

DENTAL ANXIETY: CAUSES, COMPLICATIONS AND MANAGEMENT APPROACHES

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Introduction

Over recent decades, the everyday clinical practice of dentistry has benefited from major advances in techniques, technologies and materials, as well as in infection control procedures. At the same time, public awareness of oral health has improved. Despite these gains, anxiety related to the dental environment and to specific dental treatments is a problem suffered by many patients worldwide, and it remains a significant challenge in providing dental care. Whereas anxiety is an emotional state that helps normal individuals defend themselves against a variety of threats, anxiety disorders are a dysregulation of these normal defensive mechanisms, with either excessive or deficient responses.¹ The purpose of this paper is to highlight clinical factors which can be addressed to reduce anxiety levels in dental patients.

Prevalence of dental anxiety

Dental anxiety has been ranked fifth among commonly feared situations.² Given its high prevalence, it is not unexpected that patients with dental anxiety avoid dental visits.³ Only a minority of patients claim to have no anxiety in the dental environment. A study conducted in Holland reported that only 14% of the Dutch population experienced no apprehension or anxiety when visiting a dentist, whilst almost 40% experienced "more than average" anxiety, and 22% were "highly anxious". In this study, the patients most likely to experience high levels of dental anxiety were women aged 26-35 years who were irregular attenders.⁴ In Australia, published data from 1996 reveal that some 14.9% of adults could be classified as "high dentally anxious". Once again, there was a greater prevalence and severity of dental anxiety in women than men, particularly in the 35-44 age range.⁵ A more recent study by Armfield et al. confirmed these data, with a population prevalence for dental fear of 16.4% for adults and 10.3% for children, yielding an overall prevalence of 16.1%.⁶ Other studies internationally have reported a prevalence of between 5 and 20%^{4,7}, with a recent estimate of 6-15% globally for patients who avoid dental care because of high levels of dental anxiety and dental phobia.⁸

Many cross-sectional studies have documented that the prevalence of dental anxiety reduces with age^{4,7,9-11}, and this

has been confirmed in a longitudinal study conducted by Hagglin et al. which followed individuals from 1969 to 1996. Similar declines in other general and specific phobias with age were also found in this study.¹² Few studies have not found a strong association of dental anxiety with age.^{13,14}

In relation to gender, the large majority of studies have found higher prevalence rates for dental anxiety in females than males^{9,11,13-15}, with only few noting no significant relationship.¹⁶

The relationships between dental anxiety and other demographic variables such as income level and education (socioeconomic status) have not been fully elucidated. While some studies have demonstrated that higher levels of dental anxiety are associated with low income and education^{6,13,14}, other have failed to find such relationships.^{9,10} Taken in combination with other variables, it would be expected that being female, having a low income, and having a low perception of one's oral health status would be linked with higher levels of dental anxiety, and this combination has been confirmed in a study by Doerr et al.¹³

Causes

Dental anxiety is a multidimensional complex phenomenon, and no one single variable can account exclusively for its development (Figure 1). Within the literature, there are a number of factors that have consistently been linked with a greater incidence of dental anxiety, including:

- personality characteristics,
- fear of pain,
- past traumatic dental experiences, particularly in childhood (conditioning experiences),
- the influence of dentally anxious family members or peers which elicit fear in a person (vicarious learning), and
- blood-injury fears.^{8,14-19}

Fear of pain has been linked strongly to the development of dental anxiety and to avoidance of dental treatment.^{17,18} Studies by Kent indicate that memory of dental pain is "reconstructed" over time. He found that highly anxious patients tended to overestimate the pain they would feel prior to dental procedures, and also overestimate the pain experienced, when asked to recall it later.^{20,21} This pattern of findings has also been seen in other studies.^{18,22,23} For example, in a study by Arntz et al. which examined 40 dental patients who twice underwent oral surgery, the highly anxious patients expected more pain than they actually experienced during the procedure, and also required more time for chairside

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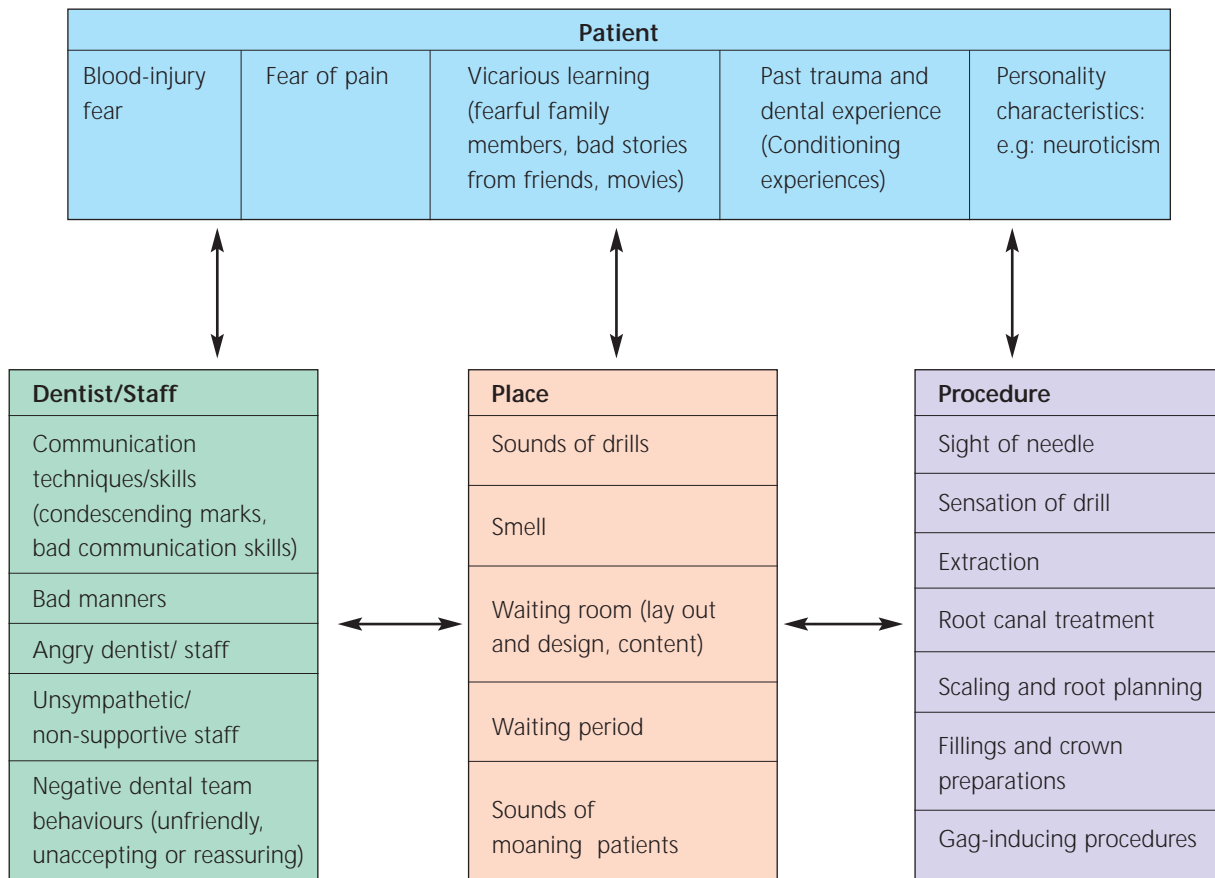


Figure 1. Interactions which lead to and modify dental anxiety.

management than did patients with low levels of anxiety.²³

Several studies have shown that restorative dentistry procedures deliver the most potent triggers for dental anxiety, namely the sight, sound and vibrational sensation of rotary dental drills^{14, 24, 25}, coupled with the sight and sensation of a dental local anaesthetic injection.^{14, 25, 26}

It is for this reason that anxious patients who must undergo restorative procedures are often managed using the “4 S” rule, which aims to reduce the triggers of stress,

- Sights (e.g. needles, drills)
- Sounds (drilling)
- Sensations (high frequency vibrations – with a high annoyance factor)
- Smells (clinical odours, such as eugenol and bonding agents)

using alternative methods such as

- atraumatic restorative technique (ART)
- Ultra-low speed cutting
- Polymer bur cutting
- Chemo-mechanical caries removal (Carisolv™)
- Air abrasion
- Pulsed Er:YAG and Er,Cr:YSGG lasers
- Ultrasonic instruments with diamond-coated tips.

In general terms, a patient's expectation of experiencing pain, being hurt and choking or gagging during treatment can

act as a major trigger for dental anxiety.²⁵ As will be discussed later, addressing these points can have powerful preventive effects.

It is also important to recognise that as well as the “4 S” anxiety triggers, there are a number of other factors which can trigger anxiety or increase it. Aspects of dentist-patient interactions are particularly important here. Triggers for dental anxiety can include statements made by the operator²⁴, in particular when they are angry or if they make condescending comments.¹⁴ A study by Moore et al. found that these types of negative dentist contact behaviours were 5-10 times more likely to be reported by highly anxiety patients.¹⁴ Furthermore, dentally anxious patients have complained that dentists make them feel guilty for being anxious.²⁷

The period of time spent waiting for dental treatment is cited commonly by patients as being anxiety-provoking, as it increases the time to think about what will (or could) happen, and to ponder the worst-case outcomes.²⁵ This emphasizes the need for support staff in the dental practice to be aware of an anxious patient, and to actively take measures to reduce their concerns. Negative feelings such as loss of control, and feeling vulnerable in the dental setting, are also cited by patients. Informing new patients (for example, using a brochure) that they can interrupt the operator during treatment, may overcome this “loss of control” fear, and has been shown to be effective in anxiety reduction.²⁸ Many dentists use a simple

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signalling system (such as a raised hand) to give control to patients, and this has been shown to be particularly useful with children as well as with anxious adult patients.²⁵

Consequences and complications

Dental anxiety has been associated strongly with poor oral health status.¹³ Eitner et al., found that avoidance of dental treatment is highly correlated with anxiety scores and with increased caries morbidity and DMFS scores.²⁴ Several studies have shown that highly anxious patients have a higher probability of irregular dental attendance and/or total avoidance of dental care^{13, 15, 18, 24, 31}. Higher dental anxiety scores have been documented amongst patients who have not visited a dentist for the last 5 years.¹⁰ Moore et al. found that patients with high levels of dental anxiety were more likely to not have sought dental care in the past two years, and were more likely to skip or cancel appointments or to hesitate in making dental appointments.¹⁴

Even if anxious dental patients attend regular dental visits, they are likely to avoid necessary follow up appointments to

complete the required dental treatment.²⁴ This avoidance of dental treatment results in higher caries prevalence^{13, 24, 29}, leading to a greater need for oral rehabilitation.²⁴ For example, Locker and Liddell found that dentally anxious patients had significantly more missing teeth and fewer filled teeth compared to non-anxious patients.³⁰ A spiral situation can occur, where poor oral health and a patient's inability to accept dental treatment, leads to feelings of inferiority and shame, which in combination may lead to greater anxiety and further avoidance of dental care.³¹ The long term consequences for the dentition may explain why dental anxiety leads to increased use of general medical services for prescription of antibiotics and analgesics.³²

As well as affecting an individual patient's oral health status, dental anxiety may have a much wider impact on their life.²⁵ Dental anxiety evokes physiological responses of the "fright or fight" type, and these can lead to feelings of exhaustion after a dental appointment. Cognitive impacts of dental anxiety include negative thoughts,²² fear, crying, aggression, sleep disturbances, disturbed eating habits, and greater self-

medication.²⁵ Impacts on social interactions, performance at work, self-esteem and confidence have also been reported.²⁵

Several studies have shown that highly anxious patients take longer to treat in the general dental practice setting.³³ The incurred additional costs may be a significant determinant of whether people will have follow-up care, since private dental insurance arrangements are not generally supportive of the longer appointment times needed to provide care.³³ It is not surprising, therefore, that some dentists perceive dentally anxious patients as being unreliable and a poor economic risk.³⁵

Other problems that dentists may encounter with anxious patients include reduced satisfaction with treatment planned or provided. Several studies have revealed a relationship between dental anxiety and satisfaction with the appearance of one's mouth. Highly anxious patients are more likely to be dissatisfied with the appearance of their teeth.^{7, 13, 14} They may also have a heightened expectation that the treatment will be unpleasant.¹⁸ As would be expected, a patient's attitude toward dentists has been shown to have an inverse linear relationship with dental anxiety, that is, more anxious patients were less positive about

their dentist.¹³ Moreover, as patients' perceptions of dentists' competence decreased, their dental anxiety was found to increase.³⁴

Management

Nearly two thirds of dentists believe that treating an anxious patients presents a challenge to them in everyday practice.³⁶ Identifying these patients and putting appropriate measures in place is therefore essential. Patients displaying behaviours such as frequent cancellation, delaying or rescheduling appointments may be doing so because of dental fear and anxiety.⁶ Upon identification of an anxious or fearful patient, a range of measures can be put into place, for example:

- allowing sufficient time for the dental appointment
- minimizing triggers, following the "4 S" principle described earlier, e.g. by altering the surgery set-up, the dental assistant can place instruments where they are blocked from view or covered³⁵, or could spray a scented oil fragrance to reduce the clinical aroma of the treatment room,
- introducing relaxation methods (see below),

- provision of extra control during the procedure,
- using distraction techniques, e.g. music via headphones, video glasses, and virtual reality glasses (especially for adults),
- providing more efficient anaesthesia, or using adjunctive methods, e.g. peristaltic injectors (Wand™), topical creams (EMLA™), and transcutaneous nerve stimulation
- referral to cognitive or behavioural specialists or psychologists for anxiety management and behaviour therapy⁶
- Conscious sedation using pharmacological agents

Using a multifaceted approach rather than relying in one single strategy improves the likelihood of success. The management of anxious patients will vary depending on factors such as the patients' age, anticipated degree of cooperation³⁹, and their medical and/or dental history.⁴²

Dentist behaviours targeted to anxiety reduction, such as having a calm manner, being friendly, giving moral support, being reassuring about pain, preventing pain, and working efficiently, have been shown to reduce anxiety.³⁷

Communication

Staff-patient communication with patients plays a very important role in anxiety reduction. Providing verbal support and reassurance is a frequently used strategy.³⁵ To be maximally effective, this approach needs to be taken by all staff members with whom the patient interacts. A receptionist who notes anxious patients can schedule sufficient time for the appointment, allowing the clinical operators some additional time to carefully explain procedures, and then to proceeding slowly with treatment.

Relaxation therapies

Relaxation therapies can enhance trust and give patients the feeling of control over their psychological state. These methods can be very effective in motivated and cooperative patients, and can be used before and during a treatment appointment. These techniques are safe, have no side effects, and give patients more control over their anxiety level.

A common method is Jacobsen's progressive muscular relaxation, which relaxes patients by reducing physical (muscle) tension, and makes them more aware of their stressed and aroused state, and how to address this. Their greater feeling of control over the situation and over their anxiety symptoms should translate into greater ability in coping with the stress of dental treatment. A simple scheme for progressive muscular relaxation involves tensing and relaxing groups of muscles in turn, for example from the feet through the lower body and abdomen to the thorax and then the head and neck.

Another simple method for promoting relaxation is paced

breathing, where patients inhale using deep diaphragmatic breathing, hold for 5 seconds, then exhale over 5 seconds. This slow paced breathing can be combined with imagery-based methods with the use of particular words, visual images or thoughts that are linked with the breathing rhythm, for example using a cue word such as "CALM" on the exhalation cycle. With repeated practice, patients can move more quickly into the relaxed state.⁴⁰

Relaxation and breathing techniques have been used successfully with patients who are fearful of receiving dental treatments, and can be easily taught to patients and applied quickly in a dental environment.⁴⁰

Distraction

Virtual reality techniques which involve the use of coloured glasses to experience a three-dimensional computer-generated images during dental treatment, have been shown to engage and relax adults, but with less positive results for children.⁴¹ In other words, dental anxiety in children may respond to simpler types of distraction that do not require complex cognitive processing. Interestingly, studies of the levels of dental anxiety in children, both before and after dental treatment, show this to be (as in adults) higher among females than males. Children with high intelligence quotients tend to show less dental anxiety at their first dental visit. There does not, however, appear to be a strong relationship between a child's anxiety and their own personality variables⁴².

In adult patients, by using distraction and other anxiety reduction measures, with repeated positive experiences, a patient's level of anxiety should reduce⁴³. For example, Marks et al. have reported that prolonged exposure to non-traumatic anxiety cues helps patients adapt to these situations and will diminish their excessive responses.¹

Techniques with reduced annoyance factors

Restorative dentistry has, historically, had a strong association with both pre-treatment dental anxiety and fear of pain during treatment. The term "annoyance factor" refers to the patient's subjective reaction to restorative dentistry procedures such as cavity preparation, and is a combination of the pressure applied to the tooth, the vibrations and noise recorded through the bones of the skull, the heat and smell generated at the interface between the tooth and the bur and the time taken to perform a given task.⁴⁴ New methods for restorative dentistry have reduced annoyance factors compared with conventional rotary instruments, and in so doing they help to eliminate or reduce a major trigger of dental anxiety. Atraumatic restorative technique (ART), air abrasion, chemo-mechanical caries removal (Carisolv™), and middle infrared lasers may now be

considered alternative methods for tooth preparation and caries removal.

The erbium (Er:YAG and Er, Cr:YSGG) lasers act selectively on water present in hard tissues, because of their wavelengths and are able to ablate carious enamel and dentine. When used properly they may induce a depressed state of responsiveness in pulpal nociceptors⁴⁴. Generally, patients undergoing cavity preparation with erbium lasers do not need local anaesthesia. Large scale clinical trials report that only 2-5% of patients will request local anaesthesia although many patients experience slight, intermittent sensations of cold in their teeth, probably caused by the cooling effects of water evaporation during laser pulses.⁴⁰ Suppressive effects on nerve firing give an analgesic effect with a duration of 10-15 minutes. Use of this analgesic effect can maintain comfort in anxious patients, allowing treatment of several teeth, in one appointment, without the need for injected local anaesthesia.

The ART method has been used extensively in dentistry for conservative management of open cavitations in dentine. On the other hand, chemo-mechanical caries removal is a minimally invasive method which involves the selective removal of soft carious dentine without the painful removal of sound dentine during cavity preparation, as a form of chemically accelerated ART.

Use of these novel methods may be effectively targeted to anxious dental patients, where the different methods reduce the major stimuli for anxiety and also provide a distraction effect, thus giving overall a reduction in dental anxiety.²⁴ If patients are aware of these methods, they may petition the dentist to use them for future dental treatment. A study by Eitner et al. found that 60% of the participants expected to be treated better if they described themselves as very anxious to the dentist.²⁴

Sedation

Conscious sedation techniques have been proven to be reliable and safe for managing dental anxiety,³⁸ while more severely anxious and uncooperative patients can be treated under general anaesthesia. Agents such as nitrous oxide and oxygen administered by inhalation are in common use, however for anxiolytic agents, a wide range of routes of administration exist, including ingestion, rectal suppository, intramuscular injection, and intravenous injection for direct application into the circulation, as in the case of midazolam, diazepam and other benzodiazepines.³⁹ Agents used for sedation must produce a relaxed state rapidly for the period needed, but must then wear off rapidly so that the patient can return to their normal state.³⁹

Clinical Scenario

A patient presented to a dental clinic for the treatment of two broken down but not painful maxillary molar teeth (16 and 17).

After examination and discussion of treatment options, the patient agreed on full coverage porcelain-fused-to-metal crowns. The dentist booked the patient with plenty of time to complete crown preparation and temporization procedures. On the appointed day, the patient, looking calm and collected, was greeted curtly by the dentist (who was running a little late) and then seated in the dental chair. The dentist, without explaining the procedure or the steps involved, reclined the dental chair fully to the supine position, and began by trying alginate trays into the mouth. Alginate was then mixed by the assistant, and the maxillary tray inserted into mouth. The patient, rather alarmed and feeling claustrophobic with a mouth full of dental impression material, began to panic, with difficulty in breathing, followed by gagging. He pulled the impression tray out of his mouth, and told the dentist that he did not want the treatment. After a brief but heated exchange between the patient and dentist, the patient stormed out of the clinic.

Case discussion

The patient was in a particularly nervous state at the start of this appointment, although he was anxious about having an unknown procedure. The lack of communication of the dentist at both the first and second visits is a critical factor, since the patient, without having had any dental impressions previously, did not know what to expect, and in particular how long the impression material would be in his mouth. With long procedures, having a clear understanding between the patient and the operator regarding "stopping points" is essential. In this case, the patient was not aware of the steps involved in the procedure, and lacked any control of his situation. This increased rapidly his level of anxiety. Lying in a supine position increases the impression of vulnerability and lack of control. The resultant anxiety was amplified by the patient's concerns of airway compromise. To balance his mental state and to preserve his wellbeing, the patient decides to take control, and removes the impression tray.

The curt and unsympathetic response of the dentist is the final trigger for the irrevocable breakdown in their relationship. The patient will now, with other dentists, remember how unpleasant his previous impression experience was, and will have heightened anxiety for his future dental treatment. The unpleasant encounter in the dental surgery will resurface in his mind when the word dentist is mentioned in conversation, and this will reinforce his negative views of dentists and will consolidate his anxiety. The dentist has lost time and income. It is likely that the disgruntled patient will relate his story to acquaintances, which could have a negative effect on the dentist's reputation because of the word-of-mouth downstream effects.

To prevent this scenario from occurring, the dentist should have had a discussion at the end of the first visit or the start of the second visit, about what the procedure involved. The

patient could have been sat upright for the maxillary alginate impression, with appropriate coaching on slow timed breathing, particularly if this was the patient's first impression. Reassurance by the dentist or chairside assistant during the impression taking procedure would have been of great benefit, and would have reinforced to the patient that the clinical staff have their wellbeing in mind. These simple steps would have eliminated the problem at its source.

Conclusion

Dental anxiety is a common problem found throughout the world, with approximately one in six adults suffering more severe forms of dental fear and anxiety. Sex and age appear to be important factors linked to dental anxiety, with females from 30-45 being particularly common within the dentally anxious group in the population.

Dental anxiety is a multidimensional complex phenomenon which is influenced by personality characteristics, fear of pain, past traumatic dental experiences in childhood, and dentally anxious family members or peers.

Severe dental anxiety is a major barrier to seeking professional dental care, and the implications of this in terms of dental disease are significant in terms of deterioration of their dentition, and a range of psychosocial problems. The management of the dentally anxious patients should involve considering both complementary and pharmacological means. Helping highly anxious patients to overcome their fear of dental treatment is a challenge, however if achieved it will result in improvement in their oral health and in their overall quality of life and wellbeing.

References

- Marks IM, Nesse RM. Fear and fitness: an evolutionary analysis of anxiety disorders. *Ethol Sociobiol.* 1994;15:247-61.
- Agras S, Sylvester D, Oliveau D. The epidemiology of common fears and phobia. *Compr Psychiatry.* 1969;10:151-6.
- Gatchell RJ, Ingersoll BD, Bowman L, Robertson MC, Walker C. The prevalence of dental fear and avoidance: a recent survey study. *J Am Dent Assoc* 1983;107:609-10.
- Stouthard M, Hoogstraten J. Prevalence of dental anxiety in The Netherlands. *Community Dent Oral Epidemiol.* 1990;18:139-42.
- Thomson WM, Stewart JF, Carter KD, Spencer AJ. Dental anxiety among Australians. *Int Dent J.* 1996;46:320-4.
- Armfield JM, Spencer AJ, Stewart JF. Dental fear in Australia: who's afraid of the dentist? *Aust Dent J.* 2006;51(1):78-85.
- Ter Horst G, De Wit CA. Review of behavioural research in dentistry 1987-1992: Dental anxiety, dentist-patient relationship, compliance and attendance. *Int Dent J.* 1993;43:265-78.
- Eli I, Uziel N, Blumensohn R, Baht R. Modulation of dental anxiety - the role of past experiences, psychopathologic traits and individual attachment patterns. *Br Dent J.* 2004 Jun 12;196(11):689-94 Jun 12;196(11):689-94.
- Hakeberg M, Berggren U, Carlsson SG. Prevalence of dental anxiety in an adult population in a major urban area in Sweden. *Commun Dent Oral Epidemiol.* 1992;20(2):97-101.
- Locker D, Liddell A. Correlates of dental anxiety among older adults. *J Dent Res.* 1991;70(3):198-203.
- Neverlien PO. Normative data for Corah's Dental Anxiety Scale (DAS) for the Norwegian adult population. *Commun Dent Oral Epidemiol* 1990;18(3):162.
- Hagglin C, Berggren U, Hakeberg M, Hallstrom T, Bengtsson C. Variations in dental anxiety among middle-aged and elderly women in Sweden: a longitudinal study between 1968 and 1996. *J Dent Res.* 1999;78(10):1655-61.
- Doerr PA, Lang WP, Nyquist LV, Ronis DL. Factors associated with dental anxiety. *J Am Dent Assoc.* 1998;129(8):1111-9.
- Moore R, Birn H, Kirkegaard E, Brødsgaard I, Scheutz F. Prevalence and characteristics of dental anxiety in Danish adults. *Commun Dent Oral Epidemiol.* 1993;21(5):292-6.
- Milgrom P, Fiset L, Melnick S, Weinstein P. The prevalence and practice management consequences of dental fear in a major US city. *J Am Dent Assoc.* 1988;116:641-7.
- Economou GC. Dental Anxiety and Personality: Investigating the Relationship Between Dental Anxiety and Self-Consciousness. *J Dent Educ* 2003; 67(9):970-80.
- Kleinknecht RA, Klepac RK, Alexander LD. Origins and characteristics of fear of dentistry. *J Am Dent Assoc.* 1973;86(4):842-8.
- Woolgrove J, Cumberbatch G. Dental anxiety and regularity of dental attendance. *J Dent.* 1986;14(5):209-13.
- Locker D, Shapiro D, Liddell A. Overlap between dental anxiety and blood-injury fears: psychological characteristics and response to dental treatment. *Behav Res Ther.* 1997;35:583-90.
- Kent G. Anxiety, pain, and type of dental procedure. *Behav Res Ther.* 1984;22(5):465-9.
- Kent G. Cognitive processes in dental anxiety. *Br J Clin Psychol.* 1985;24:259-64.
- De Jongh A, Muris P, Ter Horst G, Duyx M. Acquisition and maintenance of dental anxiety: the role of conditioning experiences and cognitive factors. *Behav Res Ther* 1995;33:205-10.
- Arntz A, Van Eck M, Heijmans M. Predictions of dental pain: the fear of any expected evil, is worse than the evil itself. *Behav Res Ther.* 1990;28(1):29-41.
- Eitner S, Wichmann M, Paulsen A, Holst S. Dental anxiety - an epidemiological study on its clinical correlation and effects on oral health. *J Oral Rehabil.* 2006;33(8):588-93.
- Cohen SM, Fiske J, Newton JT. The impact of dental anxiety on daily living. *Br Dent J.* 2000;189(7):385-90.
- Quteish Taani DS. Dental anxiety and regularity of dental attendance in younger adults. *J Oral Rehabil.* 2002;29(6):604-8.
- Kunzelmann KH, Dünninger P. Dental fear and pain: effect on patient's perception of the dentist. *Commun Dent Oral Epidemiol.* 1990;18(5):264-6.
- Jackson C, Lindsay S. Reducing anxiety in new dental patients by means of leaflets. *Br Dent J.* 1995;179:163-7.
- Hakeberg M, Berggren U, Gröndahl HG. A radiographic study of dental health in adult patients with dental anxiety. *Commun Dent Oral Epidemiol.* 1993;21(1):27-30.
- Locker D, Liddell A. Clinical correlates of dental anxiety among older adults. *Commun Dent Oral Epidemiol.* 1992;20(6):372-5.
- Locker D. Psychosocial consequences of dental fear and anxiety. *Commun Dent Oral Epidemiol.* 2003;31:144-51.
- Milgrom P, Weinstein P, Getz T. Treating Fearful Dental Patients: A Patient Management Handbook. 2nd ed. Seattle: University of Washington; 1995.
- Vassend O. Anxiety, pain and discomfort associated with dental treatment. *Behav Res Ther.* 1993;31(7):659-66.
- Rouse RA, Hamilton MA. Dentists' technical competence, communication, and personality as predictors of dental patient anxiety. *J Behav Med.* 1990;13(3):307-19.
- Moore R, Brodsgaard I. Dentists' perceived stress and its relation to perceptions about anxious patient. *Commun Dent Oral Epidemiol.* 2001;29(1):73-80.
- Weiner AA, Weinstein P. Dentists' knowledge, attitudes, and assessment practices in relation to fearful dental patients: a pilot study. *Gen Dent.* 1995;43(2):164-8.
- Corah NL, O'Shea RM, Bissell GD, Thines TJ, Mendola P. The dentist-patient relationship: perceived dentist behaviours that reduce patient anxiety and increase satisfaction. *J Am Dent Assoc.* 1988;116(1):73-6.
- Nadin G, Coulthard P. Memory and midazolam conscious sedation. *Br Dent J.* 1997;183(11/12):399-407.
- Coulthard P, Craig D. Conscious sedation. *Dent Update.* 1997;24(9):376-81.
- Hainsworth JM, Moss H, Fairbrother KJ. Relaxation and complementary therapies: an alternative approach to managing dental anxiety in clinical practice. *Dent Update.* 2005;32(2):90-2, 4-6.
- Sullivan C, Schneider PE, Musselman RJ, Dummett CO Jr, Gardiner D. The effect of virtual reality during dental treatment on child anxiety and behavior. *ASDC J Dent Child.* 2000;67(3):193-6, 60-1.
- Toledano M, Osorio R, Aguilera FS, Pegalajar J. Children's dental anxiety: influence of personality and intelligence factors. *Int J Paediatr Dent.* 1995;5(1):23-8.
- Dixon HR, Robb N. Choices in anxiety control. A comparative study. *SAAD Dig.* 1996;13(1):17-27.
- Mount GJ, Walsh LJ, Brostek A. Instruments used in cavity preparation. In: Mount GJ, Hume WR. Preservation and restoration of tooth structure. Brisbane: Knowledge Books and Software, 2005. pp. 119-143.