Evaluation of traumatic dental injuries in pediatric patients: A cross-sectional study

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ABSTRACT

BACKGROUND: This study aimed to investigate the etiology, sex distribution, types of traumatic dental injuries, and treatment methods in children referred to the Pediatric Dentistry Department. Understanding these parameters is essential for improving prevention strategies and treatment outcomes in pediatric dental trauma.

METHODS: This study retrospectively analyzed the clinical records of 822 children aged 0-14 years who visited the Pediatric Dentistry Department over a six-month period. Of these, 59 children (7.2%) presented with dental injuries. Traumatic injuries were categorized using the Andreasen and Andreasen classification system. Data were collected on the causes of trauma, the location and type of injuries, and the treatment approaches for both primary and permanent teeth.

RESULTS: Crown fractures were the most commonly observed injuries, accounting for 76.2% of cases. Other injury types included avulsion (6.6%), subluxation (5.2%), concussion (5.2%), intrusive luxation (3.4%), root fractures (1.7%), and extrusive luxation (1.7%). Permanent teeth were more frequently affected (76.3%) than primary teeth. Falls were the leading cause of traumatic dental injuries, responsible for 77.9% of cases, with schools identified as the most common setting for such incidents (37.2%). Boys (59.3%) were more likely to experience dental trauma than girls (40.7%). Among the injured teeth, 16.9% of permanent teeth showed incomplete root formation. In terms of treatment, restorative procedures were the most frequently used (44.1%), followed by endodontic treatments and extractions, which together accounted for 25.4% of cases.

CONCLUSION: Traumatic dental injuries are common among children, particularly those of school age. Falls are the leading cause, with most injuries affecting the enamel layer of the teeth. Timely and accurate diagnosis of dental trauma is essential to minimize complications and preserve long-term dental health. Implementing preventive strategies and educating children, parents, and educators about dental safety can significantly reduce the incidence and severity of these injuries.

Keywords: Traumatic dental injuries; pediatric patients; treatment modalities.

INTRODUCTION

Traumatic dental injuries (TDIs) are a significant concern in pediatric dentistry due to their high prevalence and potential for long-term dental and psychological consequences. These injuries may result from various incidents, including falls, sports activities, traffic accidents, and physical altercations. ^[1] The immediate and delayed impacts of TDIs underscore the need for a comprehensive understanding of their etiology, types, and effective treatment modalities.^[2]

Standardized classification of traumatic dental injuries (TDIs)



is essential for accurate diagnosis and effective treatment planning. The classification system developed by Andreasen and Andreasen remains one of the most widely adopted in dental traumatology, providing a comprehensive framework for categorizing various types of dental trauma.^[3] This system not only facilitates accurate diagnosis of the extent and nature of injuries but also aids in formulating appropriate treatment plans. The classification includes various types of dental injuries, such as crown fractures, root fractures, luxations, and avulsions, each requiring specific management strategies.^[4]

The prevalence of TDIs varies across different age groups and genders, with boys typically exhibiting a higher incidence due to their engagement in more physically active and risk-prone behaviors.^[5] Additionally, the location where the injury occurs plays a crucial role in understanding the circumstances leading to dental trauma. Schools are common sites for such injuries, largely due to children's active participation in playground activities and sports. Recognizing these patterns can aid in implementing targeted preventive measures to reduce the occurrence of TDIs.^[6]

Effective management of TDIs requires prompt and accurate diagnosis, which is essential for preventing complications such as infections, pulp necrosis, and developmental disturbances in teeth. Treatment options range from simple restorative procedures to complex endodontic treatments and extractions, depending on the severity of the injury. This study aims to identify the most common types of dental trauma in children and to emphasize the importance of timely and appropriate dental care in mitigating the adverse effects of these injuries. The findings of this study are intended to contribute to the existing body of knowledge and support improvements in clinical practices for managing pediatric dental trauma.

MATERIALS AND METHODS

This study was conducted at the Pediatric Dentistry Department in Türkiye and aimed to evaluate the etiology, sex distribution, types of traumatic dental injuries, and treatment modalities in pediatric patients. Clinical data from 822 children aged 0-14 years who visited the department over a six-month period were analyzed.

Study Population

The study population consisted of 822 children, among whom 59 (7.2%) were identified as having experienced traumatic dental injuries. Inclusion criteria were children aged 0-14 years who presented with dental trauma. Exclusion criteria included incomplete records and the presence of systemic conditions affecting dental health.

Data Collection

Data were collected from patient records and included demographic information (age, sex), cause of injury, location of the incident (home, school, playground, etc.), type of dental injury, and type of treatment provided. Injuries were classified according to the Andreasen and Andreasen classification system, which offers a comprehensive framework for categorizing dental trauma based on clinical presentation and radiographic findings.

Classification of Injuries

The Andreasen and Andreasen^[7] classification system was used to categorize dental injuries (Tables I and 2). This system classifies injuries into categories such as crown fractures, root fractures, luxations (including subluxation, concussion, intrusive luxation, and extrusive luxation), and avulsions. Each type of injury was documented based on clinical examination and radiographic evidence.

Traumatized Teeth Classification: Injuries were classified for primary and permanent teeth. Each affected tooth was assessed for the type and extent of injury.

Treatment Modalities: The type of treatment provided was recorded, including restorative treatments (e.g., fillings, crowns), endodontic treatments (e.g., root canal therapy), and extractions.

Statistical Analysis

Data were analyzed using statistical software (IBM SPSS Statistics for Windows, Version 25.0, IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the data. The prevalence of different types of dental injuries was expressed as percentages. Chi-square tests were applied to examine associations between categorical variables, such as sex and type of injury, as well as location and type of injury. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted in accordance with the ethical standards of the institutional research committee, GATA (date: 12.02.2014, no: 32) and the 1964 Declaration of Helsinki and its later amendments. Informed consent was obtained from the parents or guardians of all participants.



Figure 1. Distribution of dental injury types.

Type of Trauma	Description	Symptoms	Treatment
Crown Fractures			
Enamel Infraction	Incomplete fracture of enamel without loss of tooth substance.	Often asymptomatic; sometimes sensitivity to cold or sweets.	No treatment required; smoothing of surface or monitoring if needed.
Enamel Fracture	Fracture or crack confined to the enamel layer of the tooth.	Small crack or chip in the tooth; sensitivity or mild pain.	Smoothing rough edges or repairing with a filling.
Enamel-Dentin Fracture	Involves both enamel and den- tin layers.	Visible crack or chip; pain and sen- sitivity.	Repair with a composite restoration, original tooth fragment or crown.
Enamel-Dentin- Pulp Fracture	Fracture involving enamel, dentin, and the pulp (nerve tissue).	Severe pain; bleeding; visible nerve tissue exposure.	Pulp capping, pulpotomy, root canal treatment and composite restoration, original tooth fragment or crown.
Crown-Root Fracture	A fracture involving enamel, dentin, and cementum; may or may not involve the pulp.	Pain, especially on chewing; a visible fracture line; tooth mobility; pos- sible bleeding if pulp is exposed.	If pulp is not involved: removal of coronal fragment and restoration. If pulp is involved: endodontic treatment may be needed. Surgical crown lengthening or extraction in severe cases.
Horizontal Poot Eractura	A horizontal fracture along the	Tooth mobility: point consistivity	Poot stabilization: comotimos
	root of the tooth.	rooth mobility, pain, sensitivity.	surgical intervention or root canal treatment may be required.
Vertical Root Fracture	A vertical fracture along the root of the tooth, usually more	Pain around the tooth; swelling; tooth mobility.	Removal of the fractured section; sometimes extraction may be
Alveolar Fractures	serious.		necessary.
Alveolar Ridge Fracture	Fracture of the alveolar bone surrounding the teeth.	Pain; swelling in the gums and sur- rounding tissues; teeth may appear	Stabilization of the fracture, monitoring, and sometimes
Luxation Injuries		displaced.	surgical intervention.
Concussion	Tooth is not displaced but is tender to touch or percussion.	Sensitivity to touch; no visible displacement.	Observation; typically resolves without intervention.
Subluxation	Partial loosening of the tooth, which remains in its socket.	Tooth mobility; pain; bleeding from the gums.	Stabilization of the tooth; a splint may be applied if necessary.
Lateral Luxation	Lateral displacement of the tooth; often involving damage to the periodontal ligament and alveolar bone.	Tooth appears displaced; accompa- nied by pain and possible bleeding.	Repositioning of the tooth; splinting; monitoring pulp vitality.
Intrusion	The tooth is driven into the alveolar bone, causing injury to the periodontal ligament and surrounding bone.	Tooth appears shortened or miss- ing; bleeding; pain.	Allow spontaneous re-eruption or perform surgical repositioning if needed.
Extrusion	Partial displacement of the tooth outward from its socket.	Tooth appears elongated; pain; bleeding.	Repositioning and splinting if necessary; monitor for pulp vitality.
Avulsion	Complete displacement of the tooth from its socket, entirely separating it from the bone.	Tooth is completely missing; severe pain; bleeding.	Immediate replantation if possible, or store the tooth in a suitable medium and seek urgent dental care.

Type of Trauma	Description	Symptoms	Treatment
Crown Fractures			
Enamel Infraction	Incomplete enamel fracture without tooth substance loss.	Usually asymptomatic; possible slight sensitivity.	No treatment necessary; monitor and educate parents.
Enamel Fracture	A fracture or crack confined to the enamel layer of the tooth.	Small crack or chip in the tooth; sensitivity or mild pain.	Smoothing rough edges or repairing with a filling.
Enamel-Dentin Fracture	Involves both enamel and dentin layers.	Visible crack or chip; pain and sensitivity.	Repair with a composite restoration.
Enamel-Dentin- Pulp Fracture	Involves the enamel, dentin, and pulp (nerve tissue) of the tooth.	Severe pain; bleeding; visible nerve tissue exposure.	Pulp therapy or extraction depending on severity.
Crown-Root Fracture	A fracture involving enamel, dentin, and cementum; may or may not involve the pulp.	Pain during chewing; visible frac- ture line; possible mobility or bleeding.	Usually extraction is recommended due to the complexity of the fracture and risk to the developing
Root Fractures			permanent tootn.
Horizontal Root Fracture	A horizontal fracture in the root of the tooth.	Tooth mobility; pain; sensitivity.	Monitoring, stabilization, or extraction if necessary.
Vertical Root Fracture	A vertical fracture in the root of the tooth, generally more seri-	Pain around the tooth; swelling; tooth mobility.	Monitoring; extraction may be required in some cases.
Alveolar Fractures	043.		
Alveolar Ridge Fracture	Fracture of the alveolar bone surrounding the teeth.	Pain; swelling in the gums and surrounding tissues; teeth may	Stabilization of the fracture, monitoring, and sometimes
Luxation Injuries		appear displaced.	surgical intervention.
Concussion	The tooth is not displaced but exhibits increased sensitivity to touch and percussion.	Sensitivity to touch; no displace- ment.	Observation; typically heals without intervention.
Subluxation	Partial dislocation of the tooth; it remains in the socket.	Tooth mobility; pain; bleeding from the gums.	Monitoring; soft diet; possible splinting.
Lateral Luxation	Lateral displacement of the tooth with damage to the periodontal ligament and alveolar bone.	Tooth appears displaced; pain; possible bleeding.	Repositioning of the tooth; splinting; monitoring pulp vitality.
Intrusion	The tooth is driven into the alveolar bone, damaging the periodontal ligament and surrounding bone.	Tooth appears shortened or missing; bleeding; pain.	Allow spontaneous re- eruption or perform surgical repositioning if necessary.
Extrusion	Partial displacement of the tooth out of its socket.	Tooth appears elongated; pain; bleeding.	Repositioning and splinting if necessary; monitor for pulp vitality.
Avulsion	Complete displacement of the tooth from its socket, entirely separating it from the surrounding bone.	Tooth is completely missing; se- vere pain; bleeding.	Replantation is typically not performed for primary teeth; space maintenance and monitoring are important.

Table 3.	Distribution of dental traumas by location			
Location	Number of Cases	Percentage (%)	p-value	
School	22	37.2	0.05	
Home	15	25.4	0.05	
Playground	10	16.9	0.05	
Other	12	20.3	0.05	

Table 4. Distribution of dental traumas by gender

Gender	Number of Cases	Percentage (%)	p-value
Boys	35	59.3	0.03
Girls	24	40.7	0.03

RESULTS

Data from 59 children with traumatic dental injuries were analyzed. The most common type of injury was crown fractures (76.2%), followed by avulsion (6.6%), subluxation (5.2%), concussion (5.2%), intrusive luxation (3.4%), root fractures (1.7%), and extrusive luxation (1.7%) (Fig. 1). Permanent teeth were more frequently affected (76.3%) than primary teeth. Falls were the most common cause of injury (77.9%), with the highest number of injuries occurring at school (37.2%) (Table 3). Boys experienced dental trauma more frequently than girls (59.3% vs. 40.7%) (Table 4). Restorative treatments were performed in 24 patients (44.1%), while endodontic treatments and extractions were carried out in 15 patients (25.4%).

DISCUSSION

The findings of this study highlight the notable prevalence and characteristics of traumatic dental injuries in children aged 0-14 years who were referred to the Pediatric Dentistry Department. The predominance of crown fractures, observed in 76.2% of cases, is consistent with numerous other studies that have identified crown fractures as the most common type of dental injury. For instance, a study by Bastone et al.^[8] reported that crown fractures constitute a significant proportion of traumatic dental injuries, with falls being the leading cause. This consistency across studies highlights the need for targeted preventive measures, particularly in environments where children are prone to falls, such as schools and playgrounds.

Gender differences in the incidence of dental trauma have also been well documented in the literature. Our study found that boys were more likely to experience dental trauma than girls, which aligns with findings by Glendor et al.^[9] and Özgür et al.^[10] These studies suggest that boys' greater involvement in physical activities and risk-taking behaviors contributes to their increased vulnerability to dental injuries. Understanding these gender differences is important for developing genderspecific preventive strategies and educational programs.

The location where dental injuries occur is another important factor identified in this study. Our findings indicate that a significant proportion of injuries occurred at school, which is consistent with the results of previous studies.^[11,12] This underscores the importance of implementing safety measures in school environments and educating both school staff and students on the prevention and management of dental injuries.

In addition to understanding the prevalence and causes of TDIs, it is crucial for healthcare professionals to be well-informed about their immediate management. Dental trauma often requires urgent care to prevent further complications, and many cases initially present to hospital emergency departments rather than dental clinics. This is particularly true for severe injuries such as avulsions, where immediate reimplantation is critical for the survival of the tooth. Studies by Andersson et al.^[13] and Flores et al.^[14] have emphasized the importance of prompt and appropriate emergency management of dental trauma to optimize outcomes.

Furthermore, the type of treatment provided for TDIs is another key area of focus. Our study found that restorative treatments were the most common intervention, applied in 44.1% of cases, followed by endodontic treatments and extractions. This highlights the need for dental practitioners to be proficient in various treatment modalities to effectively manage different types of dental injuries. Treatment choice depends on the severity and nature of the injury, with more severe cases requiring complex procedures. Additionally, the psychological impact of TDIs on children should not be underestimated, as dental trauma can lead to significant distress and anxiety. This calls for a compassionate and comprehen-

sive approach to care.

Preventive strategies play a crucial role in reducing the incidence of TDIs. Educational programs targeting parents, teachers, and children can raise awareness about the risks and preventive measures associated with dental injuries. The use of protective gear, such as mouthguards during sports activities, along with the implementation of safety measures in playgrounds and schools, can significantly decrease the occurrence of TDIs. Furthermore, regular dental check-ups can aid in the early detection and management of potential issues, thereby helping to prevent more severe injuries.

Lastly, this study highlights the importance of continued research in this field. There is a need for large-scale, multi-center studies involving diverse populations to gain a more comprehensive understanding of TDIs and their management. Such research can provide valuable insights into the epidemiology of dental injuries and support the development of more effective preventive and therapeutic strategies. Additionally, exploring the long-term outcomes of various treatment modalities can inform clinical practices and enhance the quality of care provided to pediatric patients with dental trauma.

Limitations

This study has several limitations that should be acknowledged. First, it was conducted at a single institution, which may limit the generalizability of the findings. The specific demographic and socio-economic characteristics of the population served by the Gulhane Pediatric Dentistry Department may not reflect those of other regions or countries. Second, although the sample size is substantial, it includes only children who sought care at this particular pediatric dentistry department, potentially excluding cases managed elsewhere or those who did not seek treatment at all. Additionally, the six-month study period may not fully capture seasonal variations in the incidence of dental trauma. Future research with a prospective design, multi-center collaboration, larger sample sizes, and longer follow-up periods is necessary to provide a more comprehensive understanding of pediatric dental trauma.

CONCLUSION

Traumatic dental injuries are a prevalent issue among schoolaged children, with falls being the leading cause. This study found that crown fractures are the most common type of injury and that permanent teeth are more frequently affected than primary teeth. The findings underscore the importance of implementing preventive measures, especially in school environments where many injuries occur. Boys were found to be more susceptible to dental trauma, likely due to higher levels of physical activity and risk-taking behavior. The study also highlights the critical role of timely and accurate diagnosis in preventing complications and ensuring appropriate treatment. Overall, this study provides valuable insights into the epidemiology and management of pediatric dental trauma. The high incidence of TDIs highlights the need for enhanced preventive strategies, increased education for children and caregivers, and improved training for healthcare providers. Addressing these areas can help reduce the prevalence and impact of dental injuries, ultimately leading to better oral health outcomes for children. Future research should focus on larger, multi-center studies with extended follow-up periods to build upon these findings and further inform clinical practice and public health initiatives.

Ethics Committee Approval: This study was approved by the GATA Ethics Committee (Date: 12.02.2014, Decision No: 32).

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Çocuk hastalarda travmatik diş yaralanmalarının değerlendirilmesi: Kesitsel bir çalışma

AMAÇ: Bu çalışmanın amacı, pedodonti anabilim dalı'na yönlendirilen çocuklarda travmatik diş yaralanmalarının etiyolojisini, cinsiyet dağılımını, yaralanma türlerini ve tedavi yöntemlerini incelemektir. Bu parametrelerin anlaşılması, çocukluk dönemindeki diş travmalarının önlenmesi ve tedavi sonuçlarının iyileştirilmesi açısından büyük önem taşımaktadır.

GEREÇ VE YÖNTEM: Çalışma, 6 aylık bir dönemde pedodonti anabilim dalı'na başvuran, 0-14 yaş arası 822 çocuğun klinik kayıtlarının retrospektif analizini içermektedir. Bu çocuklardan 59'u (%7.2) diş yaralanması şikayetiyle başvurmuştur. Travmatik yaralanmalar, Andreasen ve Andreasen sınıflandırma sistemine göre kategorize edilmiştir. Çalışmada travmanın nedenleri, yaralanmanın lokalizasyonu ve türleri ile süt ve daimi dişlerde uygulanan tedavi yöntemleri değerlendirilmiştir.

BULGULAR: Travma türleri arasında en sık karşılaşılan, vakaların %76,2'sini oluşturan kron kırıklarıdır. Diğer yaralanma türleri arasında avülsiyon (%6.6), subluksasyon (%5.2), konküzyon (%5.2), intruziv luksasyon (%3,4), kök kırıkları (%1.7) ve ekstrüziv luksasyon (%1.7) yer almıştır. Daimi dişler, süt dişlerine göre daha fazla etkilenmiştir (%76.3). Travmaların en yaygın nedeni düşme (%77.9) olarak belirlenmiş ve okul, yaralanmaların en sık meydana geldiği yer olmuştur (%37.2). Erkekler (%59.3), kızlara (%40.7) kıyasla daha sık diş travması yaşamıştır. Travma geçiren daimi dişlerin %16.9'unda kök gelişimi tamamlanmamıştır. Tedavi açısından bakıldığında, en sık uygulanan yöntem restoratif işlemler (%44.1) olurken, bunu endodontik tedaviler ve diş çekimleri (%25.4) takip etmiştir.

SONUÇ: Travmatik diş yaralanmaları, özellikle okul çağındaki çocuklar arasında oldukça yaygındır. Bu yaralanmaların en önemli nedeni düşmeler olup, çoğu vakada sadece diş minesini etkilemektedir. Diş travmalarının zamanında ve doğru şekilde teşhis edilmesi, komplikasyonların önlenmesi ve uzun vadeli diş sağlığının korunması açısından hayati öneme sahiptir. Ayrıca, çocukların, ebeveynlerin ve eğitimcilerin diş sağlığı konusunda bilgilendirilmesi, bu tür yaralanmaların sıklığını ve şiddetini önemli ölçüde azaltabilir.

Anahtar sözcükler: Pediatrik hastalar; travmatik diş yaralanmaları; tedavi yöntemleri.

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