Postoperative Pain In Paediatric Patients

After Dentistry Under General Anaesthesia In The Ambulatory Setting.

By

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A thesis submitted in conformity with the requirements for the Degree of Master of Science in Dental Anaesthesia

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ABSTRACT

Purpose: To determine the prevalence, severity, and duration of postoperative pain in children ages 4-6 years undergoing general anaesthesia for comprehensive dental treatment that included extractions and/or pulp therapy in an ambulatory surgicentre in Toronto, Canada.

Methods: This prospective cross-sectional practice-based study included 33 ASA I or II, English-speaking patients. The primary outcome of pain was measured by Faces Pain Scale-Revised (FPS-R) and Parents’ Postoperative Pain Measure (PPPM) in recovery and at home, 2hr, 12hr, 24hr, 48hr, and 72hr postoperatively. Analgesic administration practices at home were also monitored.

Results and Conclusions: The prevalence of moderate-severe pain was 29.0% by FPS-R and 40.0% by PPPM at 2 hours after discharge. Pain subsided over 3 days. Postoperative pain scores were statistically different from baseline scores (p<0.001). While parents can use validated pain measures at home in the postoperative period, the administration of analgesics was infrequent.
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As always, my foundation is my family. I stand here, because they stand with me.

I dedicate my opus lovingly.
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**Abbreviations**

AMA  American Medical Association
AAPD  American Academy of Pediatric Dentistry
ASA  American Society of Anesthesiology
CDC  Centers for Disease Control and Prevention
CHEOPS  Children’s Hospital of Eastern Ontario Pain Scale
COXI  Cyclooxygenase Inhibitor
ECC  Early Childhood Caries
FLACC  Facial expression, Leg movement, Activity, Cry, Consolability
FPS  Faces Pain Scale
FPS-R  Faces Pain Scale – Revised
GAPPP Study  General Anaesthetic Paediatric Postoperative Pain Study
GA  General Anaesthetic
GI  Gastrointestinal
HCP  Health Care Provider
Hr  Hour
IASP  International Association for the Study of Pain
LTF  Loss to follow-up
NRS  Numeric Rating Scale
NSAID  Non-steroidal anti-inflammatory drug
OHRQoL  Oral-health-related quality of life
Ped-IMMPACT  Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials
PPPM  Parents’ Postoperative Pain Measure
prn  “pro re nata” or as needed
PSC  Paediatric Surgicentre
q4h  Every 4 hours
q6h  Every 6 hours
RCN  Royal College of Nursing
Remi.  Remifentanil
SD  Standard deviation
Sevo.  Sevoflurane
SSC  Stainless Steel Crown
<table>
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<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>VAS</td>
<td>Visual Analogue Scale</td>
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<tr>
<td>VRS</td>
<td>Verbal Rating Scale</td>
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<tr>
<td>WBFS</td>
<td>Wong-Baker Faces Scale</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Chapter 1: NATURE OF CONCERN

The possibility of poor management of acute pain is rooted in the prevailing belief that children suffer less pain than adults or do not feel pain at all (American Medical Association (AMA), 2010). These assumptions and attitudes exist in dentistry and may stem from the clinician’s difficulties in assessing children’s pain. As a result, pain may be unrecognized and unaddressed.

There are very few published studies regarding postoperative pain following paediatric dental rehabilitation under general anaesthesia. Of those studies, the methodologies, selection of age, demographic, and pain assessment tools are variable, making the collective interpretation of the literature difficult. The ability to translate knowledge from primary research is even more challenging because the pain assessment tools used may or may not be valid or reliable in specific ages in the clinician’s settings. Despite this inconsistency, research reveals pain to be the most common and long-lasting morbidity, significantly associated with dental procedures, especially extractions. If there is pain in children, why is treatment slow to follow?

Unfortunately, continued undertreatment of pain has consequences, not only including unnecessary suffering, but there are also long-term behavioural and developmental sequelae (AMA, 2010; Choonara, 1989; Fortier, Del Rosario, Rosenbaum, & Kain, 2010). Furthermore, the challenge remains on-going as pain assessment and management duties are delegated to a parent or caregiver once the child patient is discharged. To raise the quality of care in daily paediatrics practice, pain assessment should be an integral component of every child’s health care (AMA, 2010). A greater understanding will help dentists and anaesthesiologists limit patients’ discomfort in recovery and advise parents on how to assess and treat pain at home.
Chapter 2: LITERATURE REVIEW

ACUTE PAIN IN PAEDIATRICS

Pain is defined as an unpleasant “subjective experience that is the product of both emotional and sensory components interrelated with the context of culture and environment” (Townsend, Ganzberg, & Thikkurissy, 2009). It is a concrete experience and an abstract concept (Versloot, 2007). Pain results from actual or potential tissue damage, but the perception of pain is modified by physiological mechanisms in the complex human nervous system. Given that pain in children is inherently difficult to assess, pain may be undiagnosed or unrecognized resulting in a mistaken belief that infants and children suffer less pain than adults or do not feel pain (AMA, 2010).

Current clinical practices show that health care providers (HCP) and parents tend to underestimate children’s pain when compared with children’s self-reports (Franck, Greenberg, & Stevens, 2000). This incongruity results from the inability of young children to fully understand, verbalize and express their experience (Choonara, 1989; Finley, Franck, Grunau, & von Baeyrer, 2005; Mather & Mackie, 1983) in conjunction with adults being unable to adequately detect and identify signs of pain in the paediatric population. The International Association for the Study of Pain (IASP) acknowledges that the “inability to communicate verbally does not negate the possibility that an individual is experiencing pain and (is) in need of appropriate pain management” (World Health Organization [WHO], 2012).

Acute Pain in Preschoolers and School-aged Children

A child’s understanding of pain depends on his/her age, cognitive level and past experience of pain. Both the conceptualization and expression of pain change with age in a developmental pattern (Schechter, Berde, & Yaster, 2003). In toddlers and preschoolers (age 1-5 years old), pain is most commonly experienced in the stumble-and-fall scenario. They experience pain in situations and learn to avoid danger in similar future events. In this way, their perception of pain is shaped by increasing an understanding of their emotions and the anticipation of outcomes and feelings. Avoidance behaviour is an important learned coping mechanism. Toddlers (age 1-3 years old) often use particular vocabulary, such as “ouchie” or “boo-boo”, taught to them by caregivers to describe pain, but may advance to the utilization of “hurt” and “pain” as late preschoolers. Preschoolers (age 3-5 years old) believe and interpret the world as they see it. They may describe pain in phenomenological terms and associate adjectives and emotions to these terms (Versloot, 2007). Moreover, they tend to attribute the cause of
pain to external events that can be visible. School-aged children (age 6-12 years old) begin to use cognitive coping skills and associate pain with nonvisible physical and psychosocial variables (Versloot, 2007). By adolescence, pain concepts are better formed. With cumulative experiences and growing maturity, a child’s ability to use descriptors for pain quality, intensity, frequency, and location increases with fluency. There is a complex relationship among age, gender, temperament, learning, family cultural and societal expectations which shape a child’s perception and reaction to pain via words and behaviours (Schechter et al., 2003).

The expression of pain is not always verbal. Health care providers and parents inadequately read nonverbal cues. Toddlers often use behavioural coping skills, such as seeking comfort in hugs and kisses. Children cope through play, sleep, and other distractors unconsciously. These seemingly positive behaviours can be misleading to parents and clinicians who mistake these activities for the absence of pain (Finley et al., 2005). They may also exhibit quiet and subdued behaviour instead of distinct complaints or signs of pain (Zisk, Grey, Medoff-Cooper, & Kain, 2007). Older children may be able to identify pain and differentiate it from fear or anxiety and may be able to mask visible signs of distress, but still report increased pain. Pain assessment tools for HCPs and parents may facilitate the identification of these nonverbal cues.

**Consequences of Acute Pain**

Underassessment of pain is not without consequences. The first consequence is untreated pain. Without adequate pain management, sequelae may arise immediately, persist long-term, and manifest into adulthood. For a child, the perception and response to pain develop with every painful experience. Premature children who experience repeated painful exposures as a result of hospitalization, procedures, and surgeries during the neonatal period disrupt the normal structural and functional neurological development of pain-coping pathways. In effect, when exposed to noxious thermal and mechanical stimuli, the motor response to pull away, known as the “withdrawal reflex”, is activated at a reduced threshold. With reduced thresholds for withdrawal from noxious thermal and mechanical stimuli (Peters et al., 2005), these infants experience heightened pain responses (e.g. hyperalgesia, allodynia) to subsequent stimuli. Exaggerated experiences can affect their pain perceptions and responses in later life (Coté, Lerman, & Todres, 2009). In a study by Taddio, Goldbach, Ipp, Stevens, and Koren (1995), infants who had previously undergone unanaesthetized circumcision had increased
responses to painful vaccination in comparison to uncircumcised infants and circumcised infants who received procedural analgesics.

Full term children, despite having higher pain thresholds than premature children (Coté et al., 2009), experience more pain than adults relative to the same stimulus (AMA, 2010). The differences can be attributed to mature physiological and psychological pain coping mechanisms fostered over adult lifetimes (AMA, 2010).

Heightened postoperative pain response (or “wind-up effect”), increased duration of pain, reduced pain threshold, and reduced pain tolerance (AMA, 2010) can initiate maladaptive behaviours such as separation anxiety, insomnia or sleep disturbances, postoperative anxiety, eating difficulties (Choonara, 1989), aggression towards authority, temper tantrums, apathy, and withdrawal (Fortier et al., 2010). Moreover, a painful event in childhood can condition the patient to be fearful, anxious, and unresponsive to future health encounters and treatments (AMA, 2010; Fortier et al., 2010). Such psychological developments may hinder patients from seeking future medical and dental care as an adult (Locker, Shapiro, & Liddell, 1996). To raise the quality of care in daily paediatric practice, pain assessment should be an integral component of every child’s health care (AMA, 2010) with the goal to prevent suffering and long-term consequences.

DENTAL PAIN IN PAEDIATRICS

Neurobiology of Dental Pain

The existence of dental pain in the deciduous dentition is supported by our current understanding of pain mechanisms. Oral pain is elicited by a stimulus of tissue injury and also depends on its extent. The neurobiology of orofacial pain is well described in Sessle (1987) and Dionne, Kim, and Gordon (2006) and is summarized below.

The trigeminal nerve is the largest of the cranial nerves responsible for facial sensation. The maxillary (V2) and mandibular (V3) divisions of this fifth cranial nerve innervate mucous membranes, gingiva, and teeth. Dental pain is ignited when pulpal tissue is exposed to noxious stimuli or directly traumatized. Pulpal tissue, which is encased in dentin, consists of highly vascularised and innervated connective tissue including fast-conducting myelinated A-delta fibers, as well as slow-conducting unmyelinated C fibers (Dionne et al., 2006; Sessle, 1987). The small A-delta fibers are responsible for rapid and localizable pain, whereas C fibers are responsible for persistent, diffuse pain. These sensory trigeminal
neurons which innervate the dentinal tubules, respond to stimuli and primarily cause pain (Dionne et al., 2006; Sessle, 1987). A-delta and C fibers terminate in the laminae of the medullary dorsal horn (within the brainstem) via the trigeminal tract. Subsequent axons cross to the contralateral side and directly synapse to the cell bodies of the nucleus caudalis in the medulla. The nucleus caudalis processes noxious stimuli. Stimulation activates synaptic release of neuropeptides (substance P and calcitonin-gene-related peptide), and the amino acid glutamate (Dionne et al., 2006; Sessle, 1987).

From the brainstem, the neural information ascends rostrally along the trigeminothalamic tract to the thalamus, then enters the cortex. The cerebral cortex integrates the peripheral information with the complexities of perception, expectations, and memory to elicit pain perception and response (Dionne et al., 2006; Sessle, 1987).

In addition, mechanisms to augment the pain response exist. The central convergence of neurons signals orofacial pain (Dionne et al., 2006; Sessle, 1987). Stimulation of mucosal receptive fields excites many nociceptive and wide dynamic range neurons. The peripheral afferents from the tooth pulp and other tissues excite the neurons. Increasing the excitability and lowering the activation threshold of primary afferents can contribute to peripheral sensitization (e.g. hyperalgesia and allodynia). Extensive convergent afferent input can confound the localization of pain and contribute to the referral of pain (Dionne et al., 2006; Sessle, 1987). Another augmentation mechanism is inflammation of the oral mucosa which initiates the inflammatory cascade and cellular events to activate pain pathways. Development of central sensitization at the level of the nucleus caudalis is a consequence of repeated or prolonged nociceptive afferent stimulation. Induction of spontaneous activity, receptive field expansion, lowering the activation threshold and enhancement of responses of nucleus caudalis all augment the pain response (Dionne et al., 2006; Sessle, 1987).

Modulation of orofacial pain is achieved by four mechanisms as described by the “gate control theory of pain” (Melzack & Wall, 1965; Sessle, 1987). The first mechanism is local circuit interneurons which have inhibitory and excitatory actions on signals from primary afferents like A-delta and C fibers. Secondly, two types of projection neurons convey information: wide dynamic range neurons are activated by weak mechanical stimuli but respond maximally to intense and potentially, tissue-damaging stimuli, whereas nociceptive neurons respond only to intense noxious mechanical, thermal, or chemical stimuli. A dampening effect of pain is achieved by descending neurons that function as the endogenous pain modulatory system (γ-aminobutyric acid (GABA) and endogenous opioids). Finally, there is also a modulatory component under cerebral cortex control which activates the endogenous analgesic system (Fields, Basbaum, & Heinricher, 2006).
**Pain Associated with Caries**

Oral pain caused by early childhood caries (ECC or dental decay) may not be expressed verbally and can present as a number of behaviours in young children. Children afflicted with oral discomfort may eat less, sleep less, and/or exhibit negative behaviours. Rampant caries and toothaches may go unrecognized prolonging a child’s suffering. A review about oral-health-related quality of life (OHRQoL) after dental treatment under general anaesthetic (GA) by Jankauskiene and Narbutaite (2010) found that parents noticed improvement in their child’s appetite, sleep patterns, and physical condition, as well as the absence of toothache, increased smiling frequency and interaction with others, and better results at school. Similarly, Klaassen (2010) summarized other studies that have shown treatment of ECC under GA results in reduced toothache-related behaviours, less pain experience, improved abilities to eat, positive social impact and overall better quality of life.

**Procedural Pain Associated with Dental Treatment**

Studies conducted to describe dentists’ knowledge of and attitudes towards procedural pain in children have revealed dentists downplay procedural pain (Milgrom, Weinstein, Golletz, Leroux, & Domoto, 1994; Murthomaa, Milgrom, Weinstein, & Vuopio, 1996). The Seattle survey study by Milgrom et al. (1994) found one third of dentists who treated school-aged children did not provide postoperative medication following tooth extractions. Ten percent of the dentists surveyed regularly denied the existence of child pain, and many believed child pain reports were invalid and exaggerated. Similarly, Murthomaa et al. (1996) found American and Finnish dentists did not routinely use postoperative analgesics. One reason was 20-67% of American dentists and 7-21% of Finnish dentists “strongly disagreed” that pain reports were credible. Neither group rated paediatric dental treatment as particularly painful or unpleasant. In contrast, a survey study by Rasmussen, Frederiksen, Hallonsten, and Poulsen (2005) found that 75% of Danish dentists thought that 3-5-year-old children could report pain with ‘some’ or ‘great’ degree of certainty. This latter group of dentists placed more emphasis on observed behaviour than on a child’s verbal report of pain. Despite this increased acknowledgment of pain, a large proportion indicated that “learning to cope with slight pain is a part of life”.

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The misconception that children suffer less pain than adults or do not feel pain continues to prevail (AMA, 2010). O’Donnell, Henderson, Fearne, and O’Donnell (2007) reported that extractions of primary teeth have been, and still are, carried out without any pain relief medication in the belief that children do not experience significant amounts of pain. Studies on children receiving dental rehabilitation under GA have shown that pain is one, if not the most, significant morbidity associated with dental extractions (Atan et al., 2004; Bridgman, Ashby, & Holloway, 1999; Fung, Cooper, Barnard, & Smith, 1993).

However for unknown reasons, the impact of these studies is slow to permeate into clinical knowledge and translate into clinical intervention.

**Postoperative Pain in Children after Dentistry under GA**

Postoperative pain is often a new experience for young children. The complexity of interpreting and verbalizing pain may be further convoluted by unfamiliar postoperative sensations from GA, surgical site discomfort and disorientation.

There are less than a dozen publications that studied postoperative pain following paediatric dental rehabilitation under GA (Atan et al., 2004; Costa & Harrison, 2011; Enever, Nunn, & Sheehan, 2000; Farsi, Ba’akdah, Boker, & Almushayt, 2009; Fung et al., 1993; Holt, Chidiac, & Rule, 1991; Hosey et al., 2006; Howard et al., 2008; Jensen, 2012; Needleman, Harpavat, & Wu, 2008; O’Donnell et al., 2007; Townsend et al., 2009).

Some studies revealed that postoperative pain was the most common and long-lasting morbidity after paediatric dental rehabilitation (Atan et al., 2004; Bridgman et al., 1999; Holt et al., 1991). In the study by Atan et al. (2004), postoperative pain was reported in 74% of children aged 6 to 16 years following dental treatment under an intubated GA. Of the morbidity measures reported by postoperative telephone survey, pain had the longest duration in comparison to sleepiness, weakness, and nausea. Farsi et al. (2009) determined that the prevalence of postoperative pain was 47.8% at 36 hours and 16.7% at 72 hours. The pilot study by Fung et al. (1993) found 57.5% of children who had one or more extractions under GA experienced postoperative pain.

In the study by O’Donnell et al. (2007), none of the 70 patients in the no-analgesics group reported ‘no pain’ and 100% scored mild to high pain. 18.6% scored moderate pain and 81.4% scored moderate to high pain. All children receiving no analgesia experienced some level of pain following extractions of primary teeth under GA.

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Gazal and Mackie (2007) found that those children between the ages of 2 and 7 years had higher pain scores than those between the ages of 8 and 12 years, assessed by the Children’s Hospital of Eastern Ontario Pain Scale (Appendix A). Additionally, higher pain scores were recorded in children when 7 or more teeth were extracted than when 6 or fewer teeth were extracted. The mean time between preoperative analgesics and the patient starting to recover from the GA was 2 hours with a standard deviation of 0.64 hours. There was no statistical difference between times of the groups.

**PAIN ASSESSMENT TOOLS AND MEASURES**

The Pain Assessment Model

One may simplify pain in a linear model where a nociceptive stimulus, described by location, frequency, and intensity, initiates a unique painful sensation. In response, there are verbal expressions as well as physiological effects which are influenced by a person’s characteristics. These external signals can be observed, recorded, interpreted and assessed.

*Figure 1: Pain Assessment Model (Versloot, 2007)*
Pain Assessment Methods

The plethora of available pain assessment tools and measures illustrates continual development to capture the complex subjective experience of pain. The challenge is threefold: an assessor’s ability to effectively communicate with the child, the child’s ability to accurately understand the question and appropriately conceptualize his/her sensations and feelings, and the child’s ability to verbalize his/her feelings and/or express his/her discomfort to respond to the assessor’s query. The abstract multidimensional nature of this process makes it difficult to acquire an accurate picture of the patient’s pain.

Evidence has demonstrated that children’s self-reports are preferred over observational reports and are considered the gold standard (Franck et al., 2000; Howard et al., 2008). Pain assessment tools may assist parents and caregivers of patients in the recovery period. With standardized tools and parent education, paediatric pain assessment can be improved to better approximate self-ratings by children (Franck et al., 2000).

Selection of Pain Assessment Tool and Measures

The Royal College of Nursing (RCN) in the United Kingdom published full guidelines and a pain scales algorithm to assist in the selection of an appropriate pain assessment tool (Royal College of Nursing [RCN], 2009; Stapelkamp, Carter, Gordon, & Watts, 2011). In their algorithm, an informed choice consisted of selecting the type of tool (i.e. self-report, behavioural or physiological); the age group of interest; the type of pain (i.e. periprocedural, postoperative, or other settings); and the efficacy of the pain assessment tool.

Independent from the RCN, the Pediatric Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (Ped-IMMPACT) commissioned two systematic reviews of pain measures for children between the ages of 3 and 18 for use in clinical pain trials: one on self-report measures and the other on observational-behavioural measures (Stinson, Kavanagh, Yamada, Gill, & Stevens, 2006; von Baeyer & Spagrud, 2007, respectively). Both reviews were conducted by Canadian research groups. Based on the RCN guidelines and the Ped-IMMPACT reviews, only postoperative pain assessment tools that demonstrated discriminant validity (i.e. pain versus no pain), construct validity, test-retest reliability, internal consistency, interpretability, and feasibility were considered for this study. Comparisons are included in the tables in Appendix A.
While no individual measure can be broadly used across all children or contexts (Howard et al., 2008), it has been recommended that self-report with at least one other measure, either observational-behavioural or physiological, may be a better approach than any single measure (Howard et al., 2008). Multidimensional assessments have also been considered to be more accurate (Franck et al., 2000). Often, an observational-behavioural scale is preferred over the physiological tool (Howard et al., 2008) which requires prolonged monitoring of blood pressure, heart rate, and respiratory rate.

Moreover given the trend for dental rehabilitation under GA to be an ambulatory day surgical procedure, it is recommended that the parent or caregiver should acquire the child’s self-report. Parents’ ratings are still valuable, since they are more closely correlated to their child’s self-reports than to nurses’ ratings (Franck et al., 2000).

**Self-Reporting Tools**

Children’s self-reporting of their pain is considered the gold standard and preferred over observational reports given that pain is a subjective experience (Franck et al., 2000; Howard et al., 2008). However, age and/or level of cognition may influence scores and there may be inherent complexities and biases with this measurement. Children who understand the concepts of order and magnitude can rate intensity, describe quality, and location of pain (Franck et al., 2000). These skills usually are not present until age 7, but may be demonstrated when a child is able to arrange numbers in a sequence or place different-sized objects from smallest to largest (Coté et al., 2009). There are also self-reporting tools that do not have this prerequisite, such as faces pain scales.

**Observational Behavioural Measures**

Observational measures are popular among HCPs because they do not require active cooperation from the child. Instead, these pain assessment tools require the assessor to mark the presence or absence of listed behaviours. The items are scored to determine pain intensity.
POSTOPERATIVE PAIN MANAGEMENT STRATEGIES

The high prevalence of reported postoperative pain following dental procedures under GA signals that pain is either poorly assessed and/or poorly managed despite the availability of efficacious and effective analgesics (Howard et al., 2008). There are advocates for multimodal analgesia defined as using multiple analgesic agents of different pharmacologic classes to effectively target multiple sites along pain pathways (Jin & Chung, 2001). Recalling the neurobiology of pain, a surgical stimulus in the orofacial region initiates local inflammation in the periphery and the sensation is transmitted centrally. Administration of local anaesthetics or nonsteroidal anti-inflammatories (NSAIDs) target pain at this peripheral surgical site. On the other hand, opioids and acetaminophen target pain centrally at the level of the brain (Coté et al., 2009; Dionne et al., 2006).

Current Practices: Oral Analgesics

Given the inflammatory component in dental surgery, NSAIDs are recommended as the first line postoperative analgesic. Commonly used ibuprofen is a nonselective cyclooxygenase inhibitor (COX1) that reduces prostaglandin production at the site of tissue injury. Its anti-inflammatory action mitigates its analgesic properties. The appropriate dose is 10 mg/kg every 6 hours to a maximum of 2.4 g/day. Caution is to be taken in patients who are at risk of bleeding, or who have gastrointestinal (GI) ulcers, or kidney impairment, where acetaminophen is considered to be a good alternative (American Academy of Pediatric Dentistry [AAPD], 2012).

Acetaminophen is primarily a central-acting analgesic that has no anti-inflammatory properties. Acetaminophen has a large therapeutic window with recommended dose of 10-15 mg/kg every 4 hours and maximum of 100 mg/kg/day (Berde & Sethna, 2002; Coté et al., 2009). The drug is rapidly absorbed from the GI tract, achieves 60% bioavailability after first-pass effect, and onsets when peak plasma levels are achieved at approximately 30 minutes. There are few side effects, although hepatotoxicity can occur with acetaminophen overdose (Coté et al., 2009).

A combination of ibuprofen and acetaminophen may be recommended as multimodal analgesia to target both the peripheral and central components of pain. Gazal and Mackie (2007) found the combination taken together had significant pain reduction than either agent alone.

Codeine can be considered for breakthrough pain when NSAIDs and acetaminophen are inadequate, such as in cases of moderate to severe pain (AAPD, 2012). Codeine use is controversial in the paediatric community because of its variability and unpredictability in dose-effect (Tremlett, Anderson, & Wolf,
Codeine has low μ-receptor affinity and is 10 times less potent than morphine. Genetic polymorphisms of cytochrome P450 2D6 exist where ultra-rapid metabolizers convert codeine to morphine quickly. It is reported that 29% in the Ethiopian population and 1% in Swedish, German and Chinese populations are rapid metabolizers (Williams, Hatch, & Howard, 2001). Another source reports that 40% in North Africa, 26% in Oceania, 12% in the Middle East, 8% in North America, 3% in Europe and 2% in East Asia are ultra-rapid metabolizers (Madadi & Koren, 2008). The resultant high morphine levels increase the risk of adverse effects like GI upset, sedation, CNS depression, respiratory depression, and overdose. On the other hand, poor metabolizers have difficulty converting codeine to its active component. It is estimated that 7-10% of the Caucasian population, 2% of Asians, 30% of Hong Kong Chinese, and 1% of the Arabian population are slow metabolizers (Tremlett et al., 2010; Williams et al., 2001). Prescribing codeine may result in unaddressed pain in this group. Clinical identification of genotype variants in the population is difficult which makes the metabolism and response to codeine unpredictable.

Morphine, unlike the prodrug codeine which has uncertain and unpredictable metabolism, has a very predictable pharmacokinetic and pharmacodynamic profile (WHO, 2012). Community prescribers can use morphine for breakthrough pain after nonopioids are given round-the-clock. It is recommended to start with low doses such as 0.2-0.5 mg/kg q4h and then titrate to effect. Treatment with strong opioids needs to be individually adjusted. There is no fixed maximum dosage (WHO, 2012). Opioid use for dental pain is usually of short duration, therefore concerns about physical dependence is unsupported (AAPD, 2012). The American Academy of Pediatric Dentistry states that opioids should be considered for moderate-to-severe dental pain (AAPD, 2012). At present, morphine is recommended instead of codeine by the WHO (WHO, 2012).

**Placebo Analgesia**

Pain relief can be partially attributable to the placebo effect (Fields & Price, 2006; Turner, Deyo, Loeser, Von Korff, & Fordyce, 1994) by situating the patient in a healing, comfortable setting, providing attention from a healthcare provider or caregiver, as well as suggesting improvement which leads to the patient’s expectation of pain relief. Fields and Price (2006) refer to the presence of a consistent analgesic placebo effect in the model of dental postoperative pain. The time course of pain intensity is highly reproducible which makes the dental model useful in the study of placebo effects. Fields and Price (2006) cite 40% of subjects show a placebo response. Additionally, a mean magnitude of 5- to 10-
point reduction in VAS among these adult dental patients was demonstrated in placebo groups (Fields & Price, 2006). Placebo effects act synergistically with active treatment to achieve clinical improvement in addition to the natural course of healing (Turner et al., 1994). A literature review by Turner et al. (1994) concluded “rates of good patient outcomes after treatment that have no specific therapeutic effects vary considerably across studies, but are strikingly high on average”, often greater than the “widely accepted one-third placebo response rate”. No studies on placebo effect in the context of paediatric dental rehabilitation under GA exist.
Chapter 3: OBJECTIVES

Healthcare providers and parents may downplay paediatric procedural pain. Collective interpretation of previous studies on postoperative pain following paediatric dental treatment under general anesthesia (GA) is difficult with the variability in age, demographics and pain assessment tools that have been used.

THESIS:

Paediatric postoperative pain following dental rehabilitation under general anaesthesia is prevalent and confirmed using validated pain assessment tools in the ambulatory setting.

OBJECTIVE:

To determine the prevalence, severity, and duration of postoperative pain after paediatric dental rehabilitation under general anaesthesia using reliable and valid pain assessment tools in the clinic and at home.

SPECIFIC AIMS:

The aims of this study are to provide tools and measures for parents to assess their child’s pain and to characterize the postoperative experience by these measures, which include self-reporting Faces Pain Scale-Revised (self-reporting tool) and Parents’ Postoperative Pain Measures (observational/behavioural parent report).
Chapter 4: RESEARCH METHODOLOGY

The prospective cross-sectional study was performed at the Paediatric Surgicentre (PSC) at the Faculty of Dentistry, University of Toronto from July 1, 2012 to July 1, 2013.

Ethics approval for this practice-based study was obtained from the University of Toronto Health Sciences Research Ethics Board.

RECRUITMENT OF PARTICIPANTS

The recruiting period occurred from July 1, 2012 to April 30, 2013. Referrals to the PSC included patients who previously failed to successfully undergo treatment with oral moderate conscious sedation, nitrous oxide conscious sedation, or local anaesthesia alone for reasons of poor cooperation or extensive dental treatment plan requiring multiple appointments. Recruitment of participants occurred in three stages.

1) Screening by Paediatric Dental Residents

Participants were screened at the initial PSC preoperative consultation by the paediatric dental resident to determine eligibility based on age, English fluency, and treatment requirements (Appendix B1). If criteria were met, the patient’s chart was flagged as belonging to a potential participant.

2) Screening by Anaesthesia Residents

At the patient’s preoperative anaesthesia consultation, the anaesthesia resident performed the assessment as per usual procedures and also verified that the potential participant met all inclusion and exclusion criteria (Appendix B2). The study was explained to the parent/caregiver and the Information Sheet and Consent Form (Appendix C1, C2) were given to the parent/caregiver to review at home.

3) Consent and Final Enrollment

On the day of the procedure (typically scheduled 2 to 4 months after the initial consultation appointment based on current wait times at the PSC), the principal investigator or research assistant reviewed the Information Letter and Consent Form with the parent/caregiver using the Consent Script (Appendix C3), and answered any final questions. To complete the enrollment process, the designated parent/caregiver signed the consent form in the presence of the researcher to finalize the recruitment process. Anaesthesia staff personnel were also available to address any questions or concerns.
Inclusion Criteria

Participants were included in the study if they were:

- Referred for dentistry under general anaesthesia in the PSC at the Faculty of Dentistry, University of Toronto
- Ages 4 to 6 inclusively at the time of the dental procedure
- American Society of Anesthesiology (ASA) physical status Class I or II
- Living with an English-speaking parent/caregiver
- Requiring oral rehabilitation involving multiple dental procedures (including at least one extraction, and/or pulpectomy and/or pulpotomy) of the primary dentition.

Exclusion Criteria

Participants were excluded from the study if they were:

- ASA Class III or higher
- Developmentally delayed or cognitively impaired
- Born prematurely (defined as less than 37 weeks gestational age)
- Currently using psychotropic medications
- Using analgesics on the day of the procedure.

PROCEDURE AND TREATMENT

The dental procedures and the administration of general anaesthetic were performed to usual, accepted standards. The staff dental anaesthesiologist and resident administered anaesthesia while the paediatric dental resident, under supervision of a staff paediatric dentist, performed the dental procedures. The principal investigator was not involved in making treatment decisions or performing direct treatment on study patients. The principal investigator was not involved in direct patient care.

Anaesthetic protocols were standardized only to a limited extent to simulate real practice. All procedures required nasal intubation as per usual practice at the PSC. The current standard of practice is variable when it comes to administering an analgesic perioperatively for postoperative pain. Intravenous analgesics are not always routinely given in many practices including both hospital and ambulatory settings. Analgesic agents were administered by anaesthesiologists based on their own
clinical judgments and experiences and often in consultation with the surgeon. For this study, limitations on perioperative analgesics were implemented to control for their confounding effect on postoperative assessments. Patients received treatments that met current standards of care.

The following criteria were met:

- Oral premedication with oral midazolam was used if the child required sedation prior to entering the surgical suite. Midazolam was administered with simple syrup or flavoured syrup which had no active pharmacological components. These vehicles were used to mask the bitter taste of midazolam.
- Fentanyl was limited to the induction period (at least one hour prior to emergence).
- Remifentanil use was acceptable given that it had a short duration of action of less than 10 minutes.
- Ketorolac use was prohibited preoperatively and intraoperatively.

In recovery, analgesics for obvious pain could be administered only after pain measurements were acquired or attempted twice without success. Clinicians identified obvious pain to be prolonged distress and inconsolability. Children’s ibuprofen was the first-line agent administered by mouth. If the patient refused oral intake, intravenous ketorolac was administered as a rescue.

DATA COLLECTION

Demographics

From the paediatric dental screening records, patient chart, and tentative treatment plan, the data that were collected included:

- Number of teeth to be extracted
- Reason for extraction, i.e. dental caries or trauma
- Presence or absence of previous dental pain
- Previous use of analgesics or antibiotics
- Presence or absence of acute or chronic dental infection
Procedural Data

The anaesthesia resident or nurse recorded all anaesthetic interventions according to the usual documentation standards of practice. These data included:

- Use of oral premedication with midazolam
- Inhalational induction with sevoflurane
- Use of oral or nasopharyngeal airway
- Placement of a nasal endotracheal tube
- Maintenance by intravenous and/or inhalational technique
- Adjuncts used
- Anaesthesia duration
- Procedure duration
- Local anaesthetic used
- Number of 1.8 mL cartridges of local anaesthetics used
- Anaesthetic events
- The time when tooth extraction commenced
- The time when extraction was completed
- The time when anaesthesia was terminated
- The time when child recovered consciousness
- The time when child was discharged

The operator paediatric dentist also indicated whether the extraction was completed by forceps only or by surgical extraction, the degree of eruption of the tooth / teeth extracted, and any surgical complications.

Data on Pain

Data on pain were collected in two stages. The presence or absence of preoperative pain and analgesic use was noted during the screening and final recruitment appointments. Postoperative pain was then, measured by the designated parent/caregiver immediately in the recovery area and subsequently at home upon discharge from the clinic.
The Selection of Pain Assessment Tool and Measures

Self-report and observational behavioural measures were selected. For this study, tool selection focused on measures that assessed pain in ages 4 to 6 in the acute postoperative setting. Contrary to other protocols, this study used validated faces pain scale self-report tool and observational-behavioural pain assessment tool at home after discharge from dental rehabilitation under GA.

Faces Pain Scale -Revised

The selection of the Faces Pain Scale-Revised (FPS-R) for this study was based upon its appropriateness, advantages, reputability, and preference in children (Franck et al., 2000; Appendix A). The FPS-R design consists of a row of six gender-neutral faces outlined in black overtop a white background (Figure 2). The faces designed by Bieri et al. (1990) were developed in a staged design process where different groups of children were asked to draw facial features in ovals, then freehand faces, then specific features of eyes and mouth to depict various degrees of pain. Children can relate their own pain intensity to diagrammatic faces better than to specific persons in photographs (Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990), like those in the Oucher tool (Appendix A). Additionally, the absence of cultural features increases the tools' versatility in different populations. FPS-R can be considered a universal tool (Finley, Kristjansdottir, & Forgeron, 2009). A review by Finley, Kristjansdottir, and Forgeron (2008) reports “there is no research to show that the reliability or validity of a scale is improved based on differences in ‘ethnic’ appearance” and they found “no compelling evidence that culture significantly affects the sensory aspects of pain or pain perception”. Schiavenato et al. (2008) theorized the ‘primal face of pain’ is intrinsic to human beings where the facial expressions of pain are constant across racial and ethnic groups. For these reasons caricatured faces of pain are recognizable by a child despite cultural backgrounds.

FPS-R has been developed to omit smiles and tears to avoid the confounding effect of affect on pain intensity. Pain intensity reflects the sensory dimension, whereas affect is a behavioural response such as emotional arousal or distress to this sensation (Gracely, 1992; Jensen, Karoly, O’Riordan, Bland, & Burns, 1989). While intensity and affect are correlated, the measure of pain affect can vary independently of the sensory input (Gracely, 1992). Pain affect is more complex and less homogenous than pain intensity (Gracely, 1992). As Gracely (1992) explains: “the affective component of pain can be assessed as ‘how much a given sensation bothers you’”. The differences in affect can be related to pain type, personality type or temperament (Broome, Rehwaldt, & Fogg, 1998). Several studies have shown that faces scales with smiling no-pain anchors may provide greater pain scores in comparison with
other scales (Tomlinson, von Baeyer, Stinson, & Sung, 2010). These extremes of facial expression illustrate affect instead of pain intensity (Hicks, von Baeyer, Spafford, van Korlaar, & Goodenough, 2001). The use of a neutral face rather than a classic happy face to denote the no-pain anchor increases the sensitivity of the tool in measuring pain (Chambers & Craig, 1998).

FPS-R is appropriate for children as young as 4 years of age who can interpret pictorial faces reacting to pain and can assess severity (Bieri et al., 1990). A faces scale is preferred by children as opposed to a colour analog scale or a visual analog scale (Bieri et al., 1990; Franck et al., 2000; Tomlinson et al., 2010). The FPS-R tool is simple and does not require the child patient to make metaphoric leaps to interpret the scale (a skill that is undeveloped until age 7) (Bieri et al., 1990). Furthermore, it is an ideal self-reporting assessment tool because an adult minimally needs to explain or interpret the scale to the child patient (Bieri et al., 1990). FPS-R requires minimal training, is simple to use and is administered with a low burden of materials. Furthermore, no pre-testing is required.

Statistical analysis is facilitated by a numeric scale that has content validity, construct validity, and feasibility. The data generated is qualitative-categorical and ordinal. The scale correlates with other self-report pain measures: r=0.84 with the colour analog scale and r=0.92 with the visual analog scale (VAS) (Hicks et al., 2001). FPS-R is the recommended pain measure by Stinson et al. (2006) from the Hospital for Sick Children, Toronto, Canada. It has also been used by other Canadian research groups.

**Figure 2: Faces Pain Scale - Revised**

**Faces Pain Scale-Revised Instructions:**

“These faces show how much something can hurt. This face (point to left-most face) shows no pain. The faces show more and more pain (point to each from left to right) up to this one (point to right-most fast) – it shows very much pain. Point to the face that shows how much you hurt (right now)”. 

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Parents’ Postoperative Pain Measure

The Parents’ Postoperative Pain Measure (PPPM) is a 15-item behavioural checklist based on nonverbal pain cues that parents or caregivers may observe postoperatively at home (Chambers, Finley, McGrath, & Walsh, 2003). Points greater than or equal to 6 signify the presence of pain. This observational behavioural scale is age appropriate (4-12 years old). It has been validated in the outpatient ambulatory setting and is specifically designed for parents to easily use at home. The checklist format makes the tool to be of low burden. As a well-established measure, it has high inter-rater reliability and internal consistency, good indices of construct validity, sensitivity, specificity, and responsiveness (Chambers et al., 2003; Finley, Chambers, McGrath, & Walsh, 2003; Kokki, Kankkunen, Pietilä, & Vehviläinen-Julkunen, 2003). Von Baeyer et al. (2007) recommended it as a first choice for pain assessment at home.

Figure 3: Parents’ Postoperative Pain Measure

Parents’ Postoperative Pain Measure Instructions:

Answer yes or no to the following fifteen questions. Add the number of ‘yes answers’ to acquire a total score.

Does your child:

- Whine and complain more than usual?
- Cry more easily than usual?
- Play less than usual?
- Not do the things s/he normally does?
- Act more worried than usual?
- Act more quiet than usual?
- Have less energy than usual?
- Refuse to eat?
- Eat less than usual?
- Hold the sore part of his/her body?
- Try not to bump the sore part?
- Groan or moan more than usual?
- Look more flushed than usual?
- Want to be close to you more?
- Take medications when normally refuses?

Training the Parent on the Use of the Pain Assessment Tool and Measure

Introduction of the pain scales occurred on the day of surgery, prior to giving any premedication to the patient. The child was shown the FPS-R assessment tool in the presence of the parent/caregiver in the preoperative room and asked to select a face. This pain score was noted and the child continued with regular preoperative procedures. Once the child was admitted into the surgical suite and undergoing treatment, the nurse returned to the preoperative area and trained the designated parent or caregiver to use the two pain assessment tools for home-use. As the final step of the training, the parent
administered the FPS-R and PPPM postoperatively in the recovery area with their child. Opportunities for the designated adult to ask questions pertaining to the tools were given throughout the training. The training module is outlined in Appendix F.

Take-Home Data Collection and Survey

The take-home pain assessment package that the parent/caregiver received included:

- Tools marked by assessment date/time,
- A stamped envelope for the return of items,
- A postoperative instruction sheet (Appendix G1), and
- An analgesic prescription to the designated accompanying adult of either ibuprofen 10 mg/kg q6h prn pain or if contraindicated, acetaminophen 10-15 mg/kg q6h prn pain (Appendix H) with instructions that the analgesic may be administered at any time as needed. The parent was asked to record analgesic administration time and dose on the sheet provided.
- A sample of children’s ibuprofen

At home, the designated parent or caregiver was asked to administer and record:

1. The child’s self-report Faces Pain Score-Revised when they arrived at home and 2 hr, 12 hr, 24 hr, 48 hr, and 72 hr afterwards. (Appendix E1)
2. The observational/behaviour scales of pain, Parents’ Postoperative Pain Measure, when they arrived at home and 2 hr, 12 hr, 24 hr, 48 hr, and 72 hr afterwards. (Appendix E2)
3. The name of the analgesic medication, dose and time administered, if given, in the Pain Assessment Schedule (Appendix E3). Parents were advised that the pain medication could be administered at times other than the assessment time if required.

The designated parent or caregiver was advised not to wake the child for assessments. Assessment tools could be administered upon awakening. Notation of this event would be made on the form.
Regarding their use of FPS-R and PPPM, parents were asked to rate their satisfaction by using a Likert scale with 1 = not at all satisfied and 5 = extremely satisfied (Appendix E3) before returning all survey materials by mail.

**STUDY DESIGN CONSIDERATIONS**

**Response-Enhancement Strategies**

As a token of appreciation, a $20 Tim Horton’s gift card or two adult movie tickets equivalent to $20 value was sent to the parent participant upon receipt of returned materials. This served as an incentive for study participation.

**Sample Size Calculation and Power**

This study aimed to achieve a 90% power and an alpha level set at 0.05 using the formula for single proportion. Prevalence of postoperative pain is reported to be 57.5% (Fung et al., 1993) postoperatively. Discussions with 5 paediatric dentists revealed the expectation that postoperative pain was minimal. Given this expectation, a median value between 0 and 0.575 of \( p = 0.30 \) was selected for the sample size calculation. Using \( p_0 = 0.575 \) and \( p = 0.30 \), a sample size of at least 32 patients was calculated.
Equation 1: Sample Size Calculation

\[ n = \frac{u\sqrt{p(1-p)} + v\sqrt{p_o(1-p_o)}}{|p - p_o|^2} \]

\[ \beta = 0.10, \quad u = 1.28 \]

\[ \alpha = 0.05, \quad v = 1.96 \]

\[ n = \frac{1.28\sqrt{0.30(0.70)} + 1.96\sqrt{0.575(0.425)}}{|0.3 - 0.575|^2} \]

\[ n = \frac{2.4195}{0.0756} \]

\[ n = 32 \]

To anticipate 20% of the parents not returning the forms, the sample size increased by 8. Thus, the final sample size was 40.

STATISTICAL ANALYSIS

All data were processed in the Statistical Package for the Social Sciences (SPSS, version 20, SPSS Inc., Chicago, IL. USA) and a significance level of 5% was used in all tests. The following analyses were performed:

Demographic and Baseline Characteristics

Demographic and baseline characteristics were quantitative and continuous in nature.

- Proportions or percentages, means and standard deviations of data collected were calculated.
- Lost-to-follow-up and missing data were identified.
Pain assessment

Prevalence
Data from pain assessment tools were categorical and ordinal. It was appropriate to generate frequency tables and graphs of proportions.

- Percentages of children in moderate-severe pain indicated by FPS-R score ≥ 6 at 2 hr, 12 hr, 24 hr, 48 hr, 72 hr were determined.
- Percentages of children in moderate-severe pain indicated by PPPM score ≥ 6 at 2 hr, 12 hr, 24 hr, 48 hr, 72 hr were determined.

Wilcoxon Matched Pairs Signed Rank test
This nonparametric equivalent to paired samples t-test was used to test for significant differences for preoperative and postoperative pain by self-reporting methods at various time points. This test is appropriate for categorical ordinal data.

Spearman’s Rank Correlation Coefficient
This nonparametric coefficient identified the strength of association between self-report and observational-behavioural scores at corresponding time points

Analgesic Use
Frequency of doses received by patients during postoperative timeline were recorded. This data was quantitative and discrete.

Secondary Analysis
Correlation analyses between delta FPS-R and treatment types were performed as post hoc analyses. Delta FPS-R was devised for this study and was defined as the greatest FPS-R value within the initial 12-hour postoperative period minus the preoperative FPS-R value. Correlation coefficients: Kendall’s tau and Spearman’s rho were determined where positive correlations existed.
Chapter 5: RESULTS

RECRUITMENT & RESPONSE RATE

A total of 323 patients attended the initial paediatric dental resident consultation appointments as shown in Figure 5. Of these, 55 were accepted based on age, English comprehension, and treatment requirements. Six were subsequently deemed unacceptable study candidates because of poor English facility and medical reasons such as possibility of malignant hyperthermia susceptibility, developmental delay, or the presence of pain. Seven patients were unavailable because they sought private practice or conscious moderate oral/nitrous-oxide sedation instead of the general anaesthetic treatment option or were unavailable during the 12-month study period. Four parents declined enrollment in the study without specific reasons. Subsequently, a convenience sample of 38 patients was recruited and enrolled in this study. One participant was disqualified when mistakenly given a fentanyl infusion at the end of the anaesthetic. Postoperative assessment tools were not given to this patient. Four parents failed to return assessment and questionnaire materials despite being reminded by telephone. Reasons that were given by two parents included “inconvenience”, otherwise no reasons were given. Thirty-three patients returned materials, thereby surpassing the calculated sample size of 32 at 90% power. The response rate of 89.2% (33/37) was achieved.

Figure 5: Patient Flow Diagram
DEMOGRAPHICS

Complete records were available for 33 children. Of these, 17 were boys and 16 were girls (median age 60 months, mean age 66 months, range 48 months to 83 months) (Table 1). A total of 96 extractions, 98 pulpotomies and 3 pulpectomies of the primary dentition were performed for all patients. All the extractions were simple forcep delivery and no surgical complications were noted.

Anaesthesia regimens are summarized in Table 1 and were similar among the cases. Midazolam 0.5-0.75 mg/kg PO delivered in simple or flavoured syrup was given to 12 of 33 patients for premedication. All patients underwent an inhalational induction with 50-70% nitrous oxide then sevoflurane was incrementally increased to 8%. Prior to laryngoscopy, boluses of propofol 3-4 mg/kg IV with or without fentanyl (0.5-1 mcg/kg) or remifentanil (1-2 mcg/kg) were administered. Adjuncts included atropine (0.02 mg/kg), glycopyrrolate (0.01 mg/kg), and/or dexamethasone (0.06-0.1 mg/kg) were given by intravenous administration. General anaesthesia was maintained by a mixture of propofol-remifentanil infusion with or without accompanying nitrous oxide and/or vapour such as isoflurane or sevoflurane. Occasionally, an inhalational agent alone (either sevoflurane or isoflurane) was used for maintenance.

Local anaesthesia was administered in the form of 2% lidocaine with 1:100 000 epinephrine for 23 cases. One of these cases also received 0.5% bupivacaine with 1:200 000 epinephrine. Local anaesthesia was administered by infiltration technique and no field blocks were provided. Local anaesthetic was given during the procedure to the discretion of the operating dentist.

Ibuprofen was administered in 8 cases after acquiring a self-report pain score. Intravenous ketorolac was used in 2 cases when the child refused oral medication but was in obvious discomfort. No anaesthetic complications were observed. Morbidities reported by nurses during recovery included postoperative sore throat, oral pain, crying and emergence delirium. No nausea or vomiting was reported.
Table 1: Demographic Data

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<td>(48.5)</td>
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<tr>
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</tr>
<tr>
<td><strong>Opioid Adjuncts &gt;1h before end of procedure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl IV</td>
<td>22</td>
<td>(66.7)</td>
</tr>
<tr>
<td><strong>Adjuncts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midazolam IV</td>
<td>1</td>
<td>(3.0)</td>
</tr>
<tr>
<td>Glycopyrrolate IV</td>
<td>10</td>
<td>(30.3)</td>
</tr>
<tr>
<td>Atropine IV</td>
<td>7</td>
<td>(21.2)</td>
</tr>
<tr>
<td>Atropine+Glycopyrrolate IV</td>
<td>1</td>
<td>(3.0)</td>
</tr>
<tr>
<td>Dexamethasone IV</td>
<td>23</td>
<td>(69.7)</td>
</tr>
<tr>
<td><strong>Postop Analgesic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>23</td>
<td>(69.7)</td>
</tr>
<tr>
<td>Ibuprofen PO</td>
<td>8</td>
<td>(24.2)</td>
</tr>
<tr>
<td>Ketorolac IV (rescue)</td>
<td>2</td>
<td>(6.1)</td>
</tr>
</tbody>
</table>

The demographics of the 5 patients who were excluded from the original 38 who consented and enrolled are shown in Table 2. In this set, a total of 13 extractions, 14 pulpotomies and no pulpectomies were performed.
Table 2: Demographic Data of Participants Lost to Follow-Up or Disqualified

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 4</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td>Age 5</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td>Age 6</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td><strong>Physical Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA I</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td>ASA II</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td><strong>Premedication Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Premed</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td>Premed</td>
<td>3</td>
<td>(60.0)</td>
</tr>
<tr>
<td><strong>Inhalational induction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrous + Sevo.</td>
<td>5</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Sevoflurane alone</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td><strong>IV Infusion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Propofol</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Propofol + Remi.</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td>Remifentanil alone</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td><strong>Vapours for maintenance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td>Sevo/Isoflurane</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td><strong>Procedure Time (min)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-60 min</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>61-120 min</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td>121-180 min</td>
<td>3</td>
<td>(60.0)</td>
</tr>
<tr>
<td>181-240 min</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td><strong>Anaesthesia Time (min)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-120 min</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>121-180 min</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td>181-240 min</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td><strong>Recovery Time (min)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-40 min</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>41-60 min</td>
<td>3</td>
<td>(60.0)</td>
</tr>
<tr>
<td>61-80 min</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>81-100 min</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>&gt;100 min</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td><strong>Local anaesthesia used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Local anaesthetic</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>Local anaesthetic used</td>
<td>4</td>
<td>(80.0)</td>
</tr>
<tr>
<td><strong>Opioid Adjuncts &gt;1h before end of procedure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl IV</td>
<td>3</td>
<td>(60.0)</td>
</tr>
<tr>
<td>1 case of infusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adjuncts</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midazolam IV</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Glycopyrrolate IV</td>
<td>1</td>
<td>(20.0)</td>
</tr>
<tr>
<td>Atropine IV</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td>Atropine + Glycopyrrolate IV</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Dexamethasone IV</td>
<td>2</td>
<td>(40.0)</td>
</tr>
<tr>
<td><strong>Postop Analgesic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>5</td>
<td>(100.0)</td>
</tr>
<tr>
<td>Ibuprofen PO</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>Ketorolac IV (rescue)</td>
<td>0</td>
<td>(0)</td>
</tr>
</tbody>
</table>
PAIN ASSESSMENT RESULTS

Prevalence

The prevalence of pain was calculated with denominators excluding missing values. Values are shown in Table 3. Moderate-severe pain was defined as values equal to or greater than 6 by FPS-R scores or by PPPM. The prevalence of moderate-severe pain was 29.0% by FPS-R (highest at 2 hours after discharge from the clinic) and correspondingly, 40.0% by PPPM at the 2-hour mark. The prevalence of 42.3% by PPPM scores was highest at home arrival. The denominators shown in Table 3 differ from the total sample size of 33 because there were missing assessments in the return survey materials.

Table 3: Prevalence of Moderate-Severe Pain

<table>
<thead>
<tr>
<th></th>
<th>Recovery</th>
<th>Home</th>
<th>2 hr</th>
<th>12 hr</th>
<th>24 hr</th>
<th>48 hr</th>
<th>72 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPS-R ≥6 n (%)</td>
<td>5/25</td>
<td>8/27</td>
<td>9/31</td>
<td>5/28</td>
<td>2/31</td>
<td>2/32</td>
<td>1/32</td>
</tr>
<tr>
<td></td>
<td>20.0%</td>
<td>9.6%</td>
<td>29.0%</td>
<td>17.9%</td>
<td>6.5%</td>
<td>6.3%</td>
<td>3.1%</td>
</tr>
<tr>
<td>PPPM ≥6 n (%)</td>
<td>N/A</td>
<td>11/26</td>
<td>12/30</td>
<td>5/24</td>
<td>1/29</td>
<td>0/29</td>
<td>0/29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42.3%</td>
<td>40.0%</td>
<td>20.8%</td>
<td>3.4%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Proportions of No, Mild, Moderate, and Severe Pain

The stacked bar graph of pain levels shown in Figure 6 illustrates that almost all study participants had no pain at baseline. Baseline pain assessment scores that were elevated may suggest chronic discomfort. Postoperative pain scores by self-reporting demonstrated that the presence of moderate to severe pain was greatest within the initial 2 hours and gradually tapered towards mild and no pain over the 3-day postoperative period. A similar pattern was observed by the Parents Postoperative Pain Measure shown in Figure 7.
Figure 6: Faces Pain Scale-Revised versus Time

Table 4: Frequencies of Faces Pain Scale-Revised versus Time

<table>
<thead>
<tr>
<th>Time</th>
<th>FPS-R 0</th>
<th>FPS-R 2</th>
<th>FPS-R 4</th>
<th>FPS-R 6</th>
<th>FPS-R 8</th>
<th>FPS-R 10</th>
<th>Missing</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop</td>
<td>26</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Recovery</td>
<td>11</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>Home</td>
<td>10</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>33</td>
</tr>
<tr>
<td>2h</td>
<td>10</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>12h</td>
<td>13</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>33</td>
</tr>
<tr>
<td>24h</td>
<td>20</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>33</td>
</tr>
<tr>
<td>48h</td>
<td>24</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>72h</td>
<td>26</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>33</td>
</tr>
</tbody>
</table>
Figure 7: Parents Postoperative Pain Measure versus Time

Table 5: Frequencies of Parents Postoperative Pain Measures versus Time

<table>
<thead>
<tr>
<th>Time</th>
<th>PPPM 0</th>
<th>PPPM 1-5</th>
<th>PPPM 6-9</th>
<th>PPPM 10-15</th>
<th>Missing</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>4</td>
<td>11</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>2h</td>
<td>2</td>
<td>16</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>12h</td>
<td>8</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>24h</td>
<td>11</td>
<td>17</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>48h</td>
<td>19</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>72h</td>
<td>24</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>33</td>
</tr>
</tbody>
</table>
ANALYSIS

Wilcoxon Matched Pairs Signed Rank Test

Wilcoxon matched pairs signed rank test was used to determine whether the difference between baseline and postoperative self-report pain scores was significantly different. For the postoperative score, the highest score given within the first 12 hours was used for the comparison. Two-tailed tests were performed and a critical p-value of 0.05 was employed. Postoperative pain was significantly different from preoperative pain by self-report (p<0.001).

Table 6: Descriptives for Wilcoxon Matched Pairs Rank Test

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPS-R preop</td>
<td>33</td>
<td>0.61</td>
<td>1.273</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>High FPS&lt;12 h</td>
<td>33</td>
<td>5.21</td>
<td>3.672</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

Table 7: Wilcoxon Signed Rank Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>N</th>
<th>Mean Rank</th>
<th>Sum of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>High FPS&lt;12h - FPS-R preop</td>
<td>26b</td>
<td>13.50</td>
<td>351.00</td>
</tr>
<tr>
<td>Ties</td>
<td>7c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. High FPS<12h < FPS-R preop
b. High FPS<12h > FPS-R preop
c. High FPS<12h = FPS-R preop

Test Statistics\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>High FPS&lt;12h - FPS-R preop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>-4.488\textsuperscript{b}</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.
Spearman’s Correlation Coefficient

Spearman’s correlation coefficient analysis compared FPS-R to PPPM at equivalent time points. A correlation existed when patients arrived at home, 2- and 12- hours from discharge as evident by correlation coefficients of 0.616, 0.604, and 0.603 respectively (Table 8). This correlation was statistically significant (p<0.005). At 24-hours, the correlation coefficient was 0.364 (p=0.057).
Interestingly, the return of statistical significance (p<0.05) occurred at 48- and 72-hour assessments (rho = 0.382 and 0.392, respectively). The denominators shown in Table 8 differ from the total sample size of 33 because there were missing assessments in either FPS-R or PPPM or both from returned survey materials.

Table 8: Spearman’s Rank Correlation Coefficient between FPS-R and PPPM at Concordant Times

<table>
<thead>
<tr>
<th></th>
<th>Home</th>
<th>2 hr</th>
<th>12 hr</th>
<th>24 hr</th>
<th>48 hr</th>
<th>72 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correlation Coefficient, rho</strong></td>
<td>0.616</td>
<td>0.604</td>
<td>0.603</td>
<td>0.364</td>
<td>0.382</td>
<td>0.392</td>
</tr>
<tr>
<td>P-value (2-tailed)</td>
<td><strong>0.001</strong></td>
<td><strong>&lt;0.001</strong></td>
<td><strong>0.002</strong></td>
<td>0.057</td>
<td><strong>0.041</strong></td>
<td><strong>0.035</strong></td>
</tr>
<tr>
<td>N</td>
<td>26</td>
<td>30</td>
<td>24</td>
<td>28</td>
<td>29</td>
<td>29</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.005 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Home Analgesic Use

Parents were asked to document all analgesic doses administered over the 3-day postoperative period. Despite a child’s self-reporting of moderate-severe pain (score of ≥6 by FPS-R or by PPPM), parents rarely gave their child analgesics. The total frequency of doses is outlined in Figure 8. These values represented a combination of one dose per child and/or multiple doses per child. All parents received written and verbal instructions on analgesic use along with a sample of children’s ibuprofen. They were encouraged to give round-the-clock dosing for at least the first 2 days. Only one parent routinely gave analgesics round-the-clock as instructed. The majority of the doses shown in Figure 8 are from this parent’s administration behaviour.
Secondary Analysis

Post hoc analyses revealed a correlation between delta FPS-R and sum of pulp therapies and extractions. Delta FPS-R was devised for this study and was defined as the greatest FPS-R value within the initial 12-hour postoperative period minus the preoperative FPS-R value. Pulp therapy included pulpotomies and pulpectomies. Correlation coefficients: Kendall’s tau was 0.275 (p=0.041) and Spearman’s rho was 0.380 (p=0.029). There appeared to be no correlation between delta FPS-R score and each of the following (Appendix L):

- Number of stainless steel crowns (SSC)
- Number of pulpotomies
- Number of pulpectomies
- Number of extractions
- Number of SSC and pulpotomies
- Number of SSC, pulpotomies, extractions
- Number of treatments (SSC, pulpotomies, pulpectomies, extractions)
- Number of total treatments (SSC, pulpotomies, pulpectomies, extractions, restorations)
- Use of local anaesthesia
Chapter 6: DISCUSSION

PRIMARY OUTCOME: POSTOPERATIVE PAIN

Prevalence

This study found that 29% to 40% of children having dental rehabilitation under GA experienced postoperative pain. This prevalence highlights the need for a formalized assessment of pain in the recovery period. In 1998, the World Health Organization named pain as the fifth vital sign, highlighting the importance of its assessment (Hicks et al., 2001). This study is the first to have parents assess their child patient by using the FPS-R and PPPM to capture the paediatric postoperative experience after dental GA. Pain was most prevalent in the immediate postoperative phase. Moderate-to-severe pain appeared to peak at 2 hours, then reduced in intensity over the 3-day period, a trend which is consistent in morbidity studies focusing on paediatric dental surgery under GA (Farsi et al., 2009; Jensen, 2012; Needleman et al., 2008).

Wilcoxon matched pairs signed rank test verified that the highest FPS-R postoperative scores recorded within the first 12 hour period were significantly different from baseline scores.

Response bias may exist if parents’ observational scoring by PPPM was influenced by the child’s self-reports. It may be recommended to perform the PPPM prior to acquiring self-report measure.

The management of missing values from the pain assessment surveys required care. The values in this study were considered as missing at random (Acock, 2005; Haukoos & Newgard, 2007). Low socioeconomic status may be a mechanism for parents not performing assessments at times. Case deletion approach or exclusion of missing data seemed appropriate because prevalence was the outcome of interest. The frequency of missing values were reported transparently in Figure 6, Figure 7, Table 4, and Table 5. The decision was made not to substitute measures of central tendency which would skew data analysis and bias interpretation of prevalence for nonparametric data (Acock, 2005; Haukoos & Newgard, 2007).

Treatment Threshold for Pharmacological Intervention

Most clinicians believe the threshold for pharmacological intervention is moderate pain. Gaulthier, Claude, Finley, Allen, and McGrath (1998) determined that pharmacological intervention was required
when subjects indicated a mean pain intensity of 3.2 as measured by the Faces Pain Scale (the original seven-face scale with a scoring range from 0 to 6 as seen in Figure 9). Furthermore they found a delineation of mild, moderate, and severe pain which corresponded to mean FPS scores of 2.2, 3.2, and 4.8, respectively. Based on the findings by Gaulthier et al. (1998), a score of 3.2 corresponded to the fourth face of the FPS. The features in this facial expression appeared to be a transitional face between face #3 and face #4 of the revised version which consists of a six-faces scale. The decision was made by the principal investigator to make the selection of face #4 (score 6) and up to be the indicator for clinically significant pain. In contrast, in another reference, the SickKids Acute Pain Clinical Guidelines (Naser, Palozzi, & Crawford, 2010) demarcate the numeric pain intensity scores: 0-3 to be mild pain; 4-6 to be moderate pain; and 7-10 to be severe pain to correspond with the FPS-R (scores 0 to 10). By this delineation, face #3 identifies clinically significant pain which is a lower threshold than the decision made in the current research study. No references were provided for the divisions found in this acute pain manual. Gaulthier et al. (1998) provided support for the decision to use face #4 for the purpose of this study. However, having a lower treatment threshold allows for more “aggressive” treatment of pain. In any event, the clinician must weigh the risks and benefits of providing analgesics. Given the low likelihood of adverse effects of common analgesics, a lower treatment threshold may be an appropriate clinical decision. By extension, it can be extrapolated that a greater prevalence of pain exists if a lower threshold was used for analysis of this study’s data.

Moderate pain was delineated at a PPPM score of 6 out of 15 (Chambers, Reid, McGrath, & Finley, 1996). The PPPM has shown excellent levels of sensitivity and specificity in detecting children who reported clinically significant levels of pain (Chambers et al., 2003).

A shortened version of the PPPM is currently in development. The Parents’ Postoperative Pain Measure-Short Form (PPPM-SF) uses a ten-item checklist instead of fifteen. Von Baeyer, Chambers, and Eakins (2011) included participants age 7 to 12 who underwent medical surgical procedures and postoperative pain was monitored by this assessment tool for 2 days. The initial work towards condensing the PPPM appears promising and may become more widely utilized in future research.

The decision to provide analgesics is not only the absolute delineation for moderate pain, but is also the change in pain intensity score. According to Tomlinson et al. (2010), a change of one face represents clinical improvement or worsening of pain that the individual child can experience.
The Need for Composite Pain Measures

Spearman’s correlation coefficient showed moderately good correlation when the patient arrived home and at 2-, 12-, 48- and 72-hours, as well as fair correlation at 24-hours. The strength of the correlation at early time points may reflect the obvious nature of behavioural verbal and nonverbal cues. Parents may also be more vigilant and more closely monitor during the initial recovery period.

The correlation coefficients between PPPM and FPS-R determined by our study were 0.616, 0.604, 0.603, 0.364, 0.382, and 0.392 at home, 2-, 12-, 24-, 48-, and 72-hour intervals, respectively (Table 8). These values were comparable to the values reported by Chambers et al. (2003) who compared PPPM to FPS (original seven-faces version). The study determined Spearman’s rho correlation coefficient of PPPM and FPS in older children aged 7-12 to be 0.64 and 0.53 on days 1 and 2 respectively (p<0.001). In the ages 2-6 years, the Spearman’s rho correlations were 0.72 and 0.62 on days 1 and 2 respectively (p<0.001).

The strength of the correlation found in this study and reported in other studies raises the question whether PPPM can be used alone. While the utility of combining the self-report measure (FPS-R) and the observational behaviour measure (PPPM) provides greater information and may offer a learning tool for children and parents in their interpretation of pain, a single measure may be more practical for parents and caregivers.
Implementation in the Ambulatory Clinic

Incorporating a self-report pain assessment tool in the post-anaesthetic recovery can be challenging in the paediatric population. Oftentimes cooperation is difficult to elicit from an agitated and disoriented child. In this current study, the use of the FPS-R by parents on their child during the recovery period before discharge was a demonstration of successfully completing training. The reliability of the FPS-R during this potentially tumultuous time is unknown. For this reason, recovery nurses prefer an observational behaviour tool like FLACC (Appendix A). At times, recovery nurses found FPS-R to be burdensome if a face selection could not be obtained. This is described as “provider burden” by Hester et al. (1998).

The implementation of validated pain assessment tools in the ambulatory clinic sets the foundation for adequate pain management. While it is ideal to use both self-report and observational behavioural pain assessment measures as suggested in the pain literature, the sole use of an observational behaviour pain tool alone may be more practical and appropriate in ages 4 to 6 in the immediate postoperative period.

At the time of discharge, our nurses felt that providing the PPPM checklist empowered parents to become aware of signs of pain and to objectively assess pain at home. The time to train parents was minimal and did not impede the nurses’ routines.

Parental Satisfaction with Pain Assessment Tool Use

Parents were asked to rate their satisfaction on a Likert scale with 1 = not at all satisfied and 5 = extremely satisfied (Appendix E3). Ninety-six percent of parents were satisfied with the pain assessment tools by FPS-R or by PPPM. Fifty percent of parents were extremely satisfied with the FPS-R, while 44% of parents were extremely satisfied with the PPPM (Table 9, Figure 10). Few comments or suggestions were submitted. One mother appreciated that the FPS-R allowed her direct means for her daughter to communicate discomfort in a manner that was quantifiable.
Table 9: Parental Satisfaction Data

<table>
<thead>
<tr>
<th></th>
<th>FPS-R Frequency</th>
<th>FPS-R Valid Percent</th>
<th>PPPM Frequency</th>
<th>PPPM Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Not-at-all satisfied</td>
<td>1</td>
<td>3.8</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>2 = Somewhat satisfied</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 = Satisfied</td>
<td>8</td>
<td>30.8</td>
<td>6</td>
<td>24.0</td>
</tr>
<tr>
<td>4 = Very Satisfied</td>
<td>4</td>
<td>15.4</td>
<td>7</td>
<td>28.0</td>
</tr>
<tr>
<td>5 = Extremely Satisfied</td>
<td>13</td>
<td>50.0</td>
<td>11</td>
<td>44.0</td>
</tr>
<tr>
<td>Total No. of Respondents</td>
<td>26</td>
<td>100.0</td>
<td>25</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 10: Parental Satisfaction

ADDITIONAL FINDINGS: UNDERTREATMENT OF PAIN

In dentistry, little is known about parental practices of analgesic administration. This research identified that parents rarely provided analgesics to their children despite their child’s self-reports of moderate to severe pain. This finding is consistent with other studies in the medical literature. While the reasons for under-medication at home were not ascertained in this study, a few possible reasons behind parents’ aversion to analgesic use can be extrapolated from other studies as discussed below.
Hospital and Home Practices in Analgesic Administration for Postoperative Pain in Medical Literature

Minimal administration of analgesics to children is evident in a number studies (Finley, McGrath, Forward, McNeill, & Fitzgerald, 1996; Fortier, MacLaren, Martin, Perret-Karimi, & Kain, 2009; Mather & Mackie, 1983). The landmark study by Mather and Mackie (1983) examined 170 postoperative children and observed that no analgesics were prescribed for 16%. While 25% of children were pain free, 40% were in moderate to severe pain. Of the children who had analgesics ordered, 40% of the patients did not receive medication for pain. Mather and Mackie (1983) postulated that nurses interpreted p.r.n. to mean “as little as possible” instead of “as needed”. Medical staff frequently prescribed doses that were too small and/or too infrequent (Mather & Mackie, 1983).

Not only is in-hospital analgesic practice inadequate, administration of analgesics to children is lacking at home. In a study with children who underwent tonsillectomy and adenoidectomy surgery and were discharged after 24 hours, Fortier, MacLaren, et al. (2009) found that despite a parental rating that 86% of children were experiencing significant overall pain, only 24% received no or just one medication dose throughout the entire first day at home. On day 3 after surgery, although 67% of children were rated by parents as experiencing significant overall pain, 41% received no or one medication dose throughout the entire day. As quoted from Coté et al. (2009), “caregivers should err on the side of providing, rather than withholding analgesia”.

Reasons for parental aversion to providing analgesics to their children may stem from misconceptions and the lack of education on analgesic benefits and safety. Zisk Rony, Fortier, Chorney, Perret, and Kain (2010) showed misconceptions regarding the benefit of analgesics and fear of addiction or adverse effects are common among parents who are reluctant to medicate their children. It has been suggested that some parents believe analgesics should be used only as a last resort (Zisk Rony et al., 2010) and undertreatment of pain may be related to cultural emphasis of stoicism (Fortier, Anderson, & Kain, 2009). In an earlier study by Zisk, Grey, MacLaren, and Kain (2007), there are also indications that less educated parents are more likely to avoid giving analgesics. The majority of patients in our study were of low socioeconomic class. Despite giving samples of children’s ibuprofen to all participants in the study, very few parents gave analgesics. Postulated reasons for this behaviour may be the following:

- Knowledge gap in the safety of acetaminophen or ibuprofen in young children
- Low literacy in terms of determining and dispensing appropriate liquid dose
- Credibility of pain assessment
• Stoicism in the presence of pain and refrainment from medication use

These reasons are speculative and were not investigated in this study. Similar behaviours were reflected in the studies by Jensen (2012) and Unsworth, Franck, and Choonara (2007). Their studies revealed that the use of self-report pain scales did not show improvement in pain management at home. This finding is concerning when safe, efficacious and effective analgesics are readily available. It also signals there are unknown barriers that prevent parents from alleviating pain, even after dosing instructions are given in verbal and written form.

Historical events may play a role in the aversion to analgesics. The association between Reye’s syndrome and the use of aspirin and salicylates during varicella or influenza-like illnesses in children was broadcasted by the Centers for Disease Control and Prevention (CDC) in 1980 (Belay et al., 1999). Reye’s syndrome, first described in 1963, is an acute illness of non-inflammatory encephalopathy and fatty degeneration of the liver almost exclusively seen in children. Manifestations include profuse vomiting and degrees of neurological impairment including personality changes, irritability, agitation, confusion, delirium, and coma may develop. The surgeon general of the United States issued an advisory in June 1982 and a warning label was required for all aspirin-containing medications beginning in 1986. As a result, there has been a reduction in aspirin use in children (Belay et al., 1999). The fears about aspirin may translate to unfounded fears of ibuprofen and acetaminophen use by parents and caregivers.

The provision of ibuprofen samples to parents in this current study were to ensure access to analgesics. Despite available analgesics, few doses were administered to children postoperatively. Interestingly, the recently published randomized-controlled study by Hegarty et al. (2013) found the prevalence of moderate-severe postoperative pain to be 41% in the group that was prescribed analgesics compared to 38% in the group that was prescribed and supplied analgesics at discharge. There appeared to be no difference in the incidence of pain between the two groups. While parents were able to use the Wong-Baker Faces Scale (Appendix A) and PPPM at home, Hegarty et al. (2013) determined only 48% of parents recalled advice pertaining to analgesia.

The data in this current study indicate that in addition to current counselling, more needs to be done to alleviate fears and reassure the safety of medication use. It is unclear what additional measures are required. If there is an unmet need for analgesics, as previous studies suggest (Finley et al., 1996; Fortier, MacLaren, et al., 2009), progress needs to be made to better assess paediatric patients postoperatively in the clinic and at home.
Predictors of Pain

Secondary analysis revealed a fair correlation by Kendall’s tau which was 0.275 (p=0.041) and moderate correlation by Spearman’s rho which was 0.380 (p=0.029) when comparing treatment (the sum of pulp therapies and extractions) and delta FPS-R pain score. This positive correlation is useful to help the clinician anticipate the presence of moderate-severe pain. Further study is required before an association or cause-effect relationship can be established. Contrastingly, Fung et al. (1993) found no indication that number of teeth treated was important. The study by Fung et al. (1993) may allude to the possible greater role that a multi-rooted molar, rather than a single-rooted incisor, may have on pain. Based on neurobiology, the presence of pain after dental extractions and pulp therapy is anticipated. The review by Sessle (2000) discusses trigeminal nerve deafferentation which occurs in endodontic therapy and tooth extraction. Neural trauma, compression, or transection occurs in these procedures. The sensory changes may lead to painful conditions. Evidence suggests that these changes are mainly restricted to low threshold mechanoreceptors and are reversible following pulp deafferentation (Sessle, 2000). Additionally, neuroplasticity may play a component of pain whereby there is increased neuronal excitability and thus central sensitization (Sessle, 2000). This pain pathway is initiated by injury and inflammation which stimulates nociceptive afferent neurons.

Other predictors of pain, such as headache, sore nose and throat from intubation and throat pack placement were not determined. This study did not discern the type of pain that was present. The primary outcome of this study identified presence and intensity of pain, not characterization or localization of pain.

PAIN MANAGEMENT

Pain can be managed either pre-emptively (discussed below) or postoperatively (previously discussed).

Pre-emptive Pain Strategy

Current general anaesthesia practices for paediatric comprehensive dental surgery vary considerably. The provision of pre-emptive analgesia meets the goal of interfering with nociceptive inputs into the central nervous system, thus preventing the onset of moderate to severe pain. Subsequently, the patient emerges in reasonable comfort and requires less postoperative opioids and adjunctive
analgesics and less adverse effects result. Studies that confirm this strategy include O'Donnell et al. (2007) and Gazal and Mackie (2007). The randomized controlled trial by Gazal and Mackie (2007) found statistically significant decreases in mean pain with one-hour preoperative administration of ibuprofen 5 mg/kg alone or the combination of acetaminophen 15 mg/kg and ibuprofen 5 mg/kg in comparison to acetaminophen 20 mg/kg or control acetaminophen 15 mg/kg at 15 minutes postoperatively after extractions in children under general anaesthesia. However, the effect of pre-emptive analgesia can be inconsistent in the literature. Primosch, Nichols, and Courts (1995) conducted a study of 60 children to evaluate preoperative administration of ibuprofen or acetaminophen compared with a placebo for the extraction of primary teeth. They found that preoperative administration of neither analgesic was superior to placebo.

Local Anaesthesia

The administration of local anaesthesia perioperatively to prevent postoperative pain is oftentimes considered an analgesic option by clinicians. However, current literature suggests that local anaesthesia has no significant beneficial effect in paediatric patients undergoing extraction of primary teeth under GA. A meta-analysis by Knoll (2009) revealed perioperative administration of local anaesthetics provided no significant decrease in postoperative pain. In the double-blind randomized controlled trial by Coulthard et al. (2006), children age 4-12 who received acetaminophen preoperatively, had extractions under GA with or without local anaesthetic. Comparison of postoperative pain reports did not significantly differ between the two groups. Townsend et al. (2009) compared two groups of children of age 3 to 5.5 years old undergoing comprehensive dental rehabilitation involving extractions and stainless steel crown placement under GA. While both groups received an intravenous ketorolac 15 minutes before case completion, the subjects who were infiltrated with local anaesthetic did not have improved pain behaviours in recovery, nor improved pain behaviours 4-6 hours postoperatively as measured by the FLACC, faces, and subjective reports of parents or a nurse. Local anaesthesia may cause increased distress secondary to recovering with the unfamiliar and altered orofacial sensation and increased likelihood of cheek or tongue-biting. The American Academy of Pediatric Dentistry's 2009 local anaesthesia guidelines note the reduction of postoperative pain in the GA recovery period, but with supporting marginal evidence. Routine administration of local anaesthetics in children undergoing extraction of primary teeth under GA should be reconsidered (Knoll, 2009).
Intravenous Opioids

Parenteral opioids are commonly used intraoperatively to manage pain. The selection of the opioid is based on pharmacokinetic profiles for onset and duration of action. Opioids are the pharmacological class of choice to manage hemodynamic and respiratory changes related to surgical stimulation intraoperatively. In the ambulatory setting, clinicians prefer short-acting agents like fentanyl and remifentanil to limit the effects of respiratory depression and sedation in the postoperative period. The confinement of fentanyl use to the induction period (or at least one hour prior to emergence) for the purpose of this study and the use of remifentanil as an infusion have minimal effect in the recovery period.

Intravenous Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

Ketorolac is an excellent option as a pre-emptive analgesic for the high prevalence of moderate to severe orofacial or dental pain seen in this current study. This agent is appropriate for ambulatory practice. Ketorolac’s duration of action of 6 hours facilitates bridging to children’s ibuprofen or acetaminophen at home.

Ketorolac is an injectable NSAID shown to provide postoperative analgesia similar to opioids in children. The lack of respiratory depression, sedation, nausea, and pruritus which are known opioid effects make ketorolac an appealing alternative. However, there are risks of increased surgical site bleeding, gastrointestinal bleeding and renal dysfunction (Strom, Berlin, Kinman, & Spitz, 1996). A double-blind, four-armed randomized controlled trial by Purday, Reichert, and Merrick (1996) compared intravenous ketorolac 0.75, 1.0, and 1.5 mg/kg, and morphine 0.1 mg/kg given at induction to children age 2-10 undergoing dental restorative treatment under GA and found no patient had excessive bleeding and there were no differences in postoperative analgesic requirements between the treatment groups.
STUDY LIMITATIONS

Recruitment

The recruitment of subjects posed a greater challenge than anticipated. A large number of patients were excluded from the study (276 patients out of 323 patients). While age and English facility played a major role in the exclusions of cases, a great proportion of the patients were excluded because tentative treatment plans did not identify needs for extractions and/or pulp therapy. There were two scenarios where this could happen.

There were prolonged clinic wait-times from the initial screening to treatment day ranging from 2 to 4 months. For this reason, initial treatment plans that identified conservative treatment requirements did not meet inclusion criteria of extraction or pulp therapy. However, by the time these patients came for treatment 2 to 4 months later, more extensive treatments were required. These cases were not recruited at the initial consult stage and were therefore missed in the sample.

The implementation of this research protocol within the clinic setting posed challenges. Screening was performed by multiple paediatric residents. Oftentimes, patient cooperation was poor and preliminary treatment plans were formulated from cursory examinations and without radiographs. Cases were sometimes classified as a simple restorative case. However, examination under anaesthesia revealed the need for extractions and pulp therapy. These cases were not included because inclusion criteria were not met at the original screening appointment.

Potential Sample Errors

Convenience sampling of patients from a university-institutional ambulatory clinic was employed in this clinical study. The majority of this patient population is represented by cultural minority groups and low socioeconomic class. A true random sampling that is representative of the general population would potentially require multisite sampling from both private and institutional clinics.

Additional preoperative questions pertaining to the presence of pain-associated behaviours were not asked during the recruitment phase. Inclusion criteria of the absence of preoperative pain refers to the absence of acute pain. Identification of behaviours like lack of sleep or appetite which may signal the presence of chronic oral pain (Jankauskiene & Narbutaite, 2010) are not captured by the FPS-R which is a tool designed for the acute pain setting. The Wilcoxon matched-pairs signed rank test determined
the change in FPS-R score to be statistically significant, thus does not negate the prevalence of pain found in this study.

Response Rate and Non-responder Bias

A high response rate and low non-responder bias granted confidence in the study’s results and conclusions. The sample size of 33 was achieved which approximated the calculated sample size of 32. The power calculations were based on arbitrary values given this novel area of study. This study achieved a strong response rate of 89.2%. From the parents who did not return survey materials and who could be reached by phone, inconvenience was cited as a reason for not responding. It is unknown whether electronic versions of patient materials would improve the response rate.

Study Design and Confounders

It is commonly accepted that anxiety plays a significant role in the experience of pain. As stated in the paper by Hosey et al. (2006): a “child’s dental fear is more strongly associated with the subjective experience of pain than with objective dental pathology”. Oftentimes, the mixture of anxiety and pain in dentistry is difficult to separate in children. The multidimensional components of parental and child dental anxiety were not measured in this study because such a complex interaction was beyond the scope of this pilot study. Furthermore, FPS-R and PPPM have demonstrated good discriminant validity, meaning pain intensity is measured instead of anxiety (Finley et al., 2003; Huguet, Stinson, & McGrath, 2010).

It is possible that local anaesthesia may be a confounder in the initial FPS-R scores. However, the analysis was performed using the highest FPS-R score within the first 12 hours after discharge. Given that almost 100% of the local anaesthetic administered was 2% lidocaine with 1:100 000 epinephrine given by infiltration, it is unlikely local anaesthesia played a significant confounding role in the data. The duration of action in soft tissue is approximately 3 hours by this anaesthetic and technique. Furthermore, local anaesthesia should have minimal impact on postoperative pain reports (Coulthard et al., 2006; Knoll, 2009; Townsend et al., 2009).
Of the sample of 33 patients, 23 patients received propofol-remifentanil combination and 3 patients received plain remifentanil infusion in this current study. Concerns of hyperalgesia (defined as an increased sensitivity to noxious stimuli) have been raised secondary to the belief that acute tolerance develops in the immediate postoperative period after remifentanil use. This concern is greater for remifentanil given its potency, rapid onset and offset. Remifentanil-induced hyperalgesia has been documented experimentally in both animals and healthy human volunteers during and even in the absence of overt opioid withdrawal (Mao, 2002). The study by Vinik and Kissin (1998) demonstrated acute tolerance to remifentanil in healthy adult volunteers who were subject to thermal and mechanical noxious stimuli while on a remifentanil infusion of 0.1 mcg/kg/min. Analgesic efficacy decreased after reaching a peak effect despite continued infusion. The study by Vinik and Kissin (1998) did not explore hyperalgesia upon infusion discontinuation. Observations, as seen in the study by Vinik et al. (1998), do not distinguish between opioid tolerance or diminished opioid analgesic efficacy from an opioid-induced increased sensitization to pain (Mao, 2002). Angst et al. (2009) performed a rigorous study using healthy adult volunteers subjected to mechanical, electrical, and thermal stimuli to refute the development of acute tolerance to clinically relevant concentrations of remifentanil for infusions of 3-hour duration. These authors referenced observational studies to suggest that tolerance develops in the context of chronic opioid therapy. Furthermore, hyperalgesia does not necessarily translate to increased analgesic requirements of nonopioids. In addition to a lack of direct evidence linking intraoperative opioid use to postoperative hyperalgesia in a clinical setting (Angst, Koppert, Pahl, Clark, & Schmelz, 2003), there are no studies on opioid-induced hyperalgesia in paediatrics. Based on the summarized literature, the likelihood of elevated FPS-R scores secondary to hyperalgesia in the immediate postoperative period is low.
FUTURE DIRECTIONS

The results from this study illuminate further questions:

- Why do parents have an aversion to providing analgesics to their child?
- What are the risk factors for postoperative pain?
- Can the type of postoperative pain be discerned (e.g. dentoalveolar vs. sore throat)?
- How can validated pain scales be efficiently implemented in daily practice?

CONCLUSIONS

This study has demonstrated that postoperative pain exists in the early recovery period with greatest severity being recorded at 2 hours after the patient is discharged home. The data collected from the 3-day post GA recovery period revealed that a formal validated pain assessment can be performed at home by the parent or caregiver. While moderate-severe pain existed, parents infrequently administered analgesics. It was not clear from this study why parents/caregivers were not administering analgesics as per the postoperative instructions. Clinicians should recommend round-the-clock analgesic dosing for 2 days instead of p.r.n. dosing.

If there is an unmet need for analgesics, as previous studies have suggested (Finley et al., 1996; Fortier, MacLaren, et al., 2009), progress to better assess pain in paediatric patients postoperatively in the clinic and at home is required. Inadequately addressed postoperative pain may have long-term consequences that germinate in childhood, and grow to become challenges in adulthood. Preventing these consequences from manifesting is of utmost importance for the well-being of the individual.

This research project advances knowledge in paediatric postoperative pain in dental anaesthetic practice and brings focus to the importance of pain assessment. Greater understanding may optimize the clinician’s current practices to elevate the standard of paediatric pain management.
REFERENCES


working with children in the hospital and community, 11(3), 186–94.
doi:10.1177/1367493507079558


APPENDICES
APPENDIX A: Comparisons of Pain Assessment Tools

Self Report

6-Graded Faces Scale (Tree-Takern). The patient selects one face that best represents their level of pain. The first left-most face shows no pain, whereas the last right-most face shows very much pain. Pictorial, easy to use, validated in age 4 to 12. Upper anchor may lead to underestimation of pain by some children (Stinson et al., 2006). Chambers & Craig (1998) suggest that scales with smiling faces may be more appropriate as measures of pain. A cross-sectional study design validated this scale in children undergoing inguinal surgery.

Oucher is a 6-point photographic faces scale that has specific versions for each gender and each ethnicity (Caucasian, African-American, Hispanic, Asian, First Nations). The 10-point numeric scale for older children who must be able to count to 100, consists of a ruler marked from 0 to 100 mm. It lies adjacent to the photographic scale that is more geared towards younger children. Unlike, many other scales, this is vertically-oriented. Instructions require careful word selection. There are two sizes available. The Oucher is validated for ages 3-12 in outpatient, ambulatory surgery. Cross sectional studies validate this scale in populations of hospitalized children undergoing surgery, traumatic injury, outpatient surgery, and ambulatory surgery.

Positive correlations demonstrated between Oucher scores and those obtained using Pieces of Hurt, FPS, VAS are outlined by Coté et al. (2009). Oucher demonstrated responsivity which is defined as the ability to detect change in pain intensity before and after surgery and after administration of analgesic. The numerical component used in children older than 6 years requires the child to be pre-tested to determine whether he/she can count to 100

Pieces of Hurt Tool is also called the Poker Chip Tool uses 4 red poker chips given to the patient. The patient is instructed to put out the number of poker chips indicating pain severity. It is easy to use, a validated tool for acute pain in ages 3-12+. There is modest evidence of reliability and validity in ages 3-4. There are disadvantages given that this tool requires a pre-test of seriation before its use. The likelihood that these chips may become lost or may present a choking hazard is an issue.

There is a strong correlation with Oucher, VAS, and various versions of FPS (Coté et al., 2009).

Visual Analog Scale (VAS) consists of a 100 mm line with 10 mm rule marks. The patient is instructed to place a mark along its continuum. The VAS is validated in ages 3-12, easy to use, validated in outpatient medical surgery, and hospitalizations from traumatic injury or surgery. Younger patients
under 8 years old may not have conceptual ability to use the VAS. It has been studied in cross-sectional design.

**Verbal Rating Scale (VRS)** is a 4- or 5-point scale. It is valid for ages 3-18 years and is popular by its simplicity and ease of use. Correct word selection is essential to achieve reliable pain assessment. Hence, cultural appropriateness and language selection are key to its interpretability. VRS is validated in general surgery.

**Wong-Baker Faces Scale (WBFS)** is an extensively studied scale that shows reliability and validity in age 3-18. There is a strong positive correlation between Pieces of Hurt, faces scale and VAS. Most recent data suggests that versions with smiling face at the no-pain anchor may lead to overestimation of pain. Children with no pain but with distress from other sources may be reluctant to choose the smiling face. Yet, the Wong-Baker scale is preferred by children over the NRS, graphic rating scale, Pieces of Hurt, and the Colour Analog Scale.

*Figure 11: Wong-Baker Faces Scale*

![Wong-Baker Faces Scale](image)

**Observational**

In **FLACC** (Facial expression, Leg movement, Activity, Cry, Consolability), the five measures require scoring 0 to 2 (have a 3-point scale each). The points are summed. Despite being validated in age 3-12+, it may not be as relevant in older verbal children. Cross-sectional studies have validated FLACC in peripheral venous cannulation or percutaneous puncture of venous port, general anaesthesia and surgery, postoperative inpatients, myringotomy, tonsillectomy, adenoidectomy, and simple diagnostic radiographs. There is good inter-rater reliability.

**CHEOPS (Children’s Hospital Eastern Ontario Pain Scale)** comprise of seven parameters: cry, facial, child verbal, torso, touch, legs. Within these categories, descriptors are available with assigned points from 0 to 2 or 1 to 3 to be summed. Scores less than or equal to 6 indicate no pain. The assessment is a long checklist. Its use requires training. CHEOPS is validated in ages 3-12+. This tool is validated in
surgery, elective surgery, venipuncture, and circumcision in cross-sectional design studies. There is high interrator reliability with this scale.

Furthermore, there is good to excellent correlations with faces pain scales and VAS. The length and inconsistencies in scoring among the CHEOPS’ categories makes it cumbersome and impractical to use in a busy clinical setting (Coté et al., 2009).

Like VAS, **VAS observer** is a 100 mm line with 10 mm rule marks. The patient is instructed to indicate a mark along the line. It is validated in a wide age range of 0 to 12 years and up. Cross-sectional design studies have validated it in tonsillectomy, cardiac surgery with sternotomy incisisons.

**Combined Self-Report and Observational behavioural Scale**

**Chedoke-McMaster Paediatric Pain Management** is a combination assessment sheet that uses VAS and CHEOPS. This scale is validated in a wide age range of 18 months to 12 years old. It is intended to be used by HCP. It was used in a robust randomized controlled study.

The following table outlines the characteristics of postoperative pain scales that are inappropriate for this study’s purposes and focus.

**Table 10: Postoperative Pain Scales and Reasons for Inappropriateness**

<table>
<thead>
<tr>
<th>Pain Scale</th>
<th>Characteristics deemed inappropriate for this study</th>
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<tbody>
<tr>
<td><strong>Self-Report Scale</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Chedoke McMaster Paediatric Pain Management Sheet | Used in hospitalized patients  
Not intended for parents |
| Colour Analog Scale | Validated in ages 5-12+, excludes age 4 (inclusion criteria)  
One study |
| Wong-Baker FACES Pain Scale | Periprocedural pain  
Tears on the face in the upper anchor may lead to underestimation of pain by some children (e.g. those who do not want to admit to crying) (Stinson et al., 2006) |
| FACES Pain Scale by Bieri | Periprocedural pain |
| 6-Graded FACES scale | Tears on the face in the upper anchor may lead to underestimation of pain by some children (e.g. those who do not want to admit to crying) (Stinson et al., 2006) |
| Poker Chip Tool | Tools likely to be lost at home. May be a choking hazard in young patients. |
| OUCHER tool | Tool requires pretest of the child’s ability to demonstrate seriation by placing six bits of paper of different sizes in order from smallest to largest, |
or alternatively, by counting to 100 by 10’s which seems more appropriate for mature children (Franck et al., 2000). High burden in terms of pre-test, training, and administering materials.

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<thead>
<tr>
<th>Measure</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheffield Children’s Hospital Facial Expression Scale</td>
<td>Validated in age 5-12, excludes age 4 and &gt;12yr olds (inclusion criteria)</td>
</tr>
<tr>
<td>Verbal Rating Scale</td>
<td>May not be cognitively appropriate for children who are unable to quantify abstract phenomena (typically age 3-7 years) Dependent on correct word selection.</td>
</tr>
<tr>
<td>Visual Analog Scale</td>
<td>Patients &lt;8 years-old may not have conceptual ability to use VAS (Howard et al., 2008) Some current studies use the Visual Analog Scale (VAS), which is valid for children aged 8 years and older. However, the studied populations in these articles were younger than 8 years old. Therefore, the assessments may be invalid (Howard et al., 2008).</td>
</tr>
<tr>
<td>Word Graphic Rating Scale</td>
<td>Validated in ages 8-12+, excludes younger ages (inclusion criteria)</td>
</tr>
</tbody>
</table>

**Observer Behavioural Tools**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chedoke McMaster Paediatric Pain Management Tool</td>
<td>Used in hospitalized patients Not intended for parents</td>
</tr>
<tr>
<td>CHEOPS</td>
<td>Difficult to use for parents, many definitions, inter-rater variability among parents unknown</td>
</tr>
<tr>
<td>COMFORT</td>
<td>Tool includes physiological measures (e.g. blood pressure, heart rate)</td>
</tr>
<tr>
<td>Derbyshire Children’s Hospital Pain Tool</td>
<td>Validated age &lt;3-12, but uncommon use.</td>
</tr>
<tr>
<td>FLACC</td>
<td>May not be as relevant in older children who can verbalize Considered first choice for postoperative pain in hospital (von Baeyer &amp; Spagrud, 2007)</td>
</tr>
</tbody>
</table>

The Faces Pain Scale-Revised (self-report) and Parents’ Postoperative Pain Measure (observational-behavioural) tools made the final selection.

**Comparisons of Postoperative Pain Scale**
Table 11: Comparisons of Postoperative Self-Report Pain Scales

<table>
<thead>
<tr>
<th>Table 11: Comparisons of Postoperative Self-Report Pain Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Details of the table would be filled in here.)</td>
</tr>
</tbody>
</table>

© Michelle Wong, 2014
<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Evidence (RCN Guidelines)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-Report Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-Graded Faces Scale (Tree-takarn) Ref: (Bosenberg, Thomas, Lopez, Kokinsky, &amp; Larsson, 2003)</td>
<td>The patient selects one face out of 6 possible faces that best represents their level of pain. The first left-most face shows no pain, whereas the last right-most face which shows very much pain.</td>
<td>- Easy to use - Pictorial - Validated in age 4-12</td>
<td>- Upper anchor may lead to underestimation of pain by some children (Stinson et al., 2006) - Chambers &amp; Craig, (1998) suggest that scales with smiling faces maybe more appropriate as measures of pain</td>
<td>- Level 3 evidence, 1 study with repeated X sectional design - Validated in children undergoing inguinal surgery</td>
</tr>
<tr>
<td>Oucher <a href="http://www.oucher.org">www.oucher.org</a></td>
<td>6-point photographic scale for younger children with corresponding 10-point numeric scale for older children, vertically oriented. Instructions require use of careful word selection - Readily available - Two sizes available - both correlated. Smaller version is convenient 8.5x11”</td>
<td>- Validated for age 3-12 - Validated in outpatient, ambulatory surgery - Different ethnic scales available Caucasian, African-American, Hispanic, Asian, First Nation - Boy / Girl version of each ethnic version available</td>
<td>- Two scales: - Children who can count to 100 can use the numeric scale (Test of seriation) - Otherwise, child should use photographic equivalent - Multiple versions</td>
<td>- 5 studies performed with level 3 evidence (X sectional) - Also validated in population of hospitalized children undergoing surgery, traumatic/injury, outpatient surgery, ambulatory surgery, hospitalized children</td>
</tr>
<tr>
<td>Poker Chip Tool Or Pieces of Hurt Tool Ref: Hester et al., 1979</td>
<td>4 red poker chips given to patient. Patient is instructed to put out poker chips indicating pain severity.</td>
<td>- Validated in age 3-12+ - Easy to use - Validated in acute pain</td>
<td>- May present choking hazard? - May become lost at home - Seriation test required prior to use</td>
<td>- Modest evidence of reliability and validity in age 3-4</td>
</tr>
<tr>
<td>VAS (Visual Analog Scale)</td>
<td>100 mm line with 10 mm rule marks. Patient is instructed to indicate mark along continuum.</td>
<td>- Validated in age 3-12 - Easy to use - Validated in outpatient surgery at medical centre, hospitalized for traumatic injury or surgery</td>
<td>- Younger patients (age &lt; 8) may not have conceptual ability to use VAS</td>
<td>- Level 3 evidence, 3 studies with X sectional design</td>
</tr>
</tbody>
</table>
| **VRS (Verbal Rating Scale)** | May be 4- or 5-point scale: no pain, mild, moderate, ±strong, severe | - Valid for ages 3-18 yrs  
- Easy to use | - Cultural appropriateness and language of the tool reliant  
- Dependent on correct word selection | - Level 3 evidence, with 1 study  
- Valid in general surgery |
|-----------------------------|------------------------------------------------------------------|--------------------------------------------------|---------------------------------|--------------------------------|
| **Faces-Pain-Scale-Revised** | 6 faces scale given Rating of 3 or more has been found to represent clinically significant pain | - age 4-12  
- High feasibility  
- Content and construct  
- Psychometrically sound  
- Validated in postop surgical and non-surgical pain  
- Simple, quick to use  
- Minimal instruction in age 4-18  
- Translated in 25 languages  
- Correlated with other measures | - Excluded from RCN Guidelines although included in the references | - Not included in RCN Guidelines (Stinson et al., 2006):  
- Limited evidence regarding interpretability and mixed evidence regarding acceptability of scale with children  
- Recommended self-report scale in school aged children 4-12 yrs old  
- FPS-R has lower failure rates and higher pt preference ratings compared to Oucher NRS or VAS |
Table 12: Comparison of Postoperative Observational Behavioural Pain Scales
<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Evidence (RCN Guidelines)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observational-behavioural Scale</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents’ Postoperative Pain Measure (PPPM)</td>
<td>The PPPM is a 15-item behavioural checklist based on nonverbal pain cues that parents or caregivers may observe postoperatively at home. Points ≥ 6 signify pain.</td>
<td>- Validated for ages 1 to 12.</td>
<td>- Excluded from RCN Guideline validated scores but included as reference</td>
<td>- Systematic review by recommended as first choice for assessment at home by (von Baeyer &amp; Spagrud, 2007)</td>
</tr>
<tr>
<td>FLACC (Face, Legs, Arms, Cry, Consolability)</td>
<td>Patient is rated on 3-point scale for each of the five measures. Points are summed.</td>
<td>- Validated in age &lt;3 - 12+ yr</td>
<td>- May not be as relevant in older verbal children</td>
<td>- Level 3 evidence, 6 studies with repeated X sectional design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Validated in peripheral venous cannulation or percutaneous puncture of venous port, general anaesthesia and surgery, postoperative inpatients, myringotomy, tonsillectomy, adenoidectomy, simple diagnostic radiographs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Inter-rater reliability (K=0.85; r=0.95, n=30 ICC; K=1, n=6; K=0.52-0.82 across categories, n=30/87 observations)</td>
</tr>
<tr>
<td>CHEOPS (Children’s Hospital Eastern Ontario Pain Scale)</td>
<td>Points are allocated to descriptors under each parameter (cry, facial, child verbal, torso, touch, legs). Points are summed.</td>
<td>- Validated in age &lt;3 -12+ yr Multiparameter</td>
<td>- Training required Long assessment checklist</td>
<td>- Level 3 evidence; 4 studies with repeated X sectional design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Validated in surgery, elective surgery, venipuncture, circumcision</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Inter-rater reliability assessed in 2 studies (ICC r = 0.92, n=30) (K=0.71, n=47)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Additional studies on 2 modifications of CHEOPS available (NAPI, BOPS – see RCN Guideline p.51)</td>
</tr>
<tr>
<td>Scale</td>
<td>Description</td>
<td>Advantage</td>
<td>Disadvantage</td>
<td>Evidence (RCN Guidelines)</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>VAS (observer)</td>
<td>100 mm line with 10 mm rule marks. Patient is instructed to indicate mark.</td>
<td>- Validated in age 0-12 + yrs</td>
<td></td>
<td>- Level 3 evidence, 3 studies with X sectional design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Validated in tonsillectomy, cardiac surgery with sternotomy incision, surgery under GA</td>
<td>- Inter-rater reliability (r=0.52-0.60, Spearman rank; Lin’s concordance correlation coefficient 0.61, n=32)</td>
</tr>
</tbody>
</table>

**Table 13: Combined Self-Report and Observational Behavioural Pain Scales**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
<th>Advantage</th>
<th>Disadvantage</th>
<th>Evidence (RCN Guidelines)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chedoke-McMaster Paediatric Pain Management</td>
<td>Combination assessment sheet that uses VAS and CHEOPS.</td>
<td>- Combined scale</td>
<td>Not validity study but uniquely used a robust design to show improved outcomes</td>
<td>- Level 1 (-) evidence</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Validated 18 months to 12 yrs</td>
<td>- Intended for HCP use, not parent ?</td>
<td>- 1 RCT</td>
</tr>
</tbody>
</table>
APPENDIX B: Patient Screening Forms

B1

DENTAL GAPPP STUDY SCREENING FORM: Paedo Resident Initials ______

Patient name: ______________________  Chart No. __________  Date: ________________

Part A:

☐ Age 4 to 6 inclusive
☐ English speaking parents
☐ Multiple dental procedures needed. DMFT Score: __________
☐ At least one extraction, and /or pulpectomy and/or pulpotomy) of the primary dentition required.
☐ Not developmentally delayed
☐ No cognitive impairment
☐ Not born prematurely (definition: born less than 37 weeks gestational age)

If ‘Yes’ to ALL statements, patient is a potential candidate.
Place a blue sticker on the front of the chart

Part B:
Please provide the following information:

- Anticipated number of teeth to be extracted: ______
- Reasons for Extraction:  ☐ Dental Caries or ☐ Trauma
- Previous dental pain:  ☐ Yes  ☐ No
- Previous use of analgesics:  ☐ Yes  ☐ No
- Presence of acute infection:  ☐ Yes  ☐ No, chronic infection:  ☐ Yes  ☐ No
- Previous use of antibiotics:  ☐ Yes  ☐ No
DENTAL GAPPP STUDY ANAESTHESIA SCREENING FORM: Anaesth Resident Initials _____

Patient name: _______________________ Chart No. ___________ Date: ________________

Part A:

☐ Age 4 to 6 inclusive
☐ English speaking parents
☐ ASA I or ASA II
☐ Not developmentally delayed
☐ No cognitive impairment
☐ Not born prematurely (definition: born less than 37 weeks gestational age)
☐ Not on psychotropic medications

If ‘Yes’ to ALL statements, patient may be formally recruited. Provide patient’s parents with Information Letter and Consent Form to take home and review. Place a yellow sticker on the front of the chart to indicate patient received these documents.

Part B:

Please provide the following information:

- Previous dental pain: ☐Yes ☐No
- Use of analgesics since Paedo screening visit: ☐Yes ☐No
- Presence of acute infection since Paedo screening visit: ☐Yes ☐No
- Presence of chronic infection since Paedo screening visit: ☐Yes ☐No
- Previous use of antibiotics since Paedo screening visit: ☐Yes ☐No
APPENDIX C: Consent Documents
INFORMATION LETTER

July, 2012

Dear Parent / Caregiver:

My name is Dr. Michelle Wong, and I am a dentist studying to become a specialist in dental anaesthesia, meaning I am being trained to put patients to sleep for their dentistry. I am currently registered in the Dental Anaesthesia Master of Science program at the Faculty of Dentistry, University of Toronto. I am doing a study that looks at whether there is pain in young children who undergo dentistry while being asleep under anaesthesia.

The title of the study is: “Postoperative pain after dentistry under general anaesthesia in paediatric patients in the ambulatory setting” (Supervised by Dr. Daniel Haas, Faculty of Dentistry, University of Toronto).

Study Process

If you choose to participate, you will be shown how to assess whether your child is having pain after the dentistry is completed here in the Paediatric Surgicentre, Faculty of Dentistry. This will be done over 3 days following the appointment. You and your child’s participation is voluntary. You may refuse to participate, may withdraw at any time, and may decline to answer any question or participate in any parts of the procedures/tasks – all without negative consequences.

I would like to reassure you that the dental care and anaesthesia care that your child receives will be the same whether or not you participate in this study. Like all patients at the Faculty of Dentistry, your child will be receiving quality standard of care treatment. As a researcher, I will have no involvement in the clinical decision-making surrounding the treatment of your child. My role is to observe, to collect information and to provide paper assessment tools to help you assess any pain your child may or may not have at home after the appointment.

Privacy and Confidentiality

You and your child’s personal and health information will remain secure, private and confidential and will be used internally within the dental school in the context of this research project. The protection of your personal health information is governed by law under the Ontario Personal Health Information Protection Act (PHIPA). This Act sets out rules that must be followed when collecting, using or sharing personal health information for research purposes. An identification chart number will be assigned to your child so that his or her information will be nameless. None of the data published will identify your child.
Paper data sheets will be destroyed after two years. Electronic data without patient names will be stored for ten years after publication of study findings. Data collected from this study will be analyzed and compiled with the intention of thesis dissertation, presentation at scientific meetings, publication in a scientific journal and/or teaching in educational and academic settings.

Risk and Benefits
There will be no added risk or cost to you or your child. Upon completion and return of assessment sheets by mail, you will receive a Tim Hortons $20 gift card or equivalent as a token of appreciation for participating in this research. Your contribution to research will help dentists better understand what children experience after this type of dentistry. The information that is gained will help us improve dental care for children in the years to come.

Contact Information
The following contacts may be kept for your reference:

- If you have any questions about your rights as participants, you may contact the Office of Research Ethics at ethics.review@utoronto.ca or 416-946-3273.
- If you have any questions about the study, you may directly email michellewong.wong@utoronto.ca or call 416-979-4900 ext. 3032
- If you are interested in the results of this study, you may also request a summary of the research findings via my email.

Thank you for choosing the Faculty of Dentistry, Paediatric Surgicentre for your dental care and participating in this study.

Sincerely,

Michelle Wong, D.D.S.
Principal Investigator, M.Sc. Candidate
INFORMATION AND CONSENT FORM

Principal Investigator: Dr. Michelle Wong, D.D.S., M.Sc. Candidate, Dental Anaesthesia, Faculty of Dentistry, University of Toronto

Study title: Postoperative pain after dental care under general anaesthesia in paediatric patients in the ambulatory setting
(Supervisor: Dr. Daniel Haas).

Purpose of Research: This study investigates whether there is pain in children who undergo sleep dentistry.

Your Consent:

By signing this Consent Form, I ________________________, the parent/guardian of ________________________ (child) agree to participate, with my child, in this study and I declare that:

- I have read and understood the information provided to me on the Information Letter. I have had the opportunity to ask questions and received satisfactory answers. I was given sufficient time to think it over and make an informed decision regarding my participation.

- I agree to: i) use the pain assessment tools provided as instructed at the specified times; ii) return all materials via the provided self-sealed stamped envelope.

- I accept that information about my child contained in his/her personal health records will be examined as part of this study. I understand that at all times my child’s personal health information will be protected and my child’s confidentiality maintained.

- I accept that data collected about my child, once any information that might directly identify him/her has been removed, will be used for analysis.

- I agree to be contacted in future to provide additional information related to this research work only if necessary.

- I accept that upon return of study materials by mail, I will receive a gift card (or equivalent) as a token of appreciation. I understand that failure to return completed study materials will forfeit the gift card (or equivalent).

- I understand that participation is completely voluntary and that I can withdraw from the project at any time, without giving a specific reason, by calling the number below. I further understand that
any information I provide will continue to be available to the researcher even if I withdraw from the study.

- I accept that the information collected will be kept until at least year 2022. At this time, information may be destroyed or made irreversibly anonymous.

---

Signature of Parent / Legal guardian

Signature of Witness

---

Print Name of Parent / Legal guardian

Print Name of Witness

---

Relationship to Child

Date

---

Name of Child participant

---

Date

Contact personnel:

For further information, you may contact the Principal Investigator, Dr. Michelle Wong by:

- Calling 416-979-4900 ext 3032
- Emailing michellewong.wong@utoronto.ca

If you have any questions about your rights as participants, you may contact the Office of Research Ethics at ethics.review@utoronto.ca or 416-946-3273.
Dental GAPPP STUDY: RECEPTIONIST CONSENT SCRIPT

- “Hi. My name is ________________.
  - To child: 
    - How old are you? — should be age 4-6, English-speaking parents 
    - What grade in school are you? — should be normal grade, no learning / developmental delays

- (Child’s name) ________________ has been selected to voluntarily participate in a study. Your involvement as parents is very easy, takes little time, costs you nothing, and you get a choice to receive either a $20 Tim Horton’s card or two movie passes upon full participation.

- We would like to know if children do or do not feel pain after dental treatment under general anaesthesia — this is something we need to learn more about. We will give you assessment tools to help you monitor your child at home for the next 3 days.

- After 3 days, we ask that you mail back the materials in the provided stamped envelope (postage is paid).

- Once we receive the envelope, we send you the appreciation gift of your choosing.

- Any private information you provide is confidential.
- The data collected may be used for academic purposes such as reports, articles and presentations. Again, no name identifiers are affiliated with these.

- The dental treatment and medications that your child will receive will not be altered by your participation in this study.

- Do you have any questions? (pause & witness their signature and co-sign).

- If you need, Dr. Michelle Wong, the anaesthesia resident who is running this study, is available to you by the contact info provided on the letter you received earlier. She regrets not being able to meet you in person today, but she may contact you by phone after 3 days to follow your progress and answer questions.

- Write directly on the consent form what gift is preferred. (note: depending on availability)
  - (a) $20 Tim Horton’s gift card  or  (b) two adult movie tickets

- Is the address and phone number that we have on file accurate?

- Final questions:
  1. Has child had any recent dental pain since last visit?  
     - □ Yes □ No
  2. Has child used pain medications like Advil or Tylenol since last visit?  
     - □ Yes □ No
  3. Any pain medications used today?  
     - □ Yes □ No
  4. Any dental swelling or infections since last visit?  
     - □ Yes □ No
  5. Any long-standing dental infections since last visit?  
     - □ Yes □ No
  6. Any use of antibiotics since last visit for the teeth?  
     - □ Yes □ No

- Thank you. The nurses will check-in ________________ (child name) now and show you the materials.

Fill in the name of the child on all materials / forms and give the clipboard to the pre-op nurse before pre-op vitals.
# APPENDIX D: Intraoperative Data Collection Form

**DENTAL ANAESTHESIA RESIDENT INTRAOPERATIVE DATA COLLECTION FORM**

<table>
<thead>
<tr>
<th>Patient Chart No.</th>
<th>Patient Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Patient Information**

- Age: __________ yrs __________ months
- Gender: __________
- ASA: __________
- Weight: __________
- Height: __________

- [ ] Use of oral premedication, midazolam
- [ ] Inhalational induction with sevoflurane
- [ ] Use of oral pharyngeal airway
- [ ] Use of nasopharyngeal airway
- [ ] Nasal intubation
- [ ] Maintenance by intravenous agent
  - Circle: Propofol
  - Remifentanil
  - Other: __________
- [ ] Maintenance by inhalational agent
  - Circle: Sevo
  - Iso
- [ ] Adjuncts used
  - __________

  *Time from beginning of anaesthesia: __________ min.*

  - __________
  - __________
  - __________
  - __________

- [ ] Anaesthesia start time: __________

**Procedure Information**

- [ ] Procedure start time: __________
- [ ] Local anaesthetic used: __________
  - __________
  - Number of cartridges of local anaesthetics used: __________
- [ ] Was (were) pulpectomy and/or pulpotomy done? __________
  - (# of pulpectomies: __________
  - (# of pulpotomies: __________
- [ ] Was (were) extraction(s) done? __________
  - (# of extractions: __________

  *Time when tooth extraction commenced: __________

  Paediatric dentist to advise of:
  - Performed by: __________
  - Forceps only
  - Surgical extraction
  - (circle one)
  - Degree of eruption of the tooth / teeth to be extracted
    - Circle one: Fully Erupted
    - Partially Erupted
    - Un-erupted
  - Any surgical complications: __________
  - The time when extraction was completed: __________

- [ ] Procedure end time: __________

**Anaesthesia Events**

- [ ] The time when anaesthesia was terminated: __________
- [ ] Time when child recovered consciousness: __________
- [ ] Anaesthetic events & times: __________

**Analgesics given in Recovery?**

- (Circle one) Tylenol®
  - Ibuprofen 10 mg/kg = Dose given: __________
  - 10-15 mg/kg = Dose given: __________
- [ ] Time when child was discharged: __________
APPENDIX E: Take Home Pain Assessment Tools and Questionnaire

E1

FRONT:

PATIENT NAME: ________________________________

DATE: ____________________________ CIRCLE: HOME 2 hr 12 hr 24 hr 48 hr 72 hr

Faces Pain Scale-Revised instructions:
“These faces show how much something can hurt. This face (point to left-most face) shows no pain. The faces show more and more pain (point to each from left to right) up to this one (point to right-most fast) – it shows very much pain. Point to the face that shows how much you hurt (right now).”

E2

BACK

PATIENT NAME: ________________________________

DATE: ____________________________ CIRCLE: HOME 2 hr 12 hr 24 hr 48 hr 72 hr

Parents’ Postoperative Pain Measure Instructions:
Answer yes or no to the following fifteen questions. Count the number of ‘yes’ to acquire a total score.

Does your child:

☐ Whine and complain more than usual?   ☐ Eat less than usual?
☐ Cry more easily than usual?   ☐ Hold the sore part of his/her body?
☐ Play less than usual?   ☐ Try not to bump the sore part?
☐ Not do the things s/he normally does?   ☐ Groan or moan more than usual?
☐ Act more worried than usual?   ☐ Look more flushed than usual?
☐ Act more quiet than usual?   ☐ Want to be close to you more?
☐ Have less energy than usual?   ☐ Take medications when normally refuses?
☐ Refuse to eat?

SCORE
## PAIN ASSESSMENT SCHEDULE

<table>
<thead>
<tr>
<th>DATE OF APPT:</th>
<th>ARRIVAL AT HOME:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TIME _______</td>
</tr>
<tr>
<td>DISCHARGE TIME:</td>
<td>□ Faces</td>
</tr>
<tr>
<td></td>
<td>□ PPPM Checklist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOURS AFTER LEAVING APPT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hr __________</td>
</tr>
<tr>
<td>□ Faces</td>
</tr>
<tr>
<td>□ PPPM Checklist</td>
</tr>
</tbody>
</table>

| 12 hr __________ |
| □ Faces |
| □ PPPM Checklist |

<table>
<thead>
<tr>
<th>DAY ONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 hr __________</td>
</tr>
<tr>
<td>□ Faces</td>
</tr>
<tr>
<td>□ PPPM Checklist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DAY TWO</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 hr __________</td>
</tr>
<tr>
<td>□ Faces</td>
</tr>
<tr>
<td>□ PPPM Checklist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DAY THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>72 hr __________</td>
</tr>
<tr>
<td>□ Faces</td>
</tr>
<tr>
<td>□ PPPM Checklist</td>
</tr>
</tbody>
</table>

PLEaSE PROVIDE FEEDBACK ON YOUR EXPERIENCE USING THE FOLLOWING:
1 = NOT AT ALL SATISFIED, 2 = SOMewhat SATISFIED, 3 = SATISFIED, 4 = VERY SATISFIED, 5 = EXTREMELY SATISFIED

HOW SATISFIED WERE YOU WITH USING THE FACeS PAIN SCALE?
1 2 3 4 5

HOW SATISFIED WERE YOU WITH USING THE PPPM CHECKLIST?
1 2 3 4 5

COMMENTS AND SUGGESTIONS:

PLEASE RETURN ALL MATERIALS BY MAIL IN THE SELF-SEAL STAMPED ENVELOPE PROVIDED.
THANK YOU.
APPENDIX F: Training Module to Parents

Script for Training Parents on Pain Tools

Thank you for participating. I hope these tools will help you and your child when you return home to monitor for pain. If these are useful to parents, our clinic may begin to use these more regularly to help improve care after children go home from their surgeries.

We will go through all materials in this take-home care package together.

Please feel free to stop and ask questions. We will also practise using them together with your child before you go home.

In the envelope, there are 6 white sheets with Pain Assessment Tools. They look like this with a Front and a Back.

FRONT:

PATIENT NAME: _______________________________

DATE: _ FILL OUT ON THE DAY OF ASSESSMENT, CIRCLE: HOME 2 hr 12 hr 24 hr 48 hr 72 hr

Faces Pain Scale-Revised INSTRUCTIONS READ TO CHILD:

“These faces show how much something can hurt. This face (point to left-most face) shows no pain. The faces show more and more pain (point to each from left to right) up to this one (point to right-most fast) – it shows very much pain. Point to the face that shows how much you hurt (right now)”.

The Back is a checklist that you do by just watching your child.

Again, _FILL OUT THE DATE OF ASSESSMENT_ and CIRCLE

Answer Yes or No to each question, then count the number of YES’s and write down the number
To help you keep track, I will give you this schedule. We'll mark down what time you should check your child’s pain. The empty boxes and extra space are for you to make notes.

Write down when you give medications if any, which type and how much.

If you can’t do an assessment because your child is sleeping at the time, then don’t wake up the child, just write ASLEEP on the schedule.
Now Practice with me. Can you summarize what you need to do at home?

When your child’s surgery is over, we will do the assessments together so you feel comfortable.
APPENDIX G: Standard Postoperative Instruction Sheets

G1

UNIVERSITY OF TORONTO
FACULTY OF DENTISTRY

Paediatric Dentistry Surgicentre and Graduate Dental Anaesthesia Clinic

Patient Name: ________________________________
Appointment Date: ___________________ Arrival Time: ___________________

PRE-OPERATIVE & POST-OPERATIVE INSTRUCTIONS
TO PARENTS OF CHILDREN WHO ARE TO RECEIVE SEDATION FOR
DENTAL TREATMENT

It is important for your child's safety that you follow these instructions carefully.

FOOD & DRINK  TO AVOID VOMITING AND COMPLICATIONS DURING TREATMENT
DO NOT give your child anything to eat after midnight of the night before the scheduled procedure. Small sips of clear fluids (water or apple juice only) are allowed up to 3 hours before the appointment.

SICKNESS  If there are any changes in your child's health such as a new illness, cold/cough, fever, flu, or diarrhea, please contact the Surgicentre at (416) 979-4757.

ARRIVING  A parent/guardian must accompany the child to the appointment and remain in the building during the procedure. Please dress the child in comfortable clothing and bring a spare change of clothing. Please put a diaper on your child or bring one on the day of the procedure.

GETTING HOME  Arrangements must be made to take the child home in a private vehicle (personal car with a third person operating the car or taxi). TAKING PUBLIC TRANSIT IS NOT ALLOWED The child should be secured in a car seat or seatbelt during transportation.

ACTIVITIES  Your child should be closely monitored by a responsible adult for the remainder of the day to ensure there is no difficulty breathing.

Look  - for chest rising, skin tone retaining its natural colour
Listen  - for breathing sounds, any unusual snoring
Feel  - for breathing coming out through nose or mouth

Your child must rest at home and is NOT ALLOWED to ride a bike or play outside for the remainder of the day.

EATING & DRINKING AFTER TREATMENT

To prevent dehydration, after your child has been discharged from the recovery room Give the child some fluids. Start with a small cup and proceed with more if your child can keep the fluids down. Soft foods (lukewarm) may be taken when desired.

SEEK ADVICE 1. If there is any difficulty in breathing
2. If nausea & vomiting persists beyond 2 hours or child cannot keep fluids down.
3. If your child still seems dizzy & drowsy 6-8 hours after treatment.
4. If any other matter causes you concern.

BEFORE 4:00 pm  Contact the Surgicentre at (416) 979-4757
AFTER 4:00 pm  Contact the Dental Anaesthesiology Resident at this pager # (416) 237-2497
Contact your nearest hospital emergency clinic or
Contact The Hospital for Sick Children at (416) 813-7500.

You will receive a confirmation phone call 48 hours prior to your appointment. If a message is left, YOU MUST respond the same day, or your appointment will be cancelled. It is YOUR responsibility to ensure your contact information (phone number and address) is up to date. Please note 48 hours notice MUST be given to cancel an appointment. Insufficient notice of cancellation will result in a $50.00 charge as well as a delay in treatment, or possible cancellation of future appointments.
Dental Extractions:

1. Bite on Gauze until bleeding has stopped.
2. DO NOT rinse mouth or spit out for the remainder of the day.
3. Soft diet and fluids for the remainder of the day (nothing too hot / cold or spicy)
4. The local anaesthetic that is administered for dental extractions renders the lip and cheek NUMB for about 2-3 hours. During this period, the child COULD bite or chew the lip of cheek without feeling any pain. It is essential that the PARENTS observe their child to ensure that they DO NOT bite the cheek or lip during the time.

5. ☐ Children’s ADVIL for pain or ☐ Children’s TYLENOL for pain
   Please follow the instructions on the package for the amount to give.
   Your child’s weight is ________kg.
6. DO NOT use ASPIRIN
7. If there is an Emergency such as extensive bleeding, facial swelling, please call our clinic or go to the Emergency Clinic at the Hospital for Sick Children or your nearest hospital.
APPENDIX H: Reference Tables for Recommended Analgesics

### H1: Children’s Advil

**8 HOUR Fever relief**

<table>
<thead>
<tr>
<th>Age</th>
<th>Weight</th>
<th>Dosage</th>
<th>Tablets</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 3 months</td>
<td>2.5 - 5.4 lbs</td>
<td>Consult your Physician</td>
<td>–</td>
</tr>
<tr>
<td>4 - 11 months</td>
<td>5.5 - 7.9 lbs</td>
<td>1.0 mL</td>
<td>–</td>
</tr>
<tr>
<td>12 - 23 months</td>
<td>8.0 - 10.8 lbs</td>
<td>1.4 mL</td>
<td>–</td>
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<tr>
<td>2 - 3 years</td>
<td>10.9 - 15.9 lbs</td>
<td>3.0 mL</td>
<td>6.0 mL (1 ¼ tsp.)</td>
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<tr>
<td>4 - 5 years</td>
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<td>6 - 8 years</td>
<td>21.4 - 26.7 lbs</td>
<td>–</td>
<td>12.5 mL (2 ½ tsp.)</td>
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<tr>
<td>9 - 10 years</td>
<td>26.8 - 32.5 lbs</td>
<td>–</td>
<td>15.0 mL (3 tsp.)</td>
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<tr>
<td>11 - 12 years</td>
<td>32.6 - 43.0 lbs</td>
<td>–</td>
<td>19.0 mL (3 ¼ tsp.)</td>
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</table>

If possible, use weight to dose; otherwise use age. Do not exceed the recommended dose unless advised by a physician. Keep all medicine out of reach of children.

Dose every 6-8 hours, up to 3 doses a day.

### H2: Children’s Tylenol

**Dosage Guide**

Intended for residents of Canada only

<table>
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<tr>
<th>Age†</th>
<th>Weight</th>
<th>Most Accurate Dosing</th>
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<tr>
<td>0 - 3 mos</td>
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<td>2.5 - 5.4 kgs</td>
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<td>4 - 11 mos</td>
<td>12 - 17 lbs</td>
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<td>12 - 23 mos</td>
<td>18 - 23 lbs</td>
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<td>2 - 3 yrs</td>
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<td>11 - 15.9 kgs</td>
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<td>4 - 5 yrs</td>
<td>36 - 47 lbs</td>
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<td>6 - 8 yrs</td>
<td>48 - 59 lbs</td>
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<td>9 - 10 yrs</td>
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<tr>
<td>11 yrs</td>
<td>72 - 95 lbs</td>
<td>32 - 43.9 kgs</td>
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</table>

**Infants’ Drops**

- See doctor for dosing under 4 months
- 1 mL
- 1.5 mL
- –
- –
- 5 mL
- 7.5 mL
- 10 mL
- 12.5 mL
- –
- 15 mL
- 3 tablets

**Children’s Liquid**

- –
- –
- –
- –
- –
- 2.5 tablets
- –
- –
- 3 tablets

**Junior Strength Tablets**

- –
- –
- –
- –
- 1 tablet
- 1.5 tablets
- 2 tablets
- 2.5 tablets
- 3 tablets

Always use the measuring device that comes with the medicine. Always remember to keep package out of reach of children.

CAUTION: If fever persists for more than 3 days, pain for more than 5 days or new symptoms appear, talk to your doctor.

† Children’s Tylenol® dosage guide is based on 10-15 mg/kg. Single dose may be repeated every 4 to 6 hours, as needed. It is hazardous to exceed 5 doses of acetaminophen per day. Refer to package insert for dosing instructions.

‡ Package label does not provide dosing for use in children less than 4 months of age for Infants’ Drops, 2 years for Children’s Liquid or Junior Strength Tablets. Please see a doctor for dosing under 4 months of age.
APPENDIX J: Thank You Response to Parents

November 25, 2012.

Dr. Michelle Wong
Paediatric Surgicentre
Faculty of Dentistry, University of Toronto
124 Edward Street
Toronto, Ontario
M5G 1G6

Dear Parent(s),

Thank you for your participation in our study entitled: “Postoperative pain after dental care under general anaesthesia in paediatric patients in the ambulatory setting”. The information you have provided will help us determine whether there is pain in children after dental general anaesthesia.

As a token of our appreciation, please find enclosed a gift of $20 value.

If you are interested in the results of this study, you may request a summary of the research findings via my email: michellewong.wong@mail.utoronto.ca or call 416-979-4900 ext. 3032.

Thank you for choosing the Faculty of Dentistry, Paediatric Surgicentre for your dental care.

Best wishes to you and your family this holiday season and in the new year.

Sincerely,

Michelle Wong, D.D.S.
Principal Investigator, M.Sc. Candidate
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## APPENDIX L: Correlation between Treatment and Delta FPS-R

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*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).