

Review Article

Levels of pain assessment tools for pediatric dental patients: a narrative review

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ABSTRACT

Pain is defined as an unpleasant sensory and emotional experience associated with actual and potential tissue damage. Pain perception in children causes a number of changes in their emotional state. It can lead to emotions like fear, anxiety, sadness and might have an impact on day-to-day activities. Due to the lack of cognitive development young children are unable to express their pain verbally. Pain assessment can be carried out by using various approaches, such as self-reporting pain assessment tools, behavioural pain assessment tools and by assessment of various physiologic parameters. The process of pain evaluation for a child is strenuous as they have limited cognitive sophistication to describe their painful experiences during any disease process. Out of all the scales discussed, Wong-Bakers facial pain rating scale (WB-FPS) is considered the best as it is simple to use for the operator and can be easily reproduced and can be used in children as young as 3 years of age.

Keywords: Pain assessment, Self-reporting pain assessment, Behavioural pain assessment, Physiological pain assessment

INTRODUCTION

Pain is often referred to as the “fifth vital sign” and it should be assessed and recorded as often as other vital signs.¹ According to the international association for the study of pain (IASP) pain is “an unpleasant sensory and emotional experience associated with actual and potential tissue damage”.² Oral diseases most commonly manifest themselves as pain. A plethora of factors, including physiology, psychology, development, and behaviour etc, influence patient’s ability to convey pain sensation.³ While adults can describe the history and severity of their pain with relative ease, pain assessment is a challenge in paediatric patients, as a result, pain is often underestimated in children and thus mistreated.⁴

Pain perception in children causes a number of changes in their emotional state. It can lead to emotions like fear, anxiety, sadness and might have an impact on day-to-day

activities. Pain-related fear, social rejection, attachment insecurity, and high arousal of negative emotions may lead to greater perception of pain. These emotional factors occur not only in response to pain but also trigger, maintain, or exacerbate pain.⁵

Due to the lack of cognitive development, children are unable to express their pain verbally. Most often children younger than 3 years of age express all their negative emotions like pain by means of crying. Crying makes it even more challenging for the pediatric dentist to manage the behavior of the child and provide good treatment simultaneously.⁶ For a proper treatment, the assessment of dental pain perception is of utmost importance by a pediatric dentist. Literature evidence is suggestive of long-term negative and permanent repercussions on pain sensitivity, immune functioning, neurophysiology, and their negative attitudes due to untreated pain.⁷

Painful experience and discomfort due to dental problem can linked to anxiety levels which has direct correlation with management of child in dental operator. Child's dental anxiety may account for his/ her un-cooperative behaviour during dental appointments, resulting in stress for child, parent/ guardian and pediatric dentist.⁸

Latest literature evidence suggests that pain and negative experiences from dental treatment considered major reasons for dental fear and anxiety and dental behaviour management problems (BMP).⁹⁻¹³ It is essential that this should be acknowledged by dental personnel to decrease pain and discomfort to child undergoing dental treatment.

The aim of article is to review various pain assessment strategies and tools for children in dental operator.

PAIN ASSESSMENT TOOLS

Three components of pain assessment in children are self-report, behavioural observation and physiological measures. Most reliable indicator of pain is a combination of all 3, known as a multi-dimensional pain assessment.

The accurate assessment of pain is multi-factorial and requires a systematic approach. One of the widely accepted approaches is known as QUESTA: Question the child, use the age and developmentally appropriate pain-rating scales, evaluate behaviour and physiological changes, secure parental involvement, take the cause of pain into account and act and evaluate results.

QUESTA initiates structured approach to pain assessment and is self-explanatory. This enables the clinician to get an idea of pain tolerance of child and a brief idea about non-pharmacological and pharmacological management techniques needed to alleviate anxiety/ pain. Furthermore, it allows familiarization with specific words that they use for describing pain.⁷

Pain assessment tools can be classified as follows and summarized in Figure 1: Self-reporting pain assessment tools, behavioural pain assessment tools and physiologic measures to assess pain

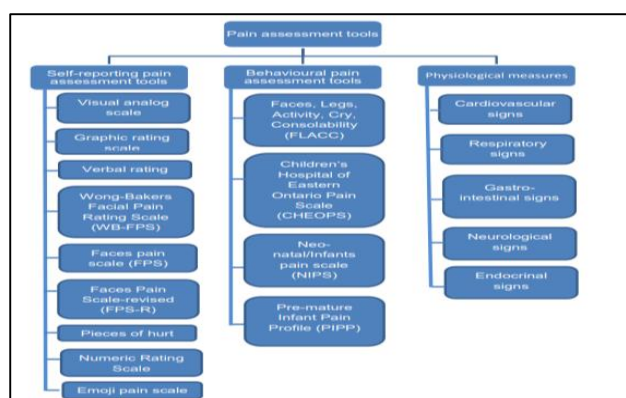


Figure 1: Pain assessment tools.

SELF-REPORTING PAIN ASSESSMENT TOOLS

Self-report pain assessment is referred to as the gold standard of assessment as it is the only direct measure of pain. Many self-reporting pain assessment tools are available and has both advantages and disadvantages. Self-report pain assessment tools should be appropriate for the child's age and developmental level; practical for use in the clinical setting; reproducible; reliable; valid; transferable between assessors. Self-report pain assessment tools can be used in children aged 3 years and older.¹⁴

Visual analog scale

Visual analog scale (VAS) for pain assessment was first introduced by Hayes and Patterson in the year 1921 and it consists of a straight line with the endpoints defining extreme limits such as 'no pain at all' and 'pain as bad as it could be' (Figure 2). The patient is asked to mark his pain level on the line between the two endpoints. The distance between 'no pain at all' and the mark then defines the subject's pain. Addition of descriptive terms like 'mild', 'moderate', 'severe' or a numerical scale to the VAS, converts it into graphic rating scale (GRS).¹⁵ VAS and GRS have been demonstrated to be sensitive to treatment effects. They were found to correlate positively with other self-reporting measures of pain intensity. However, the absence of calibration remains the major disadvantage of this scale. The distance between 'no pain' and the mark made by the patient is not pre-calibrated. Therefore, the distance must be measured which makes it more time consuming. Due to absence of pre-calibrated scale, the measurement noted is susceptible to errors when compared to a rating scale.

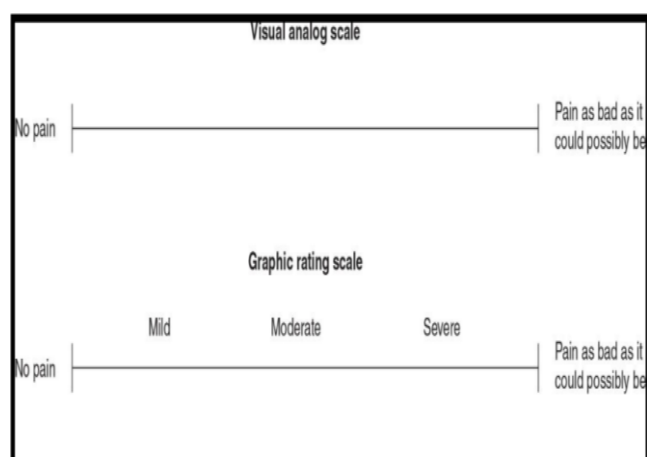


Figure 2: VAS and graphic rating scale.

Pictorial version of VAS has also been developed to make this scale more comprehensible and relatable to pediatric population (Figure 3). The pictorial representation of various emotions helps them to convey their actual emotional status. Pictorial adaptations of the VAS have been validated for children as young as 3 years of age.¹⁶

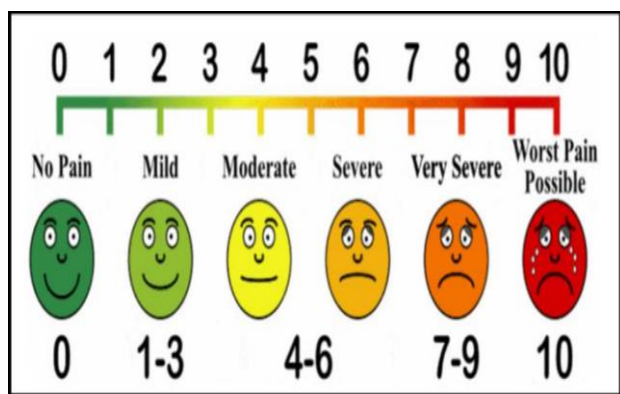


Figure 3: Pictorial VAS.

Verbal rating scale

Verbal rating scale was proposed by Ozgur Karcioğlu. 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 (Figure 4). Between these extremes, different adjectives which describe different pain-intensity levels are placed in the order of pain severity. The main disadvantage remains the limited number of possible response categories, some patients may have problems in defining which answer fits best to their pain situation.¹⁷ There is no evidence suggesting the use of VRS in pediatric population due to its complex nature.

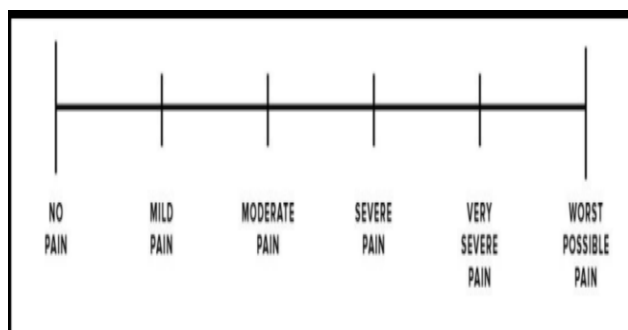


Figure 4: Verbal rating scale.

WB-FPS

Wong-Bakers facial pain rating scale (WB-FPS) was developed by Donna Wong and Cannie Baker in the year 1988. The Wong-Baker FACES scale consists of 6 faces with word descriptors and numbers from 0 to 10 (Figure 5). The child is asked to point to the face that describes how he/she feels at the particular moment and numbers on this scale can be adjusted to a 0 to 10.¹⁸ This simple scale can be easily reproduced for use at the bedside with children as young as 3 years of age, however one of the major limitations of this scale remains that the smiling face is often confused with “happiness” rather than “no pain” which acts as a confounding factor in the pain assessment process.



Figure 5: WB-FPS.

Faces pain rating scale and faces pain scale-revised

Bieri et al developed Faces pain scale for assessment of pain. This version of the scale consists of seven faces increasing in pain intensity and approximating equal intervals as assessed by children. It has several advantages over other facial expression scales. In studies done by Champion et al and Chambers and Craig it was found these scales avoided the problems inherent in inclusion of smiles and tears in a pain scale: (a) the apparent confounding of affective distress with pain intensity and (b) significantly higher pain ratings given on scales that have smiling ‘no pain’ faces compared with scales that have neutral ‘no pain’ faces.²⁰⁻²¹

The original version of the FPS required an adaptation as it is a seven-point scale and therefore does not lend itself easily to scaling on either a 0±5 or 0±10 metric. 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.

Faces pain scale-revised has high cross-cultural validity, construct validity (hypothesis testing) and responsiveness as compared to other pain assessment tools (Figure 6).²³

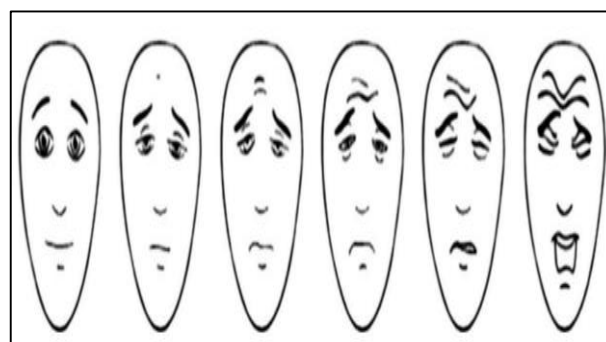


Figure 6: Faces pain rating scale-revised.

Pieces of hurt

Pieces of hurt scale was introduced by Hester in the year 1979. Pieces of hurt 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.” This tool was initially developed and tested to use with children aged between 4-6 years old. However, after this initial work this tool has been used for a wider age range (i.e., for 3-18 years old).²⁴ The pieces of hurt tool have been established to have sound psychometric properties. In study comparison of distribution of scores on various self-reports of pain was made. It was concluded that scores on pieces of hurt tool could be inflated when the younger children between 4 and 6 years old rated needle prick (short sharp) pain.²⁵

Numeric rating scale

Dr. Ronald Melzack and Dr. Warren Torgerson proposed numeric rating scale to create a quantitative measurement for pain in the year 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. Strong correlations have been shown with the VAS and FPS-R. In a study by Miro et al school-aged children 6 to 16 years of age prefer the FPS-R over the NRS for reporting their pain intensity.²⁶

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 (Figure 7).⁴ The scale consisted of 6 emojis rated from 0-10 with 0 being no pain and 10 being extreme pain. The scale was corresponding to Wong Bakers facial pain rating scale in terms of ratings. It was found that emoji pain scale showed moderate agreement with Wong-Bakers faces scale and children overwhelmingly preferred emoji pain scale over WB-FPS.

Various self-reporting pain assessment tools summarized in Table 1 with their advantages and disadvantages.

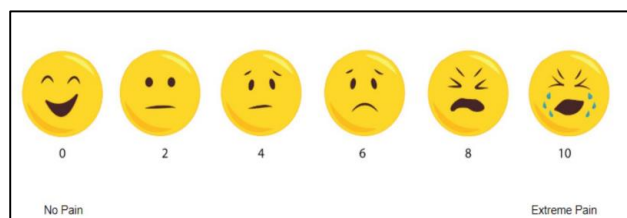


Figure 7: Emoji pain scale.

BEHAVIOUR PAIN ASSESSMENT TOOLS

Behavioural observation pain assessment tools are available for use with pre-verbal or non-verbal children

and for cognitively impaired children, one such scale is FLACC. Sandra Merkel, Terri Voepel-Lewis and Shobha Malviya developed this scale at C.S. Mott children's hospital, university of Michigan health system in the year 1997. Face legs activity cry and consolability (FLACC) has been found to have reasonable interrater reliability and validity as a measure of pain in children with varying degrees of cognitive impairment (Table 2). This simple tool contains five categories, each of which are scored from 0-2 to provide a total score ranging from 0-10.

The FLACC and paediatric pain profile (PPP) has high internal consistency, criterion validity, reliability and responsiveness.²³

However, while measures of agreement between observers were found to be acceptable for comparisons in the FLACC categories (Table 2), there low agreement in the legs and activity categories, similar to findings of Breau et al. Lower agreement in these subcategories of existing pain tools may be explained, in part, by the presence of underlying motor impairments, including spasticity, which may cloud behavioral observations.²⁷

PHYSIOLOGICAL PAIN ASSESSMENT TOOLS

Physiologic variables have been useful in examining the pain experiences associated with short-term medical procedures. In which, it is possible to detect physiologic changes indicative of autonomic arousal; with most types of disease-related and surgical pain, however, adaptation rapidly occurs, and autonomic responses return to normal.

Normal values of physiologic parameters of pain assessment have been mentioned in Table 3.

Physiological measures can aid the assessment and measurement of pain. However, 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, which affects most systems within the body, especially the cardiovascular and respiratory system and produces many of the clinical signs seen.

Cardiovascular signs are tachycardia, systemic hypertension, increased cardiac output, increased afterload and myocardial work, increased myocardial oxygen demand. Respiratory signs are tachypnoea, respiratory alkalosis, reduced vital capacity and lung expansion, reduced alveolar ventilation, retained secretions. GI signs include reduced gastric emptying and motility, reduced oral intake, nausea and vomiting. Neurological signs-behavioural abnormalities, sleep disturbances, eating disturbances, disorientation and confusion. Endocrinal signs manifest themselves as increased stress response, increased stress hormones, gluconeogenesis, glycogenolysis, hyperglycaemia, impaired glucose tolerance, increased anti-diuretic hormone causing reduced urine output, sodium and water retention.

Table 1: Summary of self-reporting pain assessment tools.

Scale	Components	Age range (Years)	Advantages	Disadvantages
Wong-baker FACES	6 faces (0-5) value 0-10	3-18	Easy, quick	Confusion with happiness
Faces pain scale revised	6 mature faces (0-5) value 0-10	4-12	Easy, quick	Confusion with happiness
Pieces of hurt	5 stones or poker chips	3-8	Simple	Time consuming
Multiple-sized poker chip	4 poker chips increasing in size	4-6	Simple	Time consuming
Visual analogue scale	10 cm line scale 0-5 or 0-10	8-18	Easy, quick, versatile	Requires proportionality
Numerical rating scale	Verbal scale 0-5 or 0-10	8-18	Easy, quick	Requires numeracy

Table 2: FLACC behavioural pain assessment tool.

Variables	FLACC behavioural pain assessment tool		
	0	1	2
Face	No particular expression or smile	Occasional grimace/ frown withdrawn or disinterested	Frequent/ constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless or 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	Moans or Whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content or relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort

Table 3: Physiological parameters of pain assessment.

Age group (Years)	Heart rate (beats/min)	Respiratory rate (breaths/ min)	Blood pressure (mm/hg)
Infant (1 mo-1)	100-150	30-55	80-100/55-65
Toddler (1-2)	70-110	20-30	90-105/55-70
Pre-school (3-5)	65-110	20-25	95-107/60-71
School age (6-11)	60-95	14-22	95-110/60-73
Adolescent (12-15)	55-85	12-18	110-124/70-79

CONCLUSION

The process of pain evaluation for a child is strenuous as they have limited cognitive sophistication to describe their painful experiences. However, for a superior quality treatment for pediatric patients, assessment of dental pain perception is of paramount importance. Self-reporting pain assessment tools are considered gold standard for assessment of pain. Out of all the scales discussed, WB-FPS is considered the best as it is simple to use for the operator and can be easily reproduced and can be used in children as young as 3 years of age. Behaviour pain assessment are useful in non-verbal patients and cognitively impaired patients and the most widely accepted behavioural pain assessment tool is FLACC. Physiological measures of pain assessment are manifested in different systems of the body such as cardiovascular system, respiratory system, gastrointestinal system,

nervous system and endocrine system and can be used with cognitive impairment and non-verbal patients.

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