Variation in Strategies for the Facilitation of Dental Treatment in Pediatric Patients

by

Gabriella Amneris Garisto

A thesis submitted in conformity with the requirements for the degree of Master of Science

Pediatric Dentistry
University of Toronto

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Abstract

**Background:** Pediatric dentists (PD) use a variety of non-pharmacological and pharmacological methods to facilitate the delivery of dental care for children.

**Aim:** To assess current treatment facilitation strategies amongst Canadian PD and to compare these strategies to facilitation strategies of dental anesthesiologists (DA) and pediatric emergency physicians (EP) who also provide care for children requiring dental interventions.

**Design:** An online survey consisting of a series of questions based on the respondent’s area of expertise was sent to Canadian PD, DA and EP.

**Results:** PD utilized restraint alone to facilitate dental treatment significantly more than DA and EP. Quebec PD were significantly more likely to choose restraint as a preferred dental treatment facilitation strategy. PD graduating from Canadian training programs were significantly more likely to utilize restraint in their practices.

**Conclusions:** PD are more likely than DA and EP to use restraint without pharmacological adjuncts in order to facilitate dental treatment.
Acknowledgments

Thanks MJC and EJB 😊
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Chapter 1

1 Literature Review

Dental treatment is often a daunting experience for young children. Pediatric dentists use a variety of non-pharmacological methods to facilitate the delivery of dental care for children. These methods include verbal and non-verbal communication techniques, positive reinforcement, distraction and control of parental presence during treatment\textsuperscript{1}. More contentious techniques, common in the 1970’s and 1980’s, included voice control, physical restraint, and hand over mouth (HOM) or hand over mouth with airway restriction (HOMAR)\textsuperscript{2,3}. Some pediatric dentists employed pharmacological methods such as sedation or general anesthesia to facilitate dental treatment\textsuperscript{1}.

Parental acceptance of non-pharmacological techniques such as restraint or HOM has recently shifted to a preference for pharmacological techniques such as sedation and general anesthesia\textsuperscript{4,5,6,7,8,9}. Parents surveyed in 1984 and 1991 preferred basic communication techniques for gaining their child’s compliance during dental procedures. Sedation and general anesthesia were two of the least acceptable techniques at that time\textsuperscript{4,5}. Over a decade later, parents indicated a strong preference for basic communication techniques, but preference for sedation and general anesthesia had surpassed voice control, restraint, and HOM\textsuperscript{6,7,8,9}. Pediatric dentists acknowledged that this shift in parental preferences occurred; however, as a group their treatment methods did not change significantly\textsuperscript{10,11,12}. The majority of North American pediatric dental training programs continued to teach physical restraint as an acceptable treatment method and it is still endorsed by the American Academy of Pediatric Dentists (AAPD)\textsuperscript{1,13}. The use of restraint to facilitate dental treatment is not practiced in most European countries and in some countries it is forbidden by law\textsuperscript{14,15}. The AAPD eliminated HOM from its clinical guidelines in May 2006;
however, surveys of AAPD members suggested pediatric dentists continued to use this technique\textsuperscript{3,11}. HOMAR was never included in the AAPD guidelines, but was used by some pediatric dentists\textsuperscript{2}. Although pediatric dentists also considered sedation an appropriate adjunct for the provision of dental treatment, sedation training was inconsistent across training programs and commonly limited to a few techniques\textsuperscript{13}. Sedation philosophies and experiences ultimately influenced whether sedation was used in practice and the sedation techniques employed\textsuperscript{16,17}.

Stressful and/or painful experiences may negatively influence a child’s ability to tolerate future health care interventions\textsuperscript{18}. Painful procedures such as circumcision, needle sticks, and immunizations, can sensitize a child’s reaction to subsequent painful, possibly even non-painful procedures\textsuperscript{19,20,21}. Children and adolescents who have experienced invasive, stressful or painful dental procedures were more likely to become anxious about future procedures\textsuperscript{22,23,24}. Adults who reported avoidance behavior or situational anxiety during dental treatment often recalled painful or negative dental experiences from childhood\textsuperscript{25,26,27,28,29}. The effect of lumbar puncture on children and their parents has been assessed in the medical literature. Like dental procedures, lumbar puncture may be performed repeatedly on fully conscious children who are immobilized during the procedure, often by their parents. Both childhood leukemia survivors and their parents who reported symptoms of posttraumatic stress frequently identified lumbar puncture as one of the most traumatic procedures during cancer treatment\textsuperscript{30}. Parents have also described the process of restraining their children for lumbar puncture as one of the most difficult experiences of leukemia treatment\textsuperscript{31,32,33}. In medicine, the use of sedation and general anesthesia for invasive procedures is commonly employed to mitigate the risk of physical and psychological trauma\textsuperscript{34,35}. General anesthesia during lumbar puncture eliminates the need for restraint and is associated with lower levels of pain and distress in parents and children\textsuperscript{33}.
Pediatric dentists have regarded restraint to allow provision of dental treatment as acceptable in the past. Restraint continues to be utilized in the practice of pediatric dentistry today. There is no research on the direct physiological or psychological effects restraint may have on children. Research on the effect of restraint in adult subjects exists, though it remains sparse. Psychiatric patients assessed for distress and traumatic impact via the Coercion Experience Scale 24 hours following exposure to seclusion with mechanical restraint scored significantly higher than patients given involuntary medication\textsuperscript{36,37}. Patients interviewed one year following a restraint intervention as a psychiatric inpatient reported feelings of helplessness, tension, fear, rage and horror; patients also scored significantly higher on the Coercion Experience Scale than patients who had experienced seclusion\textsuperscript{38}. In a large national longitudinal study, behavioral issues and cognitive performance was significantly worse for restrained nursing home residents compared to matched non-restrained residents\textsuperscript{39}. The effect of physical restraint has been researched extensively in animal models. Restraint is a classic and preferred experimental model for inducing stress in rats\textsuperscript{40,41,42,43,44,45,46}. Restraint-induced changes in rats have been measured at the hypothalamic-pituitary-adrenal axis through increases in cortisol and adrenocorticotropic hormone levels\textsuperscript{47,48}. Restraint-induced changes have also been observed as sensitization of the limbic system to future mild stressors\textsuperscript{48}. Evidence for psychological changes in rats were observed as behavioral despair and anxiety-like behaviors post-immobilization\textsuperscript{48,49}.

Children in need of emergency health care are often subjected to invasive diagnostic and therapeutic procedures. Pediatric emergency physicians reportedly used a wide spectrum of sedative medication combinations, dosing variations and routes of administration to manage medical emergencies\textsuperscript{50,51,52}. An effective sedation in pediatric emergency medicine is defined as creating the conditions necessary to safely facilitate the completion of a procedure through attenuation of pain, anxiety and movement with amnesia or decreased awareness\textsuperscript{34,35}. The aim of
sedation in pediatric emergency medicine is to spare patients from unpleasant recall of procedures, preclude the need for physical restraint for procedure completion and avoid morbidity and mortality\textsuperscript{34,35}.

There are no clear criteria for sedation success in pediatric dental practice\textsuperscript{13,53}. Sedation success was measured by the completion of planned treatment or the avoidance of general anesthesia\textsuperscript{54,55}. Oral midazolam is widely used in pediatric dental sedation owing to its short onset of action, ease of administration, anxiolytic and amnestic effects and the availability of a reversal agent. Largely based on studies of effect prior to induction of general anesthesia in children, 0.5 mg/kg of orally administered midazolam was adopted as a commonly utilized dose among pediatric dentists\textsuperscript{56,57,58}. General anesthetic induction may be achieved within minutes and is essentially unaffected by a child’s movements. In contrast, pediatric dental procedures are longer and involve a variety of stimuli such as local anesthesia administration, tooth preparation, water spray and water suction. Excessive movement during a dental procedure could pose risks to patient safety and affect the quality of treatment. Due to a lack of reliable efficacy with 0.5 mg/kg of oral midazolam, doses of 0.75 mg/kg and 1.0 mg/kg have been proposed, but improvement in sedation outcomes may be accompanied by an increase in side effects and adverse events\textsuperscript{57,58,59,60}. The maximum oral dosage of midazolam recommended by the AAPD is 15 mg, which is lower than the actual maximum oral dosage of 20 mg\textsuperscript{61,62,63}. This means that following the AAPD guidelines and using a dosage of 0.5 mg/kg a child must be 30 kg or less to receive oral sedation with midazolam. If the dosage is increased to 0.75 mg/kg, the maximum allowable dose would be reached in a 20 kg child. Unfortunately, this would mean the use of midazolam oral sedation would be precluded in most children over the age of six. Physical restraint was commonly reported as an adjunct to providing care when sedation failed to produce ideal treatment conditions that allowed for safe and effective dental care\textsuperscript{54,55,59,60}. Use of restraint
in addition to sedation for provision of dental care was taught as acceptable in training programs, and was not considered an indication of ineffective sedation\textsuperscript{13,53}. Midazolam administered orally or intranasally is used in the medical pediatric emergency setting\textsuperscript{64}. Emergency physicians rated oral or intranasal midazolam as limited in efficacy and less effective than intravenous medications\textsuperscript{64}.

Among pediatric dentists in Israel, restraint and general anesthesia were more likely to be employed by males\textsuperscript{65}. Conversely, a North American study found that females were more likely to use immobilization devices on non-sedated children, but older males were more likely to employ HOM\textsuperscript{11}. The association between pediatric dentist sex and choice of treatment approach has not been investigated in a Canadian cohort.

Young North American pediatric dentists used sedation and general anesthesia more frequently than their older colleagues\textsuperscript{11}. More recent pediatric dental graduates used less aversive techniques such as voice control and more nitrous oxide and oxygen sedation than those who had graduated in previous decades\textsuperscript{17}. The relationship between practitioner experience and choice of strategies to deliver dental care has not been studied in Canadian pediatric dentists.

The utilization of sedation by pediatric dentists for dental treatment varied among US regions\textsuperscript{16,66,67}. The variation in behavior management techniques by Canadian pediatric dentists throughout the provinces has not been previously measured.

US pediatric dentists were more likely to use the treatment strategies they were taught in residency\textsuperscript{16,17}. The teaching of behavior management varied among US residency programs\textsuperscript{13}. The influence of residency training on the treatment strategies Canadian pediatric dentists use to deliver dental care has not been investigated.
Chapter 2

2 Purpose

Pediatric dentists (PD), dental anesthesiologists (DA) and pediatric emergency physicians (EP) are all involved in the care of children with dental needs. Treatment facilitation strategies used by physicians and dentists have never been compared. The aim of this investigation is to examine current treatment facilitation strategies amongst Canadian PD, and to compare those to facilitation strategies of Canadian DA and EP. This investigation will assess healthcare provider stated preferences through a series of questions on strategies for the facilitation of dental treatment in pediatric patients and responses to clinical scenarios. The investigation will also attempt to identify demographic factors associated with PD preferences of treatment facilitation strategies and responses to clinical scenarios.
Chapter 3

3 Objectives

3.1 Primary Objective

To identify preferred strategies to facilitate dental treatment in pediatric patients and in responses to hypothetical clinical scenarios by Canadian PD and to compare this to Canadian DA and EP who also provide care for children requiring dental interventions.

3.2 Secondary Objectives

1. To identify if the sex of the PD is associated with preferred strategies to facilitate dental treatment in pediatric patients.

2. To identify if the number of years of practice experience a PD has attained is associated with preferred strategies to facilitate dental treatment in pediatric patients.

3. To identify if the geographical location a PD practices is associated with preferred strategies to facilitate dental treatment in pediatric patients.

4. To identify if where a PD received pediatric dentistry training is associated with preferred strategies to facilitate dental treatment in pediatric patients.
Chapter 4
Manuscript

4 Summary

Background: Pediatric dentists (PD) used a variety of non-pharmacological and pharmacological methods to facilitate the delivery of dental care for children.

Aim: To assess current treatment facilitation strategies amongst Canadian PD and to compare these strategies to facilitation strategies of dental anesthesiologists (DA) and pediatric emergency physicians (EP) who also provide care for children requiring dental interventions.

Design: An online survey consisting of a series of questions based on the respondent’s area of expertise was sent to Canadian PD, DA and EP.

Results: The majority of PD and EP agreed that “mild, intermittent crying”, “controllable movement”, and “minimal or limited restraint required” were the minimum criteria for a successful sedation. PD utilized restraint alone to facilitate dental treatment significantly more often than their DA and EP counterparts. PD with less experience offered GA to facilitate dental treatment in their practices significantly more often than more experienced PD. Quebec PD were significantly more likely to choose restraint as a preferred dental treatment facilitation strategy than their colleagues elsewhere in Canada. PD graduating from Canadian training programs were significantly more likely to utilize restraint in their respective practices than their US or internationally trained counterparts.

Conclusions: PD are more likely than DA and EP to use restraint without pharmacological adjuncts in order to facilitate dental treatment.
Chapter 5

5  Introduction

Dental treatment is often a daunting experience, especially for a young child. Pediatric dentists use a variety of non-pharmacological and pharmacological methods to facilitate the delivery of dental care for children. Parents surveyed in 1984 and 1991 preferred basic communication techniques for gaining their child’s compliance during dental procedures. Sedation and general anesthesia were two of the least acceptable techniques at that time. Over a decade later, parents indicated a strong preference for basic communication techniques, but preference for sedation and general anesthesia had surpassed voice control, restraint, and hand-over-mouth. Pediatric dentists acknowledged that this shift in parental preferences occurred; however, as a group their treatment methods did not significantly change.

The majority of North American pediatric dental training programs continue to teach physical restraint as an acceptable treatment method and it is still endorsed by the American Academy of Pediatric Dentists (AAPD). The use of restraint to facilitate dental treatment is not practiced in most European countries and in some countries it is forbidden by law. Pediatric dentists also consider sedation an appropriate adjunct for the provision of dental treatment; however, sedation training is inconsistent across training programs and commonly limited to a few techniques. Sedation philosophies and experiences ultimately influenced whether sedation was used in practice and the sedation techniques employed. There are no clear criteria for sedation success in pediatric dental practice. Sedation success was measured by the completion of planned treatment or the avoidance of general anesthesia. Physical restraint was commonly reported as an adjunct to providing care when sedation failed to produce ideal treatment conditions that allowed for safe and effective dental care. Use of restraint
in addition to sedation for provision of dental care was taught as acceptable in training programs, and was not considered an indication of ineffective sedation.

Stressful and/or painful experiences may negatively influence a child’s ability to tolerate future health care interventions. Painful procedures such as circumcision, needle sticks, and immunizations, can sensitize a child’s reaction to subsequent painful, possibly even non-painful procedures. Children and adolescents who have experienced invasive, stressful or painful dental procedures were more likely to become anxious about future procedures. Adults who reported avoidance behavior or situational anxiety during dental treatment often recalled painful or negative dental experiences from childhood.

In medicine, the use of sedation and general anesthesia for invasive procedures is commonly employed to mitigate the risk of physical and psychological trauma. General anesthesia during lumbar puncture eliminated the need for restraint and was associated with lower levels of pain and distress in parents and children.

Pediatric dentists (PD), dental anesthesiologists (DA) and pediatric emergency physicians (EP) are all involved in the care of children with dental needs. Treatment facilitation strategies used by physicians and dentists have never been compared. The aim of this investigation is to compare current treatment facilitation strategies amongst Canadian PD, and to compare these to facilitation strategies of Canadian DA and EP who also provide care for children requiring dental interventions. This investigation will assess healthcare provider stated preferences through a series of questions on strategies for the facilitation of dental treatment in pediatric patients and responses to clinical scenarios. The investigation will also attempt to identify factors associated with PD preferences of treatment facilitation strategies and responses to clinical scenarios.
Chapter 6

6 Materials and Methods

6.1 Methods

This investigation consisted of a survey comparing current treatment restraint, sedation and general anesthesia practices amongst Canadian PD, DA and EP who provide care for children requiring dental interventions.

Ethics approval for the investigation was obtained from the SickKids Research Ethics Board (REB file number 1000047856).

All PD and DA currently practicing in Canada were invited to participate in the survey. In addition, EP from each Canadian children’s hospital with a dental service were asked to participate. Contact information of all active PD members was obtained through the Canadian Academy of Pediatric Dentistry. Active Canadian DA were identified through communication with the Canadian Academy of Dental Anesthesia. Heads of pediatric emergency rooms were identified through their institutions publicly-accessible websites and contacted to obtain the email addresses of EP working in their department. Exclusion criteria included any one of the following: PD, DA and EP who did not consent to participate in the survey; respondents who did not complete the survey; PD, DA and EP not currently practicing in Canada; DA who do not treat children; EP currently practicing in a Canadian pediatric hospital without an active dental service.

The survey consisted of a series of questions based on the respondent’s area of expertise and took approximately five minutes to complete (Appendix 1). Demographic data were collected pertaining to respondent sex, year of pediatric dentistry training completion and province of primary practice location. Year of training completion was used as a surrogate for
practitioner experience. PD were further asked to report the school or institution where they completed training in pediatric dentistry. The survey included questions specific to treatment facilitation strategies used or offered in the respondents' practice; these strategies consisted of physical restraint, sedation forms other than nitrous oxide and oxygen sedation and general anesthesia. Next, questions were asked to determine what the respondent considered to be a successful sedation. Possible options for the criteria representing sedation success were presented with respect to the patient crying, the patient’s movements, the need for physical restraint and based on rating scales developed by Houpt and Nathan. The last section of the survey was case-based. The respondents were presented with three common hypothetical pediatric dental emergency scenarios and asked to select the answer best describing how they would ideally facilitate treatment. Pictures were provided to help respondents interpret the scenarios (Figures 1, 2, 3). Descriptions of scenarios varied slightly to be applicable to EP working in collaboration with a treating dentist in a hospital emergency department (Appendix 1).

Figure 1. Scenario one. Four year-old female presenting with a lingual luxation of the right maxillary central incisor and lingual luxation and intrusion of the maxillary central incisor. The treatment plan consisted of extraction of the maxillary central incisors.
Figure 2. Scenario two. Twenty month-old male presenting with subluxation of the maxillary central incisor requiring a radiograph.

Figure 3. Scenario three. Eight year-old female presenting with a horizontal fracture of a permanent upper left central incisor resulting in pulpal exposure. The treatment plan consisted of a pulpotomy.
The survey was pilot tested in a group of ten PD and DA residents and fellows to confirm the clarity and comprehension of questions and the estimated survey completion time. Test subjects were asked to provide feedback based on their experience with the survey.

An initial explanatory email containing a link to the survey on the web-based tool Research Electronic Data Capture (REDCap™) was sent outlining the purpose of the investigation, estimated time commitment to complete the questionnaire, confidentiality provisions, and an option to decline participation in the survey. Follow-up emails were sent once weekly for three weeks with a link to the online survey to invitees who had not already responded. The survey was closed fourteen days following the last reminder email.

### 6.2 Data Analysis

Survey responses were collected and managed using REDCap™ hosted at SickKids (REDCap, 2015). Data were exported to and analyzed using the Statistical Package for the Social Sciences (SPSS). Respondents were omitted from analysis based on the pre-set exclusion criteria. Descriptive statistics were used to report all data. The years of experience of each respondent was calculated by subtracting the year of residency completion from the year in which the survey was administered, 2015. The mean, median and standard deviation of years of experience were calculated. Frequencies were used to report demographic data, data based on respondent use of restraint, sedation and GA, opinions on criteria of sedation success, as well as answers to the case-based scenarios. The Chi-square test was used to compare responses among PD, DA and EP.

As PD was our principal group of interest, data for this group were further analyzed to assess whether a relationship existed among the demographic variables and the likelihood of a respondent to report using restraint, sedation or GA in practice, as well as what the respondent
deemed to be a successful sedation. These same variables were assessed to determine if there was an influence on how PD answered the case-based questions. Results were reported as frequencies and Chi-squared analysis was used to highlight differences.

Chi-square analysis was also conducted to assess if the treatment facilitation strategies offered by PD respondents in their respective practices corresponded to PD answers to the pediatric dental emergency scenarios. All tests were two-tailed and evaluated at the 5% significance level.
Chapter 7

7 Results

7.1 Response Rate and Exclusions

The survey was sent to a total of 265 PD, 53 DA and 116 EP via email. Two hundred twelve subjects responded to the invitation to complete the survey. Three subjects did not provide consent to participate in the survey and were thus excluded from the analysis. Overall, this represented a response rate of 48.2% (209/434). Reported by area of expertise, the response rate was 48.3% (128/265), 73.6% (39/53) and 34.5% (40/116) of solicited PD, DA and EP respectively. Two subjects were excluded due to failing to disclose an area of expertise. Four responding PD reported not practicing in Canada and were eliminated from analysis. One DA was excluded due to having a practice limited to adult patients. Ten EP were excluded for reporting their hospital facility either did not have or they were not sure if their hospital had an existing dental service. Eight subjects were excluded for failing to complete the survey in its entirety (5 PD; 3 EP). Ultimately, 42.4% (184/434) overall subjects were included in the analysis, representing 44.9% (119/265) PD, 71.7% (38/53) DA and 23.3% (27/116) EP.

7.2 Demographic Data

7.2.1 Data Transformation

For analysis, years of practitioner experience were combined into the subgroups: five years of experience or less, 6 to 10 years of experience, 11 to 15 years of experience, 16 to 20 years of experience and more than 20 years of experience. Primary practice location data were grouped into the following regions: Western Canada representing British Columbia, Alberta, Saskatchewan and Manitoba; Ontario; Quebec; and Atlantic Canada representing Newfoundland
and Labrador, New Brunswick, Nova Scotia and Prince Edward Island. There were no respondents from the Yukon, Northwest Territories and Nunavut. In addition, PD were asked to report the school at which they completed their pediatric dental residency; these data were converted into groups representing Canadian, US and international schools.

### 7.2.2 Overall Demographic Data

Table 1 provides a summary of the overall demographic data. Eighty-one (44.0%) females and 103 (56.0%) males responded to the survey. The overall group consisted of subjects with an average of seventeen years of experience in practice and ranging from one to fifty-three years of experience ($S.D. = 11.9$) (Figure 4). The majority of respondents reported having more than twenty years of experience (37.5%). Most respondents reported Ontario as their primary practice location (57.6%); Quebec was reported the least (9.8%).

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>Overall n = 185</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>81 (44.0%)</td>
</tr>
<tr>
<td>Male</td>
<td>103 (56.0%)</td>
</tr>
<tr>
<td><strong>Experience (years)</strong></td>
<td></td>
</tr>
<tr>
<td>5 years or less</td>
<td>39 (21.2%)</td>
</tr>
<tr>
<td>6 to 10 years</td>
<td>31 (16.8%)</td>
</tr>
<tr>
<td>11 to 15 years</td>
<td>27 (14.7%)</td>
</tr>
<tr>
<td>16 to 20 years</td>
<td>18 (9.8%)</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>69 (37.5%)</td>
</tr>
<tr>
<td><strong>Region of primary practice</strong></td>
<td></td>
</tr>
<tr>
<td>Western Canada (BC, AB, SK, MB)</td>
<td>40 (21.7%)</td>
</tr>
<tr>
<td>Ontario</td>
<td>106 (57.6%)</td>
</tr>
<tr>
<td>Quebec</td>
<td>18 (9.8%)</td>
</tr>
<tr>
<td>Atlantic Canada (NL, NB, NS, PE)</td>
<td>20 (10.9%)</td>
</tr>
</tbody>
</table>

Table 1. Demographic data as reported by all groups combined.
7.2.3 Demographic Data Reported by Area of Expertise

Table 2 represents all demographic data as reported by the individual PD, DA, and EP groups separately. A statistically significant difference was found in sex composition, $\chi^2 (2, n = 184) = 9.37, p = 0.009$, with DA being mostly male (76.3%), while slightly more responding EP were female (59.3%); responding PD were represented relatively equally by males and females (52.9%).

There was a statistically significant difference in the distribution of experience among the PD, DA and EP groups, $\chi^2 (8, n = 184) = 23.80, p = 0.002$. The majority of responding PD reported more than twenty years of experience (43.7%). Most DA were divided between newer graduates with five years or less of practice (28.9%) and more experienced practitioners with more than twenty years (26.3%). Thirty-seven percent of EP reported eleven to fifteen years of experience.
Most responding PD and DA practice in Ontario (60.5%; 84.2%), while of responding EP, 44.4% reported practicing in Atlantic Canada and 33.3% in Western Canada, $\chi^2 (6, n = 184) = 57.60, p < 0.001$.

Only the primary focus group, PD, were asked to report the school at which they completed their pediatric dentistry residencies. Sixty-five (55.1%) PD trained in Canadian schools, 49 (41.5%) trained in the US and four (3.4%) were internationally trained subjects.

<table>
<thead>
<tr>
<th>Descriptive Variable</th>
<th>Area of Expertise</th>
<th>$\chi^2$ test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PD n = 119</td>
<td>DA n = 38</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>56 (47.1%)</td>
<td>9 (23.7%)</td>
</tr>
<tr>
<td>Male</td>
<td>63 (52.9%)</td>
<td>29 (76.3%)</td>
</tr>
<tr>
<td><strong>Experience (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 years or less</td>
<td>26 (21.8%)</td>
<td>11 (28.9%)</td>
</tr>
<tr>
<td>6 to 10 years</td>
<td>17 (14.3%)</td>
<td>9 (23.7%)</td>
</tr>
<tr>
<td>11 to 15 years</td>
<td>10 (8.4%)</td>
<td>7 (18.4%)</td>
</tr>
<tr>
<td>16 to 20 years</td>
<td>14 (11.8%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>52 (43.7%)</td>
<td>10 (26.3%)</td>
</tr>
<tr>
<td><strong>Region of primary practice</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Western Canada (BC, AB, SK, MB)</td>
<td>26 (21.8%)</td>
<td>5 (13.2%)</td>
</tr>
<tr>
<td>Ontario</td>
<td>72 (60.5%)</td>
<td>32 (84.2%)</td>
</tr>
<tr>
<td>Quebec</td>
<td>14 (11.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Atlantic Canada (NL, NB, NS, PE)</td>
<td>7 (5.9%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td><strong>Pediatric dental residency</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian</td>
<td>65 (55.1%)</td>
<td>-</td>
</tr>
<tr>
<td>US</td>
<td>49 (41.5%)</td>
<td>-</td>
</tr>
<tr>
<td>International</td>
<td>4 (3.4%)</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 2. Demographic data reported by PD, DA and EP separately.
7.3 Treatment Facilitation Strategies

7.3.1 Reported Use of Restraint

Overall, 55.4% of all respondents reported using some form of physical restraint in practice. When comparing results from the PD, DA and EP groups individually the majority of PD (66.4%) and EP (74.1%) reported using physical restraint, while 92.1% of DA did not, $\chi^2 (2, n = 184) = 44.34, p < 0.001$ (Figure 5). Sex, experience and practice location did not appear to be significant influencing factors on whether a PD uses restraint. However, PD who trained in Canadian residency programs were significantly more likely to use restraint, $\chi^2 (2, n = 118) = 6.55, p = 0.038$ (Figure 6).

![Reported use of restraint](image)

Figure 5. Reported use of restraint in practice by PD, DA and EP, $\chi^2 (2, n = 184) = 44.34, p < 0.001$. 
Figure 6. PD reported use of restraint versus pediatric dentistry training program, $\chi^2 (2, n = 118) = 6.55, p = 0.038.$

7.3.2 Reported Use of Sedation

Of all survey respondents, 78.8% reported providing sedation forms other than nitrous oxide and oxygen sedation as an option to facilitate dental treatments in practice. Although the majority of all three groups offer sedation, significantly more DA offer this option than any other group, $\chi^2 (2, n = 184) = 7.47, p = 0.024$ (Figure 7). For PD, sex, experience and the country of training program did not influence whether sedation was utilized in practice in a statistically significant manner; however, the region in which the PD practiced did. The majority of PD practicing in Quebec did not report offering sedation as a treatment adjunct in their practices, whereas most PD elsewhere in Canada do offer sedation, $\chi^2 (3, n = 119) = 18.46, p < 0.001$ (Figure 8).
Figure 7. Reported use of sedation forms other than nitrous oxide and oxygen sedation in practice by PD, DA and EP, $\chi^2 (2, n = 184) = 7.47, p = 0.024$.

Figure 8. PD reported use of sedation forms other than nitrous oxide and oxygen sedation versus practice region, $\chi^2 (3, n = 119) = 18.46, p < 0.001$. 
7.3.3 Reported Use of GA

Overall, 88.6% of respondents reported offering GA as a treatment adjunct for dentistry. Almost all PD and DA offer GA as an option to facilitate dental treatment; however, less than half of EP reported offering GA in practice, $\chi^2 (2, n = 184) = 51.35, p < 0.001$ (Figure 9). The respondent sex, practice location or training program country did not effect whether a PD chooses to offer GA to facilitate dental treatment. PD with less experience did report the utilization of GA for treatment significantly more often than more experienced colleagues, $\chi^2 (4, n = 118) = 9.94, p = 0.041$ (Figure 10).

![Reported use of general anesthesia](image)

Figure 9. Reported use of GA in practice by PD, DA and EP, $\chi^2 (2, n = 184) = 51.35, p < 0.001$. 
Figure 10. PD reported use of GA versus practice experience, $\chi^2 (4, n = 118) = 9.94, p = 0.041$.

### 7.4 Criteria for Sedation Success

#### 7.4.1 Patient Crying During Sedation

As the minimal criterion that would still constitute a successful sedation, the overall group reported the following regarding whether their patient cried during dental treatment: 28.3% “no crying”; 67.9% “intermittent, mild crying”; 3.3% “continuous, persistent crying”; and 0.5% “hysterical crying”. There was a significant difference with respect to opinions of sedation success among the PD, DA and EP groups, $\chi^2 (6, n = 184) = 23.48, p = 0.001$. With respect to patient crying, 57.9% of DA deemed “no crying” to be a successful sedation; conversely, 76.5% of PD and 70.4% of EP accept “intermittent, mild crying” as sedation success (Figure 11). Sex, experience, practice region and training program had no significant influence on PD opinion concerning crying as a criterion for sedation success.
Figure 11. Opinions of sedation success among PD, DA and EP with respect to the criterion of patient crying, $\chi^2 (6, n = 184) = 23.48, p = 0.001$.

7.4.2 Patient Movement During Sedation

Regarding patient movements, the overall group reported the following as the minimal criterion that would still constitute a successful sedation: 11.4% “no movements”; 84.2% “controllable movements”; 3.8% “continuous movement”; and 0.5% “violent movement”. The majority of all three individual groups agreed “controllable movement” constituted a successful sedation, but a significant portion of DA (31.6%) stated that for sedation success there would have to be “no movement”, $\chi^2 (6, n = 184) = 23.42, p = 0.001$ (Figure 12). Sex, experience and practice region did not appear to significantly influence PD opinion concerning movement as a sedation criterion of success. Where a PD received pediatric training did have a statistically significant influence on what was considered a successful sedation by the respondent, $\chi^2 (6, n = 118) = 14.44, p = 0.025$. The majority of all graduates agreed “controllable movement” represented sedation success. However, 8.2% of US and 25.0% of international graduates
considered “no movement” a success, but 9.2% of Canadian graduates believed “continuous movement” still represented sedation success (Figure 13).

Figure 12. Opinions of sedation success among PD, DA and EP with respect to the criterion of patient movement, $\chi^2 (6, n = 184) = 23.42, p = 0.001.$
Figure 13. PD opinions of sedation success with respect to the criterion of patient movement versus pediatric dentistry training program, $\chi^2 (6, n = 118) = 14.44$, $p = 0.025$.

### 7.4.3 The Need for Restraint During Sedation

With regard to the need for restraint during sedation, 23.9% reported “no restraint required”; 72.8% reported “minimal or limited restraint required”; and 3.3% reported “persistent restraint required to treat with difficult interfering movements” for the PD, DA and EP groups combined. There was a significant difference with respect to opinions of sedation success among the PD, DA and EP groups, $\chi^2 (4, n = 184) = 13.03$, $p = 0.01$. The majority of PD and EP agreed “minimal or limited restraint required” would be the minimal criterion representing sedation success, but the opinions of sedation success among DA was split between “no restraint required” and “minimal or limited restraint required” (Figure 14). Sex, experience, practice region and training program had no significant influence on PD opinion concerning the need for restraint as a criterion of sedation success.
Figure 14. Opinions of sedation success among PD, DA and EP with respect to the criterion of need for physical restraint, $\chi^2 (4, n = 184) = 13.03, p = 0.01$.

7.5 Scenarios

7.5.1 Data Transformation

The final section of the survey introduced a series of common hypothetical pediatric dental emergency scenarios. For each of the scenarios, respondents were given the opportunity to select an option that best described how they would facilitate treatment in the given pediatric dental emergency scenario. If a respondent was not satisfied with the list of options provided they were able to choose the option “other” and asked to elaborate in written form. All answers were subsequently reviewed and assigned to one of the following groups for analysis: restraint; sedation; restraint and sedation; and GA.
7.5.2 Scenario One

Concerning the four year-old female patient requiring dental extractions post luxation and intrusion injuries, the overall group responded their treatment would likely be carried out using the following treatment facilitation strategies: sedation, 37.2%; sedation and restraint, 33.1%; deep sedation or GA, 16.3%; and restraint, 13.4%. Twelve of 184 respondents provided invalid answers and were excluded from this section of analysis. Comparing responses from the PD, DA and EP groups individually there was a statistically significant difference, \( \chi^2 (6, n = 172) = 49.48, p < 0.001 \). Most PD preferred to approach this case by using a combination of sedation and restraint (40.5%); over half the EP stated they would use sedation only (52.2%); and almost half the DA preferred to treat the patient under GA (47.7%) (Figure 15). The majority of PD practicing in Quebec preferred to approach treatment using restraint (76.9%), whereas the majority of PD practicing elsewhere in Canada preferred to utilize a combination of sedation and restraint or sedation alone, \( \chi^2 (9, n = 111) = 36.51, p < 0.001 \) (Figure 16). Sex, experience and training program had no significant effect on PD responses in this scenario.
Figure 15. PD, DA and EP responses regarding the ideal treatment of scenario one, $\chi^2 (6, n = 172) = 49.48, p < 0.001$.

Figure 16. PD responses regarding the ideal treatment of scenario one versus practice region, $\chi^2 (9, n = 111) = 36.51, p < 0.001$. 
7.5.3 Scenario Two

Regarding the twenty month-old male requiring a radiograph following subluxation injury of the maxillary central incisor, the overall group responded their treatment would likely be carried out using the following strategies: restraint, 75.0%; sedation, 11.6%; sedation and restraint, 11.0%; and deep sedation or GA, 2.3%. Nine of 184 respondents provided invalid answers and were excluded from this section of analysis. Comparing responses from the PD, DA and EP groups individually there was a statistically significant difference, $\chi^2 (6, n = 175) = 65.10, p < 0.001$. The majority of PD (92.0%) preferred to obtain the radiograph with restraint alone and over half the DA (55.6%) agreed with this approach. Responses from most EP were split evenly between sedation alone or sedation and restraint (37.5%), followed by those who would use restraint alone (25.0%) (Figure 17). Sex, experience, practice region and training program had no significant effect on PD responses in this scenario.

![Figure 17. PD, DA and EP responses regarding the ideal treatment of scenario two, $\chi^2 (6, n = 175) = 65.10, p < 0.001$.](image_url)
7.5.4 Scenario Three

With respect to the case of the eight year-old female requiring a pulptomy of a permanent incisor post fracture, the overall group responded their treatment would likely be carried out using the following strategies: sedation, 66.3%; deep sedation or GA, 19.4%; sedation and restraint, 9.1%; and restraint, 5.1%. Nine of 184 respondents provided invalid answers and were excluded from this section of analysis. Comparing responses from the PD, DA and EP groups individually there was a statistically significant difference, $\chi^2 (6, n = 175) = 60.10, p < 0.001$. The majority of PD and EP preferred to treat this case using sedation alone (74.8%; 70.8%), but most DA preferred to treat the patient under GA (62.2%) (Figure 18). The majority of PD practicing in Western Canada, Ontario and Atlantic Canada preferred to complete treatment using sedation as an adjunct; however, PD practicing in Quebec were split between using restraint alone (42.9%) or sedation alone (42.9%), $\chi^2 (9, n = 114) = 31.45, p < 0.001$ (Figure 19). Sex, experience and training program had no significant effect on PD responses in this scenario.
Figure 18. PD, DA and EP responses regarding the ideal treatment of scenario three, $\chi^2 (6, n = 175) = 60.10, p < 0.001$.

Figure 19. PD responses regarding the ideal treatment of scenario three versus practice region, $\chi^2 (9, n = 114) = 31.45, p < 0.001$. 
Treatment Facilitation Strategies Offered by PD in Practice Versus PD Answers to Scenarios

**Restraint:**

Most PD who reported using restraint in practice preferred to treat the patient in scenario one using a combination of restraint and sedation (54.7%), but those who do not use restraint in practice chose to treat the case with sedation alone (52.8%), $\chi^2 (3, n = 111) = 19.54, p < 0.001$.

There was no significant difference in the observed responses to scenario two as most PD responded they would treat scenario two using restraint alone whether they did or did not use restraint in practice.

Regarding scenario three, most (80.3%) of PD using restraint in practice preferred to treat the child using sedation alone, followed by sedation and restraint (13.2%). Those PD who do not use restraint in practice chose to ideally treat the patient with sedation alone (63.2%) followed by restraint alone (15.8%) and deep sedation or GA equally (15.8%), $\chi^2 (3, n = 175) = 13.24, p = 0.004$ (Table 3).
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Strategy chosen to ideally provide treatment</th>
<th>Do you use physical restraint in your practice?</th>
<th>$\chi^2$ test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
</tr>
<tr>
<td>One n = 111</td>
<td>Restraint</td>
<td>16.0%</td>
<td>27.8%</td>
</tr>
<tr>
<td>One n = 111</td>
<td>Sedation</td>
<td>26.7%</td>
<td>52.8%</td>
</tr>
<tr>
<td>One n = 111</td>
<td>Sedation &amp; Restraint</td>
<td>54.7%</td>
<td>11.1%</td>
</tr>
<tr>
<td>One n = 111</td>
<td>Deep Sedation &amp; GA</td>
<td>2.7%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Two n = 112</td>
<td>Restraint</td>
<td>90.5%</td>
<td>94.7%</td>
</tr>
<tr>
<td>Two n = 112</td>
<td>Sedation</td>
<td>2.7%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Two n = 112</td>
<td>Sedation &amp; Restraint</td>
<td>5.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Two n = 112</td>
<td>Deep Sedation &amp; GA</td>
<td>1.4%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Three n = 114</td>
<td>Restraint</td>
<td>3.9%</td>
<td>15.8%</td>
</tr>
<tr>
<td>Three n = 114</td>
<td>Sedation</td>
<td>80.3%</td>
<td>63.2%</td>
</tr>
<tr>
<td>Three n = 114</td>
<td>Sedation &amp; Restraint</td>
<td>13.2%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Three n = 114</td>
<td>Deep Sedation &amp; GA</td>
<td>2.6%</td>
<td>15.8%</td>
</tr>
</tbody>
</table>

Table 3. The use of physical restraint by PD in practice versus PD answers to scenarios.

**Sedation:**

PD respondents who reported using sedation in practice choose to treat scenario one with sedation and restraint (47.1%), but those not using sedation in practice mostly opted to treat the case with restraint alone (46.2%), $\chi^2 (3, n = 111) = 15.90, p = 0.001$. 


There was no significant difference in the observed responses to scenario two as most PD responded they would treat scenario two using restraint alone whether they did or did not use sedation in practice.

Both PD who report using sedation in practice and those who do not mostly choose to ideally treat scenario three with sedation alone (76.7%; 67.9%), $\chi^2 (3, n = 114) = 9.87, p = 0.02$ (Table 4).
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Strategy chosen to ideally provide treatment</th>
<th>Do you offer sedation forms other than nitrous oxide and oxygen sedation in your practice?</th>
<th>χ² test df = 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>One n = 111</td>
<td>Restraint</td>
<td>11.8%</td>
<td>46.2%</td>
</tr>
</tbody>
</table>
| | Sedation | 36.5% | 30.8% | $P = 0.001$
| | Sedation & Restraint | 47.1% | 19.2% | |
| | Deep Sedation & GA | 4.7% | 3.8% | |
| Two n = 112 | Restraint | 90.5% | 96.4% | |
| | Sedation | 4.8% | 0.0% | $P = 0.626$
| | Sedation & Restraint | 3.6% | 3.6% | |
| | Deep Sedation & GA | 1.2% | 0.0% | |
| Three n = 114 | Restraint | 3.5% | 21.4% | |
| | Sedation | 76.7% | 67.9% | $P = 0.020$
| | Sedation & Restraint | 11.6% | 7.1% | |
| | Deep Sedation & GA | 8.1% | 3.6% | |

Table 4. The use of sedation forms other than nitrous oxide and oxygen sedation by PD in practice versus PD answers to scenarios.

**General Anesthesia:**

There was no significant relationship observed between the use of GA in practice and treatment of any scenario presented to PD respondents. PD chose to ideally treat the patient in
scenario one with sedation and restraint followed by sedation whether GA was offered in the practice or not.

Most PD responded they would treat scenario two using restraint alone whether they did or did not offer GA in practice.

PD chose to ideally treat scenario three with sedation whether GA was offered in the practice or not (Table 5).
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Strategy chosen to ideally provide treatment</th>
<th>Do you offer deep sedation or GA in your practice?</th>
<th>$\chi^2$ test df = 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>One n = 111</td>
<td>Restraint</td>
<td>20.0%</td>
<td>16.7%</td>
</tr>
<tr>
<td></td>
<td>Sedation</td>
<td>35.2%</td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td>Sedation &amp; Restraint</td>
<td>40.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>Deep Sedation &amp; GA</td>
<td>4.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Two n = 112</td>
<td>Restraint</td>
<td>91.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td></td>
<td>Sedation</td>
<td>3.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Sedation &amp; Restraint</td>
<td>3.8%</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Deep Sedation &amp; GA</td>
<td>0.9%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Three n = 114</td>
<td>Restraint</td>
<td>8.3%</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td>Sedation</td>
<td>74.1%</td>
<td>83.3%</td>
</tr>
<tr>
<td></td>
<td>Sedation &amp; Restraint</td>
<td>10.2%</td>
<td>16.7%</td>
</tr>
<tr>
<td></td>
<td>Deep Sedation &amp; GA</td>
<td>7.4%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Table 5. The use of general anesthesia by PD in practice versus PD answers to scenarios.
Chapter 8

8 Discussion

The final overall survey response rate was 48.2% (209/434), comprised of 48.3% (128/265), 73.6% (39/53) and 34.5% (40/116) of PD, DA, and EP respectively. After taking into account exclusion criteria, 184 (42.4%) subjects were included in the analysis representing 119 (44.9%) PD, 38 (71.7%) DA and 27 (23.3%) EP.

Response rates to online surveys vary greatly, but in general have been estimated to be in the region of 10 to 15%, with 20 to 30% being a good response rate\textsuperscript{71,72}. A recent online survey of AAPD members reported a response rate of 19.3% and found it to be comparable to other online surveys of the same population\textsuperscript{17,73,74,75}. When compared to current literature, the response rate in the present study is considered good overall and by individual PD, DA and EP groups.

The email addresses of PD and DA were obtained from their respective national dental associations. As a result, PD and DA received direct, personalized emails and the survey was resent weekly a total of three times to non-responders. We were unable to obtain direct emails for Canadian EP. Instead, contact information for EP department chiefs was obtained from publicly accessible websites. Out of a possible fifteen Canadian hospital pediatric emergency departments identified, only six department chiefs responded to our request to participate. We relied on pediatric emergency department chiefs to distribute the survey on our behalf as hospital policies precluded the distribution of staff email addresses. Requests for survey participation could not be personalized and the survey was only distributed one time. This may explain the significantly lower EP response rate compared to those of PD and DA.

The demographic distribution varied significantly among the PD, DA and EP groups. The distribution of male versus female responders within the PD and EP groups was not statistically
different. However, most DA responders were of the male sex, reflecting the male predominance of this specialty according to the Canadian Academy of Dental Anesthesia membership roster.

Most PD reported having more than twenty years of experience, followed by those with less than five years of experience. The practice experience of DA was more evenly distributed, though there were fewer practitioners with sixteen to twenty years of experience. Experience of EP was also relatively even with most responders reporting between six and fifteen or greater than twenty years of experience.

The majority of PD and DA respondents reported practicing in Ontario. With respect to DA, this observation may be attributed to Ontario being the only province where dental anesthesia is a recognized specialty, making it more appealing to practice in this region versus elsewhere in Canada. Ontario is also the location of the sole Canadian training program in Dental Anesthesiology. Until recent years, Ontario and Quebec were home to the only Canadian pediatric dentistry training programs in Canada. It is likely that many graduates of these programs are from the same province in which the school is located as it is convenient and less expensive to attend a school close to home. It is also possible that these same graduates chose to stay in the same region to work after graduation because of familiarity with the area or vicinity to their family members. This reasoning however does not explain the low response rate from the region of Quebec. French is the official language in Quebec. The survey was distributed in English only; therefore, a lack of an equivalent French language survey may have dissuaded respondents in Quebec from responding. The overall low response rate among EP accounts for the low number of respondents across all regions.

PD were the only group asked to report the institution where they completed training in pediatric dentistry. Just over half of PD trained in Canada, followed closely by those who were trained in US schools. There were only four respondents who trained in international programs.
Approximately two-thirds of PD and three-quarters of EP reported using some form of physical restraint in practice. This question was purposely left open to interpretation in the survey and therefore the definition of restraint between practitioners may vary from light hand holding by a parent to the use of a device to physically restrain the patient. No matter the definition, the majority of DA reported not using any physical restraint in practice.

Although the majority of all three groups reported to offer sedation forms other than nitrous oxide and oxygen sedation in practice, significantly more DA reported to offer various forms of sedation in practice. This finding likely reflects DA comfort with administration of sedation due to more extensive training in this area.

Almost all PD and DA offer GA as a treatment adjunct for patients, however, less than half of EP offer this option. EP may not offer GA as a treatment adjunct simply due to the fact that hospital general anesthesia is usually carried out in operating rooms as opposed to the emergency department. Although EP can also arrange for treatment to be carried out under GA in an operating room, the majority of our EP respondents may feel that operating room time should be reserved for emergencies necessitating larger, more extensive surgeries.

Based on rating scales developed by Houpt and Nathan, survey respondents were asked to identify the minimal criteria that would constitute a successful sedation with regard to their patient crying, moving or requiring restraint. There was a significant difference in what DA considered sedation success compared to PD and EP. The majority of PD and EP agreed “mild, intermittent crying”, “controllable movement”, and “minimal or limited restraint required” were the minimal criteria to deem sedation successful. Over half of DA agreed “controllable movement”, and “minimal or limited restraint required” could be tolerated as the minimal criteria of a successful sedation. However, the majority of DA felt there should be “no crying” in a successfully sedated patient. One-third of DA believed there should be “no movement”, and just
under half felt “no restraint required” is what would represent a successful sedation. DA are trained to administer all forms of sedation up to and including GA in practice. PD have less training and experience with pharmacological interventions. The drugs, combination of drugs, routes and depth of sedation a PD can provide also varies depending on the rules set by the regulatory body in the province they work. EP are also limited in the sedation they can provide for patients depending on the policies in the hospital they work and their respective sedation training and experience. Many hospitals also utilize sedation teams, possibly limiting sedation experience of individual EP. The fact that PD and EP are able to tolerate more crying, movement and use of restraint and still deem sedation a success could reflect the limitations of the sedation they are able to administer.

Hypothetical scenarios were included in the survey to ascertain how PD, DA and EP would likely handle specific emergency treatment. Scenarios were carefully crafted to reflect situations any of the groups of interest may have come in contact with. Scenario one and three both introduced anxious patients requiring invasive dental interventions. In both scenarios the majority of PD chose to ideally treat the patients using a combination of sedation and restraint or sedation alone. The majority of EP chose to treat both patients with sedation alone, while DA preferred to treat the cases under GA. PD are experts in their field when it comes to non-pharmacological techniques to facilitate pediatric dental treatment. In medicine, EP are constantly faced with situations where anxious children require invasive interventions. PD and EP likely feel more comfortable treating consciously sedated patients than DA and thus would choose to treat these scenarios as such. In contrast to EP, PD may be more likely to use restraint because the depth of sedation and drugs they may safely use are not as extensive and may be more limited in effect. DA are the only group where all members would have ready access to GA facilities. Therefore, the majority of DA may have chosen to treat these scenarios under GA.
because of ease of access to GA facilities and lack of comfort with non-pharmacological behavior management.

Scenario two was purposely presented to respondents as the required intervention of a radiograph was a relatively quick, non-invasive treatment that would not evoke pain. Almost all PD and over half of DA chose to ideally treat this patient by using restraint alone. The majority of the EP group was split evenly between providing treatment with sedation alone, or a combination of sedation and restraint. Perhaps this significant difference in opinions between the dental groups and physicians reflects a different understanding of the treatment necessary or it may reflect a reluctance of EP to restrain patients without the use of sedation in order to mitigate untoward psychological sequelae.34,35,50

In the present study, the sex of PD had no statistically significant relationship with regard to treatment adjuncts offered in practice, opinions on sedation success or how respondents answered the hypothetical scenarios. This was in contrast to previous studies of PD practicing elsewhere that did find significant differences between the sexes with respect to providing pediatric dental treatment. Male PD in Israel were more likely to use restraint and general anesthesia in order to facilitate dental treatment65. Females in a North American cohort were more likely to use immobilization devices on non-sedated children, but older males were more likely to employ HOM.11

Graduation year was used as a surrogate for practice experience with the assumption that more recent graduates likely have less experience than those who had graduated in previous decades. The present study found PD with less experience offer GA more often than more experienced PD. This is similar to previous studies in which young North American PD with presumably less experience were more likely to use sedation and GA than their older, more experienced counterparts.11,17
Previous studies observed that utilization of sedation by PD for dental treatment varied between US regions\textsuperscript{16,66,67}. A similar finding was observed in the present study. The majority of PD practicing in Quebec did not report offering sedation, whereas most PD practicing elsewhere in Canada do offer sedation in their practices. When responding to the first and third hypothetical scenarios, significantly more PD in Quebec reported they would ideally use restraint alone to carry out emergency dental treatment. This was in contrast to PD practicing in other regions who reported ideally using sedation alone or in combination with restraint.

PD graduating from Canadian residency programs were significantly more likely to utilize restraint in their respective practices than their US or internationally trained counterparts. When asked about the minimal criteria for a successful sedation, the majority of all PD deemed “controllable movement” a success. A small number of Canadian graduates reported they would tolerate “continuous movement” during sedation and still consider it a success; however, some US and international graduates stated sedation would only be deemed successful if there was “no movement” while treating the patient. These differences likely reflect differences in philosophies and teaching of behavior management in pediatric dentistry training programs. Studies in the US found PD were more likely to use the treatment strategies they were taught in residency and the teaching of behavior management varied among programs\textsuperscript{13,16,17}. 
Chapter 9

9 Conclusions

1. DA and EP are less likely than PD to utilize restraint alone in the treatment of pediatric dental patients, especially when the treatment involved is invasive ($p < 0.001, p < 0.001$).

2. PD with less experience provided GA as a treatment facilitation strategy in their practices more often than more experienced PD ($p = 0.041$).

3. PD practicing in Quebec and those PD graduating from Canadian training programs were significantly more likely to choose restraint as a preferred dental treatment facilitation strategy than their colleagues ($p < 0.001; p = 0.038$).
Chapter 10

10 Clinical Relevance

1. Canadian PD utilize restraint alone as a dental treatment facilitation strategy more often than their Canadian DA and EP counterparts,

2. Pediatric dentistry training programs should continue to evolve and improve pharmacological behavior management teaching in order to produce graduates who feel comfortable providing these treatment facilitation strategies in order to improve patient care,

3. With improved sedation training and experience in pediatric dentistry programs, pediatric dentists may opt to use a greater array of drugs, combinations of drugs, dosages and routes to allow for the safe administration of more effective sedation
References


62. SickKids Drug Handbook and formulary


OTHER REFERENCES:


Manuscript References


Appendix 1

Confidential

Variation in behaviour management strategies for treatment of pediatric dental patients

Thank you for choosing to participate in this survey, it should take no longer than 5 minutes to complete.

Informed Consent Form

Research Procedures
The purpose of this research is to identify differences in stated preferences regarding current treatment approaches and responses to hypothetical clinical scenarios by healthcare practitioners who provide care for children requiring dental interventions. If you agree to participate, the questions in this survey will take approximately five minutes to answer.

Risks
There are no foreseeable risks for participating in this research.

Benefits
There are no benefits to you as a survey respondent.

Confidentiality
The data in this study will be confidential. Participants will provide informed consent by you clicking "Yes" below, completing and submitting the survey. Names and other identifiers will not be placed on surveys or other research data.

Participation
If you wish to participate, click the "Yes" button below. If you do not wish to participate, click the "No" button below. Your decision to not take part in this study will not affect your employment.

Contact
This research is being conducted by Dr. Michael J. Casas, Director of Clinics, Department of Dentistry, The Hospital for Sick Children (Primary Investigator) and Gabriella Garisto a pediatric dental masters student. Dr. Casas may be contacted at michael.casas@sickkids.ca should you have any questions or to report a research-related problem.

This research has been reviewed according to the SickKids Research Ethics Board procedures governing your participation in this research. If you have any questions or comments regarding your rights as a survey participant you may contact the Research Ethics Board main office at 416-813-8279.

By clicking "Yes", you consent that you are willing to answer the questions in this survey.  

☐ Yes
☐ No
## Area of Expertise

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your area of expertise?</td>
<td>☐ Pediatric Emergency Medicine</td>
</tr>
<tr>
<td></td>
<td>☐ Pediatric Dentistry</td>
</tr>
<tr>
<td></td>
<td>☐ Dental Anesthesia</td>
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<tr>
<td>Does your hospital have an active dental service?</td>
<td>☐ Yes</td>
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<td></td>
<td>☐ No</td>
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<tr>
<td></td>
<td>☐ Not sure</td>
</tr>
<tr>
<td>Do you treat patients under the age of 12?</td>
<td>☐ Yes</td>
</tr>
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<td></td>
<td>☐ No</td>
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</tbody>
</table>
### Demographics

What is your gender?

- [ ] Female
- [ ] Male
In what year did you complete your residency?

- 2014
- 2013
- 2012
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- 1951
- 1950
At what school did you complete your residency in pediatric dentistry?

In what province is your primary practice located?

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland & Labrador
- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Quebec
- Saskatchewan
- Yukon
- I do not practice in Canada
### Behaviour Management Strategies

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you use physical restraint in your practice?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you offer sedation forms other than nitrous oxide and oxygen sedation as an option to facilitate dental treatment in your practice?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you offer general anesthesia as an option to facilitate dental treatment in your practice?</td>
<td></td>
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</tr>
</tbody>
</table>
## Criteria for Sedation Success

| With respect to the patient crying, which of the following do you feel represents a successful sedation? | □ No crying  
□ Intermittent, mild crying  
□ Continuous, persistent crying  
□ Hysterical crying  
(Please select all that apply) |
| --- | --- |
| With respect to the patient's movements, which of the following do you feel represents a successful sedation? | □ No movement  
□ Controllable movement  
□ Continuous movement  
□ Violent movement  
(Please select all that apply) |
| With respect to the need for physical restraint, which of the following do you feel represents a successful sedation? | □ No restraint required  
□ Minimal or limited restraint required  
□ Persistent restraint required to treat with difficult interfering movements  
(Please select all that apply) |
Scenarios

The following three questions will assess how you would likely facilitate treatment in hypothetical paediatric dental emergency scenarios.

The following three questions will assess how you would likely facilitate treatment in hypothetical paediatric dental emergency scenarios where you may be asked to collaborate with a hospital dentist.

A 4-year-old healthy female fell in the playground this morning injuring her two front teeth. The patient presents with a lingually displaced right maxillary central incisor and a lingually/superiorly displaced maxillary central incisor. The child has not had anything to eat since the incident due to pain, but has been drinking water and apple juice periodically. At three years of age the patient had a primary molar extracted on an emergency basis due to an associated facial swelling. Since the extraction, the patient has become extremely anxious about visiting the dentist. She cooperates fully when a radiograph is taken, but is trembling and teary-eyed. The parents consent to the extraction of both maxillary incisors, understand the procedure will involve administration of local anesthetic and are amenable to treatment facilitation strategies as presented by you.

A 4-year-old healthy female fell in the playground this morning injuring her two front teeth. The patient presents with a lingually displaced right maxillary central incisor and a lingually/superiorly displaced maxillary central incisor. The child has not had anything to eat since the incident due to pain, but has been drinking water and apple juice periodically. At three years of age the patient had a primary molar extracted on an emergency basis due to an associated facial swelling. Since the extraction, the patient has become extremely anxious about visiting the dentist. She cooperates fully when a radiograph is taken, but is trembling and teary-eyed. The parents consent to the extraction of both maxillary incisors, understand the procedure will involve administration of local anesthetic and are amenable to treatment facilitation strategies as presented by you and the treating dentist.
Confidential

Please select the answer that best describes how you would likely facilitate treatment in this pediatric dental emergency scenario:

- Papoose board / PediWrap (or similar device)
- Oral sedation
- Oral sedation in conjunction with physical restraint
- Deep sedation or General anesthesia
- Parent holding the child still
- Intranasal sedation
- Intranasal sedation in conjunction with physical restraint
- Parenteral conscious sedation
- Parenteral conscious sedation in conjunction with physical restraint
- Nitrous oxide and oxygen sedation
- Nitrous oxide and oxygen sedation in conjunction with physical restraint
- Patient wrapped in a bed sheet or blanket
- Other (please specify)

(Please specify.)

A healthy 20 month-old male has injured his maxillary central incisor by hitting it on a coffee table. A brief visual exam was possible in the knee-to-knee position with the child’s father. Intraoral examination reveals a superficial gingival laceration, minimal bleeding in the gingival sulcus, some mobility, but no major displacement of the tooth. This is the patient’s first visit to see a dentist and he is crying and flailing his arms and legs. The tooth is not interfering with occlusion and the parents wish to leave the tooth in situ and agree to periodic follow-up visits. Although no invasive treatment will be rendered today, a radiograph is indicated in order to rule out the possibility of root fracture and provide a baseline for future follow-up. The patient is sore and reluctant to sit still or to let anyone near his mouth, but the parents are very motivated to have the radiograph taken today and are amenable to treatment facilitation strategies as presented by you.
A healthy 20 month-old male has injured his maxillary central incisor by hitting it on a coffee table. A brief visual exam was possible in the knee-to-knee position with the child's father. Intraoral examination reveals a superficial gingival laceration, minimal bleeding in the gingival sulcus, some mobility, but no major displacement of the tooth. This is the patient's first visit to see a dentist and he is crying and flailing his arms and legs. The tooth is not interfering with occlusion and the parents wish to leave the tooth in situ and agree to periodic follow-up visits. Although no invasive treatment will be rendered today, a radiograph is indicated in order to rule out the possibility of root fracture and provide a baseline for future follow-up. The patient is sore and reluctant to sit still or to let anyone near his mouth, but the parents are very motivated to have the radiograph taken today and are amenable to treatment facilitation strategies as presented by you and the treating dentist.

Please select the answer that best describes how you would likely facilitate treatment in this pediatric dental emergency scenario:

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- Nitrous oxide and oxygen sedation in conjunction with physical restraint
- Patient wrapped in a bed sheet or blanket
- Other (please specify)

(Please specify.)
An 8-year-old female has sustained a horizontal fracture of a permanent upper left central incisor resulting in a pulp exposure. All other soft and hard tissue structures are unaffected. A partial pulpotomy is indicated. The patient has infrequently visited a dentist for check-ups, but as these visits had never gone well, her mother has been reluctant to return her for recalls. The patient has never had treatment requiring local anesthetic, but has been informed by her older brother that “needles really hurt”. As a result, the patient is quite nervous about the impending treatment and was quite on edge during the exam. The mother consents to the treatment, understands the procedure will involve administration of local anesthetic and is amenable to treatment facilitation strategies as presented by you.
Confidential

Please select the answer that best describes how you would likely facilitate treatment in this pediatric dental emergency scenario:

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- Oral sedation
- Oral sedation in conjunction with physical restraint
- Deep sedation or General anesthesia
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- Patient wrapped in a bed sheet or blanket
- Other (please specify)

Other

(Please specify.)