PUBLICATIONS OF
THE UNIVERSITY OF EASTERN FINLAND

UNIVERSITY OF
EASTERN FINLAND

Dissertations in Health Sciences

PIRJO KURKI

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To be presented by permission of the Faculty of Health Sciences,
University of Eastern Finland for public examination in MS301
Auditorium, Kuopio
on March 15th, 2024, at 12 o'clock noon

Publications of the University of Eastern Finland
Dissertations in Health Sciences
No 808

Institute of Dentistry / School of Medicine
University of Eastern Finland, Kuopio
2024

PunaMusta Oy
Joensuu, 2024
Distributor: University of Eastern Finland
Kuopio Campus Library

ISBN: 978-952-61-5123-6 (print)

ISBN: 978-952-61-5124-3 (PDF)
ISSNL: 1798-5706
ISSN: 1798-5706
ISSN: 1798-5714 (PDF)

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Kurki, Pirjo
Cognitive-behavioural approach to dental anxiety : Patients' perspectives, dentists' use of management techniques and effectiveness of one-session treatment.
Kuopio: University of Eastern Finland
Publications of the University of Eastern Finland
Dissertations in Health Sciences 808. 2024, 119 p.
ISBN: 978-952-61-5123-6 (print)
ISSNL: 1798-5706
ISSN: 1798-5706
ISBN: 978-952-61-5124-3 (PDF)
ISSN: 1798-5174 (PDF)

ABSTRACT

This study investigated the management of dental anxiety in primary dental care from three cognitive-behavioural-based treatment perspectives: 1) adult patients' perceptions of their dental fear, 2) the dental anxiety management techniques used by experienced dentists and 3) the impact of diagnostic interviews (DIs) and modified one-session treatment (M-OST) in alleviating dental anxiety within an intervention setting.

Nineteen adult patients with severe or moderate dental anxiety, measured with the Modified Dental Anxiety Scale (MDAS), volunteered for the study. During the intervention, they were assigned to one of two groups: T1 received a DI before conventional treatment, while T2 received a DI in combination with M-OST, acknowledging the patient's fear. Data were gathered using questionnaires, interviews and video-recordings and analysed using both qualitative and quantitative methods. The participants' perceptions of dental fear were analysed using the DIs and the four components of dental fear (emotional, behavioural, cognitional and physiological) as a framework, exploring their previous experiences in relation to dental treatment (Study I). The dental anxiety management

techniques used by the dentists during M-OST were analysed from video-recordings and classified according to Milgrom et al. (Study II). The effectiveness of one-session cognitive-behavioural-based treatment for dental anxiety was analysed using dental anxiety scales (Study III), and statistical analyses included chi-squared, *t*- and Mann–Whitney U-tests, as well as regression analyses. Descriptive content analysis summarized the patients' subjective perspectives on the overall impact of the interventions.

Dental fear reported by the patients in DIs covered diverse emotional, behavioural, cognitive and physiological components before, during and after dental treatment. The dentists used various dental anxiety management techniques in a flexible and personalized manner during treatment situations. These techniques typically focused on building trust and enhancing informational and behavioural control throughout the M-OSTs. Psychological management techniques were also used to promote physical relaxation of the body and cognitive control of the mind, with techniques such as encouragement and distraction primarily used during the most challenging situations for the patients. Both study groups (T1 and T2) experienced a reduction in dental anxiety after the intervention, either with a DI alone or in combination with M-OST. At the 1-year follow-up, 74% of the patients had visited a dentist.

In conclusion, a brief cognitive-behavioural-based treatment for dental anxiety proved effective in creating a trustful and supportive environment for individuals with dental anxiety. The dental anxiety intervention helped the patients to gain a better understanding of their fears and the dentists to implement specific techniques based on individual situations, in addition to significantly reducing the patients' dental anxiety. Therefore, a DI alone or in combination with M-OST can be a useful method for oral health care professionals in providing a positive experience and supporting better dental treatment compliance for anxious individuals in primary dental care.

National Library of Medicine Classification: W 84.6, WU 61
Medical Subject Headings: Adult; Clinical Trial; Dental Anxiety; Cognitive-behavioural treatment; Dentists; Diagnosis; Finland; Interviews as topic;

Patients; Primary Health Care; Surveys and Questionnaires; Treatment Outcome; Therapeutics; Qualitative research

Kurki, Pirjo
Kognitiivis-käyttäytymisperustainen lähestymistapa hammashoitopelkoon : Potilaiden käsitykset pelostaan, hammaslääkäreiden käyttämät pelonhallinnan tekniikat sekä yhden käyntikerran mittaisen hoidon vaikuttavuus.
Kuopio: Itä-Suomen yliopisto
Publications of the University of Eastern Finland
Dissertations in Health Sciences 808. 2024, 119 s.
ISBN: 978-952-61-5123-6 (nid.)
ISSNL: 1798-5706
ISSN: 1798-5706
ISBN: 978-952-61-5124-3 (PDF)
ISSN: 1798-5714 (PDF)

TIIVISTELMÄ

Tutkimuksessa arvioitiin hammashoitopelon hoitoa perusterveydenhuollossa kolmesta kognitiiviskäyttäytymisperustaisen hoidon näkökulmasta: 1) Aikuispotilaiden käsitykset hammashoitopelostaan 2) Hammaslääkärien käyttämät pelonhallinnan tekniikat sekä 3) Diagnostisten haastatteluiden ja muunnellun hoitokäynnin vaikuttavuus hammashoitopelon lieventämiseen interventioasetelmassa.

Yhdeksäntoista vapaaehtoista voimakkaasta tai keskimääräisestä hammashoitopelosta kärsivää potilasta, joiden pelko arvioitiin Modified Dental Anxiety Scale (MDAS) -mittarilla, osallistui tutkimukseen. Intervention aikana, heidät jaettiin kahteen ryhmään: T1 vastaanotti diagnostisen haastattelun ennen tavanomaista hammashoitoa, kun taas T2 vastaanotti diagnostisen haastattelun yhdistettynä pelon huomioivaan hoitokäyntiin. Tietoa kerättiin kyselyillä, haastatteluilla ja videonauhoituksilla, joita analysoitiin sekä laadullisilla että määrällisillä menetelmillä. Diagnostisista haastatteluista tutkittiin potilaiden käsityksiä ja kokemuksia hammashoitopelostaan (Osatyö I). Näitä jäsennettiin

aikaisemmassa tutkimuksessa tunnistetun neljän pelon osatekijän (emotionaaliset, käytökselliset, kognitiiviset ja fysiologiset) näkökulmista. Hammaslääkäreiden käyttämiä pelonhallinnan tekniikoita analysoitiin hoitokäyntien videotallenteista (Osatyö II) ja ne luokiteltiin aikaisempaan tutkimukseen perustuen käyttämällä Milgrom ym. luokittelua. Kognitiivis-käyttäytymisperustaisen hoidon vaikuttavuutta hammashoitopelkoon analysoitiin hammashoitopelkomittareilla (Osatyö III) ja tilastolliset analyysit sisälsivät khiin neliö-, T- ja Mann-Whitney U - testit ja regressioanalyysit. Kuvailevaa sisällönanalyysia käyttäen summattiin potilaiden käsitykset intervention hyödyistä.

Potilaiden raportoima hammashoitopelko diagnostisissa haastatteluissa kattoi monia emootioihin, käyttäytymiseen, kognitioihin ja fysiologisiin reaktioihin liittyviä tekijöitä ennen hammashoitoa, sen aikana tai sen jälkeen. Hammaslääkärit käyttivät erilaisia hammashoitopelon lievittämisen tekniikoita joustavasti ja potilaskohtaisesti hoitotoimenpiteiden aikana. Tekniikoiden käyttö liittyi tyypillisesti luottamuksen rakentamiseen sekä tietoon ja käyttäytymiseen kohdistetun kontrollin vahvistamiseen koko hoitokäynnin ajan. Lisäksi käytettiin psykologisia pelonhallinnan tekniikoita edistämään kehon rentouttamista ja mielen kognitiivista kontrollia. Näitä tekniikoita, kuten potilaan kannustamista ja huomion poissiirtämistä käytettiin pääasiassa potilaille haasteellisimmissa tilanteissa. Intervention jälkeen molempien hoitoryhmien potilaat (T1 ja T2) kokivat hammashoitopelkonsa vähentyneen, joko pelkällä diagnostisella haastattelulla tai yhdistettynä pelon huomioivaan hammashoitokäyntiin. Yhden vuoden seurannassa, 74 % potilaista oli käynyt hammashoidossa.

Johtopäätöksenä todetaan, että hammashoitopelon hallintaan kohdistuva hoito osoittautui tehokkaaksi luotaessa luottamusta ja tukea tarjoava ympäristö hammashoitopelkoisille henkilöille. Interventio auttoi potilaita saamaan paremman ymmärryksen peloistaan, mahdollisti hammaslääkäreiden tilannekohtaisen tekniikoiden käytön ja vähensi merkitsevästi potilaiden hammashoitopelkoa. Näin ollen, diagnostinen haastattelu joko yksin tai yhdistettynä pelon huomioivaan hoitokäyntiin, voi tarjota suun terveydenhuollon ammattilaisille hyödyllisen toimintatavan.

Pelonhallinta edesauttaa hammashoitoa pelkäävää potilasta saamaan positiivisen ja hoitomyöntyvyyttä edistävän kokemuksen perusterveydenhuollossa.

Luokitus: W 84.6, WU 61
Yleinen suomalainen asiasanasto: aikuiset; kliiniset kokeet; kognitiivinen käyttäytymisterapia; pelko; hammaslääkärit; diagnostiikka; Suomi; Haastattelututkimus; potilaat; perusterveydenhuolto; kyselytutkimus; hoitotulokset; hoitomenetelmät; kvalitatiivinen tutkimus

ACKNOWLEDGEMENTS

Tämä väitöskirjatutkimus on toteutettu toimiessani osa-aikaisissa yliopistonopettajan ja väitöskirjatutkijan tehtävissä Itä-Suomen yliopistossa. Kiinnostukseni hammashoitopelkoon heräsi jo opiskellessani hammaslääkäriksi silloisessa Kuopion yliopistossa. Yliopistolla toimi tuolloin hammashoitopelkoklinikka ja Heikki Tuutti väitteli tästä aiheesta. Väitöstilaisuudesta mieleeni jäi psykologian alan tärkeys aiheen ymmärtämisessä. Valmistumiseni jälkeen työskentelin ensin hammaslääkärinä lähes kahdenkymmenen vuoden ajan, jonka jälkeen alkoi uusi uravaihe. Aloin opiskelemaan psykologiaa avoimessa yliopistossa, tietämättä vielä, mihin suuntaan polku lähtee viemään. Olisin ollut kiinnostunut psykoterapiaopinnoista, mikä ei kuitenkaan ollut mahdollista hammaslääkärin pohjakoulutuksella. Seuraavaksi eteeni avautuikin mahdollisuus lähteä tutkimaan hammashoitopelon hoitoa, professori Liisa Suomisen innostamana. Vahva sisäinen motivaatio ajoi minut ko. aiheen pariin.

Haluankin erityisesti kiittää pääohjaajaani, professori Liisa Suomista, hänen merkittävästä panostuksestaan väitöskirjaani sen kaikissa vaiheissa. Erityisen kiitollinen olen hänen peräänantamattomasta sinnikkyydestään löytää reittejä eteenpäin kaikissa haasteellisimmissa vaiheissa, joita oli muutamia matkan varrella. Haluan kiittää myös kahta muuta ohjaajaani, professori Kirsi Honkalampea ja dosentti Maija Korhosta heidän antamastaan tuesta ja panostuksesta psykologisten näkökulmien ja laadullisen tutkimuksen osa-alueille. Lisäksi olen kiitollinen professori Satu Lahdelle, joka auliisti jakoi laajaa tietämystään ja osaamistaan hammashoitopelon asiantuntijuudestaan käsin. Kiitän myös vastaväittäjääni, professori (emeritus) Martti Tuomistoa sekä väitöskirjani esitarkastajia, dosentti Sanna Sinikalliota ja Vesa Pohjolaa sekä kaikkia muita, jotka ovat olleet edesauttamassa väitöskirjani valmistumista.

Kiitän kliiniseen kokeeseen osallistuneita erikoishammaslääkäreitä, Margarita Rogatkinaa ja Tiina Turusta. Heidän sekä tutkimukseen potilaita lähettäneiden kollegojen avustuksella oli mahdollista kerätä ainutlaatuinen

potilasaineisto, jota hyödynnettiin tutkimuksessa monipuolisesti. Kiitos vielä kaikille niille hammaslääkäreille, jotka suosittelivat tutkimukseen osallistumista omille pelkopotilailleen. Olen erityisen iloinen ja kiitollinen jokaisesta potilaasta, joka rohkeasti ja ennakkoluulottomasti lähti tutkimaan ja avaamaan omaa pelkoaan haastatteluissa. Heidän ansiostaan tämä tutkimus oli mahdollista toteuttaa.

Lähipiiriini on aina, lapsuudestani lähtien kuulunut ihmisiä, jotka ovat luottaneet kykyihini ja rohkaisseet yrittämään. Edesmenneet vanhempani ovat omalla toiminnallaan ja esimerkillään osoittaneet, miten tärkeätä on tehdä itselleen sopivia asioita ja pyrkiä kehittämään taitojaan monipuolisesti. Sain innostuksen olla utelias ja oppia uutta. Erityisen paljon välittämistä sain osakseni lapsuudessani tapahtuneen tragedian kautta, jolloin vammauduin auto-onnettomuudessa. Tämän tapahtuman kautta olen saanut kokemuksen tulla autetuksi, joka on vahva voima elämässäni tänä päivänä.

Olen ollut onnekas, koska rinnallani on aina ollut hyviä ystäviä, opiskelukavereita, työtovereita sekä naapureita, joiden kanssa olen saanut viettää ’laatuaikaa’. Heitä on ollut suuri joukko, liittyen eri elämänvaiheisiin. Nimiä erikseen mainitsematta haluan kiittää heistä jokaista. Olette minulle tärkeitä, kullanarvoisia. Lukuisten harrastusten kautta avautuneet kontaktit ja yhteydet ovat myös arvokkaita ja ansaitsevat maininnan, samoin kuin sukulaisuussuhteet. Kiitos siskoilleni, juuret ovat merkitykselliset.

Väitöskirjatutkijan monivaiheinen polku on ollut erityisen mielenkiintoinen matka monin tavoin, myös omaan sisimpään ja ihmisenä kasvuun. Toivon oppineeni jotakin myös keskeneräisyydestä ja toisen ihmisen kunnioittamisesta. Matkalle lähtiessäni en osannut kuvitella, miten suuri ponnistus väitöskirjan tekeminen onkaan. Kuitenkin haluan uskoa, että taival on ollut kaiken vaivannäön ja ponnistelun arvoinen.

‘Elämälle kiitos’

Kuopio, helmikuu, 2024
Pirjo Kurki

LIST OF ORIGINAL PUBLICATIONS

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

I Kurki P, Korhonen M, Honkalampi K, Suominen AL. Patients' multifaceted views of dental fear in a diagnostic interview. Acta Odontologica Scandinavica 79(3):194–204, 2021.

II Kurki P, Korhonen M, Honkalampi K, Lahti S, Suominen AL. The use of dental anxiety management techniques during one-session treatment: a study on five video-recorded patient cases. Acta Odontologica Scandinavica Sep 25:1-11, 2023. Online ahead of print.

III Kurki P, Korhonen M, Honkalampi K, Suominen AL. The effectiveness of a diagnostic interview and modified one-session treatment for dental anxiety in primary dental care – A pilot study. Special Care in Dentistry 43(2):174–183, 2023.

CONTENTS

ABBREVIATIONS

CBT	Cognitive-behavioural therapy
CDAS	Corah Dental Anxiety Scale
CI	Confidence interval
DF	Dental fear
DI	Diagnostic interview
DSM-V	Diagnostic and Statistical Manual of Mental Disorders, 5. version
ES	Effect size
ICD-10	International Statistical Classification of Diseases and Related Health Problems
ICD-11	International Statistical Classification of Diseases and Related Health problems
IDAF-4C^{+}	Index of Dental Anxiety and Fear
IDAF-4C	Index of Dental Anxiety and Fear – Anxiety and fear module
MDAS	Modified Dental Anxiety Scale
M-OST	Modified one-session treatment
OST	One-session treatment
RCT	Randomized clinical trial
SD	Standard Deviation
TENK	Finnish National Board on Research Integrity
VAS	Visual Anxiety Scale
VAS-A	Visual Analogue Scale Anxiety

1 INTRODUCTION

Anxiety associated with dental treatment is a common and relatively stable phenomenon. In Finland, one-third of adults have reported dental anxiety and one-tenth high dental anxiety (Pohjola, 2009; Liinavuori et al., 2016). Dental anxiety often leads to the non-regular use of dental services and avoidance of dental care, which, in turn, may lead to the deterioration of oral health (Armfield, 2013; Carlsson, Hakeberg & Wide Boman, 2015; Liinavuori et al., 2019). These characteristics cause challenges for both dentally anxious patients themselves and for oral healthcare providers (de Jongh & Stouthard, 1993; Brahm et al., 2012). To prevent the escalation of fear among individuals at risk and mitigate the far-reaching negative consequences of dental anxiety (Berggren, 2001), early identification of dentally fearful patients is crucial.

Prior to actual treatment, various tools and instruments are available for oral health care professionals to screen and evaluate the fears and anxieties of patients (Hakeberg & Cunha, 2008; Armfield & Heaton, 2013). These tools include questionnaires and scales that assess the severity of dental fear and anxiety and identify other fear-related factors that may affect dental treatment (Andersson, Hakeberg & Abrahamsson, 2013; Höglund et al., 2019). When the oral healthcare provider is informed of a patient's high level of dental anxiety prior to treatment, the patient's state anxiety can be reduced (Dailey, Humphris & Lennon, 2002). Additionally, when the Modified Dental Anxiety Scale (MDAS) score sheet is presented to the dentist, it can open the possibility to the dentist to respond openly to the fear expressed by the patient (Hally et al., 2017). Depending on the purpose, the appropriate subjective self-reported questionnaires and scales differ, with varying levels of breadth and specificity.

For a more comprehensive and practical evaluation, various interviews are conducted to gather information about fear-related aspects prior to dental treatment. These interviews include the iatrosedative interview (Friedman, 1993), the Semi-structured Fear Assessment Interview (Milgrom, Weinstein & Getz, 2009, pp. 104–115) and the pre-treatment clinical

interview (Öst, 2013, pp. 121–124). While various diagnostic interviews have been administered to patients with dental anxiety, studies have not considered the impact or importance of a clinical diagnostic interview in alleviating anxiety (de Jongh et al., 1995; Haukebø et al., 2008; Vika et al., 2009; Spindler et al., 2015).

Within clinical encounters, oral healthcare providers can identify patients experiencing dental anxiety by recognizing physical arousal or fear-related reactions during a dental visit (Košir et al., 2021). Objective evaluation involves various physiological measurements, such as the assessment of blood pressure, pulse rate, pulse oximetry, finger temperature and the galvanic skin response (Lundgren, Berggren & Carlsson, 2004), which are usually targeted according to the study purposes and specific dental anxiety treatment procedures.

Behavioral medicine has gained global recognition in recent decades, representing a field of research and practice that emphasizes collaboration among multiple disciplines (Dekker et al., 2021). This recognition has also spurred significant evolution in dentistry, particularly in the advancement of dental anxiety management practices and procedures (Berggren, 2001; Armfield & Heaton, 2013). The psychosocial adverse consequences and general psychological distress (general anxiety and depression) among patients with severe dental anxiety are also essential factors driving this evolution (Berggren, 1993; Boman et al., 2010). Behavioural treatment strategies have proven effective in alleviating dental anxieties, including muscle relaxation, modelling, guided imagery, physiological monitoring, biofeedback utilization, hypnosis, acupuncture, distraction and systematic desensitization (Berggren, Hakeberg & Carlsson, 2000; Hoffmann et al., 2022). Cognitively oriented therapy has also proven effective in dental fear treatment (de Jongh et al., 1995). This progress has been made possible by advances in both technological and psychological fields over the last decades, as well as an expanded understanding of psychological aspects related to the treatment of dental anxieties. However, few studies have been conducted in which dentists without specialized training in the treatment of dental anxiety have been the caregivers.

Notably, cognitive-behavioural therapy (CBT) in various forms has demonstrated effectiveness in reducing severe dental anxiety and phobia in adults (Kvale, Berggren & Milgrom, 2004; Gordon et al., 2013; Wide Boman et al., 2013). Moreover, there is evidence to suggest that CBT is more efficient than traditional pharmacological treatment or hypnosis in reducing fear, improving patient acceptance of conventional dental treatment and transforming avoidance behaviours (Armfield & Heaton, 2013; Wide Boman et al., 2013; Kurki et al., 2019; Wolf et al., 2022). Additionally, specific evidence-based psychological procedures have shown the potential to be applied during the treatment of dentally anxious adults within the clinic (Hoffmann et al., 2022). However, there is a lack of evidence regarding the effectiveness of cognitive-behavioural-based interventions (Burghardt et al., 2018) in primary dental care.

Various dental anxiety management techniques, including cognitive techniques, relaxation methods and techniques to increase patients' sense of control, have also demonstrated effectiveness (De Jongh, Adair & Meijerink-Anderson, 2005; Armfield & Heaton, 2013; Gordon et al., 2013). It has been proposed that these techniques are accessible to dentists who may not have formal training in behavioural management techniques (Armfield & Heaton, 2013). To reach a deeper understanding, this study aimed to examine the treatment of dental anxiety in primary dental care from three cognitive-behavioural-based treatment perspectives: 1) adult patients' perceptions of their dental fear, 2) the dental anxiety management techniques used by experienced dentists and 3) the impact of diagnostic interviews (DIs) and modified one-session treatment (M-OST) in alleviating dental anxiety within an intervention setting. Given that most adults with dental anxiety seek dental care in conventional dental clinics, the study involved patients from primary dental care.

2 LITERATURE REVIEW

2.1 DEFINITION OF DENTAL FEAR AND ANXIETY

Fear and anxiety are normal emotional states according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V): fear is the emotional response to real or perceived imminent threats, whereas anxiety is the anticipation of future threats (American Psychiatric Association, 2013, pp.189). Although the states overlap, they also differ: fear causes clear physiological reactions through autonomic arousal, preparing the body for fight or flight, as well as thoughts of immediate danger and escape behaviours, whereas anxiety causes muscle tension, anticipation of future danger and cautious or avoidance behaviours. In specifically defined circumstances, a marked, persistent and unreasonable fear affecting daily life can be diagnosed as a disorder, or specific phobia, described in the ICD-11 classification of mental and behavioural disorders and in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in the category of anxiety disorders (American Psychiatric Association, 2013).

The terms 'dental fear' and 'dental anxiety' are often used interchangeably in the literature, although they are different entities (Gordon et al., 2013). The term 'dental anxiety' refers to an emotional state, a general feeling that precedes an encounter with a feared object or situation, and 'dental fear' represents an actual emotional response to the object or situation (Armfield & Heaton, 2013; Hare, Bruj-Milasan & Newton, 2019). Dental anxiety is a specific condition, varying from mild anxious reactions to panic attacks and behavioural disturbances, which is induced by objects or situations relating to the oral health care situation (Willumsen, Agdal & Vika, 2022, p. 175). 'Dental phobia' usually refers to the most severe form of such fear. In dental phobia, the person will usually try to completely avoid dental treatment or attend treatment with strong difficulties, because the dental stimuli will inevitably trigger severe anxious reactions.

A fear reaction involves emotional, behavioural, cognitive and physiological elements (Willumsen, Haukebø & Raadal, 2013, pp. 48–50). Attention most often focuses on aversive feelings, i.e., feelings of dread, terror, panic or a creeping sensation or tight stomach, because they are easy to observe. Four major behavioural strategies have been described in the literature related to fear-provoking situations: 1. Withdrawal, which includes the escape response and the conflict between avoidance and approach; 2. Aggressive responses when the person cannot avoid or escape the situation; 3. Immobility by means of freezing one's reactions and mobilizing all the energy in order to cope with dental treatment; and 4. Deflection of attacks by inventing reasons to handle a threatening situation. Cognitions reflect expectations of specific impending harm, when people initially exaggerate the actual danger during the first appraisal, according to Lazarus (1966). After processing the danger, reappraisal reveals that the threat was falsely defined. Internal and external bodily changes prepare us to deal with the threatening situation. The reactions can be perceived in altered body language and apprehensive facial expressions.

In this study, 'dental anxiety' refers to 'moderate' and 'severe' dental anxiety, particularly to negative feelings in the context of dental treatment. Furthermore, the term 'dental fear' is used to describe the range of responses, including emotional, behavioural, cognitive, and physiological components. The first sub-study targeted to dental fear and the second and third sub-studies to (situation-specific) dental anxiety. The patients' severity of dental anxiety has been assessed with dental anxiety scales and the diagnosis of dental phobia is unsure. The relationships between these states and the definitions have been described in Figure 1. The term originally used in the article was used when referred to the publications.

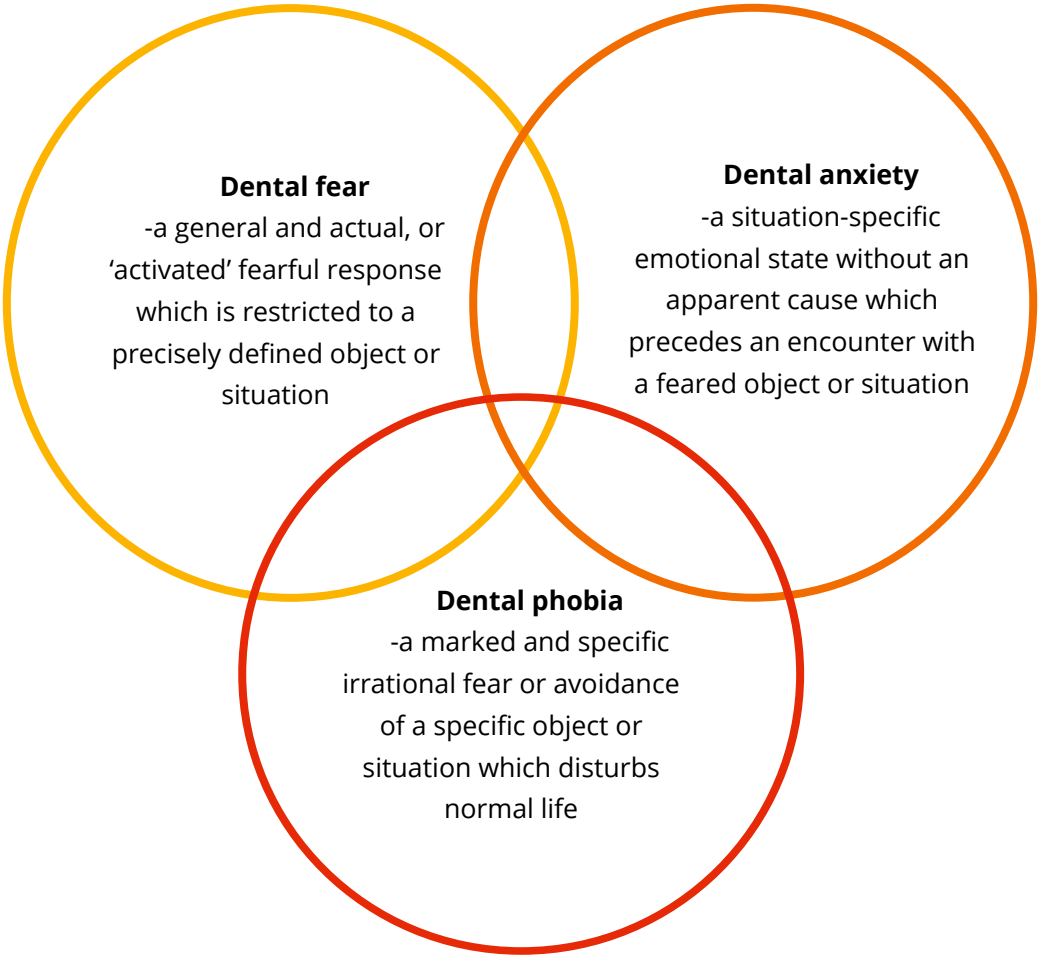


Figure 1. The relationships between dental fear, dental anxiety and dental phobia and the definitions based on the description of Armfield & Heaton (2013).

2.2 AETIOLOGY OF DENTAL FEAR AND ANXIETY

The aetiology and development of dental anxiety are complex and multifactorial. Dental consultation includes various psychological and interpersonal aspects that can influence a patient's appraisal, feelings and

coping abilities in the given situation (Willumsen, Haukebø & Raadal, 2013, pp. 45–50). According to the literature, dental anxiety can have either an endogenous or exogenous origin (Weiner & Sheehan, 1990). The endogenous origin suggests a constitutional vulnerability to anxiety disorders that manifests in general anxiety states, mood disorders and multiple severe fears (Locker, Thomson & Poulton, 2001). Exogenous factors are linked to potentially painful or stressful past experiences with dental treatment or other specific situations (Milgrom, Weinstein & Getz, 2009, p. 36). The three pathways of acquiring fear from exogenous sources involve direct conditioning experiences, indirect processes of vicarious acquisition/learning and the transmission of information and instructions (Rachman, 1977; Wolpe, 1981).

Cognitive vulnerability models are related to understanding the origins and causal factors of psychological problems (Riskind & Alloy, 2006). In the context of the aetiology of fear, this implies that some people may be more prone to developing dental anxiety, especially following stressful events in vulnerability-stress interaction during dental treatment. Moreover, these problems may persist over time. Evidence also suggests that perceived uncontrollability, unpredictability and dangerousness can influence the interpretation of negative experiences and feelings of fear associated with dental visits (Armfield, Slade & Spencer, 2008). The conceptual framework of cognitive vulnerability models shares specific features with many cognitive models (Riskind & Alloy, 2006). These features involve schematic biases in information processing, developmental factors, reciprocal feedback loops and specific vulnerabilities associated with particular problems or disorders, such as dental anxiety.

The most recent literature has presented the biopsychosocial model as a theoretical framework for the development of dental anxiety, which considers the complexity of the contributing factors. The biopsychosocial model acknowledges the interaction between biological, psychological, environmental and social factors in relation to dental anxiety (Boman et al., 2010). The model is grounded in the biopsychosocial concept that "biological inheritance together with a personal experience in a social context are involved in disease development" (Willumsen, Haukebø &

Raadal, 2013, pp. 51–55; Willumsen, Agdal & Vika, 2022, pp. 170–171). The model considers the impacts of genetic vulnerability, including dental anxiety and anxiety about pain, certain personality traits and characteristics of temperament, as well as a strong desire for control and lack of coping strategies in the dental situation. Other models also exist, such as psychoanalytic theory (Busch, Milrod & Shear, 2010) and psychodynamic theory (Stein, Hollander & Rothbaum, 2010), involving alternative perspectives on the development of anxiety disorders.

Generally, the dental treatment situation includes several aspects that can trigger a fear reaction, such as the use of sharp objects causing potential pain and bodily damage, a lying bodily position causing potential obstruction of the free air space during treatment, operating in the intimacy of the oral area, and a threat to several basic physiological functions (Willumsen, Haukebø & Raadal, 2013, pp. 45–50; Willumsen, Agdal & Vika, 2022, pp.168–171). The onset of dental anxiety varies, most typically being in childhood and early adolescence (Thomson et al., 2009), and there is evidence of negative, probably painful traumatic experiences being causative factors (Berggren & Meynert, 1984). Evidence has also implied that negative conditioning experiences appear to be unrelated to the adult onset of dental anxiety (Thomson, Locker & Poulton, 2000), although many adults with dental anxiety have reported painful, frightening and embarrassing experiences during adolescence and adulthood (Locker, Shapiro & Liddell, 1996). Some other factors, such as a limited experience of control during dental treatment and the unpredictability of the dental experience, may also act as predictors of dental anxiety (Willumsen, Haukebø & Raadal, 2013, p. 47).

Additionally, there is evidence of comorbidity with other psychological problems and disorders, such as phobias, anxieties and depression (Pohjola et al., 2011a; Halonen et al., 2018), also demonstrated in the development of dental anxiety in young adults (Locker, Thomson & Poulton, 2001). Having been the victim of sexual abuse (Willumsen, 2001), as well as impulsivity in temperament (Stenebrand, Wide Boman & Hakeberg, 2013), alexithymia (Pohjola et al., 2011b) and neuroticism

(Vassend, Røysamb & Nielsen, 2011; Arkkila et al., 2022), can predispose to dental anxiety (Willumsen, Haukebø & Raadal, 2013, p. 48).

2.3 PREVALENCE AND CONSEQUENCES OF DENTAL FEAR AND ANXIETY

In one of the latest epidemiological surveys conducted in Western countries, a meta-analysis by Silveira et al. (2021) reported a 12% prevalence of high dental fear and anxiety and 3% prevalence of severe dental fear and anxiety worldwide. However, previous population studies in the Nordic countries have shown a declining trend in severe dental fear and anxiety, with a prevalence of 5–6% among adults (Liinavuori et al., 2016; Svensson, Hakeberg & Boman, 2016) and 8% among adolescent (Strøm, Skaare & Willumsen, 2020). According to a rare longitudinal study, severe dental fear remains most stable in age groups from 35 to 54 years, but it can change over time in all age groups (Liinavuori et al., 2016). Interestingly, severe dental fear tends to be most alleviated in older age groups. Furthermore, research evidence indicates that severe dental fear and anxiety is more common among women and young adults (Liinavuori et al., 2016; Silveira et al., 2021).

The consequences of dental fear and anxiety are wide ranging, involving impacts on patient behaviour, oral health, and psychological well-being (Boman et al., 2010; Armfield, 2013). This phenomenon is described as forming a vicious circle of dental fear (Berggren & Meynert, 1984). Studies have demonstrated associations between dental fear or anxiety and irregular dental attendance (Armfield & Ketting, 2015; Hakeberg & Wide Boman, 2017; Liinavuori et al., 2019). Consequently, delayed dental visits, poor oral health, symptom-driven treatment seeking, together with feelings of shame and inferiority, and psychosocial distress, are involved in the vicious circle of dental fear and anxiety (Berggren & Meynert, 1984; Armfield, Stewart & Spencer, 2007; Boman et al., 2010). According to research, individuals with dental fear tend to have more decayed teeth but fewer filled teeth compared to those without dental fear (Armfield, Slade & Spencer, 2009; Heidari et al., 2017), indicating a higher need for dental

care. There is also considerable evidence of associations between dental fear or anxiety and impairment of oral health-related quality of life (McGrath & Bedi, 2004; Pohjola et al., 2009; Carlsson, Hakeberg & Wide Boman, 2015; Heidari, Banerjee & Newton, 2015). Feelings of shame or inferiority and psychosocial consequences, as well as distress, are usual among patients with severe dental fear and anxiety, which is emphasized when their dental status has deteriorated (Boman et al., 2010; Carlsson, Hakeberg & Wide Boman, 2015). Breaking the vicious circle of dental fear and anxiety is challenging, as fear, reinforced by avoidance and social conflicts, tends to intensify, leading to further avoidance of dental care (Abrahamsson et al., 2002). The previous findings support the biopsychosocial vicious circle's role in maintaining dental fear and anxiety over time (Boman et al., 2010; Carlsson, Hakeberg & Wide Boman, 2015). On the other hand, many dentally anxious patients regularly attend dental care, despite their fears (Pohjola et al., 2007; Svensson, Hakeberg & Boman, 2016). However, the level of avoidance and readiness to act varies between individuals (Abrahamsson et al., 2002).

2.4 MEASURING DENTAL FEAR AND ANXIETY

The evaluation of dental fear and anxiety is based on three main methods: direct self-report measures, behavioural observation, and physiological recording (McGrath, 1986; Humphris & Hull, 2007). These approaches aim to gather information from three primary sources: the patients' own reports, patients' emotions and behaviour, in addition to physiological responses (Milgrom, Weinstein & Getz, 2009, Chapters 3 and 4). While questionnaires provide subjective information about patient anxiety, the observation approach and physiological measurements are suggested to provide a more objective and comprehensive assessment of the severity of the condition. To explore patients' recent dental treatment experiences, changes in dental attendance behaviour or the specific factors contributing to maintaining their fear, researchers have developed various instruments. These include the iatrosedative process (Friedman, 1993), a semi-structured interview (Vrana, McNeil & McGlynn, 1986; Milgrom, Weinstein

& Getz, 2009, pp. 104–115), and a pre-treatment clinical interview process incorporating a behavioural analysis instrument (Öst, 2013, pp. 121–124). Structured or diagnostic interview procedures are also utilized to diagnose possible anxiety disorders and specific phobias (American Psychiatric Association, 2013; Di Nardo et al., 1993). A summary of dental fear and anxiety questionnaires, scales and interviews is presented on Table 1.

2.4.1 Self-reported assessment

Self-reported questionnaires or scales, which vary in length and specificity, are useful for measuring the level of dental fear and anxiety in patients in both studies and clinical practices. Questionnaires have also been used to assess patients' self-reported emotional experiences (Berggren, Hakeberg & Carlsson, 2000), negative cognitions associated with dental treatment (de Jongh, Muris et al., 1995), and coping strategies in the dental treatment situation (Bernson, Elfström & Berggren, 2007). Furthermore, these instruments have been utilized to explore patient satisfaction with dental visits (Corah et al., 1984; Hakeberg et al., 2000), and dental attendance following dental anxiety treatment (Willumsen & Vassend, 2003).

The shortest scale consists of a single item that assesses the changing levels of dental anxiety (Luyk et al., 1988) or overall dental anxiety (Neverlien, 1990). For example, in Finnish adults, a single-item question asks, "How much do you fear dental care or visiting a dentist?" with response options on a 3-point scale, ranging from "not scary at all" to "very scary" (Viinikangas et al., 2007). This scale can be used for screening dental anxiety in population-based studies and clinical dental situations. Another version of the short scale used in population-based epidemiological surveys to measure general dental fear of dental treatment includes the question "How afraid are you of visiting a dentist?" with three response options: "Not at all", "Somewhat", and "Very" (Pohjola et al., 2007, 2009).

Multi-item Likert-type questionnaires consist of several items that assess anticipatory feelings related to upcoming dental treatment, the severity of dental fear and anxiety, as well as other important aspects of the dental treatment situation and behaviour. Examples of brief scales

include the Dental Anxiety Scale (DAS) (Corah, 1969), and the Modified Dental Anxiety Scale (MDAS) (Humphris, Morrison & Lindsay, 1995) which extends Corah's four-items scale by one item and a wider and more consistent answering scheme (Humphris et al., 2000). These two generally used questionnaires measures situation-specific level of state anxiety and represent the most researched and used dental fear and anxiety assessments (Willumsen et al., 2022, p. 190). The brief questionnaires can provide information on patients' state of mind and other clinical important information (Humphris & Hull, 2007).

More comprehensive questionnaires commonly used include the Dental Fear Survey (DFS) (Kleinknecht, Klepac & Alexander, 1973), along with the Dental Beliefs Survey (Smith, Milgrom & Weinstein, 1987; Smith, Kroeger and Mullins, 1991), and the Dental Anxiety Inventory (DAI) (Stouthard, Mellenbergh & Hoogstraten, 1993; Stouthard, Hoogstraten & Mellenbergh, 1995). These questionnaires measure multicomponent facets of dental fear and anxiety. The Index of Dental Anxiety and Fear (IDAF-4C^{+}) (Armfield, 2010) is one of the most comprehensive scales, comprising three modules that measure dental anxiety and fear, dental phobia and feared dental stimuli.

Another measure, the Spielberger State–Trait Anxiety Scale (STAI) (Spielberger, 1985), is also used in dentistry, assessing both trait and state anxieties. Dental fear and anxiety scales (e.g., C-DAS, MDAS, IDAF-4C) are typically designed to evaluate state anxiety, which pertains to a temporary state preceding anxiety-inducing clinical situation. Fear measures for children exist but are not covered in this context. For research purposes, the questionnaires prove valuable in assessing the impact of dental anxiety treatments. Several scales, such as the Modified Dental Anxiety Scale and the Index of Dental Anxiety and Fear, have been cross validated in Finnish samples (Humphris et al., 2000; Tolvanen et al., 2017).

2.4.2 Interview

Questionnaires often have limitations in capturing all aspects of patients' dental fear and anxiety, including personality-related behavioural and

cognitive responses (Facco et al., 2011). To address this limitation, researchers have developed various interview methods. One of the initial interviews in the context of dental anxiety treatment, conducted by dentists, was described by Milgrom as a semi-structured interview (Milgrom, Weinstein & Getz, 2009, pp. 104–115). This Dental Fear Interview aimed to assess patients' dental anxiety from multiple perspectives prior to actual dental treatment. The interview items can be customized by selecting the most appropriate ones among 14 items, based on the specific objectives (Vrana, McNeil & McGlynn, 1986; Milgrom, Weinstein & Getz, 2009). Semi-structured interviews have also been conducted to explore factors related to oral health care behaviour after dental anxiety treatment (Morhed Hultvall, Lundgren & Gabre, 2010), and for embarrassment phenomena in patients with avoidance behaviour due to anxiety (Moore, Brødsgaard & Rosenberg, 2004).

Another type of interview, involved as a part in an iatrosedative process, was presented by Friedman (1989). Iatrosedative process is defined as 'an interpersonal cognitive technique by which fearful patients are calmed by the behaviour, attitude, and communicative stance of the dentist' (Friedman, 1993). In accordance with Friedman's approach, this method includes a clinical encounter following the interview. The aim is to mitigate patients' apprehension during dental treatment by actively addressing previous negative treatment experiences they may have had (Friedman et al., 1989; Friedman, 1993; Friedman & Wood, 1998).

Öst (2013) has described a clinical interview protocol conducted one week prior to one-session treatment (OST). This interview focuses on establishing a proper diagnosis of a patient's specific phobia, assessing factors that maintain the fear through behavioural analysis and explaining the OST procedure to the patient (Öst, 2013, pp. 121–124).

Psychologists or psychiatrists deliver diagnostic interviews for diagnosing blood-injection-injury (BII) phobia using the Anxiety Disorders Interview Schedule - Revised (ADIS-R) (Di Nardo et al., 1993). This is part of the Disorders Interview Schedule's specific phobia module for DSM-V (ADIS-V). The ADIS-V also assesses for disorders that have high comorbidity with anxiety disorders (e.g., mood disorders, substance abuse disorders,

and somatoform disorders) (Addicks et al., 2017). When assessing specific dental phobia, patients must meet the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (5th edition, DSM-V; American Psychiatric Association, pp.197-198). This condition could be evaluated using the Structured Clinical Interview for DSM-V Axis I Disorders (SCID-I).

Table 1. Summary of dental fear and anxiety questionnaires, scales and interviews.

Measure	Items and contents	Validity, +/-
Dental fear and anxiety scales		
Visual Analogue Scale of Anxiety (VAS)	'Please mark your current level of anxiety or nervousness with a cross () on the dotted line.'	+ (Luyk, Beck & Weaver, 1988)
Dental Anxiety Question (DAQ)	'Are you afraid of going to the dentist?'	+ (Neverlien, 1990)
Single-item question	'How much do you fear dental care or visiting a dentist?'	+ (Viinikangas et al., 2007)
Corah's Dental Anxiety Scale (C-DAS)	Four items related to the anticipated anxiety and fear	+ C-DAS (Corah, 1969) + The Dental Anxiety Scale-Revised, DAS-R (Ronis, 1994)
Modified Dental Anxiety Scale	Five items related to the anticipated anxiety and fear	+ (Humphris, Morrison & Lindsay, 1995; Humphris et al., 2000; Humphris, Dyer & Robinson, 2009)
Dental Fear Survey (DFS)	20 items focusing on specific features of dental avoidance, physiological arousal	+ (Kleinknecht, Klepac & Alexander, 1973)

	and fear stimuli associated with dental treatment	
Dental Beliefs Survey (DBS)	15 items related to beliefs, attitudes and behavior + 28-item Dental beliefs survey-Revised (DBS-R)	+ DBS (Smith, Milgrom & Weinstein, 1987) + DBS-R (Smith, Kroeger & Mullins, 1991)
Dental Anxiety Inventory (DAI)	36 three-faceted items related to time, situation and reaction + 9-item short version (S-DAI)	+ DAI (Stouthard, Mellenbergh & Hoogstraten, 1993) + S-DAI (Stouthard, Hoogstraten & Mellenbergh, 1995)
Index of Dental Anxiety and Fear (IDAF-4C)	Eight items covering various dimensions of anxiety and fear responses, including cognitive, emotional, behavioural and physiological components	+ (JArmfield, 2010; Tolvanen et al., 2017)
Interviews		
Milgrom's Dental Fear Interview	Semi-structured interview including 14 items designed to address cognitive, interpersonal, and behavioural aspects of the patient's fears	+ (Vrana, McNeil & McGlynn, 1986)
Friedman's interview	Consisting of four phases designed to promote the therapeutic process	+ (Friedman & Wood, 1998)

Öst's clinical interview	A clinical interview protocol conducted one week prior to one-session treatment (OST).	+ (Öst, 2013)

2.4.3 Observation

The activation of the autonomic nervous system results in observable physical signs in dentally anxious patients during a visit to the dentist. These signs are associated with behavioural, emotional and psychophysiological responses, which can be subjectively assessed from these patients (Milgrom, Weinstein & Getz, 2009, p. 64). However, in adults, the signs are not always easily observable, because patients tend to mask and hide them in social situations (Milgrom, Weinstein & Getz, 2009, p. 65; Appukuttan, 2016; Höglund et al., 2019). Psychophysiological responses, including an increase in heartrate, heart rate variability and skin conductance level, have been demonstrated to been provoked in a real-life dental examination (Košir et al., 2021). Study evidence of other psychophysiological manifestations is difficult to find, such as muscle tension, unsteady hands, restlessness, throat clearing, sweating of the palms, forehead and upper lip, pulsation in the carotid and temporal arteries, changes in respiration depth and speed, rigid posture, gripping objects tightly, a strong startle response and frequent urination (Appukuttan, 2016).

Dentists have also evaluated patients' behaviour during treatment (Berggren, Hakeberg & Carlsson, 2000) and assessed patient behaviour by using a behavioural avoidance test (BAT). The BAT has been employed in studies involving brief cognitive-behavioural interventions for patients meeting the DSM-IV criteria for a specific phobia (Haukebø et al., 2008; Vika et al., 2009) and in treatments combining benzodiazepine with systematic desensitization therapy (Coldwell et al., 2007). Behavioural and emotional responses acknowledged in literature (Milgrom, Weinstein & Getz, 2009, pp. 63–72; Appukuttan, 2016) cover a wide range of conditions, including hyperactivity, speaking or walking faster, feeling hurried, irritation with

delays, panic-like symptoms, blushing, speech difficulties, avoiding social interactions, nervous habits, impaired memory, confusion, stumbling over words, sitting on the edge of the chair and leading forward, rapidly flipping through magazines, pacing, inattentiveness, excessive worrying and emotional outbursts. A study has utilized videos in observing the communication behaviours in paediatric dental consultations by using an interaction coding scheme (Yuan et al., 2019). Otherwise, observation has rarely been used in research in the context of dental anxiety.

2.4.4 Physiological measurements

Physiological measurements offer a range of options for assessing anxiety levels in patients, focusing on blood pressure, the pulse rate, finger temperature, the galvanic skin response and salivary cortisol. The utilization of such measures can enhance the diagnostic process and assist in categorizing patients' anxiety levels. These measurements typically involve the recording of various physiological parameters, including heart rate (HR), surface electromyographic activity (EMG), skin conductance (SC), the cortisol level in saliva and forehead muscle tension, often in combination. Three of the methods, specifically EMG, HR and SC recordings, have been used to compare the differences in physiological activity in individuals with a presumed direct conditioned aetiology of dental fear and those with an indirectly learned fear of dentistry in response to dental video scenes (Lundgren, Berggren & Carlsson, 2004). Physiological measurements, including EMG biofeedback, have also been carried out to enhance patients' relaxation abilities during exposure to dental video scenes (Lundgren, Carlsson & Berggren, 2006). Within studies, observational approaches related to physiological measurements have been used to assess the effectiveness of midazolam and psychological treatment by monitoring heart rate and blood pressure during dental surgery (Thom, Sartory & Jöhren, 2000). The galvanic skin response is a reliable method that has been employed in various studies to assess anxiety levels, including dental anxiety (Lundgren, Berggren & Carlsson, 2004; Košir et al., 2021). As shown in research, there is evidence indicating

a correlation between skin conductance and dental anxiety (Caprara et al., 2003). Pulse or finger oximetry can be used in various circumstances, including during dental treatment procedures.

2.5 PSYCHOLOGICAL TREATMENT OF DENTAL FEAR AND ANXIETY

Psychological treatment approaches have gained recognition in the management of dental anxiety over the last few decades due to their effectiveness in reducing patients' dental anxiety and modifying avoidance behaviour (Kvale, Berggren & Milgrom, 2004; Gordon et al., 2013; Wide Boman et al., 2013; Kurki et al., 2019). The management of dental anxiety typically involves a combination of various techniques, including behaviourally and cognitively oriented psychological approaches, as well as pharmacological interventions (Berggren, 2001; Hoffmann et al., 2022). Nevertheless, traditional pharmacological approaches such as relative analgesia (nitro oxide), conscious intravenous sedation or oral sedation can have harmful drawbacks due to their potential side effects, risks and contradictions (Hoffmann et al., 2022).

2.5.1 Cognitive-behavioural approach

Within the cognitive-behavioural approach, the cognitive-behavioural theory of emotional disorders is based on the assumption that individuals tend to interpret specific situations in an excessively negative and dysfunctional manner (Trower, 2011). According to this theory, objects or situations that elicit fear and anxiety lead to beliefs that generate emotional and behavioural consequences. These events can occur in the past, present or even the future, and the cognitive processes involved can include memories, mental images, or predictions.

Behaviour therapy was first officially introduced in 1954 by Ogden Lindsley and in 1958 by Arnold Lazarus, who reported on the use of operant learning principles in treating a psychiatric condition (Öst & Clark, 2013, pp. 91–93). The concept of behaviour therapy gained prominence in

the 1960s as a new form of treatment based on principles from learning psychology, including classical and operant conditioning, as well as social learning (Bandura, 1969). This development followed significant publications by John Watson, the father of behaviourism, in 1920 regarding fear induction and generalization in a healthy baby, and Mary Cover Jone's study in 1924 on successfully treating a young boy's phobia using principles of direct conditioning and modelling.

The first treatment manual for cognitive therapy, focusing on depression, was published by Beck in 1979. Beck is considered a pioneer and developer of cognitive therapy. Subsequently, cognitive therapy was investigated in numerous studies for various conditions, including panic disorder, generalized anxiety disorder and social phobia (Beck et al., 1992; Gelder, Clark & Salkovskis, 1993; Walley, Beebe & Clark, 1994; Clark et al., 1999). In the 1990s, cognitive and behavioural therapy approaches were combined to form cognitive-behavioural therapy (CBT), which is widely applied in the treatment of anxiety disorders and phobias (Beck, Emery & Greenberg, 2005). CBT for emotional disorders is based on four basic principles: 1. correcting counterproductive beliefs or interpretations, 2. learning and testing alternative interpretations of experiences, 3. helping patients change their behaviour in specific situations and 4. encouraging patients to accept and explore new ways of understanding themselves, their experiences and assumptions about the future (Öst & Clark, 2013, pp. 98–100). Therapists can assist patients in challenging their beliefs through discussions and behavioural experiments that involve letting go of safety behaviours. Another possible treatment approach is exposure therapy conducted in real-life situations.

Among psychological treatment approaches for severe dental anxiety and phobia, CBT also has most evidence for its efficacy (Kvale, Berggren & Milgrom, 2004; Gordon et al., 2013; Wide Boman et al., 2013). From an adult perspective, one of the initial structured behavioural methods for treating dental phobia was systematic desensitization, which utilized reciprocal inhibition (Wolpe, 1954). This approach combines relaxation with the anxiety-provoking stimulus and its associated response (arousal, tension and fear) during gradual exposure (Berggren, 2001). Evidence-

based CBT methods for adults with specific phobias include *in vivo* exposure with applied tension for blood phobia and systematic desensitization for specific phobias (Öst & Clark, 2013, pp. 101–106).

CBT interventions for severe dental anxiety and phobia are typically conducted in an interdisciplinary manner, involving collaboration between psychologists and trained dentists, as reported in reviews (Kvale, Berggren & Milgrom, 2004; Wide Boman et al., 2013; Kurki et al., 2019). These interventions can be categorized into three groups: extended CBT interventions of over five sessions (Berggren, Hakeberg & Carlsson, 2000; Willumsen, Vassend & Hoffart, 2001; Lundgren, Carlsson & Berggren, 2006), brief CBT interventions of five or fewer sessions (Thom, Sartory & Jöhren, 2000; Haukebø et al., 2008; Vika et al., 2009; Wannemueller et al., 2011; Forbes, Boyle & Newton, 2012; Spindler et al., 2015) and computerized guided CBT treatments (Coldwell et al., 2007; Tellez et al., 2015). However, CBT for dentally anxious patients has also been administered by a general dentist using a manual based on literature reviews and clinical experience (Hauge et al., 2021; Hauge, Stora & Willumsen, 2022, pp. 1955–205).

2.5.2 Treatment strategies for dental anxiety in an oral health care setting

The use of psychological behavioural and cognitive techniques in an oral health care setting aims to assist dentally anxious patients in coping with conventional dental treatment and obtaining the necessary oral health care (Berggren, 2001; Armfield & Heaton, 2013; Hoffmann et al., 2022). These techniques, as presented in studies, include cognitive restructuring (de Jongh et al., 1995; Armitage & Reidy, 2012), the use of relaxation techniques (Moore, 1991) and techniques to increase the patient's sense of control over dental care (Ng, Chau & Leung, 2004). The treatment of dental anxiety has been shown to be most effective when these techniques are combined with repeated, graduated exposure (Gordon et al., 2013). The classification of various dental anxiety treatment strategies and their

elements has been described in the literature (Milgrom, Weinstein & Getz, 2009, Chapters 5 and 6; Kani et al., 2015) (See Table 2).

Table 2. Dental anxiety treatment approaches and their aims and specific means.

Approach	Aims	Means
Specific strategies to enhance trust and control	Building a trustful relationship and increasing control.	Applying of various key elements for building a trusting relationship, providing informational, cognitive, behavioural and retrospective control or debriefing.
Behavioural strategies: relaxing the body	Inducing physical relaxation of the body by using relaxation skills, mini experiments to challenge erroneous beliefs or systematic desensitization.	Training of various breathing exercises, muscle relaxation or applied tension and adapting of graded exposure to the feared stimulus, behavioural experiments or physiological monitoring via biofeedback.
Cognitive strategies: relaxing the mind	Analyzing cognitions (i.e., thoughts, beliefs, and interpretations) to facilitate a new understanding that the feared stimuli are not dangerous and avoidance or other safety behaviours are not required.	Identifying of possible cognitive control strategies, use of cognitive restructuring, Socratic questioning, psychoeducation, and stress inoculation.

The dental anxiety management models have been described by Milgrom et al. (2009) and Willumsen et al. (2022), with both models sharing

common techniques while also having some differences. The anxiety management model of Milgrom et al., from a practical perspective, emphasizes that specific strategies to enhance trust and control create the foundation of all psychological management (Milgrom, Weinstein & Getz, 2009, pp. 143–209). Other strategies include behavioural, cognitive, practice-based, and pharmacological approaches aimed at alleviating patients' anxiety. On the other hand, the model of Willumsen et al. considers both the dentists' and patient's perspectives in the prevention and management of dental anxiety (Willumsen et al., 2022, pp. 179–194). Key elements in preventing and managing dental anxiety include providing patients with predictable and controllable experiences, establishing a strong alliance with the patient and offering psychoeducation. Collaboration between the dental team and a respectful and understanding attitude towards the patients' situations and dental anxiety by dental personnel are described as crucial for successful oral healthcare for dentally anxious patients. Willumsen et al. (2022, pp. 185–188) have outlined useful coping strategies that include giving positive reinforcement, employing distraction techniques, addressing catastrophic thoughts, and working within the patient's window of tolerance. Additionally, they provide guidance on handling dentally anxious patients in emergency situations and considerations for elective treatments. Both models emphasize the benefits of incorporating both operative dentistry and psychological management of dental anxiety into the treatment plan. They also stress the importance of engaging in discussions regarding the content of each treatment session in collaboration with the dentist and the patient (Milgrom, Weinstein & Getz, 2009; Willumsen et al., 2022).

2.5.3 Brief CBT interventions

A model for addressing dental phobia in the context of dental treatment has been described by Öst (Öst, 2013, pp. 119-134). This specific model, known as one-session treatment (OST) for dental phobia, involves a clinical interview typically conducted by a psychologist one week before the actual treatment. The purpose of this initial appointment is to confirm the

diagnosis of a specific phobia and conduct a brief cognitive-behavioural analysis of the patient's phobia, in addition to introducing the OST approach. The model is grounded in the strong conviction that the patient's catastrophic beliefs about what will occur during encounters with the phobic situation are at the core of maintaining their anxiety and avoidance behaviour. These beliefs are challenged during the extended treatment session with new information. During the treatment session, which is conducted by a trained dentist, several key elements are incorporated. These include providing instructions to the patient, emphasizing the importance of involving the patient in decision-making regarding the procedures, introducing the use of the Subjective Units of Distress (SUD) scale to monitor anxiety levels, and explaining the planned, gradual and controlled progression of exposure to the phobic object in manageable steps. Open and honest communication is emphasized, and the treatment approach is based on collaborative teamwork between the dentist and patient. An agreement is established regarding the use of a 'stop signal', such as raising a hand to temporarily stop the ongoing procedure if the patient experiences pain or reaches an unbearable level of anxiety. To effectively manage the quite high levels of anxiety during the step-by-step treatment, the patient needs to be motivated.

Research evidence supports the effectiveness of brief CBT interventions, including one-session treatment, in reducing severe dental anxiety among adults (Gordon et al., 2013; Wide Boman et al., 2013; Kurki et al., 2019). These studies compared one-session treatment with five-session treatment for dental phobia (Haukebø et al., 2008) or intra-oral-injection phobia (Vika et al., 2009) based on Öst's phobia treatment model (Öst, 2013, pp. 119–134). Additionally, short-term psychotherapeutic interventions performed by dentists educated in psychotherapy (Spindler et al., 2015) or psychologists using stress management training and imaginal exposure to phobic stimuli with homework assignments (Jöhren et al., 2007) have shown effectiveness. Research has also demonstrated that a single session of cognitive restructuring led by a psychologist can effectively change negative cognitions and reduce dental trait anxiety among phobic dental patients (de Jongh et al., 1995).

Clinical trials have provided evidence demonstrating that brief psychological treatments are significantly more effective in reducing dental anxiety compared to pharmacological treatment, waiting for psychological treatment or undergoing hypnosis (Thom, Sartory & Jöhren, 2000; Haukebø et al., 2008; Wannemueller et al., 2011; Spindler et al., 2015; Kurki et al., 2019). These studies compared different dental anxiety treatment methods and pharmacological interventions in individuals with dental phobia, such as one-session psychological treatment versus benzodiazepine (Thom, Sartory & Jöhren, 2000) or brief cognitive-behavioural treatment versus hypnosis and general anaesthesia (Wannemueller et al., 2011). In certain situations, a combination of psychological and pharmacological strategies (e.g., sedatives, nitro-oxide therapy, intravenous sedation or general anaesthesia) may be used to facilitate dental treatment, particularly in emergencies or when patients are unable to cope with conventional dental procedures (Berggren, 2001). However, it is recommended that the need for more extensive psychotherapeutic interventions is assessed by mental health professionals, such as psychologists or psychiatrists (De Jongh, Adair & Meijerink-Anderson, 2005).

2.6 IMPLICATIONS OF PREVIOUS RESEARCH FOR THIS STUDY

Dentists perceive treating dentally anxious patients as stressful (Moore & Brødsgaard, 2001; Brahm et al., 2012). When they have information about the patient's anxiety prior to care, the patient's state of anxiety is usually reduced (Dailey, Humphris & Lennon, 2002). However, dentists could utilize this opportunity more often to reduce stress in patients related to dental visits (Dailey, Humphris & Lennon, 2001). Researchers have used the MDAS to evaluate the level of dental anxiety in the patients.

Brief cognitive-behavioural based interventions are suggested to be effective in reducing severe dental anxiety and dental phobia (Kvale, Berggren & Milgrom, 2004; Wide Boman et al., 2013; Kurki et al., 2019), including one-session treatment (Gordon et al., 2013). These interventions usually involve a diagnostic interview prior to exposure to dental treatment (de Jongh et al., 1995; Thom, Sartory & Jöhren, 2000; Jöhren et al., 2007;

Haukebø et al., 2008; Wannemueller et al., 2011; Spindler et al., 2015). A central notion is that previous studies have been conducted in special dental fear clinics in multiprofessional teams consisting of dental professionals and psychologists (Thom, Sartory & Jöhren, 2000; Jöhren et al., 2007; Wannemueller et al., 2011) or dentists specially trained in CBT (Haukebø et al., 2008; Vika et al., 2009). However, these clinics are rare, and effective interventions are also needed in conventional dental care practices to reduce dental anxiety and alleviate anxious behaviour. A brief cognitive-behavioural-based dental anxiety treatment intervention could be conducted by practicing dentists (Armfield & Heaton, 2013) to relieve stress for both them and their patients.

The multidimensional aspects of patients' dental fear in terms of the various components of fear and factors related to anxiety have been covered in dental anxiety questionnaires (Kleinknecht, Klepac & Alexander, 1973; Humphris et al., 2000; Armfield, 2010). However, a better comprehension of patients' views relating to the various aspects of their fear and anxiety could be reached by mapping patient-specific characteristics in a diagnostic interview. According to our knowledge, only one randomized clinical trial, RCT study has utilized the Semi-tructured Fear Assessment Interview (Milgrom, Weinstein & Getz, 2009) prior to exposure to dental treatment (Spindler et al., 2015). In that study, the interview was described as addressing cognitive, interpersonal, and behavioural aspects of the patient's fears, as well as establishing trust between the dentist and patient and instilling a sense of control in the patient. In addition to quantitative approaches also qualitative research methods should be used to gain a more profound understanding of patients' fears.

Psychological dental management techniques have been presented in the literature (Milgrom, Weinstein & Getz, 2009, pp. 169–201), as well as preventive approaches and management of dental anxiety (Willumsen et al., 2022, pp. 179–194). However, the use of these techniques in practice, especially by dentists without formal training in the use of behavioural management techniques, lacks study evidence. Video recordings have been utilized in previous research to examine the use of single techniques

to reduce dental anxiety in patients, such as the provision of information (Astramskaitė, Poškevičius & Juodžbalys, 2016; Sghaireen, 2020) and the use of desensitization (Moore, 1991). Therefore, we need evidence regarding how dental anxiety management techniques are employed by dentists in primary dental care by utilizing video-recorded dental treatment sessions.

3 AIMS OF THE STUDY

The main objective of this study was to investigate the treatment of dental anxiety in primary dental care from three cognitive-behavioural-based perspectives, focusing on a diagnostic interview (DI) and modified one-session treatment (M-OST) in an intervention setting. The two sub-studies were designed to gather a broad range of information concerning factors related to patients' dental anxieties, as well as the strategies used by dentists to alleviate anxiety during dental treatment sessions. The third sub-study was conducted to assess the impacts of two different cognitive-behavioural-based treatments administered by dentists specifically tailored for patients with dental anxiety.

The specific research objectives were to investigate:

1. How patients with dental fear describe and perceive their fear in diagnostic interviews (sub-study I);

2. How clinically experienced dentists (2) utilize dental anxiety management techniques when providing one-session treatment for dentally anxious patients in video-recorded sessions (sub-study II);

3. The effectiveness of a cognitive-behavioural intervention including either a diagnostic interview (DI) before conventional dental treatment or a DI combined with modified one-session treatment (M-OST) for dental anxiety among adults in primary dental care (sub-study III).

4 STUDY DESIGN

4.1 CONTEXT OF THE STUDY: INTERVENTION SETTING FOR DENTALLY ANXIOUS PATIENTS

The intervention, which involved a brief cognitive-behavioural-based treatment for dentally anxious patients, took place between September 2016 and December 2018. The study was conducted at the University of Eastern Finland, involving the Institute of Dentistry and School of Educational Sciences and psychology. The intervention in the study aimed to reduce dental anxiety levels in patients and to change their behaviour.

Data were collected from various dental care offices, including a university teaching clinic, public dental care practices and private dental care practices in two cities in eastern Finland. Dentists' consecutive patients who displayed fear and difficulties coping with conventional dental treatment were invited to participate in the study. The participants were provided with research information sheets and other study documents, and those who gave permission to be contacted were further informed by the researcher (PK). The inclusion criteria for the voluntary participants included being at least 18 years old, requiring dental treatment, exhibiting dentally anxious behaviour, and experiencing problems coping during previous dental treatments. The participants who met the inclusion criteria were assigned to either of the study groups, T1 or T2, based on the order in which they provided written informed consent.

The study aimed to include ten participants in each of the groups: T1, consisting of a diagnostic interview (DI) before conventional dental treatment, and T2, consisting of a DI combined with modified one-session treatment (M-OST). This sample size was determined through a power analysis, considering the desired decrease in the dental anxiety level with a target power of 98%, a confidence level of 0.05% and a standard deviation of 2.8. However, 10 participants (8 females, 1 male, one <18 years old girl) dropped out during the enrolment process. Consequently, the final study sample comprised 19 participants (16 females, 3 males), with a mean age

of 42.4 (SD 12.5, range 22–58) and a mean Modified Dental Anxiety Scale (MDAS) score of 18.84 (SD 3.88). All males scored <19 on MDAS, considered a cut-off of high dental anxiety.

4.2 ETHICAL ASPECTS

Ethical approval for the clinical trial, including the study design and the data-collection procedure, was obtained from the ethical committee of the Hospital District of Northern Savo under registration number 2811/13.02.00/2016. The voluntary participants provided informed written consent before attending the first study appointment. They had permission to withdraw from the study at any stage without giving an explanation. The data obtained before withdrawal could be utilized in the study, because the participants had given permission for this. Data gathered in the study were labelled with the participant's codes and the key was safely saved on a locked memory stick and in a researcher's data storage place at the University of Eastern Finland. The identity of participants was protected in all phases of data processing. The clinical trial was registered in ClinicalTrials.gov with the identification number: NCT02919241 before data gathering.

4.3 CONTENT OF THE INTERVENTION

Before the first study appointment, which included a diagnostic interview (DI) for all participants, the participants were asked to complete dental fear and anxiety scales and a background questionnaire. Those who completed the intervention, including either a DI before the conventional treatment or a DI in combination with modified one-session treatment (M-OST), attended a second interview in which they filled in the same dental fear and anxiety scales. However, four female participants dropped out from the intervention during the treatment, so a total of 15 (12 females, 3 males) participants attended the second interview.

In addition to the interviews, all participants were contacted via telephone to inquire about their dental care visits during a one-year follow-up period (Figure 2).

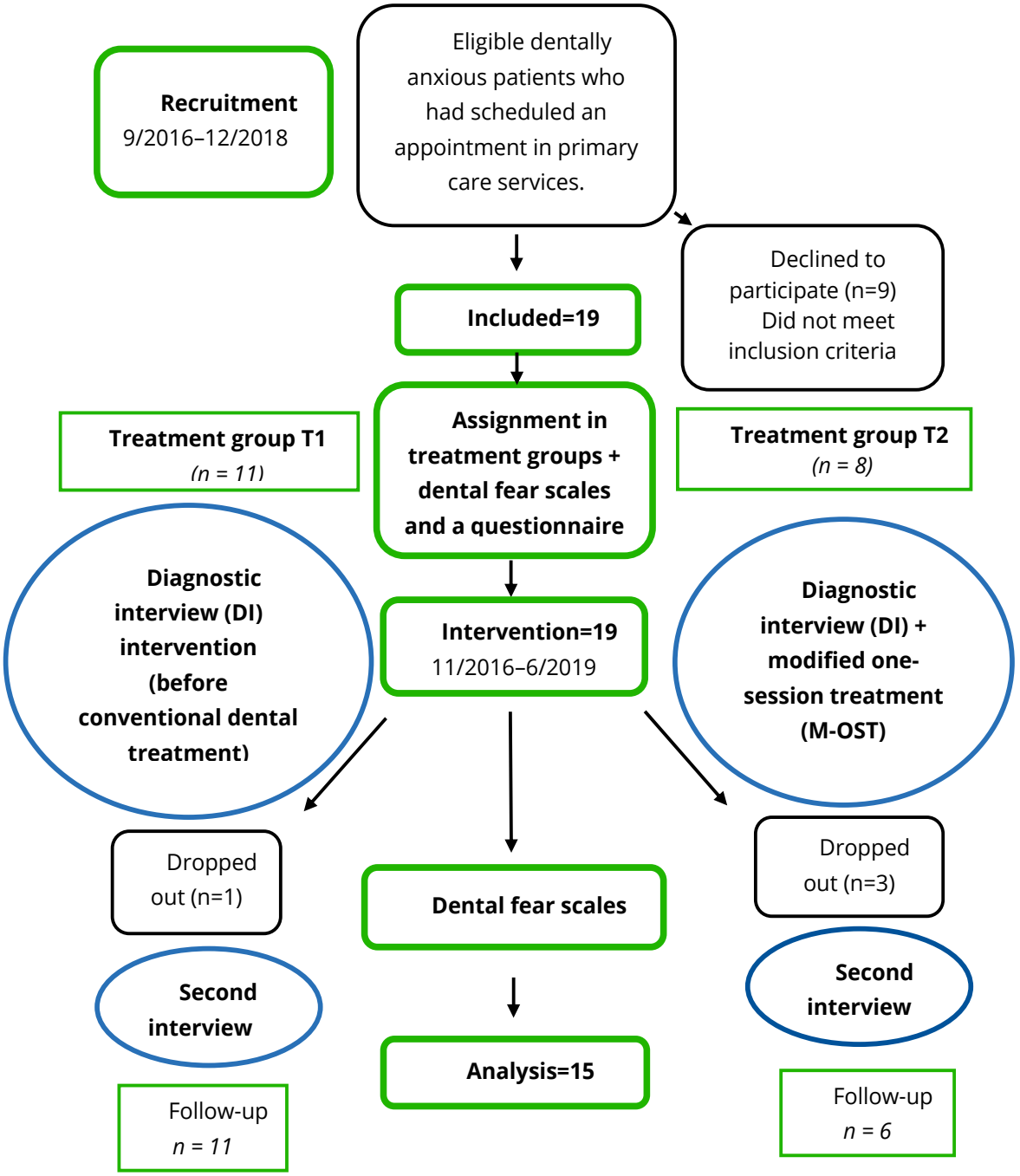


Figure 2. Overview of the study flow.

4.3.1 Diagnostic interview

All participants included in the study (n = 19) attended a diagnostic interview, which was conducted by the researcher (PK) following a specific guide developed for this study. The interviews included the use of a semi-structured fear assessment questionnaire designed by Milgrom, Weinstein and Getz (2009), and a behaviour analysis instrument developed by Öst (2013). **The semi-structured fear assessment questionnaire** that was used as a part of the diagnostic interview consisted of 14 questions (Table 3). The primary objective of the interview was to gain a comprehensive understanding of the participants' level of dental anxiety and related factors. As part of the assessment questionnaires, participants were asked about their dental attendance behaviour, including the reasons behind it, previous experiences with dental visits and the length of time since their last dental visit. The researcher also asked about the coping strategies participants had used in the past and assessed aspects related to their oral health condition. The interview focused on enhancing trust in the participants, and the researcher therefore attentively listened to the participants' responses. When discussing the information provided in the three dental anxiety scales (MDAS, VAS-A, and IDAF-4C^{+}), the researcher paid close attention to the participants' responses and asked them to talk further about their thoughts related to the situations. Additionally, information derived from the IDAF-4C^{+} questionnaire's stimulus module (IDAF-S) and the phobia module (IDAF-P) was considered in the interviews. These included items about the participants' most feared situations or objects, and evaluations of the condition of a possible specific phobia, which were considered when planning suitable psychological coping strategies and treatment options (Table 4 on page 65).

Table 3. The semi-structured fear assessment questionnaire.

Questions
1. How long has it been since your last dental visit?
2. What kind of treatment did you have? How was it? How did it feel?
3. In general, what are the most difficult/fearful things in dentistry for you?
4. What kinds of things, besides dentistry, are you afraid of?
5. How do you cope with other stressful situations?
6. What kinds of things could be done to make receiving dental care easier for you?
7. How do you feel about medical care? Blood draws? Injections?
8. How do you feel the night/morning before a scheduled dental appointment?
9. How likely are you to delay making an appointment because of your feelings of fear and anxiety? How likely are you to cancel an appointment after it has been scheduled?
10. How do you feel about the idea of taking a drug to reduce your anxiety?
11. How do you feel about the appearance of your teeth?
12. In the last two years, has the condition of your teeth caused you to cancel social activities or be absent from work? If yes, how much/how often?
13. Have you ever seriously considered having all your teeth removed and getting dentures?
14. Are your friends or family aware of your fear? If so, how have they reacted to it?

The behavioural analysis instrument, which was also used as a part of the diagnostic interview, consisted of five questions:

1. Is there something that you are not ready to do to get rid of the fear?

2. Imagine what is the worst thing you fear when visiting a dentist, and you cannot leave the situation – describe the situation.

3. What is the worst you can imagine happening in this situation?

4. How convinced are you when you are visiting a dentist that it will lead to the situation you described (0–100 per cent)?

5. How convinced are you now when you are sitting here talking rationally to me about it (0–100 per cent)?

By conducting these diagnostic interviews and utilizing the fear assessment questionnaire and behaviour analysis instrument, detailed information was gathered about the participants' dental anxieties, coping strategies and the specific aspects of dental care that caused most difficulty. This information was used to tailor the subsequent treatment interventions to address the individual needs of each participant.

4.3.2 Modified one-session treatment

In group T2 (n = 7), modified one-session treatment (M-OST) was administered after the diagnostic interview. The M-OST was video-recorded and conducted by one of the two study dentists, both of whom had years of clinical experience. Prior to M-OST, the dentists were provided with a written summary, based on a diagnostic interview, that contained patient-specific information related to their dental anxiety. This information included details such as the level of dental anxiety, the patient's history of dental attendance, previous experiences with dental care (including any negative experiences) and suitable coping strategies. During the M-OST session, the specific needs of each participant were taken into consideration. Depending on these needs, the treatment session involved either an oral examination (n = 5) or restorative dental treatment (n = 2). The principles defined in Öst's (one-session treatment) model, which was originally developed for dental phobia, were applied during the M-OST. These principles focused on building trust, examining, and challenging negative thoughts and gradually exposing the participants to the most anxiety-inducing stimuli. Before conducting the M-OST, the researcher (PK) gave the dentists a brief orientation on the main steps involved in the OST technique. This ensured that they were familiar with the approach. Throughout the M-OST session, the dentists collaborated with the patients, taking into consideration their wishes and needs. They employed various techniques for managing dental fear and anxiety, which

are described in the literature (Milgrom, Weinstein & Getz, 2009, pp. 143–209; Armfield & Heaton, 2013).
By conducting M-OST, the researchers aimed to provide a focused dental anxiety treatment session tailored to each participant's situation. The dentists utilized established principles and techniques for addressing dental fear and anxiety, aiming to alleviate the participants' anxiety and enhance their positive dental experience.

4.3.3 The second interview

The participants who completed the intervention, 15 individuals out of 19, were invited to respond to five qualitative interview questions during the second interview. These interview questions were specifically developed for this study and aimed to gather detailed information and insights from the participants regarding their experience of the intervention. The questions were as follows: "Did the intervention help you?" "What was its significance to you?" "What helped you most in this treatment?" "What helped you next most?" and "What else besides your dental fear have you learned about here?" By including these qualitative interview questions, the study aimed to supplement the quantitative data obtained from the scales and provide a deeper understanding of the participants' subjective experiences, perspectives, and the specific aspects of the intervention that they perceived as the most helpful for them.

4.3.4 Assessment of dental anxiety

The study aimed to assess changes in the severity of dental anxiety before and after a dental anxiety treatment. To measure dental anxiety, the researchers used three scales: the Modified Dental Anxiety Scale (MDAS) (Humphris, Morrison & Lindsay, 1995; Humphris et al., 2013), the Index of Dental Anxiety and Fear (IDAF-4C$^{+)}$ (Armfield, 2010; Armfield, 2011) and the Visual Analogue Scale for dental anxiety (VAS-A) (Luyk, Beck & Weaver, 1988; Facco et al., 2011). The Finnish versions of these scales, which were translated and validated by Humphris et al. in 2000 and Tolvanen et al. in 2017, were used in this study. The scales were administered at two time

points: at baseline (before the intervention) and after the completion of the dental anxiety treatment.

MDAS: The MDAS measures the imagined emotional reactions towards dental situations using a five-point Likert-type scale ranging from “not anxious” to “extremely anxious” (Humphris, Morrison & Lindsay, 1995). It consists of five items that assess the anticipatory feelings of dental anxiety related to dental treatment, being in the waiting room, tooth drilling, teeth scaling and polishing, and receiving a local anaesthetic injection in the gum above an upper back tooth. The scores for the items are summed, resulting in a total score ranging from 5 to 25. A cut-off score of 19 or above is considered indicative of high dental anxiety or possibly dental phobia (Humphris et al., 2000; Humphris, Dyer & Robinson, 2009).

https://www.standrews.ac.uk/dentalanxiety/scaletranslations/:

IDAF-4C: The Index of Dental Anxiety and Fear (IDAF-4C) assesses the emotional, behavioural, physiological and cognitive components of anxiety and fear (Armfield, 2010). It consists of eight statements that participants respond to on a five-point Likert-type scale ranging from “disagree” to “strongly agree”. The average score of the items is calculated, with a range of 1 to 5. An average score of 2.5–3.5 or above is considered indicative of high dental anxiety (Armfield, 2011; Tolvanen et al., 2017). The statements cover physiological components (e.g., feeling anxious shortly before going to the dentist, a faster heart rate), behavioural components (e.g., delaying appointments, avoiding dental visits), cognitive components (e.g., anticipating something bad happening, negative thoughts) and emotional components (e.g., feeling nervous, afraid).

VAS-A: The Visual Analogue Scale for dental anxiety (VAS-A) is a simple rating scale where participants mark their level of dental anxiety on a line measuring 100 mm in length. The left extreme represents “not at all anxious”, while the right extreme represents “very anxious” (Luyk, Beck & Weaver, 1988; Facco et al., 2011).

By using these scales, the researchers aimed to gather data on the severity of dental anxiety before and after the intervention, providing insights into the effectiveness of the treatment in reducing dental anxiety levels.

4.3.5 Questionnaire recording other baseline information

A questionnaire was used to collect additional baseline information from the participants, including their sociodemographic characteristics, self-reported oral health and use of oral health services. The sociodemographic variables assessed included age, gender, level of education (categorized as education after primary school vs. primary school education only) and employment status (categorized as full-time employment vs. other options). Self-reported oral health and the use of oral health services were assessed through specific questions. Participants were asked to rate their subjective oral health as good, moderate, or poor. They were also asked about any oral health problems they experienced in the previous 12 months, such as toothache or other issues related to their teeth or dentures. The utilization of oral health services was evaluated based on the regularity of dental attendance, categorized as regular if the participant had visited the dentist within the past 2 years, and irregular dental attendance, defined as symptom-oriented dental visits. Other specific information related to participants' general health records were not enquired for this study. However, the dentists who conducted the patients' dental treatment had this information.

During the diagnostic interviews, information about the participants' onset of dental fear and dental visiting pattern was obtained. This information, along with the scores and other data derived from the three self-reported dental fear and anxiety scales (VAS-A; MDAS; IDAF-4C^{+}) at baseline, is summarized and presented in Table 4.

Table 4. Characteristics of the study participants at baseline in both study groups: T1 = a diagnostic interview (DI) and T2 = diagnostic interview + modified one-session treatment (DI + M-OST).

	Group	
Variable	**T1** **n = 11**	**T2** **n = 8**
Onset of dental fear*: number of participants n	Childhood: 8 Early adulthood: 2 All lifetime: 1	Childhood: 7 Early adulthood: 1
Dental visit pattern**: n	Regular: 7 Irregular: 4	Regular: 1 Irregular: 7
VAS-A score, mean (SD)	4.7 (1.0)	6.1 (2.0)
MDAS score, mean (SD)	19.0 (3.9)	19.9 (3.9)
IDAF-4C score, mean (SD)	3.5 (0.8)	4.1 (0.7)
The phobia module of IDAF-4C+	Specific phobia: 4 Fear of panic attack: 6 Social phobia: 3	Specific phobia: 6 Fear of panic attack: 3 Social phobia: 4
The stimulus module of IDAF-4C+	1. Painful or uncomfortable procedures: 10 2. Feeling embarrassed or ashamed: 3 3. Not in control of what is happening: 7 4. Feeling sick, queasy, or disgusted: 3 5. Numbness caused by the anaesthetic: 2 6. Not knowing what the dentist is going to do: 5 7. The cost of dental treatment: 1 8. Needles or injections: 6 9. Gagging or choking: 8 10. Having an unsympathetic or unkind dentist: 6	1. Painful or uncomfortable procedures: 8 2. Feeling embarrassed or ashamed: 4 3. Not in control of what is happening: 6 4. Feeling sick, queasy, or disgusted: 5 5. Numbness caused by the anaesthetic: 1 6. Not knowing what the dentist is going to do: 4 7. The cost of dental treatment: 3 8. Needles or injections: 5 9. Gagging or choking: 3 10. Having an unsympathetic or unkind dentist: 3

Abbreviation: SD, standard deviation; VAS-A, Visual Analogue Scale-Anxiety; MDAS, Modified Dental Anxiety Scale; IDAF-4C, Index of Dental Anxiety and Fear

*Definition on onset of dental fear: childhood <12 years; adolescence <18 years; early adulthood <30years

**Definition of dental visit pattern: regularly for inspection; irregularly when symptoms

***The stimulus module (IDAF-4C): four or five points on a Likert scale ranging from 1 to 5

4.4 DATA AND METHODS OF THE STUDY

The overall study consisted of three sub-studies: Study I, Study II, and Study III. These studies utilized the same data collected during an intervention study and employed a combination of qualitative and quantitative methods for data collection and analysis.

4.4.1 Study I

In study I, the aim was to understand patients' perceptions of their dental fear. The data consisted of audio-recorded diagnostic interviews with seven participants. The qualitative analysis of the interview data was conducted using theory-driven content analysis (Marks & Yardley, 2004) and *Atlas.ti 8* software. The analysis focused on identifying the participants' descriptions of their dental fear, using the four components of dental fear (i.e., emotional, behavioural, cognitional, and physiological) as broad themes. In the first phase, the data-driven thematic analysis was conducted, and emergent themes were mapped according to the four components. The initial coding frame was organized after identifying all meanings; codes related to emotions, behavioural strategies, cognitions regarding dental fear and physiological reactions. After categorizing all the participants' descriptions of their dental fear under the four large themes, the detailed contents (what the fear is about) and contexts (what situations or events the fear is associated with) were identified. In the second phase, the codes were reorganized and labelled in the coding frame. Thereafter, in the last phase, the additional subcategories and categories were identified. The analysis aimed to find similarities and differences in how the

fear was described by the participants, resulting in the identification of 27 categories and 69 subcategories related to the central characteristics of patients' fear.

4.4.2 Study II

Study II focused on the identification of dental anxiety management techniques used by dentists. The data included video-recorded modified one-session treatment with five patients. Qualitative analysis was conducted using theory-driven qualitative content analysis (Marks & Yardley, 2004) and *Atlas.ti 9* software. The analysis aimed to study dentists' actions during treatment to understand their use of techniques in various treatment situations. Eight initial coding categories related to behavioural and cognitive techniques (Milgrom, Weinstein & Getz, 2009; Armfield & Heaton, 2013) were used, and the final classification of techniques was drawn from a theory-based classification by Milgrom (Milgrom, Weinstein & Getz, 2009, pp. 143–209). All episodes from five patients' treatment sessions were organized according to this classification involving the main themes: 'enhancing trust and control' and 'the physiological management of dental anxiety', and the categorization of the specific techniques. The analysis resulted in the description of dental anxiety management techniques and their characteristics used in the context of one-session treatment.

4.4.3 Study III

In Study III, the aim was to assess the effectiveness of a diagnostic interview alone or a diagnostic interview combined with one-session treatment. The data comprised three dental anxiety scales, a background questionnaire and audio-recorded second interviews. Statistical methods such as chi-squared tests, *t*-tests and regression analysis were used to analyse the quantitative data. Descriptive content analysis was used for qualitative data analysis.

The main outcome of the clinical trial was evaluated by measuring the change in the severity of dental anxiety using three self-reported dental

anxiety scales: MDAS, IDAF-4C and VAS. Differences in means and distributions were examined between or within the two treatment groups (T1 and T2), as well as in total when the groups were combined. The independent samples *t*-test was used to analyse differences between the two groups (T1 and T2), and the paired-samples *t*-test was used to analyse differences in combined groups. The proportions of participants with high dental anxiety before and after the intervention was evaluated by using cut-off scores of the MDAS and IDAF-4C adopted from previous studies. Linear regression analyses were used to evaluate the association of the study group with the post-treatment anxiety scores (measured by the MDAS or IDAF-4C) adjusted for age, gender, pre-treatment dental anxiety scores, symptom-oriented dental visits, and subjective oral health. The effect sizes (ESs) of the two interventions were calculated using Cohen's *d.*

Sociodemographic variables and other relevant factors were used as covariates in analyses. Differences in means, and the distributions between or within the two groups (T1 and T2) in baseline sociodemographic variables, self-reported oral health and the use of oral health services were examined using the independent-samples *t*-test for normally distributed continuous variables and the chi-squared test for categorical variables. The difference between the groups was considered significant when the *p*-value was <0.05. All statistical tests were performed with the SPSS Statistics 27.0 for Windows.

Participants' perceptions of the benefits of the interventions were categorized into primary topics and summarized.

Table 5 provides a summary of the subjects involved in each sub-study and the corresponding methods used for data collection and analysis, including the types of data collected, the aims of the studies and the specific qualitative and quantitative methods employed.

Table 5. Summary of the subjects and methods used.

Data	Focus of the study	Data collection	Data analysis
2016–2018 Audio-recorded diagnostic interviews (n = 7) (Study I)	Patients' perceptions of their dental fear in diagnostic interviews	Semi-structured interview, behavioural instrument	Qualitative: Theory-driven content analysis
2016–2019 Video-recorded modified one-session treatments (n = 5) (Study II)	Identification of the dental anxiety management techniques employed by dentists	Modified one-session dental treatment	Qualitative: Theory-driven content analysis
2016–2019 (n = 16 females, 3 males) Audio-recorded post-treatment interviews (n = 12 females, 3 males). (Study III)	Effectiveness of a diagnostic interview or a diagnostic interview + one-session treatment	Background questionnaire, three dental anxiety scales, interview	Statistical methods: chi-squared tests, *t*-tests, regression analysis Qualitative: descriptive content analysis

5 RESULTS

5.1 PATIENTS' MULTIFACETED VIEWS OF DENTAL FEAR IN A DIAGNOSTIC INTERVIEW (STUDY I)

In the diagnostic interviews, the participants described their dental fear (DF) in terms of emotional, behavioural, cognitive, and physiological aspects. These four aspects were diversely found in the participants' views. The descriptions of DF encompassed three contexts: before, during and after dental treatment. All four components (emotional, behavioural, cognitive and physiological) were presented within these three identified contexts, as depicted in Figures 3, 4 and 5. Within the four components, various categories of DF were identified, representing different intensities of emotions, behavioural adaptations, cognitions and physiological reactions.

Before dental treatment (see Figure 3), participants' fears were activated, leading to increased anxiety and conflicting behaviours regarding participating in dental care. The participants reported using self-soothing talk as a coping strategy. A lack of confidence was evident before treatment, reflecting the participants' cognitions. There was also an increase in physiological reactions that affected their daily life and activities.

The contents of difficult emotions reflected various facets. Often, the content of the fear was clear, but sometimes it remained undefined before dental treatment. Typically, the current fears related to past treatment experiences. Self-coping behavioural strategies included several examples, such as avoidance and exposure behaviours, the use of medicines or harmful substances to control the fear and the use of self-help and other means to alleviate the fear. The utilization of various strategies was common and related to the upcoming dental appointment. Disturbing physiological reactions were characterized by difficulties in sleeping, clear physiological reactions and restlessness. These reactions often had an

impact on daily functioning, occurring days or even weeks before an appointment. Cognitions reflected origins of fear from multiple aspects.

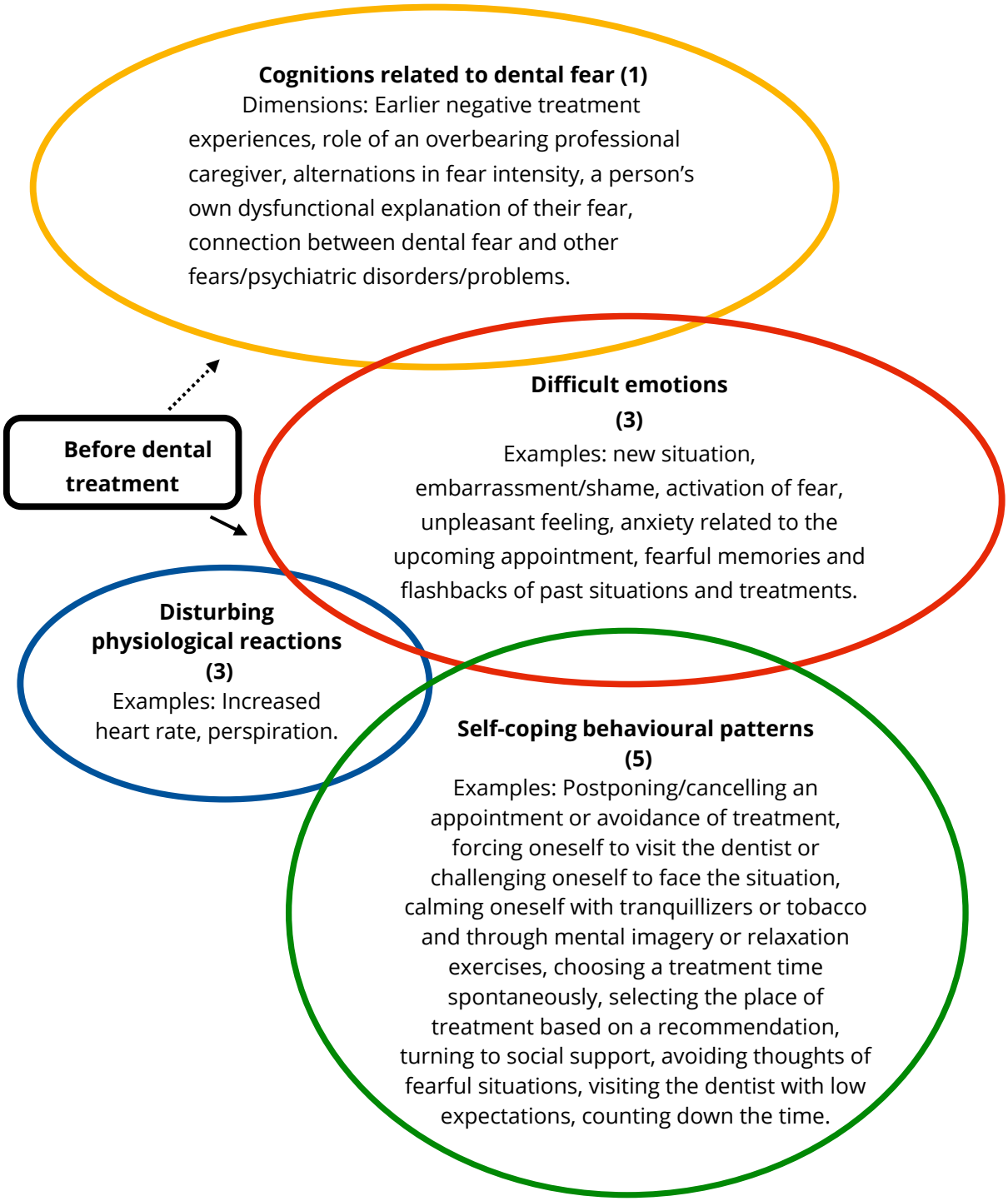


Figure 3. Components, contents and numbers of additional categories and examples of sub-categories and dimensions related to dental fear according to the context, before dental treatment.

During dental treatment (see Figure 4), participants devised ways to cope with their sensations, despite experiencing intense emotions and tough physiological reactions. The challenging treatment situation forced them to utilize behavioural coping strategies. Participants were aware of factors that alleviated their fear based on their cognitions, although controlling their reactions was difficult.

The contents of uncontrollable emotions reflected a variety of fears related to fear of an extreme reaction, fear of failure in a technical procedure and fear related to the dentist's behaviour. Examples of fears related to various objects and uncertainty were common for different reasons, in addition to recollection of past treatment situations during dental procedures.

Behavioural coping strategies reflected two conflicting patterns, involving both active and passive actions and a tendency to either manage on one's own or seek support from caregivers. The examples of these related to numerous actions and methods to navigate through the challenging dental treatment procedures. Strong physiological reactions related to panic and anxiety symptoms. The examples included extremely strong reactions and difficulties coping with dental treatment situations.

Cognitions reflected fear-alleviating factors related to a caring and reassuring caregiver, the overall atmosphere in the situation, the use of various dental anxiety management techniques, the impact of regular dental visits and individual actions.

Figure 4. Components and contents and numbers of the additional categories and examples of sub-categories or dimensions of dental fear according to the context, during dental treatment.

After dental treatment (see Figure 5), the participants still had uncertainty regarding coping with their disturbing feelings. They reported finding only a few helpful means of coping. Their post-treatment cognitions reflected unresolved problems and questions related to dental care and treatment needs. However, stress symptoms and intense sensations decreased, and the participants noted a calming of physiological reactions after the dental visits.

The contents of ambivalent emotions reflected confusion regarding the treatment session. This related to unclear reactions, a difference in opinion regarding treatment plans, uncertainty about the reasons for treatment and negative memories. Behavioural means of coping included examples of actions such as rewarding oneself and becoming passive. Long-lasting physiological reactions were characterized by the subsequent calming of physiological reactions. Cognitions reflected negative/fear-provoking factors.

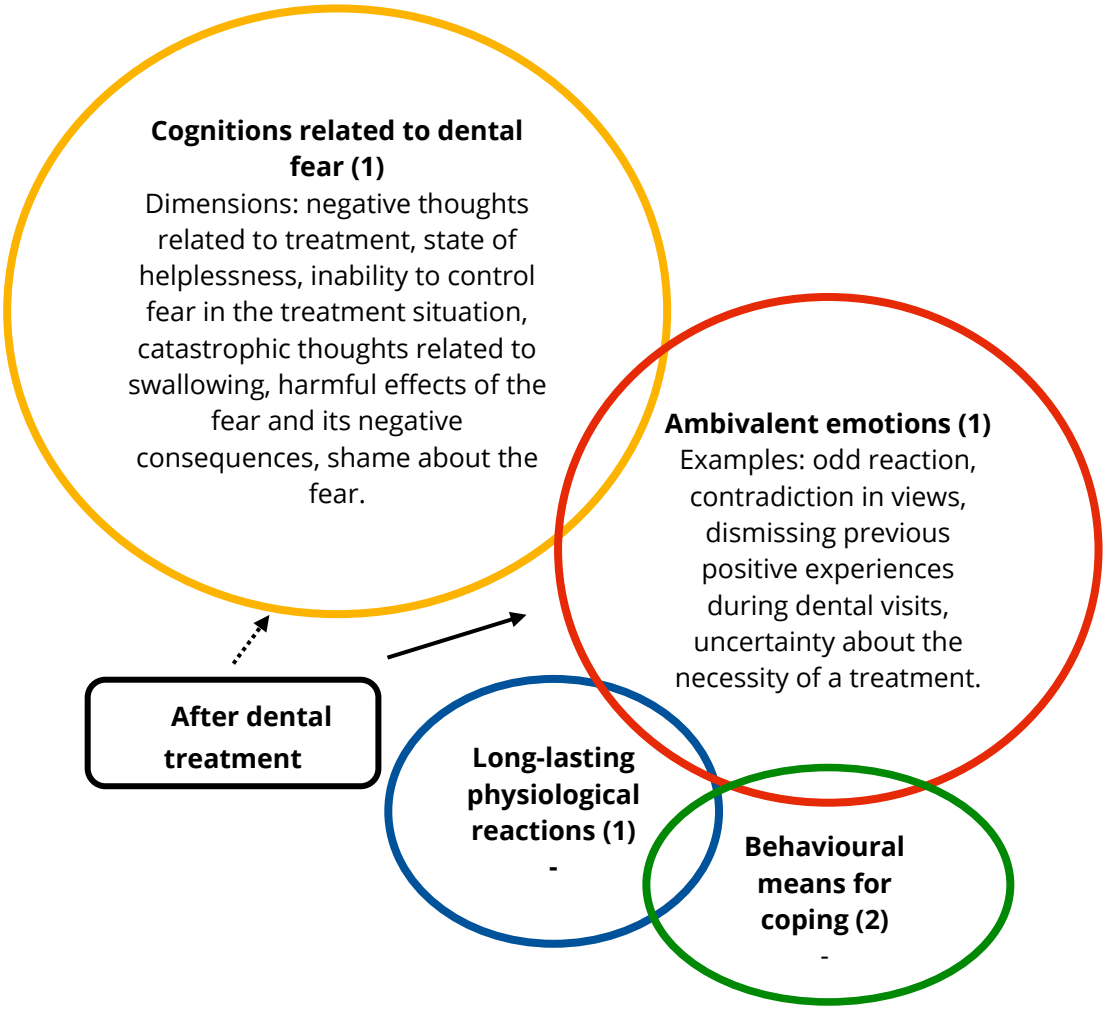


Figure 5. Components, contents and numbers of additional categories, and examples of sub-categories or dimensions of dental fear according to the context, after dental treatment.

In summary, the results highlight the diverse nature of dental fear and the various emotional, behavioural, cognitive and physiological aspects of it that the patients experienced before, during and after dental treatment. The results further reveal that each of these components maintains its distinctiveness when examined through the lens of patients' individual perceptions in the frame of a diagnostic interview. Quotations related to patients' talk can be found in the original publication (Study I).

5.2 DENTISTS' USE OF DENTAL ANXIETY MANAGEMENT TECHNIQUES (STUDY II)

The analysis of video-recorded treatments revealed a wide spectrum of dental anxiety management techniques used by the dentists, often simultaneously integrated within one-session treatment. Tables 6 and 7 present a description of fear and anxiety management strategies, offering examples of technique use based on the anxiety management classification established by Milgrom et al. The techniques described in this model are included the thematic subjects of either foundation of psychological management and specific strategies to enhance trust and control, or psychological management strategies. They are targeted building a trustful relationship and increasing control, in addition to inducing physical relaxation of the body and cognitive relaxation of the mind (see Table 2 on page 46).

The use of techniques predominantly related to specific strategies to enhance trust and control, as outlined in Table 6. Specific techniques for building a trustful relationship involved such actions as building rapport, encouraging two-way communication, expressing concern, demonstrating competence and ethics, and including significant others. Techniques for providing informational control included conveying information about the procedure in lay terms, addressing safety and comfort, employing telling-showing-doing and structuring the treatment time. Furthermore, the techniques for providing behavioural control encompassed actions such as agreeing with signaling, planning rest breaks and using behavioral strategies to control injection pain.

Overall, the dentists consistently and frequently used a variety of specific techniques to enhance trust and control. They demonstrated adaptability throughout the treatment, taking into account the patients' individual anxiety levels, patient-specific needs and oral health conditions by adopting different techniques accordingly. During challenging situations for the patients, certain techniques were combined. Despite potential interruptions, the treatment proceeded smoothly, and the use of techniques was flexible.

Table 6. Description of theme 1, including the categories of techniques and examples of their use during one-session treatment.

Theme 1: The foundation of psychological management: Specific strategies to enhance trust and control		
Building a trustful relationship **Examples:** Dentist (D): 'How does it feel to come here today for treatment?' 'How's it going?' 'Are you still okay?' 'Is it okay if you lay down or would you prefer a half-sitting position?' 'Are any of your teeth especially sensitive to cold?' 'I'll do it very carefully' 'This tooth in the upper left moves slightly, can you feel it with your tongue?'	**Providing control: informational control** **Examples:** D: 'Let's see if there is any tartar or gingival pockets' 'I'll check the upper teeth with a light' 'I'll check the gumline now with this ball-headed instrument [shows the instrument]' 'It's not sharp' 'And while I check them, I will list things and talk to the nurse about them, but it doesn't mean that there's something dangerous or wrong' 'You can feel slight scraping' I will now dry and look with the lamp like this, which will be put beside the tooth ' 'You can swallow in just a moment'.	**Providing control: behavioral control** **Examples:** D: 'And you don't have to keep your mouth open the whole time' 'Do you want that we use a topical anesthesia first to numb the mucous membrane?'.

Additionally, the use of techniques extended to specific strategies of psychological management, as outlined in Table 7. The categories of techniques related to both behavioural and cognitive strategies aimed at relaxing the patients' body and mind. Behavioural strategies included specific techniques such as relaxation breathing and muscle relaxation,

while cognitive strategies involved techniques like altering expectations: redefining success and offering praise, altering expectations: redefining the experience, distraction, and focusing attention. These techniques were regularly implemented during treatment.

Overall, the dentists used these techniques particularly in situations that triggered strong anxiety or led to changes in breathing or muscular tension. They closely monitored and responded to the patients' fearful reactions during the treatment, using the techniques to assist patients in coping with their emotional responses.

Table 7. Description of theme 2, including the categories of techniques and examples of their use during one-session treatment.

Theme 2: Psychological management	
Behavioural strategies: relaxing the body **Examples:** Dentist (D): 'Really focus on that, we will do the rest and you just remember to keep breathing' 'Just normal regular breathing, and now, if you can, you can try those things that you have learned with X about relaxing [in the diagnostic interview]'.	**Cognitive strategies: relaxing the mind** **Examples:** D: 'You have done well, really well [encouraging, supportive tone]' ' now bite your teeth gently together please, good, well done, keep breathing slowly through your nose, good, then you can swallow' 'You have so many good teeth' 'And now our goal is to try and change your mind set about the anesthetic not working' 'Lets' take our time and wait until it numbs thoroughly' 'That's Finnish schlager music, do you like it? 'The sounds are so beautiful'.

In summary, the study highlighted the use of techniques in a versatile and personalized manner. These techniques were tailored for each patient, addressing their individual needs, and they were adapted according to the level of anxiety, particularly in the most challenging situations for the patient. The dentists prioritized building trust and providing informational

and behavioural control. In addition, they used psychological management strategies to induce relaxation in the patients' body and mind. Open communication and attentiveness to the patients' anxiety were also emphasized throughout the treatment process. More examples of the dentists' use of techniques can be found in the original article (Study II).

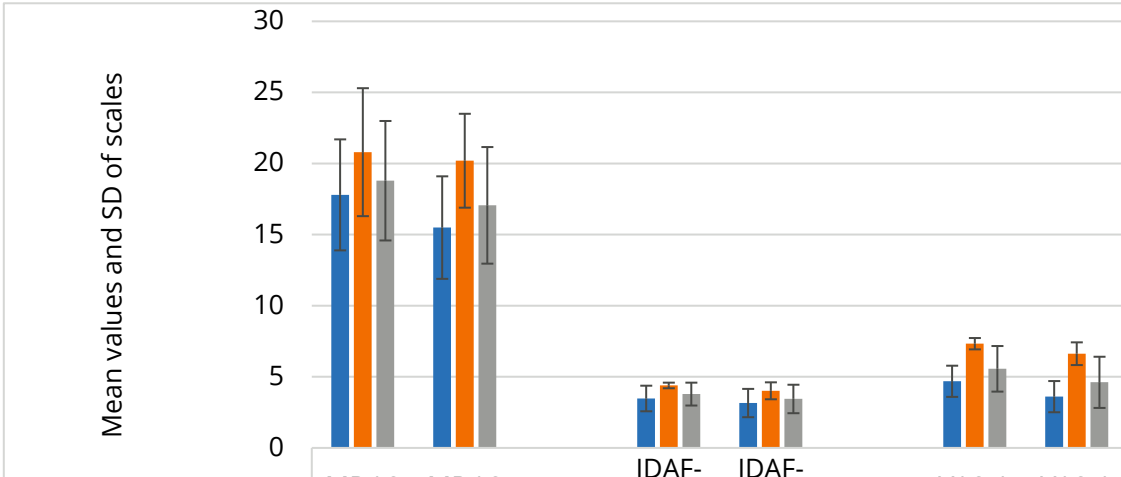
5.3 THE EFFECTIVENESS OF A DIAGNOSTIC INTERVIEW AND MODIFIED ONE-SESSION TREATMENT (STUDY III)

In study III, the effectiveness of a diagnostic interview alone (T1) or a diagnostic interview combined with modified one-session treatment (T2) was examined. At baseline, the participants in the two study groups (T1 and T2) differed only in terms of their subjective oral health. The participants in group T2 reported poorer subjective oral health compared to those in group T1 ($p < .05$). Most participants ($n = 12$) reported moderate to poor subjective oral health, and nearly all participants ($n = 16$) had experienced toothache or other dental problems in the previous 12 months. Eleven reported symptom-oriented dental visits, while only one had visited the dentist more than two years previously.

The results of the study indicated that dental anxiety decreased in both treatment groups (T1 and T2) as measured by three dental anxiety questionnaires: the MDAS, IDAF-4C and VAS-A (Figure 6). The largest decrease in dental anxiety was recorded among participants in group T1 when assessed using the VAS-A scale. Additionally, the effect size of the intervention was larger in group T1 compared to group T2, as indicated by the MDAS and VAS-A scales. Severe dental anxiety also significantly decreased in both treatment groups (T1 and T2) after the intervention, as measured by the MDAS and IDAF-4C scales. The main result in linear regression analysis was that a high severity of dental anxiety at baseline was the most significant factor predicting a high severity of dental anxiety after the intervention, based on the IDAF-4C. The participants' age, gender, severity of dental anxiety before the intervention, group, dental visit pattern, and subjective oral health were adjusted for in the model. Moreover, the participants regarded several aspects of the intervention

helpful for them. These involved an enhanced understanding of their fears, the acquisition of valuable insights for managing dental treatment, and a reduction in fear levels. The beneficial elements of the intervention encompassed the strengthening of trust, the development of practical coping strategies, the opportunity to openly discuss their fears, and the learning of breathing techniques.

For further details, please refer to the original publication (Study III), including Tables 2 and 3 and Figure 2.



	MDAS score before	MDAS score after	IDAF-4C score before	IDAF-4C score after	VAS-A score before	VAS-A score after
Group 1 Mean (SD)	17,8(3,9)	15,5(3,6)	3,48(0,9)	3,16(1,0)	4,69(1,1)	3,61(1,1)
Group 2 Mean (SD)	20,8(4,5)	20,2(3,3)	4,4(0,2)	4,02(0,6)	7,33(0,4)	6,63(0,8)
Total Mean (SD)	18,8(4,2)	17,06(4,1)	3,79(0,8)	3,45(1,0)	5,57(1,6)	4,62(1,8)

Scales: Modified Dental Anxiety Scale (MDAS); Index of Anxiety and Fear (IDAF-4C); Visual Analogue Scale - Anxiety (VAS-A)

Figure 6. Severity of dental anxiety in participants according to mean scores and standard deviations (SDs) for the three dental anxiety scales before and after the intervention in study groups T1 (diagnostic interview (DI)) and T2 (diagnostic interview + modified one-session treatment (DI + M-OST)).

6 DISCUSSION

6.1 SUMMARY OF THE FINDINGS

This multi-method study, centred on a DI and M-OST for dental anxiety, revealed the diversity of the most essential components in patients' fears and the techniques used by dentists, as well as the fear-alleviating impacts within brief cognitive-behavioural treatments. The two studies demonstrated in detail that dentally anxious patients were capable of versatilely describing their dental fears during diagnostic interviews, and the dentists used various dental anxiety management techniques in a flexible and personalized manner during treatment sessions. Additionally, the third study provided promising evidence for the usefulness and effectiveness of brief cognitive-behavioural-based treatment in alleviating dental anxiety in primary health care. This positive outcome applied to both participants who received a diagnostic interview alone and those who received a DI in combination with M-OST. The diagnostic interviews revealed various aspects of patients' dental anxieties, including their behaviour regarding dental attendance, visiting patterns, previous treatment experiences, as well as their most feared situations and objects. However, only the baseline severity of dental anxiety predicted the severity of dental anxiety after the treatment when other factors, including age, gender, treatment group, visiting pattern and oral health condition, were controlled for. Video-recorded M-OST sessions disclosed the use of a wide range of anxiety management techniques by the experienced dentists. These techniques typically focused on building trust and enhancing informational and behavioural control throughout the treatment sessions. Psychological management techniques were also used to promote physical relaxation of the body and cognitive control of the mind, with techniques such as encouragement and distraction primarily used during the most challenging situations for the patients. The patients' increased understanding of their fears, along with the dentists' use of techniques

adapted to individual situations, contributed to creating a positive treatment experience. The patients benefited from the treatment, as evidenced by their self-reported experience and a decrease in their levels of dental anxiety, which was shown in the intervention.

Patients' descriptions and perceptions of their dental fear in diagnostic interviews

The first sub-study (Study I) provided evidence highlighting the multifaceted nature of patients' fears, often rooted in their past experiences, within the frame of diagnostic interviews. Improved understanding of patients' fear-related factors was achieved through the employment of diverse tools during interviews, including dental anxiety and semi-structured fear assessment questionnaires, along with behavioural analysis. Notably, the study's findings demonstrated the willingness of patients to talk about their encounters with challenging and intense emotions, as well as physiological responses related to three contexts: before, during and after dental treatments. A previous study (Bernson et al., 2011) illustrated that through trustful relationships and a strong alliance, patients openly discussed their fears, facilitating effective cooperation between dental staff and patients during treatment. Additionally, the findings in this study shed light on patients' experiences of helpful coping strategies and struggles associated with conflicting behaviours in attending dental appointments, along with their pronounced physiological reactions before and during dental treatment. Notably, some of the self-aid methods were unhealthy and there was limited mention of beneficial strategies after a dental visit.

The findings of Study I demonstrated the significance of appropriately employing diagnostic tools for assessing dental anxiety, considering a broad spectrum of components and contexts. This has been stated to be key to the successful management of patients with dental anxiety (Bürklein et al., 2021). In the current study, the opportunity to discuss fears and past experiences with a dentist probably contributed to cognitive and behavioural change by enhancing self-reliance. This interpretation aligns with Bandura's theory, which posits that psychological processes offer the

potential to influence cognitions and initiate coping behaviours (Bandura, 1999). Overall, a diagnostic interview has the potential to strengthen relations and teamwork between dental professionals and patients, fostering positive behavioural alterations.

The dentists' use of dental anxiety management techniques during treatment sessions

Based on the second sub-study (Study II), the two dentists successfully used various dental anxiety management techniques to reduce patients' dental anxieties during treatment sessions. This was possible after receiving relevant information on the patients' fears and the principles of one-session treatment. The findings demonstrated the skilfulness of the dentists in building a trustful relationship, providing informational and behavioural control, and using appropriate strategies for behavioural and cognitive anxiety management. This provides support for the anxiety management model presented by Milgrom et al. (2009, pp. 145–152). The dentists tailored their use of techniques based on individual patient anxiety levels, needs and preferences during treatment procedures in this study. The significance of adopting a patient-centred approach has been recognized in the literature, resulting in positive treatment outcomes (Alrawiai, Asimakopoulou & Scambler, 2021). According to a literature review, patient-centred care in dentistry involves a combination of holistic and humanitarian elements, along with good communication and the provision of information to facilitate informed decision-making (Scambler, Delgado & Asimakopoulou, 2016).

Furthermore, Study II presented evidence of patients' responsibility in expressing their preferences for the use of coping strategies during treatment. According to a previous study, encouraging patients to use self-help techniques is crucial for anxiety management (Biggs, Kelly & Toney, 2003). The current study also demonstrated the utilization of psychological management techniques by dentists to reduce anxiety in the patients, especially in challenging situations. This approach aligns with the concept of the 'window of tolerance', as described in the literature (Ogden & Minton, 2000), which suggests that individuals feel safe within an optimal

zone where they can respond appropriately. By addressing the patients' pain-related reactions, the dentists probably minimized discomfort during dental procedures in this study. Previous research has also indicated that painful, frightening and embarrassing treatment experiences often contribute to dental anxiety (Locker, Shapiro & Liddell, 1996). Based on the study findings, patients can benefit from new, painless and fear-sensitive dental treatment experiences. This is particularly important, as the fear of pain and heightened pain sensitivity are critical components of dental fear, and can be associated with heredity (Vassend, Røysamb & Nielsen, 2011; Randall et al., 2017).

In summary, the findings from Study II offer evidence that dentists actively supported the patients by using versatile anxiety management techniques during treatments. These techniques were centred on building a trustful relationship, increasing control and inducing both physical and cognitive relaxation. However, the study revealed the limited use of retrospective control or debriefing, as well as relaxation techniques, such as breathing exercises, muscle relaxation and physiological monitoring via biofeedback. Based on the descriptions, some techniques were almost entirely absent, including psychoeducation, guided imagery and thought stopping, as the study focused on methods applicable during single-session treatments without additional training. Interestingly, new methods such as virtual reality relaxation (Lahti et al., 2020) and computer-based exposure with cognitive restructuring (Tellez et al., 2015) have also proven effective in reducing dental anxiety according to study reports.

Effectiveness of a brief cognitive-behavioural-based treatment for dental anxiety

The findings from the third sub-study (Study III) provide preliminary evidence for the effectiveness of the two brief cognitive-behavioural-based treatment modifications. The diagnostic interview alone and combined with one-session treatment resulted in a decrease in dental anxiety levels in the patients after treatment, usually leading to better dental treatment attendance. This was confirmed in one-year follow-ups in this study. The findings also revealed that, in some cases, the dental anxiety levels in the

patients remained the same or even increased, possibly linked to their initially elevated and underestimated or distorted levels of anxiety. Dental anxiety has previously been shown to increase more often than decrease in a brief time period after childbirth, although for the majority, it remains stable (Hagqvist et al., 2020). Thus, in the current study, the fluctuation of anxiety levels may also be related to stressful events. Nevertheless, the patients generally reported subjective benefits from the treatment, despite having high or moderate dental anxiety in this study. According to the literature, brief dental anxiety treatment has the potential to address and modify catastrophic thoughts, especially when patients are exposed to frightening stimuli (Willumsen et al., 2022, pp. 186–188).

During the one-year follow-up period in this study, 74% of the patients visited a dentist. However, changing avoidance behaviour and breaking the vicious circle of dental anxiety can be particularly challenging, especially for patients with a long history of irregular dental care visits and high anxiety levels, as indicated in a previous study (Gatchel, 1986). Additionally, the duration of avoidance and dental anxiety are associated, with longer avoidance periods correlating with higher levels of dental anxiety (Armfield, 2013; Liinavuori et al., 2019). Building on an earlier study finding (De Jongh, Schutjes & Aartman, 2011), brief cognitive-behavioural treatment should specifically target patients with high and moderate levels of dental anxiety to disrupt the avoidance pattern and prevent further escalation of anxiety. Another study provided evidence for the positive impact of dental fear treatment in children on later care and regular dental attendance (Kankaala, Kaakinen & Anttonen, 2022).

Overall, both brief cognitive-behavioural-based treatment modifications were beneficial in this research, as they offered the dentally anxious patients positive experiences and new perspectives on dental treatment.

6.2 COMPARISON WITH EARLIER RESEARCH

Diagnostic interview

The study also demonstrated the importance of conducting a thorough assessment of patients' dental anxiety during the diagnostic interview. In

this study, the assessment involved a combination of psychometric measures, an interview questionnaire and behavioural analysis to identify the patients' catastrophic thoughts. The diagnostic interview aligns with the patient-centred dental consultation model, which consists of a structural core framework for a dental consultation (Torper, Ansteinsson & Lundeby, 2019). The aim of the interview was to equip dentists with relevant information that could help alleviate patients' anxieties (Dailey, Humphris & Lennon, 2002) and enable the effective implementation of suitable dental anxiety management strategies (Höglund et al., 2019).

Incorporating an interview alongside various dental anxiety assessment measures had positive impacts on the levels of anxiety, stress and behaviour of the patients in this study. Brief scales are highly recommended for identifying and screening patients with dental anxiety within a dental treatment setting, as presented previously (Armfield & Heaton, 2013). However, assessing dental anxiety remains challenging due to its complex nature (Armfield, 2010) and variations in the fear-provoking capacity according to the wide spectrum of potential anxiety-provoking stimuli in the dental setting (Oosterink, de Jongh & Aartman, 2008). It has also been noted that recognizing and acknowledging emotions are integral components of routine patient psychological assessment (Hally et al., 2017). According to a review, the combination of a suitable questionnaire or several questionnaires along with behavioural observations is the most acceptable method for assessing dental anxiety or a possible disorder in clinical practices (Bürklein et al., 2021). It has been reported that dental clinicians are unable to accurately gauge the levels of anxiety in patients without concurrently using patient self-assessment instruments (Höglund et al., 2019). The current study also demonstrated the multifaceted nature of patients' fears and the individual variations in their contents, highlighting differences within various contexts.

The previously presented semi-structured interview questionnaire (Milgrom, Weinstein & Getz, 2009, pp. 104–115) was successfully used in the current study to gather in-depth information on the patients' circumstances, emphasizing their individual experiences of earlier dental treatment and reasons for seeking current dental care. The questionnaire

has also been employed in another study to explore critical factors in fear reduction, covering cognitive, interpersonal and behavioural aspects (Spindler et al., 2015). In that study, the primary goal of the interview was to establish a trustful dentist–patient relationship, empower patients with a sense of control, address their avoidance of dental treatment, support self-monitoring of fear and acknowledge their emotions and experiences to build trust prior to dental treatment (Spindler et al., 2015). Based on the findings of this study, appropriate questions can improve the effectiveness of communication with patients. Another study reported that the use of open questions in a pre-clinical interview supports the establishment of rapport, helps elicit the patient's concerns and aids in planning the dental visit (Torper, Ansteinsson & Lundeby, 2019).

The use of Öst's (2013) behavioural analysis brought out the patient's individual catastrophic thoughts related to dental treatment in this study. As previously noted, behavioural analysis is a crucial element of the pre-treatment clinical interview before one-session treatment for dental phobia to identify what maintains the individual patient's phobia (Öst, 2013, p. 121). However, this research affirms the significance of employing appropriate tools addressing multiple issues in assessing dental anxiety.

Dental anxiety management strategies

The study presented evidence of the dentists' ability to use diverse anxiety management strategies during treatment in primary dental care. The importance of investigating dental anxiety management strategies within real clinical settings has been emphasized by researchers (Armfield & Heaton, 2013; Hoffmann et al., 2022). Previous studies have also explored various management strategies for dental anxiety, including distraction techniques employing technological interventions such as music, virtual reality and hypnosis (Hoffmann et al., 2022). These methods, in addition to breathing techniques and focused attention, were also found to be effective (Biggs, Kelly & Toney, 2003). The current study followed a recommendation from a previous systematic review (Hoffmann et al., 2022), which suggested implementing a combination of techniques for

patients with dental anxiety. This means that multiple strategies were used together to effectively address the patient's anxiety during treatment.

Based on the study findings, the dentists skilfully utilized the management strategies, particularly the provision of control, including informational and behavioural control. They also displayed proficiency in cognitive strategies such as altering expectations by redefining success and offering praise, as well as redefining the experience and using distraction. However, there is room for improvement in the implementation of behavioural strategies given the intensity of the patients' physiological reactions. Notably, the mastery of relaxation skills is considered the most important and fundamental skill according to researchers (Milgrom, Weinstein & Getz, 2009, p. 174). It is possible that additional information on specific breathing exercises or muscle relaxation strategies may enhance the ability of dentists to address the intense physiological reactions of patients more effectively.

Brief cognitive-behavioural-based treatment for dental anxiety

The study aimed to gain insights into how to treat dental anxiety in primary dental care by using brief cognitive-behavioural-based treatment, including a diagnostic interview and modified one-session treatment. The findings indicated that conducting a diagnostic interview, either before conventional dental treatment or in combination with modified one-session treatment, significantly reduced fear in patients with dental anxiety. This was evidenced across the three sub-studies conducted as part of a clinical trial. Previous research has also demonstrated the effectiveness of one-session treatments that gradually expose patients with specific phobias, such as dental phobia, to dental procedures by acknowledging control, the window of tolerance and habituation (Haukebø et al., 2008; Vika et al., 2009). Some of these treatments have included discussions with psychologists before the actual dental treatment (de Jongh et al., 1995; Thom, Sartory & Jöhren, 2000; Jöhren et al., 2007; Wannemueller et al., 2011). In one study, a semi-structured interview was combined with exposure treatment involving a systematic desensitization method and a hierarchy of feared situations (Spindler et al., 2015). This

method is commonly used in cognitive-behavioural approaches for anxieties and phobias (Öst & Clark, 2013, pp. 91–107). Another study found that a single session of cognitive restructuring, which involves changing negative cognitions, has the potential to reduce severe dental anxiety (de Jongh et al., 1995).

Dental visits

The study confirmed findings from previous research, indicating that individuals with severe dental anxiety often exhibit irregular patterns of dental visits. Based on an earlier study, this irregularity can lead to both oral health and psychological issues (Boman et al., 2010). It also has been noted that the early detection of dental anxiety is essential, since dental anxiety can discourage people from regularly using dental services (Liinavuori et al., 2019). According to the findings of this study and a previous study, patients who experience dental fear require support from oral healthcare providers who demonstrate respect, attention and empathy (Bernson et al., 2011). According to research, building a good patient–dentist relationship and alliance is crucial for successful treatment, and adapting the dentist's behaviour based on the patients' emotions and cues is of utmost importance (Kulich, Berggren & Hallberg, 2000; Willumsen et al., 2022, p. 181). Based on another study, adolescents with high fear appreciate the efforts of dental professionals to create a positive, trusting, approving and supportive atmosphere by addressing them with kindness, calmness and patience (Jaakkola et al., 2013). However, a good alliance alone without specific treatment methods has been reported to be insufficient for a good treatment outcome in CBT (Öst, 2013, p. 125). Furthermore, it has been noted that implementing brief cognitive-behavioural interventions can help break the vicious cycle of dental anxiety, including irregular dental visits, and equip these patients with adaptive coping strategies (Bernson, Elfström & Hakeberg, 2013). It is worth noting that dentally anxious patients who maintain regular dental visits tend to develop more positive coping strategies, as reported previously (Bernson et al., 2011).

Overall, dental professionals possess the potential to enhance and support the dental attendance of patients with dental anxiety, as demonstrated in the one-year follow-up of this study.

6.3 METHODOLOGICAL AND ETHICAL CONSIDERATIONS

The study employed a mixed-method approach to improve our understanding of the relationship between theory and empirical findings (Östlund et al., 2011). This approach involved using various qualitative and quantitative methods across three sub-studies. In nursing and health science, including dentistry, the use of the mixed-method approach is relatively uncommon (Östlund et al., 2011). Therefore, this study has the potential to provide new insights into the treatment of dental anxiety by integrating both research methodologies.

The reporting of the clinical trial in the research primarily adhered to the standards outlined in the CONSORT statement (Cuschieri, 2019), with the exception of randomization. The study included participants who were dentally anxious, representing various age groups and two cities. Notably, most participants were women, a pattern consistent with studies reporting gender prevalence in this context. According to study evidence, women usually report dental anxiety more often than men (Liinavuori et al., 2016; Silveira et al., 2021). The initial patient involved in the trial served as a pilot and was recruited from the teaching clinic at Institute of Dentistry, University of Eastern Finland. This step aimed to test the study's procedures and protocols. Subsequently, dentists in primary health care settings in two cities evaluated patients who met the inclusion criteria and referred them to participate in the study. The process of patient recruitment extended over a period of more than two years. However, only patients experiencing significant challenges in coping with dental treatment due to anxiety were eligible to provide informed consent, defined in the study's inclusion criteria. It is worth noting that 10 out of the 29 potential participants declined to take part in the study, a common occurrence in studies involving individuals with severe dental anxiety (Haukebø et al., 2008; Vika et al., 2009; Spindler et al., 2015; Hauge et al.,

2021). Several factors may have contributed to this in the current study, including distrust toward new approaches, potential reluctance on the part of some dentists to refer their patients to the study or encourage their participation, and a lack of motivation among patients.

6.3.1 Considerations of the methodology, strengths, and limitations

In two of the studies, a theory-driven qualitative content analysis approach (Hsieh & Shannon, 2005) was employed to interpret the meaning derived from the collected data, including interviews and video-recorded treatment sessions. This approach, guided by existing theories, followed a naturalistic paradigm and focused on specific areas of interest (MacFarlane & O'Reilly-de Brún, 2012). These areas included patients' perceptions of dental fear in diagnostic interviews and the use of dental anxiety management techniques by dentists during treatment sessions in the studies. A theoretical framework was used to establish key concepts and pre-determined themes as initial coding categories in the studies' analyses (Potter & Levine-Donnerstein, 1999). Additionally, an inductive data processing approach (Elo & Kyngäs, 2008) was employed to explore new concepts and enhance understanding of the phenomenon (Hsieh & Shannon, 2005).

To ensure coding reliability and technique identification, the researchers in the study collaborated, discussing the coding process and techniques. This interdisciplinary dialogue improved the validity and reliability of the results. The familiarity of the researchers with both the content and theory in the studies helped in selecting appropriate strategies (Potter & Levine-Donnerstein, 1999). Moreover, the researchers' experiences of working as dentists or psychologists in the field also improved the credibility (Cutcliffe & McKenna 1999; Mays & Pope 2000).

This study offers valuable insights into the adaptation of multiple methods to evaluate the impacts of dental anxiety treatment within oral healthcare practices. The quantitative approach demonstrated the effectiveness of a brief cognitive-behavioural treatment by measuring changes in the severity of patients' dental anxiety and comparing the two

treatments included in the trial. Study reports of the post-treatment interviews using a descriptive method supplemented information on participants' experiences and perceptions of the treatments' helpfulness. This added the information of the study treatments' efficient elements. To assess changes in dental anxiety, the study utilized common and validated scales, including the VAS-A, MDAS and IDAF-4C^{+}. Based on the reported study findings, the VAS-A (Luyk, Beck & Weaver, 1988) consistently showed decreasing trends in the patients' dental anxiety levels, aligning with other scales such as MDAS (Humphris, Morrison & Lindsay, 1995; Humphris, Dyer & Robinson, 2009) and IDAF-4C^{+} (Armfield, 2010; Tolvanen et al., 2017). Notably, the VAS-A (Facco et al., 2011) emerged as suitable for evaluating changes in dental anxiety, which was a novel finding in this study. However, the MDAS occasionally underestimated the severity of anxiety in some patients according to the findings. Despite this, the MDAS remains valuable for clinical assessments and initial treatment decisions concerning dental anxiety, as presented in a study (Hare, Bruj-Milasan & Newton, 2019). The IDAF-4C^{+} proved appropriate for comprehensive dental anxiety assessment in this study, offering insights into emotional, behavioural, cognitive, and physiological aspects, potentially co-occurring mental health conditions, and specific triggers of fear.

A significant limitation in the study was the relatively small sample size, comprising only 19 individuals with dental anxiety. Recruiting an adequate number of participants can be challenging, particularly for research involving sensitive topics. Patients with dental anxiety often delay or cancel appointments for various reasons, including a higher prevalence of mental health issues, such as generalized anxiety or depression, as demonstrated previously (Kani et al., 2015; Halonen et al., 2018). This study focused on patients who had the capability to schedule conventional dental treatment appointments despite their high anxiety levels. Consequently, it is important to recognize that the results of the study may not be applicable to all patients and dentists, or even one-session treatments. Furthermore, the presence of a substantial number of refusals to participate in the study raises concerns about selection bias and biased allocation to interventions. This is partly due to inadequate concealment of allocations before

assignment, which could not be adequately ensured, given the high number of refusals. Due to previous, this study, involving brief cognitive-behavioural-based treatments for dental anxiety, provided preliminary evidence of the effectiveness of a diagnostic interview and M-OST.

One of the key strengths of this study was the use of a qualitative approach, which significantly deepened our understanding of the reality of dental anxiety treatment. This was particularly beneficial because of the lack of qualitative studies that have integrated theoretical concepts into the context of dental anxiety treatment. The theory-driven content analysis, among other qualitative approaches, aim to extract more specific and deeper information on the phenomenon, as presented earlier (Marks & Yardley, 2004). This method proved to be suitable, considering the current study's focus. The cognitive-behavioural-based approach in treatment of dental anxiety in the study's context guided the selection of this method. The use of this qualitative method provided a more comprehensive and detailed picture of the various components and contents of the treatments in this study. Specifically, it extended our understanding of patients' diverse experiences, situations, and coping mechanisms during dental treatment. The study findings clearly underscored the necessity of tailoring treatment according to the patients' unique circumstances. While other methods, such as conversation or discourse analysis, may have provided more specific information regarding dentist–patient interactions, this study was one of the pioneering research projects to employ both interviews and videos in the examination of dental anxiety treatment in clinical practices.

It is important to note that the goal of a qualitative study is not to achieve generalizability, but rather to generate new insights related to concepts and findings, based on the literature (Marks & Yardley, 2004). These insights can be transferable and applicable to other similar contexts and situations. Therefore, the knowledge gained from this study can be valuable in understanding and addressing dental anxiety in various settings beyond the scope of the study itself.

6.3.2 Ethical considerations

Data gathering for this study began in August 2016, following the necessary permission from the ethical committee and the study's registration in the ClinicalTrials.cov registry. The ethical evaluation process in this study adhered to legal requirements and guidelines aimed at safeguarding the rights of vulnerable patients involved in experiments that affect their physical or mental integrity (TENK). Consequently, the ethical commission provided a protocol for enrolling dentally anxious patients in the study. Due to ethical considerations related to the research procedure, obtaining detailed information about those who declined to participate or their reasons for withdrawal was not possible. However, limited information about these individuals was available for the researchers.

Some participants who withdrew from the study during the intervention were young adults whose dental anxieties had originated in childhood. It is important to consider this factor in future studies and treatments. Young adults often contend with various sources of stress in their lives, such as personal economic concerns, raising small children or intensive phases in their education. These additional stressors can contribute to the already difficult emotions associated with dental anxiety stemming from past experiences. It is essential to recognize that dental treatment procedures can be particularly challenging for young adults. They may not possess the necessary emotional resilience to address these difficult emotions or receive sufficient support from dental care providers. This underscores the need for tailored approaches and support mechanisms to address the unique challenges faced by children and young adults dealing with dental anxiety.

7 CLINICAL IMPLICATIONS AND FUTURE PERSPECTIVES

The new knowledge generated from this study should be taken into consideration, as it holds the potential to improve treatment practices for dental anxiety within primary dental care. The study demonstrated the effectiveness of diagnostic interviews and one-session treatment as treatment methods for experienced dentists, even if they lack formal training in behavioural management techniques. With a brief orientation and diagnostic interview, the dentists in the study successfully used various dental anxiety management strategies. Effective approaches include providing predictability during treatment, training patients' coping skills and exposing them to anxiety-inducing stimuli.

To ensure the appropriate treatment of dental anxiety, it is essential to identify and recognize patients with moderate to severe dental anxiety prior to actual treatment, as presented previously (Armfield & Heaton, 2013; Hoffmann et al., 2022). In addition to recognizing these patients through observation of signs or their self-report, valid screening tools such as the Modified Dental Anxiety Scale (MDAS) should be employed (Höglund et al., 2019; Bürklein et al., 2021). Furthermore, assessments of patients' coping resources, potential mental disorders and individual treatment needs should be conducted through comprehensive questionnaires and interviews if the initial screening indicates high or moderate dental anxiety. It is crucial to differentiate between severe situation-specific dental anxiety and dental phobia as a specific disorder to deliver appropriate treatment. If there is suspicion of comorbidity with other mental conditions, patients should be referred for further evaluation and care to a psychologist or psychiatrist.

Building on previous evidence and the positive outcomes of this study, it is advisable to incorporate brief cognitive-behavioural one-session treatment into best practice guidelines for treating dentally anxious adults in primary dental care. The significance of such guidelines, with a focus on

behavioural approaches, has been recognized in the past. By addressing trust, control and implementing psychological strategies, oral healthcare professionals can provide more comfortable and less painful dental treatment experiences for dentally anxious patients. This is crucial by means of preventing the development of severe dental anxiety and maintaining oral health.

Involving a larger number of oral health care professionals and dentally anxious patients in primary dental care settings would provide more comprehensive data and insights. This would significantly advance our understanding and refine our approaches for effectively addressing dental anxiety. Looking ahead, if financial constraints can be alleviated, exploring a clinical trial that integrates one-session treatment for dentally anxious adults could be a valuable endeavour. By investing in research, we can work towards alleviating the burden of dental anxiety and ensuring better oral health outcomes for patients.

In Finland, oral health care professionals should be well informed and trained in assessment procedures for dentally anxious patients, along with being familiar with dental anxiety management strategies. The implementation of cognitive-behavioural-based treatment methods for severe dental anxiety, involving clinical interviews and one-session treatments, could be carried out in multiprofessional teams. These teams may include experienced dentists and oral hygienists who are keen on enhancing their skills.

In cases where a specific phobia or other comorbid mental disorders are suspected, it is crucial to refer the patient to mental health professionals for consultation and treatment. Dentally anxious patients with acute and substantial oral health treatment needs, who are incapable of undergoing conventional dental treatment or behavioural interventions, should be primarily treated through pharmacological approaches, such as sedation or anaesthesia. Nitrous oxide sedation or hypnosis may also be suitable options for certain patients, particularly young adults.

8 CONCLUSIONS

Dental anxiety has a substantial impact on both oral health and psychological well-being. This study underscores the significance of diagnostic interviews in acquiring comprehensive insights into dental anxiety, as well as the capacity of experienced dentists to use diverse dental anxiety management techniques during treatment. Furthermore, the research indicates promising outcomes in alleviating dental anxiety through the implementation of brief cognitive-behavioural-based treatment. One-session treatments also exhibit potential in enhancing patients' coping mechanisms with dental procedures and promoting regular dental care visits, thereby disrupting the vicious cycle of dental anxiety.

Developing treatment plans for dentally anxious patients, should be grounded on the insights derived from reliable questionnaires, such as the compact MDAS, behavioural observations, and collaborative discussions with patients. It is highly recommended to embrace a patient-centric approach by routinely addressing dental anxiety with low thresholds and incorporate effective anxiety management methods and techniques into clinical treatment practices in primary health care.

A brief dental anxiety intervention, incorporating a diagnostic interview before conventional dental treatment or combined with modified one-session treatment, proved effective in reducing dental anxiety in primary dental care. This approach offers oral healthcare professionals one means to alleviate fear and anxiety in dentally anxious patients. Diagnostic interviews serve as valuable methods for experienced oral healthcare providers, leading to more specific diagnoses of dental anxiety and increased compliance with treatment. Employing psychological strategies can further reduce stress for both patients and dentists while potentially offering economic benefits.

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ORIGINAL PUBLICATIONS (I – III)

I

Patients' multifaceted views of dental fear in a diagnostic interview

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Acta Odontologica Scandinavica, 79(3):194-204, 2021.

ACTA ODONTOLOGICA SCANDINAVICA
VOLUME 79, 2021
NUMBER 03

Acta Odontologica Scandinavica

Taylor & Francis
Taylor & Francis Group

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iode20

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To cite this article: Pirjo Kurki, Maija Korhonen, Kirsi Honkalampi & Anna Liisa Suominen (2021) Patients' multifaceted views of dental fear in a diagnostic interview, Acta Odontologica Scandinavica, 79:3, 194-204, DOI: 10.1080/00016357.2020.1817545

To link to this article: https://doi.org/10.1080/00016357.2020.1817545

Published online: 12 Sep 2020.

ACTA ODONTOLOGICA SCANDINAVICA
2021, VOL. 79, NO. 3, 194–204
https://doi.org/10.1080/00016357.2020.1817545

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ORIGINAL ARTICLE

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Patients' multifaceted views of dental fear in a diagnostic interview

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ABSTRACT

Objectives: The aim was to examine how patients describe and perceive their dental fear (DF) in diagnostic interviews.

Material and Methods: The sample consisted of dentally anxious patients according to the Modified Dental Anxiety Scale (MDAS), who had problems coping with conventional dental treatment. The voluntary participants ($n = 7$, aged 31–62 years) attended a diagnostic interview aiming to map their DF before dental treatment. The data were analysed by theory-driven qualitative content analysis. The themes consisted of the four components of DF: emotional, behavioural, cognitional, and physiological, derived from the Index of Dental Anxiety and Fear.

Results: Within these four themes, treated as the main categories, 27 additional categories related to the patients' interpretations of DF were identified in three contexts: before, during and after dental treatment. 10 categories depicted difficult, uncontrollable, or ambivalent emotions; nine depicted behavioural patterns, strategies, or means; five depicted disturbing, strong, or long-lasting physiological reactions, including panic and anxiety symptoms. The remaining three categories related to cognitive components.

Conclusions: The results indicate that dental care professionals may gain comprehensive information about their patients' DF by means of four component-based diagnostic interviews. This helps them to better identify and encounter patients in need of fear-sensitive dental care.

Trial registration number: NCT02919241

ARTICLE HISTORY
Received 3 January 2020
Revised 14 July 2020
Accepted 23 August 2020

KEYWORDS
Dental fear/anxiety; cognitive behavioural therapy; qualitative content analysis; diagnostic interview; adults

Background

Dentists frequently encounter patients suffering from dental fear/anxiety in their daily work. Representative studies in Nordic countries showed that every third Finnish person was somewhat or very much afraid of visiting a dentist and every tenth Swedish person reported severe or moderate dental anxiety [1,2]. Researchers have highlighted the negative consequences of dental fear using the concept of a vicious circle where dental avoidance leads to greater treatment need and problem-oriented visits [3,4]. In addition, qualitative study evidence has revealed the wide-ranging negative impacts of dental anxiety on people's daily lives related to physiological, cognitive, behavioural, health and social aspects [5]. Therefore, it has been proposed that individuals who suffer from the troublesome consequences of dental fear could benefit from an intervention that focuses on reducing avoidance behaviours [6].

Furthermore, dentists may suffer stress from treating dentally anxious patients [7]. Although a patient's state of anxiety is reduced when dentists have information about this prior to care [8], dentists rarely utilise this possibility [9]. In order to specify a patient's fears, it is recommended to measure their fear level before dental care by asking them a simple question about dental fear [10,11] or by using validated psychometric measures of dental anxiety [12]. For example, the reliability of the Modified Dental Anxiety Scale (MDAS) [13] has been verified in studies [14]. The three concepts of fear (= fear, anxiety, phobia) have been defined [15] and considered in the quite new Index of Dental Fear and Anxiety (IDAF-4C^{+}) [16]. The first of the three modules in this index assess the emotional, behavioural, cognitive, and physiological components of the anxiety and fear response with eight items. In addition, the researchers have developed structured interview guides to obtain knowledge about more specific factors related to problem-oriented situations during an appointment [17,18]. When dental fear or anxiety is severe and disturbs a person's daily life, it can meet the criteria for a specific phobia included in anxiety disorders, according to the criteria of psychiatric disorders, DSM-5 [19].

Cognitive behavioural therapy (CBT) alleviated severe dental fear in adults according to systematic reviews [20,21].

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This manuscript has not been published, simultaneously submitted, or already accepted for publication elsewhere. All authors have read and approved the manuscript and participated in the planning of the content. MK is experienced in qualitative research and she guided analyses. PK conducted the interviews and contributed to the writing of the manuscript in assistance with other authors.
This article has been corrected with minor changes. These changes do not impact the academic content of the article.

Usually, the interventions in studies were composed of the diagnostic interview and exposure to dental treatment. Already thirty years ago, investigators proposed that when dentists used an interpersonal cognitive technique in the interview, patients' dental anxiety was reduced [22]. Although the discussion and diagnostic interview seem to be essential for fear reduction in the context of studies, the significance/meaning of these in relation to actual patients is still unclear. In addition, only a few studies used qualitative methods to gain a deeper understanding of an individual patient's perceptions of their dental fear. Most of the previous studies on dental fear applied grounded theory [23–26] or thematic analysis [5,27]. Grounded theory studies aimed to explore the situation of dental phobic patients or their perceptions or experiences related to their fear [23,24], how they manage to undergo dental treatment [25] and the factors used by those affected to maintain regular dental care after a dental fear intervention [26]. One of the thematized studies concentrated on the fear-inducing triggers associated with dental treatment and on expectations prior to a dental encounter [27]. Another focussed on the impacts of dental fear on daily living [5]. Furthermore, two grounded theory studies explored the patient-dentist relationship [28,29].

Due to the lack of qualitative studies regarding a patient's own perceptions of their dental fear in the context of a diagnostic interview, we wanted to study the multidimensional facets of dental fear to gain a better understanding of the phenomenon. The aim of this study was to examine how patients who suffer from dental fear/anxiety talk about their fear in the frame of a diagnostic interview based on four components of fear introduced in the Index of Dental Anxiety and Fear [16,30]. The research question is: How do the patients perceive and interpret their dental fear in terms of its four components – emotional, behavioural, cognitive, and physiological. What kinds of emotions, behaviours, cognitions, and physiological reactions do they relate to their dental fear when they talk about their fear in a diagnostic interview?

Materials and methods

Study design

The qualitative study presented is a part of a larger intervention study which, after ethical approval from The Research Ethics Committee of the Northern Savo Hospital District (Registration number: 281/13.02.00/2016) in June 2016, was registered in the clinical study in ClinicalTrials.gov (identification number: NCT02919241). Based on a power analysis related to the decrease in level of dental fear, the required number of participants in the two study groups (I: diagnostic interview + One Session Treatment according to a protocol by Öst & Skaret [31], II: diagnostic interview) was set to ten, aiming at 98% power with the confidence level of 0.05% and SD 2.8. The participants in the present study were those who participated in the in the diagnostic interview (group II), after which they were treated by their own dentist (Figure 1). The voluntary participants came from three separate private dental practices in the eastern part of Finland and they gave informed consent before participating in the study. Their own dentists evaluated participants' suitability for the study according to the following inclusion criteria: a minimum of 18 years of age and identification of some kind of problem during conventional dental treatment related to fear. In addition, the participants had to report moderate or severe dental anxiety according to the Modified Dental Anxiety Scale (MDAS) [13], at least 11 out of the maximum of 25 points [32]. Candidates who were recorded as having an acute mental or somatic disease, dementia or pregnant women were excluded from the study, because dental treatment after the diagnostic interview was a part of the study protocol. 14 participants were recruited between September 2016 and November 2017. Four participants declined to participate in the study as is usual in studies involving a sensitive topic. We were not able to gain any knowledge about them due to the ethical principles related to the research procedure. One participant was excluded from the study, because she did not need dental care. Thus, nine participants were treated once by their own dentist; thereafter they attended the final interview. Because of default tape-recorded material in two cases, the final sample consisted of five women and two men. A subsequent study will report the effects of the whole intervention study.

Diagnostic interviews

Diagnostic interviews were conducted by the first author, who is a dentist and has studied psychology. A diagnostic interview guide with dental fear questionnaires was used to ensure the internal consistency of the study; interviews consisted of questions regarding participants' answers in the quantitative scales, an individual semi-structured fear assessment questionnaire according Milgrom et al. [17] and the behavioural analysis derived from Öst's diagnostic interview model [31]. The focus was fully on participants' own responses. The researcher asked open-ended questions followed by targeted questions without commenting on the answers. The structure of the interviews allowed for concentrating on the participants' own perceptions or interpretations of their fear. Another aim was building trust between the researcher and the participants when the researcher listened carefully. The interviews lasted from one to two hours, depending on a participant's talkativeness. All interviews were tape-recorded and transcribed verbatim. A professional translator translated the quotations from Finnish to English.

Analysis

The method used in the study was theory-driven qualitative content analysis with inductive and deductive elements [33]. At the beginning of the analysis, the notion of four components of DF (described in the Index of Dental Anxiety and Fear [15,16]), was used as *a broad conceptual framework and organising principle* for approaching participants' descriptions about their DF. In the first phase of analysis, the first author conducted in-depth reading of the data and identified all the speech-episodes in which the participants talk about their DF in terms of its four components (emotional, behavioural, cognitional and physiological), by using *Atlas.ti 8* software (see Figure 1). She conducted data-driven thematic analysis

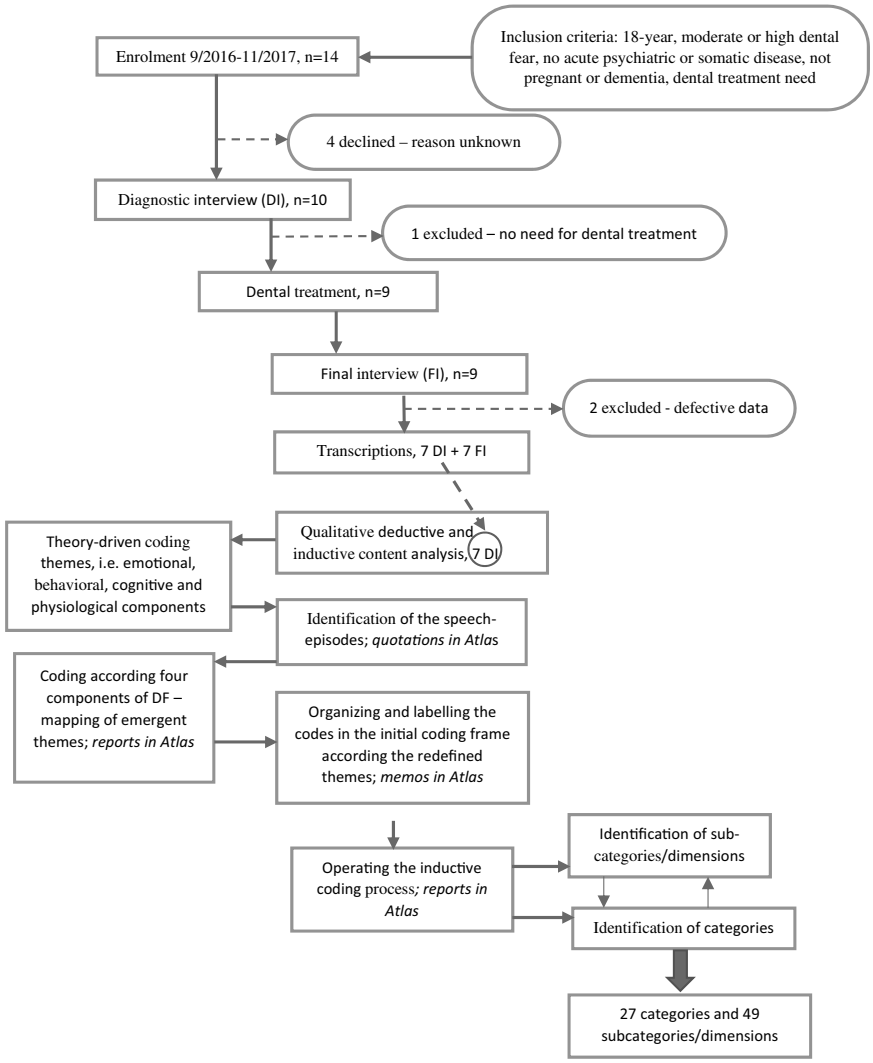

Figure 1. A summary of the sample and qualitative content analysis in the study.

and mapped the emergent themes according to the four components. The participants talk that related to four components of fear occurred in sentences of various lengths, which all were included in the units of analysis. After identifying all meanings, the first author organised the initial coding frame; codes related to emotions ($n = 13$), behavioural strategies ($n = 10$), cognitions regarding dental fear ($n = 8$) and physiological reactions ($n = 6$).

The first phase of analysis showed that all of the participants' descriptions about their DF could be loosely categorised under four large themes, i.e. data was not forced into predetermined categories. However, the first phase and the initial coding frame revealed that the participants' descriptions about their DF was diverse within the four categories in terms their thematic content. Thus, in the second phase, the first and second author identified the detailed contents (what the fear is about) and contexts (what situations or events the fear is associated with) of fear within each of the four themes and labelled the codes in the coding frame.

In the third phase of analysis, the first author proceeded with coding by identifying additional subcategories and categories within the four main categories. Categories and subcategories/dimensions were produced by looking at similarities and differences in the ways the contents and contexts of fear were described by the participants. To ensure the reliability of coding, the second author conducted a similar coding. Next, the coding done by the two authors were compared and discussed and as a result, the codes were partly redefined and renamed. Finally, all authors familiarised themselves with the categories and subcategories, and the final representation of categories was composed. Thus, the coding process involved intensive reading of data as well as dialogue between researchers. The end result of

the analysis was the identification of 27 categories and 69 subcategories, shown in Figure 1. In the following section, we will present our results by providing data extracts that were selected after systematic review of the material and that best illustrated the findings.

Results

Our analysis revealed that when participants reflected on their dental fear, the descriptions of their emotions, behaviour and physiological reactions fell within *three contexts: before, during and after dental care*. We will present our findings according to this structure. Although the participants' descriptions of their cognitions were not organised directly according to these three contexts, we decided to integrate the results concerning the cognitive components of fear into our other results, which will be presented in accordance with the three identified contexts (see Table 1). We identified 27 categories that illuminated the various facets of fear in four main categories: 24 of them related to difficult, uncontrollable or ambivalent emotions; self-coping behavioural patterns, strategies or means; disturbing, strong or long-lasting physiological reactions, including panic and anxiety symptoms. The remaining three categories related to cognitive components of fear. In addition, we identified 49 sub-categories and 20 dimensions.

Context: before dental treatment

Participants' fears were activated before an upcoming appointment for several reasons and led to increasing anxiety when previous experiences and negative expectations of the upcoming dental treatment revolved in participants' minds. Participant's expressed behaviour conflicted with behavioural patterns towards participating in dental care. Physiological reactions worsened the quality of participants' daily life. The lack of confidence towards dental care visits illustrated their cognitions.

Table 1. The contexts and contents of the main categories and the number of categories/sub-categories or dimensions related to them.

Contexts and contents related to the four main categories	Number of categories/subcategories (s) or dimensions (d)
A. Before dental treatment (Table 2)	
A.1. Difficult emotions	3/7 (s)
A.2. Self-coping behavioural patterns	5/12 (s)
A.3. Disturbing physiological reactions	3/2 (s)
A.4. Cognitions related to dental fear	1/5 (d)
B. During dental treatment (Table 3)	
B.1. Uncontrollable emotions	6/10 (s)
B.2. Behavioural coping strategies	2/8 (s)
B.3. Strong physiological reactions	1/6 (s)
B.4. Cognitions related to dental fear	1/9 (d)
C. After dental treatment (Table 4)	
C.1. Ambivalent emotions	1/4 (s)
C.2. Behavioural means for coping	2/- (s)
C.3. Long-lasting physiological reactions	1/- (s)
C.4. Cognitions related to dental fear	1/6 (d)

Content: difficult emotions

In most cases, *the content of the fear* was clear. Nearly all participants could name situations, where the fear emerged and many explained that a new dental treatment situation was scary: 'Because it was new to me and the dentist was new, the situation caused even more anxiety than usual and I would worry about the appointment for several days in advance'. Some participants felt embarrassment/shame about the fear. Furthermore, many participants described the activation of fear after making an appointment: 'I'm constantly afraid of it, and I mean constantly. It's a miracle I can even hold the phone straight when calling to book the appointment'. But sometimes the fear was *undefined* before dental treatment. The participants reported about an unpleasant feeling or anxiety related to the upcoming appointment: 'I may be slightly anxious already the previous evening, but the feeling is most intensive in the morning of, just before waking up. In fact, the anxiety is often what wakes me up'. Additionally, it was typical that *the current fears were connected with earlier experiences*. Nearly all participants told about their earlier experiences and fearful memories of past situations. They described about flashbacks related to intimidating treatments and procedures: 'After the dentist went to fetch the tongs, I jumped up and fled the room. That's the mental image I always carry with me'.

Content: self-coping behavioural patterns

All participants told about *avoidance behaviour* and that they had avoided dental care at some point of their lives. The consequences of intense dental fear were to postpone/cancel an appointment or avoid treatment for as long as possible. But it was typical that although the person postponed an appointment, he/she did not cancel it after the booking: 'I didn't quite cancel the appointment, but I kept putting it off'. *Exposure behaviour* was typical, too, and nearly all participants forced themselves to visit the dentist in an acute situation or in the case of other serious problems in the mouth. One reason behind this behaviour was the fear of pain. One participant explained that they tended to challenge themselves to face the situation: 'I've always somehow managed to find the courage … You just tell yourself that it's going to be fine, let's just get it over with'. Most participants tried to *use medicines or harmful substances to control fear*. In other words, they managed the pain with painkillers instead of visiting the dentist or calmed themselves with tranquillizer or tobacco. Some *used self-help to alleviate their fear*. For example, they aimed to calm themselves by doing mental imagery or relaxation exercises: 'I try to calm my mind, even if I can't get to sleep easily or at all the previous night'. Furthermore, most had found *other means to alleviate their fear*, for example by choosing a treatment time spontaneously or selecting the place of treatment based on a recommendation, turning to social support, avoiding thoughts of fearful situations, visiting the dentist with low expectations or counting down the time before the appointment.

Table 2. Categories and subcategories/dimensions before dental treatment.

Categories	Sub-categories
A.1. Content: Difficult Emotions	
The content of the fear was clear	New situation
	Embarrassment/shame
	Activation of fear
The content of the fear was undefined	Unpleasant feeling
	Anxiety in the morning before the appointment
The current fears were connected with earlier experiences	Fearful memories of past situations
	Flashbacks related to intimidating treatments and procedures
A.2. Content: Self-coping behavioural strategies	
Avoidance behaviour	Postponing/cancelling an appointment or avoidance of treatment
Exposure behaviour	Forcing oneself to visit the dentist
	Challenging oneself to face the situation
Use of medicines or harmful substances to control fear	Managing pain with painkillers instead of visiting the dentist
	Calming oneself with tranquillizers or tobacco
Use of self-help to alleviate the fear	Calming oneself through mental imagery or relaxation exercises
Other means to alleviate the fear	Choosing a treatment time spontaneously
	Selecting the place of treatment based on a recommendation
	Turning to social support
	Avoiding thoughts of fearful situations
	Visiting the dentist with low expectations
	Counting down the time before the appointment
A.3. Content: Disturbing physiological reactions	
Difficulties sleeping	
Clear physiological reactions	Increased heart rate
	Perspiration
Restlessness	
Category	Dimensions
A.4. Content: Cognitions related to dental fear	
Origins of fear	Earlier negative treatment experiences
	Role of an overbearing professional caregiver
	Alternations in fear intensity
	A person's own dysfunctional explanation of their fear
	Connection between dental fear and other fears/psychiatric disorders/problems

Content: disturbing physiological reactions

Many participants described *difficulties sleeping*: 'For several weeks before an upcoming dentist's appointment, I have a hard time sleeping and can have nightmares'. Additionally, many reported *clear physiological reactions*, for example increased heart rate or perspiration. *Restlessness* was typical one day before an appointment and many participants reported that they had difficulties in doing their job because of the anxiety:

'All day at work even, my heart beats much faster than normally and the thought constantly enters my mind. Just thinking about it repulses me and I can't stop thinking about it all day'.

Content: cognitions related to dental fear

Origins of fear. Because all participants described *earlier negative treatment experiences*, the interpretation was that the previous experiences underlie the fear and unconsciously affect the current dental care visits. Nearly all expressed *the role of the overbearing professional caregiver* in the development of fear. Furthermore, participants had learned that dentists' styles in dealing with fearful patients vary, and they were worried about the dentist's ability to recognise a patient's fear. Most participants described that their fear would be alleviated if the dentist knew about it, and a trustful relationship was seen as a prerequisite for this: '… because I have such an intense fear, to show it and properly talk about it with a dentist, I'd first need to trust the dentist – I couldn't just go to any random dentist and explain how I feel'. Many participants had noticed *alternations in fear intensity*, and they reported that fear had been stronger earlier in their lives. The intensity of fear related to the up-coming treatment and commonly the situation was not as fearful as the person had anticipated:

> The worst part is sitting in the waiting room and listening to the sounds from other rooms. You start thinking whether it'd be best to just run away … lately, it's gotten a little better … because the dentist will really be understanding when they know they're dealing with a patient who is afraid.

Only one participant told that he had always feared the dentist. Usually the participants saw that *their own dysfunctional explanation of fear* perpetuated the negative situation, because they considered their situation regarding fear as abnormal and it deviated from others' situations. Some participants thought that the fear was just 'between the ears' and some saw that it was related to a traumatic situation during childhood. Additionally, many participants perceived *the connection between dental fear and other fears/psychiatric disorders/problems*:

> … The first time I felt panic wasn't at a dentist, but in Egypt, while visiting the tombs … That's when I first remember the feeling I now also get there [in the dentist's chair] … I wonder if something was triggered back then … the same feeling of panic, that I really need to get out of the situation right this minute and can't control myself at all.

Table 3. Categories and subcategories/dimensions during dental treatment.

Categories	Sub-categories
C.1. Content: Uncontrollable emotions	
The fear of an extreme reaction	Fear of an allergenic reaction
	Fear of choking
	Fear of drowning
	Shortness of breath
	Fear of a panic attack
The fear of failure in a technical procedure	
The fear related to the dentist's behaviour	
Objects of fear	Fear of pain
	Fear of injections
	Distrust in own ability to cope with the fear
Uncertainty	Dentist's unclear language
	Sounds/smells at the dentist's office
Recollection of previous treatment situations	
C.2. Content: Behavioural coping strategies	
Active/passive action	Tolerating the fear
	Striving to control one's own physiological reactions and emotions
	Clasping hands
	Stopping a procedure mid-treatment
	Signalling the dentist to pause treatment
	Seeking helpful strategies
	Avoiding talking about the fear
The tendency to manage on one's own/ seeking support from caregivers	Being outspoken about the fear
	Avoiding talking about the fear
C.3. Content: Strong physiological reactions	
Panic and anxiety symptoms	Panic
	Increased heart rate/palpitations
	Sensation of fainting/ feeling paralysed
	Sensation of being strangled
	Difficulties in swallowing
	Feeling of a constricted throat
Category	Dimensions
C.4. Cognitions related to dental fear	
Fear-alleviating factors	Understanding and empathetic attitude of the caregiver
	Positive tone of the appointment
	Possibility to interrupt the treatment
	Dentist communicate information during the treatment
	Interactive negotiation of the treatment
	The patient employs strategies to mediate their emotions
	Distancing oneself
	Positive effects of regular dental care attendance
	Facing problems afterwards

Table 4. Categories and subcategories after dental treatment.

Categories	Sub-categories
C.1. Content: Ambivalent emotions	
Confusion about the treatment session	Odd reaction
	Contradiction in views
	Dismissing previous positive experiences during dental visits
	Uncertainty of the necessity of a treatment
C.2. Content: Behavioural means for coping	
Rewarding oneself	
Becoming passive	
C.3. Content: Long-lasting physiological reactions	
The calming of physiological reactions	
Category	Dimensions
C.4. Content: Cognitions related to dental fear	
Negative/fear-provoking factors	Negative thoughts related to treatment
	State of helplessness
	Inability to control fear in the treatment situation
	Catastrophic thoughts related to swallowing
	Harmful effects of the fear and its negative consequences
	Shame about the fear

Context: during dental treatment

Even though the intense emotions and physiological reactions were nearly out of participants' control, they had invented ways to cope with their strong reactions. The extremely difficult situation forced them to find behavioural strategies to control physiological distress. Cognitions revealed that the participants were aware of the factors alleviating their dental fear.

Content: uncontrollable emotions

Nearly all participants were able to name/identify the most fearful aspect and we labelled the category, *the fear of an extreme reaction,* including fear of an allergenic reaction, fear of choking, fear of drowning, shortness of breath or fear of a panic attack: 'Sometimes I've had a feeling of drowning just thinking about having to go again'. Furthermore, most participants told about *the fear of failure in a technical procedure*, especially in local anaesthesia regarding the right location for the injection or pain during injection. Many mentioned *the fear related to the dentist's behaviour*. All participants recognised *objects of fear*, which were described in three subcategories: fear of pain, fear of injections and distrust in their own ability to cope with the fear: 'During a root canal treatment, I'm afraid of whether I can keep my mouth open – what if it snaps shut while the spikes are in there? '. Additionally, most participants felt *uncertainty* and they were worried about the dentist's unclear language and about sounds/smells at the dentist's office. *Recollection of previous treatment situations* during dental treatment was also typical, and the participants remembered fearful situations from the past: ' … that horrible memory of fleeing from there is all I can remember, and the stench used to be nauseating back in the day. These days, the smell isn't that bad, even if they have all those chemicals there'.

Content: behavioural coping strategies

The first conflicting behavioural patterns towards participating in dental care was *active/passive actions*. Most participants had difficulties in coping with the treatment and tolerating the fear: 'I wonder what's going to happen, whether or not I'm going to panic'. Many ended up striving to control one's own physiological reactions and emotions: 'I don't allow it [the feeling of choking], even if it may feel as though it's about to come up, I've always managed to stop it somehow'. While aiming to be active and manage the oppressive situation, many participants had ended up clasping their hands or stopping a procedure mid-treatment or signalling the dentist to pause treatment. The patients took initiative in previous actions. Although the dentist offered the option to interrupt the treatment, one participant was reluctant to accept it: 'The dentist even told me to raise my hand at any point if I feel like it, but of course I didn't raise it as it didn't really take that long to replace the filling'. Most participants had turned to seeking helpful strategies for coping with their fear. For example, some participants told that they try to concentrate on breathing, relaxing themselves or practicing mindfulness: ' … at the point when it starts to feel like you might not be able to breathe, it helps to really focus on taking deep breaths through the nose'. Furthermore, the participants described actions they had found suitable, such as having antihistamine medicine in reserve, closing their eyes and thinking of the words of songs or concentrating on sounds during treatment: 'The squeaky sound that the machine [saliva ejector] makes is somehow calming'. The other conflicting pattern was *the tendency to manage on one's own/seeking support from caregivers*. Some participants were outspoken about their fear: 'I remember declaring already at the door that I'm scared and not to hold back on the anesthetic', others avoided talking about it: 'I've never told anyone about it [my dental fear]. It was the dentist who noticed it eventually'.

Content: strong physiological reactions

Most participants told about *panic and anxiety symptoms* when they described their dental fear: 'Because it [the anesthetic] takes a while to take effect, it didn't really help at the moment I needed it and the panic was pretty overwhelming'; 'It was like – well, I used to suffer from panic attacks, and the experience was pretty similar to those'. Furthermore, they explained other extremely strong physiological reactions, for example increased heart rate/palpitations: 'I always say that I'm not having an allergenic reaction, I'm hypersensitive to adrenaline and my body goes into overdrive … my heart starts beating terribly fast, my face turns red and I g*et al*l sweaty and feverish'. Furthermore, they described the sensation of fainting/feeling paralysed, the sensation of being strangled, difficulties in swallowing: ' … often, the dentist has to pause because I get an urge to start swallowing' and the feeling of a constricted throat: 'I feel like there's something blocking my airway and I can't breathe'.

Content: cognitions related to dental fear

Fear-alleviating factors. All participants told about *an understanding and empathetic attitude of the caregiver*. Participants appreciated a friendly dentist who listened to them and they explained the variations in a dentist's drilling style and ways of administering local anaesthesia. When they had found 'a good dentist' who treated them well, they did not want to change their dentist. It was seen as important that the patient could explain her/his wishes:

> The dentist I've been visiting lately is generally pleasant, because they listen and have come up with methods for letting me know how long the drilling will still take or what's going to happen next, for example. That somehow helps me brace myself for it or tolerate it.

All participants struggled against their fear and they had *employed strategies to mediate their emotions*. Some found it useful to calm themselves by reassuring themselves that they can do it: ' … when your heart starts racing because of the dentist, you just try to keep a cool head at that point' or by overcoming the worst fear or by thinking in a positive way. Although the participants knew that their fear was irrational, this did not alleviate the fear. They found it more helpful to *distance themselves* by turning thoughts to something else: ' … I've been able to manage fairly well so far … The trick is to focus your thoughts on something else than what's going on'. Most participants had noticed *the positive effects of regular dental care attendance*; they thought that when they attended dental care regularly, their fear decreased, and it was easier to visit the dentist: ' Sure, there's been huge progress as time has passed. Thinking

back, a few years ago I wouldn't even dream of going to the dentist unlike now. So, just going there has helped in easing my fear '.

Context: after dental treatment

Participants' doubts remained leading to ambivalent emotions and they realised only a few helpful means for coping with dental fear. The physiological stress symptoms, including the intense sensations were relieved after dental treatment. The cognitions reflected participants' unsolved problems and questions after dental visits.

Content: ambivalent emotions

Some concerns bothered participants reflecting *confusion about the treatment session*. One participant, for example, did not know the reason for an odd reaction which appeared unclear to her. Difference in opinion with the dentist was another example: 'At the first visit, it remained unclear to me when the dentist announced I'll be getting a denture. At that point, I just hoped I'd at least get a partial denture'. Furthermore, the participants talked about dismissing previous positive experiences during dental visits and remembering only the negative appointments. Moreover, some told about their uncertainty of the necessity of a treatment: 'The reason for taking out a tooth remained unclear to me'.

Content: behavioural means for coping

Participants' told about some actions they had used. We labelled the first one *rewarding oneself*, because the participant told that she rewarded herself by shopping for something nice. The second one revealed how the participants dealt with the difficult situation by *becoming passive* and therefore they were unable to handle the difficult situation afterwards, although it could be helpful: 'I mean, apparently, I'm pretty good at compartmentalising things'.

Content: long-lasting physiological reactions

Many participants reported that while certain situations triggered symptoms of a panic attack, they also experienced *the calming of physiological reactions* afterwards.

Content: cognitions related to dental fear

Negative/fear-provoking factors. All participants had *negative thoughts after dental visits*. They described that plenty of similarities existed between the treatment situations that reminded them of pain. Some participants explained that they were anticipating pain during the treatment because of previous painful experiences or stories they had heard from others. Due to this, they usually felt that the treatment was painful, and they suffered from unpleasant emotions during treatment. Additionally, the dentist's use of terms was sometimes thought to be unclear and this provoked more fear as well as suspicious thoughts towards the dentist and confusion about the treatment procedure:

> … I'm always afraid that since I've had the fillings in for so long, what if there's some horrible surprise waiting. Like when this tooth was taken out, I think it used to have fillings, but the dentist said something to the effect that the tooth had collapsed, and I just wondered what a collapsed tooth means.

Many participants thought that the prone position and having the dentist's equipment in their mouth was scary. In addition, they described that they suffered due to *a state of helplessness when they could not control themselves or the treatment*: 'Even if rationally I know I'm not going to choke, the emotion takes over … and it's such a pointless fear; I don't understand why I can't get over it' . They described worries regarding their ability to cope with the fearful treatment procedures in the future, because they felt that they had to endure their difficult feelings alone. Somehow, they seemed to be helpless victims who struggled to survive and waited for the dentist to notice and react to their fear. Some participants had *catastrophic thoughts related to swallowing*. They did not know how to be and act during the treatment:

> Because I don't know whether I'm allowed to swallow or move, if the drill is going to go through to my brain if I move just a little, or what if I drown because of all the saliva in my throat – I just don't know what they're so busily doing in there and I'm sitting here drowning.

All participants told about *the harmful effects and negative consequences of their fear*. For example, they described remembering the unpleasant feeling, memory disorders/paramnesia, avoidance behaviour or long gaps between appointments and emergency treatments, being repulsed by dental treatment, deterioration in dental condition and long-term treatment processes. Some participants perceived that they had difficulties admitting their feelings/sensations associated with fear. In addition, *the shame associated with the fear negatively* affected the ability to deal with it: ' … when the time comes to start filling the teeth, that's likely to be another pretty big stumbling block'. Sedatives did not always give relief and severe reactions were considered as normal by the patients.

Discussion

The results showed that patients' DF is a multifaceted phenomenon in terms of its emotional, behavioural, cognitive, and physiological components. In other words, each of these components appeared internally diverse when looked at from the point of view of the patients' own perceptions in the frame of the diagnostic interview. Moreover, patients described the various contents of their DF in three different contexts: before, during and after dental treatment. Within the four components, 27 more categories of DF were identified depicting the various quality of emotions, behavioural adaptations, physiological reactions, or cognitions. In addition, 69 sub-categories or dimensions were identified.

Based on this study, patients with dental fear are capable of expressing, specifying, and analysing their fears in a versatile manner in the context of a diagnostic interview. The

large number of categories and sub-categories and the related several contents of fear illuminated this. Our study differs from previous studies due to its theory-driven analysis of patients' dental fear, as most of the previous related studies aim at developing models or theories [23–26,28]. By utilising the notion of the four components of fear as the basis of our theory-driven content analysis, we were able to show how the quality, intensity and duration of participants' fears varied with respect to the context in which the fear was said to occur (before, during or after dental treatment). In addition, the analysis opened the door to better understanding of the origins of patients' fears and factors related to alleviating or provoking fear. In summary, the approach used in this study broadened the comprehension related to the multifaceted nature of variations in patients' dental fear that can be utilised in developing diagnostic practices for dentally anxious patients. For example, the IDAF-4C^{+} scale has been used successfully in Jönköping's model of diagnosing patients' fears [34]. Dentists' awareness of patients' dental fear increased, and Jönköping's model offered a holistic approach to the treatment of dental fear. We suggest that the diagnostic interview may offer a tool for dentists to gain a comprehensive and multifaceted picture of the patient's dental fear.

Patients reported negative experiences related to dental treatment in the diagnostic interview. On the other hand, they also reflected on the ways and means that enabled them to cope with their fear, as has been discovered in previous studies [25]. We noticed that the patients tried to do their best to cope with their fear, but while they were persuaded to adopt ideals learned, their challenges regarding maintaining acceptable thoughts and behaviours caused problems. A previous study showed ambivalence towards coping with dental fear and how one's emotional state affected their daily routines and worsened their quality of life [24]. The dentally anxious patients affected to stain alone with their problems in our study. If the participants had the possibility to talk about their experiences with a professional, it aided them to participate in dental care. Due to this, we propose that professionals should be initiative in reacting to a patient's fear. Although, researchers have presented results indicating that dentists need to demonstrate sensitivity and delicacy when raising patients' fears through treatment discussions [28].

The dimensions related to cognitions revealed a few essential key characteristics regarding patients who suffer for dental fear. The first of them was lack of confidence, but other confounded psychologic disorders were also underlying aspects of fear, as stated in an earlier study [35]. It has been confirmed that a new dentist can alleviate fear by using the iatrosedative process [36] and when patients are calmed by the behaviour, attitude and communicative stance of a dentist, it helps patients with dental fear to build a trustful dentist-patient relationship [37]. The second key was a patient's ability to specify several fear-alleviating factors and the third key was the dentists' attitudes towards accounting for patients' worries and wishes. Empathy was positively associated with negotiated treatment plans, treatment adherence, increased patient satisfaction, and reduced dental anxiety in a review [38]. It can be stated that a proper dentist-patient interaction is essential for the patient to maintain regular dental care visits. Study evidence showed that dentists learned to treat fearful patients over years of experience and regardless of other remaining competency challenges [39] and most patients continued to have a complicated relation with dental care even after behavioural cognitive therapy [26]. Further education for dentists who are interested in developing their skills in treating dentally anxious patients could alleviate stress related to treatment of patients with dental fear.

Fear of pain, lack of knowledge, feelings of loneliness were usual complaints and sources of stress experienced by patients in this study. A harmful consequence of the fear was the patients' difficulties in talking about the sensitive topic and they used different non-verbal expressions or euphemism for fear during their interviews. One explanation for this could be embarrassment, shame, or guilt because of deterioration in oral health, as stated earlier [40], but the meaning of non-verbal expressions requires further studies. Another reason for difficulties in admitting the sensations of fear could be the mindset to be strong, which can lead to patients tending to hide their fear and thus create negative thoughts. Regardless, the expressions patients used when reflecting on their experiences may be more meaningful than we were able to predict. For example, the deepest fears related to dental treatment were associated with a perceived threat to the person's life, however the patients avoided talking about death. Thus, some patients may benefit from interventions with professionals who can help the patient deal with the difficult sensations and to correct false impressions.

We chose the qualitative research approach to gain a better understanding of the so far under-studied issue of DF – the patient's own views about their dental fear in the frame of a diagnostic interview. The qualitative research on dental fear is currently characterised by highly inductive research designs involving the use of grounded theory methods. However, qualitative research designs informed by theoretical concepts can be useful to sensitise researchers to relevant issues, processes, and interpretations that they might not necessarily identify using purely inductive methods [41]. We acknowledge that our decision to utilise four components of DF as the broad framework of analysis offers one possible approach to investigate people's own perceptions of their DF. Possibly, some other aspects of DF may be recognised by using different theoretical and methodical approaches. However, given that the notion of the four components of DF had not been utilised in qualitative research on dental fear at the time of our study, it was meaningful to test it against the themes that emerged from the data. The analysis conducted with few interviews enabled us to make visible the multifaceted nature of DF as it is experienced by patients themselves, which speaks for the usefulness of the chosen method. In summary, our study sheds new light on the phenomenon that has so far been well recognised in everyday dental practice but very little studied, especially from a qualitative point of view. Although generalisation to

all patients with dental fear cannot be made due to the relatively small data, the detailed analysis of a few individuals' perceptions enables identifying key aspects of the phenomenon under investigation and, therefore, developing generalisations to theoretical propositions [42]. We suggest that the results gained in this study may well enhance the understanding of dental fear, especially when considered in terms of relatively similar contexts and groups of dentally anxious patients. Moreover, the outcome of this study may facilitate further and complementary analysis using the same or alternative theories and methods in the future.

The validity of the study can be evaluated through acceptable quality criteria of qualitative inquiry. To facilitate repeatability of the study, we have described the data collection and the process of analysis in detail. We suggest that credibility was reached because participants represented typical cases of dentally anxious patients in dental offices; the dentists recruited those who had difficulties coping with dental treatment and their fear level was measured using a self-report scale. We have aimed to ensure the reliability of the study by using researcher triangulation, i.e. two researchers read the emergent themes and independently coded the data. Moreover, we have provided data excerpts that cover all interviews through the analysis section to make sure that the reader has a possibility to evaluate our line of interpretation.

Conclusions

The results indicate that dental care professionals may gain comprehensive information about their patients' DF by means of four component-based diagnostic interviews. This helps them to better identify and encounter patients in need of fear-sensitive dental care.

Acknowledgements

Ethical permission for this study was granted by The Hospital District of Northern Savo under the registration number: 281/13.02.00/2016. The authors complied with the instructions of the Finnish National Board on Research integrity regarding all ethical rules and participants' rights in this study. The authors are grateful to the General Dental Practitioners and patients who participated in this study.

Disclosure statement

The authors declare no conflicts of interest related to this study and have nothing to disclose in connection to this study.

Funding

The Finnish Cultural Foundation partly supported this study under grant number 55181410.

Data availability statement

The data set and analysis material used in this study are reserved at the University of Eastern Finland (UEF) in databases for researchers:\\research.uefad.uef.fi\groups by the name 'pelkotutkimus' and on memory sticks saved in researcher rooms' locked boxes. Please contact the first author for data set questions.

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II

The Use of dental anxiety management techniques during one-session treatment: a study on five video-recorded patient cases

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Acta Odontologica Scandinavica Sep 25:1-11, 2023. Online ahead of print.

Acta Odontologica Scandinavica

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/iode20

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To cite this article: Pirjo Kurki, Maija Korhonen, Kirsi Honkalampi, Satu Lahti & Anna Liisa Suominen (2024) The use of dental anxiety management techniques during one-session treatment: a study on five video-recorded patient cases, Acta Odontologica Scandinavica, 82:1, 55-65, DOI: 10.1080/00016357.2023.2258957

To link to this article: https://doi.org/10.1080/00016357.2023.2258957

ACTA ODONTOLOGICA SCANDINAVICA
2024, VOL. 82, NO. 1, 55–65
https://doi.org/10.1080/00016357.2023.2258957

Taylor & Francis
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RESEARCH ARTICLE

The use of dental anxiety management techniques during one-session treatment: a study on five video-recorded patient cases

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ABSTRACT

Objective: The aim was to examine what kinds of dental anxiety management techniques dentists use in the context of one-session treatment.

Material and methods: The data consisted of videotaped treatment sessions for five dentally anxious adults. The treatment was conducted by two experienced dentists without formal training in the treatment of dentally anxious patients or behavioral management techniques. Theory-driven qualitative content analysis, based on the anxiety management classification of Milgrom et al. was used to identify and classify the techniques used during the treatments.

Results: Altogether, diverse categories of dental anxiety management techniques were identified under the main themes of enhancing trust and control and psychological management. Techniques that fell into enhancing trust and control included the categories of 'building a trustful relationship', 'informational control', and 'behavioral control'. These techniques were used consistently throughout the sessions. Additionally, psychological management techniques were identified and classified as 'behavioral strategies: relaxing the body' and 'cognitive strategies: relaxing the mind', which were regularly used in specific situations.

Conclusion: The results indicate that a variety of dental anxiety management techniques were used during one-session treatments. The findings provide valuable insights for dentists in managing their patients with dental anxiety and improving their overall treatment experience.

TR: NCT02919241

ARTICLE HISTORY
Received 19 April 2023
Revised 6 September 2023
Accepted 11 September 2023

KEYWORDS
Behavior management; dental anxiety; patient trust; content analysis; video recording

Background

One-third of Finnish adults report dental anxiety, and one-tenth report high dental anxiety, which typically leads to avoidance of dental treatment [1]. Avoidance, in turn, can lead to the deterioration of oral health, further feelings of shame and inferiority, and psychosocial distress, which is the vicious circle of dental anxiety [2–5]. These characteristics make the treatment of dentally anxious patients a major challenge for dental care providers [6] and increase the financial costs of oral health care. Nevertheless, several techniques are available to help patients cope with dental anxiety [7].

A dental fear and anxiety management classification by Milgrom et al. [8] has been introduced into the literature, which includes specific strategies to enhance trust and control in addition to behavioral, cognitive, practical, and pharmacological strategies to reduce patient fear and anxiety. Interventions and treatments based on cognitive behavioral therapy (CBT) have been shown to be effective in reducing severe dental anxiety in adults, including one-session treatment [9,10]. Brief CBT interventions consist of one to five exposure-based dental treatment sessions delivered by trained dentists [11,12] or one to three psychological treatment sessions delivered by psychologists prior to conventional dental treatment [13–15]. Approaches to the treatment of dental anxiety, such as cognitive restructuring [16,17], the use of relaxation techniques [18], and techniques to increase the patient's sense of control over the dental treatment [19], have also been described in the literature. Treatment has been shown to be most effective when techniques are combined with repeated, graded exposure [9].

However, there is a lack of studies that focus on how different dental anxiety management techniques are used by dentists in conventional dental care. Previous studies have typically been conducted with dentists specially trained in CBT [11,12] or by psychologists in dental anxiety clinics [16]. Video recordings have been used in previous research to investigate the use of individual techniques to reduce dental anxiety in patients, such as the provision of information [20,21], the use of desensitization [18], and the qualitative evaluation of health information in dental anxiety videos on YouTube [22]. However, there is a lack of studies examining video-recorded treatment sessions in which dentists use different techniques for patients with dental anxiety. We suggest that data from real dental treatment situations is needed to illustrate how dental anxiety management techniques

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conceptualized in previous research are used in practice by clinically experienced dentists who have no formal training in the treatment of dentally anxious patients or in behavioral management techniques. Therefore, we aimed to examine what kinds of dental anxiety management techniques dentists use in real-life dental situations, focusing on videotaped patient cases during one-session treatments for individuals with dental anxiety. The data were analyzed using qualitative theory-driven content analysis drawings from the classification of Milgrom et al. [8].

Material and methods

The data used in this study are part of an intervention study that included a diagnostic interview (DI) alone or combined with modified one-session treatment (M-OST) for dentally anxious patients (Figure 1). The study was conducted in eastern Finland from 09/2016 to 12/2018 (ClinicalTrials.gov: NCT02919241) [23]. According to the inclusion criteria, the participating adult patients displayed dentally anxious behavior and had difficulty attending conventional dental care. After the voluntary participants provided verbal informed consent, their dental anxiety was measured using the Modified Dental Anxiety Scale (MDAS) [24]. The participants in this study consisted of five of the eight participants (aged 31 to 58 years, one male, all with irregular and/or emergency dental attendance patterns) who attended a DI + M-OST and the second interview. Prior to the intervention, one of these participants scored 13 points, and four scored 19 points or above, which is the established cut-off point for high dental anxiety on the MDAS [25,26].

The data for the present study consisted of video recordings of 18 to 58 min of dental treatment performed by two dentists with eight and 18 years of clinical experience, respectively. A video camera was installed at a distance of two meters on the dentist's side and focused on the patient. The recording started when the patient sat in the dentist's chair at the beginning of the treatment session and stopped when the patient left the room. The method and technique (videotaped data + *Atlas.ti 9* computer software) allowed us to observe in detail how the dentists dealt with anxious patients during the treatment. The dentists were briefly oriented by the researcher (PK) on the principles of gradual exposure (max. half an hour) and provided with a one-page written information sheet on the main phases of a specific one-session treatment (OST) [27] in the intervention [23]. These meetings with the dentists lasted half an hour and included a description of M-OST. The one-session treatment was aimed at helping the patient manage the dental treatment, which consisted of an oral examination ($n = 4$) performed by one of the two dentists or restorative dental treatment ($n = 1$). General information about the patient's dental anxiety was available to the treating dentists on a sheet of paper. This information included the severity of dental anxiety, previous dental attendance behavior, the experience of the previous dental visit, any negative experiences of dental care, and treatment preferences expressed in the diagnostic interview [23]. The baseline interviews with the patients about their dental anxiety, which lasted one to two hours, were conducted by the researcher (PK), after which the treatment session was scheduled for another time. The interview included three self-reported dental anxiety scales, a semi-structured fear assessment questionnaire [8], and a behavioral analysis instrument [28].

Method of analysis

Video recordings of five dental treatment sessions were analyzed using theory-driven qualitative content analysis consisting of inductive and deductive elements [29]. This approach was chosen because the theoretical framework allowed the researchers to focus on the dental anxiety management techniques identified in previous research [30]. The theoretical framework used in this study draws from the classification of Milgrom et al. [8] concerning techniques for treating fearful patients (Table 1). Another classification described in previous research was used to identify the range of behavioral and cognitive techniques [7].

In the initial phase of the analysis, the first two authors watched the videos independently, focusing on one patient at a time and identifying all emerging episodes according to the predetermined initial coding categories: building rapport and communication, information, providing control, distraction, positive reinforcement, diaphragmatic or relaxation breathing, cognitive restructuring, and systematic desensitization. The first author (PK) highlighted, point by point, the episodes from the videos in which the dentists used these techniques (*quotation in Atlas)* and added descriptions to them (*comments in Atlas*). The themes were used as *a broad conceptual framework and organizing principle* for coding (*codes in Atlas*). An episode lasted from a few seconds to approximately 90 s and included the dentist's verbal and nonverbal actions and reactions toward the patient, as well as the patient's responses. The unit of analysis helped to evaluate the use of techniques in the context of situations, a dentist-patient relationship, and communication, although the interaction was beyond the focus of the study.

In the second phase, the first author organized all episodes according to the classification of Milgrom et al. (Table 1). The classification divides the techniques into two specific strategies: enhancing trust and control and the psychological management of dental anxiety. These two were treated as the main themes and the categories of techniques were adjusted to fit them. The analysis also considered findings that did not fit with the theoretical classification. At this stage, the identified episodes were composed into the following categories of techniques (*codes in Atlas*): 'behavioral control', 'building a trustful relationship', 'cognitive chance', 'informational control', 'relaxing the body through relaxation', 'relaxing the mind', 'retrospective control or debriefing', 'supporting verbally', and 'usage of structured methods'. The dentists' actions within an episode often involved many techniques that overlapped within a short period of time. In the third phase of the analysis, these techniques were differentiated from each other using a constant comparative method to look for similarities and differences in the ways

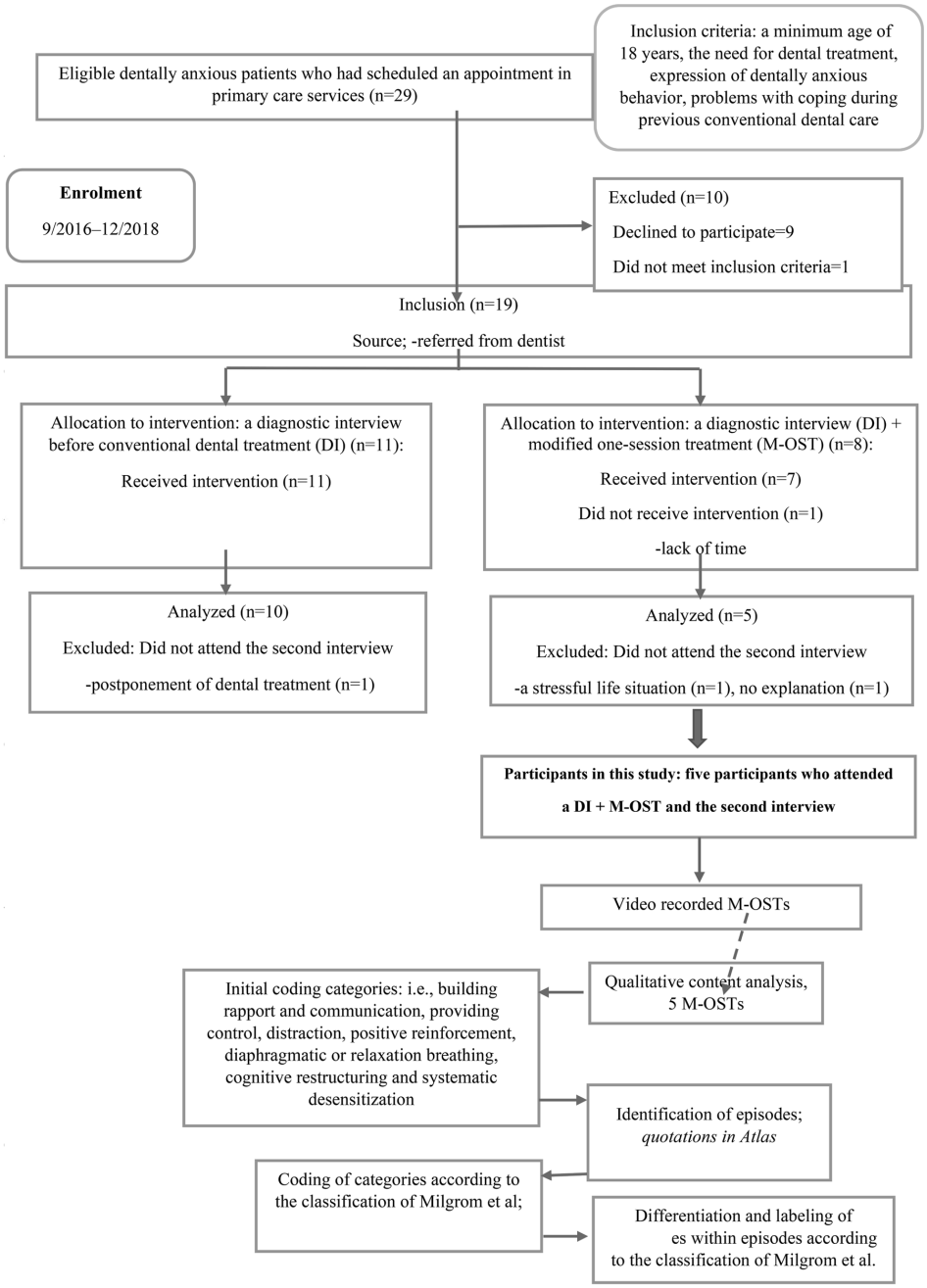

Figure 1. A summary of the sample and qualitative content analysis in the study.

they emerged. They were then further classified and labeled into more specific techniques (*descriptions in quotations' comments in the Atlas*). In the final step, the data from all patients' treatments and the identified episodes were brought together to form an overall description of the dental anxiety management techniques observed in the videos. As a result, the theory-driven analysis of the two themes and their categories led to the description of fear and anxiety management techniques and their characteristics used during one-session treatment, based on hundreds of episodes (Table 2). The classification of techniques was discussed among all authors, refining some of the categorizations and original

Table 1. A description of the classification of dental anxiety management techniques according to Milgrom et al. [8].

The foundation of psychological management: specific strategies to enhance trust and control	
Building trustful relationship	• Building rapport • Encouraging two-way communication • Expressing concern • Demonstrating competence and ethics • Including significant others
Providing control	
Information, cognitive change, behavioral control, retrospective control	
Informational control	• Tell-show-do • Time-structuring
Behavioral control	• Signaling • Behavioral strategies to control injection pain • Planning rest breaks
Retrospective control or debriefing	
Psychological and pharmacological Management: specific strategies	
Behavioral strategies: relaxation the body through relaxation breathing	• Muscle relaxation • Physiological monitoring: biofeedback
Cognitive strategies: relaxing the mind	• Altering expectations: redefining success and offering praise • Altering expectations: redefining the experience • Distraction • Guided imagery • Focusing attention • Thought stopping
Practice strategies	• Graduated exposure and its variants • Rehearsals • Systematic desensitization
Pharmacological strategies	• Oral agents • Nitrous oxide • Intravenous sedation

interpretations. Once the classification was finalized, two authors (PK and MK) selected examples from the taped treatment sessions that best illustrated the findings. The first author then transcribed these episodes verbatim for a more detailed analysis to be presented in this article.

Results

The results revealed the use of a wide variety of dental anxiety management techniques and demonstrated that the techniques were often used in combination with each other during the one-session treatment. Typically, the techniques fell into Theme 1 (specific strategies to enhance trust and control) and included the categories of 'building a trustful relationship', 'informational control', and 'behavioural control'. Relatively frequently, the techniques also fell into Theme 2 (specific strategies of psychological management) and included the categories of 'behavioural strategies: relaxing the body' and 'cognitive strategies: relaxing the mind'.

The results are presented below in accordance with the two main themes and their related categories, including the specific techniques presented in Table 2. In order to better understand the use of specific techniques, we added to the data examples the context of an episode (i.e. what is taking place in the treatment and what is known about the patient's dental fear) and the emotions and tones of voice. The voice tones varied according to the situation, i.e. when the dentist was persuading the patient, the voice was encouraging, and when she was assuring the patient, the voice was firm. Table 2 provides brief examples of the use of techniques, while longer examples are included in the main text. Participating patients are numbered one through five. The first dentist treated patient 1 and the second dentist treated patients 2, 3, 4 and 5 in a session. The time points of the video excerpts (in minutes and seconds) are included in the data examples.

Enhancing trust and control

Overall, the dentists used a variety of specific techniques related to Theme 1. They tended to reduce patients' dental anxiety by *building rapport*, *encouraging two-way communication*, *expressing concern, demonstrating competence and ethics*, and *including significant others*. The dentists' clinical skills were used when they adopted the techniques according to the patients' anxiety patient-specific needs, and oral health situation, especially when precisely *providing information about the procedure in lay terms or about safety* or *comfort.* The techniques of *telling-showing-doing* and *structuring the time* were used in situations that seemed unpleasant to the patients. The use of the techniques was flexible, and the treatment proceeded smoothly despite interruptions. When using the techniques of *agreeing with signaling*, *planning rest breaks*, and *using behavioral strategies to control injection pain*, the dentists assisted the patients in managing their feelings of pain.

'Building a trustful relationship' with the patient involved specific techniques, which included different means and methods of building trust through communication. The following three examples illustrate the main characteristics of these techniques:

Extract 1a. *The dentist is inspecting the patient's gums. The patient has expressed concern about her moving teeth and the dental treatment.* (Patient 5; 5.59–6.34)

1 Dentist (D): What about the air blower that dries the tooth? [Shows the dental air syringe to 2 the patient] Do your teeth ache? [Speaks in a friendly tone]
3 Patient (P): It is, no, it's fine with that. [Overlapping talk with the dentist]
4 D: So no, okay. I will keep blowing with it.
5 P: You won't put anything inside, right? [Gives a nervous laugh while talking]
6 [Overlapping talk with the dentist]
7 D: No, I'll just use it for blowing and will look with the mirror. I might have to test some of 8 the teeth, but look, the ball is here, [shows the instrument] so I will just brush with it. It's
9 not a sharp one. [The dentist brushes the ball-headed instrument against the patient's finger]
10 P: So not inside? [Nervous tone]
11 D: Not to the gum or inside the tooth, just the outside. [Encouraging tone]
12 P: Okay.
13 D: So, I will blow now and look with the mirror. [Determined tone]
14 P: Hmm hmm. [Approvingly]

Extract 1b. The dentist is examining a moving tooth. The patient has expressed worry about extractions (Patient 2; 14.4–14.58)

1 D: And of course, if the gum is infected. [You can feel pain when testing the mobility]

Table 2. Description of fear and anxiety management techniques and their characteristics used during one-session treatment with examples under the main themes and their categories based on the theory-based classification of Milgrom et al. [8].

Categories under the themes	Techniques and examples
Theme 1: The foundation of psychological treatment: specific strategies to enhance trust and control	
Building a trustful relationship	• **Building rapport:** • Dentist (D): *Were you in the waiting room when I left for lunch about half an hour ago? How's it going? Are you still okay? How does it feel to come here today for treatment? I thought that none of them will go* [a friendly comment from the dentist when the patient shared their thoughts after the treatment about removing all teeth] • **Encouraging two-way communication:** • D: *Is it okay if you lay down or would you prefer a half-sitting position? Would you like to take a look at a picture of the tooth? Here we have two teeth that need filling, so do you want us to do the smaller one today? Are any of your teeth especially sensitive to cold?* • **Expressing concern:** • D: *And I would never do anything by force… let's see how it feels; Is it sore?* [when the patient moves suddenly]; *I'll do it very carefully* [when the patient shows signs of pain]; *Yeah, it's harmless* [an answer to the patient's concern] • **Demonstrating competence and ethics:** • D: *This tooth in the upper left moves slightly, can you feel it with your tongue?* • **Including significant others:** • D: *But reinforcements are always welcome, so yes, they can come.*
Providing control: informational control	• **Information about the procedure in lay terms** • D: *Let's see if there's any tartar or gingival pockets* [while explaining how the instrument is used]; *I'll check the upper teeth with a light* [shows the fiber-optic light tool to the patient]; *Sometimes there are anatomical differences in people, as there's a hole where the anesthetic needs to go.* • **Information about safety** • D: *I'll check the gumline now with this ball-headed instrument* [shows the instrument]*; It's not sharp; Then I'll check the mucous membranes*; *And then we'll check the downstairs.* • **Information about comfort** • D: *And while I check them, I will list things and talk to the nurse about them, but it doesn't mean that there's something dangerous or wrong; You can feel slight scraping; So now you will first feel the small puncture… this really is unpleasant* [when the dentist carefully infiltrates the anesthetic into the lower jaw]. • **Telling-showing-doing:** • D: *I will now dry and look with the lamp like this, which will be put beside the tooth* [while showing the instrument and thereafter starting the inspection with the lamp]. • **Structuring the time:** • D: *And this is the last one; You can swallow in just a moment; For the last thing, I'll just test* [shows the movement with a finger] *if there's any mobility in the tooth; Why don't we continue in these shorter stretches, okay? I'll drill just a little and then we'll take a break; Now I'm already done with the drilling, I'll then move on to applying the filling.*
Providing control: behavioral control	• **Agreeing with signaling** • **Planning rest breaks:** • D: *And you don't have to keep your mouth open the whole time; And you can swallow every now and again; Just keep your mouth closed please* [when telling the patient that they will check the images in the meantime]. • **Using behavioral strategies to control injection pain:** • D: *Do you want that we use a topical anesthesia first to numb the mucous membrane?*
Theme 2: Psychological management: specific strategies	
Behavioral strategies: relaxing the body	• **Relaxation breathing:** • D: *Really focus on that, we will do the rest and you just remember to keep breathing; Deep breaths through the nose; Remember to breathe, this is just an instrument on your tooth.* • **Muscle relaxation:** • D: *Now try to keep your tongue relaxed, and keep breathing through the nose; And then you can keep it relaxed* [during the extra-oral examination]; *And try to keep your shoulders as relaxed as possible* [the dentist touches the patient's shoulder with their hand]; *Just normal regular breathing, and now, if you can, you can try those things that you have learned with X about relaxing* [in the diagnostic interview].
Cognitive strategies: relaxing the mind	• **Altering expectations: Redefining success and offering praise:** • D: *You have really clean teeth, you know how to brush them; You have done well, really well* [encouraging, supportive tone]; *I will blow it a bit and take a look with the mirror, and you can turn your head slightly towards me, good; Now bite your teeth gently together please, good, well done, keep breathing slowly through your nose, good, then you can swallow; So, open your mouth wide please, good, and close and open* [friendly tone]; *Excellent, keep breathing just like that* [when the patient takes a slightly deeper breath]; *You have so many good teeth.* • Dental assistant: *You speak good Finnish; This has been going well* [towards the end of the filling]; *You're doing great* [in a situation that scares the patient]. • **Altering expectations: Redefining the experience:** • D: *And now our goal is to try and change your mind set about the anesthetic not working; Let's take our time and wait until it numbs thoroughly; If we can't finish the filling now, that's okay* [with an approving tone]; *It will numb just fine* [convincing tone]. • **Distraction:** • D: *That's Finnish schlager music, do you like it?* [a question to a foreign-born patient, as they agreed at the beginning to play music as a distraction]. • **Focusing attention:** • D: *The sounds are so beautiful* [a small child chats in the background in their own language].

2 P: Aah. [Loud sound that expresses pain]
3 D: I'll be as careful as I can [while testing the mobility], remember to keep breathing.
4 P: Mmm-
5 D: This tooth [with emphasis] had slight mobility, so I will test this one. Let's see if there's a
6 periodontal pocket (unclear word).
7 P: Aaah. [Sound that expresses pain]

Extract 1c. *The dentist has followed through with the examination and tells the patient about the findings in the mouth. The patient has expressed worry about her dental situation and symptoms related to the tooth* (Patient 3; 21.46–22.00)

1 Dentist (D): But then the staining can also be, as you can see the darker spots –
2 Patient (P): [Right.]
3 D: from smoking, and if it hasn't been cleaned for a long time.
4 P: [Mm.]
5 D: So, something has ingrained between the teeth or stuck in the seam of the filling.
6 P: [Right.]
7 D: But there is no hole.
8 P: Okay.

First, the dentists *built rapport*, especially at the beginning and the end of the treatment. This involved asking patients direct questions about the ongoing treatment (Extract 1a, lines 1–2), especially when the patient had expressed concerns about the condition of the teeth. This also occurred when the patient showed no reaction and spoke briefly about the sensations during the treatment situation. In building rapport, the dentists' voices also expressed kindness, after which the patients usually responded by talking about their opinions and sensations related to the procedures (Extract 1a, lines 2–4).

Second, the dentists *encouraged two-way communication* throughout the sessions. They told beforehand what was going to happen, listened carefully to the patient's wishes related to the treatment, and responded to the suggestions (Extract 1a, lines 5–9). Patients' previous dental treatments, symptoms, and radiographic inspections were considered when planning their ongoing dental treatment together. The dentists *expressed concern* when they patiently responded to the patient's questions and worries (Extract 1a, lines 10–12). This also occurred when they responded to the patients' unexpected, especially fearful reactions by interrupting the examination or treatment and by calming the patients down. (Extract 1b, lines 1–4). The dentists anticipated the patients' pain and took it into account when the patients suddenly flinched or showed other signs of anxiety, such as bodily movements or verbal expressions. (Extract 1b, lines 5–7).

Third, the dentists *demonstrated competence and ethics* when they talked to the patients about the treatment procedures. The treatment usually progressed thereafter, and the patients agreed with the dentists' proposals (Extract 1a, lines 13–14). The dentists discussed the findings in detail afterward and when the patients asked about them. In particular, the dentists put effort into responding to the patient's worries or doubts by offering explanations when the patient was suspicious of the dentist's findings (Extract 1c, lines 1–8). The dentists *suggested including significant others* when the patients were worried about their ability to cope with future dental treatment (Table 2).

We observed different techniques and their characteristics related to 'providing control' to the patient, which took the form of either 'informational control' or 'behavioural control'. These included providing information about the technique in lay terms, as well as providing safety and comfort to increase the patient's control over the dental procedure and the predictability of what would happen during treatment (Table 2). The following two examples illustrate the main characteristics of the techniques related to informational control:

Extract 2a. *The dentist has just told the patient that she will inspect the gums with a certain instrument. The patient has expressed high pain sensitivity.* (Patient 4; 14.50–15.19)

1 Dentist (D): So, the last thing I would need to do is inspect the gum with the ball-headed
2 instrument. [Shows the instrument to the patient]
3 Patient (P): Mmmh. [Terror-struck sound]
4 D: Like this one. It's not sharp. [Calming statement]
5 P: Can you feel it? [Interrupts the dentist and asks in a voice that indicates fear]
6 D: You will feel it on the gum, but I'll just gently brush with it. I'll do it very carefully with
7 slight pressure, but I'll mainly just look to see if there's tartar or gingivitis, things that this is used
8 to measure. We can focus on a few teeth here and there, no need to do all of them.

Extract 2b. *The dentist is applying a filling to the patient's tooth. The patient has expressed worry related to pain.* (Patient 1; 35.43–35.54)

1 D: Like this. [Shows the matrix in their hand to the patient] Are you familiar with a matrix like this?
2 P: Yeah.
3 D: Okay. Now I will also put it [the matrix] into your mouth, and as the mucous membrane has
4 already numbed, you can no longer feel it. [Emphatic, reassuring tone]

Dentists frequently use these techniques when preparing patients for dental treatment procedures. This involved talking about the procedure by using understandable language and avoiding technical terms, showing the instruments, and depicting the sensations related to inspection and treatment (Extract 2a, lines 1–4). Since providing informational control occurred just before conducting the procedure, the patients had the possibility to express themselves in some way (Extract 2a, line 5). In addition, the dentists talked in detail about the reasons for the treatment and tried to be gentle when performing the procedure which provoked fear in the patients (Extract 2a, lines 6–8). The patients showed their understanding and acceptance of the dentists' actions by nodding their heads and sometimes by short words.

The specific technique of *telling-showing-doing* was used in situations that were difficult and possibly painful for the patients (Extract 2b, lines 1–4), and *structuring the time* in situations where the patients' endurance needed to be strengthened (Table 2). Because the patients' reactions varied, and some clearly showed their pain, the dentists adapted the activities according to the patient's needs. Not all the patients wanted to see the instruments, and some needed more emotional support than others. Due to this, the drilling procedure was divided into shorter phases.

The following two examples illustrate the main characteristics of the specific techniques related to behavioural control:

Extract 3a. *The dentist is preparing the situation for a filling. The patient has expressed a strong belief that local anaesthesia is ineffective.* (Patient 1; 2.35–2.51)

1 Dentist: You can always interrupt me whenever you want to close [your mouth] or something

2 and can no longer stay still.
3 Patient: Mm.
4 D: Which signal should we use? You can raise your arm, which means that we'll stop, okay?
5 P: Yeah. [Nods in approval]
[More anesthetic has been applied in between and they have been waiting for it to take effect for over 20 min]
6 D: So, you can decide when we stop, when we end it or when we take a break. Whenever you
7 feel like it. We'll of course know if it aches. I mean, if you want to take a break, just raise your
8 arm and I'll stop. But is it okay if we'll do a tiny, let's call it a test drill, just test it a little, okay?
9 P: Mm.
10 Dental nurse: And I'll follow your arm closely, while the dentist looks at the tooth.
11 P: Mm.

Extract 3b. *The dentist is examining the patient's gum with a special instrument. The patient has expressed a strong fear of pain.* (Patient 4; 15.18–16.10)
1 D: I'll start here from the top. Just remember to keep breathing. It will feel like this. [After a few 2 s of examining] Just keep breathing slowly the whole time.
3 You can swallow in a second. Good, you can close your mouth now.
[Noises from a small child playing can be heard in the background]
4 D: And then the left side. Turn your head towards me again, please.
[Continues after a few seconds]
5 D: I'll test just one of the front teeth. You might feel it in the front but don't get scared.
6 P: Mmmh. [Terror-struck sound]
7 D: Right, you can swallow now. Then there's only the bottom left, and that's it.

The dentist *agreed to signal* with the patient by telling the patient to raise a hand as a sign to stop (Extract 3a, lines 1–5). This was repeated before starting to drill and when ensuring the numbness of the tooth through a brief test drilling (Extract 3a, lines 6–9). The dental nurse also reassured the patient about the possibility of signalling (Extract 3a, lines 10–11).

Planning of rest breaks occurred by agreeing with the patients at the beginning of the treatment that interruptions were allowed during treatment (Table 2). Usually, breaks were taken regularly throughout the session, but the patients' need for breaks and swallowing sometimes led to more frequent rest breaks (Extract 3b, lines 1–4). The dentists responded to the patients' anxious movements, deep or rapid breathing, or breath-holding with a pause. The timing of the pauses was usually decided by the dentists, but the patients themselves also regulated the duration of the pauses by opening their mouths only when they were ready to continue. The importance of pauses was emphasized in certain situations, such as when the patients clearly showed anticipation of pain and when the dentists used the technique in conjunction with *structuring the time* (Extract 3b, lines 5–7). Dentists used *behavioural strategies to control injection pain* when they asked the patient's opinion about the use of surface anaesthesia before injections and when they infiltrated the local anaesthetic extremely slowly (Table 2).

Specific behavioral and cognitive strategies

In summary, the dentists used several specific techniques related to theme 2. *Relaxation breathing* and *muscle relaxation* techniques were used in situations that elicited strong anxiety and changes in breathing or muscle tension. The dentists closely monitored the patients' anxious reactions during the treatment procedures. The techniques of *altering expectations by redefining success and offering praise* and *by redefining the experience* were used to encourage patients' possibilities of coping. The other techniques, *distraction,* and *focusing attention*, were suggested to patients to help them redirect their thoughts away from the treatment.

Techniques related to 'behavioural strategies: relaxing the body' were observed. These techniques focused on actions to promote physical relaxation of the patients by paying attention to breathing and muscle relaxation. The following examples illustrate the main characteristics of these techniques:

Extract 4a. *The dentist is performing an external examination of the mouth. The patient has expressed strong anxiety related to the sensitiveness of her teeth.* (Patient 5; 3.50–4.02)
1 Dentist (D): And just remember to keep breathing the whole time. It's really important [soothing
2 [voice].
3 Patient (P): I'll try. [Slightly worried tone]
4 D: Good.

Extract 4b. *The dentist is applying local anesthesia in the mouth. The patient has expressed worry about the ineffectiveness of numbing.* (Patient 1; 11.26–12.59)
1 (D): So, keep your mouth wide open, please. I will test it first to find the right spot. Next, you will
2 feel a slight puncture. Just remember to keep breathing slowly. This is unpleasant, but I'll start
3 giving the anesthesia in a second and the tissue will start to numb. Yes. Just remember to keep
4 breathing.
5 Dental nurse: You can also lower your shoulders if you can to relax. [Encouraging tone]
6 D: Yes. Great. Excellent. Remember to breath… Remember to breath… This takes a long time, but 7 it will be over soon.

First, *relaxation breathing* occurred when the patients showed anxiety during a procedure and the dentists reminded them to breathe. Some of the patients had difficulties breathing (Extract 4a, lines 1–4) and sometimes laughed uncomfortably after the dentist reminded them to breathe. This technique also occurred when the dentist demonstrated deep breathing before the drilling procedure while waiting for the tooth to become numb. Usually, patients were reminded to relax during the procedure, and the dental nurse participated in this (Extract 4b, lines 1–7). Second, dentists urged *muscle relaxation* if they noticed that patients were having difficulty coping or that their limbs were stiff during the procedures. Reminding patients about relaxation breathing and muscle relaxation often occurred in combination (Table 2).

Various techniques related to 'cognitive strategies: relaxing the mind' could also be observed. These techniques focused on the patient's negative presumptions and perceptions about dental treatment, doubts about their ability to cope, and the condition of their own teeth. The following three examples illustrate the main characteristics of these techniques:

Extract 5 a. *The dentist examines the patient's mouth and gives instructions during actions. The patient has expressed severe dental anxiety and many previous negative experiences.* (Patient 3; 4.05–4.33)

1 Dentist (D): And you can swallow. I'll press your tongue slightly, and then you can say AAH.
2 Patient (P): AAH.
3 D: One more time, please.
4 (P): AAH.
5 D: Well done. Then stick out your tongue for me and I will take hold of the tip. There we go.
6 Now, try to keep it relaxed and keep breathing through your nose the whole time. I will check
7 the edges of the tongue. You can swallow in just a moment.
8 Comment: The patient keeps his/her mouth open the whole time.
9 D: Great, you can close it now.
10 Comment: The patient closes their mouth immediately after getting permission.

Extract 5b. *The dentist is talking about patient's oral situation after treatment. The patient has expressed worry about the poor condition of her tooth.* (Patient 2; 17.00–17.31)

1 D: Yes, and most of your teeth are really, really good. And you know how to brush, to keep them clean. [Dentist's tone is appropriate, neutral, thoroughly convincing]
3 P: You know, I've just been able to get an electric toothbrush.
4 D: Alright. That's really good.
5 P: Yeah, yeah. I think I've used it only for a year now. [While the nurse lifts the chair up]
6 D: Okay. [In a kind tone]

Extract 5c. *The dentist is talking about the option to watch videos during treatment. The patient has expressed willingness to turn his thoughts away from the treatment.* (Patient 1; 1.14–2.12)

1 D: Did you talk about watching a video? [Refers to the interview]
2 P: Yeah, we did.
3 D: So, you think that it might help and calm you down a bit?
4 P: Well, I guess so, as it could give me something else to think about.
5 D: [Yes], yes. Well, I could move the monitor over here or YouTube for example. We can play a 6 video on it. Let's try it at the beginning to see if it helps. What do you think? Do you want
7 something?
8 P: Mm, yeah. I don't know. [Gives out a laugh]
9 D: You don't know? Okay, I see. Well, it's up to you. If you start feeling unwell at any point, we 10 can try the video then to get your mind off of it, okay?
11 P: Mmm.

The technique of *altering expectations by redefining success and offering praise* emerged in many situations during and after the treatment. This technique was used regularly when the dental team praised the patients for their good coping and for managing well in a difficult situation (Table 2). In particular, praise was used together with the other techniques when the dentists gave positive feedback to the patients for managing to follow the instructions (Extract 5a, lines 1–10). It also occurred when the dentists praised the patients' teeth and oral hygiene skills. The patients responded by talking about their success in daily dental care (Extract 5b, lines 1–6).

Dentists used another technique of *altering expectations by redefining the experience* when patients had previous negative experiences and difficulties in following dental instructions and coping with dental treatment. When using this technique, the dentist responded to the patient's doubts about the ineffectiveness of local anaesthesia and ensured that the patient had no difficulties with numbness (Table 2).

The other specific techniques, *distraction* and *focusing attention*, were used when the dental team helped patients divert their attention from the dental procedure to something else. For example, the dentists suggested a concrete way for patients to divert their attention before they started drilling (Extract 5c, lines 1–7). Patients' hesitation was acknowledged by offering them the possibility to change their minds later (see Extract 5c, lines 8–11). The dentists and dental nurses directed the patients' attention to children playing in the background or to the sounds of the suction machines (Table 2).

Discussion

This qualitative study on five cases of dentally anxious patients treated by two dentists found that dental anxiety management techniques were used in a variety of ways and in an individualized manner during one-session treatment. The detailed analysis of episodes identified from videotaped treatment sessions revealed that the techniques were often used simultaneously in specific treatment situations. The use of techniques was related to specific strategies to enhance trust and control in terms of building a trustful relationship and providing the patient with informational and behavioural control. These consisted of a wide variety of techniques that were consistently used throughout the treatment. In addition, the use of techniques related to specific strategies of psychological management, and more specifically, behavioral, and cognitive techniques to relax the patient's body and mind. These included several techniques that were regularly used in situations that were most uncomfortable for the patients. Overall, the use of these techniques indicated diversity, flexibility, and coherence in the proceeding.

Based on the findings, we argue that the two dentists with clinical experience but without formal training in behavioural management techniques were able to use a wide range of techniques in accordance with patient-specific situations in the context of a one-session treatment. Firstly, the use of techniques to enhance trust and control seems appropriate, because previous research has shown that a good patient–dentist relationship and the provision of control are sufficiently helpful for most dentally anxious patients to manage their dental treatment [31,32] and become familiar with the patient can create a trustworthy atmosphere that leads to a supportive and successful interaction [33]. These techniques may help patients to take control of the treatment situation and of their own reactions, thereby empowering them. 'Kind atmosphere' and 'mutual communication' as well as 'trust and safety' have also been preferred by dentally anxious patients [34]. In addition, certain actions, such as efforts to avoid pain, providing the patient with control, and keeping the patient informed about what the dentist is doing and what sensations the patient may experience, have all been demonstrated to alleviate dental anxiety [32]. The use

of such techniques was possible because the dentists were aware of patients' fears and received a brief orientation. In previous studies, videos were not used for data gathering but merely as a method to help the patient, for example by providing control before tooth extraction procedures [20]. Pre-operative information during dentoalveolar surgery [19] has also been shown to reduce the patient's anxiety levels after viewing the videos, but only in participants with low-trait anxiety. Other visual methods, such as virtual reality relaxation [35] and computer-based exposure with cognitive restructuring [36], have demonstrated effectiveness in reducing dental anxiety, specifically among highly anxious patients, while techniques like music-based distraction and hypnosis [37] also show promise. However, preoperative information and verbal information were found to be more effective than visual information for patients undergoing dental implant therapy [21].

Secondly, the implementation of psychological anxiety management approaches and techniques is useful because we have evidence of their effectiveness in reducing patients' anxiety [7]. This study also highlighted the combined use of behavioural and cognitive techniques during dental procedures that the patients appeared to find difficult to cope with. This is important, because focusing on relaxation may be critical when the patients have an unrealistic understanding of their ability to cope, and previous negative treatment experiences tend to influence patient behaviour in dental treatment situations [8]. Patients participating in desensitization treatment have also reported relaxation as being one of the most important factors in their fear reduction [18]. All in all, this study supported the previous finding that treatment should be proportionate to the severity of dental anxiety [38] and provided new evidence for the deployment and utilization of techniques according to the patient and treatment situation. This study provided examples of dentists' actions and communication as well as dentist-patient cooperation, in treatment situations that were successfully finished. We did not include the patients' perceptions of the helpfulness of techniques, because the focus was on the use of techniques in the context of one-session treatment. However, the benefit of restructuring the positive memories of dental care (e.g. through positive feedback and praise) could have an influence on patients' future regular dental care and break the 'vicious circle' of dental anxiety, which should be the main goal of dental anxiety management.

The validity of this study relied on a theory-driven qualitative study approach that followed the acceptable quality criteria of qualitative inquiry, except for data gathering [30]. The theory-based analysis was mainly based on a classification of techniques according to Milgrom et al. [8]. The use of another model, such as the one-session treatment model of Öst [27] or the most recent classification by Willumsen et al. [39] could have led to a slightly different categorization. An alternative approach, such as coding schemes [40] was not suitable for our study because it focuses on counting the elements that occur in treatment situations. Thus, it would have not allowed for a subtle identification of the versatile use of techniques. Perhaps none of the existing classifications or models [8,27,39] alone are comprehensive enough to assess the range of behavioral and cognitive techniques, or even superior in the context of one-session treatment. The selection of methods in a qualitative study is guided by specific aims, objectives, and contextual factors [30]. We described the data and the process of analysis in detail in order to facilitate repeatability and transparency, as well as to trace the interferences, based on the systematic identification of characteristics related to the use of the techniques. Overall, data adequacy in qualitative health research is best judged by the specific characteristics of the study at hand [41]. Saturation was achieved with five patient cases treated by two dentists because the use of the same techniques was repeated in these five patient cases. The findings are based on hundreds of episodes that contributed to the understanding of the dentist–patient relationship and dyad. To ensure the reliability of the study, we used investigator triangulation, i.e. two researchers viewed the videos independently, focusing on one patient at a time, and identified all emerging episodes according to the eight themes. In addition, all authors participated in discussions at several stages during the study, and the interpretations and final classification of the techniques were refined based on shared discussion and evaluation. Moreover, throughout the analysis section, we have provided a substantial number of data excerpts from all five dental treatment sessions to enable the reader to evaluate the credibility of our interpretations.

The limitations of this study include, firstly, the small sample composing five cases of one-session treatments. More heterogeneity in the variables relevant to the study could have been obtained if more than five patients had completed the intervention in the pilot study [23]. Moreover, sampling was not specifically designed for this qualitative study, as the material was gathered for the intervention. The results of this study are not generalizable to all groups of dentists or treatment situations, especially because our data included only two dentists and the patients had attended a diagnostic interview prior to the treatment in the context of one-session treatment. However, generalizability was not the aim of this study nor of qualitative research in general. The findings gained in this study may well be transferable and applicable to other contexts and situations that are similar enough compared to our study design. Further research is needed to investigate the use of techniques to manage dental anxiety in different settings, and the findings should be verified in future studies of dentally anxious patients involving a larger number of dentists and patients.

Secondly, this study could not capture those techniques and structured methods that would have required prior training or the implementation of more than one session, such as guided imagery, thought-stopping, biofeedback, or systematic desensitization [7,8]. Thirdly, the use of a video camera enabled us to capture all of the patient's reactions, but not those of the dentist. Another approach, conversation analysis could have revealed the interactive dynamics of the conversation between the dentist and the patient [5]. When using this approach, it should be possible to observe the reactions of both partners without face shields and more than one camera should be used.

Despite its limitations, the study has several methodological strengths. Firstly, the theory-driven content analysis of the video recordings of five dental treatment sessions succeeded in capturing the multifaceted process of reducing dental anxiety with different techniques and covered different aspects of dental anxiety, such as behavioural and psychological, that the techniques were targeted. The use of *Atlas.ti 9* software helped us to systematically conduct the analysis that increased the credibility and the opportunity to achieve our research objective, the identification of techniques in the form of their occurrence in real-life treatment situations. To our knowledge, this is the first study to use videotaped treatment sessions to gain a deeper understanding of dental anxiety management techniques in a real-life dental setting. Previous studies have had different study designs [11,12] or focused on the use of individual techniques [18–21]. The use of videotaped treatment sessions provided more reliable and ecologically valid information about the use of the techniques compared to the information obtained from self-reported questionnaires or interviews with dentists. The uniformity of the video-recording set-ups, and findings from earlier research related to the same intervention [23, 28] confirmed the internal validity of the results. This study confirmed previous findings suggesting that dentists have the ability and willingness to use many behavioural and cognitive treatment methods [33], especially when they have prior information about their patient's dental anxiety. The rating of patient dental anxiety [42] helps in discussing fear and fear-related factors and in building trust with the patient [18]. Asking about dental anxiety also helps to increase patient satisfaction and has been shown to reduce dental anxiety [43–45]. However, the dentists understood that they would be providing treatment as part of the study. Moreover, awareness of being videotaped may have had an effect, as well as the skill and experience of the dentists.

Conclusion

In conclusion, the results indicate that a variety of dental anxiety management techniques were used during one-session treatments by dentists who had only briefly been informed about the patient's dental anxiety. The findings provide valuable insights for dentists in managing their patients with dental anxiety and improving their overall treatment experience.

Acknowledgements

The authors are grateful to the two dentists conducting the dental treatment sessions on the participants and the patients who participated in this study.

Ethics statement

Ethical permission for this study was granted by the Hospital District of Northern Savo under registration number 281/13.02.00/2016. The authors complied with the instructions of the Finnish National Board on Research Integrity regarding all ethical rules and participants' rights in this study.

The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy and ethical restrictions.

Disclosure statement

The authors declare no conflicts of interest and have nothing to disclose in this study.

No external funding, apart from the support of the authors' institutions, was available for this study.

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III

The effectiveness of a diagnostic interview and modified one-session treatment for dental anxiety in primary dental care – A pilot study

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Special Care in Dentistry, 43(2):174-183, 2023.

Received: 15 February 2022 | Revised: 11 July 2022 | Accepted: 12 July 2022

DOI: 10.1111/scd.12760

ARTICLE

WILEY

The effectiveness of a diagnostic interview and modified one-session treatment for dental anxiety in primary dental care—A pilot study

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ClinicalTrials.gov: identification number: NCT02919241

Abstract

Aims: To investigate the effectiveness of a cognitive–behavioral intervention that included either a diagnostic interview (DI) or a DI combined with modified one-session treatment (M-OST) for dental anxiety among adults in a primary care setting.

Methods and results: Nineteen participants were assigned to either a DI before conventional dental treatment (group T1) or DI and M-OST (group T2). The severity of dental anxiety was measured with three self-reported measures before and after the intervention: the Modified Dental Anxiety Scale (MDAS), the Index of Dental Anxiety and Fear (IDAF-4C), and the Visual Analogue Scale-Anxiety (VAS-A). Dental care attendance was enquired in a 1-year follow-up. The scores for all three scales decreased among both study groups, with the largest decrease recorded in treatment group T1 assessed with the VAS-A. A higher dental anxiety score measured before the intervention associated most significantly with a higher dental anxiety score after the intervention. At the 1-year follow-up, 82% of participants in T1 and 67% in T2 had visited a dentist.

Conclusion: A DI alone and combined with M-OST is potentially effective in reducing dental anxiety and in supporting the engagement of adult patients with dental treatment in primary dental care.

KEYWORDS

adults, cognitive-behavioral intervention, dental anxiety, diagnostic interview, one-session treatment

1 | INTRODUCTION

Although decreasing in northern countries,[1,2] dental anxiety remains stable, particularly in adults aged 35–54 years.[1] By avoiding regular dental care, people with severe dental anxiety manifest deteriorated oral health in the short term, which in the long term results in poor oral health-related quality of life[3–5] and poor self-image.[6] Dentists have tools to assess patient anxiety that can help in predicting and preventing difficulties.[7] This situation requires the

attention of our health care systems, as severe dental anxiety could be treated.

Cognitive–behavioral therapy (CBT) is effective in the treatment of severe dental anxiety.[8] It has two essential aims: to reduce dental anxiety, including dental phobia, in the short term and change avoidance behavior in the long term.[9,10] Even brief behavioral interventions (one to five therapy sessions) are effective when they involve cognitive techniques or behavioral methods, or combinations of them.[8] This has been demonstrated in studies that have applied various models of brief interventions in the treatment of moderate or severe dental anxiety. These have included four different treatment approaches: one-session cognitive treatment,[11] one- versus five-session treatment,[12] short-term psychotherapeutic intervention,[13] and brief cognitive–behavioral intervention.[14] Further evidence has been provided by clinical trials demonstrating brief psychological treatments to be significantly more effective in reducing dental anxiety when compared to pharmacological treatment, being on a waiting list and waiting for treatment, or undergoing hypnosis. These two studies compared different dental anxiety treatment methods and pharmacological approaches among participants with dental phobia: one-session psychological treatment versus benzodiazepine,[15] and brief cognitive–behavioral treatment versus two types of hypnosis and general anesthesia.[16] In previous studies, the number of therapy sessions before exposure to dental treatment has varied from one to five sessions performed by a psychologist or a psychotherapist and a dentist. Moreover, various diagnostic procedures have been implemented before starting the therapy in these studies.[12,15,16]

Brief cognitive–behavioral interventions can also reduce severe dental anxiety, including dental phobia.[8–10] However, clinical experiments and trials have not considered the effect of a clinical diagnostic interview (DI).[11–16] Moreover, nearly all interventions have been conducted in special dental fear clinics. Because these clinics are rare and most adults with dental anxiety and problems with coping receive dental care in conventional dental clinics within primary health care, we focused on these patients. Effective interventions are needed in primary dental care to reduce dental anxiety and alleviate anxious behavior, which is a source of stress for both patients and dentists. A brief cognitive–behavioral-based intervention could be conducted by a practicing dentist following a DI.

In this study, we aimed to examine the effectiveness of a cognitive–behavioral intervention that included either a DI or a DI combined with modified one-session treatment (M-OST) for dental anxiety among adults in a primary care setting.

2 | MATERIALS AND METHODS

Participants were recruited from 09/2016 to 12/2018 from among patients who had scheduled an appointment in primary dental care services in eastern Finland. To reach an adequate number of participants for this clinical trial (registered in ClinicalTrials.gov with the identification number: NCT02919241), dentists assessed the eligibility of their consecutive patients according to the inclusion criteria (see Figure 1). The exclusion criteria were patients with an acute somatic or mental disease, dementia, pregnancy, and no previous dental treatment during their lifetime. The dentists approached 29 patients with dentally anxious behavior. If a patient provided permission to make contact after receiving the study documents, the researcher (PK) telephoned the possible participant and provided more detailed information about the study. Thereafter, the voluntary participants were alternately assigned to one of two treatment groups (T1 or T2) in the study in the order they provided written informed consent (see Figure 1). The target number of participants in the study groups was set to ten, aiming at 98% power with a confidence level of 0.05% and SD 2.8. This was based on power analysis aimed at a five-point decrease in the dental anxiety score measured by the Modified Dental Anxiety Scale (MDAS).[17] Finally, 19 participants were scheduled for the first study appointment, which was a DI. The mean age was 42.4 (SD 12.5, range 22–58).

All participants were first asked to complete three dental fear scales. Participants in group T1 ($n = 11$) participated in an intervention that included a DI and thereafter attended conventional dental treatment performed by their own dentist (see Figure 1). Those in group T2 ($n = 8$) participated in an intervention that included a DI followed by modified one-session exposure to dental treatment (M-OST) performed by a new dentist. Participants in both groups received a written summary of the DI to be delivered to their dentist before dental treatment. Within 1–4 weeks of the intervention, the participants who had fully completed the intervention, that is, the initial DI followed by a dental treatment visit or M-OST, attended a second interview (see Figure 1). They were again asked to complete the same three dental fear scales and respond to five qualitative interview questions formulated for this study: "Did the intervention help you?" "What was its significance to you?" "What helped you most in this treatment?" "What helped you next most?" and "What else besides your dental fear have you learned about here?" Twelve months after the second interview, all participants ($n = 19$) were asked by telephone about their dental care attendance, because they were advised to attend dental care twice a year.

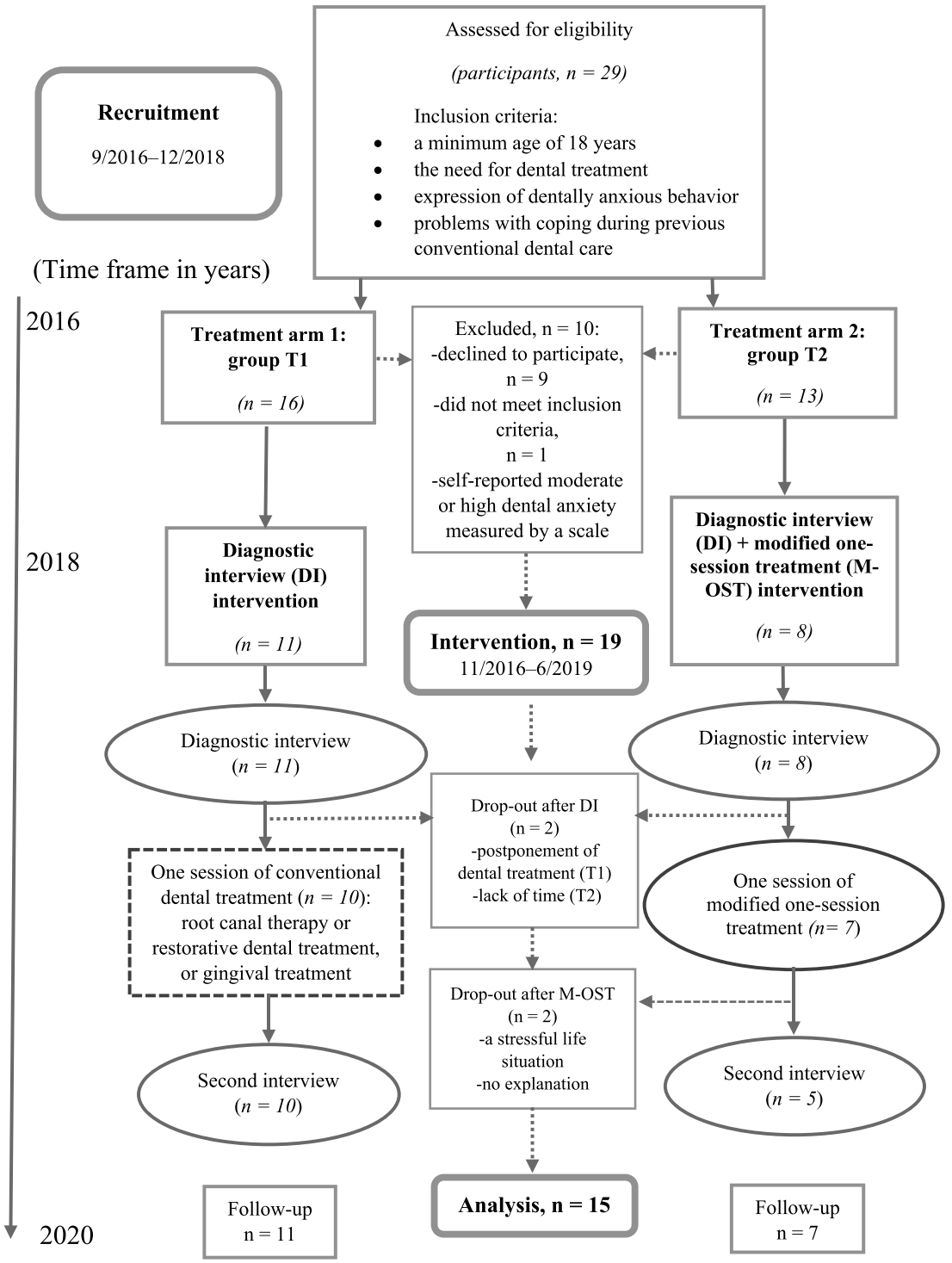

FIGURE 1 Participant flow diagram

2.1 | Interventions

All the DIs in the study were based on a DI guide. They were conducted by the first author, who had studied psychology and familiarized herself with the treatment of dental anxiety. The interviews lasted from one to two hours, depending on the participant's talkativeness. The structure of the DIs was based on three components: the three self-reported dental anxiety scales, a semi-structured fear assessment questionnaire,[18] and a behavior analysis instrument.[19] These tools focused on mapping the severity of dental anxiety, dental attendance behavior, the last dental visit, and previous negative experiences of dental treatment, and on making visible their effects on the patients' behavior in the current dental treatment. Knowledge of the most feared situations or objects gained through the interview questionnaires and behavioral analysis guided the search for appropriate strategies for managing dental treatment and techniques to control the situation. Overall, the DI enabled us to address the most relevant emotional, behavioral, and physiological components of participants' dental fear and anxiety.[20] The second goal was to increase the participants' self-efficacy. A summary of the DI was provided to the participants.

The M-OST was conducted by one of two dentists specializing in clinical dentistry. This session included an oral examination or restorative dental treatment and was based on the three principles defined in Öst & Skaret's one-session treatment (OST) model developed for dental phobia: building trust, inspecting and challenging the negative thoughts, and exposing the most threatening stimulus.[19] OST aims to replace a patient's negative treatment experience with a positive one by utilizing a specific gradual exposure technique during a dental treatment session. The principles and technique used in the M-OST were derived from OST. The assumption in OST is that patients have dental phobia (a marked fear towards a clear object or situation) and a strong belief that something catastrophic can happen in a dental treatment session. This differed in M-OST, as the participants had severe dental anxiety and the object of fear was not always obvious. Therefore, the gradual exposure described in OST was applied as appropriate in M-OST. Before conducting M-OST, both dentists familiarized themselves with this treatment and the DI. Thereafter, M-OST was performed in co-operation with the participant and lasted from 0.5 to 1.0 h, depending on the scope of the treatment. The dentists used various dental fear and anxiety management techniques presented in the literature.[18]

All the DIs were audio recorded and each M-OST was video recorded to ensure the internal consistency of the trial. The first and second authors confirmed this by evaluating the adherence of the DIs to the DI guide and by comparing each M-OST with the written summaries of the DIs.

2.2 | Evaluation of dental anxiety

The main outcome of this clinical trial was the change in the severity of dental anxiety as assessed using three self-reported dental anxiety scales differing in wideness and specificity. The MDAS measures the imagined emotional reactions towards dental situations with a five-point Likert-type scale ranging from "not anxious" to "extremely anxious."[17] The item scores are summed (range: 5–25) and a cut-off score of 19 or above is considered to indicate high dental anxiety.[21,22] The first module in the Index of Dental Anxiety and Fear (IDAF-4C) assesses the emotional, behavioral, physiological, and cognitive components of anxiety and fear using eight statements,[23] with response options on a five-point Likert-type scale ranging from "disagree" to "strongly agree." The average of the item scores is calculated (range 1–5), and an average of 2.5–3.5 or above is considered to indicate high dental anxiety.[24,25] The Visual Analogue Scale for dental anxiety (VAS-A) was used to record the participants' dental anxiety on a line of 100 mm in length, where "not at all anxious" and "very anxious" are at the left and right extremes, respectively.[26,27] The validity and reliability of the three scales are well documented; the versions validated in Finnish were used.[22,25]

2.3 | Covariates

Questionnaires collected information on the participants' sociodemographic characteristics, self-reported oral health, and use of oral health services. Sociodemographic variables included age, gender, education after primary school (categorized as education after primary school vs. only primary school education), and full-time employment (categorized as full-time employment vs. other options). Self-reported oral health was recorded with two questions that related to subjective oral health (categorized as good vs. moderate to poor), oral health problems (occurrence of toothache or other problems related to the teeth or dentures during the previous 12 months), and the use of oral health services (categorized as regular if under 2 years from the previous dental attendance) or an irregular dental attendance pattern (defined as symptom-oriented dental visits).

2.4 | Statistical analyses

Differences in the distributions and means between or within the two treatment groups (T1 and T2) in baseline sociodemographic variables, self-reported oral health, the use of oral health services, and dental anxiety scales (MDAS, IDAF-4C, and VAS-A) were examined using the χ^2 test for categorical variables, *t*-tests for normally distributed continuous variables, and the Mann–Whitney *U*-test for skewed continuous variables. The scores on MDAS and IDAF-4C scales were examined in both groups by comparing the scores measured before and after the intervention using cut-off scores adopted from previous studies (MDAS, score 19 or above;[21,22] IDAF-4C, score 3.5 or above).[24,25] Linear regression analysis was performed to determine the association of the study group with the post-treatment dental anxiety scores adjusted for age, gender, pre-treatment dental anxiety scores (measured by the MDAS or IDAF-4C), symptom-oriented dental visits, and subjective oral health. The magnitude of the difference (according to the three dental anxiety scales) between intervention groups T1 and T2 was calculated using Cohen's d as a measure of the effect size (ES) (small if $d = 0.2$, medium if $d = 0.5$, and large if $d = 0.8$). A p-value of $< .05$ was considered statistically significant in analyses. All statistical tests were two-tailed, and analyses were conducted with the SPSS statistical package (IBM® SPSS® Statistics version 27.0).

3 | RESULTS

The intervention was completed by 17 out of 19 participants (10 in T1 and 7 in T2), because two participants withdrew from the study after the DI (see Figure 1). Participants in group T1 ($n = 11$) underwent a DI, whereafter 10 of them attended one session of conventional dental treatment. Participants in group T2 ($n = 8$) underwent a DI, whereafter seven of them attended one session of M-OST. During M-OST, the dentists used techniques for building a trustful relationship or providing the patient with control and behavioral or cognitive strategies to relax the patient's body or mind. Fifteen participants attended the second interview.

Prior to the intervention, the two groups did not differ in sociodemographic characteristics, self-reported oral health, or the use of oral health services. An exception was subjective oral health, which was more often reported to be from moderate to poor in T2 than in T1 ($p < .05$) (Table 1).

3.1 | Change in the severity of dental anxiety

Reduced dental anxiety scores were observed among both treatment groups when measured using all three scales (i.e., MDAS, IDAF-4C, and VAS-A; Table 2). A larger reduction in dental anxiety scores was recorded among participants in T1 when measured with the VAS-A. The effect size of the intervention was larger in T1 than T2 according to the MDAS scores (ES = 1.37) and VAS-A measures (ES = 3.11) after the intervention. The overall effect size of the DI intervention was large within T1 based on the changes in VAS-A measures (ES = 0.98).

In both groups, the proportion of those with high MDAS scores ($n = 9$) decreased by 44% ($n = 4$) and the proportion of those with high IDAF-4C scores ($n = 10$) decreased by 40% ($n = 4$) during the interventions (Figure 2). Altogether, this meant that severe dental anxiety significantly decreased in both treatment groups (T1 and T2) after the intervention when measured with MDAS and IDAF-4C. However, four participants reported increased dental anxiety scores after the intervention according to MDAS and IDAF-4C scores, and for two participants in each group, the changes in scores (increase or decrease) were inconsistent between the two scales.

3.2 | Associations according to linear regression analysis

In linear regression, a higher dental anxiety score before the intervention was significantly associated with a higher dental anxiety score at the end of the intervention when measured using both the MDAS and the IDAF-4C in unadjusted models (Table 3). In the adjusted models, the result remained the same for the IDAF-4C. Belonging to treatment group T1 significantly associated with a lower dental anxiety score after the intervention in unadjusted models, but non-significantly in adjusted models when fear was measured using the MDAS. When fear was measured with the IDAF-4C, the treatment group was not associated with the dental anxiety score after the intervention, whereas an irregular dental attendance pattern (defined as symptom-oriented dental visits) associated with a higher score in unadjusted models.

3.3 | Self-reported helpfulness of the intervention in the second interview

We identified the informational content with respect to the research questions and conducted a descriptive summary

TABLE 1 Participants' sociodemographic characteristics, self-reported oral health, and use of oral health services according to the study group: T1 = diagnostic interview (DI) and T2 = diagnostic interview + modified one-session treatment (DI + M-OST)

	Group T1 ($n = 11$)	Group T2 ($n = 8$)	Total T1 + T2 (n = 19)	*p*-Value
Sociodemographic characteristics				
Age, mean (SD)[a]	44.3 (13.7)	35.2 (12.1)	42.4 (12.5)	.151
Female gender, *n* (%)[b]	9 (81.8)	7 (87.5)	16 (84.2)	1.000
Education after primary school, *n* (%)	11 (100)	8 (100)	19 (100)	–
Full-time occupation, *n* (%)[b]	5 (45.5)	4 (50)	9 (47.4)	1.000
Self-reported oral health				
Moderate to poor subjective oral health, *n* (%)[b]	4 (36.4)	8 (100)	12 (63.2)	.013*
Toothache or other problems related to the teeth or dentures during the previous 12 months, *n* (%)[b]	8 (72.7)	8 (100)	16 (84.2)	.228
Use of oral health services				
Symptom-oriented dental visits, *n* (%)[b]	4 (36.4)	7 (87.5)	11 (57.9)	.968
Over 2 years since previous dental visit, *n* (%)[b]	0 (0)	1 (12.5)	1 (5.3)	.421

Abbreviation: SD, standard deviation.

The significance of differences between groups was assessed with the following tests:.

[a]Independent-samples *t*-test for normally distributed continuous variables.

[b]χ^2 test for categorical variables.

*Indicates a statistically significant difference between groups ($p < .05$).

[Correction added on 20 March 2023, after first online publication: The *p*-value has been corrected in table 1]

TABLE 2 Participants' severity of dental anxiety (mean, standard deviation SD) before and after the intervention in each treatment group: T1 = diagnostic interview (DI) and T2 = diagnostic interview + modified one-session treatment (DI + M-OST)

Scale	Group T1 ($n = 10$)	Group T2 ($n = 5$)	*p*-Value	Total ($n = 15$)
	Mean (SD)			
MDAS score before	17.80 (3.93)	20.80 (4.54)	.208	18.80 (4.24)
MDAS score after*	15.50 (3.59)	20.20 (3.27)	.029***[a]	17.06 (4.07)
MDAS score change ***p-Value*[2]**	−2.30 (3.43) 0.063	−0.60 (3.20) 0.697	.373	−1.73 (3.34) 0.065
IDAF-4C score before*	3.48 (.87)	4.40 (.22)	.042***	3.79 (.83)
IDAF-4C score after	3.16 (.98)	4.02 (.62)	.101	3.45 (.95)
IDAF-4C score change ***p-Value*[2]**	−0.32 (.81) 0.237	−0.37 (.49) 0.164	.902	−0.34 (.70) 0.080
VAS-A before*	4.69 (1.08)	7.33 (0.41)	.000***	5.57 (1.56)
VAS-A after*	3.61 (1.13)	6.63 (0.78)	.000***[b]	4.62 (1.78)
VAS-A change**	−1.07 (1.00)	−0.69 (0.77)	.474	−0.94 (0.92)
***p*-Value**	0.008****[c]	0.115		0.001*****[d]

Notes: Effect size (Cohen's *d*) [a] = 1.37, [b] = 3.11, [c] = 0.98, [d] = 0.57.

Scales: Modified Dental Anxiety Scale (MDAS); Index of Dental Anxiety and Fear (IDAF-4C); Visual Analogue Scale for Anxiety (VAS-A).

*Independent-samples *t*-tests when equal variances were assumed;.

**Paired-samples *t*-tests.

***Indicates a statistically significant difference between groups, $p < .05$.

****Indicates a statistically significant difference within the group, $p < .05$.

*****Indicates a statistically significant difference in combined groups, $p < .05$.

of the key informational content, which was categorized into the main topics.

Nearly all the participants in groups T1 ($n = 9$) and T2 ($n = 4$) stated that the dental anxiety intervention (DI alone and combined with M-OST) was helpful. The significance of the intervention related most strongly to three aspects in the view of the participants: increased comprehension of one's fear was considered helpful ($n = 4$), the new

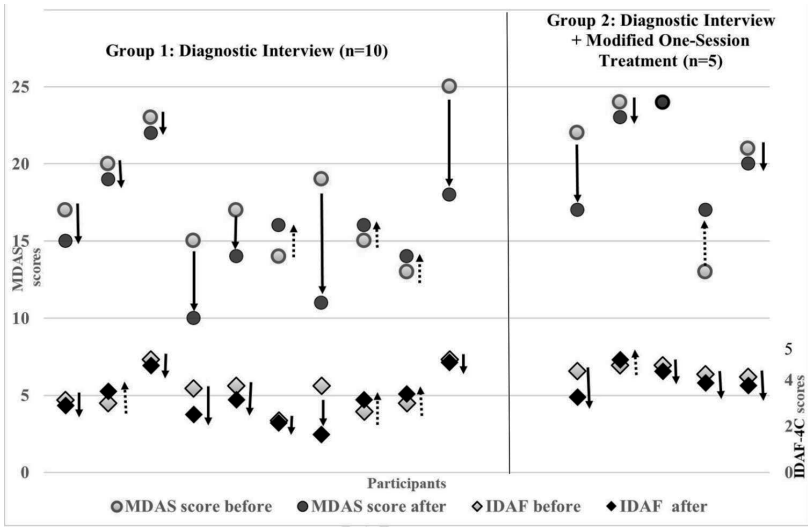

FIGURE 2 Participant scores on the Modified Dental Anxiety Scale (MDAS) and Index of Dental Anxiety and Fear (IDAF-4C) before and after the study intervention measurements

TABLE 3 Unadjusted and adjusted associations between independent factors and participants' severity of dental anxiety after the intervention measured using the Modified Dental Anxiety Scale (MDAS) and the Index of Dental Anxiety and Fear (IDAF-4C) based on linear regression (n = 15)

	Unadjusted				Adjusted			
Independent factors	***β***	***t***	***p*-Value**	**95% CI**	***β***	***t***	***p*-Value**	**95% CI**
MDAS								
Age, years	0.04	0.04	.969	−0.19 to 0.20	0.28	1.35	.215	−0.65 to 0.25
Female gender (ref. male)	−0.43	−1.72	.108	−9.58 to 1.08	−0.31	−1.10	.305	−9.50 to 3.38
Severity of dental anxiety before the intervention	0.65	3.32	.006*	0.23–1.07	0.34	1.09	.310	−0.37 to 1.03
Group T1: DI (ref. T2: DI+M-OST)	−4.7	−2.45	.029*	−8.84 to -0.56	0.42	1.69	.131	−1.30 to 8.33
Symptom-oriented dental visits (ref. regular visits)	0.42	1.68	.116	−0.95 to 7.63	0.36	1.33	.221	−2.11 to 7.85
Moderate to poor subjective oral health (ref. good)	0.29	1.09	.294	−2.27 to 6.95	−0.17	−0.60	.564	−6.43 to 3.77
IDAF-4C								
Age, years	−0.006	−0.26	.796	−0.05 to 0.04	0.43	2.09	.070	−0.03 to 0.07
Female gender (ref. male)	−0.25	−0.39	.701	−1.63 to 1.13	−0.16	−0.96	.364	−1.27 to 0.52
The severity of dental anxiety before the intervention	0.80	3.55	.004*	0.31–1.29	0.74	2.55	.034*	0.08–1.61
Group T1: DI (ref. T2: DI+M-OST)	−0.86	−1.77	.101	−1.92 to 0.19	0.12	0.52	.615	−0.77 to 1.22
Symptom-oriented dental visits (ref. regular visits)	0.67	3.28	.006*	0.42–2.07	0.52	2.16	.063	−0.07 to 2.00
Moderate or poor subjective oral health (ref. good)	0.27	1.01	.333	−0.58 to 1.56	−0.41	−1.80	.110	−1.76 to 0.22

Abbreviations: DI, diagnostic interview; M-OST, modified one-session treatment; *t*, *t*-test.; *β*, standardized beta coefficients.

95% CI = 95% confidence intervals.

*Statistically significant values ($p < .05$).

information gained about dental fear helped in managing dental treatment ($n = 4$), and fear was alleviated when the dentist had knowledge of it beforehand ($n = 2$). The participants' perceptions of helpful aspects in the intervention could be categorized into four topics: reinforced trustfulness towards dentists ($n = 4$); the identification of concrete coping strategies ($n = 4$); the possibility to bring up fear through openness and communication with the dentist ($n = 3$), which alleviated embarrassment; and paying attention to breathing helped the participants ($n = 3$). Most participants ($n = 11$) had learned some other new aspects while participating in this study.

At the 1-year follow-up, 74% of the participants ($n = 17$ out of 19) had attended dental care following the intervention: 82% ($n = 9$) in T1 and 67% ($n = 4$) in T2. Two participants in each treatment group who completed the intervention had not made a dental appointment following the intervention.

4 | DISCUSSION

The main finding of this study was that dental anxiety decreased in both treatment groups: among those participants who participated in a DI before conventional dental treatment and those who participated in a DI combined with M-OST. Similar results were observed when dental anxiety was assessed using the MDAS, IDAF-4C, and VAS-A. The results also demonstrated that the baseline severity of dental anxiety was the most significant factor predicting the severity of dental anxiety after the intervention. However, most participants in both treatment groups found the dental anxiety treatment helpful. Therefore, we have preliminary evidence that DI alone conducted before conventional dental treatment and combined with M-OST can reduce dental anxiety, which has not been reported in earlier studies.[11–16] In addition, on 1-year follow-up, dental care attendance was good among all participants, including those who withdrew from the study. However, the results need to be validated in future research because of the limitations of this study.

In this study, when comparing a DI before conventional dental treatment with a DI combined with M-OST, no significant differences were observed. This indicates that M-OST provided little additional effect. The information from the DIs probably enabled the use of dental fear and anxiety management techniques[18] and enhanced the co-operation in both interventions. A structured interview has been shown to reduce dental anxiety,[28] as has the use of self-reported dental fear scales.[29] The semi-structured interview focuses on establishing a trusting relationship between the dentist and participant,[14] which succeeded in this study. Researchers have stated that discussions concerning the management of dental anxiety help patients to cope with stress related to dental visits and help dentists to tailor dental anxiety treatment to their patients' individual needs.[30] This is significant because the possibility to control the dental treatment situation has been regarded as one of the key elements in confirming patient trust.[18] Cognitive restructuring has been shown to be a possible explanation for the reduction in dental trait anxiety after a single session,[11] and behavioral analysis aims to reveal those factors that maintain the fear.[19] The participants found the treatment for dental anxiety helpful, as they gained new insights into their own fears and wider comprehension of dental fear. This could also be one possible explanation for the increased anxiety among some participants, as they perhaps became more aware of their situation regarding the fears. Overall, both study interventions included several possible anxiety-reducing elements targeting the management of dental treatment.[29,31] However, with the present study design, it is not possible to completely separate the effectiveness of M-OST from DI, because their effect in combination could be more than their sum, that is, synergistic.

The main strength of this study was the use of three dental fear scales that enabled us to confirm the reliability of the results, that is, the effectiveness of a brief cognitive–behavioral-based intervention for dental anxiety.[14] Because the scales used in the interventions differ from each other, comparison with other studies is difficult.[11–16] In addition, differences in the initial situation and inclusion criteria can affect the outcomes of interventions, as well as the number of withdrawals. In this study, the dentists were involved in all the procedures, differentiating it from previous studies.[12–16] The lack of differences between the treatment groups was probably due to differences in the baseline level of dental anxiety and in the content and frequency of dental treatment. In addition, the treating dentist probably also had an influence, because treatment was performed by a familiar dentist in group T1 and an unfamiliar one in group T2. The small number of participants, causing a lack of statistical power, must also have had an effect. However, dental anxiety decreased according to all three scales in both treatment groups.

Because the study results are based on a small, nonrandomized trial for which follow-up data were only available from a limited number of participants, we need to be cautious in drawing conclusions. It is well known that with this type of target group, forming a control group is challenging,[13,14] and studies have therefore used patients who are waiting for treatment as controls. The number of participants in each group was not equal because of withdrawals, which is typical. However, attempts were made in this study to increase the number of dentally anxious participants attending primary dental care, and

data collection consequently took over 2 years. Because we excluded patients who had acute health problems, as well as those who had not previously attended dental treatment at all, this study focused on a restricted group of patients. Consequently, the findings cannot be suitably generalized to all patients with dental anxiety.

This study indicated that anxious behavior in patients during conventional dental treatment may be a notable criterion for offering a brief cognitive–behavioral intervention. To diminish the harmful consequences of dental anxiety, it is potentially effective to carry out a DI before conventional dental treatment or combined with M-OST to reduce severe dental anxiety in adults and to enhance their attendance in dental care. Experienced general dental practitioners have been suggested to be capable of identifying patients with dental anxiety,[32] but the further assessment and treatment of severe dental anxiety requires additional training for dentists and co-operation with other professionals. These viewpoints should be considered when planning treatment programs for dentally anxious patients in primary health care.

ACKNOWLEDGEMENTS

Ethical permission for this study was granted by the Hospital District of Northern Savo under registration number 281/13.02.00/2016. The authors complied with the instructions of the Finnish National Board on Research Integrity regarding all ethical rules and participants' rights in this study. The authors are grateful to the two specializing dentists conducting the modified one-session treatment on participants, the general dental practitioners and patients who participated in this study, and to Riitta Myllykangas, who contributed to the statistical analyses in SPSS.

CONFLICT OF INTEREST AND SOURCE OF FUNDING STATEMENT/DISCLOSURE OF CONFLICT OF INTEREST

The authors declare no conflicts of interest and have nothing to disclose in this study. No external funding, apart from the support of the author's institution, was available for this study.

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How to cite this article: Kurki P, Korhonen M, Honkalampi K, Suominen AL. The effectiveness of a diagnostic interview and modified one-session treatment for dental anxiety in primary dental care—A pilot study. *Spec Care Dentist*. 2023;43:174–183. https://doi.org/10.1111/scd.12760

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This doctoral thesis investigated the treatment of dental anxiety. While dental anxiety is general, diagnostic procedures and management techniques remain understudied. The study found that patients openly talked about their fears during diagnostic interviews, and dentists demonstrated proficiency in using various anxiety management techniques, as determined through quantitative methods. The clinical trial demonstrated the effectiveness of a brief dental anxiety treatment, emphasizing its utility for both patients and oral health care professionals.

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**PUBLICATIONS OF
THE UNIVERSITY OF EASTERN FINLAND**
Dissertations in Health Sciences

ISBN 978-952-61-5123-6
ISSN 1798-5706