Clinical Article



Continued Care of Children Seen in an Emergency Department for Dental Trauma

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Abstract: *Purpose:* The purpose of this retrospective study was to determine the rate of continuing care for dental trauma patients seen after-hours in a hospital emergency department (ED) and identify predictors for and barriers to seeking continuing care. **Methods:** Records of 856 patients treated at Nationwide Children's Hospital (NCH) ED for dental trauma between September 2003 and December 2007, were screened for avulsion, luxation, and intrusion injuries. A qualifying cohort (QC) of 175 patients was included based on injury and root development. A quality assurance survey was conducted with 96 parents of these patients to determine barriers and predictors for follow-up treatment. **Results:** Patients averaged 2.5 follow-up visits at NCH. The most commonly reported barriers to receiving treatment were: having to miss school (21%), taking time off of work (17%), and costs associated with dental care (13%). No statistical significance (P=.22) was found between number of follow-up visits and the patient retaining the injured tooth. The number of follow-up visits was not significantly different between patients with private and public insurance. **Conclusions:** School, work, and costs associated with ongoing trauma management affect follow-up compliance irrespective of payment source. (Pediatr Dent 2011;33:426-30) Received March 15, 2010 | Last Revision July 28, 2010 | Accepted September 12, 2010

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Dental trauma in children is a serious dental public health issue. In a 10-year study of over 9500 cases of craniomaxillofacial trauma, nearly 50% involved a dentoalveolar component.¹ Up to 50 percent of 5- to 18-year-olds will incur some type of dental injury during their school years.² The morbidities associated with dental trauma can range from emotional distress for both the patient and guardian to serious physical injury and physiologic dysfunction.

Substantial life-long costs are associated with the replacement of teeth lost to trauma in childhood. Using the most recent cost data available, estimates range from \$20,000 to \$35,000 to replace a single tooth lost during adolescence.³⁻⁵ Due to the provisional nature of dental prostheses, they may need to be replaced several times during the patient's life. In addition to the lifetime cost to replace an injured tooth, there are also costs associated with follow-up care. In an assessment of the socioeconomic burden of treating dental avulsions, Nguyen et al. estimated that treatment cost and direct time (dentist) for the first-year post-trauma management was \$1,465 (Canadian dollars) and 7.2 hours of treatment time, respectively.⁶ Ninety percent of patients and 86% of parents reported that school and work time was lost, as well.

Dental injuries with the poorest prognosis are lateral luxation, intrusive luxation, and avulsion.⁷ The incidence of pulpal

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necrosis in mature teeth with these injuries is reported to be as high as 100%. Progressive inflammatory root resorption can cause significant damage to the tooth's integrity within days, ultimately leading to early loss of the tooth. If a patient is noncompliant with recommended follow-up appointments, irreversible damage can occur within a matter of months.

To assure the best possible outcomes, traumatic dental injuries need to be followed longitudinally.^{8,9} Accepted protocols for diagnosis, treatment, and follow-up of dental injuries vary according to severity and type of injury incurred.⁸⁻¹⁰ Current guidelines recommend that patients with luxation, intrusion, or avulsion injuries to permanent teeth should have at least 3 follow-up visits within the first 2 months following trauma.^{8,9} In spite of their importance, however, patient compliance with follow-up appointments is less than optimal.^{11,12}

Poor compliance with follow-up appointments is not unique to dental injuries. Several medical studies have shown poor rates for follow-up care after being treated in a hospital emergency department (ED) for acute illnesses and injuries.^{13,16} Barlas et al., reported that over 30% of patients instructed to obtain follow-up care after an ED visit failed to do so.¹⁴ The most common reasons cited by patients for not obtaining follow-up care after discharge from the ED were: the symptoms had diminished; inability to obtain a follow-up appointment; or they did not understand the instructions.¹⁴ Zorc et al.,13 conducted a study to improve patient follow-up after a pediatric emergency visit for asthma and showed that factors impeding parents from complying with follow-up care were health system barriers, including a lack of appointments and long waits in the primary care physician's office. Finding transportation, taking care of other children, and missing work to

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attend follow-up appointments were all noted as barriers to seeking treatment.¹⁵

Although several studies have tracked follow-up care obtained by patients treated in a hospital ED, the follow-up rate of patients treated there for dental trauma has not been reported. Lewis et al. reported that nearly 740,000 patients were treated annually in U.S. hospital emergency departments with a chief complaint of tooth pain or tooth injury.¹⁷ While these patients are often told to follow-up with their private dentists for further treatment, compliance with these follow-up instructions is unknown. It is also unknown if dental patients have the same barriers encountered in seeking follow-up care with a dentist as are reported with a primary care physician.

Identifying predictors for dental trauma follow-up is important to improve compliance and to plan treatment. The primary objective of this study was to examine hospital dental clinic records of trauma patients to determine the rate of follow-up care for patients seen after-hours in a hospital emergency department. A secondary aim was to survey parents/ guardians (caregivers) of trauma patients to identify predictors for and barriers to seeking follow-up care after receiving treatment in a hospital ED.

Methods

This retrospective quality assurance analysis examined charts of discharged ED patients at Nationwide Children's Hospital (NCH), Columbus, Ohio, who were instructed to obtain followup care within 2 weeks at the NCH dental clinic or at a private dental practice. Caregivers contacted for this survey had children who were initially seen in the ED at NCH for trauma to the permanent dentition between September 2003 and December 2007. This was a departmentally initiated quality assurance study that is exempt from Institutional Review Board approval.

Sample. Inclusion criteria for this quality assurance survey were that the patient presenting to the ED had: (1) a permanent tooth injury including avulsion, luxation, or intrusion; (2) completed root development of the involved tooth; and (3) initial treatment rendered in the ED of NCH. Patients meeting these criteria comprised the study's qualifying cohort (QC_{175}).

Record review. Data from a trauma collection form describing oral findings at the ED trauma visit were entered into an Access database (Microsoft Inc, Redmond, Wash). This database provided 4 main functions: (1) record a patient's initial visit; (2) open/review an existing patient visit; (3) create new or used preprogrammed queries to search for specific factors; and (4) create graphical reports to review clinical information.¹⁸ This information was entered by trained research assistants and the study coordinator. Clinic dental records of the QC₁₇₅ were reviewed to determine: if the patient followed-up with the dental clinic at NCH following initial injury; how many times a patient followed up; and, the treatment rendered at each visit.

Completion of gutta percha obturation within 6 months from the time of injury was the outcome measure designated as treatment completion and success. Whether the patient received a pulpectomy and calcium hydroxide fill within 21 days was also recorded. The dental clinic records allowed access to information in determining the type of dental insurance the patient had at the time of injury and contact information for the parent/guardian of the patient to conduct the phone survey.

Caregivers survey. A standardized phone survey and protocol algorithm were used to interview the parents/guardians about the quality of follow-up care they received and factors that may have affected patient follow-up rates. Before the survey was administered, it was reviewed and edited by NCH's health literacy department staff to ensure an appropriate language level below an eighth grade reading level. Prior to conducting phone surveys, a pilot study was conducted by the study coordinator in a face-to-face interview with the parent or guardian of 20 patients treated for trauma follow-up in the NCH dental clinic. Between 2 and 4 weeks later, the research assistant called each person originally surveyed and conducted the same interview over the phone. The study coordinator and a calibrated research assistant conducted all phone surveys. Analysis determined an inter-rater reliability (K) of 0.94 between the study staff.

Three attempts were made to contact the parent/caregiver of the QC_{175} by phone. If the parent/guardian who accompanied the patient to the NCH ED was unavailable, another parent or guardian was given the survey. Patients were excluded from the study if the parent/guardian could not be reached after 3 phone calls. The parent/guardian could also choose to be excluded from the survey.

Data management and statistics. Data from the phone surveys were collected and tabulated. Results gathered allowed a determination of relative success (defined by pulpectomy within 21 days and obturation within 6 months) of follow-up care received and parent perception of treatment rendered. Descriptive statistics were obtained for all explanatory and outcome variables. Due to a normal distribution, the mean, in conjunction with the standard deviation, was determined to be the best central measure of tendency for mileage traveled and number of follow-up visits.

Categorical variables (pulpectomy or obturation completed within predetermined time spans) were analyzed using Fisher's Exact Test. Ordinal variables (means, number of follow-up visits) were analyzed using 2-tailed t tests. A multiple regression model was employed to assess the relationship of predictor variables (insurance status, age of patient at time of injury, number of follow-up visits) to outcomes. Comparisons were considered significant at P<.05.

Results

Patient selection. The study sample consisted of 175 patients who fulfilled the inclusion criteria. Of this qualifying cohort (QC_{175}) of 175 patients, the parents/guardians of 96 patients agreed to participate in the quality assurance survey. This group of patients comprised the contacted cohort (CC_{α}) .

Demographic information: Qualifying cohort of 175. The mean age of the QC_{175} children was 13.8 ±3.0-years-old at the time of injury. The type of injuries they suffered and their insurance status are noted in Table 1. The most common injury was luxation (56%) followed by avulsion (38%) and intrusion (6%). Fourty-eight per cent of the patients were covered by Medicaid while 44% had private insurance.

Treatment variables: Qualifying cohort of 175. Dental records at NCH were reviewed to determine continuing care. The type and frequency of follow-up care received by these patients outside NCH is unknown; therefore, all treatment figures reported here pertain only to patients who received follow-up care for dental injuries at the NCH dental clinic. Forty-four (25%) patients did not return to NCH for follow-up care. Forty-nine (28%) returned for 1 to 2 follow-up visits, 51 (29%)

returned between 3 to 4 times, and 31 patients returned between 5 and 12 times (Figure 1). Followup appointments by insurance and injury type are noted in Table 1. Intrusion injuries required the most follow-up appointments (four). Patients with no insurance averaged one follow-up appointment, the fewest of the groups.

Treatment completion data is noted in Table 1. Notably from the QC_{175} , 79 patients (45%) had a pulpectomy within 21 days of injury at NCH, which is normal protocol.

Demographic information: Contacted cohort of 96 (CC₉₆)The CC₉₆ whose parents were contacted for completion of the quality assurance survey had a mean age of 13.7 ± 1.3 years old at the time of injury. Their injuries sustained and insurance coverage is noted in Table 1. The injuries sustained and insurance coverage for this group were consistent with those of the QC₁₇₅. Luxations were the most common injuries and intrusions the least. This group was evenly split between Medicaid and private insurance coverage.

Caregivers were contacted a mean of 2.5 years after the traumatic injury occurred. The ethnicity of the CC_{96} was 57% Caucasian, 26% African American, and Hispanic, Asian, Native American and Other making up the remaining 17%. Race was not a significant predictor for trauma follow-up or root canal treatment completion in this

study (*P*>.54). Demographic values from the QC_{175} and CC_{96} are very similar, illustrating that the CC_{96} is a well-distributed sample of the QC_{175} . There was no significant difference between the demographic information of the QC_{175} and CC_{96} .

Treatment variables: CC_{96} . As with the qualifying cohort, the type and frequency of follow-up care received by these patients outside NCH is unknown; therefore, all treatment figures reported pertain to patients who received follow-up care for dental injuries at the NCH dental clinic. The CC_{96} children had a mean number of 2.7±2.1 follow-up visits and drove a mean of 16.5±19 miles for treatment at NCH. Follow-up appointments by insurance and injury type are noted in Table 1.

Treatment completion data are noted in Table 1. A total of approximately 88% of the CC_{96} reportedly retained the injured tooth/teeth. In the group receiving a pulpectomy within 21 days, approximately 85% retained the traumatized tooth vs 90% in the group that did not receive a pulpectomy within 21 days at NCH. Ninety percent of all respondents reported that, to their knowledge, all treatment had been completed; and yet only 23% of the group that did not receive the pulpectomy at NCH reported following up with another dentist.

The most common barriers reported by CC_{96} parents to obtaining follow-up care are noted in Table 2. Parents reported the most commonly perceived barriers to follow-up care as: (1) the patient or siblings having to miss school (~22%); (2) parents having to take time off of work (~17%); and (3) costs associated with dental treatment (~13%).

Regression analysis. The number of follow-up visits was evaluated by regression analysis. There were no significant relationships between caregivers' responses to follow-up barriers and the number of follow-up visits (Table 2). To further evaluate responses, the CC_{96} was broken down into 2 groups: (1)

Table 1. INJURY CLASSIFICATION, INSURANCE STATUS, AND PULPECTOMY STATUS OF OUALIFYING COHORT (OC...; N=175) AND CONTACTED COHORT (CC...; N=96)

	Variable		N (%)	Pulpectomy completed within 21 days (%)	Gutta percha obturation completed within 6 months (%)	Follow-up appointments
QC ₁₇₅	Injury type	Luxation	99 (56)	36	32	2.3±2.3
		Avulsion	66 (38)	64	46	2.7±2.3
		Intrusion	10 (6)	20	30	4.0±2.2
	Insurance	Medicaid	83 (48)	52	35	3.0±2.5
		Private	77 (44)	42	27	2.2±2.1
		No insurance	11 (6)	27	2	1.0±1.6
		Unknown	4 (2)	25	1	1.5±2.4
CC ₉₆	Injury type	Luxation	57 (59)	36.8	31.6	2.4±2.4
		Avulsion	35 (37)	77.1	51.4	2.9±1.8
		Intrusion	4 (4)	0	25.0	4.5±2.5
	Insurance	Medicaid	46 (48)	47.8	34.8	2.8±2.5
		Private	46 (48)	52.2	41.3	2.6±2.2
		No insurance	3 (3)	33.3	66.7	2.0±1.7
		Unknown	1 (1)	100	0	0.0 ± 0.0



Figure 1. Compares $\rm QC_{175}$ and $\rm CC_{96}$ percentage of patients that returned by number of follow-up visits.

pulpectomy completed within 21 days; and pulpectomy not completed within 21 days. The only question/potential barrier for which the responses were significantly different, as revealed by Fisher's exact test, was whether the caregiver had other children to care for (P=.03). All other associations were not significant.

Discussion

This retrospective study examined hospital dental clinic records to determine the rate of follow-up care for children seen after hours in an urban hospital ED for dental trauma. A secondary aim was to survey caregivers of the trauma patients in an attempt to identify predictors and barriers for seeking followup care. Follow-up success was defined by whether or not the

Table 2. DIFFERENCES IN TREATMENT PREDICTORS OF THOSE PATIENTS WHO DID OR DID NOT HAVE PULPECTOMY COMPLETED WITHIN 21 DAYS

Survey question		Pulpectomy completed within 21 days (48 patients)		Pulpectomy not completed within 21 days (48 patients)	
	Yes	No	Yes	No	
 Did patient receive any follow-up care at dental office other than Nationwide Children's Hospital? 	12	36	11	37	1.00
3. From what you know, did the patient finish all needed treatment?	43	0	43	0	1.00
4. Does the patient still have injured teeth?	41	7	46	2	0.16
Did any of the following make it difficult to complete follow-up care?					
5a. The costs associated with treatment?	7	41	6	42	1.00
5b. The language spoken at the clinic?	0	48	1	47	1.00
5c. Are you taking time off work?	10	38	7	41	.59
5d. Do you have other children to care for?	8	40	1	47	.31
5e. Are you able to schedule an appointment this clinic?	3	45	5	43	.72
5f. The cost or availability of transportation to and from clinic?	2	46	0	48	.49
5g. Did the patient or any siblings have to miss school?	12	36	9	39	.62
5h. The number of follow-up visits needed to complete treatment?	3	45	2	46	1.00
5i. Other problems associated with receiving follow-up care?	4	44	5	43	1.00

patient received: a pulpectomy within 21 days; and a gutta percha (GP) obturation within 6 months of the trauma. From the QC_{175} , 65 (~37%) patients had the gutta percha obturation within 6 months of the initial injury. It is not known whether the remaining 63% of the patients initially treated in the ED either sought follow-up care with another dental professional or were seen in the NCH dental clinic but root canal therapy was not completed, not indicated, or avoided.

Treatment variables. The International Association of Dental Traumatology recommends at least 5 follow-up visits during the first year following luxation and avulsion injuries.^{8,9} The mean number of follow-up appointments for both the QC_{175} and CC_{96} in this study was less than 3, and at least 75% of our patients returned for at least 1 visit. This is similar to a study by Barlas et al., where over 30% of patients instructed to obtain follow-up care after an ED visit failed to do so.¹⁴

No significant difference in follow-up rates at NCH was noted between patients with private insurance vs those with public insurance (P=.61). This could indicate that patients with private insurance are more likely to return to their own dentists for needed follow-up care or could reflect limited reimbursement rates for multiple and expensive endodontic treatments follow-ing trauma. Patients without any insurance at the time of injury were significantly less likely to return for follow-up visits (P=.02).

The relatively low number of follow-up visits in this study contrasts with reports of up to 16 visits for complicated dental trauma involving damage to the periodontal ligament over a 3-year period.^{19,20} These studies, however, were conducted in countries with socialized health care systems requiring limited financial burden for the patients/parents. It might be assumed that financial barriers to receiving care in those countries would not have as great an effect on follow-up rates as with a privatized insurance system.

Due to this study's retrospective nature, the amount of time between injury and evaluation of the patients' charts varied significantly. These patient records were evaluated between 6 months and 3.5 years post-injury. 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.

Demographic information: Contacted cohort of 96. Although 45% of patients' caregivers were not contacted to complete the survey, the 55% who did and were included in the CC_{96} produced very similar demographic information to the QC_{175} . On average, patients' caregivers/parents were contacted to complete the quality assurance survey 2.5 years (range=1-3.5-years-old) after the date of initial trauma.

Treatment variables and data analysis: Contacted cohort of 96. The treatment variables reported on these patients are solely from individuals treated in the dental traumatology clinic at NCH for follow-up care. If the patient never returned to NCH for dental follow-up, it remained unknown what type or frequency of follow-up care those patients received. Near-

ly all (90%) parents/caregivers who responded to the survey, however, reported that "to their knowledge" all needed dental treatment had been completed. Yet, of the patients who did not receive a pulpectomy at NCH, only 23% reported following-up with another dental professional. Social desirability response bias, which is the tendency for people to present a favorable image of themselves on questionnaires, may have contributed to the 90% of parents responding they felt as though all the treatment had been completed.

Over 87% of parents/caregivers reported the child still had the injured tooth/teeth. It is worth noting that approximately 85% of patients who received a pulpectomy at NCH within 21 days of the trauma reported still having the traumatized tooth. In the other group of patients who did not have the pulpectomy done within 21 days, 90% reportedly still had the injured tooth. The number of clinic follow-up visits at NCH and the relationship to "tooth present at time of contact" was not significant (P=.22). If clinic records and parent reports are accurate, one questions why so many teeth are retained and asymptomatic for such a long period of time with a "treatment completed" rate (gutta-percha obturation at 6 months) of approximately 37%. Many of these teeth may have been asymptomatic, and the parent may have not seen a reason to return for follow-up care. Root resorption can occur without symptoms, and some of these teeth may yet be lost. On the other hand, some of these teeth may have healed in spite of their injury and lack of treatment. Andreasen et al., have reported such occurrences and discussed apparent contradictions in treatment guidelines and

outcomes owing to the lack of evidence-based protocols for treating traumatized teeth.²¹

Parents reported the most commonly perceived barriers to follow-up care as: (1) the patient or siblings having to miss school (-22%); (2) parents having to take time off of work (-17%); and (3) costs associated with dental treatment (-13%). None of these barriers, however, were associated with the number of follow-up visits made by the QC₁₇₅ of patients (Table 2). These findings are similar to that of Kyriacou et al., in that sociodemographic characteristics such as race, age, insurance status, and distance traveled did not affect ED patients' followup compliance.¹⁶

Our results are also similar to those found in a study examining barriers to obtaining follow-up care after receiving emergency treatment in the ED for asthma.¹³ Zorc et al., reported that the most common barriers parents reported to follow-up care with a physician were: missing school or work (23%); and caring for other children (9%).¹³ As part of our quality assurance effort, we are now testing several methods of assuring follow-up appointments for dental trauma patients treated in the ED.

Limitations in our study design impacted our results. Using pulpectomy and gutta percha obturation at NCH as sole measures of treatment success fails to account for treatment provided by other dentists. Additionally, recall bias may have affected parents responding to the phone survey as they tried to recall events occurring 1 to 3.5 years previously.

Conclusions

Based on this study's results, the following conclusions can be made:

- 1. Patients averaged fewer than three follow-up visits at Nationwide Children's Hospital.
- 2. Over 62% of this study's patients never received the recommended pulp therapy at NCH.
- 3. Socioeconomic factors most frequently cited as barriers to receiving treatment included having to miss school, taking time off work, and cost of treatment, although none had a statistically significant effect on treatment completion.
- 4. Type of insurance (public or private) had no significant effect on number of follow-up visits or treatment completion.

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