

Review Article

Exploring Pain Assessment and Management Techniques in Pediatric Dentistry: A Comprehensive Review

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ABSTRACT:

Pain presents a major stimulus for seeking emergency dental treatment. Pain can be classified into typical and atypical pain; acute and chronic pain; superficial or deep pain depending on various factors. Orofacial pain correct diagnosis and management report a vast majority of challenges. For the effective pain management, thorough diagnosis is important which require proper history, examination and relevant investigations. Valid and reliable measurements of pain are needed to identify patients who require intervention and to evaluate the effectiveness of intervention. Pain measures are classified as self-report, behavioural or physiological measures. Pain is managed by both pharmacological and non-pharmacological methods. The pharmacological methods include opioids, NSAID's and Nonopioid, non-NSAID drugs. Non pharmacological therapy includes maintain a calm environment, encouraging deep breathing, distraction, hypnotherapy, virtual reality, aromatherapy and other (acupuncture, transcutaneous nerve stimulation) techniques. Pain is often referred to as the 5th vital sign and the perception of pain in paediatrics is complex which entails physiological, psychological, behavioural and developmental factors.

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INTRODUCTION

Pain is always a subjective experience that is influenced to varying degrees by biological, psychological and social factors. According to the IASP, pain is defined as "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."¹ Orofacial pain correct diagnosis and management report a vast majority of challenges. For the effective pain management, thorough diagnosis is important which require proper history, examination and relevant investigations. Although the principles of pain evaluation and management apply across the human lifespan, infants and children present unique challenges that necessitate consideration of the child's age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs.² Valid and reliable methods of pain measurement are needed to evaluate the effectiveness of intervention.³ Pain measures are classified as self-report, behavioural or

physiological measures. Most reliable indicator of pain is a combination of all 3, known as a multi-dimensional pain assessment.⁴ One of the most important criteria that patients appreciate and rank a dental care provider for, far beyond knowledge and academic background, skills, and professional accolades, is effective pain management.⁵ Due to fear and anxiety pain management becomes more difficult in children than adults. Pain is managed by both pharmacological and non-pharmacological methods. The pharmacological methods include opioids, NSAID's and Non opioid, non SAID drugs. Non harmacological therapy includes maintain a calm environment, encouraging deep breathing, distraction, hypnotherapy, virtual reality, aromatherapy and other (acupuncture, transcutaneous nerve stimulation) techniques

MEASUREMENT OF PAIN

Accurate pain assessment is crucial and difficult to achieve in children, which has led to development of

various tools over the years. Three main methods for pain measures are :Self-report measures, behavioural and physiological measures. Most reliable indicator of pain is a combination of all 3, known as a multi-dimensional pain assessment.⁴

sufficient cognitive and language development to understand the task and to generate an accurate response.³ These tools can be used in children aged 3 years and older.

SELF-REPORT MEASURES

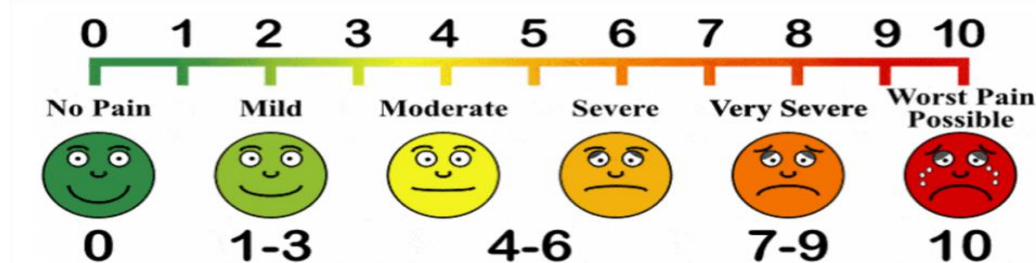
Self-report measures are considered the “gold standard,” and most valid approach to pain measurement in children. Self-report measures exist in verbal and nonverbal formats, both require

1. Visual analog scale and Graphic Rating Scale

Visual analog scale (VAS) for pain assessment was first introduced by Hayes and Patterson (1921). It is a horizontal line, 100mm in length, attached to word descriptions at each end, “not hurting” or “no pain” to “hurting a whole lot” or “severe pain

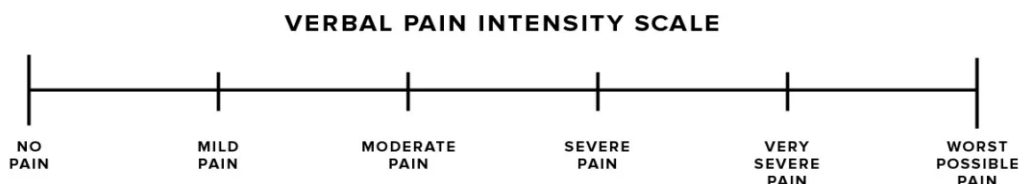


Pictorial version of VAS has also been developed to make this scale more comprehensible and relatable to paediatric population.⁴



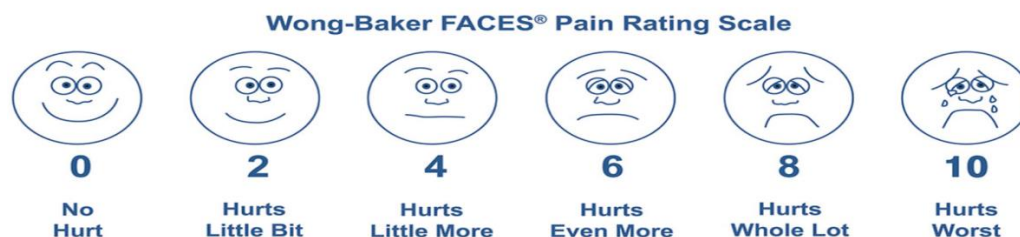
2. Verbal rating scale

Verbal rating scale was proposed by Ozgur Karcioglu. In this scale adjectives are used to describe different levels of pain. On a linear pointer scale which is marked from no pain to worst possible pain at extreme end points.⁴



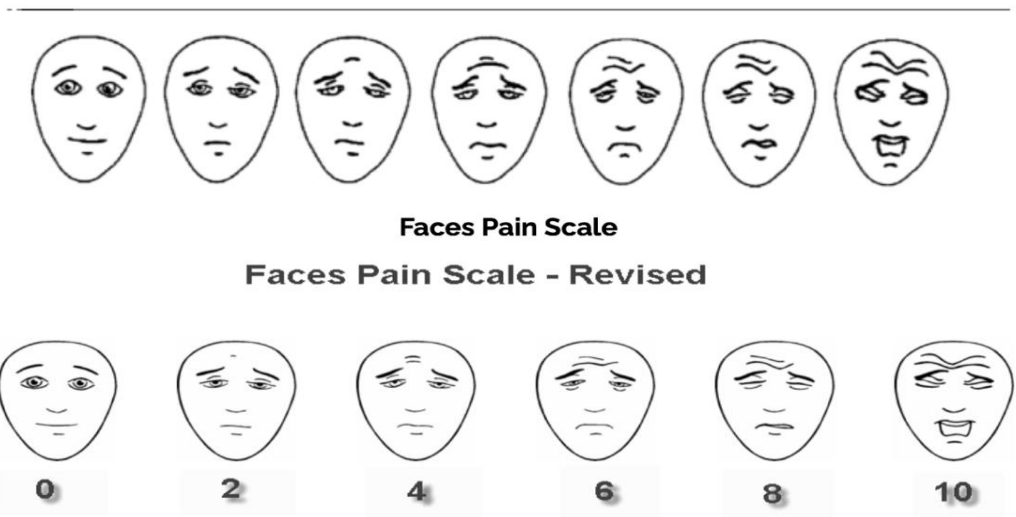
3. Wong-Bakers facial pain rating scale (WB-FPS)

Wong-Bakers facial pain rating scale (WB-FPS) was developed by Donna Wong and Cannie Baker in the year 1988. This scale consists of 6 faces with word descriptors and numbers from 0 to 10. This simple scale can be easily reproduced for use at the chairside with children as young as 3 years of age.⁴



4. Faces pain rating scale and faces pain scale-revised

Wong and Baker developed Faces pain scale for assessment of pain. A revision of this scale was done by Bieri et al in same year to allow the scores from the FPS to be on same metric or scale as numerical self-report and observational measures of pain thus making it easy for numeric evaluations.⁴

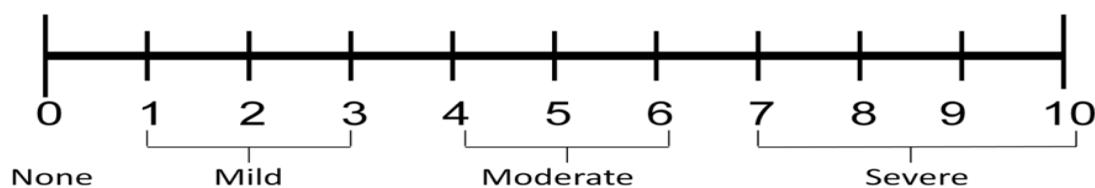


5. Pieces of hurt

Pieces of hurt scale was introduced by Hester (1979). It uses four red poker chips. The chips are aligned horizontally in front of the child. Each chip is depicted as equal to pieces of hurt. One chip represents “a little bit of hurt,” and four chips represent “the most hurt the child could ever have.” Although most studies focus on using it in children four to thirteen years old, adolescents have used it successfully as well.³

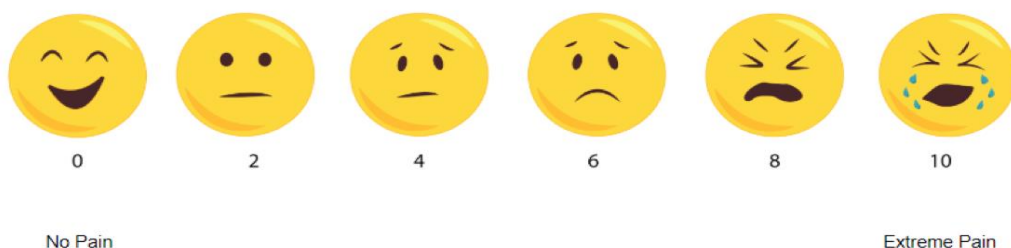
6. Numeric rating scale

Dr. Ronald Melzack and Dr. Warren Torgerson proposed numeric rating scale (1977). The numeric rating scale (NRS) allows patients an opportunity to quantify their pain, ranking pain severity on a scale of 0-10 or 0-5, with the 0- anchor representing “no pain” and 5 or 10 representing the “worst possible pain”. The scale is easy to use, and scores can be tracked over time.⁴



7. Emoji pain scale

In the year 2018, Dhillon et al developed Emoji pain scale while considering the increased use of smart phones by children these days. Emoji have a strong communicative utility and are essentially an international language making them a valuable tool for communication with children. The scale consisted of 6 emojis rated from 0-10 with 0 being no pain and 10 being extreme pain.



BEHAVIORAL MEASURES

For the infants, very young children, and children with severe cognitive or communication impairments, it may be impossible to use self-report measures; therefore, behavioral measures are required. Behavioral measures include measures of crying, facial expression, body posture and movements, daily routines, or some combination of these items.³

- 1. Faces Legs Activity Cry Consolability Scale (FLACC):** It is a behavioral scale for measuring the intensity of post procedural pain in young children. FLACC is an easy and practical scale to use in evaluating and measuring pain especially in pre-verbal children from 2 months to 7 years.³

Category	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to; distractable	Difficult to console

Each of the five categories is scored from 0 – 2, resulting in total range of 0 – 10, FLACC = Face, Leg, Activity, Cry, Consolability

The **r-FLACC (revised Face, Legs, Activity, Cry and Consolability)** pain score is an internationally acclaimed tool for assessing pain in children with Cerebral Palsy unable to self-report because of its ease to use, its use of core pain behaviours and its clinical utility. In addition the r-FLACC pain score is superior to other pain assessment tools since the

revision introduced an open-ended descriptor for incorporation of typical and atypical individual pain behaviours. Children with cognitive impairment may have atypical pain behaviour due to idiosyncrasies masking the typical expression of pain among others laughing, singing, clapping of hands, anger, aggressiveness and self-injury.

(REVISED) FLACC Scale SCORING			
Categories	0	1	2
Face	No particular expression or smile.	Occasional grimace or frown, withdrawn, disinterested, Sad, appears worried.	Frequent to constant quivering chin, clenched jaw, distressed looking face, expression of fright/ panic.
Legs	Normal position or relaxed; usual tone and motion to limbs.	Uneasy, restless, tense, occasional tremors.	Kicking, or legs drawn up, marked increase in spasticity, constant tremors, jerking.
Activity	Lying quietly, normal position, moves easily, regular, rhythmic respirations.	Squirming, shifting back and forth, tense, tense/guarded movements, mildly agitated, shallow/splinting respirations, intermittent sighs	Arched, rigid or jerking, severe agitation, head banging, shivering, breath holding, gasping, severe splinting.
Cry	No cry (awake or asleep)	Moans or whimpers: occasional complaint, occasional verbal outbursts, constant grunting	Crying steadily, screams or sobs, frequent complaints, repeated outbursts, constant grunting.
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or being talked to: distractable	Difficult to console or comfort, pushing caregiver away, resisting care or comfort measures.
Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score between zero and ten.			

- 2. Children’s Hospital of Eastern Ontario Pain Scales (CHEOPS):** One of the earliest tools used in young children. It is used to assess the efficacy of interventions used in alleviating pain. It includes six categories of behaviour: cry, facial,

child verbal, torso, touch, and legs. Each is scored separately (ranging from 0–2 or 1–3) and calculated for a pain score ranging from 4–13.³

Physiological Measures: Physiological or biological measures constitute the third category of pain measures. Physiologic variables have been useful in examining the pain experiences associated with short-term medical procedures. Physiological measures can aid the assessment and measurement of pain, but like behavioural changes, they are not always specific to pain and often stress and pain can cause an increase in activity in the sympathetic nervous system. They include cardiovascular, respiratory, GIT, neurological, endocrinal signs.

MULTIDIMENSIONAL SCALES

Multidimensional pain measurement tools can be used to assess the wider pain experience. They are most appropriate for assessing chronic and recurrent pain in children.

- Brief Pain Inventory (BPI)
- Initial Pain Assessment Inventory (IPAI)
- McGill Pain Questionnaire (MPQ)
- Memorial Pain Assessment Card
- Pain drawing

The McGill Pain Questionnaire (MPQ): It was developed by Melzack in 1971. It is an assessment tool that combines a list of questions about the nature and frequency of pain with a body-map diagram to pinpoint it. The McGill Pain Questionnaire (MPQ) provides estimates of the sensory, affective and evaluative dimensions of pain, and is often considered to be the gold standard of the pain measurement tools. After the patient is done rating their pain words, the administrator allocates a numerical score, called the “Pain Rating Index”. Scores vary from 0–78 with the higher score indicating greater pain. In terms of utility, the MPQ is time consuming to administer, 5-20 min, and often requires supervision. This may make it unusable for very sick and debilitated patients.⁶

MANAGEMENT OF PAIN: Effective pain management is a critical aspect of pediatric healthcare, particularly in dental settings where fear and anxiety can make pain management more challenging in children than in adults. Both pharmacological and non-pharmacological techniques are used to address pain in children.



• **PHARMACOLOGICAL**

- Opioids
- NSAIDs
- Non- opioid, Non- NSAID drugs

• **NON - PHARMACOLOGICAL**

- Distraction
- Hypnotherapy
- Virtual Reality
- Aromatherapy
- Acupuncture
- TENS

PHARMACOLOGICAL METHODS

Pharmacological pain management involves the use of medications to alleviate pain. Different time frames are set for controlled substances based on the type of pain: acute pain (up to 4 weeks from onset), postoperative pain (up to 4 weeks from surgery), subacute pain (4 to 12 weeks from onset), and chronic pain (over 12 weeks from onset).⁵ Pharmacokinetic and pharmacodynamic differences exist between adults and pediatric populations, which need to be considered. Neonates have an immature blood-brain barrier, making them more susceptible to drug delivery to the brain. Children have lower plasma levels of albumin, resulting in less protein binding of drugs and potentially increased action or toxicity. Higher body water content in neonates and infants

increases the volume of distribution of water-soluble drugs, extending their duration of action. Hepatic clearance of drugs may be greater in children aged 2 to 6 years due to a larger hepatic mass relative to body weight, requiring adjustments in dosing and intervals. Renal function and drug excretion are reduced in neonates.⁵ Three main categories of analgesics are used in dental settings: opioids, nonsteroidal anti-inflammatory drugs (NSAIDs), and nonopioid, non-NSAID drugs. Opioids can be agonists, partial agonists, or antagonists.⁵ They are effective in moderate to severe pain relief but Activation of opioid receptors can cause respiratory depression, pupil constriction (miosis), euphoria, sedation, physical dependence, endocrine disruption, and suppression of opiate withdrawal. Pruritus (itching) may occur due to

histamine release that accompanies some opioid analgesics. The FDA and AAP issued warnings and safety communications on codeine and tramadol over

the past few years because of potentially resulting in overdose, respiratory depression, and even death.⁷

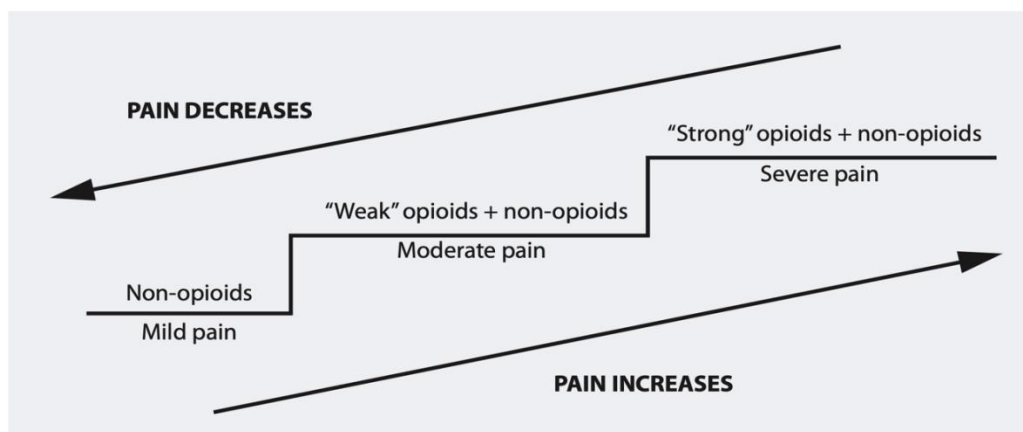
OPIOID DOSAGES FOR CHILDREN

Opioid Medication	Starting Dose for Children (Oral)
Morphine Oral - immediate release	1-2 y: 200-400 µg/kg q4 h 2-12 y: 200-500 µg/kg q4 h (max 5 mg)
Morphine Oral - prolonged release	200-800 µg/kg q12 h
Hydromorphone Oral - immediate release	30-80 µg/kg q3-4 h (max 2 mg/dose)
Oxycodone Oral - immediate release	125-200 µg/kg q4 h (max 5 mg/dose)
Oxycodone Oral - prolonged release	5 mg q12 h
Hydrocodone	100-200 µg/kg q4 h
Codeine	0.5-1 m/kg q4 h
Tramadol	1-2 mg/kg q6 h (max per dose: 100 mg max per day 400 mg)

NSAIDs are among the most commonly used class of drugs and have anti- inflammatory, analgesic, antipyretic, and antiplatelet properties. They work by inhibiting the synthesis of prostaglandins, which are involved in inflammation and pain. Ibuprofen in oral or intravenous (IV) form is a safe and commonly used analgesic and antipyretic agent in paediatrics. However, NSAIDs should be used cautiously in children with asthma, impaired renal function, coagulation disorders, or on nephrotoxic medications.⁷

Dosages for common analgesics in children			
Medication	Dose (mg/kg)	Frequency (h)	Max per day (mg/kg/d)
Aspirin	10-15	4-6	90
Ibuprofen	5-10	6-8	40
Naproxen	5-10	12	20
Acetaminophen children	10-15	4-6	Children: 100
Acetaminophen infants	10	4-6	Infants: 75

Nonopioid, non-NSAID drugs like acetaminophen is an analgesic with efficacy for mild to moderate pain and is an antipyretic. Unlike NSAIDs, they are centrally acting and does not have anti-inflammatory effects or an effect on gastric mucosal lining or platelets. Allergic reactions are rare, but toxicity from overdose may result in acute liver failure and are commonly used in children due to their superior tolerability profile.⁷Recent studies have shown that acetaminophen, when used with NSAIDs, can reduce opioid requirements in children after surgery.⁵



World Health Organization analgesic ladder for treating chronic pain

NON-PHARMACOLOGICAL METHODS

Non-pharmacological pain management techniques have gained attention in recent years. Studies suggest that nonpharmacologic interventions may be effective alone or as adjuncts to pharmacological interventions in managing procedure-related pain, anxiety, and distress with minimal risk of adverse effects. These methods include distraction, imagery, hypnotherapy, virtual reality, smart phone applications, many other techniques.⁷ Distraction techniques involve diverting the child's attention away from the painful stimuli using interactive and engaging stimuli such as magic tricks, toys, cartoons, films, or music. Cognitive interventions (like imagery and preparation/education/information) and Behavioural interventions (like breathing exercises, modelling positive coping behaviours, desensitization, and positive reinforcement) guide the child's attention away from procedure-related pain. Hypnotherapy aims to alter sensory experiences and dissociate from pain experiences, and hypnosis is best for children of school age or older. There is evidence hypnotherapy is effective in reducing needle-related pain and distress in children and adolescents; however, there is no evidence hypnotherapy alone is capable of producing an anaesthetic effect necessary for invasive dental procedures. Using digital technology can provide distraction and reduction in pain and distress for children undergoing painful procedures. The use of virtual reality, video games, and smart-phone applications has shown a reduction in self-reported and observer-reported pain and distress.⁷ Recently, aromatherapy (application of fragrant volatile essential oils for therapeutic targets) has gained much more attention and have been propounded as a complementary approach in medical and dental settings. The concept of the therapeutic use of aromatic essential oils is supported as it can produce a positive physiological effect through the sense of smell. Aromatherapy can induce relaxation and relieve anxiety symptoms in an inexpensive, simple way. The aroma of lavender essential oil may lead to improved mood, decreased anxiety, and increased sedation due to parasympathetic stimulation of the

autonomic nervous system.⁸ Trigger point deactivation is form of acupuncture used to improve pain associated with my of ascial pathology. Acupuncture is performed by inserting fine, solid needles (typically 32–36 gauge) into the selected acupuncture points.⁹ Transcutaneous electrical nerve stimulation (TENS) is a non-invasive, inexpensive, safe, and easy-to-use approach for acute and chronic pain management. TENS is administered at varying frequencies of stimulation: high (>50 Hz), low (<10 Hz), or burst TENS (burst of high-frequency administered at a much lower frequency).⁹

CONCLUSION

In conclusion, pain evaluation for a child is tedious process because of multifactor like limited cognitive development, dental fear and anxiety and inability to differentiate between pain and different sensations. However, for a superior quality treatment for pediatric patients, correct pain assessment and management is of paramount importance. Non-pharmacologic interventions may be effective alone or as adjuncts to pharmacological interventions in managing procedure-related pain. Pharmacotherapy has some side effects when given among paediatric patients, non-pharmacological intervention in reducing dental pain and anxiety has proven good results among children than in adults. It should be used as first line treatment before administration of drugs. Recent advances are coming in the measurement and management of pain.

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