Measurement and Assessment of Pain In Children – A Review

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Pain is a common experience during childhood. Despite the magnitude of effects that pain can have on a child, it is often inadequately assessed and treated. Numerous myths, insufficient knowledge among caregivers, and inadequate application of knowledge contribute to the lack of effective management. The pediatric pain experience involves the interaction of physiologic, psychologic, behavioral, developmental, and situational factors. Pain is an inherently subjective multifactorial experience and should be assessed and treated as such. Pediatric Dentists are responsible for eliminating or assuaging pain and suffering in children when possible. To accomplish this, we need to expand our knowledge, use appropriate assessment tools and techniques, anticipate painful experiences and intervene accordingly. As an assessment of pain which constitutes the foundation for all pain treatment, developing valid measures is both a clinical and research challenge. Clinicians and researchers should select measures with full knowledge of their psychometric strengths and weakness, as well as in keeping with their explicit conceptual model of pain. The purpose of this paper is to address potential sources of pain measurement, and responses to pain control and distractions based on the pediatric developmental stages.

Keywords: *Pain, Pain measurement, Pain assessment, Pain scales, Children*

INTRODUCTION

Pain is a common experience during childhood. All children encounter "everyday" pain associated with minor bumps and bruises,[1, 2] and many endure pain resulting from serious injuries, diseases, and other health conditions requiring medical as well as dental care.[3, 4] Research and critical review of the knowledge generated over the past 3 decades have dramatically increased the understanding of the pain mechanisms,[5-7] consequences,[8-10] and its management;[11-13] however, the transfer of this knowledge into clinical practice has been slow and sporadic.[14] This slow transfer has precipitated national and international efforts to develop and implement clinical practice guidelines to improve pain identification and management.[15] Barriers to good pain management include erroneous beliefs about the neurobiology of pain, fears about pharmacological management, and deficits in the knowledge and the skills by health care professionals who care for children.[16-20] One area of professional expertise that is reported to be consistently lacking is the knowledge and systematic use of the pediatric pain measures that yield valid and reliable data.[14, 16, 18, 21]

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Perception of pain in pediatrics is complex, and entails physiological, psychological, behavioral, and developmental factors.[22] However, in spite of its frequency, pain in infants, children, and adolescent is often underestimated and under treated.[23-29] Pain in the infants and children can be difficult to assess which has led to the creation of numerous age-specific pain management tools and scores. Health care workers need to be able to detect the symptoms and signs of pain in different age groups and determine whether these symptoms are caused by the pain or other factors.[22] It is difficult for the health care professionals to foresee which measurement systems apply to accurately measure the pain in the pediatric population.[22] Effective care in pediatrics requires special attention to the developmental stage of the child. Current research does not adequately discuss the effectiveness of certain tools and measurements used to assess pain in children at various ages.[30]

Consensus guidelines by numerous organizations, including the World Health Organization, responded to the evidence on unrelieved pediatric pain by mandating the rights of children to have their pain alleviated.[31-36] These guidelines target the responsibility of health care organizations and the professionals working within them to manage pain effectively and declared it morally unjust to allow the children to experience unrelieved pain.[37]

As the experience of pain is inherently private and subjective, it is not directly accessible to others and requires considerable judgment and skill on the part of the observers in the use of clues that are available if inferences are to be accurate. As an assessment of pain which constitutes the foundation for all pain treatment, developing valid measures is both a clinical and research challenge. The purpose of this paper is to address potential sources of pain measurement, and responses to pain control and distractions based on the pediatric developmental stages.

Pain communication in children

Craig and Korol (2008)[38] have proposed a model for under-

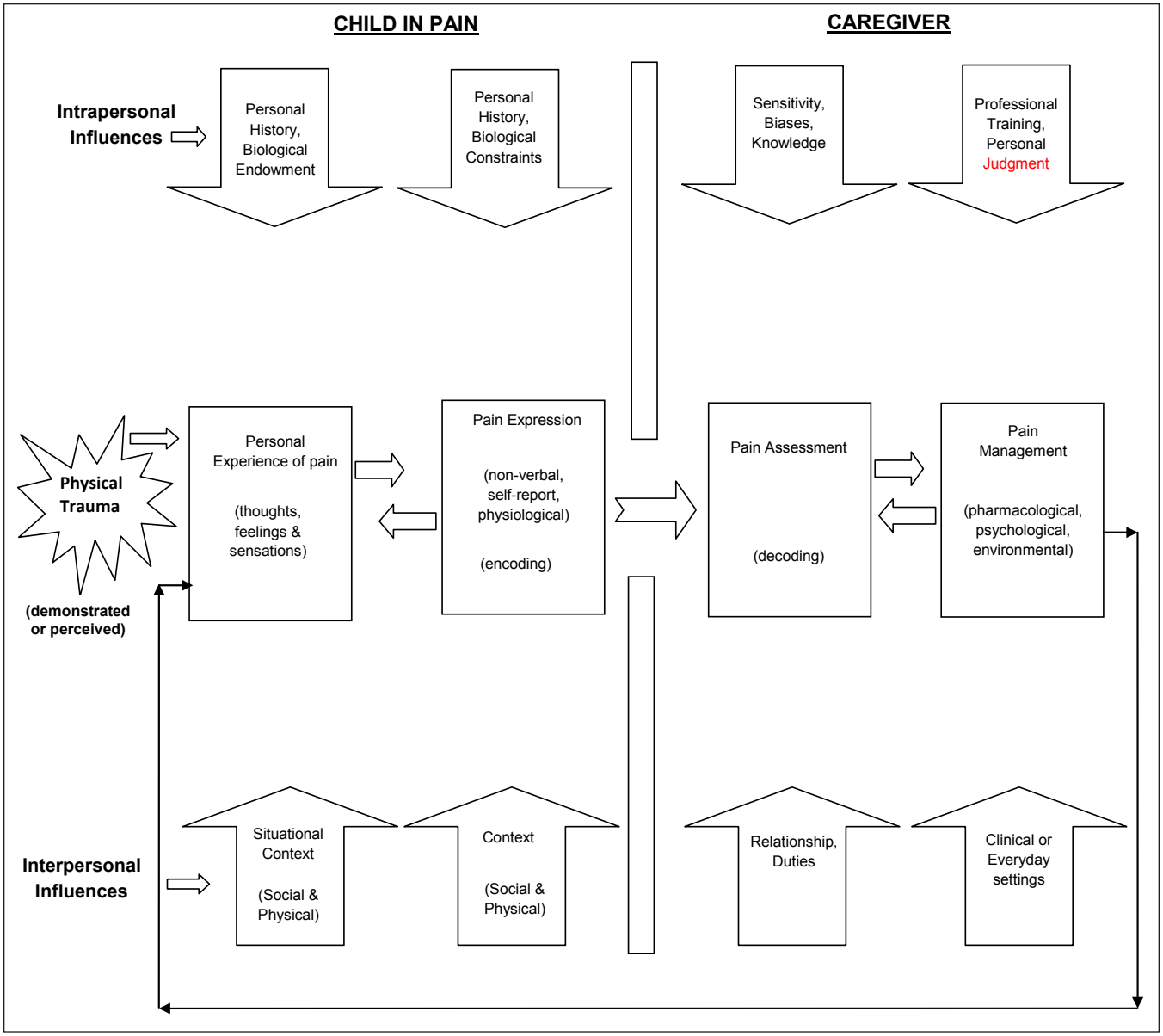

Figure 1: The Social Communication Model of Pain [38]

standing pain that gives priority to understanding the numerous social factors, whether children are successful in communicating painful distress (Figure 1). The model follows the communication process in accordance with the typical sequence of stages whereby the first stage of tissue damage or stress, e.g. dental trauma, treatment or toothache instigates the experience and expression of pain. The experience of pain is influenced by one's thoughts, feelings and sensations that lead to the pain expression which can be nonverbal, verbal and physiological. Both the experience and expression of pain are further influenced by intra personal factors such as personal history and biological endowment and by interpersonal factors such as the context. The next stage is the assessment of pain by the observer of the pain expression. The assessment depends on intrapersonal factors such as sensitivity and knowledge of the observer as well as on factors such as the relationship between the person in pain and the observer. The last stage of the model is the pain management in accordance with how the reaction of the person in pain is interpreted.

Measurement of Pain in children

Valid and reliable measurements of pain are needed to identify patients who require intervention and to evaluate the effectiveness of intervention. The terms "measurement" and "assessment" are widely used in the pain literature and differentiated in the following manner. Measurement refers to the assignment of a number or value and is commonly associated with the dimension of pain intensity. Assessment describes a more complex process in which information about pain, its meaning, and its effect on the person is considered along with quantitative values.[30,39] Although the principles of pain examination and evaluation apply across the life span, infants and children present some unique challenges that require consideration of the child's age, developmental level, cognitive and communication skills, previous pain experience, and associated beliefs and fears.

Pain measures are classified as self-report, behavioral, or physiological measures. Kirshner and Guyatt[40] categorized health

measures into discriminative, evaluative, and predictive forms. Discriminative measures differentiate among people based on some attribute (eg, identify those with and without pain). Evaluative measures detect and quantify the magnitude of change in a specific attribute over a time period for a person or for a group. Predictive measures categorize individuals based on prognosis for a test result, condition, or function in the future.[40] Most pain measures are used to identify people in pain (discriminative) or to detect and measure changes in pain over time (evaluative). Evaluative pain measures should demonstrate the property of responsiveness, or the ability to detect clinically meaningful changes in pain, whereas discriminative measures should be sensitive and specific in identifying pain. A plethora of pediatric pain measures that provide valid and reliable measurements have been developed for the clinical and research purposes and the literature describing their use is expanding rapidly and is available in many forms.[30,41-47]

Self-Report Measures

Self-report measures are considered the "gold standard," and the most valid approach to pain measurement in children.[48,49] It is important to note that, although self-report measures exist in verbal and nonverbal formats, both require sufficient cognitive and language development to understand the task and to generate an accurate response[30,44] Verbal self-report measures include structured interviews, questionnaires, self-rating scales, and pain adjective descriptors. Nonverbal measures include facial expression scales, visual analog scales (VASs), and drawings.[30,44] The ability of the children to report and to describe pain emerges with increasing age and experience and typically follows a developmental progression, although there is always considerable variation associated with individual differences.[44,50] Most 2-year-old children can report the presence and location of pain, but they do not develop the cognitive skills needed to describe pain intensity until about 3 or 4 years of age. As a rule of thumb, most 3-year-old children can use a 3-level pain intensity scale with simple terms such as "no pain," "a little pain," or "a lot of pain." Four-year-old children can usually manage 4- or 5-item scales.[51-54] Before using even simple pain intensity scales, clinicians should determine a child's understanding of basic concepts such as quantification, classification, and matching.[53] Self-report measures are not limited to the dimension of pain intensity. Measures of pain affect (emotional reactions), provide information about general distress, unpleasantness, mood, and anxiety associated with pain. A child's ability to rate pain affect emerges later than pain intensity, and these measures are usually introduced when children are 5 years of age or older.[55-57] When children are approximately 8 years of age, they are able to rate the quality of pain.[44,58]

Facial expression scales are often used with young children to obtain a self-report of pain. The response requirement for young children is to point to the face that corresponds most closely to how much pain they have (intensity),[51,59,60] how the pain makes them feel (affect),[55] or both .[61] Facial expression scales are easy to administer, and most of them demonstrate adequate to excellent psychometric properties. Regrettably, health care professionals often misconstrue children's self-reports of their discomfort as inaccurate or invalid, leading to further mismanagement of their pain.[35,36,62–66] Several studies have shown that 55–90% of pediatric nurses believe that children over-report their pain levels.[25,48,54,67,68]

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. [69-71] Behavioral measures include measures of crying, facial expression, body posture and movements, daily routines, or some combination of these items. The interpretation of crying, particularly in infants, is often challenging because this behavior represents general distress rather than pain specific behavior. Furthermore, infants and children who are very ill or medically fragile are less equipped to mount a vigorous cry in response to pain than their more robust peers who are not very ill or medically fragile. In contrast, the measures that involve the detailed coding of infant facial expressions, body postures, and movements have proved to be excellent behavioral measures of pain. Moreover, detailed coding of facial expressions and body movements may be problematic for children with atypical motor development because of muscle weakness, paralysis, contractures, abnormal postures, and involuntary movements. Fortunately, pain in this population of children has received greater attention in recent years and has resulted in some very encouraging new developments.[2,69,72-74] Several research groups have developed, or are in the process of developing, methods to measure pain in this population.[69,70,72-78] The Non-communicating Children's Pain Checklist (NCCPC) is an example[69,74,79] and it was initially validated for use by family members and caregivers of children with severe disabilities in the home setting. A postoperative version of the checklist, the NCCPC-PV, was developed for health care providers to use in hospital settings. Breau *et al* [80] found that the NCCPC-PV was effective in detecting postoperative pain in children with severe cognitive and communication impairments. The NCCPC was recently revised following research that involved a larger group of children and their caregivers, and the psychometric properties of this revised version (NCCPC-R) are excellent.[81]

Physiological Measures

Physiological or biological measures constitute the third category of pain measures. Studies of the physiological responses to pain in infants and children often include the heart rate, vagal tone (parasympathetic inhibitory influence on the heart), blood pressure, respiration rate, oxygen saturation rate, and palmar sweating.[82] Neuroendocrine responses (e.g. catecholamine, corticosteroid, growth hormone, glucagon, and cortisol levels) to painful events also have been studied.[83] Reviews of the research evidence demonstrate several challenges associated with interpreting the physiological responses to painful events.[39,82] First, pain is a stressor, and physiological responses to various types of stress are similar and not unique or specific to noxious stimuli. Second, these measures have been used to study responses to short duration, sharp pain, and physiological responses to long-term pain appear to habituate. Finally, the general health and maturational age of the infant or child also may influence physiological responses to pain. Consequently, physiological indicators of pain are used in conjunction with other measures.

Composite Measures

Pain measures that use some combination of the physiological, behavioral, or self-report variables are termed composite measures.[84] This combined approach is often used to measure pain in infants and in children who are medically fragile. Infant measures also may include information about gestational age and general behavioral

state. The Premature Infant Pain Profile (PIPP)[85] and the Neonatal Infant Pain Scale (NIPS)[86] are examples of composite scales used to evaluate pain in premature and full-term infants.

Surrogate Reporting of Pain

It involves the evaluation of the response of the infant, toddler, and developmentally nonverbal child to parents and the environment in the assessment of pain. Responsiveness to interventions by a trusted caregiver to console the child, such as rocking, touch, and verbal reassurance, must be considered when observing distressed behaviors. Parents usually know their child's typical behavioral response to pain and can identify behaviors unique to the child that can be included in the assessment of pain. However, the nursing staff may be most familiar with the infant or young child's pain behavior if the child has not been home since birth.

Unfortunately, there is a pervasive and systematic tendency to underestimate the pain experience of others. For example, it is known that healthcare professionals who often work with painful procedures can develop "pain blindness", leading them to underestimate the extent of pain experienced by children, a judgment that increases the risk of failure to deliver needed care.[87] Alternatively "pain blindness" could be argued as serving as a self-protective mechanism allowing the professional to provide care without becoming overwhelmed by the procedure. The use of systematic scales to guide judgments can reduce risk of erroneous judgment.

PAIN ASSESSMENT TOOLS ACCORDING TO THE AGE GROUP

The current research supports the belief that infants possess the anatomical and functional requirements to perceive pain.[88] Recent studies also demonstrate that infants elicit certain behavioral responses to pain perception.[89] Pain in infants, despite this data, remains under-treated and often mismanaged.[90] The most common pain measures used for infants are behavioral. These measures include crying, facial expressions, body posture, and movements. The quality of these behaviors depends on the infant's gestational age, and maturity.[91]

Neonates and Infants

Numerous scales[92] are currently available for neonates and infants as Neonatal Facial Coding System (NFCS),[93-95] Neonatal Infant Pain Scale (NIPS),[86] The Premature Infant Pain Profile (PIPP),[85,96] Crying Requires Increased Vital Signs Expression Sleeplessness (CRIES),[59,97] and the Maximally Discriminate Facial Movement Coding System (MAX).[85,97-102] These assessment scales are not considered in detail in this paper as majority of them are beyond the scope of implementation in daily clinical practice by a Pediatric Dentist.

Toddlers

In the toddlers, the verbal skills remain limited and quite inconsistent. Pain-related behaviors are still the main indicator for assessments in this age group. Nonverbal behaviors, such as facial expression, limb movement, grasping, holding, and crying, are considered more reliable and objective measures of pain than self-reports.[103] Most children of this age group however are capable of voluntarily producing displays of distress, with older children displaying fewer pain behaviors (e.g., they cry, moan, and groan less often). Most two-year-old children can report the incidence and location of pain, but do not have the adequate cognitive skills to describe its severity.[104] Three-year-old children, however, can start to differentiate the severity of pain, and are able to use a three-level pain intensity scale with simple terms like "no pain, little pain or a lot".[104] Children in this age group are usually able to participate in simple dialogue and state whether they feel pain and "how bad it is".[104] The common scales in this age group are:

a) The Children's Hospital of Eastern Ontario Pain Scales (CHEOPS): It is one of the earliest tools used to assess and document pain behaviors in young children.[105] It is used to assess the efficacy of interventions used in alleviating pain. It includes six categories of behavior: 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.[105] Its length and changeable scoring system among categories makes it complicated and impractical to use compared to other observational scales.

b) The Faces Legs Activity Cry Consolability Scale (FLACC): It is a behavioral scale for measuring the intensity of post procedural pain in young children.[106] It includes five indicators (face, legs, activity, cry, and consolability) with each item ranking on a three point scale (0–2) for severity by behavioral descriptions resulting in a total score between 0–10.[106] 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. Numerous studies have proven its validity and reliability.[107]

c) The COMFORT Scale: It is a behavioral scale used to measure distress in critically ill unconscious and ventilated infants, children, and adolescents.[108,109] This scale is composed of 8 indicators: alertness, calmness/agitation, respiratory response, physical movement, blood pressure, heart rate, muscle tone, and facial tension. Each indicator is given a score between 1 and 5 depending on behaviors displayed by the child and the total score is gathered by adding all indicators (range from 8–40). Patients are monitored for two minutes. The COMFORT scale has been proven to be clinically useful to determine if a child is adequately sedated.[109]

d) The Observational Scale of Behavioral Distress (OSBD): It remains the most frequently used measurement in procedure-related distress studies.[110] It consists of 11 distress behaviors identified by specialists to be associated with pediatric procedure-related distress, anxiety, and pain. Scores are calculated from summing up all 11 distress behaviors. The behaviors are usually organized into categories of growing intensity, considering their level of interference with medical procedures.[111] The validity and reliability of the OSBD has been widely reported.[112,113] Limitations of the OSBD are noted, where the explanations of the different phases of the procedure: anticipatory (when the child is waiting for the procedure), procedural (distress while the procedure is taking place), and recovery (post-procedural distress) are interchangeable among studies.[112,113] In instances where procedural phases are constant, differences arise in initiating the procedure (e.g., venipunctures) which are frequently independent of the child's behavior, and affect the duration of the procedure and the number of observation intervals. This ultimately increases or decreases the scores.[114]

e) Observational Pain Scale (OPS): It is intended to measure pain in children aged 1 to 4 years, and is used to assess pain of short or long duration.[115] The scale was primarily produced at the University of Amsterdam in the Netherlands. The scale measures 7 parameters: facial expression, cry, breathing, torso, arms and fingers, legs and toes, and states of arousal.[115] The OPS has a simple scoring system which makes it easy to use by all healthcare professionals to obtain valid and reliable results.[116] The indicators are rated from 0-1 with a maximum score of 7, where the higher score indicates greater discomfort.[115]

f) The Toddler-Preschooler Postoperative Pain Scale (TPPPS): It is used to assess pain in young children during and after a medical or surgical procedure. It is most commonly used for children aged 1–5 years.[117] In order to observe verbal, facial, and bodily movement, the child needs to be awake. This scale relies on behavioral observations, but also includes a self-report element. The TPPPS includes seven indicators divided into three pain behavior groups: vocal pain expression, (verbal complaint, cry, moan) facial pain expression (open mouth, squinted eyes, brow bulging and furrowed forehead) and bodily pain expression (restlessness, rubbing touching painful area).[118] It is a useful tool for evaluating the effectiveness of medication administration in children, but does not measure pain intensity.[119] If a behavior is present during a 5-minute observation period, a score if 1 is given whereas a score of 0 is given if the behavior was not present. The maximum score obtained is 7, which indicates high pain intensity.[117]

Pre-schoolers

By the age of four years, most children are usually able to use 4-5 item pain discrimination scales.[54] Their ability to recognize the influence of pain appears around the age of five years when they are able to rate the intensity of pain.[120] Facial expression scales are most commonly used with this age group to obtain self-reports of pain. These scales require children to point to the face that represents how they feel or the amount of pain they are experiencing.[51] The commonly used scales in this age group are:

a) The Child Facial Coding System (CFCS): It is adapted from the neonatal facial coding system and developed for use with preschool children (aged 2–5 years). It consists of 13 facial actions: brow lower, squint, eye squeeze, blink, flared nostril, nose wrinkle, naso-labial furrow, cheek raiser, open lips, upper lip raise, lip corner puller, vertical mouth stretch, and horizontal mouth stretch.[121] The CFCS has been useful with acute short-duration procedural pain.[122]

b) Poker Chip Tool: It is a tool that was developed for preschoolers to assess "pieces of hurt".[123] The tool uses four poker chips, where one chip symbolizes "a little hurt" and four chips "the most hurt you could experience". The tool is used to assess pain intensity. Health care professionals align the chips in front of the child on a flat surface, and explain, using simple terms, that the chips are "pieces of hurt". The child is asked "how many pieces of hurt do you have right now?".[124] Although most studies focus on using it in children four to thirteen years old, adolescents have used it successfully as well.[125]

c) Faces Pain Scale: It was developed by Wong and Baker and is recommended for children ages 3 and older.[61] The scale requires health care professionals to point to each face and describe the pain intensity associated with it, and then ask the child to choose the face that most accurately describes his or her pain level.[61] Most pain rating scales using faces that portray degrees of distress are divided into two categories: those starting with neutral face as the "no pain" indicator and those with a smiling face. Results showed that children exposed to smiling scale had considerably higher pain scores in the no pain categories and lower scores for positive pain than children who used the neutral faces scale.[126] A study by Chambers and colleagues indicated that children's pain ratings differ depending on the types of faces scale used, and that faces scales with smiling faces may confuse emotional states with pain ratings.[126] The revised pain scale (FPS-R) is a simplified 6-face adaption of Bieri's validated faces pain scale. It does not contain smiling faces or tears thus avoiding the confounding of affect and pain intensity.[51]

d) The OUCHER Scale: It was developed by Beyer in 1980.[127] It is an ethnically based self-report scale, which has three versions: Caucasian, African-American, and Hispanic.[128,129] Even though it covers a wide array of patients, it still has limits. For example, females are not represented, as well as other cultures. It is used for children older than 5 years.[129] The tool has two separate scales: the numeric scale (i.e., 0–100) and the photographic scale usually used for younger children. The photographic scale entails six different pictures of one child, portraying expressions of "no hurt" to "the biggest hurt you can ever have".[130] Children are asked to choose the picture or number that closely corresponds to the amount of pain they feel.

School-Aged Children

Health care professionals depend more comfortably on self-reports from school-aged children. Although children at this age understand pain, their use of language to report it is different from adults. At roughly 7 to 8 years of age, children begin to understand the quality of pain.[44] Self-report visual analogue and numerical scales are effective in this age group. A few pain questionnaires have also proven effective for this age such as the pediatric pain questionnaire and the adolescent pediatric pain tool.[131,132]

a) Visual Analogue Scale (VAS): 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". The children are asked to mark on the line the point that they feel represents their pain at this moment.[133] A color analogue scale can also be used, where darker more intense colors (i.e., red) represent more pain.[134]

b) Pediatric Pain Questionnaire: It is a self-report measure to assess children and adolescents coping abilities using 8 subscales "information seeking, problem solving, seeking social support, positive self-statements, behavioral distraction, cognitive distraction, externalizing and internalizing as well as three more complex scales (approach, distraction, and emotion-focused avoidance).[131] It contains 39 items in total, with scores ranging from 1 ("never") to 5 ("very often"). Children or adolescents are requested to state

Table 1: Summary of various pain assessment scales in children

Name of the Scale	Intended age group	Type of pain	Dimension Measured	Type of Measure	Psychometric Properties *
Adolescent Pediatric Pain Tool (APPT)[58, 137, 142, 143]	8-17 y	Acute	Pain location, intensity, and quality	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Child Facial Coding System (CFCS)[122, 144, 145]	1-6 y	Acute	Pain intensity	Behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)[105,146-148,119]	1-7 y	Acute	Pain intensity	Behavioral	Reliability: excellent Validity: excellent Responsiveness: excellent
Children's Comprehensive Pain Questionnaire (CCPQ)[46]	8 y and older	Recurrent	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Colored Analogue Scale (CAS)[149-151]	5 y and older	Acute, recurrent, and chronic	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Crying Requires Increased vital signs Expression Sleeplessness (CRIES)[97]	32-60 weeks	Acute	Pain intensity	Composite	Reliability: adequate Validity: adequate Responsiveness: adequate
COMFORT Scale[108]	3-7 y	Acute	Pain intensity	Composite	Reliability: adequate Validity: adequate Responsiveness: adequate
Distress Scale for Ventilated Newborn Infants (DSVNI)[152]	Ventilated newborns	Acute	Pain intensity	Behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Eland Color Scale [153-155]	5 y and older	Acute	Pain location, intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Likert Scale[156-160]	8 y and older	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Faces Pain Rating Scale[61,147]	3 y and older	Acute	Pain intensity and affect	Self-report	Reliability: adequate Validity: adequate Responsiveness: poor
Faces Pain Scale (FPS)[52,60,150,151,161,162]	4 y and older	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: excellent
Faces Pain Scale – Revised (FPS-R)[51]	4 y and older	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Facial Affective Scale (FAS)[55,56,57]	5 y and older	Acute, recurrent and chronic	Pain affect	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
FLACC (Face, Legs, Activity, Cry and Consolability) Behavioral Pain Assessment Scale[106,107,163]	Infancy to 7 y	Acute	Pain intensity	Behavioral	Reliability: excellent Validity: excellent Responsiveness: adequate

Name of the Scale	Intended age group	Type of pain	Dimension Measured	Type of Measure	Psychometric Properties *
Hester Poker Chip Tool[57,164–167]	4-7 y	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Maximally discriminate facial movement coding system (MAX)[99]	Infants	Acute	Pain intensity	Behavioral	Reliability: excellent Validity: excellent Responsiveness: excellent
McGill Pain Questionnaire[141,140,168]	12 y and older	Acute, recurrent and chronic	Pain location, intensity, and quality	Self-report	Reliability: excellent Validity: excellent Responsiveness: excellent
Neonatal Facial Coding System (NFCS)[89,94,169,170]	Preterm and full-term infants	Acute	Pain intensity	Behavioral	Reliability: excellent Validity: excellent Responsiveness: excellent
Neonatal Infant Pain Scale (NIPS)[86, 171]	Preterm and full-term infants	Acute	Pain intensity	Composite	Reliability: adequate Validity: adequate Responsiveness: adequate
Non-communicating Children's Pain Checklist (NCCPC),[74,79] postoperative version (NCCPC-PV),[80] revised version (NCCPC-R)[81]	3-19 y	Acute	Pain intensity	behavioral	Reliability: excellent Validity: excellent Sensitivity/ specificity: excellent
Oucher Scale[59,128, 130,172]	3 y and older	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: excellent
Observational Pain Scale[115]	1-4 y	Acute	Pain intensity	Behavioral	Reliability: excellent Validity: excellent Responsiveness: adequate
Observational Pain Scale of Behavioral Distress (OSBD)[111,112]	3-13 y	Acute	Pain intensity	behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Pediatric Pain Questionnaire (PPQ)[131,173]	8 y and older	Chronic	Pain intensity, affect, and quality	Self-report	Reliability: excellent Validity: excellent Responsiveness: adequate
Premature Infant Pain Profile (PIPP)[85,96,174]	Premature infants	Acute	Pain intensity	Composite	Reliability: excellent Validity: excellent Responsiveness: adequate
Riley Infant Pain Scale (RIPS)[175]	Infancy to 3 y	Acute	Pain intensity	Behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Toddler-Preschooler Postoperative Pain Scale (TPPPS)[117]	1-5 y	Acute	Pain intensity	Behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Thermometer Pain Scale[176]	5 y and older	Acute	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: excellent
University of Wisconsin Children's Hospital (UWCH)[177]	1-3 y	Acute	Pain intensity	Behavioral	Reliability: adequate Validity: adequate Responsiveness: adequate
Visual Analog Scale (VAS)[55,178,179]	5 y and older	Acute, recurrent, and chronic	Pain intensity	Self-report	Reliability: excellent Validity: excellent Responsiveness: excellent

* Psychometric properties rated using criteria described by Law *et al*. [180] **Excellent:** More than 2 well-designed and supportive studies. **Adequate:** 1 or 2 well-designed and supportive studies. **Poor:** Studies unavailable or poorly designed, or non-supportive studies.

how often they "say, do, or think" certain items when they are hurt or in pain. The questionnaire usually takes about 10–15 minutes to complete.[135]

c) Adolescent Pediatric Pain Tool (APPT): It is a valid all encompassing pain assessment tool used for individual pain assessments and measures intensity, location, and quality of pain in children older than 8 years of age.[136] The APPT is most useful with children and adolescents who are experiencing complex, difficult to manage pain.[132] It consists of a body map drawing to allow children to point to the location of pain on their body and a word graphic scale to measure pain intensity. The word graphic rating scale is a 67 word list describing the different dimension of pain and a horizontal line with words attached that range from "no," "little," "medium," "large," to "worst" possible pain.[58,132,137,138]

Adolescents

The adolescents tend to minimize or deny pain, especially in front of friends, so it is important to provide them with privacy and choice. For example, they may or may not choose to have parents present. They expect developmentally appropriate information about procedures and accompanying sensations. Some adolescents regress in behavior under stress. They also need to feel able to accept or refuse strategies and medications to make procedures more tolerable. To assess pain and, specifically chronic pain, the adolescent pediatric pain tool or the McGill pain questionnaire are helpful.

a) The McGill Pain Questionnaire (MPQ): It was developed by Melzack in 1971.[139] 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.[140] The questionnaire uses word lists separated into 4 classes to assess the total pain experience. The categories are (1) sensory, which contains words describing pain in terms of time, space, pressure, heat, and brightness, (2) affective category which describes pain in terms of tension, fear, and autonomic properties, (3) evaluative, and (4) miscellaneous. After the patient is done rating their pain words, the administrator allocates a numerical score, called the "Pain Rating Index".[141] Scores vary from 0–78 with the higher score indicating greater pain.[140]

SUMMARY AND CONCLUSIONS

Though there is an overwhelming amount of the data regarding how to assess pediatric pain in the clinical set up (Table-1) and its management, it is often not being applied effectively due to various constraints. Current studies demonstrate that the pain management in the children remains undertreated because of many influencing factors[181] (Figure-2). The use of these scales by a Pediatric Dentist depends on the strength of psychometric evaluation, the clinical feasibility of these assessment tools and the target population when selecting a specific tool. Thus, the appropriateness of a scale must be assessed patient by patient, and no one scale should be an institutional mandate for all patients in a certain group.[182] All the measurement methods presented in this article can be used either alone or in combination. It is recommended for clinicians to select at least two different scales to use in daily practice.[183] Clinicians and researchers should select measures with full knowledge of their psychometric strengths and weakness, as well as in keeping with their explicit conceptual model of pain. Intensity scales are best suited to the assessment of acute pain and pain of short duration. The behavioral and physiological measures, when used together, can provide a more accurate picture of pain in neonates and very young infants. Multidimensional methods of pain assessment are most appropriate for assessing chronic and recurrent pain in children. It is the responsibility of health care professionals to educate their peers and advocate for appropriate pain management in children. Children present a unique challenge that necessitates consideration at each age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs. Selection of appropriate measures requires a thorough understanding of pain, measurement, and child development. The following factors should be considered when choosing a particular test or scale; a) Aim and objectives of the scale b) purpose of the measurement c) defining the specific instrument for the specific measurement situation d) reliability and validity of the scale e) discriminatory power of the scale f) utility of the scale and g) specific target group and the clinical situation. Pediatric Dentists are well positioned to support and improve the identification and management of pediatric pain and to contribute new knowledge through the ongoing research.

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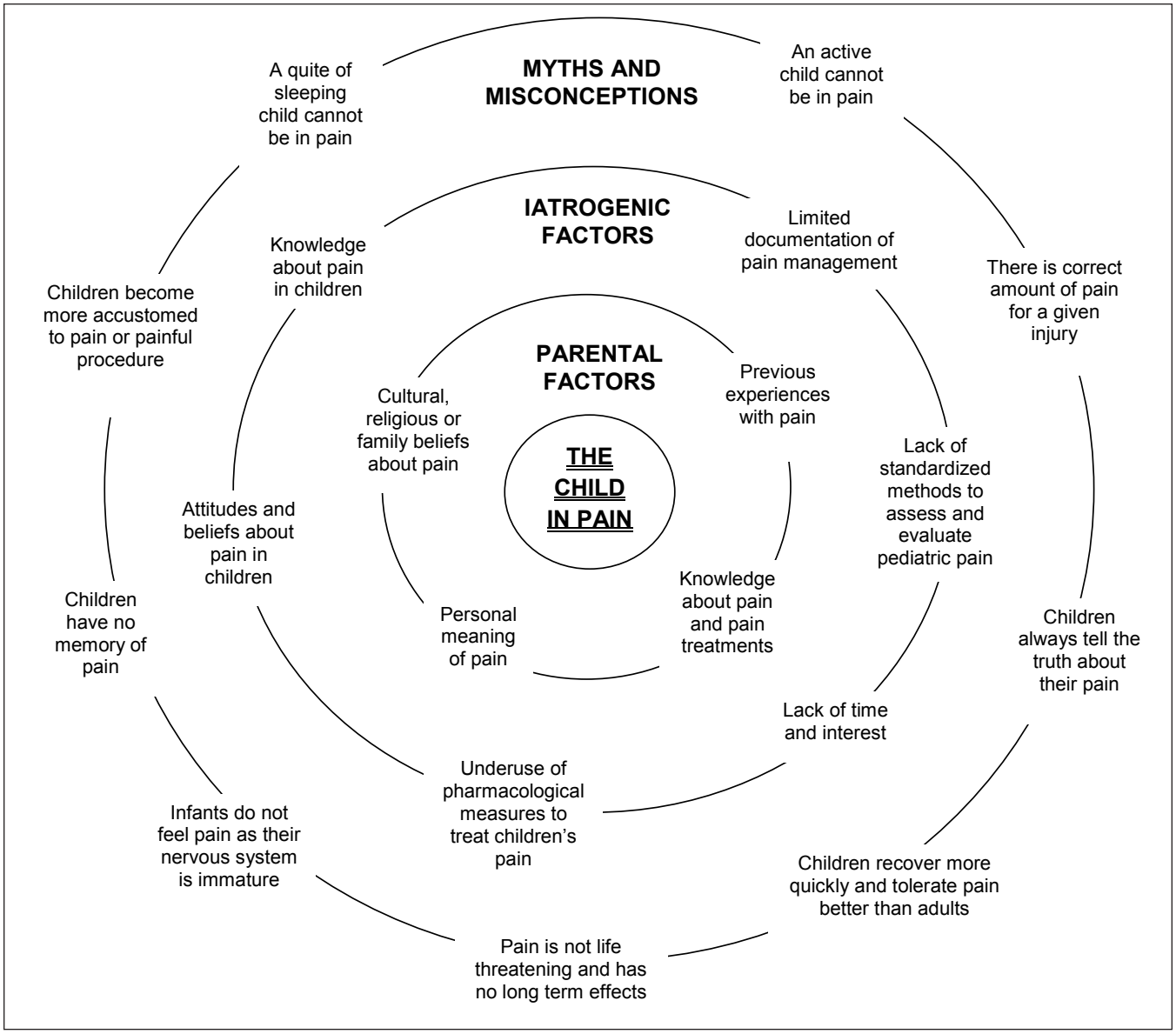

Figure 2: Obstructions in the management of pain in children (Adapted from Olmstead, Scott & Austin, 2010 [181] and further modified by including iatrogenic factors)

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