**Trauma in Young Permanent Teeth: Factors Associated with Adverse Outcomes**

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**Abstract**

# Trauma in Young Permanent Teeth: Factors Associated with Adverse Outcomes

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**Purpose:** To determine variables associated with adverse outcomes for dental trauma in young anterior permanent teeth in a university dental clinic setting.

**Methods:** Electronic charts (AXIUM) of patients at a university-based dental clinic who experienced dental trauma between July 1, 2009 and June 30, 2012 were included. Variables such as demographics (age, gender, American Society of Anesthesiologists classification, and insurance type), affected teeth distribution, trauma characteristics, type of dental trauma using Andreasen's classification, elapsed time between trauma and immediate treatment, elapsed time between the immediate and final treatment, immediate treatment type, immediate and final restoration type, and number of follow-up visits were evaluated. Adverse outcomes were defined as root canal treatment, decoronation, and extraction. The association between adverse outcomes and each variable of interest was calculated using the Chi Square test, Fisher's Exact Test, and logistic regression.

**Results:** A database of approximately 1265 charts was screened and 50 patients; [age range 7–18 years (mean, 11 years (SD, 3.13)); 32 (64 %) males and 18 (36%) females] were included in this

study. The maxillary central incisors were most commonly affected by dental trauma (90%). Adverse outcomes were significantly associated with the type of dental trauma ($P = 0.001$), presence of luxation injury ($P = 0.048$), immediate dental treatment ($P < 0.001$), immediate dental restoration type ($P = 0.019$), and number of follow-up visits ($P < 0.001$). Teeth with complicated crown fractures had a greater than 8-times increase in the odds of future adverse outcomes (OR: 8.56; 95% CI: 1.48, 49.35) compared with uncomplicated crown fractures, while the odds for adverse outcomes for teeth without fracture was14 times higher than teeth with uncomplicated crown fractures (OR: 14.67; 95% CI: 1.54, 139.79). The odds of an adverse event when placing a dental restoration at the emergency visit is 0.08 times that of no dental treatment (OR: 0.08; 95% CI: 0.01, 0.54). Specifically, the odds of an adverse event when placing a filling at the emergency visit is 0.21 times the odds of an adverse event with no dental treatment (OR: 0.21; 95% CI: 0.06, 0.75). Patients who come back for more than three times for follow-up visits showed more than nine times higher odds of having an adverse outcome compared with patients who come back for two visits or less (OR: 9.17; 95% CI: 2.00, 42.04).

**Conclusions:** Not treating dental trauma in a timely manner in young permanent teeth might severely impact a good prognosis for the injured tooth. In a university dental clinic setting, the factors associated with adverse outcomes in young permanent teeth after dental trauma were the type of dental trauma, presence of luxation injury, type of immediate dental treatment, type of immediate dental restoration, and number of follow-up visits.

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## ACKNOWLEDGEMENTS

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## DEDICATION

I dedicate this thesis to my wife, Nesreen, and my daughters, Lojain, Jana, and Talya for their continuous support and love. I deeply appreciate all the sacrifices that they have made over the last two years and making this achievement possible. I also dedicate this thesis to my parents, who are the reason for who I am today.

## Introduction

The occurrence of dental trauma in permanent teeth is a common event worldwide (1). Children and adolescents are most frequently affected, and two-thirds of all dental trauma are found among these populations (2, 3). In fact, traumatic dental injuries amongst children and adolescents can be as high as 58% in some populations, with the anterior permanent teeth being the most affected (1, 4-6).

Dame-Teixeira et al. carried out an extensive study in which approximately 1500 12-year-old children attending over 33 state and private schools in Brazil were evaluated. The prevalence of dental trauma was 34.79%, and male children from a low socio-economic status were more likely to be affected by traumatic dental injury (5). In the United Kingdom, Marcenes et al, reported a dental injury prevalence of 23.7% in 2242 fourteen-year-old children. Similar to the Brazilian study, being male, coming from a lower socio-economic status, and living in an overcrowded household increased the risk of dental injuries (7). In the United States, a study based on NHANES data in 1988–91 showed that approximately 25% of the American population aged 6–50 years had at least 1 traumatized permanent incisor (4).

The consequences of dental trauma vary based on the trauma type, the dental age at which the injury occurred, and the management of the trauma. One of the challenges in managing dental trauma is that a number of different injury types involving the tooth and the supporting structures exist (8). Several methods have been proposed for classifying dental trauma, and Andreasen's dental trauma classification is the most commonly used and has been accepted worldwide (3, 9).

The dental age of the traumatized tooth may impact its prognosis. The stage of root development at the time of injury appears to be associated with pulp healing only in cases of crown fracture with concomitant luxation injury, and immature teeth have a greater rate of pulp revascularization (10). Andreasen et al. followed 400 intra-alveolar root fractures and assessed the factors associated with successful healing. The authors reported that young age, immature root formation, and positive pulp sensibility at the time of injury were positively associated with pulpal healing and hard tissue repair (11).

One of the main goals when managing dental injuries is to preserve the vitality of the dental pulp. Studies have shown an increased risk of pulp necrosis when crown fractures are concomitant with luxation injuries (10, 12-15). This is even more challenging when pulp exposure is present. Pulpal healing does not occur spontaneously and, if left untreated, pulp necrosis may occur. For this reason, different dental procedures such as simple restorations, direct pulp capping, or Cvek pulpotomy can be involved (16-21). Direct pulp capping is a well-established method of treatment in which the exposed dental pulp is covered with a material that protects the pulp from additional injury and permits healing and repair while maintaining pulp vitality (22, 23). Mineral trioxide aggregate (MTA) and calcium hydroxide are the 2 commonly used materials for direct pulp capping. However, recent studies have shown that MTA has superior characteristics and better biocompatibility compared to calcium hydroxide (24-28). A recent study suggested that MTA has higher levels of activation when it is placed in direct contact with the dental pulpal cells such as in a direct pulp cap procedure, which in turn could be translated into more effective pulpal repair and faster and more predictable formation of a dentinal bridge (29, 30). Direct pulp caps and pulpotomies promote normal development of the root complex in teeth with incomplete root formation. Compared to apexification, these

treatments have long-term prognostic advantages: a high quantity of tooth structure is formed and its composition appears to have greater structural integrity (18). The type of restoration following dental trauma may impact the tooth's future prognosis. Broken dental restorations may occur as a result of inadequate retention to maintain the function and esthetic of the traumatized tooth. A study that followed teeth for five years after trauma found that loss of pulp vitality of the tooth usually occurs within the first six months after a restoration is placed (31).

The response to traumatic dental injuries is often associated with the level of dental pulp tissue damage (12-15, 32). The possible reactions of the pulp tissue include reversible or irreversible pulpitis and pulp necrosis or pulp canal obliteration, while adverse outcomes such as root canal treatment, decoronation, apexification, and dental extraction may be indicated. Andersson et al. found that an ankylosed root will be resorbed and replaced by bone at a higher rate in patients aged 8–16 years compared to older patients (33). Decoronation is a procedure that may be used at an early age to preserve the alveolar ridge bone structure and to overcome the adverse consequences of ankylosis, which could compromise a future implant or prosthetic treatment (34-37).

**Purpose**

The main purpose of this study was to determine the variables associated with adverse outcomes in dental trauma in young anterior permanent teeth in the setting of a university dental clinic. Because different populations have different characteristics, we sought to describe the pediatric dental population who experienced dental trauma in permanent teeth and attended our university pediatric dental clinic. We will compare the similarities and differences in this population to other worldwide populations and will simultaneously create our own database for future research purposes.

## Materials and Methods

The study protocol was reviewed and approved by the University of Washington Institutional Review Board. Inclusion criteria were patients 7–18 years old with a history of a traumatized permanent tooth who were treated in our university pediatric dental clinic for over a three-year period. All electronic charts at a university-based dental clinic for patients who experienced dental trauma in anterior permanent teeth between July 1, 2009, and June 30, 2012, were included in this study. The current electronic chart notes software of the dental school (AXIUM) was used. Follow-up appointments scheduled through December 2012 were obtained. Chart notes were reviewed by a single dentist to assess detailed information regarding the dental trauma to the permanent anterior teeth, any treatment rendered, and the follow-up visits.
The following variables were collected: age, gender, American Society of Anesthesiologists (ASA) classification, type of dental insurance (as a proxy for socio-economic status), type of dental trauma using Andreasen's classification, tooth location, stage of root development (using the Nolla scale) (38), elapsed time between the trauma and the immediate treatment, elapsed time between the immediate and final treatment, type of immediate treatment (pulp therapy, restorative only, splinting, or none), type of immediate and final restoration (filling, crown, or none), and number of follow-up visits. Adverse outcomes were defined as root canal treatment, decoronation, or extraction.

### Statistical analysis

Collected data were entered into a spreadsheet in Microsoft Excel 2010 ® designed for this project and were subsequently imported into a statistical software package (STATA 12 ®) for analysis. Descriptive statistics were calculated for all data collected. The associations between

adverse outcomes and the variables of interest (age, gender, ASA type, number of follow-up visits, type of dental insurance, type of dental trauma, tooth location, stage of root development, presence of luxation and displacement injury, elapsed time between the trauma and the immediate treatment, type of immediate treatment, type of restoration, and elapsed time between the immediate and final treatment) were calculated using a Chi Square test and Fisher's Exact Test. Bivariate logistic regression was performed for variables that were found to be associated with adverse outcomes in order to determine the impact of the association within categories. The significance level was set at five percent.

## Results

After reviewing approximately 1265 electronic dental charts, 50 patients were selected for this study. The mean and median ages were 11.1 (SD, 3.13) and 10 (range, 7–18) years, respectively. Males accounted for 64% of the patients and most patients were ASA classification type I (74%). Thirty patients had three or more follow up visits (60%), and most of the study sample (35 patients, 70%) had state insurance. Adverse outcomes (namely, root canal treatment and decoronation) were found in 50% of the cases. Neither broken restorations nor dental extractions occurred in our sample set **(Table 1)**.

The teeth most commonly affected by dental traumatic injuries were the maxillary central incisors (90%). The most common type of dental trauma was uncomplicated enamel and dentin fracture without pulp exposure (62%). Luxation injuries were present in only half of the cases. The stage of root development was not significantly associated with adverse outcomes ($P$ = 0.532) **(Table 2).**

A few cases (16%) underwent direct pulp capping by either MTA or calcium hydroxide. The immediate treatment in 62% of the cases was a filling (conventional and flowable resin or glass ionomer restoration), which did or did not involve pulp therapy; a crown was placed in 2% of the cases and another treatment like splinting (luxated teeth) was used in 36% of the cases **(Table 3).**

Adverse outcomes were significantly associated with the type of dental trauma ($P$ = 0.001), presence of luxation injury ($P$ = 0.048), immediate dental treatment ($P$ < 0.001), type of immediate dental restoration ($P$ = 0.019), and the number of follow up visits ($P$ < 0.001) (**Tables 2 and 3**).

We found that teeth with complicated crown fractures have more than an eight times increase in the odds of future adverse outcomes [odds ratio (OR): 8.56; 95% confidence interval (CI): 1.48, 49.35] compared with uncomplicated crown fractures, while the odds for adverse outcomes for teeth without fracture was14 times higher than teeth with uncomplicated crown fractures (OR: 14.67; 95% CI: 1.54, 139.79). The odds of an adverse event when placing a dental restoration at the emergency visit is 0.08 times the odds of an adverse event with no dental treatment (OR: 0.08; 95% CI: 0.01, 0.54). Specifically, The odds of an adverse event when placing a filling at the emergency visit is 0.21 times the odds of an adverse event with no dental treatment (OR: 0.21; 95% CI: 0.06, 0.75). Patients who come back for more than three times for follow-up visits showed more than nine times higher odds of having an adverse outcome compare to patients who showed up for one or two follow up visits (OR: 9.17; 95% CI: 2.00, 42.04) **(Table 4).**

**Discussion:**

Consistent with the current dental trauma literature, our study shows that a male with an injury to the maxillary central incisor is the most common type of patient with a traumatized tooth. The prevalence of trauma to the maxillary central incisors was about 90% in our study, while the national level is approximately 60% (1, 4, 6). A possible reason for this discrepancy is that our university pediatric dental clinic does not offer care after hours. Instead, our postgraduate students see emergency cases at the nearby local hospital. Therefore, full data regarding after-hours dental trauma patients may not be captured within our database.

The chance of preserving pulp vitality in a crown fracture with or without pulp exposure in the absence of concomitant luxation injuries is up to 99% (10). On the other hand, luxation and displacement injuries such as lateral luxation, extrusion, and intrusion injuries compromise the blood and nerve supply of the pulp. This increases the chance of pulp necrosis in 40–93% of cases, depending on the type of injury and the stage of root development (14, 15). These findings are similar to our study, in which 64% of the cases with adverse outcomes had combined luxation injuries and crown fractures ($P = 0.048$). We observed that a lack of fracture after dental trauma was significantly associated with adverse outcomes (OR: 14.67; 95% CI: 1.54, 139.79). A possible explanation for this observation is that a concomitant luxation injury causes the periodontal tissues to absorb the energy of the impact fully in the absence of tooth fracture; this consequently compromises the blood and nerve supply, which could lead to pulp necrosis.

Similar to our study, Lauridsen et al. did not find a significant association between the stage of root development and pulp necrosis among concomitant luxation injuries and crown fractures ($P = 0.532$) (14). These findings are discrepant with previous studies that demonstrated a higher

incidence of adverse events when the root apex was mature compared with immature root development (10-13). A possible explanation for this discrepancy is the limited number of teeth in both studies.

In the past, dentin coverage using a liner, base, or dental restoration soon after dental trauma in uncomplicated crown fractures to prevent bacterial penetration to the pulp was a common practice (3). Current research has demonstrated that maintaining pulp vitality can be achieved despite the dentin coverage procedure because bacterial penetration stops after a certain period, which has not yet been determined, following the injury (32, 39, 40). In our study, placing an immediate restoration during the emergency visit significantly decreased the odds of adverse outcomes (OR: 0.08; 95% CI: 0.01, 0.54). The logical rationale for the increased odds of adverse outcomes with more follow-up visits is that the pulp had not healed properly and caused pain or discomfort.

We did not find a significant association between the time that elapsed before a traumatized tooth received immediate treatment and the presence of adverse outcomes ($P = 0.072$). A study by Robertson et al., in which most of the treatment was initiated within 4 hours of the incident, found no statistical difference between the time interval of the dental injury and the initiation of dental treatment (10).

Our study had several limitations, primarily the small sample size. A possible reason for this small sample size is that many traumatic dental injuries occur after hours or over the weekend. After-hour and weekend care is provided at a nearby tertiary care facility, Seattle Children's Hospital, and these medical and dental records are not part of our university chart system. Further, the period of our study was relatively short for this type of event.

Currently, we do not have a logbook system to track trauma cases. For this study, we listed all potential procedure codes that may be used in dental trauma and we reviewed the electronic charts individually in order to access all trauma cases with those procedure codes. Since one of the goals of this study was to develop a database of dentally traumatized teeth within our university clinic for use in clinical research, we have created a logbook sheet to register all of the dental trauma cases at our facility and the database will be updated on a weekly basis.

Another limitation of our study was the lack of a standardized system for documenting injuries. This challenge has been addressed in the past. In a retrospective study, Andreasen et al. found that only about 53% of the information of a standardized record was recorded in the absence of a standardized questionnaire for collecting data concerning the injuries. They recommended records that include, but are not limited to, a complete medical, dental, and trauma history, a dental examination with detailed objective findings for each involved tooth and necessary examination tools (like a pulp vitality test), the treatment performed, and future follow-up (41, 42).

We created a form for standardized intake records of acute traumatic injuries based on the American Academy of Pediatric Dentistry recommendations (43), which will provide valid information for future studies. In addition, the efforts to generate one common database for our university dental clinic and the dental medicine department at the local children's hospital will make the vast majority of dental trauma data in the region available for future research.

One of the most important tools during dental trauma management is the Dental Trauma Guidelines developed by the International Association of Dental Traumatology (IADT) (44-46). The main purpose of these guidelines is to give the health care provider access to the most

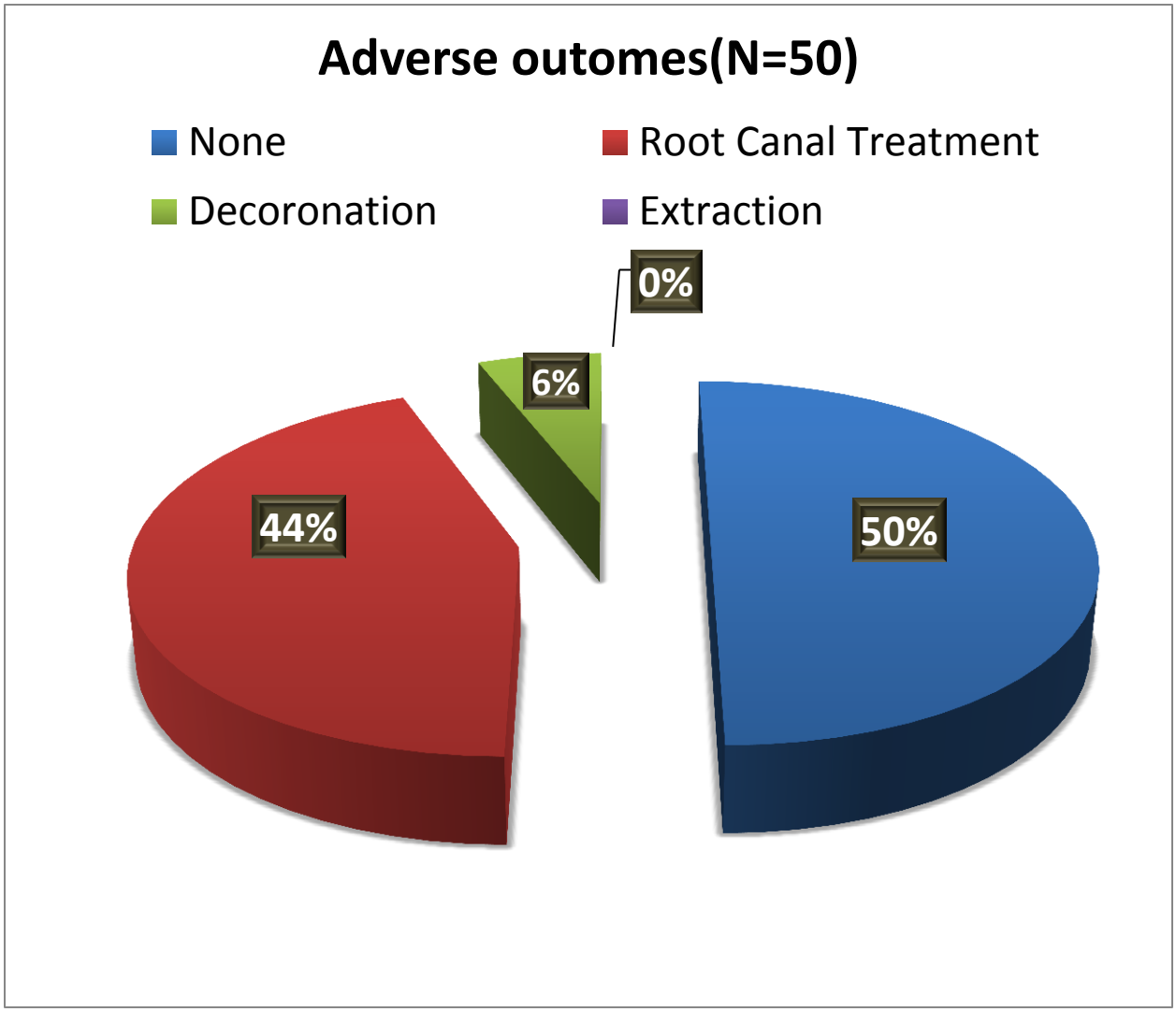
current evidence-based recommendations on the management of dental trauma injuries. However, these guidelines were not intended to be the standard of care. The clinician's judgment is necessary for each individual case and this is a crucial factor in treating traumatic injuries of the teeth and the supporting structures (35).

## Conclusion

Dental trauma in young permanent teeth might have a severe impact on the prognosis of the injured tooth if it is not treated in a timely manner. In a university dental clinic setting, the factors found to be associated with adverse outcomes in young permanent teeth after dental trauma were the type of dental trauma, presence of luxation injury, type of immediate dental treatment, type of immediate dental restoration, and the number of follow-up visits. This research was intended to be a baseline study and to provide a structured foundation to facilitate future investigations of different variables that might affect the adverse outcomes of dental traumatic injuries.

**Figure**

**Figure1.** Prevalence of adverse outcomes



## Tables

| Table 1: Demographic data by adverse outcomes | | | | |
|---|---|---|---|---|
| | Adverse outcomes* | | | |
| | Yes (N = 25) | No (N = 25) | Total (N = 50) | P-value |
| | N (%) | N (%) | | |
| **Age group:** | | | | 0.382** |
| **<12 years** | 14 (45%) | 17 (55%) | 31 | |
| **≥ 12 years** | 11 (58%) | 8 (42%) | 19 | |
| **Gender** | | | | 0.239** |
| **Male** | 18 (56%) | 14 (44%) | 32 | |
| **Female** | 7 (39%) | 11 (61%) | 18 | |
| **ASA** | | | | 0.446† |
| **ASA I** | 20 (54%) | 17 (46%) | 37 | |
| **ASA II** | 5 (45%) | 6 (55%) | 11 | |
| **ASA III** | 0 (0%) | 2 (100%) | 2 | |
| **Type of insurance** | | | | >0.999† |
| **Private** | 5 (50%) | 5 (50%) | 10 | |
| **Medicaid** | 17 (49%) | 18 (51%) | 35 | |
| **Self-pay** | 3 (60%) | 2 (40%) | 5 | |

**Adverse outcomes: root canal treatment, decoronation, and dental extraction.*

† *Calculated using Fisher's Exact Test*

*** Calculated using a Chi-square Test.*

| Table 2: Teeth distribution and trauma characteristics | | | | |
|---|---|---|---|---|
| | Adverse outcomes* | | | |
| | Yes (N = 25) | No (N = 25) | Total (N = 50) | P-value |
| | N (%) | N (%) | | |
| **Tooth** | | | | 0.479† |
| **Maxillary Central** | 24 (53%) | 21 (47%) | 45 | |
| **Maxillary Lateral** | 1 (50%) | 1 (50%) | 2 | |
| **Mandibular Central** | 0 (0%) | 2 (100%) | 2 | |
| **Mandibular Lateral** | 0 (0%) | 1 (100%) | 1 | |
| **Stage of root development** | | | | 0.532† |
| **Stage 8** | 1 (20%) | 4 (80%) | 5 | |
| **Stage 9** | 5 (56%) | 4 (44%) | 9 | |
| **Stage 10** | 18 (54%) | 15 (45%) | 33 | |
| **Not evaluated** | 1 (33%) | 2 (67%) | 3 | |
| **Type of dental trauma** | | | | 0.001† |
| **Uncomplicated fracture** | 9 (29%) | 22 (71%) | 31 | |
| **Complicated fracture** | 7 (78%) | 2 (22%) | 9 | |
| **Avulsion** | 3 (100%) | 0 (0%) | 3 | |
| **No fracture** | 6 (86%) | 1 (14%) | 7 | |
| **Presence of luxation injury** | | | | 0.048** |
| **Yes** | 16 (64%) | 9 (36%) | 25 | |
| **No** | 9 (36%) | 16 (64%) | 25 | |

**Adverse outcomes: root canal treatment, decoronation, and dental extraction.*

*† Calculated using Fisher's Exact Test*

*** Calculated using a Chi-square Test.*

| Table 3: Association of variables of interest and adverse outcomes | | | | |
|---|---|---|---|---|
| | Adverse outcomes* | | | |
| | Yes (N = 25) | No (N = 25) | Total (N = 50) | P-value† |
| | N (%) | N (%) | | |
| **Time between trauma and receiving immediate dental treatment** | | | | 0.072 |
| **≤12 hours** | 10 (71%) | 4 (29%) | 14 | |
| **> 12 - ≤24 hours** | 2 (29%) | 5 (71%) | 7 | |
| **> 24 - ≤48 hours** | 1 (12%) | 7 (88%) | 8 | |
| **> 48 - ≤72 hours** | 1 (100%) | 0 (0%) | 1 | |
| **> 72 hours** | 3 (50%) | 3 (50%) | 6 | |
| **not specified** | 8 (57%) | 6 (43%) | 14 | |
| **Immediate dental treatment** | | | | < 0.001 |
| **None** | 6 (60%) | 4 (40%) | 10 | |
| **Involved Pulp therapy** | 8 (73%) | 3 (27%) | 11 | |
| **Restoration only** | 2 (11%) | 17 (89%) | 19 | |
| **Splinting** | 9 (90%) | 1 (10%) | 10 | |
| **Type of immediate dental restoration** | | | | 0.019 |
| **Filling** | 11 (35%) | 20 (65%) | 31 | |
| **Crown** | 1 (100%) | 0 (0%) | 1 | |
| **None** | 13 (72%) | 6 (28%) | 18 | |
| **Type of pulp capping material** | | | | 0.847 |
| **MTA** | 2 (50%) | 2 (50%) | 4 | |
| **Calcium hydroxide** | 3 (75%) | 1 (25%) | 4 | |
| **No pulp capping** | 20 (48%) | 22 (52%) | 42 | |
| **Type of final dental restoration** | | | | 0.668 |
| **Filling** | 14 (50%) | 14 (50%) | 28 | |
| **Crown** | 4 (67%) | 2 (33%) | 6 | |
| **None** | 7 (44%) | 9 (56%) | 16 | |
| **Time between immediate and final dental restoration** | | | | 0.367 |
| **No difference** | 5 (36%) | 9 (64%) | 14 | |
| **1-14 days** | 4 (44%) | 5 (56%) | 9 | |
| **15-30 days** | 2 (40%) | 3 (60%) | 5 | |
| **30+ days** | 14 (64%) | 8 (36%) | 22 | |
| **No. of follow up visits** | | | | < 0.001 |
| **None** | 0 (0%) | 7 (100%) | 7 | |
| **1-2 visits** | 3 (23%) | 10 (77%) | 13 | |
| **3+ visits** | 22 (73%) | 9 (27%) | 30 | |

**Adverse outcomes: root canal treatment, decoronation, and dental extraction.*
*†Calculated using Fisher's Exact Test*

| Table 4: Associations between Adverse Outcomes and selected variables using Logistic regression | |
|---|---|
| | Bivariate Logistic regression OR (95% CI***) |
| **Type of dental trauma†** | |
| **Uncomplicated fracture** | Reference |
| **Complicated fracture** | 8.56 (1.48, 49.35)¥ |
| **No fracture** | 14.67 (1.54, 139.79)¥ |
| **Presence of luxation injury** | |
| **No** | Reference |
| **Yes** | 3.16 (1.00, 10.03) |
| **Immediate dental treatment** | |
| **None** | Reference |
| **Pulp therapy** | 1.78 (0.28, 11.12) |
| **Restoration** | 0.08 (0.01, 0.54) ¥ |
| **Splinting treatment** | 6.00 (0.53, 67.65) |
| **Type of immediate dental restoration††** | |
| **None** | Reference |
| **Filling** | 0.21 (0.06, 0.75)¥ |
| **No. of follow up visits‡** | |
| **1-2 visits** | Reference |
| **3+ visits** | 9.17 (2.00, 42.04) |

***CI = Confidence Interval

¥ $p < 0.05$

†Avulsion was excluded since all 3 patients with avulsion had no adverse outcomes.

††Crown was excluded since only 1 patient had a crown.

‡'No follow up visits' was excluded since every patient with no follow up had no adverse outcomes.

**Appendix A.** Variables labeling for STATA 12

| variable name | variable description | units | category label | category coding |
|---|---|---|---|---|
| ptagecat | Patient age | | <12 years | 0 |
| | | | >=12 | 1 |
| gender | Gender | | Male | 1 |
| | | | Female | 2 |
| asa | ASA Type | | I | 1 |
| | | | II | 2 |
| | | | III | 3 |
| | | | IV | 4 |
| newfuvisits | Number of follow-up visits | | none | 1 |
| | | | one or two | 2 |
| | | | three or more | 3 |
| insurance | Patient insurance type | | Private | 1 |
| | | | Medicaid | 2 |
| | | | Self-pay | 3 |
| toothtype | Number of first involved tooth | | Maxillary central | 1 |
| | | | Maxillary lateral | 2 |
| | | | Mandibular central | 3 |
| | | | Mandibular lateral | 4 |
| txtdate1 | Treatment date of tooth 1 | mm/dd/yyyy | | |
| rootdev1 | Stage of root development of tooth 1 | | Stage 7 | 1 |
| | | | Stage 8 | 2 |
| | | | Stage 9 | 3 |

| | | | | |
|---|---|---|---|---|
| | | | stage 10 | 4 |
| | | | not evaluated | 5 |
| trauma1 | Type of dental trauma of tooth 1 | | uncomplicated fx | 1 |
| | | | complicated fx | 2 |
| | | | Avulsion | 3 |
| | | | No fx or avulsion | 4 |
| luxation1 | Presence of luxation injury of tooth 1 | | yes | 1 |
| | | | no | 2 |
| timetraumtxt1 | Time between trauma and treatment of tooth 1 | | less than12hrs | 1 |
| | | | 12-24hrs | 2 |
| | | | 25-48 | 3 |
| | | | 49-72 | 4 |
| | | | more than 72 hrs | 5 |
| | | | not specified | 6 |
| provider1 | Provider type of tooth 1 | | Faculty | 1 |
| | | | Resident | 2 |
| | | | not specified | 3 |
| newimmtx1 | Immediate dental treatment tooth 1 | | none | 1 |
| | | | Indirect pulp capping | 2 |
| | | | direct pulp capping | |
| | | | Cvek pulpotomy | |
| | | | Pulpectomy | |
| | | | Extraction | |

| | | | | |
|---|---|---|---|---|
| | | | Temporary restoration | 3 |
| | | | Permanent restoration | |
| | | | Tooth reimplant | 4 |
| | | | Splint | |
| pulpcap1 | Type of pulp capping of tooth 1 | | MTA | 1 |
| | | | Calcium hydroxide | 2 |
| | | | No pulp cap | 3 |
| newimmrest1 | Type of immediate restoration of tooth 1 | | GI base material | 1 |
| | | | GI restoration | |
| | | | Resin filling | |
| | | | Flowable resin | |
| | | | Temporary restoration | |
| | | | Crown | 2 |
| | | | none | 3 |
| newfinalrest1 | Type of final restoration of tooth 1 | | Resin restoration | 1 |
| | | | Flowable composite | |
| | | | GI | |
| | | | Crown | 2 |
| | | | None | 3 |
| finaltxttime | Time between immediate and final restoration of tooth 1 | | 0 | 1 |
| | | | > 0 & timeimmfinal1 <=14 | 2 |
| | | | > 14 & timeimmfinal1 <=30 | 3 |

| | | | | |
|---|---|---|---|---|
| | | | > 30 | 4 |
| newfuoutcme1 | Follow up outcome 1 | | RCT | 1 |
| | | | Decoronation | |
| | | | no change | 2 |
| | | | The treatment required is not completed | |

**Appendix B.** The spreadsheet for data entry

| Variables | Pt age | Gender | ASA | fuvisits | Insurance | Tooth1 | Tx date | Rootdev1 | Trauma1 | Luxation1 | timetraumtx1 | Immtx1 | pulpcap1 | immrest1 | Finalrest1 | timeimmfinal1 | fuoutcme1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
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