Follow-Up for Dental Trauma Presenting to a Hospital Emergency Department

Alec Justin Montemayor

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2024

Committee:

Barbara Sheller

Bryan Williams

Nestor Cohenca

Program Authorized to Offer Degree:

Pediatric Dentistry

© Copyright 2024
Alec Justin Montemayor

University of Washington

Abstract

Follow-Up for Dental Trauma Presenting to a Hospital Emergency Department

Alec Justin Montemayor

Chair of Supervisory Committee:
Barbara Sheller
Department of Pediatric Dentistry

Purpose: This study describes ED presentation/management, subsequent follow-up visits and family experience for a cohort of patients initially presenting to a hospital with dental trauma.

Methods: Patients presented with dental trauma between March 2021 and February 2022. Data was collected from the ED visit notes and follow-up appointment visit notes. All families were invited to participate in a telephone survey about their experience.

Results:

168 patients (mean age 6.2 years) were included. Insurance status was private insurance 54.2%, Medicaid 45.2%, and no dental insurance 0.6%. Primary tooth injuries (N=100) were isolated luxation N=51, combination injuries N=33, isolated crown fractures N=14, and isolated avulsion N=2. Permanent tooth injuries (N=68) were combination injuries N=33, isolated crown fracture N=18, and isolated avulsion N=5. Most frequent treatments were extraction for injured primary teeth 46% and baseline exams for injured permanent teeth 63%. Follow-up visit details were available for 40 patients: 20 with primary tooth injuries and 20 with permanent tooth trauma. At

the follow-up visit the most frequent management of primary teeth was monitoring for re-eruption (95%) and monitoring/vitality testing for permanent teeth (57.9%). Thirty-six parents completed surveys: 22 for primary injuries and 14 for permanent tooth injuries. Of the surveyed parents 47.2% had private insurance. All reported that the ED experience was intense. All but one patient had follow-up within the recommended time frames. Three families reported barriers to obtaining follow-up: available appointments (N=3) and restricted insurance network (N=2).

Conclusions:

Guidelines recommend timely dental clinic follow-up for dental injuries that are initially treated in an ED. Given the stress of an ED encounter, families may best be supported by development of clear multimodal roadmaps specific to their child's dental trauma.

Table of Contents:

List of Tables……………………………………………………………………………...…...iv

List of Appendices……………………………………………………………………………...v

Introduction………………………………………………………………………………......1

Methods…………………………………………………………………………………………2

Results………………………………………………………………………………………..5

Discussion………………………………………………………………………………………9

Tables…………………………………………………………………………………………….14

References……………………………………………………………………………………..24

Appendices…………………………………………………………………………………..…26

List of Tables

Table 1. Demographics and emergency type for patients presenting to a hospital emergency department with dental trauma between 3-01-2021 and 2-28-2022

Table 2: Established Dental Home vs No Dental Home

Table 3a: Dental Treatments for patients presenting to an emergency department with primary tooth trauma emergencies in the study period. N=100

Table 3b.: Dental treatments for 68 patients presenting to an emergency department with permanent tooth trauma emergencies in the study period. N=68

Table 4: Characteristics of Patients completing F/U at vs. Not completing F/U

Table 5a.: Primary tooth injuries and treatment completed at follow up. N=20

Table 5b.: Treatment completed at Follow up for Permanent Teeth N=20

Table 6: Characteristics of patients with survey vs. not completing survey

Table 7. Survey Responses. N=36

Table 8: Comments from Survey Participants

List of Appendices

Appendix A: Invitation letter sent to families to participate in telephone survey

Appendix B: Questions asked during telephone survey

Acknowledgements:

I wish to thank my research team for their constant support and guidance through this project;

Dr. Sheller, thank you for being generous with your time and expertise with the study design, redcap, and manuscript.
Dr. Willaims, thank you for spending weekends with me, helping collect data and improve the manuscript.
Dr. Cohenca, thank you for your passion regarding dental trauma and ability to share your wealth of knowledge.

A special thanks to Dr. Celeith Acevedo for your help. I am excited to see all the big things you accomplish throughout your career.

To my coresidents: Dillon, Jake, Kazi, and Sydney. Thank you for the constant laughs and support through residency.

Additional acknowledgements to the Dr. Bryan J. Williams Endowment for Pediatric Dental Medicine at Seattle Children’s Hospital for providing additional funding and making this project possible.

Dedication:

To Kennedy Montemayor, my wife. The constant support
and belief in me fueled me to see this thesis through.

Por mis abuelos, porque sin los sacrificios
y trabajo duro de ellos, no estaria aqui.
Esto es para ustedes.

Introduction

Dental injuries occur often in children and adolescents. About 25 percent of school aged children and 33 percent of adults have experienced dental trauma to the permanent teeth before the age of 19 years (Leven 2020). Dental injuries include fracture of alveolar bone, soft tissue injuries (abrasions, lacerations), displacement of teeth, and fractures of teeth. In a 1997 study completed in an academic children's hospital, 541 patients had dental trauma; 59% of these patients were under the age of seven years and the most common cause of dental injuries was falling (Wilson 1997). A three-year study of 487 patients with dental trauma was completed in a children's hospital in 1998. The highest frequencies of patient age were around age two years and a lesser degree to age eight for dental trauma, 64% of patients were under age six (Lombardi 1998).

International Association of Dental Traumatology (IADT) Guidelines provide evidence-based treatment recommendations for dental injuries including frequency of dental visits for monitoring, frequency of radiographs, and lists of favorable or unfavorable outcomes (Leven 2020). Following a dental injury, receiving follow up care is thought to be associated with better dental outcomes as it allows the dentist to monitor the injury, address any complications in a timely manner, and make appropriate referrals to other dental specialties if indicated.

Most studies of follow up after care in the emergency department (ED) relate to medical concerns. Compliance with follow up care after receiving initial medical treatment in the ED is less frequent than recommended. A 2003 cohort study of 461 patients in a university-based teaching hospital ED documented 60.4% compliance with recommended follow up after being seen for a medical problem (Wang 2006). A 2009 study of 278 patients presenting with medical

concerns to an urban children's hospital ED described barriers to follow up included: appointment availability, wait time to see a physician, and having to miss school or work (Zorc 2003).

Few studies describe follow up for pediatric patients with dental injuries presenting initially to an ED. A study conducted from 2003-2007 of 175 patients treated for dental trauma in the ED was done at Nationwide Children's Hospital. Patients averaged less than three follow up visits. Among barriers to receiving follow up care reported by parents/guardians were: missing work and/or school and the cost of dental treatment (Gustafson 2011). In a study completed in 2007-2011 of 264 patient records from Children's Hospital New Orleans ED, only 42% of patients who received care in the ED for emergency related dental trauma had follow up care at a dental clinic (Ritwick 2015).

The purpose of this study is was to 1) describe a cohort of patients presenting to a pediatric hospital emergency department with dental trauma including recommendations for follow up, 2) assess follow up appointment attendance, treatment(s) for the injured tooth/teeth, and outcomes specific to the injured tooth/teeth, and 3) survey these patients at least one year after their encounter in the ED to: determine efficacy of current discharge protocol, identify barriers to obtaining follow up care, and assess status of injured teeth.

Methods

Seattle Children's Hospital (SCH) is a 407 bed tertiary care pediatric hospital. The SCH Emergency Department (ED) provides services 24 hours per day. Patients presenting to the ED with dental complaints are initially evaluated by the medical team. When requested by the medical team pediatric dentistry residents and attending pediatric dentists manage these patients.

Treatment in the ED includes baseline examinations, appropriate radiographs, followed by any necessary treatment per IADT guidelines.

The discharge protocol for dental trauma patients managed through the SCH ED includes both verbal and printed recommendations for timing and type of follow up appointments. For patients who do not have a dental home to provide follow up care, an appointment at SCH-affiliated clinics including the University of Washington Center for Pediatric Dentistry was offered. No outreach is made by the SCH dental department following the ED encounter.

Dental Trauma Cohort EHR Review

Data for this institutionally approved retrospective study was collected by review of electronic health records (EHR) (IRB #00004431). Study participants were identified via SCH Dentistry Department reports. Patients in the study cohort presented to the SCH ED in 2021 and 2022 for dental trauma. Inclusion criterion was: Patients aged 0-21 years old presenting to SCH ED for dental trauma and treated by attending pediatric dentists and/or dental residents between 3-1-2021 and 2-28-2022. Exclusion criterion were: 1) patients seen outside of the study period, 2) patients with dental/facial trauma managed by oral and maxillofacial surgery, 3) patients with injuries limited to perioral soft tissue, or 4) patients with fractured teeth secondary to advanced dental caries. Patients with language of care other than English or Spanish were excluded from the survey portion of the study. Study data were collected and managed using REDCap electronic data capture tools hosted at SCH (PA Harris 2009; PA Harris 2019).

Patient information included date of birth, sex assigned at birth, race/ethnicity, language of care, date of ED visit for dental injury, and insurance payor. Patients were classified as presenting to the SCH ED with either primary dental trauma or permanent dental trauma; in

instances where both primary and permanent teeth were injured, the injury was categorized as "permanent". Data collected regarding dental trauma included tooth number, tooth diagnosis at the time of ED encounter, dental treatment completed in the ED, recommended time frame for follow up, and whether a specialty referral was provided.

Follow Up Cohort EHR Review

Data regarding follow up was collected by reviewing the EHR of patients where a follow up appointment was completed at SCH-affiliated dental clinics (SCH or OBCC) or at the University of Washington Center for Pediatric Dentistry (UW). Data included date of follow up appointment, dental diagnosis, treatment completed during the appointment, if specialty referral was provided, and if the appointment was completed in the timeframe recommended during the ED encounter.

Telephone Survey

Not all patients that presented to the ED in the study period met the criteria to participate in the survey portion of study. Patients were excluded if 1) the patient/family declined to be contacted for research purposes, or 2) required a language other than English or Spanish. A packet explaining the study and including an invitation to participate was sent to the address of record in the EHR for all potential participants. The invitation letter had a readability score approximating a 7th grade reading level. (Appendix A). After a period of at least two weeks, families were contacted by phone to determine their interest in participation in the survey. Three attempts were made to contact each family by phone, if no contact was made it was assumed that the potential subject did not wish to participate and there were no further attempts to contact.

A twelve-item institutionally approved survey was developed (SCH IRB #00004431) (Appendix B). Survey questions inquired about patient or parent recall of follow up care instructions at the time of the SCH ED encounter, current insurance type, and barriers to obtaining follow up care. All patients were given the opportunity to share "anything else you would like us to know about your experience with follow up care after the ED."

Prior to asking the survey questions, consent/assent was obtained for the patient or parent. Questions were asked to determine whether the subject/representative understood the information provided about the study, didn't feel pressured by time or other factors to make a decision, ensured understanding that participation was optional, and to clarify whether the subject/guardian is capable of making and communicating informed consent. Responses were recorded using SCH REDCap. As a thank you for completing the survey, a $10 grocery store gift card was mailed to the preferred address for the participating subjects.

Results

During the one-year study period, 337 patients presented to the SCH ED with a dental complaint. Of those, 168 (49.9%) visits were related to dental trauma managed by the pediatric dentistry team and made up the initial study cohort. Of the 168 patients, 104 (61.9%) were male and 64 (38.1%) female. The mean age was 6.23 years (SD= 4.08, range 1.08-16.81). Race of the patients were: White 57.7%, Black 13.7%, Asian 10.7%, and other 17.9%. Patient ethnicity was Non-Hispanic 85.7%, Hispanic 12.5%, and declined reporting 1.8%. Language of care was English 92.3%, other languages 5.4%, and Spanish 2.4%. Dental home status was: private pediatric dental office 44.3%, private family dental office 22.2%, no dental home 21%, hospital affiliated clinic 7.8%, community clinic 3.6%, and not recorded 1.2%. (Table 1)

The 35 patients without a dental home had a mean age of 3.37 (SD=2.88, range 1.08-13.30). Of the 35 patients, 19 were male and 16 were female. Race of the patients were: White 51.4%, Black 20.0%, Asian 8.6%, and other 20.0%. Patient ethnicity was Non-Hispanic 82.9%, Hispanic 14.3%, and declined reporting 2.9%. Insurance payors were Medicaid 51.4% and private insurance 48.6%. Language of care was English 85.7%, other languages 8.6%, and Spanish 5.7%. (Table 2)

Dental injuries involved primary tooth/teeth 59.5% and permanent tooth/teeth 40.5%. Primary dentition injury classifications were: isolated luxation N=51, combination injuries N=33, isolated crown fracture N=14 and isolated avulsion N=2. Treatments completed in the ED for primary tooth injuries were: extraction 46%, baseline exam 63%, and pulp treatment 3.5%. Recommended time frame for follow up was: within one week 57%, within 2 weeks 40%, and at next recall exam 3%. (Table 3a)

Permanent dentition injury classifications were: combination injuries 51.4%, isolated crown fracture 26.5%, isolated luxation 14.7%, and isolated avulsions 7.4%. Treatments completed in the ED were baseline exams 54.5%, splint placement 30.3%, pulpal treatment 24.2%, and replant/reposition 21.2%. Recommended time frame for follow up was: within one week 61.8% and within 2 weeks 38.2%. Eight patients were referred for specialty care: seven to Endodontics, and one to Oral and Maxillofacial Surgery. (Table 3b)

Patients with Follow-Up through Hospital Affiliated Clinics

Follow up information was available for 40 patients, 24 were male and 16 female. The mean age was 6.74 years (SD= 4.01, range 1.18-15.84). Race of these patients were: White 40%, Black 25.0%, Asian 10%, and other 25.0%. Ethnicity was: Non-Hispanic 85%, Hispanic

12.5%, and declined reporting 2.5%. Insurance for this study group was Medicaid 62.5% and private insurance 37.5%. Language of care was 35 English and five languages other than English or Spanish. Dental home for this cohort was: no dental home 35%, private pediatric dental office 25%, private family dental office 25%, hospital affiliated clinic 12.5%, and community clinic 2.5%. (Table 4)

Twenty of the patients who followed up at hospital affiliated clinics had primary tooth injuries. Nineteen of these patients had only examinations in the ED and one patient had been managed with an extraction. Recommended follow up was: within one week 57%, within 2 weeks 40%, and at next recall 3%. Time elapsed between initial ED visit and first follow up was a median of 9 days (Figure 1). Treatment completed at the follow up visit was continued monitoring for re-eruption 95% and extraction 5%. (Table 5a)

Total Count (N)	Missing*	Unique	Min	Max	Mean	StDev	Sum	Percentile						
								0.05	0.10	0.25	0.50 Median	0.75	0.90	0.95
20	0 (0.0%)	14	4	380	36.35	84.35	727	4	5.80	8	9	15.50	82.10	106.40

Lowest values: 4, 4, 6, 7, 8
Highest values: 17, 24, 81, 92, 380

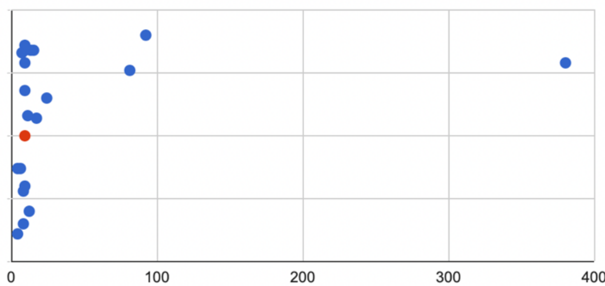

Fig.1. Time elapsed between initial ED visit and first follow up (days)

Twenty of the patients who followed up at a hospital affiliated clinic had permanent dental traumas: combination injuries 35%, isolated crown fracture 35%, isolated avulsion 20%, and isolated luxations 10%. Treatments completed in the ED were baseline exam only 54.5%, pulpal treatment 24.2%, and splint placement 30.3%. Recommended follow up was within one

week 61.8% and within two weeks 38.2%. Time elapsed between initial ED visit and first follow up was a median of 7.5 days (Fig. 2). Treatment completed at the follow up visit was continued monitoring/vitality testing 57.9%, pulpal treatments 21%, restorations 10.5%, reposition/splinting 5.3%, and extraction 5.3%. Five patients were referred for specialty care: four to Endodontics, and one to Orthodontics. (Table 5b)

Total Count (N)	Missing*	Unique	Min	Max	Mean	StDev	Sum	Percentile						
								0.05	0.10	0.25	0.50 Median	0.75	0.90	0.95
20	0 (0.0%)	15	1	148	17.80	32.76	356	1.95	2	3.75	7.50	14.75	34.50	53

Lowest values: 1, 2, 2, 3, 3
Highest values: 17, 18, 33, 48, 148

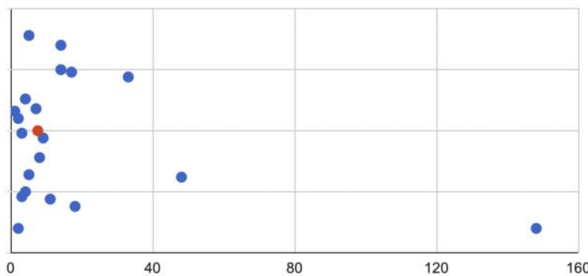

Fig.2 Time elapsed between initial ED visit and first follow up for permanent tooth treatment (days)

<u>Patients with Completed Telephone Surveys about ED Experience</u>

Telephone surveys were completed for 36 patients: 35 by parents and one by an 18 year old patient. Twenty six of the patients were male and 10 female. The mean age at the time of the ED visit was 5.87 years (SD= 4.19, range 1.08-15.84). Race of the patients were: White 50%, other 30.6, Black 16.7%, and Asian 2.8%. Patient ethnicity was Non-Hispanic 72.2%, Hispanic 25%, and patient declined reporting 2.8%. Insurance for this study population was Medicaid 52.8%, private insurance 47.2%. Language of care was English 91.7% and 8.3% Spanish. Dental home for the telephone survey group was: private pediatric dental office 44.4%, private family

dental office 25%, no established dental home 19.4%, community clinic 5.6%, and hospital affiliated clinic 5.6%. (Table 6)

Dental injuries involved 22 primary tooth/teeth and 14 permanent tooth/teeth. When asked if the family recalled directions about when to follow up with a dentist after injury, 18 families reported yes and 18 reported no. When asked if the family recalled directions about where to follow up, 36 reported yes and two reported no. Families were asked if they remembered receiving printed recommendations after being discharged from the ED, and if so asked if recommendations were helpful. Responses were: remembered/helpful 55.6%, not remembered 33.3%, remembered/unhelpful 11.1% (Table 7). Few barriers to follow up care were reported, these were: no available appointments in recommended time frame (N=3), unable to get time off work (N=2), and problems with scheduling by telephone (N=2). When families were invited to give comments regarding the ED experience, one parent expressed dissatisfaction with the way she was treated in the ED and attributed it to her race. Another parent was satisfied with the attention from the dental team, however felt that the medical team did not do a thorough examination. One parent stated it was difficult to schedule a follow up appointment with their dental home. (Table 8)

Discussion

Favorable outcomes following dental trauma have been associated with early diagnosis and management and timely appropriate follow up (Levin 2020). Multiple studies describe dental trauma in the setting of pediatric emergency departments (ED). (Wilson 1997, Lombardi 1998; Rowley 2006; Mitchell 2014; Walsh 2023). There are few studies describing follow up care for pediatric patients whose emergency dental trauma care originated in an ED. Barriers to receiving

follow up care in a 2003-2007 study included missing work and/or school and the cost of dental treatment (Gustafson 2011).

The Affordable Care Act (ACA) enacted in the United States in March 2010 defined dental care for children as an essential health care service. This mandate dramatically improved access to dentistry for children up to age 18 years. (Song J 2021). There have been no studies of pediatric dental trauma follow up during the time when financial barriers were reduced.

Original Cohort Commentary

The patient demographics and dental injuries of the subjects in this study are consistent with emergency patient cohorts from the same pediatric hospital done between 1994-2023 (Zeng 1994; Lombardi 1998; Rowley 2006; Michell 2014; Walsh 2023). In the most recent study at this hospital completed in 2023, the mean age was 6.38 years. The majority of the patients were male with an almost equal distribution of private and public insurance and permanent vs primary teeth.

A notable finding is the large number of patients (67%) who had an established dental home with a private pediatric or general dentist yet utilized the ED for initial assessment of a dental injury. Interestingly, none of these patients had been evaluated by their dentist prior to being seen in the ED. Treatments provided to the patients in the ED were standard dental procedures (e.g. extractions of primary incisors, splinting of mobile teeth) that dentists could do more efficiently and cost effectively in a dental office or clinic setting.

Emergency departments serve as a safety net providing care to patients without established medical and dental providers. Nearly all patients without a dental home were preschool age and younger. Interestingly, these children all had dental insurance coverage. Those without a dental home should be considered at risk for failure to follow up with a dentist after

receiving initial care for a dental injury in the ED. Such patients would be expected to benefit from clear communication of both the follow up plan and direct referral to available dental clinics for follow up.

Follow Up Cohort Commentary

Follow up information was available only for the 40 patients seen at the hospital or affiliated clinics. Remarkably, 90% received this follow up in the recommended time frame per IADT. The patients who chose to follow up at these clinics were significantly more likely to have Medicaid insurance and injury to a permanent tooth. Valuable procedures that occurred at follow up for primary dental trauma included establishing a dental home, radiographs, monitoring re-eruption of intruded teeth, and extractions. Key services at follow up appointments for permanent dental trauma included continued monitoring/vitality testing, pulpal treatments, restorations, reposition/splinting, extractions, and appropriate referrals to specialty clinics.

Survey Cohort Commentary

The emergency department discharge process includes verbal instructions and a printed summary of findings, treatment in the ED, and follow up recommendations. Surprisingly, a third of the survey participants did not remember receiving this information. Despite the time elapsed between the ED visit and the survey, a few parents reported frustration and distress associated with ED experience. Length of the ED visit was a dissatisfier. A 2020-2021 study at the same hospital ED found the mean time for trauma emergencies exceeded four hours (Walsh 2023). In general, comments about the dental team were more positive than comments about the medical providers. Parents were present during dental treatment and reported traumatic memories of their child's care when extraction was the treatment.

Suggested Modifications to Current State

These results indicate areas for improvement within the dental home, during the ED visit, and at follow up. Dentists and dental clinics in the community should have clear protocols in place for after-hours dental emergencies and communicate this to their patients. Dentists should encourage their patients to download mobile application based professional resources such as ToothSOS. This tool can guide parents through triaging a dental injury (Khehra 2020).

Dentists relying on the ED to meet their obligation to provide emergency care should realize they are directing patients into a system which is not designed to manage dental trauma. Visit lengths should be expected to exceed three hours. A medical evaluation will always precede dental treatment which dramatically increases costs and time for care. When dental injuries are uncomplicated, the medical evaluation does not add value (Mitchell 2014).

Parents may have no alternative to the ED for emergency care if they have not established a dental home for their child or the dental home is inaccessible after hours. This forces families into time inefficient care which is more expensive than treatment in a dental clinic and shifts the cost of treating dental emergencies from dental to medical payors.

Potential improvements for patient experience within the ED include expectation management with parents about procedures such as extraction of a primary tooth and refinement of discharge materials to include illustrations and timelines to guide parents as their child heals. A text or email reminder regarding follow up timeframe and clinic could serve as a prompt for scheduling post ED dental visits. Recognizing that private dentists and clinics do not have access to patient hospital electronic health records, it would be prudent to encourage parents to take a

photograph of dental imaging acquired in the ED and to print a copy of the dental ED note to share with their dentist.

Limitations

Data for the original ED trauma patient group and the follow up patient cohort was collected retrospectively and information was restricted to that in the record. Follow up appointments completed outside of the hospital and affiliated clinics were not included due to IRB restrictions. Surveys were offered to those who spoke English or Spanish and may not reflect the experience of those speaking other languages. This study was done at a single hospital ED and may not reflect the dental community standards and practices of other areas. Specific tooth outcomes may be of interest for future studies but were not the focus of this study.

Conclusions

A hospital ED is not an ideal venue for management of straightforward dental trauma. This study illustrates a need for an alternative to the ED for managing children with dental emergencies. First, as a matter of professional responsibility patients' dental homes should have some provision for emergency coverage for patients of record for routine dental emergencies. Patient screening using teledentistry could appropriately triage and direct patients to better venues. An after hours emergency dental clinic in the community could treat most dental injuries with reduced burden on patient, families, and healthcare resources while meeting professional ethical standards.

Table 1: Demographics and emergency type for patients presenting to a hospital emergency department with dental trauma between 3-01-2021 and 2-28-2022						
	All patients		Patients with follow up		Patients with survey	
	N=168		N=40		N=36	
Age in Years						
Mean	6.23		6.74		5.87	
SD	4.08		4.01		4.19	
Range	1.08 - 16.81		1.18 - 15.84		1.08 - 15.84	
Gender	n	%	n	%	n	%
Male	104	61.9	24	60	26	72.2
Female	64	38.1	16	40	10	27.8
Race						
Asian	18	10.7	4	10.0	1	2.8
Black	23	13.7	10	25 .0	6	16.7
White	97	57.7	16	40.0	18	50.0
Other	30	17.9	10	25.0	11	30.6
Ethnicity						
Non-Hispanic	144	85.7	34	85.0	27	75
Hispanic	21	12.5	5	12.5	9	25
Patient Declined	3	1.8	1	2.5	0	0
Language of Care						
English	155	92.3	35	87.5	33	91.7
Spanish	4	2.4	0	0.00	3	8.3
Other	9	5.4	5	12.5	NA	NA
Payor						
Medicaid	76	45.2	25	62.5	19	52.8
Private	91	54.2	15	37.5	17	47.2
No dental insurance	1	0.6	0	0	0	0
Type of Emergency						
Primary Trauma	100	59.5	20	50.0	22	61.1
Permanent Trauma	68	40.5	20	50.0	14	38.9

Table 2: Established Dental Home vs No Dental Home				
	Established Dental Home		No Dental Home	
	N=133		N=35	
Age in Years				
Mean	6.99		3.37	
SD	3.99		2.88	
Range	1.47-16.81		1.08-13.3	
Gender	N	%	N	%
Male	85	63.9	19	54.3
Female	48	36.1	16	45.7
Race				
Asian	15	11.3	3	8.6
Black	16	12	7	20
White	79	59.4	18	51.4
Other	23	17.3	7	20
Ethnicity				
Non-Hispanic	115	86.5	29	82.9
Hispanic	16	12	5	14.3
Patient Declined	2	1.5	1	2.9
Language of Care				
English	125	94	30	85.7
Spanish	2	1.5	2	5.7
Other	6	4.5	3	8.6
Payor				
Medicaid	58	43.6	18	51.4
Private	74	55.6	17	48.6
No Dental Insurance	1	0.8	0	0
Type of Emergency				
Primary Trauma	69	51.9	31	88.6
Permanent Trauma	64	48.1	4	11.4

Table 3a: Dental Treatments for patients presenting to an emergency department with primary tooth trauma emergencies in the study period. N=100		
	All patients	
	n	%
Patient Dental Injury		
1 tooth injured	33	33
2 or more teeth injured	67	67
Maxillary injury only	87	87
Maxillary and Mandibular injury	7	7
Mandibular injury only	6	6
Diagnosis		
# of patients with Luxation/Displacement	78	78
# of patients with isolated Luxation/Displacement	51	51
# of patients with crown fracture	38	38
# of patient with isolated crown fracture	14	14
# of patients with avulsion	7	7
# of patients with isolated avulsion	2	2
Treatment Completed		
# of patients with extraction	46	46
# of patients with monitoring	63	63
Other	6	6
Recommended follow up		
Within 1 week	57	57
Within 2 weeks	40	40
At next recall	3	3

Table 3b.: Dental treatments for 68 patients presenting to an emergency department with permanent tooth trauma emergencies in the study period.		
	All patients N=68	
	n	%
Tooth Number		
1 tooth injured	21	30.9
2 or more teeth injured	47	69.1
Maxillary only	60	88.2
Max + Mand	5	7.4
Mand. Only	3	4.4
Diagnosis		
# of patients with luxation/displacement	36	52.9
# of patients with isolated luxation/displacement	10	14.7
# of patients with crown fracture	42	61.8
# of patients with isolated crown fracture	18	26.5
# of patients with avulsion	15	22.1
# of isolated avulsions	5	7.4
Avulsion Media		
Diary Product	3	50
Saliva	1	16.7
Other	2	33.3
Extraoral Dry Time		
0-15 minutes	4	26.7
16-30 minutes	2	13.3
31-45 minutes	1	6.7
46-60 minutes	0	0
61+ minutes	5	33.3
Tooth not found	3	20
Treatment Completed		
# of patients: Reposition/Reimplant	14	21.2
# of patients: Splint	20	30.3
# of patients: Pulpal treatment	16	24.2
# of patients: Monitoring	36	54.5
Specialty Referral Given	N=8	
Specialty Type		
Endodontics	7	
Oral Maxillofacial Surgery	1	
Recommended follow up		
Within 1 week	42	61.8
Within 2 weeks	26	38.2

Table 4: Characteristics of Patients completing F/U at vs. Not completing F/U				
	Patients who did not complete F/U		Patients completing F/U	
	N=128		N=40	
Age in Years				
Mean	6.08		6.74	
SD	4.07		4.01	
Range	1.08-16.81		1.18-15.84	
Gender	N	%	N	%
Male	80	62.5	24	60
Female	48	37.5	16	40
Race				
Asian	14	10.9	4	10.0
Black	13	10.2	10	25.0
White	81	63.3	16	40.0
Other	20	15.6	10	25.0
Ethnicity				
Non-Hispanic	110	85.9	34	85.0
Hispanic	16	12.5	5	12.5
Patient Declined	2	1.6	1	2.5
Language of Care				
English	120	93.8	35	87.5
Spanish	4	3.1	0	0
Other	4	3.1	5	12.5
Payor				
Medicaid	51	39.8	25	62.5
Private	76	59.4	15	37.5
No dental Insurance	1	0.8	0	0
Type of Emergency				
Primary Trauma	80	62.5	20	50
Permanent Trauma	48	37.5	20	50

Table 5a.: Primary dental trauma and treatment completed at follow up. N=20		
	Patients with follow up	
	N	%
Tooth Number		
1 tooth injured	5	25
Two teeth	16	75
Maxillary only	18	90
Mand. Only	2	10
Diagnosis		
# of patients with luxation/displacement	16	80
# of patients with isolated luxation/displacement	9	45
# of patients with crown fracture	9	45
# of patients with isolated crown fracture	2	10
# of patients with avulsion	1	5
Treatment Completed		
# of patients: Extraction	1	5
# of patients: Monitoring	19	95

Table 5b.: Treatment completed at Follow up for Permanent Teeth N=20		
	Patients with follow up	
	N	%
Tooth Number		
1 tooth injured	12	60
2 or more teeth injured	8	40
Maxillary only	18	90
Max+ Mand	2	10
Diagnosis		
# of patients with luxation/displacement	10	50
# of patients with isolated luxation/displacement	2	10
# of patients with crown fracture	13	65
# of patients with isolated crown fracture	7	35
# of patients with avulsion	6	30
# of isolated avulsions	4	20
Treatment Completed		
# of patients: Extraction	1	5.3
# of patients: Reposition/Reimplant/ Splint	1	5.3
# of patients: Restoration	2	10.5
# of patients: Pulpal treatment	4	21
# of patients: Monitoring	11	57.9
Specialty Referral Needed	N=5	
Specialty Type		
Endodontics	4	21.1
Orthodontics	1	5.3

Table 6: Characteristics of patients with survey vs. not completing survey				
	Patients who did not complete Survey		Patients completing Survey	
	N=132		N=36	
Age in Years				
Mean	6.34		5.87	
SD	4.03		4.19	
Range	1.18-16.81		1.08-15.85	
Gender	N	%	N	%
Male	78	59.1	26	72.2
Female	54	40.9	10	27.8
Race				
Asian	17	12.9	1	2.8
Black	17	12.9	6	16.7
White	79	59.8	18	50.0
Other	19	14.4	11	30.6
Ethnicity				
Non-Hispanic	117	88.6	26	72.2
Hispanic	12	9.1	9	25.0
Patient Declined	3	2.3	1	2.8
Language of Care				
English	122	92.4	33	91.7
Spanish	2	1.5	3	8.3
Other	8	6.1	0	0
Payor				
Medicaid	57	43.2	19	52.8
Private	74	56.1	17	47.2
No dental insurance	1	0.8	0	0
Type of Emergency				
Primary Trauma	78	59.1	22	61.1
Permanent Trauma	54	40.9	14	38.9

Table 7. Survey Responses. N=36		
	All patients	
	n	%
Who is completing survey?		
Patient	1	2.8
Parent or Guardian	35	97.2
Who came to the ED with patient?	87	87
Parent(s) or Guardian	36	100%
Recall: When to follow up		
Yes	18	50
No	18	50
Recall: Where to follow up		
Yes	34	94.4
No	2	5.6
Recall: Receiving written instructions	2	
Yes/helpful	20	55.6
Yes/Unhelpful	4	11.1
Do not remember	12	33.3
Recall: Received follow up care with dentist		
Yes	35	97.2
No	2	2.8
Location of follow up		
Hospital Affiliated Clinic	9	25
Other	26	72.2
I do not know	1	2.8
Current dental insurance		
Medicaid	19	52.8
Private insurance	17	47.2
Barriers to follow up care		
Yes	3	8.3
No	33	91.7
Tooth still present		
	Yes	52.8
	No	47.2

Table 8: Comments from Survey Participants		
	n	Examples of comments
Dental Specific Comments		
Positive comments about dental staff	10	…dentist came fast and was very caring and concerned….. ... it help that that dentist had a positive attitude.... ...Dental team was awesome... ...Grateful for the recommendations of the doctors... ...Exceptional care! Keep doing that extra mile....
Overall positive dental experience	10	
Negative comments about dental staff	10	...it was traumatic to see the extraction..... ...Felt mistreated because my race... ... There was not communication between ED dentist and primary dentist.... ... would like a ED follow-up within a week..
Long waiting time for dentist in the ED before being seen	3	
Problems with communication	8	
Dental Traumatic experience	1	
One week follow up suggested by parents	2	
Medical Specific Comments		
Positive comments about medical staff	10	...the nurses speak Spanish and wait until an interpreter was present for me... .... The overall experience was great... ... we are thankful...
Overall positive medical experience	10	
Negative comments about medical staff	4	...Felt mistreated because my race.. ... mom felt medical providers were not conducting a thorough examination... ... Overall traumatic experience...
Felt mistreated by the medical staff	2	
Waiting time in the ED before being seen by medical team	1	
Felt unheard by the medical staff	2	
Medical Traumatic experience	1	

References

Gustafson D, McTigue D, Thikkurissy S, Casamassimo P, Nusstein J. Continued care of children seen in an emergency department for dental trauma. Pediatr Dent. 2011 Sep-Oct;33(5):426-30. PMID: 22104712.

Khehra A, Cohenca N, Cehreli ZC, Levin L. The International Association of Dental Traumatology ToothSOS mobile app: A 2-year report. *Dent Traumatol.* 2021; 37: 145–150. https://doi.org/10.1111/edt.12609

Levin L, Day PF, Hicks L, O'Connell A, Fouad AF, Bourguignon C, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: general introduction. Dent Traumatol. 2020; 36: 309–13.

Lombardi S, Sheller B, Williams BJ. Diagnosis and treatment of dental trauma in a children's hospital. Pediatr Dent. 1998 Mar-Apr;20(2):112-20. PMID: 9566015.

Mitchell J, Sheller B, Velan E, Caglar D, Scott J. Managing pediatric dental trauma in a hospital emergency department. *Pediatr Dent.* 2014;36(3):205-210.

PA Harris, R Taylor, R Thielke, J Payne, N Gonzalez, JG. Conde, Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support, *J Biomed Inform. 2009 Apr;42(2):377-81.*

PA Harris, R Taylor, BL Minor, V Elliott, M Fernandez, L O'Neal, L McLeod, G Delacqua, F Delacqua, J Kirby, SN Duda, REDCap Consortium, The REDCap consortium: Building an international community of software partners, *J Biomed Inform. 2019 May 9 [doi: 10.1016/j.jbi.2019.103208]*

P. Ritwik, C. Massey, J. Hagan. Epidemiology and outcomes of dental trauma cases from an urban pediatric emergency department. Dent Traumatol, 31 (2015), pp. 97-102.

Rowley ST, Sheller B, Williams BJ, Mancl L: Utilization of a hospital for treatment of pediatric dental emergencies. *Pediatr Dent*. 2006; 28(1):10-17.

Song J, Kim JN, Tomar S, Wong LN. The Impact of the Affordable Care Act on Dental Care: An Integrative Literature Review. Int J Environ Res Public Health. 2021 Jul 25;18(15):7865. doi: 10.3390/ijerph18157865. PMID: 34360160; PMCID: PMC8345350.

Walsh D, Sheller B, Williams G, Reeves A, Carlin K. Early Covid-19 Pandemic Emergency Department Utilization for Pediatric Dental Emergencies. *Pediatr Dent* 2023;45(3):245-251.

Wang NE, Kiernan M, Golzari M, Gisondi MA. Characteristics of pediatric patients at risk of poor emergency department aftercare. Acad Emerg Med. 2006 Aug;13(8):840-7. doi: 10.1197/j.aem.2006.04.021. PMID: 16880500.

Wilson S, Smith G, Preisch J, Casamassimo P. Epidemiology of dental trauma in an urban pediatric emergency department. Pediatr Emerg Care 1997;13:12-5.

Zeng Y, Sheller B, Milgrom P. Epidemiology of dental emergency visits to an urban children's hospital. Pediatr Dent 1994;16:419-23.

Zorc JJ, Scarfone RJ, Li Y, Hong T, HarmelinM, Grunstein L, Andre JB. Scheduled follow-up after a pediatric emergency department visit for asthma: A randomized trial. Pediatrics 2003;111:495-502.

Appendix A: Invitation Letter

Date
Name
Address

Dear <Patient>,

We are writing to invite you to participate in a short telephone survey about follow up care after tooth injury treatment in the Emergency Department at Seattle Children's Hospital.

We are a team of dentists from Seattle Children's Hospital. We are doing research on follow up care and the outcomes after receiving dental care in the emergency room at Seattle Children's Hospital following a tooth injury. We want to improve the follow up information provided to families in the Emergency Department. A second goal is to study the outcomes of tooth injuries one year after the injury.

You are eligible to be included in this study because you or your child came to the Seattle Children's Hospital Emergency Department between March 1, 2021 and February 28, 2022. Your contact information was obtained from you registration in the medical record.

The telephone survey has 11 questions and will take 5-10 minutes to complete. It asks questions about your dental care since being seen in the Seattle Children's Hospital Emergency Department.

If you received follow up care from a community dentist or clinic, you will be asked for permission to allow your dentist to share details about the follow up treatment provided after the injury.

All information collected in this study will be kept private and will not be added to your medical or dental record. Your answers will be seen only by members of the research team listed below. Being in this study is voluntary. Your future medical or dental care will not change if you decide to participate in the survey or not.

We will be calling you to ask if you are interested in taking the survey and answer any questions you may have about the research study. If you do not want to be part of this research survey, please contact us by email or phone call (Information below). If you do not want to participate in the research but do not notify us with an email or phone call, you can tell us this when we call with the telephone survey.

The survey will be done over the phone. If the patient is younger than 18 years, the survey will be done with parent or guardian. You will be compensated a $10 grocery store gift card after completing this survey.

Thank you very much for your time and help with this important research. If you have any questions about this research project, please contact Dr. Alec Montemayor by email at Alec.Montemayor@SeattleChildrens.org or by phone at 206-987-4162.

Sincerely,

Nestor Cohenca, DDS,MSD
Director of Endodontics & Traumatology
Department of Dentistry

Celeith Acevedo Mores
Certified Spanish Interpreter
Dentist and Research team member
Department of Dentistry

Barbara Sheller, DDS, MSD
Chief of Pediatric Dentistry
Department of Dentistry
Seattle Children's Hospital

Bryan Williams, DDS, MSD, MEd
Pediatric Dentist
Department of Dentistry
Seattle Children's Hospital

Alec Montemayor, DDS
Pediatric Dentistry Resident
Seattle Children's Hospital
& University of Washington

Appendix B: Survey

Survey about tooth trauma follow up after your visit to Seattle Children's Hospital Emergency Department

Survey Instructions:
- If you are age 18 or older, you may complete this survey or you may choose to have a parent or guardian help you complete this survey.
- If you are the parent or guardian, please complete this survey on behalf of your child.

1. **Who is completing this survey?** [SELECT ONE]
   - □ Patient – I am completing this survey
   - □ Patient – I am completing this survey for myself with help from a parent or guardian
   - □ Parent or guardian – I am completing this survey on behalf of my child

2. **Who came with the patient to the Emergency Department for the tooth injury?**
   - □ Patient only
   - □ Patient with parent(s) or guardian(s)
     - ▪ Relationship(s) to patient:________________________

3. **Do you remember what you were told about when to follow up?**
   - o Yes
     - i. If so, what do you remember? ________________________________
   - o No

4. **Do you remember what you were told about where to follow up?**
   - o Yes
     - i. If so, what do you remember? ________________________________
   - o No

5. **Do you remember receiving printed follow up recommendations when you left the emergency department? Was this helpful?**
   - □ Yes, I remember receiving printed follow up recommendations. It was helpful.
   - □ Yes, I remember receiving printed follow up recommendations. It was not helpful.
   - □ No, I did not receive printed follow up recommendations.
   - □ I do not remember.

Study ID Number: ________

6. **Since the Children's Hospital ED visit have you seen a Dentist to follow up about the tooth injury?**
   - ◻ Yes, I have seen a dentist since the ED visit about the tooth injury.
   - ◻ No, I have not seen a dentist about the tooth injury since the ED visit.

7. **Which dentist or clinic did you see for follow up, or which dentist or clinic do you plan to see for future dental care?** [SELECT ONE]
   - ◻ University of Washington Center for Pediatric Dentistry
   - ◻ Odessa Brown Children's Clinic
   - ◻ Seattle Children's Hospital
   - ◻ Other: ______________________________
   - ◻ I don't know

8. **What type of dental insurance do you currently have?** [SELECT ONE]
   - ◻ Apple Health (Medicaid) insurance
   - ◻ Private dental insurance (example: Delta Dental, Cigna, Humana, Tricare)
   - ◻ No dental insurance
   - ◻ Other, please write in: ____________________________

9. **Were there any problems in getting an appointment in the recommended time frame? If so, what were they?**
   - ◻ Yes, I did have problems. They were: [SELECT ALL THAT APPLY]
     - o Transportation to the appointment
     - o Time off work
     - o Time off school
     - o No appointments available in recommended time frame
     - o Language barrier
     - o Other: ____
   - ◻ No, I did not have any problems.

10. **Is the tooth still present?**
    - o Yes
    - o No
    - o Tooth #:__________________________________

Study ID Number: ________

11. **What is your current mailing address to send a thank you gift card?:**
    - ☐ ______________________
      ____
      ____

12. **Is there anything else you would like us to know about your experience getting follow up care after the ED?**
    - ○ No
    - ☐ Yes:____
      ____
      ____
      ____
      ____

Study ID Number: ________