Research article

Exploring dental anxiety as a mediator in the relationship between mindfulness or self-compassion and dental neglect

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ABSTRACT

Dental anxiety and dental neglect are interconnected constructs with profound consequences for oral health and corresponding challenges for dental professionals. Meanwhile, other literature has indicated that mindfulness and self-compassion relate negatively to different forms of anxiety, and propose elements of potential interventions. This study aimed to explore the potential impact of dental anxiety as a mediator on the relationships between mindfulness or self-compassion and dental neglect. The results showed significant negative associations between mindfulness and self-compassion with dental anxiety and dental neglect. Mediation analyses supported the hypothesis that dental anxiety mediates the positive associations between mindfulness or self-compassion and dental neglect, providing preliminary evidence for the potential effectiveness of mindfulness and self-compassion interventions in addressing dental anxiety and dental neglect. Future research and potential clinical implications are discussed.

1. Introduction

Dental anxiety and dental neglect are prevalent issues and interconnected phenomena that have significant implications for oral health [1–3]. Dental anxiety refers to the fear and apprehension individuals experience in dental settings, while dental neglect refers to the persistent failure to seek dental care [4]. Research indicates that individuals with dental anxiety are more likely to neglect dental care [5,6], with dental anxiety and neglect coming together to form a vicious cycle that is hard to overcome for patients, researchers, and clinicians. In this short communication, we aimed to identify preliminary cross-sectional findings on the potential effectiveness of future mindfulness-based interventions on both dental neglect and dental anxiety.

Dental anxiety is a common occurrence, with approximately up to 20 % of adults and 40 % of children experiencing dental anxiety or fear [7]. Dental anxiety is not limited to specific demographic groups but is prevalent across various age groups, cultures, and socioeconomic backgrounds [5,8], with statistics on mild and severe anxiety offering a more distressing clinical picture [9,10]. One primary factor that further intensifies dental anxiety is former negative dental experiences, such as painful treatments, as well as fear of needles, the dental environment, and the sound and vibration of dental instruments [11]. Psychological factors, such as general anxiety and a tendency towards negative thinking, have also been linked to dental anxiety [11–13]. Dental anxiety has significant consequences for both the individual and the dental healthcare professionals [14]. Patients with dental anxiety pose challenges for dental

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professionals, as treating anxious patients can be time-consuming and challenging, as they tend to delay or avoid dental treatment, leading to a decline in oral health and an increased need for invasive and costly procedures [1,15,16]. Therefore, addressing dental anxiety is crucial not only for improving patient comfort, but also for enhancing the overall efficiency and effectiveness of dental care.

Separately from anxiety, and despite observed association to dental neglect can result in the progression of existing oral health problems, increased pain and discomfort, and compromised oral function [15,17]. Past reviews and population studies found that participants showed significant dental neglect across populations [18–20], while other literature showed a higher prevalence in specific populations, such as children, and individuals with low income and limited access to dental care [12,18,21–23]. Still, a lack of oral health literacy, negative dental experiences, and cultural beliefs toward oral health suggest the significance of the association between anxiety and neglect [21]. Several factors contribute to dental neglect, and Locker et al. [24] listed dental anxiety as a leading avoidance behavior and a common barrier to seeking dental care. Consequently, efforts to reduce dental neglect must also address the underlying dental anxiety, as both issues are deeply interconnected and mutually reinforcing.

The cyclical relationship between dental anxiety and dental neglect has profound consequences for oral health and has been studied over the past two decades. Quteish Taani [3] reported that approximately one-fifth of adults exhibited dental anxiety, and dental anxiety was associated with higher levels of dental neglect (see also 6). Individuals with dental anxiety are more likely to delay or avoid dental treatments, leading to a higher risk of dental caries, periodontal disease, and tooth loss [6,25,26]. Other literature identified that previous negative dental experiences, perceived lack of control, and anticipation of pain are factors that contribute to dental anxiety and subsequent dental neglect [3,11,27]. The psychosocial implications of dental anxiety and neglect can include reduced psychosocial well-being, including impaired self-esteem, social withdrawal, and reduced quality of life [12,18,21]. Significantly, the lack of preventive care and early intervention exacerbates oral health problems, resulting in increased pain, discomfort, and functional limitations [17], reinforcing avoidance and neglect. Therefore, this cyclical relationship underscores the need for comprehensive strategies to break the cycle of anxiety and neglect.

Researchers suggest education programs and community interventions to enhance oral health knowledge and access to dental care [17,27,28]. Improving communication skills among oral health professionals can alleviate dental anxiety and neglect [29,30], and a multidisciplinary approach, including interventions for anxiety symptoms, has been proposed [24,31]. Cognitive-behavioural therapy (CBT) is effective in reducing dental anxiety and increasing dental attendance [29,32]. CBT focuses on altering negative thoughts, teaching relaxation techniques, and gradual exposure to dental settings [33]; however, traditional treatments like CBT may not be cost-effective or scalable to meet the needs of those avoiding dental care [29]. Therefore, exploring alternative approaches is crucial in providing psychological support for common dental difficulties.

With an aim to identify alternative approaches, recent interest and literature in mindfulness-based interventions (MBIs) as anxiety treatments have been showing promise, offering cost-effective and single-session solutions [34–37]. MBIs appeal to those averse to traditional treatments due to their non-stigmatizing nature [38], with practices that cultivate present-moment awareness and non-judgmental observation [39,40], and an enhancement of psychological flexibility and coping skills crucial for anxiety management [41]. They also reduce maladaptive processes like rumination and worry [42]. Moreover, mindfulness modulates emotional reactivity, enhancing emotion regulation and reducing anxiety responses [41,42]. Studies supported MBIs' efficacy across various anxiety disorders [43,44], and meta-analyses show moderate to large effects in reducing anxiety symptoms [45,46]. Acceptance and mindfulness-based interventions improve anxiety and depression outcomes through various mediators, including mindfulness skills and self-compassion [47]. These findings highlight the potential of MBIs to address dental anxiety, and thereby reduce dental neglect.

Interest has also been growing in self-compassion as a stand-alone MBI and anxiety treatment, enhancing psychological well-being and resilience [48]. Self-compassion interventions significantly reduce anxiety and depression symptoms [49–53], proposing an additional method to lead to health and wellbeing. Trials utilizing self-compassion have demonstrated reductions in anxiety symptoms and improved well-being [54–57]. While traditionally practiced through meditation, MBIs include non-meditative approaches [58, 59], creating some flexibility and adaptability to individual differences. Breathing interventions, like diaphragmatic breathing, show promise in reducing dental anxiety [60], although follow-up research is lacking, and importantly neglecting key aspects of mindfulness-based interventions. Continued research in these areas is essential to develop robust, scalable interventions that can effectively reduce both dental anxiety and neglect, and mindfulness and self-compassion may offer collectively or in isolation methods of treatment and care.

While mindfulness and self-compassion propose associations to, and are predictive of, several types of anxiety, and other research proposes a strong association between dental anxiety and dental neglect, mindfulness and self-compassion relating to and predicting dental neglect is a probable research hypothesis. If and once such potential associations were identified, the present research hypothesized that dental anxiety would be an explanatory factor of the association between mindfulness or self-compassion and dental neglect, to supply preliminary results that could support intervention development. Therefore, the aim of the present research was twofold. First, it investigated the associations between dental anxiety and dental neglect, and potential associations with mindfulness and self-compassion. Second, it explored whether mindfulness and self-compassion predicted dental neglect, potentially through influencing dental anxiety.

2. Method

2.1. Participants

Four-hundred and seven undergraduate students were recruited through a university participant pool, of which 369 were female and 30 were male (eight participants did not provide information about their sex). Participants' ages ranged from 18 to 56 years (M =

21.66, SD = 4.92). Two-hundred and ten participants stated their ethnicity as White, 82 as South Asian, 51 as Mixed, 47 as Black, four as Arab, two as Chinese and 11 did not provide information about their ethnicity. The inclusion criteria specified that participants should not have been diagnosed with any disorder within the past 12 months and should not have lost all of their teeth (which was not the case for any participants). According to Fritz and MacKinnon [61], a sample size of 368 participants would enable observations of an indirect effect of a small-sized alpha pathway coefficient (i.e., predictor to mediator) and a small-to-medium-sized beta pathway coefficient (i.e., mediator to criterion) at 80 % power using bias-corrected bootstrapping estimating procedures.

3. Materials

3.1. The Modified Dental Anxiety Scale (MDAS; Humphris et al., [62])

The MDAS includes 5 items that measure levels of dental anxiety (e.g., 'If you went to your Dentist for TREATMENT TOMORROW, how would you feel?'). Responses are provided through a five-point Likert scale ranging from 1 ('Not Anxious') to 5 ('Extremely Anxious'). Final summed scores range from 5 to 30, with a score of 23 or above indicating a highly dentally anxious patient or dentally phobic. Humphris et al. reported good reliability for MDAS (e.g., Cronbach's alpha, $\alpha = .72$ for dental phobic patients and $\alpha = .90$ for a community sample), with the MDAS in the present study similarly showing good reliability (Cronbach's $\alpha = .90$; McDonald's omega, $\omega = .90$).

3.2. The Dental Neglect Scale (DNS; Thompson and Locker, [63])

The DNS measures levels of dental neglect through 6 items (e.g., 'I need dental care, but I put it off'). Response items range from 1 ('Strongly Agree') to 5 ('Strongly Disagree'), with final summed scores indicating higher dental neglect. Thompson and Locker reported good reliability for the DNS (Cronbach's α of .71), which was replicated in the present study (Cronbach's $\alpha = .71$; McDonald's $\omega = .71$).

3.3. The Self-Compassion Scale (SCS; Neff, [48])

The 26-item SCS measures levels of self-compassion comprising the facets of Self-Kindness (e.g., 'I'm kind to myself when I'm experiencing suffering.'), Self-Judgment (e.g., 'I'm disapproving and judgmental about my own flaws and inadequacies.'), Common Humanity (e.g., 'I try to see my failings as part of the human condition.'), Isolation (e.g., 'When I fail at something that's important to me, I tend to feel alone in my failure.'), Mindfulness (e.g., 'When something upsets me I try to keep my emotions in balance.') and Over-Identification (e.g., 'When something painful happens I tend to blow the incident out of proportion.'). Responses range from 1 ('Almost Never') to 5 ('Almost Always') and mean final scores (after reverse scoring) indicate higher self-compassion levels. Neff (2003) reported good internal reliability for the SCS (Cronbach's $\alpha = .92$). In the present study, the SCS similarly showed good internal reliability (Cronbach's $\alpha = .93$; McDonald's $\omega = .94$).

3.4. The Five Facet Mindfulness Questionnaire – Short Form (FFMQ-SF; Bohlmeijer et al., [64])

The 24-item FFMQ-SF, which corresponds to the original 39-item FFMQ [65], measures the five facets of mindfulness: observe (e.g., 'I notice the smells and aromas of things'), describe (e.g., 'I'm good at finding words to describe my feelings'), acting with awareness (e.g., 'I am easily distracted'), non-judge (e.g., 'I disapprove of myself when I have irrational ideas') and non-react (e.g., 'I watch my feelings without getting lost in them'). Responses are provided through a Likert scale ranging from 1 ('never or rarely true') to 5 ('very often or always true'), with higher scores indicating higher levels of mindfulness. Bohlmeijer et al. reported good subscale reliability (Cronbach's alphas ranging from $\alpha = .73$ to $\alpha = .91$). The present study showed good internal reliability with Cronbach's α and McDonald's ω for total FFMQ-SF to be .83 and .81 respectively.

3.4.1. Procedure

Participants responded to a research advertisement placed exclusively on a university recruitment system in the West Midlands of the United Kingdom between 2022 and 2023. No other recruitment methods were employed. Participants read the participant information statement and continued with granting their consent for participation in the study. Then, participants filled in demographic information (i.e., age, sex and ethnicity) and completed the four self-report measures (i.e., MDAS, DNS, SCS, and FFMQ-SF). Participants were debriefed upon completion of the study. Ethical approval information is detailed in the declarations section.

3.4.2. Analysis

This study used Pearson's bivariate correlation to explore the relationships between variables. Next, mediation analyses were run to assess the impact of dental anxiety as a mediator on the relationships between mindfulness or self-compassion and dental neglect. Mediation analyses (Model 4) were carried out using the PROCESS macro [66] in SPSS version 28, with 5000 bootstrapped samples and bias-corrected 95 % confidence intervals.

4. Results

4.1. Bivariate correlations

Pearson's correlations confirmed the presence of previously reported associations, such as the positive correlation between dental anxiety and dental neglect and the positive correlation between mindfulness and self-compassion. The findings suggest that both mindfulness and self-compassion are negatively related to both dental anxiety and dental neglect (see Table 1).

4.2. Mediation analyses

Table 2 displays the mediation analysis results for the potential mediating role of dental anxiety in the relationship between mindfulness and dental neglect. The indirect effect was supported (95 % $CI = -.046$ to $-.008$), confirming the hypothesis of dental anxiety mediating the positive association between mindfulness and dental neglect.

An additional mediation analysis explored the potential mediating role of dental anxiety in the relationship between self-compassion and dental neglect. The indirect effect was supported (95 % $CI = .006$ to $.037$), advocating the hypothesis of dental anxiety mediating the positive relationship between self-compassion and dental neglect (see Table 3, Figs. 1 and 2).

5. Discussion

The present research aimed to investigate the relationships between dental anxiety, dental neglect, mindfulness, and self-compassion. Specifically, the research focused on two main objectives. First, to analyse the correlations between dental anxiety, dental neglect, mindfulness, and self-compassion. Second, to explore whether mindfulness and self-compassion influence dental anxiety and, consequently, predict dental neglect. Understanding these relationships could provide valuable insights for developing effective interventions to improve oral health outcomes, and potentially explain the mechanisms behind mindfulness and self-compassion.

The findings reported in the study from correlations extend previous research by confirming the presence of established associations within the context of dental anxiety, dental neglect, mindfulness and self-compassion. Specifically, the positive correlation observed between dental anxiety and dental neglect supports prior research findings (e.g., 1; 3; 6). Similarly, the study replicated a positive correlation between mindfulness and self-compassion, corroborating previous research (e.g., [49–51,67]). Of particular interest, the negative association of mindfulness and self-compassion to both dental anxiety and neglect proposed original findings, and potential for further examinations. Further assessment could explore the expectancy of mindfulness-based constructs and the well-known relationship to anxiety and anxiety-related disorders (e.g., 34; 26; 52; 55) to suggest a relative explanation for predicting dental neglect.

In particular, the investigation inquired into the potential mediating role of dental anxiety in the relationship between mindfulness or self-compassion and dental neglect. The results of the mediation analyses for mindfulness and self-compassion in predicting dental neglect were explained at least in part through the association with dental anxiety. Present findings replicate other similar research that has been conducted where the predictive value of self-compassion and mindfulness were mediated by anxiety (e.g., [68,69]). While currently the knowledge is restricted to individual differences and trait constructs of mindfulness and self-compassion, the potential for future development of interventions proposes significant clinical implications.

Both mindfulness and self-compassion exhibit negative associations with dental anxiety and dental neglect, separately and in association. These results indicate that fostering mindfulness and self-compassion may hold promise in promoting favorable oral health behaviors by mitigating dental anxiety. Future investigations may benefit from exploring targeted interventions aimed at cultivating mindfulness and/or self-compassion as a means of alleviating dental anxiety and observing overall outcomes of oral health, as well as secondary outcomes such as the promotion of regular dental visits. Such future research will certainly address the common limitations found in cross-sectional studies and in research limited to university students, as in the present research, thereby enhancing its generalizability to the broader population. Present findings may also differ across older adult populations, and people who have suffered from psychological and/or dental difficulties, where clinical trials may be more decisive on the potential impact of mindfulness and/or self-compassion. Present findings are of clinical importance in that dental anxiety is a prevalent issue with substantial implications for both individuals and dental healthcare professionals. Future research should also focus on developing innovative,

Table 1
Correlation results and corresponding descriptive statistics for the measured variables.

	FFMQ-SF	SCS	DAS	MDNS	*M*	*SD*
FFMQ-SF	–				72.70	11.00
SCS	.679**	–			77.90	21.55
DAS	−.265**	−.173**	–		14.56	5.50
MDNS	−.293**	−.199**	.255**	–	14.26	3.76

Note. FFMQ-SF = Five Facet Mindfulness Questionnaire – Short Form; SCS = Self-Compassion Scale; MDAS = Modified Dental Anxiety Scale; DNS = Dental Neglect Scale; *M* = Mean; *SD* = Standard Deviation.
**. $p < .001$.

Table 2

Mediation results of dental anxiety on the effect of mindfulness on dental neglect.

	Effect	SE	95%CI	
			Lower	Upper
Total effect	−.103	.024	−.150	−.057
Direct effect	−.079	.024	−.123	−.033
Indirect effect	−.024	.009	−.046	−.008

Note. SE = Standard Error; 95%*CI* = 95 % Confidence Interval.

Table 3

Mediation results of dental anxiety on the effect of self-compassion on dental neglect.

	Effect	SE	95%CI	
			Lower	Upper
Total effect	−.035	.009	−.052	−.018
Direct effect	−.028	.009	−.045	−.011
Indirect effect	−.007	.003	−.014	−.003

Note. SE = Standard Error; 95%*CI* = 95 % Confidence Interval.
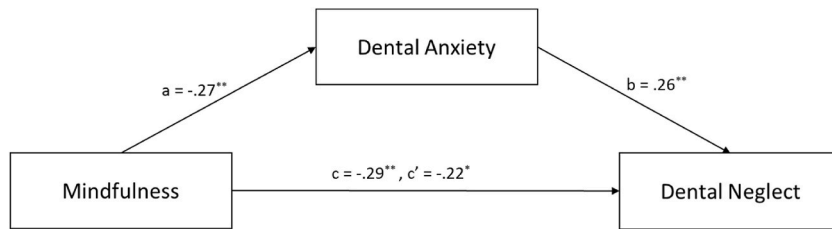
Note: ** = *p* < .0001, * = *p* < .001

Fig. 1. Parallel mediation using standardized regression coefficients to examine the interaction of mindfulness and dental neglect through dental anxiety. *Note*: ** = *p* < .0001, * = *p* < .001.
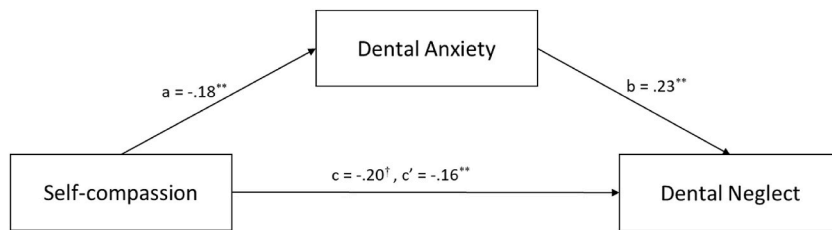
Note: ** = *p* < .0001, † = *p* = .0015

Fig. 2. Parallel mediation using standardized regression coefficients to examine the interaction of self-compassion and dental neglect through dental anxiety. *Note*: ** = *p* < .0001, † = *p* = .0015.

individualized, and patient-centered approaches that are possible and easily implemented through mindfulness-based practices.

In conclusion, findings reinforce established connections between dental anxiety and dental neglect, as well as mindfulness and self-compassion, aligning with prior research. Notable original contributions are negative associations linking mindfulness/self-compassion to dental anxiety and neglect. The mediation analyses suggest that dental anxiety may partly explain the relationship between mindfulness/self-compassion and dental neglect. While current knowledge focuses on individual differences and traits, the potential for future interventions to cultivate mindfulness and self-compassion holds promise for improving oral health behaviors by mitigating dental anxiety.

Consent for publication and ethical approval

Consent and ethical approval were obtained. Informed consent was obtained from all individual participants included in the study.

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the corresponding author's University (Reference Number: xx/4998/R(A)/2020/Feb/BLSS FAEC.

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Data availability statement

Data will be available on request from the corresponding author.

CRediT authorship contribution statement

Charalampos Beltes: Writing – review & editing, Writing – original draft, Conceptualization. **Kyriaki Giannou:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Michail Mantzios:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

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