

ORIGINAL REPORT: EPIDEMIOLOGIC RESEARCH

Dental Care–Related Fear and Anxiety: Distress Tolerance as a Possible Mechanism

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Abstract: *Distress tolerance, the degree to which one is able to cope with and endure negative emotional states, has been broadly applied to understand and treat a variety of health (including behavioral) problems, but little is known about its role in oral health care and specifically dental care–related fear and anxiety, making it a novel construct in the oral health care literature. This cross-sectional study examined distress tolerance as a possible predictor of dental fear and anxiety among a sample of adults with and without diagnoses of dental phobia, investigated possible differences in levels of distress tolerance between adults with and without dental phobia, and determined possible associations between distress tolerance and fear of pain, anxiety sensitivity, and depression. Using 52 volunteers (n = 31, dental phobia group; n = 21, healthy comparison group), this investigation used self-report measures of distress tolerance, fear of pain, anxiety sensitivity, dental fear, and depression. The Anxiety*

Disorders Interview Schedule, a semi-structured interview, was used to assess for dental phobia and other psychological disorders. Distress tolerance significantly predicted dental fear and anxiety, even after controlling for age, sex, fear of pain, anxiety sensitivity, and depression. In addition, the dental phobia group had lower distress tolerance than the healthy comparison group. Distress tolerance was significantly associated with fear of pain, anxiety sensitivity, and depression. Findings indicate that low distress tolerance plays a unique and distinct role as a possible mechanism in the genesis of dental care–related fear and anxiety and phobia and may exacerbate the experience of other states, including fear of pain and anxiety sensitivity.

Knowledge Transfer Statement:

Results indicate that patients who have a lower ability to tolerate emotional and physical distress may have higher levels of dental care–related fear and anxiety and even dental phobia,

as well as associated sequelae (e.g., avoidance of dental care). Treatment of highly fearful dental patients may helpfully entail focus on increasing distress tolerance.

Keywords: dental anxiety, dental fear, clinical psychology, anxiety disorders, phobia, behavioral science

Distress tolerance can be defined as an individual's ability to tolerate negative, aversive, or uncomfortable emotional states, such as anxiety, fear, disgust, depression, sadness, and anger (Simons and Gaher 2005; Marshall-Berenz et al. 2010). The concept of distress tolerance is relevant and crucial to oral health care generally, given that dental patients' treatments include procedures that sometimes are lengthy (e.g., scaling and root planing), uncomfortable (e.g., endodontic treatments), and even painful (e.g., extractions involving gingival inflammation).

Components of distress tolerance include appraising distressing emotions as unacceptable, being overly distracted by distress, a tendency to regulate

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feelings of distress via emotional avoidance, and generally low tolerance of distressing feelings. Previously studied in the context of treatment for substance abuse disorders (Daughters et al. 2005), panic disorder (Schmidt et al. 2011), and borderline personality disorder (Bornovalova et al. 2008), among others, distress tolerance's role in dental phobia is unknown. Because most patients report experiencing some pain or discomfort during dental care (Vassend 1993), and many patients experience anxiety and fear (McNeil and Randall 2014), tolerance of these distressing experiences may be important to understanding the theoretical and practical aspects of dental care avoidance and dental phobia. Distress tolerance, therefore, shows promise as a key variable to be addressed in improving the theoretical and practical understanding of dental care-related fear and anxiety (albeit less precise, described subsequently as "dental fear" for simplicity).

Despite major technological advances in oral health care, dental phobia and other, less severe characterizations of dental fear remain significant barriers to proper dental care globally (Edmunds and Buchanan 2012; McNeil and Randall 2014). Dental phobia is characterized by excessive fear in the anticipation or presence of dental care-related stimuli, extreme anxiety when presented with dental care-related stimuli, avoidance of dental care-related stimuli, and interference with an individual's daily functioning (American Psychiatric Association 2013). Individual and public health consequences of avoiding dental care are translational in nature and include oral disease, as well as systemic issues such as cardiovascular disease and respiratory infection (Deshpande et al. 1998–1999; Mojon 2002). As such, and given that patients with dental phobia present with very high levels of dental fear, an improved understanding of the etiologies and maintenance of dental fear is imperative.

The etiology of dental fear has been explained using classical conditioning theory, operant conditioning, social

learning, genetics, and cognitive vulnerability (Mowrer 1939; Melamed and Williamson 1991; Armfield et al. 2008; Ray et al. 2010; McNeil et al. 2014; McNeil and Randall 2014). It is possible that low distress tolerance, or inability to tolerate negative internal states, also plays a role in the etiology or maintenance of dental fear. Depression is known to co-occur and may be synergistic with both dental fear (McNeil and Randall, 2014) and intolerance of distress (Clen et al. 2011).

Individuals with lower distress tolerance may avoid or make great efforts to change situations that cause distressing emotions or states (Simons and Gaher 2005), such as anxiety, fear, pain, or depression. Pain tolerance and distress tolerance are separate but likely related constructs (Bernstein et al. 2009). Lower distress tolerance may be related to greater fear of pain and/or anxiety sensitivity, both of which play a role in dental fear (McNeil and Berryman 1989; Locker et al. 1999). Pain may be particularly noxious for individuals lower in distress tolerance, and thus fears about pain may be higher in this group. Therefore, individuals with lower distress tolerance may be particularly likely to avoid feeling fear about pain by not seeking dental care, which is part of a vicious cycle resulting in dental phobia (McNeil and Randall 2014).

Parallel to fear of pain is anxiety sensitivity, which can be defined as the "fear of arousal-related sensations," and comprises cognitive, social, and physical components (i.e., fear of losing control, fear that others might observe anxiety symptoms, and fear of physical sensations; Taylor et al. 2007; Wheaton et al. 2012). Similar to the conceptualization of fear of pain and distress tolerance, it is possible that individuals with lower distress tolerance may be particularly sensitive to feelings of anxiety and fear and find these feelings extremely aversive. Because of this increased sensitivity, individuals with lower distress tolerance may avoid situations (e.g., dental ones) in which they are likely to experience these aversive symptoms.

The objective of the present study was to enhance understanding of specific emotional mechanisms of dental phobia by determining whether distress tolerance predicted self-reported dental fear and comparing self-reported levels of distress tolerance between adults with dental phobia and those in a healthy comparison group. It was hypothesized that a) distress tolerance would significantly predict dental fear and anxiety, b) participants with dental phobia would have lower levels of distress tolerance (and all its components) in comparison to participants in a healthy comparison group, and c) distress tolerance would be negatively correlated with measures of fear of pain, anxiety sensitivity, and depression.

Methods

Experimental Design

This study used a 2-group, between-subjects, cross-sectional design. Methods employed in this study are consistent with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

For the purposes of reducing bias, participants with dental phobia were matched with healthy comparison participants on the bases of age (i.e., within 5 y), sex, and income.

Participants

A sample of 52 community-dwelling participants were recruited for the current study between August 2013 and October 2014. Participants in the dental phobia group ($n = 31$) were involved in a larger dental phobia treatment study, which required for eligibility at least 2 y of avoidance of dental care. As expected, the dental fear scores for participants in the dental phobia sample were high and relatively narrow in range. In the general population, however, dental fear exists on a wide continuum and is positively skewed (see McNeil and Randall 2014). Thus, to capture variation in dental fear so as to better elucidate the emotional

Table 1.

Total Number/Mean (and Percentages or Standard Deviations) for Demographic Characteristics.

Characteristic	Group		χ^2	df	P Value
	Dental Phobia (n = 31)	Healthy Comparison (n = 21)			
Sex, n (%)			.03	51	1.0
Female	14 (45.2)	9 (42.9)			
Male	17 (54.8)	12 (57.1)			
Age, mean (SD)	38.6 (14.4)	35.7 (14.8)	-.7 ^a	50	0.49
Ethnicity/race, n (%)					
Caucasian	21 (67.7)	19 (90.4)			
African American	7 (22.6)	1 (4.8)			
Asian	1 (3.2)	—			
Multiracial	2 (6.5)	1 (4.8)			
Relationship status, n (%)			1.5	51	0.32
Married	9 (29.0)	3 (14.3)			
Unmarried	22 (71.0)	18 (85.7)			
Income, n (%)					
<\$9,999	8 (25.8)	8 (38.1)			
\$10,000–\$24,999	9 (29.0)	3 (14.3)			
\$25,000–\$49,999	6 (19.3)	1 (4.8)			
\$50,000–\$99,999	4 (12.9)	7 (33.3)			
≥\$100,000	4 (12.9)	2 (9.5)			
Education (12 = high school diploma), mean (SD)	14.8 (2.8)	14.4 (2.6)	.28 ^a	50	0.78

^aAge and education were measured as continuous variables; therefore, *t* values are presented.

mechanisms underlying dental phobia, 21 healthy control (i.e., without dental phobia) participants were recruited to serve as a comparison group specifically for the analyses presented here. Data were collected at 2 separate sites: West Virginia University (WVU) and Indiana University (IU). All participants were able to understand, speak, read, and write English. See the online Appendix for additional information on recruitment, exclusionary criteria, and participant payment. Data collection for this study was approved by institutional review

boards at both WVU and IU. See Table 1 for participant characteristics and the Appendix for more detailed participant information.

Measures

Psychometric information about each self-report measure/interview is included in the Appendix.

Distress Tolerance Scale

The Distress Tolerance Scale (DTS; Simons and Gaher 2005) is a 15-item

self-report measure designed to assess an individual's ability to experience and withstand negative emotional states. The DTS comprises 4 subscales, including perceived ability to tolerate emotional distress, self-report appraisal of distress, attention absorbed by distress, and behaviors to alleviate distress (Simons and Gaher 2005).

Fear of Pain Questionnaire-III

The Fear of Pain Questionnaire-III (FPQ-III) is a 30-item self-report

Table 2.
Results of Multiple Linear Regression Testing Distress Tolerance as a Predictor of Total DFS Scores.

Variable	B	SE (B)	β	Adjusted R^2	ΔR^2
Step 1				.02	.02
Age	.25	.37	.13		
Sex	-5.39	7.91	-.10		
Step 2				.43**	.47**
BDI-II total score	-.46	.31	-.15		
ASI-III total score	.79	.24	.43**		
FPQ-III total score	.45	.12	.47**		
Step 3				.49**	.06**
DTS total score	-.70	.29	-.37*		

B refers to the unstandardized slope, and the symbol β refers to the standardized slope. ASI-III, Anxiety Sensitivity Index-III; BDI-II, Beck Depression Inventory-II; DFS, Dental Fear Survey; DTS, Distress Tolerance Scale; FPQ-III, Fear of Pain Questionnaire-III. The regression equation included 52 participants. The variable "sex" was coded as male = 1 and female = 0; being female was associated with higher DFS scores (nonsignificant). The variable "age" was entered as age in years; older age was associated with higher DFS scores (nonsignificant).

* $P < 0.05$. ** $P < 0.01$.

measure of pain-related fear (McNeil and Rainwater 1998).

Anxiety Sensitivity Index-III

The Anxiety Sensitivity Index-III (ASI-III; Taylor et al. 2007) is an 18-item questionnaire that measures fear of anxiety-related sensations or arousal.

Dental Fear Survey

The Dental Fear Survey (DFS; Kleinknecht et al. 1973) is a 20-item questionnaire used to identify fearful stimuli and reactions associated with dentistry.

Beck Depression Inventory-II

The Beck Depression Inventory-II (BDI-II; Beck et al. 1996) is a 21-item self-report measure designed to assess the affective, cognitive, and physiological symptoms of depression.

Anxiety Disorders Interview Schedule-IV

The Anxiety Disorders Interview Schedule-IV (ADIS-IV; Brown et al. 2001) is a structured interview designed to assess and diagnose current episodes of anxiety disorders. The ADIS-IV also

assesses for disorders that have high comorbidity with anxiety disorders, including mood disorders, substance abuse disorders, and somatoform disorders. This instrument allows for a standardized diagnosis of participants' dental phobia (American Psychiatric Association 2013), as well as any other relevant clinical syndromes.

Procedure

Potential participants contacted a designated local phone number or study email address in regard to advertisements. A research assistant screened and scheduled each participant for the study. When a participant arrived for the study, he or she was provided information verbally and given a written informed consent form that provided information on study procedures. Thereafter, the participant completed the self-report measures, as well as the ADIS-IV interview. Procedures for the larger study began 1 wk later.

Statistical Analyses

To determine whether distress tolerance predicted dental fear scores, a multiple linear regression was conducted

with step 1 (age and sex), step 2 (FPQ-III total score, ASI-III total score, and BDI-II total score), and step 3 (DTS total score). Bivariate correlational analyses were conducted to determine the extent to which distress tolerance was related to self-reported fear of pain, anxiety sensitivity, dental fear, and depression.

Results

Distress Tolerance as a Predictor of Dental Fear Survey Scores

The first hypothesis was supported, as distress tolerance significantly predicted participants' self-reported level of dental fear, even after controlling for known contributors to dental fear, such as fear of pain and anxiety sensitivity. Both step 2 (FPQ-III, ASI-III, and BDI-II) and step 3 (DTS) of the regression model explained significant proportions of the variance in DFS scores (see Table 2). Distress tolerance, therefore, may be a distinct contributor to the etiology and maintenance of dental fear.

Differences in Distress Tolerance between Groups

In regard to the second hypothesis, distress tolerance differed between

Table 3.
Means (and Standard Deviations) and Results of *t* Tests for Distress Tolerance Scale.

Characteristic	Group, Mean (SD)		<i>t</i>	<i>df</i>
	Dental Phobia (<i>n</i> = 31)	Healthy Comparison (<i>n</i> = 21)		
DTS total	47.2 (14.6)	62.6 (9.4)	4.35**	50
DTS subscale average	3.1 (1.0)	4.1 (.7)	4.23**	50
Absorption	3.0 (1.2)	3.9 (1.0)	2.87*	50
Regulation	2.9 (1.2)	3.0 (1.2)	3.13*	50
Appraisal	3.3 (1.1)	4.4 (.7)	3.77**	50
Tolerance	3.1 (1.0)	4.2 (.8)	4.21**	50

DTS, Distress Tolerance Scale.
P* < 0.05. *P* < 0.01.

Table 4.
Summary of Bivariate Intercorrelations on the DTS, FPQ-III, ASI-III, DFS, and BDI-II.

Measure	DTS	FPQ-III	ASI-III	DFS	BDI-II
DTS					
FPQ-III	-.55**				
ASI-III	-.61**	.48**			
DFS	-.57**	.62**	.57**		
BDI-II	-.64**	.48**	.54**	.30*	

N = 52. ASI-III, Anxiety Sensitivity Index—III; BDI-II, Beck Depression Inventory—II; DFS, Dental Fear Survey; DTS, Distress Tolerance Scale; FPQ-III, Fear of Pain Questionnaire—III.
P* < 0.05. *P* < 0.01.

groups of participants with and without a diagnosis of dental phobia; participants with dental phobia had lower levels of distress tolerance in comparison to participants in the healthy comparison group on the total DTS score and all 4 DTS subscales. The effect size, calculated using eta squared, was .34. This difference in mean scores was “large,” based on Cohen’s (1988) guidelines. In addition, the dental phobia group reported significantly lower scores on all 4 subscales—Appraisal, Absorption, Regulation, and Tolerance (see Table 3). This difference was expected yet unique, as low distress tolerance has been shown to exist in other anxiety disorders (Timpano et al. 2009; Marshall-Berenz et al. 2010) but never before in specific phobias, let alone dental phobia.

Associations between Distress Tolerance and Other Constructs

The third hypothesis was that total DTS scores would be negatively correlated with scores on the ASI-III, FPQ-III, DFS, and BDI-II. All of these hypothesized correlations were confirmed with bivariate correlational analyses (see Table 4). Total DTS scores were found to be significantly negatively correlated with scores on the FPQ-III, ASI-III, DFS, and BDI-II, such that lower distress tolerance was associated with higher fear of pain, higher anxiety sensitivity, higher dental fear, and higher depressive symptomatology.

Discussion

Distress tolerance uniquely predicted dental fear, separate from anxiety

sensitivity and fear of pain. Given this finding, distress tolerance plays a unique role in dental fear, such that low levels of distress tolerance may compound or exacerbate fear of pain and anxiety sensitivity, thus making experiences with dental care particularly aversive. This is perhaps the most critical conclusion and deepens our conceptualization and understanding of dental fear.

Simons and Gaher’s (2005) distress tolerance theory explains that individuals with low distress tolerance a) appraise their feelings of distress as unacceptable, b) become absorbed in their feelings of distress, c) have a strong desire to regulate feelings of distress by escaping negative emotions, and d) have a difficult time tolerating negative emotions in general. These components of distress tolerance—appraisal, absorption,

regulation, and tolerance—can be applied to dental phobia. When dental patients with lower distress tolerance associate dental visits with negative emotions (e.g., fear of pain, disgust, helplessness), they may appraise these feelings as being unacceptable and difficult or impossible with which to cope (appraisal). Dental patients with low distress tolerance can become preoccupied about their feelings of fear of pain and anxiety (absorption) and desire to regulate their negative emotions via avoidance or engaging in safety behaviors, such as self-medication (regulation). Dental patients with low distress tolerance in general may struggle to tolerate negative emotions associated with dental care (tolerance).

Participants' scores on the DTS had a strong negative correlation with their scores on the FPQ-III. Given that fear is distressing to most people, it is not surprising that individuals with lower distress tolerance reported more fear of pain; painful stimuli may be particularly noxious to individuals with low distress tolerance. Participants' scores on the DTS were negatively correlated with their scores on the BDI-II, such that lower distress tolerance was associated with higher levels of depression. Clen et al. (2011) suggested that distress tolerance is implicated in 3 crucial components of depression: rumination, emotional suppression, and behavioral avoidance. Individuals with lower distress tolerance perceive unhappy emotions as "bad" or "negative," and their attempts at trying to remedy the negative emotions result in depressive rumination; individuals with lower distress tolerance also view themselves as being unable to cope with negative emotions, so they suppress them (resulting in muted affect), and avoid activities that they perceive could cause negative feelings (resulting in behavioral avoidance).

Distress tolerance may play a role in dental phobia that is exclusive to stimuli involved in dentistry, particularly painful ones. In most anxiety disorders, exposure to feared stimuli can cause a great deal of emotional distress and

exhaustion but rarely causes direct physical pain (e.g., a person with social phobia giving a speech in front of a class, or an individual with obsessive-compulsive disorder abstaining from engaging in a particular compulsion may be distressing and difficult but will unlikely result in physical pain, discomfort, or tissue damage). When someone with dental phobia confronts feared stimuli (i.e., visiting the dentist), there is a realistic possibility of experiencing physical pain and discomfort (Vassend 1993).

Application of Findings to Dental Practice

These results suggest that the inclusion of a measure of distress tolerance in the assessment of dental phobia could enhance case conceptualization and treatment planning. In addition, some patients may benefit from brief distress tolerance skill building (see Linehan 1993) as an adjunct to exposure and other therapies for dental phobia. Implementation of cognitive-behavioral therapy, however, likely is outside the scope of competence of oral health professionals. Still, these results can be applied to dentistry practice. Oral health professionals should consider behavioral and pharmacotherapeutic interventions to help those who may be less able to tolerate the distress of fear-evoking and painful situations in dental care. In addition, oral health professionals should be aware of the high rates of comorbidity with other psychological disorders and how these other disorders may exacerbate or even complicate the "vicious cycle" of dental fear (Armfield et al. 2007).

Prior research suggests that, for many people, ability to tolerate physical pain/discomfort is distinct from the ability to tolerate emotional distress (Bernstein et al. 2009; Schmidt et al. 2011). Given the strong bivariate correlation between distress tolerance and fear of pain in the present sample, it is likely that for individuals with dental phobia, distress tolerance and pain tolerance may be theoretically linked. Similar to how

increased anxiety sensitivity can affect expectations of pain and reports of pain experience (Klages et al. 2006), it is possible that lowered distress tolerance leads an individual to have difficulty tolerating various negative emotions associated with dental care (e.g., disgust, sadness, helplessness, fear) and in turn affects pain sensitivity (i.e., those with lower distress tolerance report experiencing more pain).

Given high levels of dental fear worldwide and the common experience of pain during dental care, distress tolerance is a crucial construct to oral health care, particularly as it relates to individuals with dental phobia. Distress tolerance plays a unique role in dental fear and may exacerbate fears of pain and anxiety sensitivity. As a construct, distress tolerance may deepen our understanding of dental phobia and even the reactions of dental patients generally.

Future Directions for Research

Future work should elucidate possible distinctions between distress tolerance and pain tolerance, as well as other constructs. A better understanding of these constructs could aid in treatment development. For example, if it is found that distress tolerance and pain tolerance are separate but related constructs, then targeting distress tolerance could make uncomfortable dental procedures more tolerable for patients who struggle to cope with negative emotions. Any future work in the area of distress tolerance would benefit from both self-report and behavioral measures. The inclusion of behavioral measures is of particular importance in the case of comparing distress tolerance and pain tolerance, as pain tolerance typically is measured using a behavioral pain task (e.g., algometer; Rainwater and McNeil 1991).

Author Contributions

S.H. Addicks, D.W. McNeil, C.L. Randall, contributed to conception, design, data acquisition, analysis, and interpretation, drafted and critically revised the manuscript; A. Goddard,

contributed to conception, design, and data acquisition, critically revised the manuscript; L.M. Romito, B.D. Weaver, contributed to design, data acquisition, and interpretation, critically revised the manuscript; C. Sirbu, G. Kaushal, contributed to design, critically revised the manuscript; A. Metzger, contributed to data analysis and interpretation, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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References

- American Psychiatric Association. 2013. Diagnostic and statistical manual of mental disorders. 5th ed. Arlington (VA): American Psychiatric Publishing.
- Armfield JM, Slade GD, Spencer AJ. 2008. Cognitive vulnerability and dental fear. *BMC Oral Health*. 8:2.
- Armfield JM, Stewart JF, Spencer AJ. 2007. The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. *BMC Oral Health*. 7:1.
- Beck AT, Steer R, Brown G. 1996. Beck Depression Inventory–Second Edition manual. San Antonio (TX): Psychological Corporation.
- Bernstein A, Zvolensky MJ, Vujanovic AA, Moos R. 2009. Integrating anxiety sensitivity, distress tolerance, and discomfort intolerance: a hierarchical model of affect sensitivity and tolerance. *Behav Ther*. 40(3):291–301.
- Bornovalova MA, Gratz KL, Daughters SB, Nick B, Delany-Brumsey A, Lynch TR, Kosson D, Lejuez CW. 2008. A multimodal assessment of the relationship between emotion dysregulation and borderline personality disorder among inner-city substance users in residential treatment. *J Psychiatr Res*. 42(9):717–726.
- Brown TA, Di Nardo PA, Lehman CL, Campbell LA. 2001. Reliability of DSM-IV anxiety and mood disorders: implications for the classification of emotional disorders. *J Abnorm Psychol*. 110(1):49–58.
- Clen S, Mennin D, Fresco D. 2011. Major depressive disorder. In: Zvolensky M, Bernstein A, Vujanovic AA, editors. *Distress tolerance: theory, research, and applications*. New York (NY): Guilford. p. 149–170.
- Cohen J. 1988. *Statistical power analysis for the behavioral sciences*. Hillsdale (NJ): Lawrence Erlbaum.
- Daughters SB, Lejuez CW, Bornovalova MA, Kahler CW, Strong DR, Brown RA. 2005. Distress tolerance as a predictor of early treatment dropout in a residential substance abuse treatment facility. *J Abnorm Psychol*. 114(4):729–734.
- Deshpande RG, Khan M, Genco CA. 1998–1999. Invasion strategies of the oral pathogen *Porphyromonas gingivalis*: implications for cardiovascular disease. *Invasion Metastasis*. 18(2):57–69.
- Edmunds R, Buchanan H. 2012. Cognitive vulnerability and the aetiology and maintenance of dental anxiety. *Community Dent Oral Epidemiol*. 40(1):17–25.
- Klages U, Kianifard S, Ulusoy Ö, Wehrbein H. 2006. Anxiety sensitivity as predictor of pain in patients undergoing restorative dental procedures. *Community Dent Oral Epidemiol*. 34(2):139–145.
- Kleinknecht RA, Klepac RK, Alexander LD. 1973. Origins and characteristics of fear of dentistry. *J Am Dent Assoc*. 86(4):842–848.
- Linehan M. 1993. *Cognitive-behavioral treatment of borderline personality disorder*. New York (NY): Guilford.
- Locker D, Liddell A, Shapiro D. 1999. Diagnostic categories of dental anxiety: a population-based study. *Behav Res Ther*. 37(1):25–37.
- Marshall-Berenz EC, Vujanovic AA, Bonn-Miller MO, Bernstein A, Zvolensky MJ. 2010. Multimethod study of distress tolerance and PTSD symptom severity in a trauma-exposed community sample. *J Trauma Stress*. 23(5):623–630.
- McNeil DW, Berryman ML. 1989. Components of dental fear in adults? *Behav Res Ther*. 27(3):233–236.
- McNeil DW, Rainwater AJ III. 1998. Development of the Fear of Pain Questionnaire–III. *J Behav Med*. 21(4):389–410.
- McNeil DW, Randall CL. 2014. Dental fear and anxiety associated with oral health care: conceptual and clinical issues. In: Mostofsky DI, Forgione AG, Giddon DB, editors. *Behavioral dentistry*. 2nd ed. Ames (IA): Blackwell. p. 89–107.
- McNeil DW, Vargovich AM, Sorrell JT, Vowles KE. 2014. Environmental, emotional, and cognitive determinants of dental pain. In: Mostofsky DI, Fortune F, editors. *Behavioral dentistry*. 2nd ed. Ames (IA): John Wiley. p. 89–107.
- Melamed BG, Williamson DJ. 1991. Programs for the treatment of dental disorders: dental anxiety and temporomandibular disorders. In: Sweet JJ, Rozensky RH, Tovian SM, editors. *Handbook of clinical psychology in medical settings*. New York (NY): Plenum. p. 539–566.
- Mojon P. 2002. Oral health and respiratory infection. *J Can Dent Assoc*. 68(6):340–345.
- Mowrer OH. 1939. A stimulus-response analysis of anxiety and its role as a reinforcing agent. *Psychol Rev*. 46(6):553–565.

- Rainwater AJ, McNeil DW. 1991. Reinventing the algometer: synopsis of the literature and presentation of a reliable, inexpensive model. *Behav Res Methods Instrum Comput.* 23(4):486–492.
- Ray J, Wide Boman U, Bodin L, Berggren U, Lichtenstein P, Broberg AG. 2010. Heritability of dental fear. *J Dent Res.* 89(3):297–301.
- Schmidt NB, Mitchell M, Keough M, Riccardi C. 2011. Anxiety and its disorders. In: Zvolensky MJ, Bernstein A, Vujanovic AA, editors. *Distress tolerance: theory, research, and applications.* New York (NY): Guilford. p. 105–125.
- Simons JS, Gaher RM. 2005. The Distress Tolerance Scale: development and validation of a self-report measure. *Motiv Emot.* 29(2):83–102.
- Taylor S, Zvolensky M, Cox B, Deacon B, Heimberg R, Ledley D, Abramowitz J, Holaway R, Sandin B, Stewart S, et al. 2007. Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index–3. *Psychol Assess.* 19(4):176–188.
- Timpano KR, Buckner JD, Richey JA, Murphy DL, Schmidt NB. 2009. Exploration of anxiety sensitivity and distress tolerance as vulnerability factors for hoarding behaviors. *Depress Anxiety.* 26(4):343–353.
- Vassend O. 1993. Anxiety, pain and discomfort associated with dental treatment. *Behav Res Ther.* 31(7):659–666.
- Wheaton MG, Mahaffey B, Timpano KR, Berman NC, Abramowitz JS. 2012. The relationship between anxiety sensitivity and obsessive-compulsive symptom dimensions. *J Behav Ther Exp Psychiatry.* 43(3):891–896.