

AN EXAMINATION OF CONSTRUCTS ASSOCIATED WITH DENTAL
ANXIETY AND AVOIDANCE AMONG ADULTS SEEKING DENTAL CARE

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ABSTRACT

Dental anxiety and the avoidance of dental treatment serve as substantial barriers to dental care and are associated with a range of maladaptive behaviors and outcomes. However, many important psychological constructs that may increase our understanding of anxiety and avoidance in relation to dental care and hence our ability to properly intervene have been poorly examined or neglected in the literature.

The present study examined the prevalence of dental anxiety, specific phobia of dental procedures, and avoidance of dental care among dental patients presenting for routine ($n = 78$) and emergency ($n = 42$) care using self-report questionnaires, clinician-administered interview, and 6-month follow-up dental appointment data. We investigated correlates of dental anxiety, dental phobia, avoidance of dental care, and oral-health related quality of life (OHRQoL). It was expected that emergency patients would exhibit significantly greater impairment than regular care patients across several variables, with a similar pattern expected for patients with a specific phobia relative to those without the diagnosis. Further, it was hypothesized that emotion regulation, distress tolerance, experiential avoidance, and mindfulness would moderate the anxiety-avoidance and anxiety-OHRQoL relationships. Additional models tested the moderating roles of pain, optimism, and re-experiencing symptoms related to a prior traumatic dental event on the relationship between social appearance anxiety and avoidance of dental care.

Dental anxiety, severity of phobia, and OHRQoL correlated with social appearance anxiety, pain experienced at the last dental appointment, re-experiencing symptoms, and blood-injection-injury fears, among other variables; however, there was no evidence that they were related to emotion regulation, and limited relationships

emerged with experiential avoidance, distress tolerance, and mindfulness. Avoidance of dental care was unrelated to dental anxiety, other forms of anxiety, OHRQoL, pain, pessimism, and several other constructs related to emotion dysregulation, and difficulties with mindfulness. Our hypotheses that emergency patients would have a higher prevalence of dental phobia, longer avoidance, and greater pain at the last dental appointment than regular care patients was supported, although the groups did not differ on dental anxiety or remaining variables. As expected, patients with specific phobia ($n = 26$) scored higher than those without a diagnosis ($n = 94$) on dental anxiety, OHRQoL, social appearance anxiety, re-experiencing symptoms, and pain, but these groups did not differ on avoidance or other constructs. Our moderation hypotheses had minimal support: Dental anxiety was most strongly associated with avoidance of a dental appointment among those reporting the greatest experiential avoidance and the least mindful awareness, and dental anxiety was most strongly associated with OHRQoL among those demonstrating the greatest mindful observing. Implications of these findings are addressed, followed by a discussion of study limitations and directions for future research.

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CHAPTER 1

INTRODUCTION

An Examination of Constructs Associated with Dental Anxiety and Avoidance among Adults Seeking Dental Care

Dental anxiety, or the fear of dental procedures, is a relatively common problem affecting 10-20% of the adult population in the United States (Doerr, Lang, Nyquist, & Ronis, 1998; Locker, Liddell, & Shapiro, 1999; Milgrom, Fiset, Melnick, & Weinstein, 1988; Sohn & Ismail, 2005), with estimates ranging from 4% to 30% abroad (Humphris, Dyer, & Robinson, 2009; Humphris & King, 2011; Schwarz & Birn, 1995; Vassend, 1993). Despite improvements in modern dentistry, dental anxiety scores have remained stable since the mid-1900s (Smith & Heaton, 2003). Dental anxiety results in postponement or avoidance of dental treatment and, hence, poorer oral health and oral health-related quality of life (Berggren & Meynert, 1984; Hakenberg, Berggren, Carlsson, & Grondahl, 1993; Ng & Leung, 2008; Thomson, Stewart, Carter, & Spencer, 1996). One study found that dentally anxious individuals had eight to nine decaying teeth compared with one or two in the general population (Thom, Sartory, & Jöhren, 2000). Patients with elevated dental anxiety also experience negative thoughts and feelings, sleep disturbance, increased use of medication, a greater tendency toward somatization, and impaired social and occupational functioning, relative to patients without dental anxiety (Berggren, 1993; Cohen, Fiske, & Newton, 2000; Kaufman, Bauman, Lichtenstein, Garfunkel, & Hertz, 1991; Kent, Rubin, Getz, & Humphris, 1996). Moreover, these individuals report elevated scores on a broad range of psychological difficulties as measured by the Symptom Checklist 90-Revised (Aartman, de Jongh, &

van der Meulen, 1997). Of note, not all of these studies controlled for comorbidity, which could account for some of these findings. Dental anxiety has important public health implications; however, the literature generally fails to examine specific constructs which may moderate the anxiety response to dental procedures and settings.

One of the primary measures of dental anxiety is the Modified Dental Anxiety Scale (MDAS; Humphris, Morrison, & Lindsay, 1995), which assesses self-reported anticipatory anxiety associated with an upcoming dental appointment, fear of dental cleaning and drilling, and fear of local anesthetic injection. This constellation of fears reflects the research community's widely accepted operationalization of dental anxiety. In contrast to dental anxiety, the diagnosis of specific phobia of dental procedures, as classified in the *Diagnostic and Statistical Manual of Mental Disorders – 4th edition* [DSM-IV; American Psychiatric Association (APA), 1994], can be distinguished by the significant degree to which the fear or avoidance of dental procedures (i.e., the feared stimulus) interferes with an individual's daily routine, occupational or social functioning, or to which the presence of the fear itself is associated with significant distress.

Attempts to measure prevalence, correlates, and consequences of dental anxiety have been limited by the use of different measures to assess dental anxiety across studies. With regard to inconsistent measurement, a study comparing three self-report instruments for the assessment of dental anxiety found that, despite significant associations between scores on pairs of measures, agreement among them was only fair to moderate (κ ranged from .37 to .56; Locker, Shapiro, & Liddell, 1996). The use of different measures to assess the construct of dental anxiety may pose problems for the reliability of its operationalization and consequently lead to inconsistent findings across studies. This may

be one factor contributing to the wide range of prevalence estimates reported in the literature.

The study of dental anxiety has been further complicated by the imprecise use of the terms *fear* and *anxiety*, resulting in conflicting findings. Although the distinction between these constructs is well-documented (Craske, 1999; McNaughton & Corr, 2008; Sylvers, Lilienfeld, & LaPrairie, 2011), it is largely disregarded in the dental literature. Fear is a primitive, basic emotion tied to the fight or flight response, activated in response to an imminent and specific threat; anxiety is a conditioned response characterized by anticipation of or worry about a potential future threat. Because the majority of studies in the dental literature use these terms interchangeably and often measure them with the same instruments, the current proposal draws from the entire literature but exclusively uses the term *dental anxiety*.

Etiology and Maintenance of Dental Anxiety

Half of the individuals who develop dental anxiety report onset during childhood, 22% in adolescence, and 27% in adulthood (Locker, Liddell, Dempster, & Shapiro, 1999). Across numerous studies, a larger portion of individuals within the age range of 18 to 39 have reported high dental anxiety, compared with younger and older age groups (Hakeberg, Berggren, & Carlsson, 1992; Humphris et al., 2009; Schwarz & Birn, 1995; Stouthard & Hoogstraten, 1990; Thomson, Stewart, Carter, & Spencer, 1996). Liddel and Locker (1997) compared patients in different age groups and found that dental anxiety decreased significantly with age just among the 64 years and older group. A gender difference in the prevalence and severity of dental anxiety has consistently been found, with women reporting significantly higher prevalence and severity of dental anxiety

(Doerr et al., 1998; Hakeberg et al., 1992; Liddel & Locker, 1997; Milgrom et al., 1988; Stouthard & Hoogstraten, 1990; Thomson et al., 1996). Dental anxiety also tends to be related to socioeconomic status (SES), as there is evidence of higher prevalence and severity of dental anxiety among individuals falling into groups receiving welfare benefits or lacking health insurance (Doerr et al., 1998; Stouthard & Hoogstraten, 1990; Thomson, Dixon, & Kruger, 1999).

The overarching etiological explanations proposed for dental anxiety have broadly highlighted conditioned responses to aversive dental experiences, predisposing temperamental or personality characteristics, and heightened pain sensitivity or fear of dental pain (Locker, Liddell, Dempster, & Shapiro, 1999; Locker, Liddell, & Shapiro, 1999). Such etiological factors may also contribute to the maintenance of anxiety; personality traits are enduring, and conditioned responses do not have a chance to extinguish in the absence of repeated exposure to the feared stimulus (i.e., regular attendance at dentist appointments). The acquisition of dental anxiety has been most consistently tied to aversive conditioning experiences (Davey, 1989; Locker, Liddell, Dempster, & Shapiro, 1999; Thomas, Locker & Poulton, 2000; Weiner & Sheehan, 1990). Further, Weiner and Sheehan (1990) noted that, along with direct or indirect conditioning experiences, an underlying vulnerability to anxiety may increase the likelihood of developing dental anxiety. With regard to personality variables, high dental anxiety was associated with neuroticism in a longitudinal study of women in Sweden (Hagglin et al., 2001). A twin study conducted in Norway expanded these findings by showing that dental anxiety and neuroticism share considerable overlap of genetic, but not environmental, variance (Vassend, Roysamb, & Nielsen, 2011). Furthermore, trait

anxiety and anxiety sensitivity are both associated with dental anxiety (Locker, Liddell, & Shapiro, 1999).

Poulton, Waldie, Thomson, and Locker (2001) found, in a longitudinal study examining early- and late-onset dental anxiety, that conditioning experiences, indexed by number of dental caries and tooth extractions, serve as a major risk factor for dental anxiety. Additionally, the likelihood of developing late-onset dental anxiety increased substantially if one or more teeth had been lost due to caries and if more caries were present in adolescence. Poulton et al. (2001) also found that late-onset dental anxiety was more likely to occur among individuals who were symptomatic, rather than preventive, users of dental health services. Moreover, an external locus of control over one's health (i.e., the belief that health outcomes depend on chance and/or a medical/dental professional rather than oneself) was associated with a significantly greater likelihood of acquisition of dental anxiety.

History of trauma and dental pain.

A history of traumatic experiences, including those in the dental setting, was reported significantly more frequently by individuals with high dental anxiety (73%) than those with low dental anxiety (21%; de Jongh, Fransen, Oosterink-Wubbe, & Aartman, 2006). Three quarters of the traumatic events reported occurred in the dental setting ("traumatic" was defined as "horrific"), and 46% of the high anxious participants endorsed at least one symptom of posttraumatic stress disorder (PTSD) relating to any type of trauma. The PTSD symptoms most frequently endorsed by individuals in the high anxious group belonged to the symptom clusters of re-experiencing and avoidance. Severity of dental anxiety was significantly associated with both the number of self-

reported symptoms of specific phobia of dental procedures and of PTSD relating to any type of trauma (de Jongh et al., 2006). These findings are consistent with an earlier examination of conditioning in an undergraduate sample, which showed that traumatic, painful, and frequent negative experiences in the dental setting were positively correlated with dental anxiety and likely served as powerful conditioning experiences (de Jongh, Muris, Horst, & Duyx, 1995). In a separate study, when asked what led to the onset or worsening of their dental anxiety, the majority of patients identified one or more prior aversive dental experiences (de Jongh, van der Burg, van Overmeir, Aartman, & van Zuuren, 2002). Given the evident association between PTSD symptoms and high dental anxiety it is likely that re-experiencing symptoms related to a traumatic dental event would also be positively related to greater avoidance of dental care following such an experience.

In a study examining adult dental patients who endorsed self-reported dental anxiety or specific phobia of dental procedures, Oosterink, de Jongh, and Aartman (2009) found that dental anxiety and phobia were strongly associated with a history of negative or invasive direct and vicarious experiences in the dental setting, such as injections and extractions, with negative emotional responses to dental procedures, such as helplessness and embarrassment, and with perceived negative characteristics of the dentist (e.g., rudeness). Of these significant findings, helplessness, or the perceived lack of control, had the strongest association to dental anxiety and specific phobia. This finding is not surprising, as hopelessness (a larger construct of which helplessness and lack of control are a part) is a key element of traumatic experiences and subsequent maladaptive reactions to those events. In contrast to other studies (e.g., de Jongh et al., 2006;

Humphris & King, 2011), Oosterink and colleagues (2009) did not find dental anxiety to be related to traumatic experiences outside the dental setting, and this inconsistency may be attributable in part to the lack of comorbid disorders in their study sample.

The association of pain experienced in the context of dental procedures and dental anxiety is well documented (Arntz, van Eeck, & Heijmans, 1990; de Jongh et al., 1995; Vassend, 1993), with research also indicating a significant correlation between pain during scaling (i.e., cleaning) and presence of dental anxiety (Sanikop, Agrawal, & Patil, 2011). Furthermore, higher anxiety predicted higher intensity and longer duration of reported pain during dental injections (Maggirias & Locker, 2002; van Wijk & Hoogstraten, 2009). Arntz and colleagues (1990) examined experiences and expectations of dental pain and anxiety and found that patients with high dental anxiety expected more pain than they experienced, compared with low anxious patients whose expectations of pain were more accurate. Catastrophizing has also been examined in dentally anxious individuals in relation to pain; Sullivan and Neish (1998) found that catastrophizing over pain during a dental scaling predicted heightened levels of pain during scaling procedures, even when controlling for oral hygiene status. This combination of findings suggests that the relationship between anxiety and pain is complex and bidirectional.

Despite the subjectivity of pain and the recall bias inherent in its retrospective reporting, research linking pain to dental anxiety has provided consistent evidence about their significant association. However, Vassend et al. (2011) failed to find such a correlation when using heat and cold-pressor pain tests as measures of pain sensitivity. This lack of findings may have several explanations, such as the possibility that temperature stimuli are not relevant to dental pain, the possibility that pain experienced in

the context of dental procedures stems from anxiety rather than causing it, or a problem of recall bias for pain severity in retrospective reports of other studies.

Optimism.

Another construct shown to be associated with the development of dental anxiety is the optimism-pessimism dimension. Optimism is characterized as a general positive expectancy concerning life outcomes in the future and has been associated prospectively with various positive health-relevant outcomes (Carver, Scheier, & Segerstrom, 2010). Compared to pessimists, optimists manage adversity with less subjective distress and less harmful impact on their physical well-being, possess better coping skills, and engage in less avoidant coping (Carver et al., 2010; Scheier & Carver, 1992). With regard to dental health, optimism correlates positively with favorable dental health behavior such as tooth brushing and utilization of preventive care (Ylostalo, Ek, & Knuuttila, 2003). Further, Bernson, Elfstrom, and Hakeberg (2012) found that optimism (e.g., thoughts such as “I just keep on despite the fear” and “I try to think years ahead, about what everything will be like after the treatment”) was significantly positively related to regular visits to the dentist.

A study among children age 10 to 12 years was the first to examine the relationship between optimism and dental anxiety and found that optimism was negatively related to dental anxiety (Neverlien & Johnsen, 1991). A 5-year follow-up of 58% of this sample failed to show that the optimism-pessimism dimension predicted dental anxiety over time (Neverlien, 1994). Instead, results indicated the opposite relationship, suggesting that dental anxiety at Time 1 contributed to pessimism at Time 2

five years later. Further research is warranted to link low levels of optimism to the prediction of dental anxiety and avoidance.

It is clear that pessimism has a negative influence on coping ability and is associated with poor dental health. Enduring personality traits (e.g., neuroticism) and avoidance of dental treatment may also contribute to the development and maintenance of dental anxiety. However, there is a paucity of research examining other constructs that may affect individuals' ability to cope with negative emotion and adverse experiences in the dental context and which may contribute to the severity and persistence of dental anxiety and dental treatment avoidance.

Psychological Correlates of Dental Anxiety and Avoidance

Comorbidity.

Dental anxiety and dental treatment avoidance are associated with a variety of other variables and psychological disorders. Dental anxiety is linked with behavioral and conduct disorders, mood disorders, and alcohol dependence (Berggren, 1992; Hagglin et al., 2001; Locker, Poulton, & Thomson, 2001; Pohjola, Mattila, Joukamaa, & Lahti, 2011; Roy-Byrne, Milgrom, Khoon-Mei, Weinstein, & Katon, 1994). It has also been associated with anxiety disorders, including generalized anxiety disorder (GAD), agoraphobia, specific phobias such as fear of injections and blood, and social anxiety disorder (SAD), with some inconsistency in findings relating dental anxiety to social fears (Kaakko et al., 2000; Locker et al., 2001; McNeil & Berryman, 1989; Moore & Brodsgaard, 1995; Oosterink, de Jongh, & Hoogstraten, 2009; Pohjola et al., 2011; Stouthard & Hoogstraten, 1987; Vika, Skaret, Raadal, Öst, & Kvale, 2008). One study

found that 40% of dentally anxious individuals had psychiatric disorders, with 20% having an anxiety disorder and 16% having a mood disorder (Roy-Byrne et al., 1994).

The most recent and methodologically sound study of comorbidity used a diagnostic interview and assessed a nationally representative sample of individuals in Finland who participated in the 2000 Health Survey (Pohjola et al., 2011). This study found that those with GAD, SAD, major depressive disorder, and dysthymic disorder more frequently reported dental anxiety than those without these comorbid conditions. Furthermore, of those with high dental anxiety, 17% reported at least one anxiety disorder but no depressive disorders, 21% reported a depressive disorder but no anxiety disorder, and 60% endorsed both anxiety and depressive disorders (Pohjola et al., 2011).

With regard to the link between dental anxiety and a closely related psychiatric disorder, the blood-injection-injury (BII) type of specific phobia, research has shown that dental anxiety and avoidance of dental treatment are significantly related to both subtypes of BII phobia, blood and injection-injury (Vika et al., 2008). This study of 18-year-old Norwegians replicated previous findings linking dental anxiety to BII phobia in patient samples in the Netherlands and New Zealand (de Jongh, Bongaarts, Vermeule, Visser, De Vos, & Makkes, 1998; Poulton, Thomson, Brown, & Silva, 1998). Additionally, the presence of both dental anxiety and BII phobia was associated with significantly higher levels of tooth decay and longer intervals of dental treatment avoidance compared to the presence of dental anxiety alone among young adults in New Zealand (Poulton et al., 1998).

Research examining the nature of the relationship between dental phobia and BII phobia has demonstrated that, although their co-occurrence is high, dental phobia should

be considered a specific phobia independent of the BII subtype (van Houtem et al., 2013; de Jongh et al., 1998) because the majority of patients with dental phobia do not commonly exhibit a vasovagal fainting response during dental procedures. Further, individuals with dental phobia fear dental-related stimuli (e.g., sound of the drill) significantly more than blood, injury, and injections. The study by Houtem and colleagues (2013) was limited by its use of online self-report to assess dental phobia. There is room in the literature to clarify the nature of the relationship between these two specific phobias; specifically, to determine whether BII phobia is simply a related condition, whether dental anxiety falls under the larger umbrella of the BII phobia type, whether the diagnosis of BII phobia indicates a clinical level of dental anxiety, or whether BII phobia is one specific piece of dental anxiety in instances, for example, in which patients fear nothing but needles in the dental context. Given the correlational findings abroad, it is likely that an association between BII phobia and dental anxiety and co-occurrence of BII phobia with specific phobia of dental procedures, would generalize to individuals in the United States.

Inconsistent results across studies examining the relation of dental anxiety to other psychological constructs and disorders may be due to the varied use of diagnostic instruments, such as self-report measures vs. clinician-administered interviews, along with the inclusion of varying samples, such as individuals in varying stages of treatment-seeking at dental clinics vs. community samples. Almost all of the studies examining comorbidity of dental anxiety used self-report measures rather than interviews; therefore, specific phobia of dental procedures has not been appropriately assessed across the literature. Despite these limitations, the majority of research does show a significant

association of dental anxiety to psychiatric disorders, with much of the comorbidity involving other anxiety disorders. This pattern of results suggests that some people may be vulnerable to the development of dental anxiety (Armfield, 2006).

Social appearance anxiety.

A type of anxiety closely related to SAD that has begun to garner attention in the context of dental anxiety is social appearance anxiety. Dental patients in an American city who reported high dental anxiety were significantly less satisfied with the appearance of their mouths than low anxious patients (Doerr et al., 1998). Another study found that dissatisfaction with dental aesthetics was positively associated with irregular dental treatment utilization and higher dental anxiety among women in Sweden (Hägglin, Hakeberg, Ahlqwist, Sullivan, & Berggren, 2000). Furthermore, there is evidence that dental anxiety has a negative social impact on patients who reported that their poor dental appearance contributed to low self-esteem and self-confidence and to creating a negative interpersonal impression, thereby negatively affecting perceived career prospects and ability to form close relationships (Cohen, Fiske, & Newton, 2000).

Social appearance anxiety becomes especially relevant for patients who cannot afford dental treatment, as one of their predominant fears regarding dental treatment relates to not being able to afford procedures necessary to maintain basic dental aesthetics. Some patients report engaging in mouth-hiding behaviors, such as inhibiting smiling and laughing, hiding teeth with their lip, tongue, or hand, or moving their heads in a direction that will hide their mouths from others, with such behaviors positively correlated with number of years of dental treatment avoidance (Moore, Brodsgaard, & Rosenberg, 2004). The patients in this sample also reported symptoms similar to those

characterizing SAD, related to the fear of negative social evaluation. Another study found a relationship between self-perceived irregularities in dental aesthetics and oral health-related quality of life; self-consciousness had a significant effect on social appearance concerns, appearance disapproval, and dentally-related low self-confidence (Klages, Bruckner, & Zentner, 2004). These studies indicate that dental anxiety and avoidance of dental treatment are associated with social appearance anxiety, but it is yet unclear how significant a role this construct plays in the avoidance of dental treatment and whether this potential relationship is moderated by other factors.

Emotion regulation.

Emotion regulation is the process by which individuals influence which emotions they experience and how the emotions are experienced and expressed (Gross, 1998). Although difficulties with emotion regulation have been well documented in the majority of anxiety disorders (Cisler, Olatunji, Feldner, & Forsyth, 2010), there is a paucity of research investigating this process in specific phobias, particularly among individuals with dental anxiety or a phobia of dental procedures. It may be expected that dentally anxious individuals engage in thought suppression, an element of emotion dysregulation, to avoid distressing cognitions and feelings, which may paradoxically result in reinforcement of the anxiety. Two studies in the Netherlands examined the relationship between thought suppression and dental anxiety or specific phobia of the dentist. In an undergraduate sample, participants were asked to engage in a one-minute imagery exercise in which they vividly imagined getting a filling while suppressing negative thoughts about the dental procedure (De Jongh, Muris, Merckelbach, & Schoenmakers, 1996). High dental anxiety was positively correlated with the frequency of negative,

intrusive dental-related thoughts and negatively associated with expected and actual efficacy of thought suppression.

The second study evaluated dental patients with and without a specific phobia of dental procedures who were about to undergo invasive dental procedures which required local anesthesia (Muris, de Jongh, Merckelbach, Postema, & Vet, 1998). Patients were instructed to either suppress or focus on their negative dental-related cognitions throughout the procedure after which they rated their level of anxiety using a 0-100 scale. Patients with high dental anxiety reported significantly more intrusive thoughts and engaged in more thought suppression than low anxiety patients, even when instructed to focus on their negative thoughts. The act of suppression was associated with a significant increase in intrusive thoughts and anxiety in the low anxiety group, thereby increasing dental anxiety; however, this effect was not found in high anxiety patients. These results suggest that dentally anxious individuals are prone to suppress negative thoughts. Further, thought suppression contributes to the exacerbation of dental anxiety in non-anxious individuals.

Constructs unexamined in the dental anxiety literature.

Poor distress tolerance, experiential avoidance, and low levels of mindfulness are important constructs shown to contribute to the development and maintenance of various anxiety disorders (Leyro, Zvolensky, & Bernstein, 2010; Kashdan, Barrios, Forsyth, & Steger, 2006; Kabat-Zinn, 2003); however, no research has examined their relationship with dental anxiety. Distress tolerance refers to one's ability to experience and withstand negative emotional states (Simons & Gaher, 2005). Experiential avoidance is defined as the unwillingness to remain in contact with personal experiences, such as bodily

sensations, thoughts, and emotions, and an attempt to change (e.g., avoid) the nature of these experiences or their contexts (Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). Mindfulness is the mental state of nonjudgmental awareness of the present moment, including one's thoughts, physical sensations, and environment, that is experienced with curiosity, awareness, and openness (Bishop et al., 2004). Based on literature linking these three constructs to other anxiety disorders, it is likely that individuals with dental anxiety would exhibit low distress tolerance, engage in experiential avoidance (sometimes referred to as psychological inflexibility), and experience difficulty with mindfulness.

Consequences of Dental Anxiety

Dental anxiety appears to be characterized by a maladaptive cycle, in which the anxiety leads to delay or avoidance of dental treatment, causing dental problems that are related to more invasive or even emergency treatment, which, in turn, leads to the maintenance or exacerbation of dental anxiety (Armfield, Stewart, & Spencer, 2007). The cycle has also been described as involving guilt, shame, and feelings of inferiority, which facilitate and amplify dental anxiety and avoidance (Berggren & Meynert, 1984; Moore et al., 2004). Patients with dental anxiety are considered a population of public health importance because of the extensive dental health consequences caused by this cycle of anxiety and treatment avoidance. Research summarized above points to numerous negative consequences associated with this cycle. Two of the more extensively studied outcomes of dental anxiety are the avoidance of dental treatment and poor oral health-related quality of life.

Avoidance of dental treatment.

A major component of the aforementioned cycle is infrequent attendance at dental appointments, or avoidance of dental procedures, often limited to symptomatic or problem-oriented visits rather than preventive care (Armfield, 2012). The Surgeon General's report on oral health indicated that only two-thirds of adults in the United States (U.S.) had visited a dentist within the past year (U.S. Department of Health and Human Services, 2000), and another national study reported that only 74% of adults surveyed reported attending a dentist appointment within the past year (Smith & Heaton, 2003). Studies in Scandinavia and Australia have demonstrated a strong relationship between dental anxiety and avoidance of dental care (Armfield et al., 2007; Hägglin et al., 2000; Munster Halvari, Halvari, Bjornebekk, & Deci, 2010). Research from Germany shows that the need for patients to have control over dental treatment in combination with patients' low level of perceived control predicts avoidance of dental treatment, suggesting that increasing patients' control over dental treatment may reduce avoidance behavior (Sartory, Heinen, Pundt, & Jhren, 2006). It is likely that dental anxiety is one part of a complex pattern of variables contributing to irregular dental attendance. Further research exploring variables that may moderate the relationship between dental anxiety and avoidance is called for, particularly in an examination of U.S. samples to determine generalizability of findings generated abroad.

Oral health-related quality of life.

Another significant consequence of dental anxiety is impairment in oral health-related quality of life (OHRQoL). This construct is defined as an individuals' perception of the impact of oral conditions on his or her well-being, with consequences spanning

such dimensions as functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. In a large sample of residents of the United Kingdom, individuals with high dental anxiety were twice as likely to report the poorest OHRQoL (McGrath & Bedi, 2004). Among Swiss dental patients, a similar pattern emerged: highly anxious patients were 3.55 times more likely to report poor OHRQoL compared to individuals reporting low to moderate dental anxiety (Gisler, Bassetti, Meriscske-Stern, Bayer, & Enkling, 2012). A study conducted in Germany also found a positive correlation between elevated dental anxiety and impaired OHRQoL, in addition to significantly higher impairment in patients with dental anxiety than in the general population (Mehrstedt, John, Tonnie, & Micheelis, 2007). An investigation of Chinese dental patients similarly reported a positive association between dental anxiety and poor OHRQoL (Ng & Leung, 2008). The same relationship, but among a female sample of the general population in Sweden, was reported by Boman, Wennstrom, Stenman, and Hakeberg (2012). Hakeberg and Berggren (1993) found a reduced number of sick-leave days in patients who completed treatment for dental anxiety, compared to controls, in a Swedish sample. These studies all used a common OHRQoL self-report measure (Short-Form Oral Health Impact Profile; Slade, 1997).

A qualitative study in the UK analyzed 20 dental patient interviews assessing the impact of dental anxiety on daily living (Cohen et al., 2000). Five broad categories of impairment emerged: physiological (e.g., autonomic symptoms such as increased heart rate), cognitive (e.g., negative beliefs about self and dental treatment), behavioral (e.g., avoiding certain foods and dental treatment), health (e.g., sleep disturbance prior to dentist appointment and poor oral health), and social (e.g., work performance and social

interaction) (Cohen et al., 2000). Quality of life impairment has also been shown to correlate with long-term avoidance of dental treatment (Agdal, Raadal, Öst, & Skaret, 2012). This consistent pattern of results linking OHRQoL with dental anxiety and avoidance would likely generalize to a U.S. population, but thus far the majority of such studies have been conducted abroad. An investigation into the directionality of these correlations is warranted, along with examination of potential moderators of the relationship.

The Present Study

A considerable amount of research evidence suggests that dental anxiety and the avoidance of dental treatment serve as substantial barriers to dental care and are associated with a range of maladaptive behaviors and outcomes. However, many important psychological constructs that may increase our understanding of anxiety and avoidance in relation to dental care and hence our ability to properly intervene have been poorly examined or neglected entirely in the literature. The aim of the present study was to conduct a more comprehensive and precise examination of the associations of dental anxiety and avoidance of dental treatment¹ with several of these additional constructs and to test these constructs' potential moderating effects on the anxiety-avoidance relationship and on the relationship between anxiety and oral health-related quality of life. As the majority of research in dental anxiety and avoidance of dental treatment has been conducted outside the U.S., in countries whose healthcare systems differ, findings

¹ Throughout this document, avoidance of dental treatment refers to nonattendance to dental care appointments. It is acknowledged that nonattendance may be due to several factors that are not limited to dental anxiety and, therefore, all nonattendance should not be characterized as avoidance. Such factors may include the dental treatment plan, a lack of access to resources (finances, dental insurance, transportation, child care), or forgetting about the dental appointment.

may not generalize to the domestic population; therefore, the present study expands the data available in the U.S.

The present study examined prevalence of dental anxiety and specific phobia of dental procedures in this population using the most widely utilized measure of dental anxiety (MDAS; Humphris et al., 1995) and a clinician-administered, semi-structured diagnostic interview (Anxiety Disorders Interview Schedule for DSM-IV; Brown, Di Nardo, & Barlow, 1994). Additionally, demographic differences were compared among patients with dental anxiety or specific phobia and non-anxious individuals seeking dental care.

This study was the first to examine the correlates of dental anxiety, specific phobia of dental procedures, and avoidance of dental care, in regular and emergency treatment-seeking dental patients residing in north Philadelphia. The potential correlates examined in this study included social appearance anxiety, emotion dysregulation, pessimism, dental-related physical pain, re-experiencing symptoms related to prior traumatic dental events, oral health-related quality of life, and BII phobia. With regard to BII phobia, the present study sought to clarify the nature of relationship between dental anxiety and BII phobia. The correlations of other constructs that had not been previously examined in the dental anxiety literature were also explored; these included distress tolerance, experiential avoidance, and mindfulness.

The present study also tested a number of models to examine the constructs moderating the relationships between dental anxiety and avoidance, and between dental anxiety and oral health-related quality of life. The proposed moderators tested included emotion regulation, distress tolerance, experiential avoidance, and mindfulness; these

constructs, with the exception of emotion regulation, had been left unexamined in the dental anxiety literature but may well play a role in the anxiety-avoidance cycle, based on the larger anxiety disorders literature.

Additionally, the relationship between social appearance anxiety and avoidance was tested, with proposed moderators including the optimism-pessimism dimension, re-experiencing symptoms related to prior traumatic dental events, and dental-related physical pain. These proposed moderator variables have been found to correlate with dental anxiety and avoidance of dental treatment, but their more specific roles had yet to be examined.

In light of its recruitment of a patient sample from an understudied population, prospective design, and multimethod measurement, the present study has the potential to significantly advance the body of knowledge on dental anxiety and dental treatment avoidance, with implications for improving treatment for dental anxiety and specific phobia, and, in turn, improving public health. Although cognitive behavioral treatments have consistently proven effective in managing dental anxiety and specific phobia of dental procedures, rates of dental treatment avoidance have only seen a slight reduction, anxiety treatment is underutilized, and prevalence rates for dental anxiety remain high (Choy, Fyer, & Lipsitz, 2007; Kvale, Berggren, & Milgrom, 2004).

Hypotheses

Hypothesis comparing emergency and regular patients in regards to dental phobia and avoidance of dental care.

1. Emergency patients will demonstrate significantly more severe dental anxiety, as well as a higher prevalence of specific phobia of dental

procedures, and they will have avoided dental care for a longer interval than regular care patients prior to their presentation to the dental clinic.

Hypotheses related to correlates of dental anxiety, specific phobia of dental procedures, and avoidance of dental care, with differences by patient classification.

2. Putative markers of the severity of dental anxiety (i.e., higher levels of dental anxiety, the clinician-rated severity of a specific phobia diagnosis, prolonged avoidance of dental care, and poor oral health-related quality of life) will all be positively associated with difficulties with emotion regulation (i.e., self-reported emotion dysregulation, low distress tolerance), difficulties with mindfulness, experiential avoidance, trait pessimism, pain, and related anxiety symptoms (i.e., re-experiencing symptoms related to prior traumatic dental events, self-reported severity of blood-injection-injury phobia, social appearance anxiety).
3. Compared to participants without a diagnosis of specific phobia of dental procedures, individuals with a diagnosis will demonstrate significantly more severe dental anxiety, will have avoided dental care for a longer interval, and will demonstrate more impairment in OHRQoL and emotion regulation (i.e., self-reported emotion dysregulation, low distress tolerance), mindfulness, experiential avoidance, trait pessimism, pain, and related anxiety symptoms (i.e., re-experiencing symptoms related to prior traumatic dental events,

self-reported severity of blood-injection-injury phobia, social appearance anxiety).

4. Emergency patients will demonstrate significantly more impairment in OHRQoL and constructs listed in Hypothesis 2 than regular care patients.

Hypotheses related to moderation of the relationship between dental anxiety and avoidance of dental treatment or oral health-related quality of life.

5. The relationship between dental anxiety and avoidance of dental treatment will be moderated by the following constructs: emotion regulation, distress tolerance, mindfulness, and experiential avoidance. Difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance will interact with dental anxiety to increase avoidance.
6. The relationship between dental anxiety and oral health-related quality of life will be moderated by the same variables listed in Hypothesis 5. Difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance will interact with dental anxiety to reduce oral health-related quality of life.

Hypothesis related to moderation of the relationship between social appearance anxiety and avoidance of dental treatment.

7. The relationship between social appearance anxiety and avoidance of dental treatment will be moderated by the following variables: optimism-pessimism, re-experiencing symptoms relating to a prior

negative dental experience, and dental-related physical pain.

Pessimism and significant re-experiencing symptoms will interact with social appearance anxiety to increase avoidance of dental care, and the intensity of dental-related pain will interact with social appearance anxiety to decrease avoidance.

CHAPTER 2

METHOD

Participants

Participants were 120 individuals with dental appointments at various clinics within Temple University's Kornberg School of Dentistry (TUKSoD) in north Philadelphia, recruited by telephone. All individuals, with the exclusion of pediatric patients, who were scheduled for any type of dental appointment (e.g., regular, emergency) to be seen by any type of provider (e.g., dental student, licensed dentist) were contacted. They were invited by telephone to participate in a research study for monetary compensation and told that participation would consist of completing questionnaires online or by telephone and participating in a brief telephone interview. Regular care patients were not invited to participate in person as this may have confounded attendance, the primary outcome variable. Only those patients presenting for emergency dental care were recruited in person; attendance data were not collected for these individuals as they were all seen for their dental emergencies. Exclusion criteria limited participants to those dental patients 18 to 75 years of age who could complete participation prior to their scheduled dentist appointment. Otherwise, there were no selection criteria based on participants' gender, ethnic background, economic status, or other significant descriptors. Additionally, individuals with all levels of dental anxiety were eligible for the study, as we were interested in exploring the prevalence of dental anxiety and dental treatment avoidance in this population, along with their correlates and moderators across a continuum of anxiety. TUKSoD serves a high percentage of low-income (34% of patients are supported by Medicaid), minority individuals, the majority of whom reside in north

Philadelphia (United States Census Bureau, 2010); therefore, participants in the current study were largely representative of the demographic diversity of the population of north Philadelphia.

Measures

Self-Report. The *Modified Dental Anxiety Scale* (MDAS; Humphris et al., 1995) is a 5-item self-report measure assessing fear of dental procedures, including cleaning, drilling, and local anesthetic injections; for example, “If you were about to have your tooth drilled, how would you feel?” Items are rated on a 5-point Likert-type scale ranging from 1 (*not anxious*) to 5 (*extremely anxious*). The total score ranges from 5 to 25; a score of 19 or above indicates high anxiety based on receiver operating characteristic analyses from two studies (Humphris et al., 1995; King & Humphris, 2010). The MDAS has demonstrated good internal consistency ($\alpha = .89$) and test-retest reliability ($r = .82$, interval unspecified; Humphris et al., 1995). Cronbach’s alpha was .91 in the current sample.

The *Short-Form Oral Health Impact Profile* (OHIP-14; Slade, 1997) is a 14-item self-report measure that assesses individuals’ perceptions of the social impact of oral conditions on their well-being. This scale evaluates the consequences of oral conditions across dimensions of functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Items are rated on a 5-point Likert-type scale ranging from 0 (*never*) to 4 (*very often*), regarding how frequently impact has been experienced. The total score ranges from 0 to 56; higher OHIP-14 scores indicate greater impact, hence poorer oral-health-related quality of life. The OHIP-14 has been validated in two national surveys of populations in the UK and

Australia (Kelly et al., 1998; Steele et al., 2004) and demonstrated good reliability, construct and discriminant validity, and internal consistency (Slade & Spencer, 1994, Slade, 1997). Cronbach's alpha was .87 in the current sample.

The *Social Appearance Anxiety Scale* (SAAS; Hart, Flora, Palyo, Fresco, Holle, & Heimberg, 2008) is a 16-item measure developed to assess anxiety about being negatively evaluated by others because of one's overall appearance, including body shape. Items are rated on a 5-point Likert-type scale ranging from 1 (*not at all characteristic of me*) to 5 (*extremely characteristic of me*). Example items from the SAAS include: "I am concerned people would not like me because of the way I look" and "I get nervous when talking to people because of the way I look." The total score ranges from 16 to 80; higher SAAS scores indicate greater social appearance anxiety. The measure exhibited excellent internal consistency, test-retest reliability, and convergent validity (Hart et al., 2008, Levinson & Rodebaugh, 2011). Cronbach's alpha was .96 in the current sample.

The *Acceptance and Action Questionnaire-II* (AAQ-II; Bond et al., 2011) is a 10-item revision of the original nine-item AAQ (Hayes et al., 2004) that assesses experiential avoidance. Example items from the AAQ-II include: "I am afraid of my feelings" and "Worries get in the way of my success." A total score is calculated, accounting for three reversed items, and ranges from 10-70, with higher AAQ-II scores indicating less experiential avoidance. The AAQ-II has been shown to have good internal consistency (Cronbach's $\alpha = .78 - .88$), good test-retest reliability (three-month interval, $r = .81$; 12-month interval, $r = .79$), and good convergent, discriminant, and incremental

validity (Bond et al., 2011). Factor analytic findings suggest the AAQ-II is a unidimensional measure. Cronbach's alpha was .87 in the current sample.

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) is a 10-item self-report measure assessing trait expressive suppression (four items, e.g., "I keep my emotions to myself") and cognitive reappraisal (six items, e.g., "When I want to feel less negative emotion, I change the way I'm thinking about the situation"). Items are rated on a 7-point Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The suppression and reappraisal subscales are summed and range from 4 to 28 and 6 to 42, respectively. Higher ERQ scores indicate less suppression and greater reappraisal. Internal consistency was comparable for both factors (reappraisal $\alpha = .79$; suppression $\alpha = .73$), and both factors demonstrated adequate test-retest reliability across a three-month interval ($r = .69$; Gross & John, 2003). Cronbach's alpha in the current sample was .61 for suppression (4 items) and .85 for reappraisal (6 items).

The *Distress Tolerance Scale* (DTS; Simons & Gaher, 2005) is a 15-item self-report measure assessing one's perceived ability to experience and tolerate negative emotional states. This scale measures four dimensions of distress tolerance: subjective appraisal of distress, ability to tolerate emotional distress, absorption of attention by negative emotions, and regulation efforts to alleviate distress. Items are rated on a 5-point Likert-type scale ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). The total score ranges from 15 to 75, with higher scores reflecting higher levels of distress tolerance. This scale has high internal consistency ($\alpha = .89$), appropriate convergence with other self-report ratings of affective distress and regulation, and adequate six-month test-retest

reliability ($r = .61$; Simons & Gaher, 2005). Cronbach's alpha was .89 in the current sample.

The *Five Facet Mindfulness Questionnaire – Short Form* (FFMQ-SF; Bohlmeijer, ten Klooster, Fledderus, Veehof, & Baer, 2011) is a 24-item revision of the original 39-item FFMQ (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The scale assesses five facets of mindfulness: observing, describing, acting with awareness, non-judging of inner experience, and nonreactivity to inner experience. Items are rated on a 5-point scale from 1 (*rarely or very rarely true*) to 5 (*very often or always true*). Subscale totals range from 4 to 20 (observing) to 5 to 25 (remaining subscales), with higher scores indicating greater mindfulness. The FFMQ-SF was developed and evaluated in a Dutch sample of adults with depression and anxiety and cross-validated in an independent sample of patients with fibromyalgia. Confirmatory factor analyses showed good model fit for the five-factor structure in both samples, internal consistency was comparable to the original FFMQ (Cronbach's $\alpha = .75 - .87$), and the scale was highly sensitive to change (Bohlmeijer et al., 2011). Cronbach's alpha in the current sample was .60 for observing (4 items), .78 for describing (5 items), .81 for acting with awareness (5 items), .73 for non-judging (5 items), and .72 for nonreactivity (5 items). The low alpha for the observing subscale may be due to the small number of items in the subscale.

The *Life Orientation Test – Revised* (LOT-R; Scheier, Carver, & Bridges, 1994) is a 10-item measure assessing trait optimism and pessimism via generalized, dispositional outcome expectancies of the respondent. The LOT-R consists of 3 positively worded items (*"In uncertain times, I usually expect the best."*), 3 negatively worded items (*"If something can go wrong for me, it will."*), and 4 filler items that do not contribute to the

total optimism score. Responses are provided on a 5-point Likert-type scale ranging from 0 (*strongly disagree*) to 4 (*strongly agree*). Negatively worded items are reverse scored, and all non-filler items are summed to create an overall optimism score. The total score ranges from 0 to 24, and higher scores indicate greater optimism. In a college sample, the LOT-R showed acceptable construct validity, good test-retest reliability ($r = .79$ over a 4-month interval), and good internal consistency ($\alpha = .78$; Scheier et al. 1994). Cronbach's alpha was .80 in the current sample.

The *Pain Intensity Numeric Rating Scale* (PI-NRS) is a widely utilized, but poorly documented 11-point self-report measure ranging from 0 (*no pain*) to 10 (*worst possible pain*) to measure physical pain intensity. The PI-NRS has been used to assess pain intensity in several studies conducted in medical settings (Farrar, Polomano, Berlin, & Strom, 2010; Farrar, Young, LaMoreaux, Werth, & Poole, 2001; Rowbotham, Goli, Kunz, & Lei, 2004; van der Roer, Ostelo, Bekkering, van Tulder, & de Vet, 2006). This scale was used to assess the intensity of dental-related pain that participants experience currently, experienced at their most painful dental appointment, and experienced at their most recent dental appointment.

The *PTSD Checklist – Stressor Specific Version* (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993, as cited in Blanchard, Jones-Alexander, Buckley, & Forneris, 1996) is a 17-item self-report measure assessing symptoms of posttraumatic stress disorder (PTSD) for the previous month. Individuals rate the degree to which they have been bothered by particular symptoms using a 5-point Likert-type scale ranging from 1 (*not at all*) to 5 (*extremely*). The PCL-S has good reliability with structured interviews for PTSD in victims of motor vehicle accidents and sexual assault ($r = .93$), good internal

consistency ($\alpha = .87$ for re-experiencing symptoms; Blanchard et al., 1993), and good test-retest reliability ($r = .96$; Weathers et al., 1993). The present study identified the specific stressor as the painful dental experience that participants judged most severe. When a painful experience was not endorsed, the participant was asked to answer the questions as they related to their least comfortable dental experience. The current study utilized only the five items comprising the re-experiencing subscale of the PCL-S to examine whether and to what extent re-experiencing of traumatic dental experiences was associated with avoidance of dental treatment. The total score for this subscale ranges from 5 to 25, with higher scores reflecting more frequent re-experiencing symptoms over the past month. Cronbach's alpha was .92 in the current sample of patients who endorsed a prior painful or traumatic dental event ($n = 112$).

The blood-injection-injury (BII) subscale of the *Fear Questionnaire* (FQ; Marks & Mathews, 1979) is comprised of 5 items from the complete scale. The BII subscale assesses the degree to which an individual avoids situations involving blood-injury-injection because of fear, including in the context of dental procedures. Items are rated on a nine-point scale ranging from 0 (*would not avoid it*) to 8 (*would always avoid it*). Total scores range from 0 to 40 with higher scores indicating greater phobic avoidance. The FQ is sensitive to treatment-induced improvements in phobic responding, demonstrates adequate psychometric properties, and is a commonly used measure for research on phobias (Barlow & Wolfe, 1981). Cronbach's alpha was .78 in the current sample.

Interview. The *Anxiety Disorders Interview Schedule for DSM-IV* (ADIS-IV; Brown et al., 1994) is a semi-structured interview designed to establish reliable diagnoses of the *DSM-IV* (APA, 1994) anxiety, mood, somatoform, and substance use disorders.

Only the specific phobia module of the interview was administered to assess the presence or absence and severity of specific phobia of dental procedures. Diagnosticians were advanced graduate students or research assistants, trained to strict reliability standards (for details on training procedures, see Brown, Di Nardo, Lehman, & Campbell, 2001). For each diagnosis, clinicians assign a dimensional clinical severity rating (CSR), ranging from 0 = *none* to 8 = *very severely disturbing/disabling*, with scores of 4 or greater indicative of the severity of distress and impairment that would meet criteria for diagnosis. All interviews were audio-recorded for use in reliability coding; reliability analyses were conducted by raters blind to the outcome of the original interview. Interviewers have demonstrated excellent interrater reliability for the principal diagnosis of specific phobia in a mixed sample of anxiety disorder patients ($\kappa = .86$; Brown et al., 2001).

For the present study we examined agreement on presence of diagnosis and its severity among raters by conducting reliability coding on 15% of the interviews in which the patient endorsed any fear or avoidance of dental procedures. Inter-rater reliability analyses were conducted using intraclass correlation coefficients (ICCs). Because ICCs are interpreted in a manner similar to kappa coefficients (Fleiss & Cohen, 1973), interpretation of ICCs was based on guidelines used in previous studies using kappa coefficients to assess the reliability of anxiety and mood disorders (e.g., Brown et al., 2001). According to these standards, excellent agreement is indicated by $r \geq .75$, good agreement is indicated by $.60 \leq r \leq .74$, fair agreement is indicated by $.40 \leq r \leq .59$, and poor agreement is indicated by $r < .40$. Of the total 120 patients, 65 endorsed any anxiety or avoidance of dental procedures upon probing; therefore, the module was fully

administered and a CSR was assigned. Ten (15%) of these interviews were coded for inter-rater reliability and demonstrated excellent agreement ($r = .93, p < .001$), and all 10 sets of ratings were coded within 1 CSR point.

Avoidance of dental care was operationalized as lack of attendance at a scheduled dental appointment. Avoidance was measured by participant report, as part of the demographic and background questionnaire (see Appendix). Items assess the length of time that has passed since the last (i.e., most recent) and second-to-last dental appointments the participant attended. Participants also reported on whether they avoided dental appointments or had gone a long time without seeing the dentist due to dental anxiety and whether they would have attended more appointments if not for their anxiety. Additionally, a dichotomized variable differentiated patients who did and did not attend the dentist appointment immediately following study participation (subsequently referred to as the index appointment). Participants who did not attend this appointment were contacted by telephone and asked whether dental anxiety contributed to their avoidance. Lastly, dental appointment attendance records were obtained using an electronic patient scheduling program used by the dental clinics at TUKSoD during a 6-month follow-up period to measure how many of their scheduled appointments the participants attended following completion of the study. This variable was dichotomized in two ways: (1) “all” or “not all,” and (2) “attended at least one of the scheduled appointments” or “attended none.” In addition, a ratio was calculated indicating the percentage of appointments attended in the 6-month follow-up period.

Procedure

TUKSoD patients appearing in the electronic scheduler were contacted by telephone and invited to participate in the study. Patients presenting for emergency dental care were recruited in person in the dental clinic waiting room as they waited to be seen. Participation for regular care patients involved completing a battery of self-report questionnaires online or by telephone for those individuals without internet access. Telephone administrations of the questionnaires were limited to asking the questions as stated on the questionnaires, without further elaboration. These patients were not invited to participate in person as this may have confounded attendance at dental appointments, the primary outcome variable. Also for this reason, consenting occurred by telephone, and a copy of the consent form to which the participant agreed via telephone appeared before the questionnaire battery (if completed online) and was mailed to all participants with payment. All regular care participants were also administered the specific phobia module of the ADIS-IV by telephone. Emergency patients completed the questionnaires and interview in person; their attendance data were not collected as they were all seen for their dental emergencies that day following participation. Interviews with regular care patients were recorded and coded for reliability. It was not possible to record interviews with emergency patients as the interviews were conducted in a loud waiting room; therefore, interviews with emergency patients were not coded for reliability. Upon completion of the study, a money order for \$25.00 was mailed via certified mail with signature confirmation to the participant as compensation.

Regular care participants who failed to attend the index appointment were contacted by telephone within one week of their missed appointment to obtain

information about why they did not keep the appointment in an effort to measure self-reported reason(s) for dental treatment avoidance. This query was made in an exploratory, open-ended format; however, for participants who had trouble identifying reasons for not attending the dentist appointment, scripted prompts were provided (e.g., felt anxious, feared pain, preoccupied by negative prior experience with dental care, embarrassment over dental hygiene or oral appearance, forgot about appointment, etc.). Participants who provided a reason to the open-ended query were not provided prompts. Participants' attendance records were also accessed via the electronic scheduler for 6 months following their participation to collect follow-up data. No compensation was provided to participants over the follow-up period as it did not involve their direct participation. Therefore, participants' dental treatment attendance and avoidance were measured prospectively based on information regarding their attendance (e.g., kept, cancelled, or broken appointment) at their upcoming index appointment and in the follow-up period. The initial recruitment and data collection for all study participants took approximately five months, with follow-up data collected (via electronic attendance record review) by six months after the last participant was run. Follow up data were collected for both regular care and emergency patients.

Data Analytic Strategy

Preliminary analyses. First, all variables were examined to determine whether they satisfied assumptions of normality. Next, tests examining differences in study variables of interest (dental anxiety, dental phobia, dental treatment avoidance, and oral health-related quality of life) as a function of demographic variables (age, sex, race, SES, education level, marital status) were conducted using Pearson's correlations, independent

samples *t*-tests, analyses of variance (ANOVAs), or chi-squared tests, depending on variable properties (continuous, dichotomous, categorical). Any demographic variables significantly associated with variables in the tested models were included as covariates when relevant.

Associations between the study's main variables of interest, dental anxiety, dental treatment avoidance, and oral health-related quality of life, were also examined. Depending on variable properties, these relationships were tested using Pearson's correlations, independent samples *t*-tests, ANOVAs, or chi-squared tests.

Frequencies were calculated to explore the prevalence of elevated dental anxiety and specific phobia of dental procedures in the current sample. Depending on variable properties, chi-squared tests or independent samples *t*-tests were used to explore whether there were significant differences in prevalence of elevated dental anxiety, presence and severity of specific phobia, and avoidance of dental care between subgroups that vary on the following demographic variables: sex, age, level of education, and SES.

Tests of hypotheses. *Hypothesis 1.* A chi-squared test was used to examine whether the subset of patients who sought dental treatment on an emergency basis was significantly more likely to endorse a specific phobia of dental procedures than regular care patients, and a *t*-test was used to examine whether emergency patients would report a longer interval of dental care avoidance prior to presenting to the dental clinic than regular care patients. Independent samples *t*-tests and chi-squared tests were used to examine whether patients who sought dental treatment on an emergency basis would have significantly higher dental anxiety scores (as measured by a total score and by

categorization into high, moderate, and low anxiety subgroups) than those participants who attended as regular care patients.

Hypothesis 2. A series of bivariate correlations were used to explore the degree to which dental anxiety, the severity of a specific phobia diagnosis, oral health-related quality of life, and retrospective length of avoidance of dental care (number of days without seeing a dentist prior to study participation) were associated with the following constructs: social appearance anxiety, experiential avoidance, emotion regulation, distress tolerance, mindfulness, pessimism, dental-related physical pain, the presence of re-experiencing symptoms related to prior traumatic dental events, and severity of blood-injection-injury phobia. The Benjamini-Hochberg (1995) method was used to correct for multiple comparisons. This method adjusts for multiple comparisons by controlling the false discovery rate instead of family-wise error rate as is done with the Bonferroni and Tukey HSD methods. It is a less conservative but more powerful approach and provides adequate protection against type I error. Adjusted alpha values are calculated for each analysis based on the number of hypotheses tested within each family of comparisons and their rank order (by significance).

Hypotheses 3-4. Independent samples *t*-tests were used to examine differences in a variety of measures across patient subgroups, by presence or absence of specific phobia and by patient status as emergency or regular care.

Hypotheses 5-7. Separate hierarchical logistic or multiple regressions were used to explore the impact of each proposed moderator for models listed in Hypotheses 5-7. Logistic regressions were used for the dichotomous dependent variable, attending or avoiding a dentist appointment. Linear multiple regressions were conducted for

continuous dependent variables, including oral health-related quality of life, number of days of dental treatment avoidance, and percentage of scheduled dentist appointments attended over the follow-up period. Predictor variables were centered to reduce multicollinearity, and indeed tolerance and variance inflation factor coefficients were within normal limits. Preliminary analyses determined that age was the sole covariate for models in which dental anxiety was the predictor; thus, age was entered into those models first. The centered independent and moderator variables were entered into the second step of the regression to examine main effects, followed by the interaction term in the last step. The Johnson-Neyman technique (Johnson & Fay, 1950) was used to probe for regions of significance for regression models that resulted in a significant interaction.

Statistical power. Power calculations were conducted for the present study using G*Power 3.1.6, a general power analysis computer software (Faul, Erdfelder, Buchner, & Lang, 2009). Since the present study design was unique in its examination of moderators affecting dental treatment avoidance and oral health-related quality of life, previous research was relied upon to choose an appropriate effect size. Little such research has been conducted, but one German study by Sartory and colleagues (2006) found a moderate effect in a regression analysis suggesting that the discrepancy between desired and perceived control over dental procedures contributed to the prediction of dental treatment avoidance in a sample of patients with specific phobia of dental procedures. Because the present study seeks to detect significant interaction effects, a small to moderate effect size was used in calculation of sample size.

The G*Power program uses the f^2 effect size, with $f^2 = .02$ indicating a small effect, $f^2 = .15$ indicating a moderate effect, and $f^2 = .35$ indicating a large effect. To

calculate the sample size for the regression models described above, statistical parameters were set for two-tailed tests with an alpha level of $p = .05$, power = .80, effect size $f^2 = .10$, number of predictors = 5-8 (including 2-5 possible covariates), and numerator degrees of freedom = 3 into G*Power calculations. Preliminary analyses determine the exact predictor and control variables.

This resulted in a recommended overall sample size of 114 participants to achieve adequate power for detecting small to moderate effects in these analyses.

CHAPTER 3

RESULTS

Preliminary Analyses

Data management. Data were examined for accuracy of input and the presence of missing data. There were no out-of-range values for any study variables. There were no missing data on self-report measures. Eight participants denied a history of any past negative dental event; therefore, they did not complete the PCL-S in which questions refer directly to such an event. There were data missing or excluded from the behavioral portion of the study, in cases when attendance at the index appointment and in the follow-up period were examined. Specifically, 51 participants were excluded from analyses examining 6-month follow-up scheduled dental appointment avoidance as they had not scheduled any appointments in that time period. Additionally, 43 participants were excluded from analyses examining avoidance at the scheduled index appointment as data were missing for one regular care patient and the variable was not measured for the 42 emergency patients who were seen immediately in the emergency clinic rather than by scheduling a later appointment. Participants were deleted listwise or pairwise as necessary for analysis. Overall, no more than 51 individuals were deleted from any single analysis.

All variables were examined to determine whether they satisfied assumptions of normality. The distribution of the PCL-S in the full sample did not meet assumptions of normality due to significant deviations in skewness and kurtosis. The positive skew was not surprising as the majority of participants denied experiencing troubling dental appointments horrific enough to produce significant (i.e., item rated “Moderately” or

above) re-experiencing symptoms in the past month. A natural log transformation did not result in a normal distribution; we subsequently conducted all analyses with the original, non-transformed PCL-S scores. Additionally, the avoidance variable measuring the percentage of scheduled dental appointments patients attended in the 6-month follow-up period demonstrated a bimodal histogram although measures of skewness and kurtosis were normal, with several participants clustering around zero (i.e., attending 0% of scheduled appointments) and 50 percent. This variable was thus dichotomized to represent patients who attended at least one dental appointment in the follow-up period and those who attended none. We utilized both forms of this outcome variable, the continuous ratio and the dichotomous variable, in regression models. The remaining variables satisfied assumptions of normality, and there were no influential outliers.

Sample characteristics. All demographic information is provided in Table 1. The sample consisted of 120 participants, comprised of 78 (65%) regular care and 42 (35%) emergency dental patients. Patients were 54.2% female and ranged in age from 19 to 74 years. Of the entire sample, 26 (21.7%) individuals were assigned a diagnosis of specific phobia of dental procedures. Dental anxiety, as measured by the MDAS, was reported as high (score of 19-25) by 22.5%, moderate (score of 13-18) by 26.7%, and low (score of 5-12) by 50.8% of the full sample. Severity of phobia was positively associated with self-reported dental anxiety ($r = .65, p < .001$). The regular care and emergency patients did not significantly differ on any of the demographic variables, nor did the individuals with or without a diagnosis of specific phobia of dental procedures. Age was significantly correlated with MDAS scores ($r = .19, p = .04$) and was therefore included as a covariate when relevant. None of the other study variables of interest (self-reported dental anxiety,

dental treatment avoidance, OHIP-14, CSR, regular or emergency care status, presence of dental phobia) differed as a function of demographic variables (all $ps > .09$). SES was unrelated to dental outcomes (self-reported dental anxiety, dental treatment avoidance, OHIP-14, CSR, regular or emergency care status, presence of dental phobia; all $ps > .06$).

Table 1. Demographic characteristics for the entire sample (N = 120)

Sex	65 F, 54 M, 1 T
Age mean (SD)	39.08 (13.16)
Race	
African American	52.5%
Caucasian	37.5%
Asian American	3.3%
Other	6.7%
Ethnicity	
Hispanic	9.2%
Non-Hispanic	85.8%
Missing or not reported	3.3%
Marital Status	
Married	20.8%
In a relationship	23.3%
Single (never married)	35.8%
Widowed, divorced, or separated	20.0%
Religious Affiliation	
Christian	74.2%
Muslim	7.5%
Jewish	5.0%
Other	13.3%

Table 1, continued

Highest Level of Education Completed	
Some high school	4.2%
Completed HS or GED	36.7%
Some college	29.2%
2-year degree	14.2%
4-year degree	8.3%
Some graduate	3.3%
Completed graduate	4.2%
Annual Family Income	
Less than \$9,999	26.7%
\$10,000-19,999	24.2%
\$20,000-39,999	25.0%
More than \$40,000	24.2%

Note. F = female; M = male; T = transgender; *SD* = standard deviation; HS = high school; GED = general educational development. Percentages do not always add to 100 because of rounding error.

Associations between main variables of interest. Significant correlations among the study's main variables of interest (dental anxiety, CSR, oral health-related quality of life, and avoidance at index appointment and over follow-up) are presented in Table 2.

Table 2. Bivariate correlations among primary variables of interest (N = 120)

	MDAS <i>r</i> (<i>p</i> -value)	CSR (<i>r</i>)	OHIP-14 (<i>r</i>)
MDAS	-		
CSR	.65**	-	
OHIP-14	.29*	.38**	-
Past Avoidance	-.09 (.48)	.01 (.97)	.13 (.28)

Note. MDAS = Modified Dental Anxiety Scale; CSR = Clinical Severity Rating; OHIP-14 = Short Form Oral Health Impact Profile; Past avoidance = days since last dentist appointment. * $p < .01$; ** $p < .001$.

Avoidance of dentist appointments. Of the 77 regular care patients for whom we have data regarding their attendance at the scheduled index appointment (data were missing for one regular care patient and emergency patients did not have an index appointment), 66.2% attended the appointment and the remaining third either cancelled or failed to appear for their appointment. A chi-squared test found no significant differences in avoidance of this appointment among groups differing on the severity of their self-reported dental anxiety (low, moderate, and high scores on the MDAS). Patients who did not attend this dentist appointment ($n = 26$) were contacted by phone within one week to inquire about the reason for missing the appointment. Of the 21 individuals who

provided a response, nine cited an inconvenient time (e.g., had to work, had to take child to doctor) and six reported lacking insurance or not being able to pay for the appointment. The remaining five patients reported missing the scheduled dentist appointment due to anxiety about the appointment ($n = 1$), lacking social or other resources (e.g., not having child care or transportation to dental clinic; $n = 1$), forgetting about the appointment ($n = 2$), or having an emergency (e.g., being hospitalized, death in the family; $n = 2$).

With regard to avoidance in the 6-month follow-up period, 51 (42.5%) of all patients did not schedule any dentist appointments. Of the remaining 69 patients who scheduled at least one appointment, 21.7% did not attend any of them, 78.3% attended at least one, and 58% attended at least half of their appointments (including those who only scheduled one and attended it).

Hypothesis Testing

Anxiety, specific phobia, and avoidance of dental care among regular and emergency care patients (Hypothesis 1). We hypothesized that emergency care patients would report significantly more severe dental anxiety, higher prevalence of specific phobia of dental procedures, and a longer interval of avoiding dental care prior to presenting at the dental clinic than regular care patients. Dental anxiety did not significantly differ between emergency ($M = 14.02$, $SD = 6.01$) and regular care ($M = 12.92$, $SD = 5.42$) patients, either in terms of MDAS total score [$t(118) = -1.02$, $p = .31$], or when classified into three groups of low vs. moderate vs. high anxiety [$\chi^2(2, N = 120) = 1.96$, $p = .38$] or two groups of low/moderate vs. high anxiety [$\chi^2(1, N = 120) = 1.37$, $p = .24$]. Emergency patients had a significantly higher prevalence of specific phobia (36%)

than regular patients (14%), $\chi^2(1, N = 120) = 7.51, p < .01$. Further, emergency patients ($M = 1135.81, SD = 1679.07$) waited a significantly longer time, in days, between dental appointments than regular patients [$M = 278.45, SD = 600.28; t(118) = -4.07, p < .001$].

Correlates of dental anxiety, specific phobia severity, avoidance of dental care, and oral health-related quality of life (Hypothesis 2). We hypothesized that higher levels of dental anxiety, greater severity of a specific phobia diagnosis, prolonged avoidance of dental care prior to study participation, and poor oral health-related quality of life would all be positively associated with the following constructs: social appearance anxiety, experiential avoidance, difficulties with emotion regulation, distress tolerance, and mindfulness, pessimism, dental-related pain, the presence of re-experiencing symptoms related to prior negative dental appointment over the past month, and severity of blood-injection-injury phobia. Table 3 shows a series of bivariate correlations demonstrating the degree of association among these constructs. Unexpectedly, avoidance of dental care, measured retrospectively (i.e., number of days gone without seeing a dentist prior to participation in the study) and prospectively (i.e., percentage of scheduled follow-up appointments attended), was not significantly correlated with any of the constructs when corrected for multiple comparisons.

Dental anxiety was positively correlated with social appearance anxiety, pain experienced at the last dental appointment, BII fears (SAAS, PI-NRS, FQ-BII, all p 's $< .001$), and re-experiencing symptoms related to a prior negative dental procedure (PCL-S, $p < .01$). Dental anxiety was negatively correlated with the non-judging facet of mindfulness (FFMQ-SF non-judging, $p < .01$). The remaining constructs were not significantly correlated with dental anxiety.

The CSR, a continuous variable which denotes the severity of a specific phobia diagnosis at the score of 4 or above and of sub-clinical phobia at scores of 3 and below, was positively correlated with social appearance anxiety, pain experienced at the last dental appointment, BII fears, and re-experiencing symptoms related to a prior negative dental procedure (SAAS, PI-NRS, FQ-BII, PCL-S, all p 's < .001). The CSR was positively correlated with experiential avoidance and negatively correlated with the absorption subscale of the Distress Tolerance Scale (AAQ-II, DTS absorption, p 's < .01) and with optimism (p < .001). The remaining constructs were not significantly correlated with the CSR.

Impairment in oral health-related quality of life was positively correlated with social appearance anxiety, pain experienced at the last dental appointment, and re-experiencing symptoms related to a prior negative dental procedure (SAAS, PI-NRS, PCL-S, all p 's < .001), and with BII fears (FQ-BII, p < .01). Impairment in OHRQoL was negatively correlated with optimism, the appraisal subscale of the Distress Tolerance Scale, and the acting with awareness facet of mindfulness (LOT-R, DTS appraisal, FFMQ-SF acting with awareness, all p 's < .01), and with (AAQ-II, p < .001). The remaining constructs were not significantly correlated with impairment in OHRQoL.

Overall, there was strong evidence for the relationship of dental anxiety with social appearance anxiety, pain severity, BII fears, and re-experiencing symptoms, with only weak support for the relationship between dental anxiety and mindfulness. CSR was found to be related to social appearance anxiety, pessimism, pain severity, BII fears, re-experiencing symptoms, and experiential avoidance, with minimal support for the relationship between CSR and distress tolerance. Strong evidence was found for the

relationship between OHRQoL and social appearance anxiety, pessimism, pain severity, BII fears, re-experiencing symptoms, and experiential avoidance, with minimal support for the relationship between OHRQoL and distress tolerance and mindfulness. No support was found for a relationship between number of days since the last dental appointment and the various constructs.

Table 3. Bivariate correlations among primary outcome variables with other constructs
(*N* = 120)

	MDAS	CSR	OHIP-14	Past Avoidance
	(<i>r</i> , <i>p</i> -value)	(<i>r</i> , <i>p</i> -value)	(<i>r</i> , <i>p</i> -value)	(<i>r</i> , <i>p</i> -value)
SAAS	.39, < .001*	.44, < .001*	.40, < .001*	-.02, .80
LOT-R	-.06, .49	-.26, < .001*	-.26, < .01*	-.12, .18
PI-NRS	.35, < .001*	.30, < .001*	.44, < .001*	.20, .03
PCL-S re-experiencing	.32, < .01*	.42, < .001*	.41, < .001*	-.09, .37
FQ-BII	.47, < .001*	.43, < .001*	.23, < .01*	.07, .45
AAQ-II	-.21, .02	-.28, < .01*	-.34, < .001*	.01, .98
ERQ reappraisal	-.03, .79	-.05, .96	.09, .31	.17, .06
ERQ suppression	-.06, .51	-.01, .88	-.05, .61	-.12, .20
DTS mean	-.17, .07	-.20, .03	-.19, .03	-.13, .17
DTS tolerance	-.14, .14	-.16, .09	-.11, .25	-.01, .91
DTS absorption	-.23, .01	-.27, < .01*	-.19, .04	-.06, .55
DTS appraisal	-.11, .23	-.18, .04	-.29, < .01*	-.18, .05
DTS regulation	-.05, .59	-.01, .88	-.04, .66	-.17, .07
FFMQ-SF observing	.05, .60	.01, .93	-.03, .79	-.18, .05
FFMQ-SF describing	-.06, .49	-.07, .48	-.17, .06	-.06, .54
FFMQ-SF awareness	-.24, .01	-.17, .07	-.26, < .01*	.23, .01
FFMQ-SF non-judging	-.27, < .01*	-.13, .15	-.21, .02	-.01, .97
FFMQ-SF non-reacting	-.07, .48	-.20, .03	-.05, .63	-.07, .43

Note. $N = 120$, except for correlations including the PCL-S for which $N = 112$. MDAS = Modified Dental Anxiety Scale; OHIP-14 = Short Form Oral Health Impact Profile; CSR = Clinical Severity Rating; Past avoidance = days since last dentist appointment; SAAS = Social Appearance Anxiety Scale; LOT-R = Life Orientation Test – Revised; PI-NRS = Pain Intensity Numeric Rating Scale regarding last dentist appointment; PCL-S = PTSD Checklist – Stressor Specific Version, re-experiencing subscale; FQ-BII = Fear Questionnaire, Blood-Injection-Injury subscale; AAQ-II = Acceptance and Action Questionnaire - II; ERQ = Emotion Regulation Questionnaire; DTS = Distress Tolerance Scale; FFMQ-SF = Five Facet Mindfulness Questionnaire – Short Form. Significance values are corrected for multiple comparisons using FDR method with asterisks denoting corrected significance.

Differences among patients with and without specific phobia (Hypothesis 3).

We hypothesized that patients with and without specific phobia of dental procedures would differ in their level of self-reported dental anxiety, avoidance, and impairment on OHRQoL and other constructs examined in Hypothesis 2, such that those with a specific phobia diagnosis would report greater dental anxiety, avoid dental care longer, and have more impairment in OHRQoL and remaining constructs. A complete listing of study variables with means and standard deviations is presented in Table 4 below, with mean differences by presence or absence of specific phobia. Significance values of mean differences between groups were corrected for multiple comparisons using the FDR method (described above). Patients with a diagnosis of specific phobia scored significantly higher than those without a diagnosis on the intensity of dental anxiety,

impairment in oral health-related quality of life, social appearance anxiety, the intensity of pain experienced at the most recent dentist appointment, and the frequency of re-experiencing symptoms over the past month related to a prior negative dental appointment (MDAS, OHIP-14, SAAS, PI-NRS, PCL-S, all p 's < .001). Groups did not differ on length of avoiding dental care retrospectively or upon follow-up, or on the remaining constructs.

Upon examining MDAS scores among patients with and without specific phobia, it was discovered that several patients provided inconsistent reports between self-report (MDAS) and interview (ADIS-IV) measures of anxiety/phobia. Specifically, four patients reported low anxiety on the MDAS (score of 5-12) and five patients reported moderate anxiety (score of 13-18), yet during the diagnostic interview these nine individuals endorsed symptoms significant enough to warrant to a diagnosis of specific phobia. Additionally, ten patients reported high anxiety (score of 19-25) but did not receive a diagnosis of specific phobia at interview. The remaining 101 patients reported symptoms consistently across measures (i.e., high anxiety and specific phobia, moderate anxiety and no phobia, and low anxiety and no phobia). Despite these inconsistencies, a *post hoc* chi-squared test of independence suggested that MDAS categorization varied significantly by presence or absence of specific phobia, $\chi^2(2, N = 120) = 36.02, p < .001$.

Table 4. Means and standard deviations for measure scores of patients with and without a diagnosis of specific phobia of dental procedures

	Phobia <i>n</i> = 26 <i>M</i> (<i>SD</i>)	No Phobia <i>n</i> = 94 <i>M</i> (<i>SD</i>)	<i>t</i>	<i>p</i> value
MDAS	19.08 (4.20)	11.71 (4.90)	6.98	< .001*
OHIP-14	30.27 (10.85)	18.54 (12.15)	4.45	< .001*
CSR	5.23 (1.07)	0.81 (1.06)	18.79	< .001*
SAAS	38.62 (19.10)	25.83 (10.80)	4.44	< .001*
LOT-R	13.38 (5.97)	16.03 (4.33)	-2.53	.01
PI-NRS	6.04 (3.52)	3.22 (3.15)	3.93	< .001*
PCL-S re-experiencing	10.84 (5.67)	6.99 (3.16)	4.41	< .001*
AAQ-II	47.31 (14.82)	54.02 (10.98)	-2.53	.01
ERQ reappraisal	30.38 (10.16)	29.87 (7.68)	0.28	.78
ERQ suppression	16.69 (5.66)	17.28 (4.78)	-0.53	.60
DTS mean	3.20 (0.86)	3.44 (0.82)	-1.28	.20
DTS tolerance	3.09 (1.30)	3.40 (1.02)	-1.28	.20
DTS absorption	3.10 (1.12)	3.64 (1.08)	-2.23	.03
DTS appraisal	3.53 (0.94)	3.71 (0.93)	-0.87	.38
DTS regulation	3.09 (1.18)	3.01 (1.09)	0.34	.74
FFMQ-SF observing	14.54 (3.39)	13.83 (3.11)	1.01	.32

Table 4, continued

FFMQ-SF describing	19.00 (4.55)	19.01 (3.34)	-0.01	.99
FFMQ-SF awareness	18.81 (4.95)	19.69 (3.80)	-0.98	.33
FFMQ-SF non-judging	15.65 (4.02)	16.49 (3.89)	-0.96	.34
FFMQ-SF non-reacting	14.96 (4.51)	16.06 (3.49)	-1.34	.18

Note. MDAS = Modified Dental Anxiety Scale; OHIP-14 = Short Form Oral Health Impact Profile; CSR = Clinical Severity Rating; Past avoidance = days since last dentist appointment; SAAS = Social Appearance Anxiety Scale; LOT-R = Life Orientation Test – Revised; PI-NRS = Pain Intensity Numeric Rating Scale regarding last dentist appointment; PCL-S = PTSD Checklist – Stressor Specific Version, re-experiencing subscale; AAQ-II = Acceptance and Action Questionnaire - II; ERQ = Emotion Regulation Questionnaire; DTS = Distress Tolerance Scale; FFMQ-SF = Five Facet Mindfulness Questionnaire – Short Form. Significance values are corrected for multiple comparisons using FDR method with asterisk (*) denoting corrected significance.

With regard to avoidance, we hypothesized that individuals with specific phobia would report longer periods of treatment avoidance retrospectively and exhibit more avoidance during the follow-up period than those without a diagnosis, with a similar pattern expected when grouped by self-reported dental anxiety (i.e., high, moderate, low) rather than by diagnosis. Of the full sample of 120 participants, individuals with a diagnosis of specific phobia ($n = 26$; $M = 779.5$, $SD = 1586.2$) and those without a diagnosis ($n = 94$; $M = 522.9$, $SD = 1032.6$) did not differ significantly on the number of

days gone without seeing a dentist prior to study enrollment [$t(118) = 0.99, p = .33$]. Similarly, among the 69 patients who scheduled at least one dentist appointment in the follow-up period, individuals grouped by self-reported dental anxiety level did not significantly differ on the percentage of scheduled dentist appointments attended during follow-up [$F(2, 66) = 0.19, p = .83$] or on whether they attended at least one [$\chi^2(2, N = 69) = 0.69, p = .71$] or half [$\chi^2(2, N = 69) = 0.20, p = .90$] of the scheduled follow-up dentist appointments, according to ANOVA and chi-squared tests.

Differences among emergency and regular care patients (Hypothesis 4).

Emergency patients reported significantly greater intensity of pain experienced at the most recent dentist appointment than regular care patients (PI-NRS, $p < .001$). No other group differences across constructs were found after alpha correction (see Table 5).

Table 5. Means and standard deviations for measure scores of emergency and regular care patients

	Emergency <i>n</i> = 42 <i>M</i> (<i>SD</i>)	Regular Care <i>n</i> = 78 <i>M</i> (<i>SD</i>)	<i>t</i>	<i>p</i> value
OHIP-14	23.43 (12.56)	19.82 (12.82)	-1.48	.14
CSR	2.38 (2.42)	1.44 (1.86)	-2.38	.02
SAAS	29.07 (14.31)	28.35 (13.90)	-0.27	.79
LOT-R	15.02 (4.60)	15.69 (4.97)	0.72	.47
PI-NRS	5.38 (3.49)	3.00 (3.10)	-3.84	< .001*
PCL-S re-experiencing	9.23 (5.54)	7.11 (2.98)	-2.64	.009
AAQ-II	51.43 (12.77)	53.18 (11.87)	0.75	.45
ERQ reappraisal	31.19 (7.16)	29.33 (8.74)	-1.18	.24
ERQ suppression	17.24 (5.12)	17.10 (4.91)	-0.14	.89
DTS mean	3.20 (0.94)	3.49 (0.76)	1.78	.08
DTS tolerance	3.33 (1.08)	3.33 (1.10)	-0.02	.98
DTS absorption	3.26 (1.20)	3.67 (1.03)	1.93	.06
DTS appraisal	3.44 (1.08)	3.79 (0.82)	2.02	.05
DTS regulation	2.79 (1.16)	3.15 (1.06)	1.76	.08
FFMQ-SF observing	14.02 (3.65)	13.96 (2.90)	-0.10	.92
FFMQ-SF describing	20.04 (3.22)	18.45 (3.72)	-2.35	.02

Table 5, continued

FFMQ-SF awareness	20.67 (4.14)	18.87 (3.91)	-2.35	.02
FFMQ-SF non-judging	16.45 (4.36)	16.23 (3.69)	-0.29	.77
FFMQ-SF non-reacting	15.76 (4.13)	15.86 (3.54)	0.14	.89

Note. OHIP-14 = Short Form Oral Health Impact Profile; CSR = Clinical Severity Rating; Past avoidance = days since last dentist appointment; SAAS = Social Appearance Anxiety Scale; LOT-R = Life Orientation Test – Revised; PI-NRS = Pain Intensity Numeric Rating Scale regarding last dentist appointment; PCL-S = PTSD Checklist – Stressor Specific Version, re-experiencing subscale; AAQ-II = Acceptance and Action Questionnaire - II; ERQ = Emotion Regulation Questionnaire; DTS = Distress Tolerance Scale; FFMQ-SF = Five Facet Mindfulness Questionnaire – Short Form. Significance values are corrected for multiple comparisons using FDR method with asterisk (*) denoting corrected significance.

Moderation of the relationship between dental anxiety and avoidance

(Hypothesis 5). We hypothesized that the relationship between dental anxiety and avoidance would be moderated by the following constructs: emotion regulation, distress tolerance, mindfulness, and experiential avoidance, such that difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance would interact with dental anxiety to increase avoidance. Avoidance was measured in four ways, as described previously, so the models for each proposed moderator were run four times; however, only models using the dichotomous measure of avoidance indicating

whether a patient attended the index appointment resulted in significant interactions. The remaining measures of avoidance (percentage of dentist appointments attended in the follow up period, attendance to at least one appointment in the follow up period, or attending less or more than half of appointments in the follow up period) were not associated with significant interactions. Age was correlated with dental anxiety and thus included as a covariate in regression analyses. These models excluded emergency care patients because they participated in the study upon presenting to their appointment, whereas the regular care patients participated prior to their scheduled appointment.

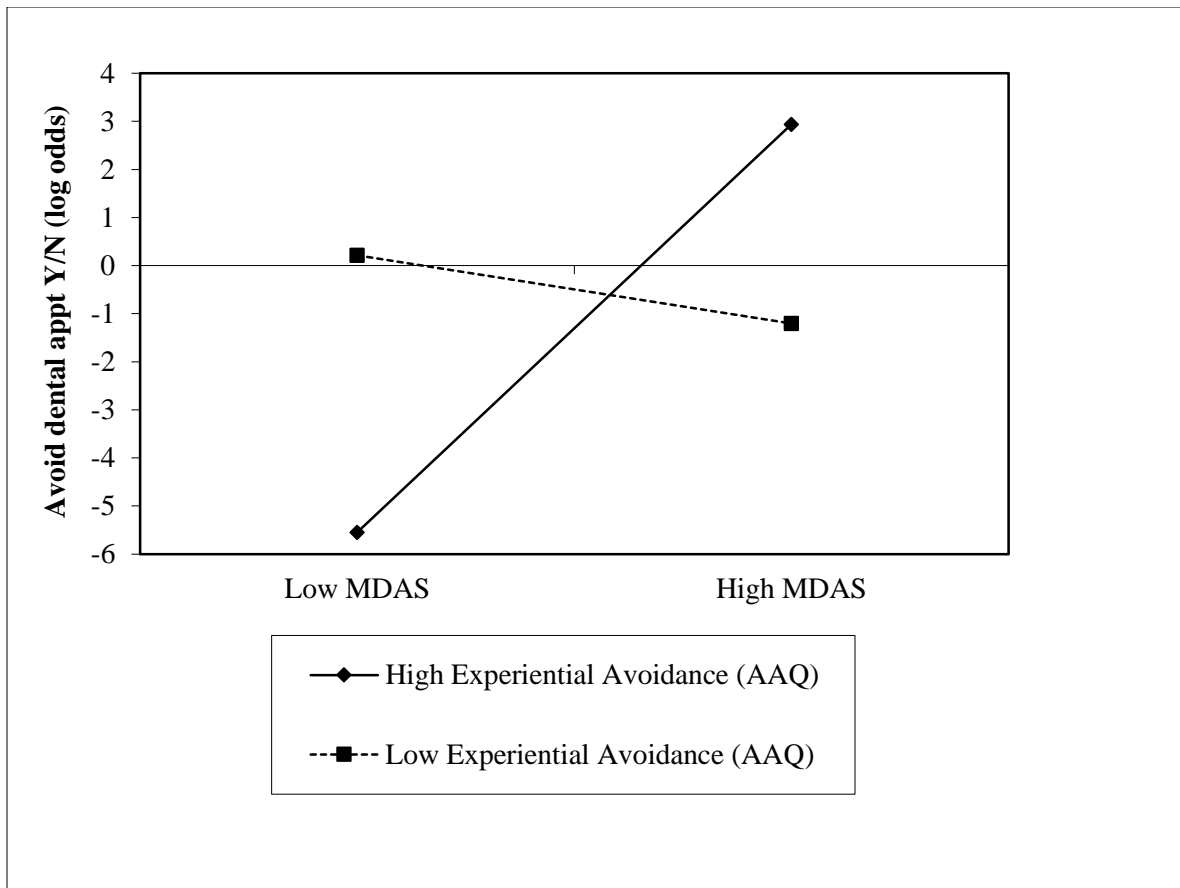
In the analysis of the effects of dental anxiety and experiential avoidance on patients' avoidance of the index appointment, there were significant main effects of age and dental anxiety (MDAS). The interaction of dental anxiety with experiential avoidance was significantly associated with a patient's avoidance ($OR = .978, p = .02$); therefore, the relationship between dental anxiety and avoidance of the index appointment was moderated by experiential avoidance. See Table 6 and Figure 1. The Johnson-Neyman analysis revealed that the region of significance for the effect of dental anxiety was a score of 56.30 or lower (possible range = 10-70, with lower scores indicating more experiential avoidance). In other words, the effect of dental anxiety on avoidance was significantly positive at or below a score of 56.30 on the AAQ-II, but not significant above that. Dental anxiety was most strongly associated with avoidance of the index dental appointment among those demonstrating the greatest experiential avoidance.

Table 6. Hierarchical logistic regression model for the moderating role of experiential avoidance on the effect of dental anxiety on avoidance of the index appointment (n = 77)

	<i>Variable</i>	<i>B</i>	<i>SE B</i>	<i>Odds Ratio</i>	<i>Confidence Interval</i>
Block 1					
	Age	-0.039	0.020	0.960*	0.925 – 0.999
Block 2					
	Age	-0.051	0.023	0.950*	0.909 – 0.994
	Dental anxiety (MDAS)	0.098	0.050	1.103*	1.001 – 1.216
	AAQ-II	0.020	0.023	0.020	0.975 – 1.067
Block 3					
	Age	-0.065	0.026	0.937*	0.891 – 0.985
	Dental anxiety (MDAS)	0.186	0.076	1.204*	1.038 – 1.398
	AAQ-II	0.066	0.039	1.069	0.989 – 1.154
	MDAS * AAQ-II	-0.022	0.009	0.978*	0.961 – 0.996

Note: AAQ-II = measure of experiential avoidance. * $p < .05$. Block 1 $\chi^2(1, N = 77) = 4.42, p < .05$, Model $\chi^2(1, N = 77) = 4.42, p < .05$; Block 2 $\chi^2(2, N = 77) = 4.56, p = .10$, Model $\chi^2(3, N = 77) = 8.98, p < .05$; Block 3 $\chi^2(1, N = 77) = 13.54, p < .001$, Model $\chi^2(4, N = 77) = 22.52, p < .001$.

Figure 1. *The moderating role of experiential avoidance on the effect of dental anxiety on avoidance of the index appointment*



Note: Plotted moderator values are one standard deviation above and below the mean.

The logit of Y is plotted, rather than the probability. All variables are centered.

In the analysis of the effects of dental anxiety and mindful awareness on patients' avoidance of the index appointment, there was a significant main effect of age. The interaction of dental anxiety (MDAS) with the awareness subscale of the mindfulness scale was significantly associated with a patient's avoidance of the index appointment ($OR = .973, p = .04$); therefore, the relationship between dental anxiety and avoidance

was moderated by difficulties with mindful awareness. See Table 7 and Figure 2. The Johnson-Neyman analysis revealed that the region of significance for the effect of dental anxiety was a score of 18.47 or lower (possible range = 5-25, with lower scores indicating less mindful awareness). In other words, the effect of dental anxiety on avoidance was significantly positive at or below 18.47, but not significant above that. Dental anxiety was most strongly associated with avoidance of the index dental appointment among those demonstrating the least mindful awareness.

The covariate age demonstrated a significant main effect on avoidance in models testing all moderators except for distress tolerance. The MDAS had a significant main effect on avoidance in models testing the moderators AAQ-II, the reappraisal subscale of the ERQ, and mindful non-judging. Additionally, the proposed moderator mindful observing had a significant main effect on avoidance. Of these analyses, the interaction effect was only significant in the analysis examining the AAQ-II, as reported above. For regression analyses in this set of models that did not result in significant interactions odds ratios ranged from 0.876 to 1.013 (p range = .06-.99) and Betas ranged from -0.223 to 0.015 (p range = .08-.91).

Table 7. Hierarchical logistic regression model for the moderating role of mindful awareness on the effect of dental anxiety on avoidance of the index appointment ($n = 77$)

	<i>Variable</i>	<i>B</i>	<i>SE B</i>	<i>Odds Ratio</i>	<i>Confidence Interval</i>
Block 1					
	Age	-0.039	0.020	0.962*	0.925 – 0.999
Block 2					
	Age	-0.051	0.023	0.950*	0.908 – 0.993
	Dental anxiety (MDAS)	0.103	0.051	1.109*	1.004 – 1.224
	FFMQ-SF-AA	0.081	0.068	1.084	0.949 – 1.238
Block 3					
	Age	-0.066	0.022	0.936*	0.891 – 0.983
	Dental anxiety (MDAS)	0.091	0.052	1.096	0.990 – 1.212
	FFMQ-SF-AA	0.171	0.089	1.186	0.996 – 1.413
	MDAS * FFMQ-SF-AA	-0.027	0.013	0.973*	0.948 – 0.999

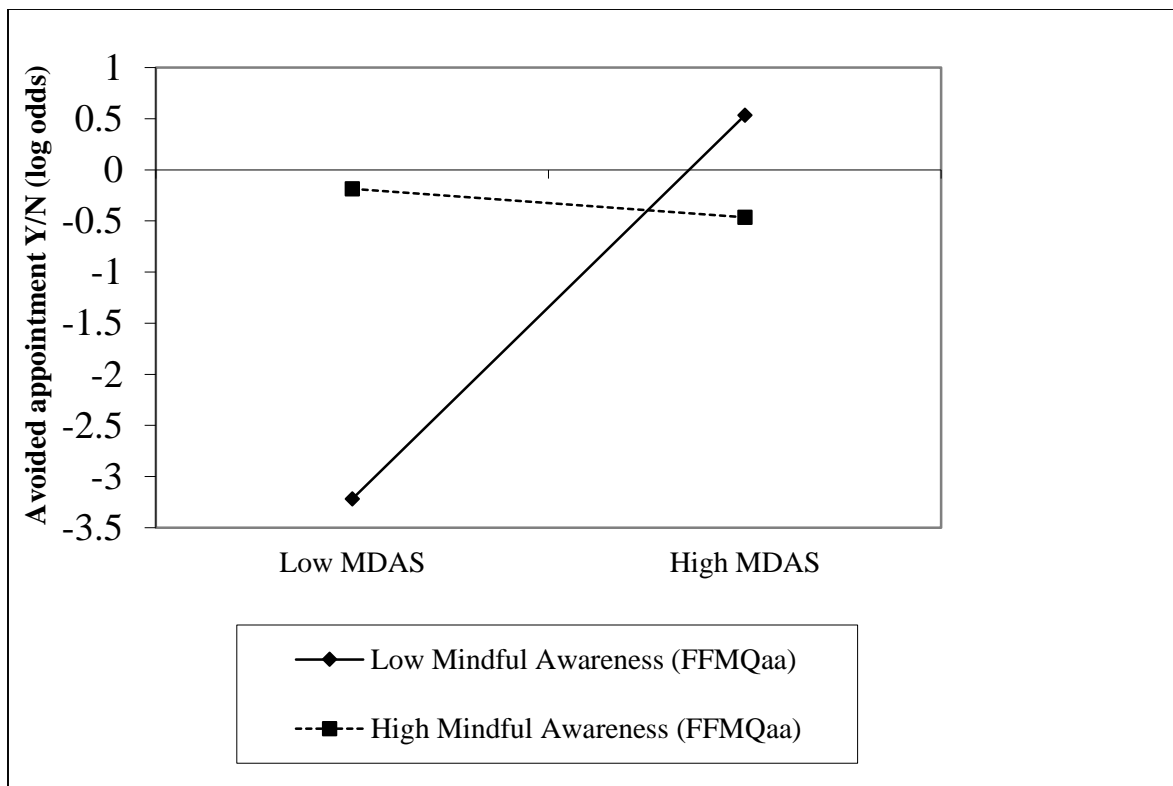
Note: FFMQ-SF-AA = Mindfulness acting with awareness subscale. * $p < .05$. Block 1

$\chi^2(1, N = 77) = 4.42, p < .05$, Model $\chi^2(1, N = 77) = 4.42, p < .05$; Block 2 $\chi^2(2, N = 77) =$

$5.25, p = .07$, Model $\chi^2(3, N = 77) = 9.67, p < .05$; Block 3 $\chi^2(1, N = 77) = 4.65, p < .05$,

Model $\chi^2(4, N = 77) = 14.32, p < .01$.

Figure 2. *The moderating role of mindful awareness on the effect of dental anxiety on avoidance of the index appointment*



Note: Plotted moderator values are one standard deviation above and below the mean.

The logit of Y is plotted, rather than the probability. All variables are centered.

These moderation models were the only two of the large set of regression models that demonstrated significant interactions. The remaining proposed moderators (difficulties with emotion regulation and distress tolerance) did not interact with dental anxiety to predict avoidance. It is possible that the few significant findings we did find were due to chance, particularly because a *post hoc* power analysis with these interaction effects revealed that a sample size of 77 achieves a negligible statistical power of .05 in a

test based on an alpha of .05. A sample size of several thousand would be necessary to obtain statistical power at the .80 level.

Moderation of the relationship between dental anxiety and oral health-related quality of life (Hypothesis 6). We hypothesized the relationship between dental anxiety and oral health-related quality of life would be moderated by the same variables listed in Hypothesis 5, such that difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance would interact with dental anxiety to reduce oral health-related quality of life (OHRQoL). In the analysis of the effects of dental anxiety (MDAS) and mindful observing on OHRQoL, there was a significant main effect of dental anxiety. The interaction of dental anxiety with mindful observing was significantly associated with OHIP scores ($\beta = .183, p = .04$); therefore, the relationship between dental anxiety and impairment in OHRQoL was moderated by mindful observing. See Table 8 and Figure 3. The Johnson-Neyman analysis revealed that the region of significance for the effect of dental anxiety was a score of 12.56 or higher (possible range = 4-20, with higher scores indicating greater mindful observing). In other words, the effect of dental anxiety on impairment in oral health-related quality of life was significantly positive at or above 12.56, but not significant below that. Dental anxiety was most strongly associated with OHRQoL among those demonstrating the greatest mindful observing. This result is the opposite of what was expected.

The MDAS had a significant main effect on OHRQoL in models testing all moderators. Additionally, the proposed moderator AAQ-II had a significant main effect on OHRQoL. The interaction effect was not significant in any analyses other than that between dental anxiety and mindful observing. For regression analyses in this set of

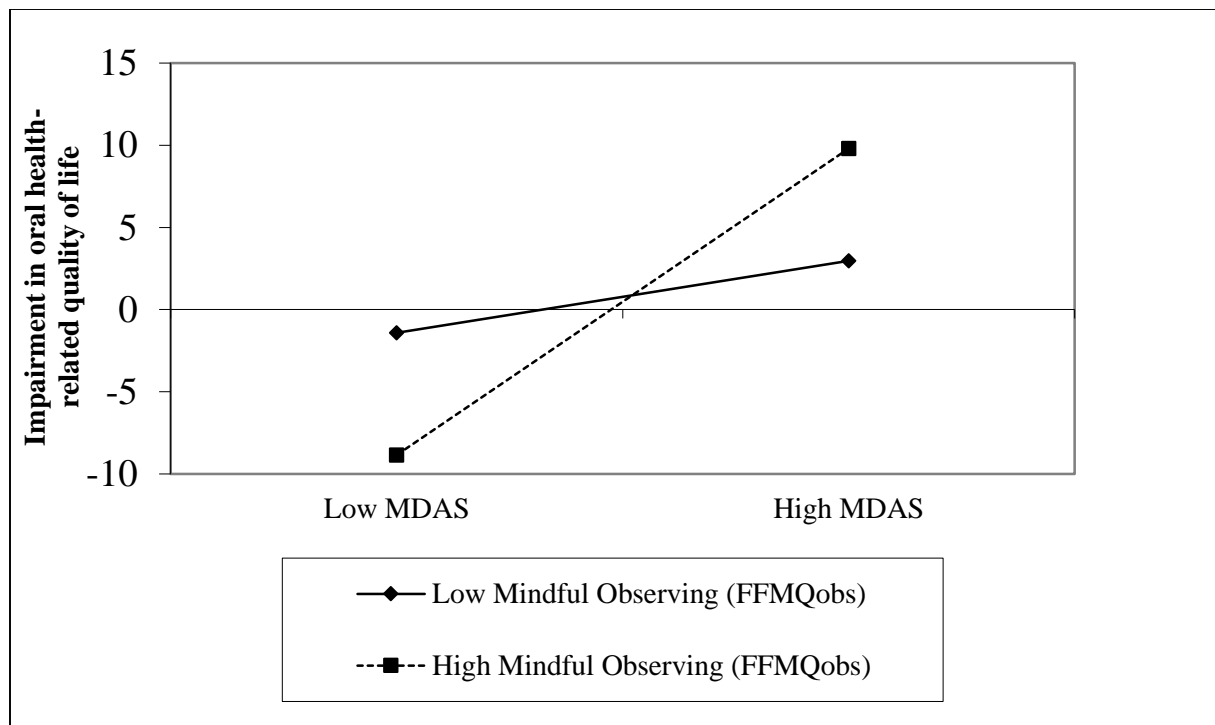
models that did not result in significant interactions Betas ranged from -0.161 to 0.023 (p range = .07-.95).

Table 8. Hierarchical regression model for the moderating role of mindful observing on the effect of dental anxiety on oral health-related quality of life ($N = 120$)

Variable	B	$SE B$	β
Block 1			
Age	0.138	0.089	.142
Block 2			
Age	0.087	0.088	.089
Dental anxiety (MDAS)	0.627	0.205	.276**
FFMQ-SF-Obs	-0.157	0.357	-.039
Block 3			
Age	0.084	0.086	.086
Dental anxiety (MDAS)	0.606	0.202	.267**
FFMQ-SF-Obs	-0.189	0.352	-.047
MDAS * FFMQ-SF-Obs	0.118	0.056	.183*

Note: FFMQ-SF-Obs = Mindfulness observing subscale. $R^2 = .020$, $F(1,118) = 2.417$ for Block 1 ($p = .12$); $\Delta R^2 = .074$, $\Delta F(2,116) = 4.735$ for Block 2 ($p < .05$); $\Delta R^2 = .033$, $\Delta F(1,115) = 4.403$ for Block 3 ($p < .05$). * $p < .05$; ** $p < .01$.

Figure 3. *The moderating role of mindful observing on the effect of dental anxiety on impairment in oral health-related quality of life*



Note: Plotted moderator values are one standard deviation above and below the mean. All variables are centered.

Moderation of the relationship between social appearance anxiety and avoidance (Hypothesis 7). We hypothesized that the relationship between social appearance anxiety and avoidance of dental treatment would be moderated by the following variables: optimism, re-experiencing symptoms relating to a prior negative dental experience, and dental-related physical pain, such that pessimism and significant re-experiencing symptoms would interact with social appearance anxiety to increase avoidance of dental care, and the intensity of dental-related pain would interact with social appearance anxiety to reduce avoidance. The interaction of social appearance

anxiety (SAAS) with optimism (LOT-R) was significantly associated with the percentage of appointments patients attended during the six-month follow-up period ($\beta = -.345$, $p = .03$); therefore, the relationship between social appearance anxiety and attendance was moderated by optimism. See Table 9 and Figure 4.

Despite the presence of a significant interaction, the simple slopes were not significant and the Johnson-Neyman analysis revealed no regions of significance; however, there was a trend for a positive slope for low values of the moderator and a trend for a negative slope for high values of the moderator ($p < .10$). These extreme values of the moderator had larger standard errors than moderate values of the moderator, which may contribute to the lack of significant simple slopes and regions of significance. These trends suggest that the effect of social appearance anxiety on the percentage of follow-up appointments attended is positive at low values of optimism and negative at high values of optimism. In other words, at low optimism, high social appearance anxiety tends toward being associated with attending more appointments, whereas at high optimism, high social appearance anxiety trends toward being associated with avoiding more appointments.

This model included a sample of 69 patients because the remaining individuals did not schedule any dentist appointments during the six-month follow-up period and therefore follow-up avoidance data were not available. The moderator values appeared to follow a curvilinear trend, so we considered conducting a non-parametric test; however, it is likely that the number of cases in the tails of the distribution was small and did not reach significance as a function of the sample size. This moderation model was the only one of the large set of regression models that demonstrated a significant interaction. The

remaining proposed moderators (pain intensity at last dentist appointment and re-experiencing symptoms) did not interact with social appearance anxiety to predict avoidance. Further, there were no significant main effects of social appearance anxiety or of the hypothesized moderators on dentist appointment attendance in any of the models tested. It is possible that the few significant findings and the lack of significant simple slopes in the model demonstrating significant interaction with optimism were due to chance or a lack of power. A *post hoc* power analysis with this interaction effect revealed that a sample size of 69 achieves a statistical power of .61 in a test based on an alpha of .05. A sample size of approximately 107 would be necessary to obtain statistical power at the .80 level. With a larger sample size, we would have likely found significance at the low and high values of the moderator when analyzing regions of significance. For regression analyses in this set of models that did not result in significant interactions odds ratios ranged from 0.995 to 1.044 (p range = .07-.98) and Betas ranged from 0.094 to 0.113 (p range = .37-.46).

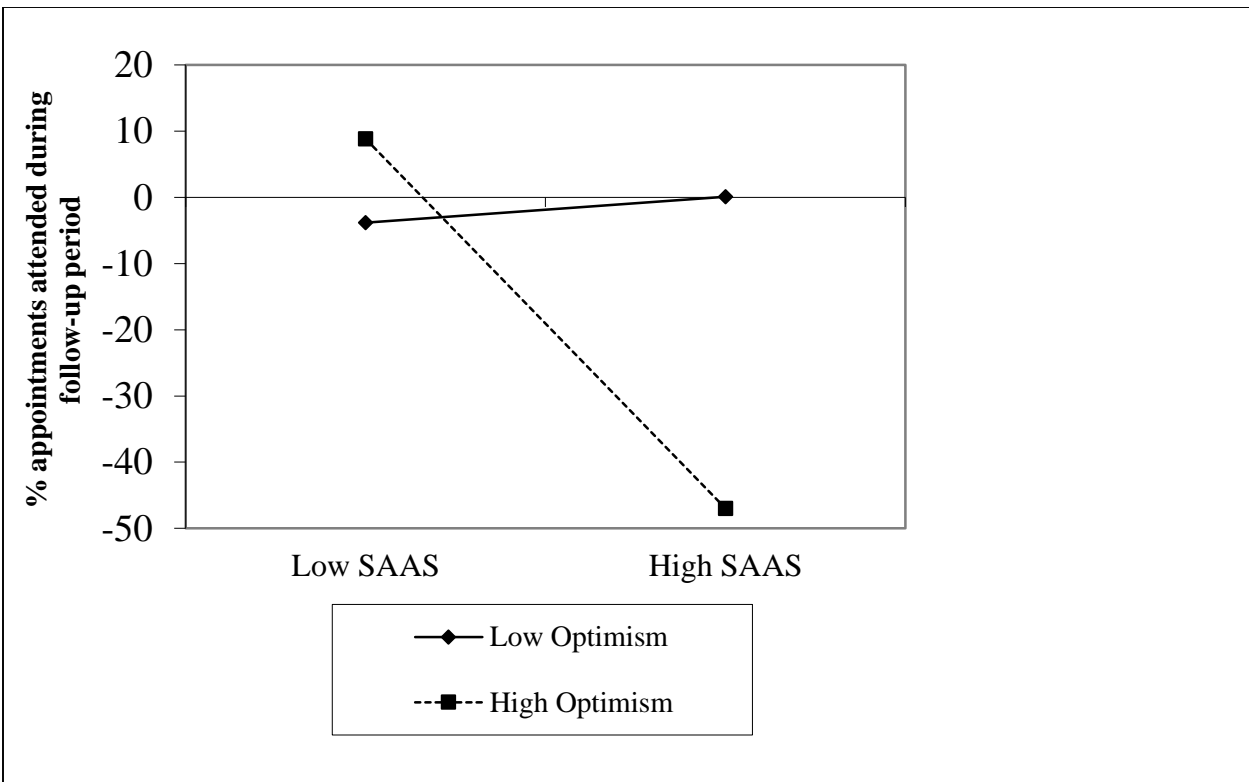
Table 9. Hierarchical regression model for the moderating role of optimism on the effect of social appearance anxiety on follow-up dentist appointment attendance (n = 69)

	Variable	B	SE B	β
Block 1				
X ₁	Social appearance anxiety (SAAS)	-0.001	0.359	.000
X ₂	Optimism (LOT-R)	-0.642	1.018	-.087
Block 2				
X ₁	Social appearance anxiety (SAAS)	-0.433	0.399	-.167
X ₂	Optimism	-0.001	1.030	.000
X ₁ *X ₂	SAAS * LOT-R	-0.108	0.048	-.345*

Note: $R^2 = .008$, $F(2,66) = .254$ for Block 1 ($p = .78$); $\Delta R^2 = .070$, $\Delta F(1,65) = 4.953$ for

Block 2 ($p < .05$). * $p < .05$.

Figure 4. *The moderating role of optimism on the effect of social appearance anxiety on follow-up dentist appointment attendance*



Note: Plotted moderator values are one standard deviation above and below the mean. All variables are centered.

CHAPTER 4

DISCUSSION

Dental anxiety is a relatively common problem with important medical, public health, and psychiatric implications. Several studies show that dental anxiety and the avoidance of dental treatment considerably impair oral health and oral health-related quality of life, lead to more complex care at increased cost, and are associated with a range of psychological symptoms. To date, there has been little examination of constructs that may enhance our understanding of anxiety and avoidance in relation to dental care and hence inform anxiety treatment.

The current study aimed to more thoroughly investigate the prevalence of dental anxiety, specific phobia of dental procedures, and avoidance of dental care among dental patients presenting for routine and emergency care in north Philadelphia. Psychological constructs hypothesized to be associated with anxiety, phobia severity, and avoidance included oral health-related quality of life, emotion regulation, distress tolerance, mindfulness, experiential avoidance, social appearance anxiety, pessimism, dental-related physical pain, re-experiencing symptoms related to prior traumatic dental events, and BII fears. We expected to find impairment in these variables to be positively correlated with anxiety and avoidance. Beyond this general exploration, we also sought to examine how patient subgroups, including those presenting for regular or emergency care, along with patients with or without a specific phobia diagnosis, differed on these constructs. It was hypothesized that emergency patients would exhibit significantly greater impairment than regular care patients, with a similar pattern expected for patients with a specific phobia relative to those without the diagnosis.

Further, the present study tested three sets of moderation models. Based on the larger anxiety disorders literature, we proposed that the relationships between dental anxiety and avoidance and between dental anxiety and oral health-related quality of life would be moderated by emotion regulation, distress tolerance, experiential avoidance, and mindfulness. We expected that impairment in the moderating variables would interact with dental anxiety to increase avoidance and reduce oral health-related quality of life. Additionally, it was hypothesized that the relationship between social appearance anxiety and avoidance would be moderated by pessimism, re-experiencing symptoms related to prior traumatic dental events, and dental pain. It was expected that elevated scores on the moderator variables would interact with social appearance anxiety to increase avoidance.

Prevalence of dental anxiety and phobia

We found that 22.5% ($n = 27$) of our sample reported experiencing high dental anxiety and 22% ($n = 26$) met the DSM-IV criteria for a specific phobia of dental procedures, with an overlap of 17 patients. Consistent with this, self-reported dental anxiety was positively correlated with severity of specific phobia of dental procedures. The rates of elevated anxiety reported here are consistent with the broad range of prevalence estimates abroad (4-30%; Humphris et al., 2009; Humphris & King, 2011; Schwarz & Birn, 1995; Vassend, 1993) and are slightly higher than those estimated across studies conducted in the U.S. (10-20%; Doerr et al., 1998; Locker et al., 1999; Milgrom et al., 1988; Sohn & Ismail, 2005). This is likely a function of our sample's demographic characteristics; we recruited patients from Temple University's dental school which primarily provides treatment for north Philadelphia's urban population,

comprised of minority individuals who report low income levels and have limited access to health care. Although income level was not significantly related to avoidance, the income variable had a restricted range and exhibited a positive skew, with 50% of our sample reporting a household income less than \$20,000. The only demographic variable significantly correlated with dental anxiety was age (ranging from 19 to 74 years), indicating that older patients reported heightened anxiety. The literature has generally shown that anxiety tends to decrease with age, and this discrepancy may also be due in part to the nature of our sample; barriers to accessing or affording dental care throughout the lifespan result in more oral health impairment and the need for more complicated dental treatment procedures which are often painful and perceived as scary. Further, without repeated exposure to positive experiences with dental care, there is little opportunity for extinction of fears, which instead worsen with time.

Avoidance of dental care

With regard to avoidance of dental treatment, two-thirds of the regular care patients who had a scheduled dentist appointment following study participation (the index appointment) attended the appointment, with the remaining third of patients missing it. This is consistent with previous findings which demonstrated that 66-74% of American adults visited a dentist within the past year (U.S. Department of Health and Human Services, 2000; Smith & Heaton, 2003). We expected a higher ratio of patients with elevated dental anxiety to avoid the appointment, more so than those with moderate or low anxiety, but avoidance did not differ by self-reported level of dental anxiety. The primary reasons for missing the appointment included an inconvenient time or inability to

pay (including not having insurance); only one patient of the 21 who provided reasons endorsed anxiety as the primary factor keeping her from attending.

Upon 6-month follow-up of the entire sample, including emergency patients, we found that almost half (42.5%) of patients did not make any new dentist appointments in the follow-up period, regardless of whether additional dental care was recommended by the dental provider. Dental treatment plans were not available to us, so it is possible that for some of these patients further dental work was not indicated, and those who were instructed to return in 6 months for a routine examination may have scheduled their appointment slightly outside of the 6-month follow-up window and were therefore not captured in our analyses of dental avoidance. Of those who scheduled at least one appointment during the follow-up, 21.7% did not attend any and 78.3% attended at least one. Including those who scheduled only one appointment, 42% attended less than half of their scheduled dentist visits. These are relatively high avoidance numbers.

Because the literature has consistently shown dental anxiety to be positively associated with avoidance of dental treatment (Armfield et al., 2007; Hägglin et al., 2000; Muster Halvari et al., 2010) and impairment in oral health-related quality of life (McGrath & Bedi, 2004; Gisler et al., 2012), we were surprised to find in the present study that nonattendance of dental appointments measured retrospectively and prospectively was not correlated with self-reported dental anxiety or with impairment in oral-health related quality of life. This may be explained by the possibility of other factors contributing to nonattendance that we did not systematically measure, such as specific socioeconomic barriers (e.g., not being able to pay or lacking insurance, not being able to take time off of work, not having child care available when needed), other

life instability factors, or the presence of comorbidity and associated factors (e.g., the lack of motivation or lethargy that accompany depression). We also did not find a significant difference in avoidance between patients with and without a specific phobia of dental procedures, nor did group differences emerge between patients grouped by high, moderate, and low self-reported dental anxiety on avoidance in the follow-up period. Although group differences were not statistically significant, the phobia group reported a longer interval without seeing the dentist prior to study participation than the group without phobia, and the low anxiety group had the highest rate of attendance at dental appointments (index and follow-up).

Comparison of emergency and regular care patients

We hypothesized that emergency care patients would report significantly more dental anxiety, have a higher rate of specific phobia, and avoid dental treatment longer than regular care patients. Although emergency ($n = 42$) and regular care ($n = 78$) patients did not differ on self-reported dental anxiety, relative to regular patients, those presenting to the emergency clinic did have a significantly higher prevalence of specific phobia (14% vs. 36%, respectively) and had avoided the dentist for a longer period of time. This pattern among emergency patients of seeking dental care less frequently under emergent circumstances likely perpetuates their phobia.

The lack of significant findings with regard to differences in self-reported dental anxiety, along with the discrepancy found between self-reported anxiety and the interviewed-based diagnosis of specific phobia among 15.8% of our sample may be attributed to the format and scoring of the self-report instrument (i.e., MDAS) used to measure dental anxiety. It is possible that patients reporting low, moderate, or high dental

anxiety on the MDAS are more similar in anxiety severity than the MDAS categorization implies, such that, for example, a low to moderate score can actually characterize someone severely anxious in some specific dental situations. The cutoff for high anxiety is 19; however, if a patient only endorses “extreme anxiety” on one to three of the five situations on the measure, and marks the remaining items as not anxiety evoking, he or she would not meet the cut-off for the classification of “high anxiety.” For example, a patient may rate anticipatory anxiety the day before and the day of the appointment, along with drilling, all as eliciting “extreme anxiety,” but if he or she marks scaling and injection procedures as “not anxious,” the patient would not qualify for classification in the high anxiety group because he or she would achieve a total score of 17, which is below the cut-off. In contrast, the DSM-IV does not require that several dental situations be extremely anxiety provoking to meet criteria for the diagnosis of specific phobia. To better examine group differences, future studies should consider the use of a different self-report measure or a variation of the scoring system for the MDAS upon further psychometric exploration of the scale.

With regard to differences among regular care and emergency patients on a variety of other constructs (see list under Hypothesis 2), the only significant difference between the two groups was related to intensity of pain experienced at the last dental visit, with emergency patients reporting greater pain. This is in line with our hypotheses, as emergency patients tend to avoid preventive care and are therefore primarily exposed to the dentist office in the context of intense pain and complex procedures. Further, emergency patients’ presentation to the emergency dental clinic despite a high rate of specific phobia among this subgroup speaks to the severity of pain.

The lack of significant differences between regular and emergency patients on other psychological constructs (i.e., experiential avoidance, mindfulness, distress tolerance, emotion regulation, social appearance anxiety, pessimism, BII fears, and re-experiencing symptoms) is surprising given that we expected emergency patients to experience greater impairment in a broad set of domains. However, their status as emergency patients may well be related to logistic or social barriers to regular dental care rather than generally greater impairment.

Differences among patients with and without specific phobia

We hypothesized that patients with a diagnosis of specific phobia of dental procedures would have significantly higher dental anxiety scores, longer treatment avoidance, and more impairment in a variety of constructs than those patients without a diagnosis. Patients with a diagnosis of specific phobia ($n = 26$) scored significantly higher than those without a diagnosis ($n = 94$) on the intensity of dental anxiety (MDAS), impairment in OHRQoL, social appearance anxiety, the intensity of pain experienced at the most recent dentist appointment, and the frequency of re-experiencing symptoms over the past month related to a prior negative dental appointment. These results support our hypotheses, as impairment across several constructs contributes to the interference and distress captured by diagnostic criteria. Other measures, many of which were constructs that had not been previously examined in the context of dental phobia (e.g., distress tolerance, mindfulness, experiential avoidance), did not differ significantly between the two groups.

Avoidance of dental appointments both prior to study participation and through six month follow-up did not differ across groups. Although it was expected that patients

with specific phobia would engage in more avoidance, this result may be a function of our sampling procedure: We assessed only dental treatment-seeking patients who initiated services with the dental clinic, thereby excluding those individuals whose dental treatment avoidance was so high that they did not seek care.

Correlates of dental anxiety, phobia severity, oral health-related quality of life, and avoidance

In our exploration of correlates of dental anxiety, severity of specific phobia (CSR), and oral health-related quality of life (OHRQoL), several of our hypotheses were supported. Dental anxiety was positively correlated with social appearance anxiety, pain experienced at the last dental appointment, BII fears, and re-experiencing symptoms related to a prior negative dental procedure, and was negatively correlated with the non-judging facet of mindfulness. These findings are consistent with literature showing a positive relationship between dental anxiety and these variables: dissatisfaction with the appearance of one's mouth (Doerr et al., 1998), pain (Arnzt et al., 1990; de Jongh et al., 1995; Vassend, 1993), BII fears (Vika et al., 2008), and a history of traumatic dental experiences (de Jongh et al., 2006). The CSR was positively correlated with social appearance anxiety, experiential avoidance, pain experienced at the last dental appointment, BII fears, and re-experiencing symptoms related to a prior negative dental procedure, and was negatively correlated with the absorption subscale of the distress tolerance scale and optimism. Impairment in OHRQoL was positively correlated with social appearance anxiety, experiential avoidance, pain experienced at the last dental appointment, re-experiencing symptoms related to a prior negative dental procedure, and

BII fears, and OHRQoL was negatively correlated with optimism, the appraisal subscale of the Distress Tolerance Scale, and the acting with awareness facet of mindfulness.

Dental anxiety, CSR, and OHRQoL were rarely correlated with measures of emotion regulation, distress tolerance, and mindfulness. It is possible that they are indeed unrelated. The extant literature has not examined distress tolerance and mindfulness in the context of dental anxiety so our basis for expecting them to be related was based only on these constructs' established roles in other anxiety disorders. Previously, patients with high dental anxiety reported more intrusive thoughts and engaged in more thought suppression than low anxiety patients (Muris et al., 1998), so we expected that this finding may extend to emotional suppression, but our results did not support this hypothesis. The lack of correlations may also be due in part to possible difficulty patients had understanding or interpreting the questionnaires as intended. Although the ERQ, DTS, and FFMQ-SF are psychometrically sound in several samples, they have not been validated in this specific population. In our sample, 40.9% of patients did not achieve more than a high school or equivalent education. It is likely that individuals in this sample interpreted the questions from varying perspectives, for example, through the lens of their religious or spiritual beliefs, as these patients are more likely to have access to clergy than mental health professionals as function of socioeconomic status and access to health care. Another example of imprecise interpretation can be exemplified with reference to the describing subscale of the FFMQ-SF (example item: "I'm good at finding words to describe my feelings"); patients may understand the questions as referring to describing their experiences to others rather than to themselves (Bruce, Matt, Jensen, Morrison, & Heimberg, 2012). Anxiety impedes one's ability to mindfully and

nonjudgmentally describe one's experiences to oneself, but it may also result in the perceived ability to describe experiences to oneself very vividly in a way that is actually maladaptive and inconsistent with the FFMQ-SF items. Future research should examine the psychometric properties of the measures used to assess these constructs in this population or one with comparable demographic characteristics.

The five FFMQ-SF subscales acted differently within the same families of comparison (i.e., only the non-judging subscale correlated with dental anxiety, only the acting with awareness subscale correlated with OHRQoL, only the acting with awareness subscale moderated the anxiety-avoidance relationship, only the observing subscale moderated the anxiety-OHRQoL relationship). This may be due to the fact that they are related but separate facets of the broader mindfulness construct. Another possibility for the subscales' differing relationships or lack of relationships with dental anxiety, avoidance, and OHRQoL may be that the few subscales emerging as significant correlates or moderators behaved this way due to chance. The low internal consistency of the brief observing subscale (4 items; $\alpha = .60$) may have also played a role, as well.

With regard to avoidance of dental care prior to study participation and in the follow-up period, no significant associations were found with the proposed constructs. This is consistent with the lack of correlations between avoidance and dental anxiety or with OHRQoL. For reasons similar to those described above, that avoidance may be better explained by other unexamined factors. It is also possible that this measure of avoidance was not precise as it relied entirely on retrospective self-report and may have therefore been affected by memory bias (i.e., difficulty remembering how much time passed since the patient's last dental visit).

Moderation of the relationship between dental anxiety and avoidance

We hypothesized that difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance would interact with dental anxiety to increase avoidance. Among regular care patients, controlling for age, our results demonstrated that dental anxiety was most strongly associated with avoidance of the index dental appointment among those reporting the greatest experiential avoidance and the least mindful awareness. Avoiding one's internal experiences and avoiding being present and aware in the present moment are factors that contribute to the maintenance of anxiety because they impede emotional processing. In this sample, the more such avoidance in which anxious patients engage, the likelier they are to miss the feared dental appointment. These moderation models were the only two of the large set of regression models that demonstrated significant interactions; emotion regulation and distress tolerance did not interact with dental anxiety to predict avoidance. It is possible that the significant results we did find were due to chance based on the number of analyses conducted and that the lack of significant findings across the other analyses in this set may be a result of lack of power. A *post hoc* power analysis with these interaction effects revealed that our sample size achieves a negligible statistical power and to obtain a power at the .80 level a much larger number of participants would be necessary.

Moderation of the relationship between dental anxiety and oral health-related quality of life

It was expected that difficulties with emotion regulation, distress tolerance, and mindfulness, and heightened experiential avoidance would interact with dental anxiety to reduce oral health-related quality of life. Among the full sample, we found that dental

anxiety was most strongly associated with OHRQoL among those demonstrating the greatest mindful observing. This unexpected finding may be explained by a misinterpretation of the observing subscale of the FFMQ-SF. The observe scale is intended to measure mindful and nonjudgmental observation of one's experiences (example item: "I watch my feelings without getting carried away by them"), but it may be misconstrued, similar to how the describe subscale has been misinterpreted (discussed above). Individuals with anxiety may indeed observe their experiences closely, but in a maladaptive manner consistent with cognitive biases.

The remaining proposed moderators (emotion regulation, distress tolerance, and experiential avoidance) did not interact with dental anxiety to predict OHRQoL. As these are exploratory analyses of moderators that have not been examined in the literature prior to the present study, it will be worthwhile to further study their potential roles in the anxiety-OHRQoL cycle, possibly with the use of measures more appropriate for the population or via interview.

Moderation of the relationship between social appearance anxiety and avoidance

We expected that pessimism, significant re-experiencing symptoms, and the intensity of dental-related pain would interact with social appearance anxiety to affect avoidance of dental care. Among those who scheduled follow-up dental appointments, we found that optimism moderated the relationship between social appearance anxiety and avoidance of the dental appointments, with a trend suggesting that at low optimism, high social appearance anxiety is associated with attending more appointments, whereas at high optimism, high social appearance anxiety is associated with avoiding more appointments. It may be that high optimism reduces patients' fears that their social

appearance concerns would interfere in their lives, thereby reducing the urgency to receive dental care to correct oral hygiene issues. This moderation model was the only one of the large set of regression models that demonstrated a significant interaction.

Pain intensity at last dentist appointment and re-experiencing symptoms did not interact with social appearance anxiety to predict avoidance. As discussed above with regard to the anxiety-avoidance model, it is possible that the few significant findings and the lack of significant simple slopes in the model demonstrating significant interaction were due to chance or a lack of power. A *post hoc* power analysis with this interaction effect revealed that a sample size of approximately 107 would be necessary to obtain statistical power at the .80 level. Another potential reason for limited findings here may be related to the SAAS measure, as it assesses general social appearance concerns not related specifically to the mouth. The use of an oral-specific social appearance anxiety measure may produce a different pattern of results.

Pain failed to moderate the social appearance anxiety and avoidance relationship despite the expectation that elevated pain would increase the likelihood that a patient with high social appearance anxiety would seek dental care, as the pain may override fears about the way their mouth appears to a dental provider. Pain was measured using a one-item scale; this increases the likelihood that it is an unreliable measure and may explain its lack of interaction with social appearance anxiety.

Further, despite the hypothesis that heightened re-experiencing symptoms would interact with elevated social appearance anxiety to drive more avoidance due to patients' fear of activating memories or flashbacks of the prior dental event, this result did not turn out. A possible explanation is that the majority of participants denied experiencing a

negative dental event horrifying enough to produce significant re-experiencing symptoms.

Limitations

Although the present study has several strengths, including its recruitment of a patient sample from an understudied population, prospective design, and multimethod measurement, it also has several limitations, one of which is its recruitment strategy. Only dental treatment-seeking patients who initiated contact with the TUKSoD dental clinics were recruited into the study, thereby excluding individuals whose anxiety and treatment avoidance may be present at higher levels, thus preventing them from accessing dental care. This strategy facilitated the collection of dental treatment avoidance data, which were obtained by tracking dental patients' attendance to scheduled dentist appointments, without confounding this variable. This limitation may have affected study results by reducing the actual range of anxiety and avoidance levels present in this population, thereby affecting the generalization of study findings. Additionally, questionnaires were administered by telephone to regular care patients who lacked internet access; although questions were posed as written and without elaboration, this portion of data collection was less standardized than for those patients completing the measures online. Further, emergency care patients were administered the diagnostic interview in a public waiting area where privacy was limited despite best efforts to use less populated areas of the room, which may have introducing such confounding factors as limited levels of disclosure or the minimizing of symptoms.

Further, follow-up data measuring dental treatment avoidance were obtained six months following study completion. This time period was chosen due the common

recommendation that dental check-ups occur every six months, although this recommendation may vary based on a patient's oral health and presence of various dental risk factors. In the present sample, 51 patients did not schedule any additional appointments in the follow-up period, reducing the sample size in analyses examining avoidance of scheduled dentist appointments falling within that time period. It is possible that due to scheduling constraints some of these patients presented for future appointments slightly after the six month period had elapsed, if another appointment was recommended by the dentist, and the study therefore failed to capture these patients. Further, it is possible that some patients were not instructed by the dentist to return in as early as six months, based on the state of a patient's oral health and absence of risk factors. Future research may therefore consider expanding the follow-up period to 12 to 18 months so as to capture those patients who presented slightly after the 6 month period or were not advised by the dentist to return in as soon as six months. We also did not have access to the reasons why patients did not attend follow-up dental appointments and cannot assume that avoidance was due primarily or even at all to anxiety. Another limitation to the collection of avoidance data, both immediately following study participation (i.e., at the index appointment) and through the 6-month follow-up, is the human error inherent in the manual entry of patient's appointment records into the electronic scheduling program. Patient reports of retrospective avoidance (i.e., time elapsed since last dental appointment, prior to study participation) may also be flawed by memory bias.

Another significant limitation is the lack of power that compromised the moderation models. *Post hoc* power analyses showed that to obtain a statistical power at

the .80 level we would have needed a substantially larger sample size for a number of the proposed logistic regression models. Several models were run, only four of which revealed significant interactions. This may imply that the significant results we did find were due to chance. As this study was the first to examine the roles of social appearance anxiety, experiential avoidance, distress tolerance, mindfulness, and emotion regulation in the cycles of dental anxiety and avoidance, and dental anxiety and impairment in OHRQoL, it will be important to further investigate this in a properly powered study, using measures appropriate for the target population.

Another limitation is related to the low internal consistency of the observing subscale of the FFMQ-SF and the suppression subscale of the ERQ found in this sample (.60). This may explain why they did not perform as expected in analyses. These are brief scales, comprised of 4 items each, which may explain the low alphas.

Additionally, the OHIP is a measure of lifetime ORHQoL impairment. Altering the instructions to specify a more recent or specific time period may result in a higher likelihood of results consistent with hypotheses across the various analyses.

Conclusion and Future Directions

The current study makes an important contribution to the body of research in the area of dental anxiety. To date, few studies have examined factors affecting the relationships between dental anxiety and dental treatment avoidance or dental anxiety and oral health-related quality of life. Similarly, social appearance anxiety is a construct that is relevant yet understudied in the dental anxiety literature. Given the relatively high prevalence of dental anxiety and associated avoidance of dental care, it is important to identify what influences this cycle and the extent to which anxious patients experience

diminished OHRQoL. The current study makes further contributions to the body of research by including regular care and emergency dental patients, using a prospective design, and incorporating a multimethod assessment approach that included a clinical interview to examine specific phobia of dental procedures. This study also expands upon the exploration of constructs associated with dental anxiety and OHRQoL.

The present study also opens several doors for further inquiry into dental anxiety and avoidance. First, future research may circumvent the limitation noted above regarding sampling patients with a restricted range of anxiety and avoidance by recruiting from community members who have not already scheduled dentist appointments. This would result in enhanced ecological validity and likely lead to more fruitful outcomes in the examination of correlates of avoidance and group differences in avoidance between individuals with and without specific phobia of dental treatment.

Additionally, further studies may seek access to patients' dental charts in order to investigate whether avoidance is related to particular dental procedures. This may be especially relevant for dental treatments involving injections, as examination of avoidance of these specific treatment procedures may further elucidate the connection between blood-injection-injury phobia and the broader dental phobia.

Another potential for further inquiry involves a more precise examination of patients' prior traumatic or otherwise distressing dental treatment experiences and the associated re-experiencing symptoms. The current study utilized the re-experiencing subscale of the PCL-S to probe for such an event and the severity of re-experiencing symptoms. This measure was positively skewed, as most patients denied a history of events horrific enough to produce significant re-experiencing symptoms. Conducting a qualitative

analysis of the reported events to see how they relate to anxiety and avoidance, and/or dichotomizing events that were or were not accompanied by re-experiencing symptoms rather than using a sum score of re-experiencing severity, may provide a clearer look at how such events and related symptoms are related to dental treatment avoidance.

Also, psychometric re-evaluation or the examination of alternate scoring methods for the MDAS may provide a more nuanced assessment of self-reported dental anxiety. Given the inconsistency between self-reported and interview-based accounts of patients' dental anxiety severity detailed in this study, a more accurate reflection of the severity of one's dental anxiety may be produced by counting the number of items endorsed as "very" or "extremely" anxiety evoking rather than using a sum to indicate "high" anxiety.

We found that emergency and regular care patients did not differ on self-reported dental anxiety, although emergency patients did have a higher rate of specific phobia, longer dental treatment avoidance, and more pain than regular care patients. Future research may further investigate factors that differentiate regular care and emergency patients within the high anxiety group by examining moderators of the relationship between dental anxiety and the presenting status of a patient as regular or emergency care.

With regard to relevant moderation models that were beyond the scope of the current study, future research can expand on the analyses conducted here by examining emotion dysregulation, distress tolerance, experiential avoidance, and mindfulness as moderators of the relationship between social appearance anxiety and dental treatment avoidance. Furthermore, pain, optimism, and re-experiencing symptoms may be investigated as moderating the relationships between dental anxiety and avoidance, and dental anxiety and oral health-related quality of life. This line of inquiry may be further

broadened by looking at dental anxiety as a moderator itself, perhaps affecting the strength or direction of the relationship between factors that are proposed in the current study as moderators but may very well function as independent variables (e.g., pain, optimism, mindfulness) and dental treatment avoidance. These suggestions for future study emphasize the importance of elucidating what maintains dental anxiety, how it interacts with other constructs to bring about maladaptive behaviors, and how dental anxiety interventions may be enhanced.

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APPENDIX

DEMOGRAPHIC AND BACKGROUND INFORMATION SELF-REPORT

MEASURE

Demographic and Background Information**Age** _____**Sex** Male
 Female
 Transgender**Natural Hair Color** Blonde OR Brunette (brown/black)
 Red/orange**Race** White or Caucasian or European American
 Black or African American
 American Indian or Alaska Native
 Asian
 Native Hawaiian or Other Pacific Islander
 Other _____**Ethnicity** Hispanic/Latino
 Non-Hispanic/Latino**Primary Language** English
 Spanish
 Other _____**Religion** Christian
 Jewish
 Muslim
 Other**Sexual Orientation** Exclusively heterosexual
 Heterosexual with some homosexual experience
 Bisexual
 Homosexual with some heterosexual experience
 Exclusively homosexual
 Other

Current marital status (select ONE)

- Married
- In a relationship (not married)
- Single (never married)
- Widowed
- Divorced
- Separated

Living Situation

- Alone
- With other(s)

Employment status

- Working full time (35+ hours per week)
- Working part time (less than 35 hours per week)
- Armed Forces
- Homemaker
- Retired
- Unemployed (due to _____)

Student status

- In school full time
- In school part time
- Not in school

Annual household income

- Less than \$9,999
- \$10,000 – 19,999
- \$20,000 – 29,999
- \$30,000 – 39,999
- \$40,000 – 49,999
- \$50,000 – 59,999
- \$60,000 – 69,999
- \$70,000 – 79,999
- \$80,000 – 89,999
- \$90,000 – 99,999
- More than \$100,000

Level of education (check highest level completed)

- No formal schooling
- Completed grade K, 1 or 2
- Completed grade 3 or 4
- Completed grade 5 or 6
- Completed grade 7
- Completed grade 8
- Some high school (grades 9-11)
- Completed high school
- Graduate equivalency degree (GED)
- Some college (no degree)
- Completed associate or other technical 2-year degree
- Completed college (Bachelor's degree)
- Some graduate/professional study (completed Bachelor's but not graduate degree)
- Completed graduate or professional degree (Master's degree or higher)

Are you currently in psychotherapy? ___ YES ___ NO

In treatment for _____

Nature of therapy _____

Start date _____

Frequency _____

Provider
 ___ Psychologist ___ Psychiatrist
 ___ Social Worker ___ Other _____

Medication currently prescribed for psychological disorder(s), such as anxiety or depression

- 1)** Medication Name _____
 Dosage (mg) _____
 Start date _____
 Frequency _____
 Prescribed for _____
 Prescribed by ___ Psychiatrist ___ Family Doctor
- 2)** Medication Name _____
 Dosage (mg) _____
 Start date _____
 Frequency _____
 Prescribed for _____
 Prescribed by ___ Psychiatrist ___ Family Doctor
- 3)** Medication Name _____
 Dosage (mg) _____
 Start date _____
 Frequency _____
 Prescribed for _____
 Prescribed by ___ Psychiatrist ___ Family Doctor

Currently taking any prescription medication that is not prescribed for you? __ YES __ NO

If you answered YES:

Medication Names _____
 Dosages (mg) _____
 Start dates _____
 Last used _____

Currently taking any street or recreational drugs? __ YES __ NO

If you answered YES:

1. Drug _____
 Amount _____
 Last used _____

2. Drug _____
 Amount _____
 Last used _____

Dental Treatment History

1. Have you had major or painful dental work done in the past 2 weeks? __ YES __ NO

If you answered YES, briefly describe the procedure:

2. How long has it been since the last (most recent) dentist appointment that you attended?
(For example, "10 days" or "7 months" or "3 years," etc.) Please do NOT include any
appointments that you cancelled or did not come in for. Only include the most recent
appointment that you kept. _____

3. How much time passed between the appointment you indicated in the previous question
and the dentist appointment before *that one*? (For example, "10 days" or "7 months" or "3
 years," etc.) *Please do NOT include any appointments that you cancelled or did not come in*
for. Only include the second most recent appointment that you kept.

4. Have you avoided dentist appointments or gone a long time without going to the dentist
because you were anxious, nervous, or scared of the dentist or dental procedures?

__ YES __ NO

5. If you answered YES to the previous question, would you have gone to the dentist more
often if you did not feel anxious, nervous, or scared of the dentist or dental procedures?

__ YES __ NO