

Is this the real life? Is this just fantasy?: the future of managing dental anxiety with virtual reality

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Abstract

This paper aims to give a brief overview of the background of dental anxiety including its origins and prevalence, and why the effective management is pivotal to providing quality dental care. The Modified Dental Anxiety Scale (MDAS) is then explored for both its benefit in population wide studies, but additionally its use as a quantifier in daily dental practice when attempting to 'measure' a patient's perceived state anxiety levels. The article finally contemplates current, commonplace methods of managing the anxious patient and attempts to investigate the rising idea of virtual reality technology as an original tool to tackle anxiety in future generations of dentistry.

Abbreviations

GDP – General Dental Practitioner
IV – Intravenous
MDAS – Modified Dental Anxiety Scale
VR – Virtual reality

Fear (noun)

"The emotion of pain or uneasiness caused by the sense of impending danger, or by the prospect of some possible evil."

Anxiety (noun)

"Worry over the future or about something with an uncertain outcome; uneasy concern about a person, situation, etc.; a troubled state of mind arising from such worry or concern."

Phobia (noun)

"A fear, horror, strong dislike, or aversion; esp. an extreme or irrational fear or dread aroused by a particular object or circumstance."

- Oxford English Dictionary, 2021

Conventionally managing dental anxiety

Dental phobias and anxiety surrounding anticipated dental pain are confounding factors regarded as principal barriers to good dental care, often resulting in appointment avoidance. With the acquisition of >66% of phobias originating in childhood, the predicament can be deep-rooted and difficult to manage.¹

Dental anxiety frequently stems from the patient's anticipated perception of noxious stimuli, or pain, prior to commencement of procedures, often from past negative experiences.²

For the clinician to contend with this, whilst providing optimum patient-centred care, anxiolytic relief is quintessential from the offset.³

Dental professionals possess a plethora of methods readily implemented in practice to quell anxiety. These approaches can be pharmacological, such as conscious sedation, or non-pharmacological, such as patient behaviour management (see **Table 1**).⁴ The latter is always introductory due to its inexpensive and non-invasive nature; however, it can be ineffective for severe phobias or for longer procedures, such as extractions, resulting in the need for pharmacological intervention.

Table 1. A non-exhaustive list of pharmacological and non-pharmacological management options for the dentist to consider.

Pharmacological	Non-pharmacological
<p>Oral Premedication</p> <p><i>Low dose benzodiazepines may be prescribed to anxious patients prior to treatment, for example, to aid in getting a good night's sleep beforehand, or to make travelling to the practice (under supervision by a chaperone) more bearable.</i></p>	<p>Desensitisation</p> <p><i>This is where the patient is gradually exposed to the stimuli that triggers anxiety. For example, in a dental scenario, an initial desensitisation visit may be as simple as asking the patient to sit in the dental chair for a verbal consultation. This way they can become accustomed to the surroundings and the dental team, and slowly gain the confidence to undergo more invasive treatments as appointments progress.</i></p>
<p>Inhalation sedation</p> <p><i>Titrated nitrous oxide and oxygen are inhaled by the patient nasally via a mask. This can be used as a standalone or as an adjunct to intravenous (IV) sedation during cannulation.</i></p>	<p>Tell, Show, Do</p> <p><i>A commonly used technique in paediatric dentistry, which is also valuable when treating anxious patients. 'Tell' is where the dentist explains the procedure step by step. 'Show' is where the patient is introduced to the equipment to be used such as how it sounds, feels, looks, etc. (Note: This step should be avoided if the instrument is likely to trigger more fear e.g., needles before injections). Finally, 'Do' the dentist carries out the procedure as closely as just explained to the patient, this way they feel informed and more in control of the situation.</i></p>
<p>Oral sedation</p> <p><i>Oral or transmucosal midazolam is administered to the patient. This is a useful technique when inhalation or intravenous methods are contraindicated, for example, if the patient is extremely needle-phobic, however it is a less predictable method.</i></p>	<p>Distraction</p> <p><i>This is anything that prevents the patient from concentrating on the stimulus causing fear. For example, encouraging the patient to talk about their hobbies to distract from the dental surrounding.</i></p>
<p>Intravenous sedation</p> <p><i>Midazolam is given intravenously, usually through a cannula in the back of the hand, using a titrated dose dependant on the patient's response. It has a very fast onset of around two minutes but can take up to an hour for the final increment to wear off after treatment.</i></p>	<p>Hypnosis</p> <p><i>This can be defined as an altered state of consciousness where the patient is more susceptible to suggestion. One visualisation technique used is the 'Comfort Dial';⁵ the patient is asked to visualise a dial from zero to ten, zero being most comfortable and ten indicating pain. The patient visualises a dial of their own choosing and over several rehearsal sessions learns to respond to the suggestion of lowering the pain they feel by turning down their dial.</i></p>
<p>General anaesthetic</p> <p><i>This is where the patient is 'put to sleep' so they are completely unaware of their surroundings and the procedure taking place. Avoided, where possible, due to associated risks.</i></p>	

Measuring dental anxiety

A valuable screening tool used to determine levels of patient anxiety is the Modified Dental Anxiety Scale (MDAS).⁶ Its intended use is in population-based studies, however, MDAS is also a screening tool for the General Dental Practitioner (GDP) on a case-by-case basis if a patient's need for sedation is to be assessed. It is divided into 5 segments, each scored 1-5, with a maximum achievable score of 25. Any score greater than 19 denotes severe anxiety or phobia and can primarily indicate the necessity for pharmacological intervention.

It is preferable to avoid the use of pharmacological agents, where possible, due to the risks associated with each drug and procedure. Therefore, several novel techniques have arisen to circumvent this matter.

Novel methods of management

In the last decade, virtual reality (VR), a technology that allows for combined fully-immersive audio-visual sensory stimulation, has made an emergence and its practical uses as a distraction technique are now being explored.

Attention-demanding distraction tasks are known to reduce anxiety-related distress exhibited in response to noxious stimuli. Increasing the attentional capacity demanded from said tasks further reduces the distress exhibited. This is thought to be partly due to the psychological nature of the perception of noxious stimuli. Hence, if a patient's focus is elsewhere when experiencing a situation that would ordinarily trigger anxiety, the anxious feelings are perceived less intently than with no distraction in place.^{7,8}

Engaging with VR requires a large portion of the attention span due to its immersive nature and, therefore, results in less perception of anxious feelings during dental treatment.

VR is non-invasive, non-addictive and its frequency of use does not correlate with diminished efficacy; therefore, it demonstrates strong potential as a feasible tool to manage anxiety in a variety of healthcare settings.⁹ Despite this noticeable potential, dentistry, as a field, has received little attention from VR researchers and studies of VR in a dental context are scarce.¹⁰

Ougradar *et al* are among initial proprietors for the research into the use of VR distraction to manage dental-based anxiety. Fifty patients were pre-screened using MDAS to determine anxiety levels prior to extractions. All patients included had previous history of having experienced a dental extraction. The procedure was carried out using a Virtoba VR headset simulating the patient being under the sea. Following the study, responses showed that 87.5% wanted VR to be used during their next appointment, suggesting VR relieved some level of dental anxiety or at least made the experience more bearable than having an extraction without the use of VR.¹¹

Summary and conclusions

VR holds promising potential as a tool to aid treatment of the anxious patient, but there are drawbacks. Some patients have reported motion sickness associated with the use of VR, meaning it may not be tolerated by all users.¹² Cost of the equipment and availability, as well as sterilisation of the units, are also areas to be considered if VR is to become commonplace within the dental setting.

Additional research with larger sample sizes and varied patient groups are necessary to explore these ideas further. Despite this, rapid technological advances hold potential for the future of fear-

free dentistry and, hopefully, this avenue of thought will receive increasing attention from researchers during this generation of dentistry and the next.

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References

1. Milgrom, P., Fiset, L., Melnick, S., et al. (1988). The prevalence and practice management consequences of dental fear in a major US city. *The Journal of the American Dental Association*, 116(6), pp.641-647.
2. Arntz, A., van Eck, M., Heijmans, M., et al. (1990). Predictions of dental pain: The fear of any expected evil, is worse than the evil itself. *Behaviour Research and Therapy*, 28(1), pp.29-41.
3. Ram, D., Shapira, J., Holan, G., et al. (2010). Audiovisual video eyeglass distraction during dental treatment in children. *Quintessence International*, 41(8), pp.673-679.
4. Appukuttan, D. (2016). Strategies to manage patients with dental anxiety and dental phobia: literature review. *Clinical, Cosmetic and Investigational Dentistry*, p.35.
5. Brann, L., Owens, J. and Williamson, A., 2012. *The handbook of contemporary clinical hypnosis*. Wiley-Blackwell, pp.326-330.
6. Humphris, G., Morrison, T., Lindsay, S., et al. (1995). The Modified Dental Anxiety Scale: validation and United Kingdom norms. *Community Dental Health*, 12(3), pp.143-150.
7. McCaul, K. and Haugtvedt, C. (1982). Attention, distraction, and cold-pressor pain. *Journal of Personality and Social Psychology*, 43(1), pp.154-162.
8. McCaul, K. and Malott, J. (1984). Distraction and coping with pain. *Psychological Bulletin*, 95(3), pp.516-533.
9. Morris, L., Louw, Q. and Crous, L. (2010). Feasibility and potential effect of a low-cost virtual reality system on reducing pain and anxiety in adult burn injury patients during physiotherapy in a developing country. *Burns*, 36(5), pp.659-664.
10. Tanja-Dijkstra, K., Pahl, S., White, M., et al. (2014). Improving Dental Experiences by Using Virtual Reality Distraction: A Simulation Study. *PLoS ONE*, 9(3), p.e91276.
11. Ougradar, A. and Ahmed, B. (2019). Patients' perceptions of the benefits of virtual reality during dental extractions. *British Dental Journal*, 227(9), pp.813-816.
12. Chang, E., Kim, H. and Yoo, B. (2020). Virtual Reality Sickness: A Review of Causes and Measurements. *International Journal of Human-Computer Interaction*, 36(17), pp.1658-1682.