Point-of-Entry Follow-up Appointments For Patients Seen in the Emergency Department as a Predictor of Compliance after Dental Trauma.

THESIS

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By

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Abstract

Objective: The purpose of this study was to evaluate whether giving a parent a specific follow-up appointment at the time of the emergency room dental trauma visit would improve follow-up appointment rates. Methods: This randomized cohort study was conducted for quality assurance. All children presented with luxation or avulsion injuries on mature permanent teeth. Patients were randomly included in either a ‘scheduled appointment’ group or a ‘nonscheduled walk-in’ group following ED presentation and treatment. Nonscheduled patients were told to walk-in following the appropriate interval based on injury. Results: Data were collected from subjects (26 scheduled group / 28 non-scheduled group). The mean age of children was 12 years 2 months (± 2.8 years). There was no significant difference in age between the two groups. Lateral luxations were the most common (63.6%) injury reported followed by avulsions (32.7%) and extrusions (3.6%). Patients who received a scheduled appointment followed-up in fewer days (12.5±2.6) than the group without scheduled appointments (19.9±13.4). This difference was statistically significant (p=0.008). The scheduled group also received pulpectomies in significantly fewer days (14.6±8) (p=0.045) than the non-scheduled group (21.1±14.2). There was no difference in the overall number of follow-up appointments between the two groups (p=0.794). Conclusions: Giving parents of children with dental trauma a specific follow-up appointment time improved follow-up compliance.
Dedication

This document is dedicated to my wife, Stephanie, as well as my mother and father for always believing in me and encouraging me throughout my life to achieve all that I have and will.
Acknowledgments

First and foremost I need to thank my best friend and beautiful wife Stephanie for all your love and support over the past eight years. Thank you for always supporting and putting up with me. Every night I am reminded what matters most in life. I truthfully could not have done this without you and can’t wait to start the next chapter of our lives together with our boy to be.

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Introduction

Dental Injuries in children are common occurrences which present in outpatient dental offices as well as in hospital emergency departments (ED). According to the American Academy of Pediatric Dentistry (AAPD), practitioners have the responsibility to recognize, differentiate, and either appropriately manage or refer children with acute oral traumatic injuries, as dictated by the complexity of the injury and the individual clinician’s training, knowledge and experience (2). More than half of all school-aged children traumatize either their primary or permanent dentition (1). During a four-year period from 1997 to 2000, there were approximately 3 million visits to the ED in the United States for dental injury or dental pain (3). Traumatic dental injuries (TDI) in those aged 18 years and younger are often related to falls during play, contact sports and accidents. Older patients are more often injured in; assaults, falls and motor vehicle accidents (1-3). When facial trauma occurs, dental injuries are the most common result (4).

The long-term sequelae of dental injuries go beyond physical injury and treatment. TDI’s can be stressful for children as well as their parents and can have significant negative functional, esthetic and psychological effects (2). Glendor et al. reported the total time spent on treatment of luxation and avulsion dental injuries to be 8.5 hours during an average of 11.9 visits during the first year after the injury (5). Nguyen et al. looked at the socioeconomic impact of dental avulsions and found that the
mean cost of treatment the first year after these injuries was $1465 CAD. Even after having gone through reimplantation, the demands of recalls, endodontic treatment and in some cases extraction, a majority of patients and parents stated that they still would have made the same decision to re-implant the tooth (6).

Dental injuries have many causes varying from sporting activities to assaults or altercations. Hedegard and Stalhane identified falls or collisions as being the most frequent cause of dental trauma in children aged 7-15 years, comprising 69% of the 4,926 traumatized teeth recorded (7). Injuries occurring to the teeth during sports are another prevalent cause of dental trauma. The literature indicates that between 13% and 39% of all permanent tooth dental injuries are sports related, with a male predilection (6).

Traumatic dental injuries presenting to the ED usually involve the permanent dentition and most commonly the anterior teeth (3). Gutmann and Gutmann reported in a survey of 653 permanent traumatized teeth treated by endodontists, that 82% were maxillary incisors with 64% being central incisors, 15% lateral incisors, and 3% canines (8).

The most severe dental injuries and those requiring immediate assessment and care are luxation injuries (lateral, intrusive) and avulsions. Receiving immediate care following these injuries may help the patient achieve optimal post-trauma results (12,13).

After a serious dental injury, the health of the pulp tissue as well as that of the periodontal ligament (PDL) cells are of utmost concern. Pulpal necrosis after lateral luxation, intrusion, and avulsion injuries of mature teeth with a closed apex has been reported to be as high as 100% (9). In most cases, the blood vessels of mature injured teeth with narrow apical foramina do not reattach and blood supply to the pulp is lost resulting in necrosis
of the pulp tissue. Human as well as animal studies have shown that, with time, up to 92% of non-vital pulps become infected which may lead to root resorption (10).

Inflammatory root resorption is a process by which the necrotic pulp becomes infected with bacteria via patent dentinal tubules that communicate with an area of damaged predentin or precementum (11-13). Bacteria are then able to reach the necrotic pulp from the gingival sulcus or damaged marginal gingival via the periodontal ligament. (10). This results in periapical inflammation with abscess formation that, in turn, may resulting tooth loss due to inflammatory root resorption.

This infectious inflammatory response is accompanied by production and release of macrophage-chemotactic factor, osteoclasts activating factor, prostaglandins as well as endotoxins from lymphocyte cells (11). The resultant damage of the tooth’s root may occur in the root canal itself resulting in resorption on the root surface causing external resorption.

Internal resorption is caused by longstanding chronic inflammation in a damaged pulp which is, at least, partially vital (11). When internal resorption lacunae are seen radiographically, endodontic treatment (pulp extirpation) is needed to prevent the resorptive process from leading to a communication between the root canal system and the PDL.

External root resorption may be extensive in teeth that have suffered displacement injuries such as an avulsion, intrusion, or luxation. Displacement injuries and subsequent repositioning during treatment may cause damage to the precementum, and cementum as well as PDL cell necrosis causing an inflammatory reaction. After displacement of teeth and subsequent pulpal necrosis, an infection may be established in 2-3 weeks that will
initiate root resorption if root canal treatment is not initiated promptly. After a few weeks, the resorption may be recognized radiographically as radiolucent areas encompassing the tooth root as well as alveolar bone. This process can progress to total root destruction in a matter on months (11).

The American Academy of Pediatric Dentistry (AAPD) and International Association of Dental Traumatology (IADT) revised the guidelines on management of acute dental trauma in 2010. These guidelines were developed and revised to reflect the most current evidence based on research and expert clinical experience. Due to the speed in which root resorption can occur, the IADT and AAPD have recommended that patients with closed-apex permanent tooth displacement injuries (avulsion, luxation, intrusion) have a follow-up evaluation within 2 weeks of the trauma for pulp testing and extirpation of the potentially necrotic pulp tissue. Inflammatory root resorption can be prevented with endodontic treatment and removal of the necrotic pulp tissue and irritants in the root canal. Gutta percha obturation of the injured tooth is also recommended as soon as an intact lamina dura can be seen around the injured tooth. Three follow-up visits within the first two months of a luxation, intrusion or avulsion injury are also recommended (2,12).

In severe luxation and avulsion injuries, dento-alveolar ankylosis occurs when extensive necrosis of the periodontal ligament has occurred. Ankylosis is caused by the process of replacement resorption in which osteoclasts gradually resorb dentin and cementum and osteoblasts replace it with bone (11). Replacement resorption is a serious complication in many cases of post-traumatic healing. Replacement resorption can only be reversed when the integrity of PDL is restored via ingress of fibroblasts. Current treatment for teeth at high risk of replacement resorption involves extirpation of the pulp...
tissue and intra-canal placement of calcium hydroxide (12,13). Calcium hydroxide may alter the pH neutralizing acid phosphatase and osteoclasts as well as promote the release of alkaline phosphatase thus preventing dissolution of the root (13). When more than 20% of the root surface is involved in replacement resorption, the PDL fibroblasts have little chance to repopulate the area and replacement resorption continues (30). Once this has occurred, no clinical treatment has yet been found to reverse ankylosis.

There are variable outcomes in luxation, intrusion and avulsion injuries in the permanent dentition. Because of this, these injuries require longitudinal follow-up over time (13). The IADT recommends at least five follow-up visits during the first year following these injuries. A 2010 retrospective quality assurance analysis reviewing charts of discharged ED patients at Nationwide Children’s Hospital’s Hospital (NCH) assessed patients who were verbally instructed to obtain follow-up care for luxation, intrusion, and avulsion injuries within two weeks (14). In this review, the mean number of follow-up visits was 2.5 with 25% of patients not returning for any follow-up care. Only 45% of patients in this review received a pulpectomy within 21 days at Nationwide Children’s Hospital with 37% having a gutta percha fill within 6 months of injury. The issue of patients having poor follow-up rates is not unique to treatment of dental trauma.

There are 110 million emergency department patient visits in the United States each year (24). Approximately 45% of these patients are referred for outpatient follow-up at another clinic or with a physician. Becker has written of the importance of patient follow-up after ED dismissal to insure proper treatment continuation of the initial condition, identification of misdiagnosis, management of treatment failures, and recognition of patient non-compliance to the therapeutic plan (27).
Several studies in medicine have assessed follow-up for patients dismissed from a hospital ED after presenting for acute illness or injury. Compliance in the United States is frequently poor and has been estimated to be between 26% to 56% overall (28). In an observational study conducted in 2009, 455 children with common childhood illnesses, between 6 weeks and eight years of age were followed to see if these children received the recommended 1-4 day follow-up (18). This study found that a total of 45% of caregivers adhered to the short-term follow-up adherence recommended.

A retrospective cohort study of 561 children in Michigan sought to determine frequency of follow-up outpatient asthma visits after emergency department discharge. This study found that almost two-thirds of children (66%) did not receive outpatient follow-up for asthma within 30 days of the ED visit as recommended by the National Heart, Lung, and Blood Institute (19).

A 1999 prospective study was done at the ED at New York University at Stony Brook, which sought to determine the follow-up rate of discharged patients who were instructed to obtain reevaluation within 48 hours. After 48 hours, a phone interview of 300 patients was completed showing that over 30% of these patients had not obtained the recommended follow-up (20).

In this same study, patients were given the following options for follow-up care: follow-up care at no expense in the ED (for those with no medical insurance), in a health clinic, or with a private physician. Those referred to the ED had a higher follow-up rate (82.7%) than those referred to clinics (59.6%) or private physicians (52.7%). The most common reasons cited by patients for not obtaining follow-up care after discharge from the
ED were that the symptoms had diminished (37.4%), inability to obtain a follow-up appointment (34.3%), or they did not understand the instructions (9.1%) (20).

Low compliance of recommended follow-up may be the result of many factors that patients perceive as barriers to care. A survey of 278 caregivers during ED visits for children who presented with asthma attempted to identify the barriers that patients feel prevent them from obtaining follow-up. Among the top reasons given were: child may miss work or school for the follow-up; caregiver may have to miss work or school due to follow-up; trouble reaching the office or clinic by phone and difficulty obtaining a convenient appointment (21). The results of this study were similar to the National Cooperative Inner-City Asthma study which was a national study of eight urban sites that conducted in-depth interviews with families of children with asthma. Parents were surveyed about barriers to follow-up care in three areas: personal and social: system and organizational: and financial (22). The authors found that the most common barrier to follow-up related to system and organizational problems such as having no available appointments with over one-fourth of respondents feeling this way.

A 2008 article published in the *Annals of Emergency Medicine* by Vieth and Rhodes explored the non-price barriers to ambulatory care after emergency department visits. In this study, graduate student research assistants were trained to pose as patients using standardized scripts. Posing as patients, these research assistants called 603 clinics attempting to obtain timely outpatient follow-up for new onset medical conditions per discharge instructions from the previous night. The primary goal of the study was to obtain an appointment within 7 days using the telephone numbers from actual ED-provided lists of physicians and clinics available for follow-up care. In the study only 242
(23%) of 1065 total calls resulted in an appointment within one week, for an ultimate caller success rate of only 40% after multiple calls were made (23).

The study by Vieth and Rhodes specifically examined the success of the initial call to reach a follow-up number on the premise that patients are less likely to comply with follow-up if it involves a cumbersome process. Multiple call attempts, being placed on hold and complex appointment scheduling systems can prevent successful follow-up. Patients could avoid the timely process of trying to obtain a follow-up appointment by receiving a scheduled appointment at the time of discharge.

Circumventing these barriers by scheduling an appointment and providing patients with a confirmed follow-up appointment on discharge has been cited in the medical literature as a major factor in improving follow-up compliance (21).

Baren et al. in 2006 explored follow-up of patients with acute asthma by giving the patients one of three following interventions; A) giving patients usual ED discharge instructions; B) providing free prednisone, vouchers for transport to and from the primary care visit and a telephone reminder to schedule an appointment or; C) a scheduled appointment prior to discharge. This study found that primary care follow-up was significantly higher in group C, the scheduled appointment on discharge with 65% obtaining follow-up versus 42% in group A and 48% in group B (25).

A 2005 study found that ED patients who made their outpatient follow-up appointments at discharge had a significantly greater probability of follow-up compliance compared with patients given standard discharge instructions. It also found that the demographic characteristics of age, race, gender, insurance status, and distance from home had no affect on the ED patient’s follow-up compliance (24).
The literature evaluating patient follow-up and compliance after being given a scheduled appointment has been done in acute medical problems that presented to the ED. There are no known studies examining the follow-up rate of patients treated in a hospital ED for dental trauma. Nearly 740,000 patients are treated annually across the nation in hospital emergency departments with a chief complaint of tooth pain or tooth injury (26). These patients are often told to call and schedule an appointment, either at a private dentist or the dental department if present at that hospital. How well these patients comply with follow-up instructions is unknown. Owing to the frequency of traumatic dental injuries in children and the importance of long term follow-up for these injuries, the primary objective of this study was to evaluate whether giving a parent a specific follow-up appointment at the time of emergency room dental trauma visit would improve follow-up appointment rates for those dental injuries requiring time dependant treatment. This information may better help clinicians maximize follow-up compliance so that those patients who have suffered traumatic dental injuries can obtain the timely care that is required to achieve the most favorable outcomes.
**Materials and Methods**

This randomized cohort study was conducted for quality assurance to evaluate if giving parents a specific follow-up appointment at the time of an emergency room dental trauma visit would improve follow-up appointment rates of patients at Nationwide Children’s Hospital (NCH). Patients discharged from the ED for trauma to the permanent dentition were given either a scheduled follow-up appointment or given the standard verbal and written instructions to follow-up as a walk-in within two weeks from the date of the injury. All injuries in this study occurred between March 2010 and January 2011.

Following triage and registration by the ED nursing staff, all patients were triaged for systemic medical concerns. Medically stable patients with isolated oral trauma were examined and treated by a pediatric dental resident or fellow (14 residents and 4 fellows). Patients requiring care for head and other injuries were screened by a pediatric emergency medical physician. Injuries were treated in order of medical priority. Dental treatment was rendered in accordance with the NCH’s dental trauma recommendations provided to each resident and fellow in the *Pediatric Dental Residents Manual 2010*. These recommendations reference and follow the most recent International Association of Dental Traumatology (IADT) guidelines for management of dento-alveolar trauma in permanent teeth with mature apices.
Following emergency treatment of the traumatized permanent teeth, the resident completed a standardized data collection form used for quality control and treatment review (Appendix A). This data collection form provided the following information; biographical data, date and time of injury, pertinent medical history, cause of injury, Frankl scale of behavior, classification and severity of injury, occlusal analysis, and what care was provided. All data forms completed during the dates of data collection were reviewed by a single attending dentist (DJM) and subsequently reviewed for adherence to the study criteria by the study coordinator (KTW)

Data from the trauma collection forms were entered into a Microsoft Access for Windows 2000 (v8.0, Microsoft Corp., Redmond, WA) database. This database provided the ability to record the patient’s initial visit and injuries as well as search capabilities for data on specific injuries and collective information regarding each injury (14).

Inclusion criteria for this quality assurance survey:

(1) A permanent tooth injury including avulsion, luxation, or intrusion;

(2) Completed root development of the involved tooth judged by Moorees apical development scale score of 5 or 6;

(3) Initial treatment and discharge from the ED of NCH.

Patients meeting these criteria comprised the study’s qualifying cohort (QC).

The determination of whether a patient received a scheduled appointment or the standard verbal instructions to follow-up as a walk in patient was done in advanced and rotated on a nightly basis between a “schedule” night and “non-schedule” night. All patients discharged from the ED received a patient information sheet informing parents about dental injuries and the importance of follow-up due to the uncertain prognosis, for
several months following a serious dental injury (Appendix B). This patient information sheet was edited and approved by the health literacy department of NCH for patient readability and understanding. This information sheet displayed a visual scale showing dental injuries of the permanent dentition in order from least severe to most severe to emphasize to parents the importance of follow-up.

On nights when patients received verbal follow-up instructions on discharge from the ED ("non-schedule" night), patients and their parents were instructed to walk into the Dental clinic at NCH on the second Thursday following the injury to obtain follow-up care. Patients were told they could walk in any time from 9:00am to 3:00pm. Patients were given contact information for the dental clinic, standard discharge instructions and the patient information sheet referenced above. The dental resident on call then filled out the standardized data collection form and this data was assessed as noted previously. The patient follow-up status was checked in the dental clinic after 3 weeks. If no follow-up had occurred after one month, a standardized phone survey and protocol algorithm (see Appendix C) was used during contact with the patient’s parent/guardian.

The follow-up surveys were developed to interview the parent/guardian of the patient about the quality of follow-up care they received, as well as factors that may have affected patient follow-up rates. If the parent/guardian that accompanied the patient to the NCH ED was unavailable, another parent or guardian was administered the survey. If the parent/guardian could not be reached after three phone calls, the patient was excluded from the study. If the phone number was disconnected, or the parent/guardian had moved, they were excluded from the study. The parent/guardian could also choose to be excluded from the survey. Before the survey was administered it was reviewed and
edited by staff of the Health Literacy Department at NCH to ensure a proper language level below an 8th grade reading level. The study coordinator and a trained research assistant conducted all phone surveys.

If the patient followed up at NCH dental clinic, the following information was entered into the Excel database: i) date of birth, ii) date of injury, iii) teeth injured, iv) type of injury, v) follow-up date, vi) days from injury to follow-up, vii) if pulpectomy required, viii) days from injury to pulpectomy, ix) if gutta percha was placed, x) days from injury to gutta percha placement, xi) dental provider in ED, xii) number of follow-up appointments, xiii) number of broken appointments, xiv) distance (miles) from patient’s home to NCH, xv) insurance status.

On those nights when patients received a written formal appointment (“schedule” night), it was scheduled at a specific date and time on the second Thursday after the date of their injury. All patients were given the same information sheet and discharge instructions as the “non-schedule” study group. The resident on call was provided with an up-to-date dental clinic schedule the night they were on call so that available appointments could be given to patients who fit the inclusion criteria. The morning after the patient was treated and scheduled for follow-up treatment, their information was added to the dental clinic schedule with a note indicating potential need for pulpectomy. Patient information was gathered after three weeks to assess if follow-up had occurred. If no follow-up had occurred, the same standardized phone survey and protocol algorithm (Appendix) was used as with the non-scheduled patients. If the patient had followed up at the NCH dental clinic the chart was gathered and the same data was recorded as for the non-scheduled patients with the addition of how many days over or under that scheduled
appointment the patients presented. This indicated if the patients were keeping their scheduled appointment date and time.

All data were analyzed using JMP 8.2 (SAS, Cary, NC). Data were recorded as frequencies of occurrence. All categorical variables, such as whether patient obtained pulpectomy within 14 days etc. were analyzed using Fisher Exact test. All continuous variables, such as ages, means, number of days, number of appointments, etc. were analyzed using a two-tailed students t-test. Comparisons were considered significant at p < 0.05.
Results

Entire Cohort (n = 54)

Data were collected over an 11-month period. 185 patients were treated in the ED for permanent tooth trauma during the study period and 54 patients (29%) fulfilled the inclusion criteria of permanent tooth injury including avulsion, luxation, or intrusion: completed root development of the involved tooth judged by Moorees apical development scale score of 5 or 6: and initial treatment and discharge from the ED of NCH.

All data were analyzed using JMP 8.2 (SAS, Cary, NC). Data were recorded as frequencies of occurrence. All figures reported pertain to patients who received their follow-up care for dental injuries at NCH dental clinic. Of the entire cohort (n=54), the mean age was 12.2 +/- 2.8 years at the time of injury, and their injuries were as follows: 63.6% luxations: 32.7 % avulsions: and 3.6% intrusions. The average number of follow-up appointments was 2.8 (sd 2.1). Eighty-nine percent of all patients in the current study came back to NCH for at least one follow-up appointment. Of the patients in the qualifying cohort, 74.1% had a pulpectomy completed on the traumatized tooth at NCH. Fifty-eight percent had the traumatized tooth obturated by last chart review. The average number of broken appointments for each patient during the course of treatment was 0.5 (sd 0.8) (Table 2).
The mean mileage traveled by patients for treatment was based on driving directions entered from each patient’s listed home address to NCH. The mean mileage traveled for treatment was 17.2 +/- 21.2 miles (Table 2).

The insurance status of each patient was determined using the registration information the patients provided at the ED visit or at a subsequent follow-up visits to the NCH dental clinic. The insurance status was grouped into: private, public, and none. Public insurance included all Medicaid-type plans, such as Caresource, Medicaid, Molina etc. Private insurance was the most common with 51.9% of patients being privately insured. Public insurance provided coverage for 40.7% of patients and 7.2% of patients had no insurance coverage (Figure 2).

Scheduled Patients (n=26)

All figures reported pertain to patients who received their follow-up care for dental injuries at NCH dental clinic. The mean age of the patients who received scheduled appointments for their dental injuries on dismissal from the ED was 11.8 +/- 3.1 years. Injury distribution was as follows: 56% luxations: 36% avulsions: and 9.2% intrusions.

The mean days to follow-up for patients receiving a scheduled appointment on dismissal from the ED was 12.5 +/- 2.6 days from injury. The average time to a pulpectomy was 14.6 +/- 8 days with the mean time to final obturation taking place 58.8 +/- 27.2 days from the injury.

The mean number of follow-up appointments for each patient receiving a scheduled appointment on ED dismissal was 2.6 (sd 1.4). Broken appointments for these
patients during the course of their treatment 0.45 (sd 0.6). The mean mileage as determined from directions entered from each patient’s listed home address to NCH was 17.2 +/- 21.2 miles. The insurance status for scheduled patients consisted of 50% private, 38.5% public, and 11.5% reporting no insurance coverage.

Non-scheduled patients (n=28)

All figures reported pertain to patients who received their follow-up care for dental injuries at NCH dental clinic. The mean age of the patients who received scheduled appointments for their dental injuries on dismissal from the ED was 12.6 +/- 2.6 years. These patients’ injuries were as follows: 68% luxations and 32% avulsions.

The mean number of days to follow-up for patients receiving a scheduled appointment on dismissal from the ED was 19.9 +/- 13.4 days. The average time to a pulpectomy was 21.1 +/- 14.2 days with the mean time to obturation taking place 49.3 +/- 60.7 days from the injury.

The mean number of follow-up appointments for each patient receiving a scheduled appointment on ED dismissal was 2.5 (sd 1.36). Broken appointments for these patients during the course of their treatment 0.4 (sd 0.65). The mean mileage as determined from directions entered from each patient’s listed home address to NCH was 15.9 +/- 19.4 miles. The insurance status for scheduled patients consisted of 53.5% private, 42.8% public, and 3.7% reporting no insurance coverage.
Comparative statistics between patients given a scheduled appointment on ED dismissal and those who were not scheduled.

A significant relationship was determined between the group who was given a scheduled appointment on ED discharge versus those who were not scheduled when days to follow-up and days to pulpectomy were assessed. The scheduled group followed up in significantly fewer days \((p= 0.008)\) and received a pulpectomy in significantly fewer days \((p= 0.045)\). However, when days to obturation was assessed, no significant difference was determined \((p= 0.468)\). When comparing the two groups further, no significance was found when evaluating whether a patient had received a pulpectomy \((p=0.252)\) or obturation \((p=1)\) (Table 1).

There were no significant relationships between groups when comparing total number of follow-up appointments \((p= 0.794)\), number of broken appointment during the course of treatment \((p=0.771)\), or miles traveled from home to NCH \((p=0.694)\) (Table 2).
Discussion

This randomized cohort study evaluated whether giving a parent a specific follow-up appointment at the time of the emergency department dental trauma visit would improve follow-up appointment rates for those dental injuries requiring time dependant treatment. This study was done for quality assurance to provide clinicians with information that may better help maximize follow-up compliance so that those patients who have suffered traumatic dental injuries can obtain the timely care that is required to achieve the most favorable outcomes.

The average age of the patients who qualified for this study was 12.2 years. Twenty-nine percent of the patients treated for permanent tooth trauma at NCH ED between 3/30/10 and 3/1/11 qualified for the study. The age distribution in our study is attributed to the inclusion criteria of only allowing teeth with closed apices to be included. In this study, luxation injuries were the most common with 63.6% followed by avulsion with 32.7% and intrusive injury at 3.6%. These injury ratios are consistent with previous findings at our institution (NCH) as well as other current dental trauma literature (1,14).

Previous dental trauma findings at NCH have revealed that 47.4% of patients had public insurance, 44.2% had private insurance and 6.3% had no dental insurance (14). This data varies slightly from the data collected in the current study that found that 40.7% of patients had public insurance, 51.9% had private insurance and 7.2% had no insurance coverage. The NCH dental clinic typically consists of a population that is enrolled in
public health insurance (80-85%). This dramatic difference in the number of patients with public health insurance could be attributed to the fact that patients seen in the ED may be referred by private dental professionals in the community. It is possible that a practicing dentist may not feel comfortable treating trauma in their office, especially when the trauma occurs after the regular operating hours of the dental practice.

The trauma collection form (see Appendix A) used to record patients’ trauma information was completed for all 185 patients seen in the ED after the regular operating hours of the dental clinic at NCH. At this time, most private dental practitioners have also closed their offices or are not able to handle immediate treatment of the patient in their office. Upon receiving treatment in the ED, several patients reported the after hours emergency contact number of their private dentist instructed them to call NCH in the case of a dental emergency.

To obtain follow-up care at NCH, patients traveled an average of 17 miles with the furthest patient traveling 88 miles. The current study found no difference when comparing those patients who followed up and those who did not when evaluating distance traveled to obtain the follow-up appointment at NCH. Those patients traveling over 50 miles appeared as likely to follow-up at NCH as those residing in Columbus proper. This data presents itself as conflicting; one would think that distance from home would be a barrier to care and that those patients who live further away would be more likely to seek dental care closer to home. This was not the case in our study; which may be attributed to lack of access to care or dentists in rural communities not accepting public insurance. Data from NCH in 2009 found that patients traveled an average of 16.2 miles for treatment of dental trauma. This similarity to our mean of 17 miles indicates...
that a majority of patients seen for dental trauma at NCH reside within Columbus proper and the surrounding suburbs.

The mean number of follow-up visits in this study was determined to be 2.8 visits. This is consistent with previous data collected from NCH of 175 trauma patients with the same inclusion criteria that found a mean of 2.5 visits (14). Although this is below the IADT recommendations of 5 follow-up visits during the first year following a luxation or avulsion injury, this would provide the clinician with the opportunity to remove the necrotic pulp tissue and place calcium hydroxide at one appointment and to obturate the tooth at a subsequent appointment. Generally, once a patient has completed root canal treatment they are transferred to the hygiene clinic where trauma follow-up may have been done as part of the patient’s periodic recall appointments. Because of variation in private insurance plans, which comprised 51.9% of our study population, the different providers may not cover the cost of repeated follow-up visits. Patients without any insurance coverage would be 100% financially responsible for the cost of each follow-up. Studies in European countries with socialized healthcare have claimed follow-up rates from complicated dental trauma involving damage to the PDL to be as high as 16 visits over a three-year period (5,31). An explanation for the relatively high number of follow-up visits in these studies could be the change in trauma treatment guidelines that formerly involved replacing CaOH several times after the pulpectomy (10,11,13). Since our findings spanned over eleven months and injuries occurred throughout, further monitoring of the patients involved in this study is need to determine if additional follow-ups occurred. It is possible that a patient with a shorter treatment span from their date of injury to when the record was evaluated would have fewer follow-up visits. This could
have given us a lower over-all average for patient follow-ups. When follow-ups were
gathered, only specific trauma appointments were counted. Although several patients
received subsequent hygiene and operative appointments, the assumption was not made
that the traumatic dental injury was addressed at that time. However, with an average
follow-up rate of 2.8 “trauma” visits per patient, special attention should be made to
complete all needed pulp therapy within those visits.

The “Guidelines for the management of traumatic dental injuries” revised in 2007
by the IADT, reduced the number of follow-up visits recommended for successful
treatment (12). Previous guidelines had recommended calcium hydroxide to be placed
from anywhere between 6-24 months before obturation was considered. Interim follow-
up visits to change intrapulpal medicaments and assess for the presence of resorption
were common on a monthly basis during the first year post injury (34). The new
guidelines recommend 3-5 visits within the first six months depending on the injury (12).
With only 58% of all patients receiving obturation, low rates of patient compliance with
completing the recommended treatment seem to confirm the IADT’s reduced number of
appointments and time allowed between appointments.

Eighty-nine percent of all patients in the current study came back to NCH for at
least one follow-up appointment. This rate is higher than has been described in the
literature. In a study by Barlas et al. it was shown that over 30% of patients instructed to
obtain follow-up care after an ED visit failed to do so (20). Barlas’ follow-up rate of 70%
is very similar to previous findings at our institution that 75% of patients attended at least
one follow-up appointment (14). The increased follow-up ratio may be due to the
addition of all patients being discharged from the ED with an information sheet
informing parents about the importance of follow-up and the uncertain prognosis, for several months following a serious dental injury (Appendix C). This information sheet displayed a visual scale showing dental injuries of the permanent dentition in order from least to most severe to emphasize to parents the importance of follow-up. The treating resident at the time of discharge from the ED may have also stressed follow-up to a greater degree than previously.

Of the patients in the qualifying cohort, 74.1% had a pulpectomy completed on the traumatized tooth at NCH. Fifty-eight percent had the traumatized tooth obturated by last chart review. Using the pulpectomy and obturation as measures for follow-up success has some limitations. In mature teeth, the frequency of pulpal necrosis with avulsion or intrusion is near 100%. Andreasen and Pedersen reported a rate of pulpal necrosis in mature, luxated teeth at a rate of 58% (32). It is possible that patients with luxation injuries could have received the needed follow-up care, and because the tooth remained vital, pulp therapy was never indicated or the practitioner may wait a longer period of time to see if pulpal necrosis occurs. Alternatively, patients with severe luxations, intrusions and avulsions may have been evaluated after the pulpectomy appointment and found to have ankylosis occurring to the injured tooth. A study published by Andreason and Borum following replantation of 400 avulsed permanent incisors followed for a mean of five years found that 64% of avulsed teeth exhibited ankylosis on follow-up (33). In cases of confirmed ankylosis, injured teeth would not have progressed to obturation in our study. This could have contributed to the relatively lower rates of follow-up treatment using pulpectomy and obturation as treatment milestones.
Of the 11% (n=7) of patients who did not follow-up at NCH for any care after one month, only 3 patients could be contacted for survey regarding follow-up. Three of the patients who received no follow-up care could not be reached due to phone number listed in hospital records being disconnected when a call was attempted. One patient could not be reached after three call attempts and a voice mail message was left unreturned. Of the three patients that were reached by telephone, two were scheduled at the time of the call and ultimately followed up. One of the patients opted to follow-up with their private dentist after the injury and was not interested in follow-up at NCH dental clinic. From a quality assurance standpoint it is encouraging that a strong majority of patients did follow-up at least once between ED treatment and follow-up dental care.

In the current study, when comparing the “schedule” and “non-schedule” groups for days from ED dismissal to follow-up at NCH dental clinic, significant differences were found between groups for the number of days to follow-up (p=0.008) as well as number of days to pulpectomy (p=0.045). The average days to follow-up for the “schedule” group was 12.5 +/- 2.6 compared to the average number of days to follow-up in the “non-schedule” group being 19.9 days with a much larger variance of 13.4 days. When evaluating time of ED dismissal to a pulpectomy being completed, patients in the “schedule group” received a pulpectomy in an average of 14.6 +/- 6.8 days whereas the “non-schedule” group did not receive a pulpectomy for 19.9 +/- 13.4 days. This data would indicate that not only did patients who received a scheduled appointment make that appointment, but they also received the recommended treatment of a pulpectomy in significantly less time.
Statistical as well as clinical significance can be seen in the “schedule” versus “non-schedule” groups’ time to follow-up and pulpectomy. With an average of 12.5 days to follow-up appointment for the “schedule” group these patients satisfied the IADT guidelines recommending clinical and radiographic examination within 2 weeks (12). The recommendation of the IADT as well as the AAPD is for closed apex teeth with a luxation injury to have a Ca(OH)$_2$ pulpectomy within 2 weeks of the injury. This was more likely to be satisfied in the “schedule” group with the mean time to pulpectomy occurring in 14.6 days (12,25). The “non-schedule” groups’ mean time to follow-up of 19.9 days and mean days to pulpectomy of 21.1 do not satisfy the IADT or AAPD treatment recommendations for luxation injuries to closed apex permanent teeth. By the “schedule group receiving the recommended pulp extripation, the risk of future morbidities involved with pulpal necrosis and odontogenic infections is reduced (34-36). Pulp necrosis can lead to progressive inflammatory root resorption causing significant damage to the integrity of the tooth within days, ultimately leading to diminished long-term retainability of the tooth. Osteoclastic activity in the periradicular or pulpal tissues associated with pulpal damage can ultimately lead to external or internal root resorption (36).

Our findings that a scheduled appointment given at the time of ED discharge improves patients’ adherence to recommended follow-up is consistent with published medical literature. Kyriacou et al. demonstrated that patients who had their outpatient follow-up appointment made at discharge had a significantly greater probability of follow-up compliance compared with patients given standard discharge instructions (24). A similar study by Zorc et al. showed 22% increase in parent compliance with follow-up
visits when a follow-up appointment was scheduled at the time of the ED treatment (21). Scheduling an appointment for the patients we treat in the ED appears to improve our patient follow-up compliance.

Both “scheduled” and “non-scheduled” patients showed no statistical significance when evaluating days from ED discharge to obturation, number of follows-ups, number of broken appointments, miles from NCH and whether they had a pulpectomy or obturation completed. It appears that giving the patient an appointment at ED discharge reduced the time to follow-up and pulpectomy but did not affect whether or not the pulpectomy or obturation was completed or how many times the patient followed-up. Finding no significant difference in obturation or number of total appointments indicates that, although a scheduled appointment results in less time to pulpectomy, patient follow-up and education needs to be stressed at each appointment. It is possible that once the patient’s caregiver perceives that pain and the emergent nature of the injury has subsided; they are no longer motivated to follow-up to complete the treatment. This could be a possible explanation as to why 74% of patients received a pulpectomy but only 58% of patients continued obturation. Literature on adult patients who received emergent dental care with the chief complaint of pain found that once palliative care to relieve pain was administered, nearly 40% of patients failed to follow-up and were left with incomplete treatment (37). It appears that the original dental emergency is not a strong motivating factor toward more comprehensive care. This again stresses the importance of providing all necessary care in as few appointments as necessary.

The average number of broken appointments or “no-shows” was 0.5 +/- 0.8. There was no significant difference in the number of broken appointments between
“schedule” and “non-schedule” groups. A majority of broken appointments appear to have occurred as the last appointment on record. Many of these broken appointments occurred after the pulpectomy was completed. This could explain the discrepancy between those patients who received a pulpectomy (74.1%) versus those who continued to obturation (58%). This discrepancy indicates the importance of ongoing patient education throughout treatment as well as being cognizant of patient barriers to care. Medical Literature reported that the most common barriers that parents reported to follow-up care with a physician were; missing school or work (23%) and caring for other children (9%) (21). All “trauma” appointments offered to patients were offered on Thursdays between the hours of 9:00am and 4:00pm which would result in the child missing additional school as well as the parent possibly missing work.

This study was conducted for 11 months with 14 dental residents and 2 dental fellows performing treatment, making diagnosis of injuries, and giving parents instructions for post-op care and explaining the importance of follow-up. Although the residents were all given the same protocol to follow and had similar oversight by faculty, some variability in diagnosis and treatment is expected as well as the ability to communicate effectively with the parents and explain the need for follow-up treatment. The diagnosis of avulsion and intrusion is more objective than that of luxation. One practitioner may have felt the tooth had been displaced while another may determine the injury to be of less significance. Because of this discrepancy it would be expected that some of the initial luxation injuries never received a pulpectomy or root canal treatment because they were never treatment planned to do so. This would have made using the milestones of pulpectomy and obturation inaccurate. A patient information sheet was to

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be given to all patients with dental injuries to educate the patient as to the potential complications after traumatic dental injuries as well as the importance of follow-up. Assessing whether each patient received this information or was able and willing to understand it is difficult to determine and may have affected the outcome.

Implications of this quality control study may be to schedule all patients who have presented to the ED with dental trauma for their follow-up appointment at the time of ED discharge. This would not only eliminate barriers to care for the patient but also allow the treating dentist to schedule that patient into their schedule to improve continuity of care at NCH.

Future research should focus on implementing protocols to improve the links between the ED and dental clinic as well as private dentists. Although this is the second study to use permanent teeth with a closed apex as the inclusion criteria, no information has been gathered as to the follow-up of primary tooth injuries dismissed from the ED and told to “walk-in” to the dental clinic for follow-up. Since all patients in the study received an information sheet about dental trauma, an assessment could be made to determine what extent patient education contributed to follow-up. Future ED-based interventions that may improve ongoing care should be assessed to assure patients receive comprehensive care for their dental emergencies.
APPENDIX A

OSU/NCH DENTAL TRAUMA FORM
DENTAL TRAUMA FORM

1. Significant medical history/meds/allergies?
   a. NO
   b. YES (list) ____________________________________________

2. Tetanus status (circle one): current  booster needed

3. Accident Etiology/History: ____________________________________________
   ____________________________________________
   ____________________________________________

4. Time from injury to evaluation at Children's (circle one): <30 min. 30-60 min. 1-3 h 3-6 h 6-12 h 12-24 h 24+ h

4. Concomitant Facial Fracture (circle one): none  maxilla  mandibular  other (list) ____________________________________________ (other than alveolar fx)

5. Horizontal Overjet (circle one): -6 to -4 mm  -3 to -1 mm  0mm  1 to 3 mm  4 to 6 mm  6+ mm

6. Vertical Occlusion Type (circle one): deep  normal  open

3. Patient Behavior (circle one): 1  2  3  4
   * see legend

5. Post-operative systemic antibiotics prescribed (circle one): no
   yes (list type) ____________________________________________

5. Post-operative topical antibiotics prescribed (circle one): no
   yes (list type) ____________________________________________

Patient gender (circle one): Male  Female

PATIENT STICKER
# DIAGNOSES & TOOTH SPECIFIC FACTORS

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<tr>
<th>Tooth #</th>
<th>concussion</th>
<th>subluxation</th>
<th>lateral luxation</th>
<th>intrusion</th>
<th>avulsion</th>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**check all that apply for each tooth**

- fx: enamel only
- fx: enamel & dentin
- fx: enamel, dentin, pulp
- fx: enamel, dentin, & cementum-no pulp
- fx: enamel, dentin, cementum & pulp
- isolated root fracture

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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>1</th>
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<tr>
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<td>alveolar fracture</td>
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<td>percussion +</td>
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<td>cold/ice +</td>
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<tr>
<td></td>
<td>previous trauma to tooth</td>
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<td>yes/no</td>
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PERIODONTAL INJURIES

**Concussion**
* no other information needed

**Subluxation**

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</table>

**Lateral Luxation**

| Tooth # | F | L | M | D | F | L | M | D | F | L | M | D | F | L | M | D | F | L | M | D |
| direction of displacement | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR | EXTR |
| tooth mobility | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 |
| displacement | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| treatment | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none |

**Intrusion**

| Tooth # | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 | 0 | 1 | 2 | 3 |
| tooth mobility | | | | | | | | | | | | | | | | | | | | |
| displacement | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| treatment | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none | repos./splint none |

**Avulsion**

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**Tooth #**

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<td>time in transport medium (min)</td>
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**Avulsion**

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**Avulsion**

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<th>HBSS water</th>
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<th>HBSS saliva</th>
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<th>HBSS saliva</th>
<th>HBSS saline</th>
<th>HBSS water</th>
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# CROWN & CROWN/ROOT FRACTURES

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<tr>
<th>Fracture:</th>
<th>Enamel only</th>
<th>(Ellis Class I)</th>
<th>Enamel &amp; Dentin</th>
<th>(Ellis Class II)</th>
<th>AND</th>
<th>Enamel, Dentin, Cementum - No Pulp</th>
<th>(Ellis Class IV)</th>
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<td>Tooth #</td>
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<td>craze line tissue lost</td>
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<tr>
<td>discoloration</td>
<td>yes / no</td>
<td>yes / no</td>
<td>yes / no</td>
<td>yes / no</td>
<td>yes / no</td>
<td>yes / no</td>
<td>yes / no</td>
</tr>
<tr>
<td>band-aid</td>
<td>build-up</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
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<td>treatment</td>
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</table>

| Fracture: | enamel & dentin | (Ellis Class III) | AND | enamel, dentin, cementum and pulp | (Ellis Class IV with pulp) |
| --- | --- | --- | --- | --- |
| discoloration | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no |
| pulp blushing | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no |
| treatment | band-aid | rebond fx | none | band-aid | rebond fx | none | band-aid | rebond fx | none | band-aid | rebond fx | none |
| | | | | | | | | | | | | |

<p>| Fracture: | enamel, dentin, pulp | (Ellis Class III) | AND | enamel, dentin, cementum and pulp | (Ellis Class IV with pulp) |
| --- | --- | --- | --- | --- |
| discoloration | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no | yes / no |
| size of pulp exposure (mm) | | | | | | | | | | | | |
| pulp | treatment Cvek-MTA Cvek-CaH pulp cap pulp cap | none | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap | pulp cap pulp cap |</p>
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<th>Location of fx</th>
<th>Coronal Fracture Displacement</th>
<th>Tooth Mobility</th>
<th>Crown Discoloration</th>
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<td>yes</td>
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<tr>
<td></td>
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<td>no N/A- lost</td>
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<td>splint pulpectomy extraction none</td>
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</table>

34
Trauma Form Legend

Behavior Scale (modified Frankl):

**RATING 1 – DEFINITELY NEGATIVE**
Refuses treatment, cries forcefully, is fearful, or portrays any other overt evidence of extreme negativism.

**RATING 2 – NEGATIVE**
Is reluctant to accept treatment, is uncooperative, portrays some evidence of negative attitude but not pronounced, that is, sullen or withdrawn.

**RATING 3 – POSITIVE**
Accepts treatment; at times is cautious, is willing to comply with the dentist, at times with reservation but follows the dentist’s directions cooperatively.

**RATING 4 – DEFINITELY POSITIVE**
Has good rapport with the dentist, interested in the dental procedures, laughs and enjoys the situation.

Apical Development Scale (Moorees):

- **Stage 1** - ¼ anticipated root length formed
- **Stage 2** - ½ anticipated root length formed
- **Stage 3** - ¾ anticipated root length formed
- **Stage 4** - full anticipated root length, no apical closure
- **Stage 5** - full anticipated root length, apical foramen ½ closed
- **Stage 6** - full anticipated root length, apical foramen constricted

Tooth Mobility

- **Grade 0** – no more than physiologic mobility
- **Grade 1** – slightly more than physiologic mobility (in a lateral direction only)
- **Grade 2** – grossly more than physiologic mobility (in a lateral direction only)
- **Grade 3** – severe mobility in a lateral and axial direction
APPENDIX B

DENTAL INJURY PATIENT INFORMATION SHEET
DENTAL INJURIES: FOLLOW-UP CARE

If your child has had a serious dental injury, it is important to follow-up with your dentist within 2 weeks. Broken teeth are the least severe injuries, followed by loose teeth. Teeth that have been pushed in or knocked out are the most serious dental injuries.

TYPES OF TRAUMATIC DENTAL INJURIES

- BROKEN
- LOOSE
- PUSHED IN
- KNOCKED OUT

WHY FOLLOW UP IS SO IMPORTANT

- We may not be sure of the outcome of a dental injury for a few months.
- Even if the tooth does not hurt right after the injury, it still needs treatment and check-ups.
- If a patient does not follow up, permanent damage to the tooth or even tooth loss may occur.
- To prevent serious permanent damage, the patient needs to have at least 3 follow-up visits within the first 2 months after the injury.

OUTCOMES

- When a child with a dental injury receives timely care and proper treatment, the chance of tooth loss is reduced.
- It is very important that all tooth injuries are diagnosed, treated and controlled in time.
- With the proper follow-up care, future problems and high cost treatments can be prevented.

For more information, please contact the Department of Dentistry at Nationwide Children’s Hospital, 700 Children’s Drive, Timken Building 2nd Floor, (614) 722-5650.
APPENDIX C

QUALITY ASSURANCE PHONE SURVEY AND PHONE ALGORITHM
APPENDIX D

METHODS ALGORITHM
Every other night get schedule for second Thursdays printed at end of day.

Place schedule with open appts next to calendar with sign for residents to give appts. All Patients get info sheet.

Patient Presents

- Record if patient made appt or if Broken Appt.
  - If given appt.
    - If patient kept made appt.
      - Collect info - 4 appts - Pulpectomy - GP Fill
      - Monitor chart for info
    - If incomplete Tx

- Record info from trauma forms we already fill out. Record when scheduled appt was made if one was made.
  - If standard protocol
    - Determine if patient followed up in 2 weeks by checking to see if dental chart was created.

- Determine follow-up status
  - If no follow-up
    - Collect info;
      - 4 appts
      - Pulpectomy
      - GP Fill
    - Get contact info from ED to contact 1 month after trauma for phone survey (see attached)

- Able to contact
  - Phone survey and attempt to schedule if not getting care

- Not able to contact
  - Eliminate from study
APPENDIX E

TABLES AND FIGURES
<table>
<thead>
<tr>
<th>GROUP</th>
<th>N</th>
<th># Days to Follow-up (sd)</th>
<th># Days to Pulpectomy (sd)</th>
<th># Days to Obturation (sd)</th>
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<td>SCHEDULED</td>
<td>26</td>
<td>12.5 (2.6)</td>
<td>14.6 (8)</td>
<td>58.8 (27.7)</td>
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<td>NON-SCHEDULED</td>
<td>28</td>
<td>19.9 (13.4)</td>
<td>21.2 (14.2)</td>
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<td>p-Value</td>
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<td>0.008*</td>
<td>0.045*</td>
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<td>TOTALS</td>
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Table 1. Time Dependant Variables Breakdown of Qualifying Cohort (N=54)

* Indicates significance
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<thead>
<tr>
<th>GROUP</th>
<th>N</th>
<th>Age (sd)</th>
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<td>12.2 (2.8)</td>
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Table 2. Breakdown of Non-Significant Variables Between Groups in Qualifying Cohort
Figure 1. Distribution of Injuries between groups and within Qualifying Cohort (n=54).
Figure 1. Distribution of Insurance Status between groups and within Qualifying Cohort (n=54).
REFERENCES


14. Gustafson DB et al. Follow-up rates and predictors for follow-up of patients seen in the emergencet department for dental trauma. NCH 2009. IN PRESS


