

## Review Article

# Virtual reality in pediatric dentistry

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### Abstract:

Distraction is a common method to deal with dental anxiety and pain in Pediatric Dentistry. One such newer technique that utilises the benefits of distraction is the use of virtual reality. VR has been used as both a distraction tool and as an acclimatisation tool to prepare a child before and during a dental procedure. It is not used as widely as of this date , but theoretically could have a great role in non-pharmacological space management.

**Key words:** Virtual Reality, Pediatric Dentistry, Behaviour Management.

## INTRODUCTION

Dental anxiety is a common and extensive problem faced by Pediatric Dentists. Pain elicited during dental extractions or restorative procedures may lead to uncooperative behaviour and general dissatisfaction. Several techniques, both pharmacological and psychological, can be used to reduce patients' pain and anxiety during dental procedures.

Several psychological techniques have been used for pain management, distraction is one such simple psychological pain control technique that can be used in addition to traditional pain medications, to help control acute pain during medical procedures. According to the Attention Pain Theory by Eccleston and Crombez (1999), distraction can reduce the amount of attentional resources the patient's brain has available to process incoming neural signals from pain receptors, with the result of a reduced subjective pain experience. However, the effectiveness of traditional distractions, such as music, for reducing pain and fear is often limited (Aitken et al., 2002; Koller and Goldman, 2012; Bellieni et al., 2013).

## VIRTUAL REALITY IN PEDIATRIC DENTISTRY

VR is a computer technology that creates an artificial 3-dimensional simulated environment through audio and visual immersion. It consists of a head mounted display and a pair of goggles that are connected to either a computer or a cell phone. The headset has sensors that track user's head movements, creating the illusion of moving around in the virtual space. (1)

When it comes to pediatric dentistry, as the patient's attention is focused on the VR scenario, the visual and audio stimuli that usually trigger anxiety are shunted. The reduction in fear in pediatric needle procedure is significant while using VR compared with standard methods of behavioral management or distraction (2)

VR is also indicated for cognitive and behavioral therapies based on progressive exposition to different stimuli such as the dental anesthesia needle. Psychological preparation for a surgical intervention by virtual visit of the operating room is possible and allows a reduction in preoperative anxiety scores (3)

## MEDICAL HYPNOSIS THROUGH VIRTUAL REALITY

Recent development in software has made use of multisensory immersion in sync with a hypnosis suggestion speech, thus allowing a more standardized hypnosis therapy. Combining the benefits of the visual distraction through VR with

synopsis scripts based on cardiac coherence and suggestion. It often includes musical constructions that have been clinically proven to affect the patient's heart rate through relaxation, associating the ambient sounds with music therapy compositions. Hypnogram© is one that software that are easy and clinically ready-to-use and don't require hypnosis skills for the practitioner with proven effectiveness as a natural anxiolytic. Making it of use as a premedication before extensive surgeries to reduce pre-treatment anxiety. It also provides analgesia with reduced side effects. Post-operative hypoalgesia can reduce pain and opioid use with a faster recovery.

## DISCUSSION

A study in 2018, Virtual Reality Analgesia for Pediatric Dental Patients by Barbara Atzori et al. showed mean pain ratings were significantly lower during VR compared to the control condition for affective, and sensory components of pain. The mean "pain unpleasantness" during No VR was 2.40 ( $SE = 1.52$ ), and dropped to 0.60 ( $SD = 0.55$ ) during virtual reality,  $t(4) = 3.67, p < 0.05, SD = 1.10$ .

While undergoing the painful dental procedure while interacting with VR, patients reported mean presence ratings of 7.40 ( $SD = 2.70$ ) corresponding to "a strong sense of going inside the computer generated world," and a mean of 7.40 ( $SD = 1.82$ ) for the realism of VR objects, corresponding to "very real." Mean nausea ratings were considered negligible in both conditions ( $<1$  on a 0–10 scale). When interacting with VR, patients reported significantly higher levels of fun during the painful procedure, compared to the control condition. Fun during No VR (mean = 3.20,  $SD = 4.32$ ) was "mildly fun" vs. "pretty fun" during Yes VR (mean = 8.20,  $SD = 2.49$ ),  $t(4) = 2.80, p < 0.05, SD = 4.00$ .

The dentist felt more relaxed and was able to be more concentrated on his job when he performed the dental procedures while the patient was interacting with VR, compared to the routine standard care.

Another study, "Effectiveness of Virtual Reality Eyeglasses as a Distraction Aid to Reduce Anxiety among 6–10-year-old Children Undergoing Dental Extraction Procedure", by Paloni Koticha et al. found that the mean pulse rate values after extraction procedure in group I were  $107.833 \pm 1.356$  and group II were  $108.4 \pm 0.927$  respectively. The pulse rate values in intergroup comparison were found statistically significant  $p = 0.03$ .

Systematic reviews and randomised control trials have demonstrated the successful use of VR to both distract patients perioperatively during medical procedures, and also preoperatively to prepare them for these interventions. However, to date, VR has only been applied to dentistry in a very limited number of studies. Three studies using virtual reality in a dental setting demonstrated decreased pain and anxiety compared with no intervention. All three of these studies were carried out in the perioperative period. A fourth study used a bespoke dental app and imagery to prepare patients with Autism Spectrum Disorder (ASD) for dental treatment, finding statistically significant decreases in both the number of appointments and number of attempts required to carry out a procedure

## CLINICAL IMPORTANCE

Medical studies have shown VR to be beneficial both as a form of distraction and acclimatisation, it follows that the same may be true in dentistry.

If children and adolescents can be suitably acclimatised to accept examination and treatment in an outpatient setting, a number of general anaesthetics could be avoided.

The field of VR is continuing to grow, and has innumerable applications in patient preparation, distraction, information and indeed in dental education.

## CONCLUSION

Virtual reality is a promising tool which to date has been under-utilised in dentistry. Perioperative use of virtual reality in dentistry is less ideal than in other medical procedures due to the field of interest and need for the head to remain

immobile, but nonetheless further high quality trials are indicated to assess if it holds any benefit over distraction with a tablet or audiovisual glasses.

Recent mass production of immersive VR goggles has increased their availability and affordability, and there is growing interest in non-pharmacological techniques for pain management, making VR analgesia a promising direction for future clinical research. Associating with medical hypnosis scenario, it combines the benefits of both distraction through VR and hypnosis. Children can discover the dental office in a playful and fun way.

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