International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 15; Issue: 4; April 2025
Website: www.ijhsr.org
Review Article *ISSN: 2249-9571*

Pain Control in Pediatric Dentistry

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DOI: https://doi.org/10.52403/ijhsr.20250417

ABSTRACT

Pain management is a complex undertaking in pediatric patients as the ability to discern one's own level of pain isn't there in most cases. Pain is the main symptom that may include conditions that are associated with the hard and soft tissue of head, neck and all intraoral structures the diagnostic range includes headache, musculoskeletal pain, neurogenic psychogenic pain, pain from major diseases etc. Thus, the main objective of pain control is to eliminate the pain and this occurs by removing the main cause of it like dental caries, pulpal pathology, etc. or blocking the pathways of painful impulses by local anesthetics or using pharmacotherapy agents like analgesics to help the child be relieved of pain. Thus, this review elaborates on the various pain management techniques.

Keywords: pain, local anaesthesia, pediatric dentistry, management

INTRODUCTION

As quoted by Dr. Lorimer Moseley, "Pain comes into consciousness. The brain doesn't produce pain, the human does." Pain as defined by the International Association for the Study of Pain in year 2020 is as follows: "An unpleasant sensory and emotional experience associated with, or resembling that associated with actual or potential tissue damage."[1]

The main goal of pain management is to relieve discomfort. It can be accomplished by identifying the root cause and treating it, or by blocking painful signals using local anesthetics or medication like analgesics. Ultimately, the aim is to ease the child's pain.

Management of Pain

Pain management in pediatric patients is a complex issue that involves emotional and sensorial components. Psychological methods of treating pain are becoming more common, with behavioral strategies grounded in classical and operant conditioning. Cognitive behavioral therapy (CBT) has grown from these early models and encompasses techniques like relaxation, biofeedback, imagery, and distraction.

Hypnosis

It combines deep relaxation with imagery under the direction of a trained therapist, helps decrease sympathetic activity associated with anxiety and pain, reducing the intensity of the experience. It carries great therapeutic benefits in

medicine/psychology and has potential therapeutic and operative uses in dentistry.[2]
A randomized control study by Ramírez-Carrasco et al (2017) found that hypnosis combined with behavior management techniques can decrease heart rate during anesthetic infiltration, indicating improvement in anxiety/pain control.[3] A clinical case report by Wolf et al (2021) successfully used hypnosis in the treatment of two primary molars with a composite filling in an anxious four-year-old child, reducing dental anxiety and pain perception.[4] Hypnosis also increased communication and rapport between the practitioner and the child. A study by Sabherwal et al (2021) found hypnosis and progressive muscle relaxation effective for anxiolysis and pain control in pediatric dental patients.[5] M Tieri et al (2023) found hypnotherapy as a valuable substitute for nitrous oxide sedation in achieving patient compliance in pediatric patients.[6]

Distraction

It is an effective method of pain management in the pediatric population, either cognitive or behavioral, aiming to shift attention away from pain.
Techniques such as bubbles, counting, conversation, music, television, toys, and video games can be used by healthcare providers or the child's caregiver.[7] Active distraction promotes a child's involvement in an activity during a procedure, involving sensory components. Interactive toys, such as interactive video and electronic games, are multisensory toys that require active cognitive, motor, and visual skills to reduce pain and anxiety.

Virtual Reality (VR)

It offers a multisensory, immersive environment that can be used to reduce anxiety during dental procedures. Al-Halabi et al. (2018) found that virtual reality glasses and Tell Show Do effectively reduced anxiety during local anesthesia administration.[8] Kumari et al (2021) found that immersive VR and non-immersive VR diversions effectively lowered kids' discomfort during dental treatments, particularly during the stimulating phase.[9] These findings suggest that immersive VR can be an effective addition to pediatric dentists' standard behavior management techniques.

Controlled breathing

It involves patients deliberately pacing their breathing, which can help reduce pain perception during dental procedures. Sowmya Sridhar et al (2019) found that bubble breath exercise reduces pain perception in children aged 7-11 during maxillary buccal infusion anesthesia.[10] Zahra Bahrololoomi et al (2022) found that bubble blower breathing exercises are effective distraction and relaxation tools for 7-10-year-old children with moderate to severe anxiety during inferior alveolar nerve block.[11]

Guided imagery

Guided imagery, which involves allowing patients to visualize a pleasurable, peaceful, or relaxing scene, has been shown to foster positive relationships between pediatricians and patients. Yu Chen Ko et al's 2021 study found that guided imagery can reduce anxiety in children and caregivers about dental surgery. The two-group prospective randomized experiment involved children imagining an adventure in a spacecraft. The study found that guided imagery fostered positive relationships between pediatricians and patients, reduced agitation, and improved their ability to respond to stressful situations.[12]

Passive distraction

Passive distraction, which requires the child to remain calm and quiet during a procedure, is achieved through patients' observation of an activity or stimulus. Amal Al-Khotani et al (2016) found that audiovisual distraction (AV) can reduce children's anxiety and worry during dental treatment.[13] Natália Baschirotto Custódio et al (2020) found that virtual reality glasses

improved behavior and reduced pain perception during caries removal.[14] Ekram Alsibai et al (2022) found that using a wireless joystick and tablet for video games was the most effective method for reducing dental fear and pain in schoolchildren (6-10 years old), outperforming passive distraction methods like cordless headphones and AV tablets.[15]

Musical intervention

It is a noninvasive and inexpensive form of auditory distraction that has been shown to reduce discomfort and anxiety in children during dental treatment. Adler et al's systematic review found that children experienced less pain and anxiety during dental treatment when exposed to audio-only media. Different musical genres, such as pop, kids', and classical, provided stronger pain-relieving effects when played alone[16]. Ting B et al's meta-analysis of 38 RCT publications found that a consistent musical style and a purely aural experience were crucial for pain management.[17] Both studies suggest that MI is a suitable, low-stress, and safe non-pharmacological treatment for clinical pain alleviation in pediatric patients. Identifying individual patient preferences and temperament is key to determining best practices in pediatric dental treatment.

Aromatherapy

Aromatherapy is a non-invasive therapy using natural essential oils to improve mood, relieve pain, and cognitive function. Arslan et al found that lavender oil reduced pain during surgical procedures,[18] while Faezeh Ghaderi et al found that lavender essential oil reduced pulse rate and salivary cortisol levels in children undergoing dental treatment.[19] Kamalapuram Nirmala's randomized clinical trial found that sweet orange aromatherapy reduced discomfort in children, while lavender used in a nebulizer reduced pain.[20]

Low-level laser acupuncture

It is a key component in traditional Chinese medicine, has also been used to reduce pain using acupuncture points. Low-level laser acupuncture shows analgesic effects when compared to 20% benzocaine gel, and it can be used to manage discomfort during local anesthetic treatment in pediatric patients.

Taras I Usichenko et al (2016) found that acupoint LI4 stimulation lowers pain and autonomic discomfort in children undergoing LA injection during dental treatments.[21] B Sandhyarani et al (2021) found that low-level laser acupuncture showed analgesic effects compared to 20% benzocaine gel.[22] Gül Uçar et al (2022) found that using topical anesthesia plus LLLT with an 810-nm diode laser before local infiltration anesthesia reduced injection discomfort but had no effect on anesthesia efficacy or duration in children.[23] Pooja et al. (2023) conducted a randomized clinical experiment to investigate the effectiveness of LA in reducing pain perception in 112 children receiving dental local anesthesia. The study demonstrated the safety, noninvasive nature, and friendly adjunct to pain management in pediatric patients.[24]

Counter irritation

It involves applying vibratory or pressure stimuli manually or by vibrating devices adjacent to the injection site. Vibratotactile devices like DentalVibe and Buzzy can be used comfortably in pediatric patients, but their design can disturb the injection process and be scary for children.

Tung J et al.'s 2018 study compared children's injection discomfort using three methods: DentalVibe, manual stimulation, and no stimulation. The study found that the DentalVibe group experienced a significant decrease in pain rating and pulse rate compared to the control and manual stimulation groups. The study suggests that using DentalVibe may reduce pain during dental injections.[25]

Cryoanesthesia

It blocks the neural transmission of painful stimuli by cooling a localized area. Coolant agents like ice or a refrigerant spray can be used, and Buzzy, a battery-operated, hand-held plastic 'bee' with a vibrating motor, can cause a distractive environment. In a study done by Lakshimi Lakshmanan et al (2021) precooling the injection site using cryotherapy was more effective than topical anesthetic gel in lowering pain before local anesthesia administration in pediatric patients.[26]

Eye movement desensitization and reprocessing (EMDR)

Developed by Francine Shapiro in 1989, aims to heal traumatic memories and stress symptoms, particularly in individuals with post-traumatic stress disorder (PTSD). Namita Kalra et al's 2023 study found that children in the EMDR group showed less anxiety after extraction surgery and local anesthesia compared to those in the traditional behavior management group, indicating potential benefits for anxiety reduction.[27]

Pharmacological pain management

Natural remedies with analgesic properties date back to ancient Egypt and the Greeks, including Dioscorides and Hippocrates who prescribed willow bark with salicylic acid as the main ingredient. In the late nineteenth century, three prototypes of modern nonopioid antipyretic analgesics were discovered: acetaminophen, aspirin, and phenazon, which still make up about 50% of the market of antipyretic analgesics worldwide. Opiates such as morphine, codeine, and methadone were also used for thousands of years.

Odontogenic pain is a complex cascade process initiated from dental tissue damage and accompanied by heterogeneous neuronal stimuli as a consequence of neurovascular, neuroinflammation, and morphologic reactions. Analgesics are considered one of the most important drug groups in dental practice due to their prescription rate, clinical efficacy, cost-effectiveness, and safety profile. Most clinical indications of analgesic prescriptions relate to the treatment of acute and chronic dental pain and adjunctive intraoperative and postoperative pain.

Nonsteroidal anti-inflammatory drugs (NSAIDs) and opioids exhibit their analgesic effect due to the inhibition of prostaglandin synthesis at the peripheral nerve endings, while opioids demonstrate their effect in the central nervous system through its depression. Multimodal and multiapproach therapy is the cornerstone of pain management in children, using different analgesia and nonpharmacological complementary approaches to enhance pain control and minimize drug-induced adverse effects. Dosage calculations of analgesics for children are based on mg/kg body weight administered by intravenous, oral, and rectal routes, while intramuscular injections should be avoided.

Local anesthesia for pediatric patients should be administered through desensitization to reduce dental fear and help them cope with the treatment. The most commonly used local anesthetics for pediatric dentistry are amide-type agents, such as Lidocaine hydrochloride (HCl) 2% with 1:100,000 epinephrine. The maximum dose of lidocaine and mepivacaine is 4.4 mg/kg body weight and 7 mg/kg body weight for lidocaine with vasoconstrictors. The average duration of pulpal anesthesia is 60 minutes for 20% lidocaine with 1:100,000 epinephrine, 50 minutes for 2% mepivacaine with 1:20,000 levonordefrin, and 25 minutes for 3% mepivacaine without vasoconstrictor. Soft tissue anesthesia is more common than pulpal anesthesia, and 2% lidocaine with 1:100,000 epinephrine is recommended for young children.

There is no perfect technique for anesthetizing all children, but several key procedures can help reduce pain during local anesthetic injections. These include controlling the child's head, using topical anesthesia, slowing down the rate of infiltration, distracting the child, vibrating

the tissue around the injection site, and applying heat and cold before the injection. Topical anesthesia is a reversible abolition of sensitivity in a small part of the body, blocking the terminal fibers of sensory nerve endings, decreasing pain perception, and improving the relationship between the child and the practitioner.

CONCLUSION

Pediatric dentists face acute dental pain, which can be managed using both non-pharmacological and pharmacological strategies. Modern pain control methods, such as local analgesia, are essential in pediatric dentistry. Traditional methods are not as effective, but modern techniques make the process more enjoyable and strengthen the patient-dentist bond, making it a critical skill for practitioners.

Declaration by Authors

Ethical Approval: None
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Komal Pravin Bhosale, Vishnu Rekha Chamarthi, Dhanraj Kalaivanan, Santham Krishnamoorthy, Sumaiyya Saleem, Sai Sarath Kumar Kothimbakkam et.al. Pain control in pediatric dentistry. *Int J Health Sci Res.* 2025; 15(4):110-115. DOI: *https://doi.org/10.52403/ijhsr.20250417*

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