	
University or higher	160	74.4		121	57.3		281	66.0	
Negative dental experience									
No	155	71.8		137	64.6		292	68.2	
I don't know	6	2.8		11	5.2		17	4.0	
Yes	55	25.5		64	30.2		119	27.8	
MDAS total score	216	11.1	4.8	211	12.9	5.2	427	12.0	5.1
MDASAnticipatory	216	3.6	2.0	212	4.5	2.3	428	4.1	2.2
MDASTreament	216	7.4	3.1	211	8.4	3.2	427	7.9	3.2
PCS total score	215	35.3	10.6	211	37.0	11.8	426	36.1	11.2
Rumination	215	16.9	4.6	212	17.5	5.0	427	17.2	4.8
Magnification	215	11.2	4.3	212	11.9	4.8	427	11.6	4.6
Helplessness	215	7.2	2.8	211	7.6	3.0	426	7.4	2.9
TAS total score	212	45.7	9.9	209	48.0	11.1	421	46.8	10.6
DIF	214	13.5	5.0	212	14.9	6.1	426	14.2	5.6
DDF	215	12.5	3.8	212	13.2	4.2	427	12.9	4.0
EOT	213	19.8	3.8	209	19.9	3.9	422	19.8	3.9
Sensory sensitivity	211	33.4	9.2	202	36.6	9.2	413	35.0	9.3
Sensory avoidance	210	34.0	9.1	204	36.2	9.1	414	35.1	9.1
Low registration	212	26.1	6.7	208	27.7	8.1	420	26.9	7.5
Sensation seeking	209	36.0	7.6	204	36.3	7.8	413	36.2	7.7

Abbreviations: DDF, difficulty in describing feelings; DIF, difficulty in identifying feelings; EOT, externally oriented thinking.; MDAS, Modified Dental Anxiety Scale; MDASAnticipatory, Anticipatory dental anxiety, items 1–2; MDASTreatment, Treatment-related dental anxiety, items 3–5; PCS, Pain Catastrophizing Scale; TAS; Toronto Alexithymia Scale.

TABLE 2 Correlations among variables using Spearman's correlation coefficient.

	MDAS total	MDAS Anticipatory	MDAS Treatment	PCS total	Rumination	Magnification	Helplessness	TAS total	DIF	DDF	EOT	Sensory Sensitivity	Sensory Avoidance	Low Registration	Sensation Seeking
MDAS total	–														
MDASAnticipatory	0.896	–													
MDASTreatment	0.971	0.773	–												
PCS total	0.395	0.397	0.366	–											
Rumination	0.329	0.329	0.306	0.914	–										
Magnification	0.392	0.389	0.362	0.924	0.743	–									
Helplessness	0.363	0.375	0.334	0.873	0.709	0.753	–								
TAS total	0.284	0.311	0.250	0.444	0.314	0.489	0.428	–							
DIF	0.303	0.338	0.260	0.471	0.334	0.499	0.472	0.868	–						
DDF	0.255	0.306	0.211	0.414	0.303	0.439	0.407	0.873	0.752	–					
EOT	0.083	0.063	0.089	0.093	0.037	0.150	0.070	0.555	0.186	0.280	–				
Sensory sensitivity	0.435	0.416	0.405	0.429	0.369	0.403	0.417	0.440	0.482	0.441	0.068	–			
Sensory avoidance	0.352	0.343	0.324	0.383	0.342	0.359	0.368	0.322	0.368	0.354	0.000	0.704	–		
Low registration	0.299	0.262	0.292	0.426	0.338	0.457	0.359	0.545	0.525	0.512	0.205	0.593	0.488	–	
Sensation seeking	−0.065	−0.093	−0.042	0.006	0.049	−0.045	0.007	−0.146	−0.039	−0.126	−0.210	0.036	−0.028	0.106	–

Abbreviations: DDF, difficulty in describing feelings; DIF, difficulty in identifying feelings; EOT, externally oriented thinking; MDAS, Modified Dental Anxiety Scale; MDASAnticipatory, Anticipatory dental anxiety, items 1–2; MDASTreatment, Treatment-related dental anxiety, items 3–5; PCS, Pain Catastrophizing Scale; TAS, Toronto Alexithymia Scale.

was associated with treatment-related dental anxiety and anticipatory dental anxiety. The goodness-of-fit indices for gender-specific SEM (The results of the likelihood ratio test: χ^2/df = 9.41/10.0, p = 0.49) indicated no gender differences in the association between dental anxiety and alexithymia.

Item analysis of sensory sensitivity in the Adult Sensory Profile was carried out to confirm unidimensionality for SEM. Results of the preliminary item analysis on the 15 items for sensory sensitivity among the total of 60 items are presented in Table S3. Items A7 and A9 were removed based on the polychoric correlation coefficient and factor loadings, and items A13, A16, A54, and A60 were removed based on the difficulty matrix. The eigenvalues from the categorical factor analysis showed 2.879, 1.007, 0.930, and 0.820, suggesting a one-factor structure. When item analysis was conducted again with the nine items extracted above, the polychoric correlation coefficients, factor loadings, and item analysis results were all within the reference range (Table S4). The constructed item information curves are shown in Figure S1. The test information functions for the nine items for sensory sensitivity were found to have higher accuracy for subjects with higher characteristic values. The nine items include three items related to vision (items A20, A22, and A25), while two items relate to general tactile sensations (items A27 and A33), two items relate to oral tactile sensations (items A31 and A34), one item relates to long-term concentration (item A48), and one item relates to acoustic sense (item A54). The nine items related to this sensory sensitivity were used in subsequent SEM analysis.

The exploratory factor analysis indicated a one-factor solution for the Pain Catastrophizing Scale, the eigenvalues being 7.031, 1.035, and 0.873 (Figure S2). Thus, the main SEM model treats the Pain Catastrophizing Scale as a one-factor structure.

The estimated SEM model applying the shortened version of sensory sensitivity, difficulty identifying feelings (a subscale of alexithymia), and catastrophic thinking is shown in Figure 3. After adjusting for negative dental treatment experience, age, and gender, only sensory sensitivity and pain catastrophizing were significantly associated with both anticipatory and treatment-related dental anxiety. Standardized regression coefficients showed that negative dental treatment experiences were more strongly associated with treatment dental anxiety than with anticipatory dental anxiety. On the other hand, sensory sensitivity and catastrophic thinking were relatively equally related to the two dimensions of dental anxiety. Difficulty identifying feelings was not independently associated with dental anxiety but was highly correlated with sensory sensitivity and pain catastrophizing.

Figure 4 presents the result of the mediation analysis. It shows that sensory sensitivity and pain catastrophizing served as full mediators of the association between difficulty

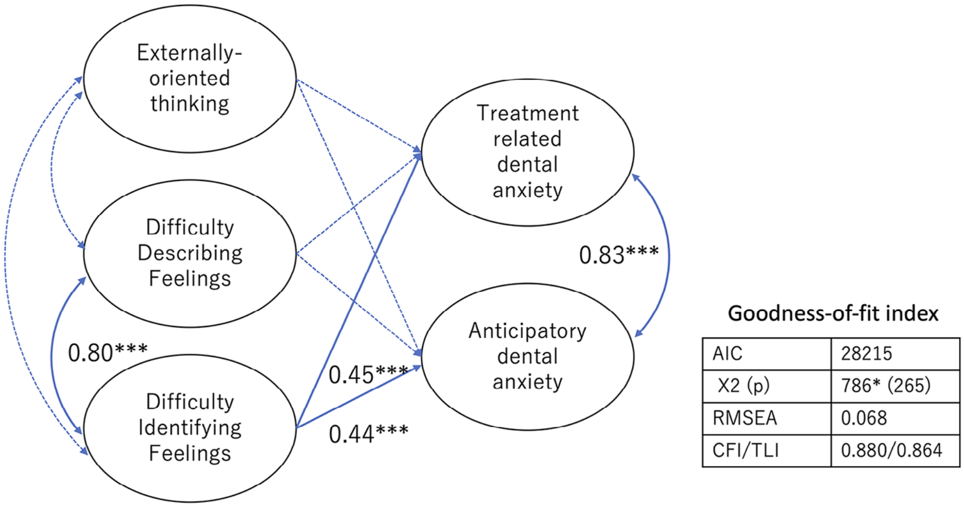

FIGURE 2 The estimated structural equation model with standardized coefficients and covariances among dental anxiety and alexithymia dimensions. ***$p < 0.001$. AIC, Akaike's information criterion; CFI, comparative fit index; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

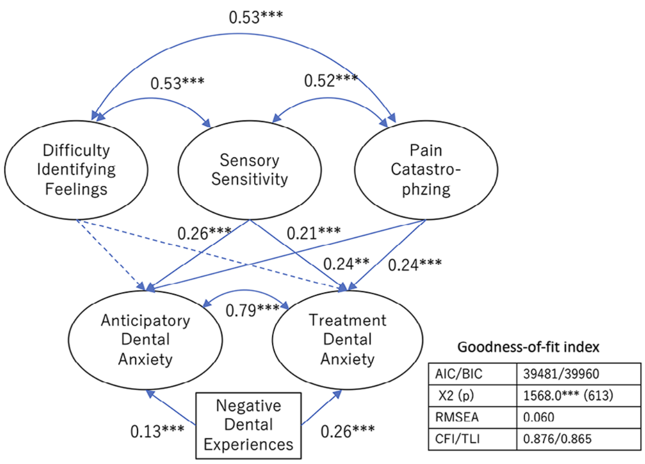

FIGURE 3 The estimated structural equation model with standardized coefficients and covariances among difficulty identifying feelings, nine items of sensory sensitivity, pain catastrophizing, and the dimensions of dental anxiety, adjusted for negative dental experiences, gender, and age. *$p < 0.05$, ***$p < 0.001$. AIC, Akaike's information criterion; CFI, comparative fit index; RMSEA, root mean square error of approximation; TLI, Tucker–Lewis index.

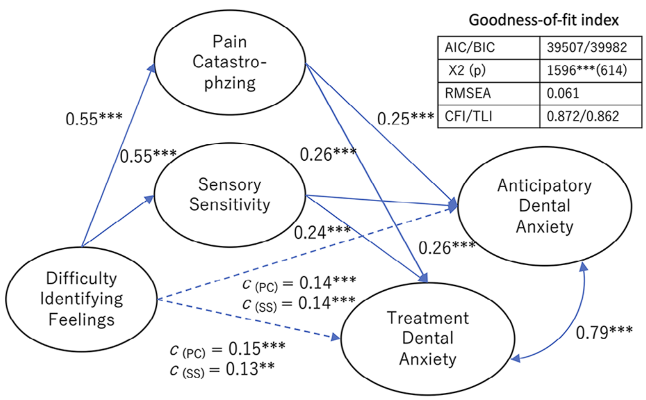

FIGURE 4 The estimated structural equation model with indirect effect of difficulty identifying feelings to dental anxiety via pain catastrophizing and sensory sensitivity, adjusted for negative dental experiences, gender, age. Path c indicates indirect effects. **$p < 0.01$, ***$p < 0.001$. AIC, Akaike's information criterion; CFI, comparative fit index; PC, pain catastrophizing; RMSEA, root mean square error of approximation; SS, sensory sensitivity; TLI, Tucker–Lewis index.

identifying feelings and both anticipatory and treatment-related dental anxiety.

DISCUSSION

Our findings indicate that sensory sensitivity and catastrophic thinking are independently associated with anticipatory and treatment-related dental anxiety. Moreover, the effect of difficulty identifying feelings, a subscale of alexithymia, on dental anxiety can be explained only by indirect effects using sensory sensitivity and catastrophic thinking as mediating variables.

Our findings suggest that hypersensitivity to visual, tactile, or hearing sensations also affects both dimensions of dental anxiety in adults. This extends and strengthens the previous findings on sensory sensitivity [18] in patients with high dental anxiety who feel uncomfortable with the sounds, vibrations, and smells in dental treatment [48]. Our findings indicated that sensory sensitivity in general, that is, not necessarily related to dental treatment, was associated with dental anxiety. In addition, we observed that pain catastrophizing was an important cognitive factor associated with both dimensions of dental anxiety. These findings are consistent with previous findings on catastrophic thinking being associated with pain and anxiety during dental treatment [25, 49, 50]. Our model's regression coefficients also indicate that sensory sensitivity and pain catastrophizing may be more important for the development of dental anxiety than self-reported negative experience as an exogenous factor.

Our finding that sensory sensitivity and pain catastrophizing served as full mediators of the association between difficulty identifying feelings and both anticipatory and treatment-related dental anxiety is novel. It is also supported by previous findings linking alexithymia to altered sensory processing, as well as interoceptive awareness, which appear to be linked to specific neurophysiological underpinnings [51, 52]. These associations have not previously been explored in the context of dental anxiety or in a setting where the alexithymia dimensions are assessed separately. Difficulty identifying feelings relates to experiencing unpleasant emotions but lacking a capability to differentiate them. The present findings shed light on the mechanisms by which these traits are linked to dental anxiety, and possibly also to anxiety on a more general level.

The present findings may suggest the importance of patients' sensory sensitivity and catastrophic thinking as targets for coping strategies for their treatment-related and anticipatory dental anxiety, which may increase risk for avoidance of dental treatment. Cognitive-behavioral therapy, if effective in treating dental anxiety [53, 54], can correct cognitive distortions related to pain catastrophizing. Patients with high sensory sensitivity can be helped with a sensory-adapted dental environment that is considerate to light, sound, smell, and touch, and this is particularly so for children with autism spectrum disorder [55–57], and adults with intellectual or developmental disabilities [58]. Relaxation techniques such as breathing and muscle relaxation [59], music therapy, a music-mediated relaxation method [60], or aromatherapy [61] can help in reducing dental anxiety in sensory-sensitive adults. Targeting these techniques to the most sensitive stimuli is also possible. It may also be helpful for a dentist to understand that some dentally anxious patients' reactions to stimuli and their inability to regulate reactions may arise, in patients with alexithymia, from a lack of capability to differentiate unpleasant emotions.

Since the participants in this study were individuals registered with a research company, their social background may differ from that of the general population. However, they were selected to obtain a roughly equal distribution of gender and a wide age range of 20−80 years, to improve the likely generalizability of the findings. Additional studies in large population-based samples are needed. In addition, we consider that the online method allows participants who normally avoid dental treatment to participate and is closer in nature to the general population than the recruitment of participants at medical institutions. Thus, we believe that our findings can be generalized to some extent to the general Japanese adult population.

To conclude, the present study sheds light on how the effect of trait-like phenomena on dental anxiety may be mediated by neurophysiological and cognitive factors such as sensory sensitivity and pain catastrophizing. In the presence of dental anxiety, patients' catastrophic thinking and sensory sensitivity may be important points for intervention, but further research on this is required.

AUTHOR CONTRIBUTIONS

Conceptualization: Mika Ogawa; Satu Lahti; Max Karukivi; Akihiro Saito; **Methodology**: Mika Ogawa; Satu Lahti; Akihiro Saito; **Validation**: Mika Ogawa; Satu Lahti; Akihiro Saito; **Formal analysis**: Mika Ogawa; Akihiro Saito; **Investigation**: Mika Ogawa; Akihiro Saito; **Data curation**: Mika Ogawa; Akihiro Saito; **Funding acquisition**: Mika Ogawa; **Writing—original draft preparation**: Mika Ogawa; **Writing—review and editing**: Mika Ogawa; Satu Lahti; Max Karukivi; Akihiro Saito.

ACKNOWLEDGMENTS

This work was supported by JSPS KAKENHI: Grant-in-Aid for Early-Career Scientists Grant Number 20K18817.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Ogawa M, Saito A, Karukivi M, Lahti S. Associations of sensory sensitivity, pain catastrophizing, and alexithymia with dental anxiety. Eur J Oral Sci. 2024;e12973. https://doi.org/10.1111/eos.12973