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Original Article

Profile of Traumatic Dental Injuries Among Children in NGHA Hospital, Riyadh, Saudi Arabia: A Retrospective Cohort Study

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Abstract

Objective: Traumatic dental injuries (TDIs) are common in the pediatric population in Saudi Arabia and can significantly affect children's oral and overall well-being. While global data are widely available, studies on the prevalence and management of TDIs in Saudi Arabia remain limited. The objective of the study is to assess the prevalence, characteristics, management, and outcomes of TDIs among children treated at the National Guard Health Affairs hospital in Riyadh, Saudi Arabia.

Materials and Methods: A retrospective study evaluated records of pediatric patients (aged 1–16 years) with TDIs treated between January 2019 and January 2024 at King Abdulaziz Medical City and King Abdullah Specialized Children Hospital, National Guard Health Affairs, Riyadh. Data included demographics, injury characteristics, management, complications, and follow-up outcomes. Cases with incomplete records were excluded. Injuries were classified according to International Association of Dental Traumatology (IADT) guidelines. Statistical analysis was performed using IBM SPSS Statistics (version 22.0), with Generalized Estimating Equations used to assess factors influencing treatment decisions, complications, and patient-reported outcomes.

Results: A total of 107 patients with 209 injured teeth were included. Most participants were male (64.5%), as shown in Table 1, with a median age of 6 years and no relevant medical history in 98% of the study population. Falls were the predominant cause (84.2%), mainly occurring at home (81.1%). The upper right central incisor was most affected (25.4%), and uncomplicated crown fractures were the most common injury (20.1%). Most patients (58.1%) presented within 1–24 hours. Conservative management, primarily observation, was the most frequent approach (44.6%). Reported complications included pathological mobility (14 teeth), root resorption (13 teeth), and persistent pain (16 cases). Delayed presentation beyond 24 hours was associated with a higher frequency of complications. Multivariable GEE analysis showed dentition type significantly influenced management decisions ($p=0.024$) and dental anxiety ($p<0.001$).

Conclusion: This study highlights patterns in the management of pediatric TDIs in a tertiary care setting. Early presentation and standardized trauma assessment are important to reduce complications and improve outcomes. Further multicenter prospective studies in Saudi Arabia are recommended to enhance prevention and optimize pediatric oral health care.

Keywords: Retrospective study, traumatic dental injuries, TDIs, children, primary teeth, permanent teeth, etiology, treatment

Introduction

Traumatic dental injuries (TDIs) are a frequent concern in pediatric oral health, significantly affecting children's overall well-being. A recent global study estimated that approximately one billion people have experienced TDIs, with prevalence rates of 22.7% in primary teeth and 15.2% in permanent teeth.[1] However, data on the

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occurrence of TDIs in Saudi Arabia remain limited. A study examining schoolboys aged 5–6 and 12–14 years in Riyadh, the capital city, found prevalence rates of 33% and 34%, respectively.[2] Despite the high frequency of these injuries, many cases either go untreated or receive substandard care.[2,3] This trend is not unique to Saudi Arabia. Research by Hamilton et al[4] revealed that fewer than half (47%) of injured teeth in children aged 11–14 received dental treatment, and of those, over half (59%) were deemed inadequate. Timely and appropriate management of TDIs is crucial, as it greatly enhances outcomes and reduces the risk of complications such as tooth discoloration, necrosis of the pulp, root resorption, increased mobility, and eventual tooth loss.[5,6] Moreover, failure to manage injuries properly at the outset often results in higher long-term treatment costs.[7,8] Understanding the patterns of TDIs is essential for developing preventive strategies, improving treatment protocols, and shaping educational initiatives.[9,10] Given the current lack of comprehensive data on TDIs in Saudi Arabia, the aim of this study is to seek and explore the characteristics, treatment approaches, and complications associated with these injuries in a sample of children in the NGHA hospital in Riyadh, Saudi Arabia.

Materials and Methods

The retrospective study was conducted to evaluate the data records of pediatric patients (aged one – 16 years) who sustained traumatic dental injuries (TDIs) and received treatment at the Pediatric Dentistry Department of King Abdulaziz Medical City (KAMC) and King Abdullah Specialized Children Hospital (KASCH), National Guard Health Affairs (NGHA), Riyadh, Saudi Arabia. Ethical approval was obtained from the King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia (No: 00000178125, Date: 24/06/2025) and the study is conducted according to Declaration of Helsinki. The study covered patients' records for a 5-year period, from January 2019 to January 2024. Patients' data were retrieved electronically. All available cases within the study period were included. All pediatric patients aged 1–16 years who presented with traumatic dental injuries (TDIs) between January 2019 and January 2024 were included. Cases with incomplete or missing key clinical data (e.g., injury type, management, or follow-up outcomes) were excluded. The collected data were extracted from the electronic patients' medical records, covering patients' demographic data, including age, gender, medical history, and the year of injury. Traumatic dental injuries were classified according to the International Association of Dental Traumatology (IADT) guidelines. Injury related details such as the type of dentition affected (primary or permanent), number of injured teeth, cause and location of the incident, and clinical management information, including time of presentation to the emergency department, managing clinician (General dentist, post graduate pediatric dentist, Pedodontist, AGD consultant), immediate treatment provided, and follow up protocols in reference to the International Association of Dental Traumatology (IADT) guidelines. Additional data collected included the number of clinical visits and treatment outcomes, such as the presence of complications (e,g, bone loss, gingival recession, tooth mobility, ankylosis, root resorption), and pulpal status (healing, infected, necrotic), presence of pain, tooth discoloration, tooth loss, and the impact of the developing permanent successor. Clinical outcomes, including pain, pathological mobility, and root resorption, were assessed based on the most recent documented follow-up visit. Patient-centered outcomes, including dental anxiety and patients' aesthetic perception, were also documented when available. Dental anxiety was assessed based on clinician-documented patient behavior recorded in the medical records. Due to the unavailability of total pediatric visit data during the study period, institutional prevalence could not be calculated.

Statistical analysis

All data were entered into a spreadsheet in Microsoft Excel (version 2024), and descriptive and inferential analysis were performed using IBM SPSS Statistics (version 22.0). To assess the association and prediction of injury outcomes, a Generalized Estimating Equations (GEE) model was applied using both multivariable ordinal and binary logistic models, with statistical significance at $p<0.05$.

Results

As reported in Table 1, the analysis included 107 patients, with demographic and injury-related characteristics summarized. The majority of the study population was male (64.5%), and the median age was 6 years. Falls were the most common mechanism of injury, accounting for 84.2% of cases, with most of these injuries occurring in a home setting (81.1%). Primary teeth were most commonly affected (58.9%), with a median of two teeth injured per patient. A relevant medical history was reported in 8.4% of patients. Missing data included the mechanism of injury for 12 patients and the place of occurrence for 33 patients.

Table 2 presents the distribution of the 209 traumatic dental injuries. The most commonly reported injury

Table 1. Demographic and injury-related characteristics of the patients (N=107)

Variables	Category	N	%
Age (years), median (IQR)		6	6
Gender	Male	69	64.5
	Female	38	35.5
Etiology of injury	Car or bicycle accident	3	3.2
	Falling	80	84.2
	Fight	5	5.3
	Hitting	3	3.2
	Playing	2	2.1
	Struck by an object	2	2.1
Place of occurrence	Home	60	81.1
	Playground	2	2.7
	School	7	9.5
	Street	5	6.8
Number of injured teeth, median (IQR)		2	1
Injured dentition	Mixed	2	1.9
	Permanent	42	39.3
	Primary	63	58.9
Medical history	No important medical history	98	91.6
	Important medical history	9	8.4

Data on the etiology of injury were missing for 12 patients. Data on the place of occurrence were missing for 33 patients.

Table 2. Distribution of injury types, severity, and timing (N=209 injuries)

Variables	Category	N	%
Injury type	Concussion	1	0.5
	Subluxation	40	19.1
	Extrusion	7	3.3
	Lateral luxation	15	7.2
	Intrusion	34	16.3
	Avulsion	18	8.6
	Enamel fracture	6	2.9
	UCF	42	20.1
	CCF	21	10.0
	CCRF	4	1.9
	Root fracture	11	5.3
	Alveolar bone fracture	2	1.0
	Complex injury	8	3.8
Time of presentation	<1 h	24	12.6
	>1 h - <24 h	111	58.1
	>24 h	56	29.3

Data on the time of presentation were missing for 18 patients.

type was uncomplicated crown fracture (UCF) (20.1%), subluxation (19.1%), and intrusion (16.3%). In terms of time presentation, the majority of injuries (58.1%) were seen at the clinic between 1- and 24-hours post-incident. A smaller proportion of cases (29.3%) presented after more than 24 hours post-injury. The time of presentation data was missing for 18 injuries.

Table 3 summarizes the frequency of injuries by specific teeth. The distribution shows that maxillary anterior

Table 3. Injured teeth (N=209 injuries)

Variables	Category	N	%
Injured tooth	UR Central Incisor (11)	30	14.4
	UR Lateral Incisor (12)	6	2.9
	UL Central Incisor (21)	34	16.3
	UL Lateral Incisor (22)	9	4.3
	LL Central Incisor (31)	4	1.9
	LR Central Incisor (41)	6	2.9
	LR Lateral Incisor (42)	2	1.0
	UR Primary Central Incisor (51)	53	25.4
	UR Primary Lateral Incisor (52)	8	3.8
	UR Primary Canine (53)	1	0.5
	UL Primary Central Incisor (61)	46	22.0
	UL Primary Lateral Incisor (62)	6	2.9
	LL Primary Lateral Incisor (72)	1	0.5
	LL Primary First Molar (74)	1	0.5
	LR Primary Central Incisor (81)	1	0.5
	LR Primary Lateral Incisor (82)	1	0.5

Table 4. Management provided (N=188 injuries)

Variables	Category	N	%
Immediate treatment	No treatment + monitoring	84	44.6
	Restoration	32	17.0
	Fragment reattachment	2	1.1
	Pulpotomy + restoration	2	1.1
	Extraction	29	15.4
	Repositioning + splint	33	17.6
	Replantation + splint	5	2.7
	Replantation + splint + RCT	1	0.5

teeth were more frequently affected. Among these, primary central incisors were injured more often than permanent central incisors. Specifically, the upper right primary central incisor (tooth #51) was involved in 25.4% of cases, while the upper left primary central incisor (tooth #61) accounted for 22.0% of cases. Permanent maxillary central incisors were also commonly affected, with the upper left central incisor (tooth #21) involved in 16.3% of injuries and the upper right central incisor (tooth #11) in 14.4%. In contrast, injuries to posterior teeth and mandibular teeth were less frequent.

Table 4 presents the immediate management approaches for all 188 injuries. Conservative management was the most common, with "no treatment and monitoring" accounting for nearly half of cases (44.6%). Active management strategies included repositioning and splinting (17.6%), restoration (17.0%), and extraction (15.4%). More invasive procedures, such as replantation and pulpotomy, were performed much less frequently, together representing less than 5% of treatment cases.

Table 5 presents the results of a multivariable Generalized Estimating Equation (GEE) model assessing factors associated with the type of immediate management provided. The analysis revealed that only dentition type emerged as a statistically significant predictor of the management decision (p=0.024). In contrast, time of presentation (p=0.147), gender (p=0.321), and age (p=0.884) were not statistically significant after controlling for all other factors in the model. These findings suggest that, within the context of this study, dentition type appears to be the primary factor influencing the immediate management approach, while time, gender, and age do not significantly contribute to the decision-making process.

Table 5. Multivariable ordinal GEE model for factors associated with the type of immediate treatment

Predictor	Category	Adjusted OR (AOR)	95% Confidence interval (CI)	p
Dentition type				0.024*
	Primary	1.00 (Reference)		
	Mixed	1.304	0.508–3.347	0.581
	Permanent	0.523	0.134–2.041	0.351
Time of presentation				0.147
	<1 hour	1.00 (Reference)		
	1–24 hours	1.571	0.627–3.936	0.335
	>24 hours	3.129	0.982–9.975	0.054
Gender				0.321
	Male	1.00 (Reference)		
	Female	1.480	0.682–3.209	0.321
Age (years)	(per year increase)	1.012	0.861–1.190	0.884

Statistically significant at p<0.05.

Table 6. Multivariable GEE analysis of factors associated with dental anxiety

Predictor	Category	Adjusted OR (AOR)	95% Confidence interval (CI)	p
Dentition type				<0.001*
	Primary	1.00 (Reference)		
	Permanent	0.010	0.001–0.107	<0.001*
Gender				0.029*
	Male	1.00 (Reference)		
	Female	5.167	1.187–22.481	0.029*
Time of presentation				0.585
	<1 hour	1.00 (Reference)		
	1–24 hours	1.428	0.055–37.034	0.830
	>24 hours	0.708	0.029–17.099	0.832
Age (years)	(per year increase)	1.334	0.973–1.828	0.073

Statistically significant at p<0.05.

The Factors related to dental anxiety were assessed using a multivariable ordinal Generalized Estimating Equation (GEE) model, with the results summarized in Table 6. The analysis revealed that dentition type (Overall p<0.001) and gender (Overall p=0.029) were significant predictors of dental anxiety. Specifically, patients with permanent teeth had 99% lower odds of reporting anxiety compared to patients with primary teeth (Adjusted Odds Ratio (AOR)=0.010; 95% Confidence Interval (CI): 0.001–0.107; p<0.001). Gender was found to be a significant factor; Females were over five times more likely to report anxiety than males (Adjusted Odds Ratio (AOR)=5.167; 95% Confidence Interval (CI): 1.187–22.481; p=0.029). Although not statistically significant, there was a noticeable trend suggesting that older age might be associated with an increased likelihood of experiencing anxiety (p=0.073). This might indicate that age could be an influencing factor, although further research would be required to establish a definitive relationship. The time of presentation was not significantly associated with dental anxiety.

A multivariable Generalized Estimating Equation (GEE) model was used to identify factors associated with patients' attendance at follow-up appointments. As shown in Table 7, none of the predictor variables (all p>0.05). However, a trend was observed for dentition type (p=0.056), indicating that patients who sustained a permanent dentition injury were 11 times more likely to attend follow up appointments compared to those with a primary dentition injury (Adjusted Odds Ratio (AOR)=11.358). There were no statistically significant associations found between follow-up appointment attendance and factors such as gender, time of presentation, or age.

Table 7. Multivariable GEE analysis of factors associated with attendance to follow-up clinic visits

Predictor	Category	Adjusted OR (AOR)	95% Confidence interval (CI)	p
Dentition type				0.056
	Primary	1.00 (Reference)		
	Permanent	11.358	0.937–137.748	0.056
Gender				0.330
	Male	1.00 (Reference)		
	Female	1.857	0.535–6.452	0.330
Time of presentation				0.199
	<1 hour	1.00 (Reference)		
	1–24 hours	3.618	0.419–31.275	0.243
	>24 hours	1.288	0.140–11.889	0.823
Age (years)	(per year increase)	0.963	0.685–1.354	0.828

No statistically significant predictors were identified at the p<0.05 level.

The patients' reported outcome of pain at follow-up is summarized in Figure 1. The vast majority of the 102 injuries with recorded pain outcomes were asymptomatic, with 86 patients reporting no pain. In contrast, 16 cases involved persistent pain, suggesting ongoing issues such as inflammation or pathology that required further clinical attention.

Pathological tooth mobility at follow-up is demonstrated in Figure 2. Of the 112 injuries that had data available for this outcome, 98 teeth had no mobility, suggesting a favorable periodontal healing outcome. In contrast, 14 injuries exhibited with continued or new-onset mobility, indicating an unfavorable periodontal outcome.

In Figure 3, the number of cases that presented with root resorption during follow-up is shown. This outcome was assessed in 98 injuries. The majority showed no signs of resorption and were considered to have a stable periodontal outcome. A total of 13 cases were identified with pathological root resorption, highlighting its relevance as a serious posttraumatic dental outcome.

Figure 4 illustrate the prevalence of injuries managed by different types of clinicians. The data reveal that the overwhelming majority of cases (191 injuries) were treated by postgraduate pediatric dentists. In contrast, pedodontists handled 13 injuries, General dentists man-

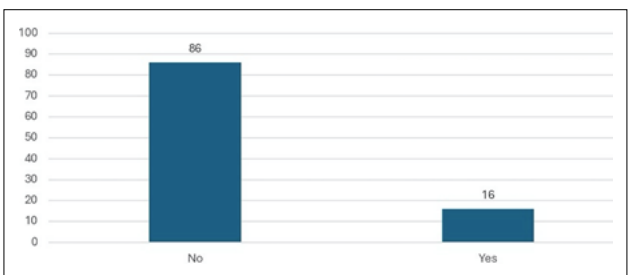

Figure 1. Pain.

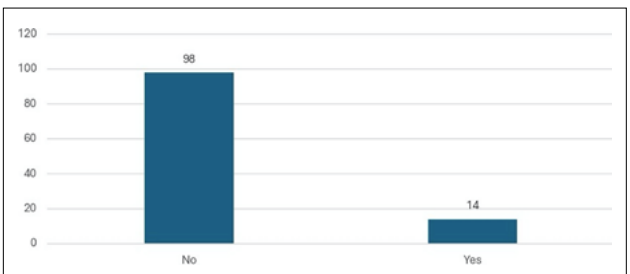

Figure 2. Mobility.

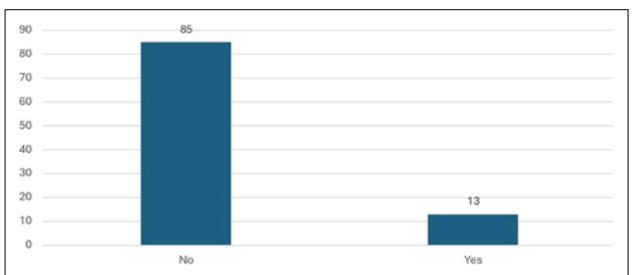

Figure 3. Resorption.

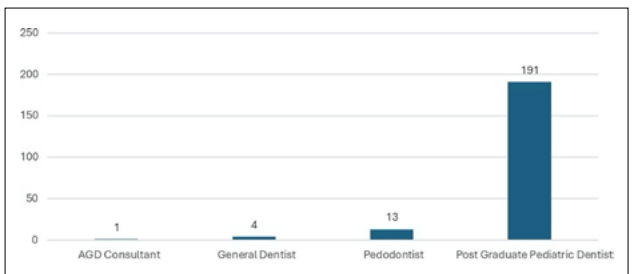

Figure 4. Managing clinician.

aged 4 cases, and an AGD consultant treated just 1 injury. This distribution highlights the dominant role of postgraduate pediatric dentists in managing traumatic dental injuries in this study.

A higher frequency of complications, including persistent pain, pathological mobility, and root resorption, was observed among patients presenting more than 24 hours after injury compared to those presenting earlier, suggesting an association between delayed presentation and adverse clinical outcomes. Institutional prevalence could not be determined due to the lack of available data on total pediatric dental visits during the study period.

Discussion

Due to the lack of TDIs data in Saudi Arabia, this study was carried out to explore the characteristics, management, and associated complications of traumatic dental injuries in a pediatric population treated at the NGHA hospital in Riyadh. A male predominance was observed, supporting findings from previous studies. [2,11–14] This trend is often linked to boys' higher engagement in physically active or risk-prone activities during early childhood. While Gümüş et al[9] found no gender difference in the Turkish population, Patidar et al[11] found that the majority of TDI cases were in boys. The evidence suggests that environmental and social factors may play a role in the different risks of dental trauma between genders.

Our sample indicated that (58.9%) of injuries involved primary dentition, with falls being the predominant cause (84.2%), and the majority of incidents occurring at home (81.1%). These findings closely resemble international trends. Zhang et al[12] in China and Özgür et al[14] both pointed out that falls are the main cause of dental injuries in young children.

Vieira et al[15] similarly found that younger children are more vulnerable to traumatic dental injuries at home, due to inadequate safety precautions and insufficient supervision. Lam[6] corroborated this tendency, demonstrating that most traumatic dental injuries in primary teeth occur due to falls in household environments, particularly among preschool-aged children.

The distribution of injuries in our study exhibited a clear pattern, with maxillary primary central incisors being the most affected. Vieira et al[15] and Gokcek et al[16] also found that maxillary incisors, particularly the primary central incisors, are among the most frequently affected teeth in pediatric dental trauma cases. Studies by Özgür et al[14] and Zhang et al[12] reveal a comparable incidence of trauma linked to anterior primary teeth. This observation aligns with the IADT guidelines supported by the AAPD, which indicate that the maxillary incisors are the most commonly injured teeth in the primary dentition.

The most predominant types of injuries were uncomplicated crown fractures (20.1%), subluxation (19.1%), and intrusion (16.3%). Our findings align with those of Patidar et al[11], who similarly reported an increased prevalence of subluxation and intrusion injuries in children with primary dentition. Lam[6] conducted a comprehensive literature analysis indicating that displacement injuries are significantly more prevalent than fractures in primary teeth, particularly among preschool-aged children. The International Association of Dental Traumatology (IADT) guidelines highlight that luxation injuries occur more frequently in primary dentition because of the thinner cortical bone and incomplete root formation. Clinicians must recognize these patterns, as early identification can directly influence treatment decisions and long-term results.

In our study, the majority of cases (58.1%) were seen between one and twenty-four hours following the injury, while only 12.6% presented within the first hour. A notable proportion (29.3%) arrived after more than 24 hours had passed. Although a significant number of patients received care within a relatively reasonable window, delays beyond the first few hours can still impact healing outcomes. Andreasen et al[5] emphasized that even slight delays in management increase the risk of complications, including pulp necrosis, root resorption, and impaired periodontal healing. Similarly, Al-Jundi[10] reported that delayed presentation is frequently associated with more complex treatment needs and less favorable long-term prognosis. Vieira et al[15] also observed that younger children are susceptible to complications when initial care is postponed. Gokcek et al[16] supported this by identifying a strong association between delayed presentation and the increased possibility of adverse outcomes, including tooth discoloration and mobility. These findings reinforce the need for rapid clinical assessment and public awareness regarding the urgency of dental trauma care.

The management strategies in this study differed based on the type and severity of the injury as well as the type of dentition. The predominant approach was conservative, with "no treatment and monitoring" provid-

ed in 44.6% of cases, indicating a common tendency to avoid intervention in minor injuries or when spontaneous healing is predicted, particularly in primary teeth.[6,14] This was followed by splinting (17.6%), restorations (17.0%), and extractions (15.4%). Splinting was mostly used for displacement injuries in permanent teeth aligned with IADT guidelines, while restorations were performed primarily for uncomplicated crown fractures.[15,16] Furthermore, extractions were indicated mainly for primary teeth, either non-restorable or with severe displacement injuries, to avoid damaging the permanent successor, a decision also supported by the AAPD guidelines.[16] Replantation, pulpotomy, and root canal therapy were infrequently used, especially in primary teeth, aligning with Patidar et al[11]'s findings and Özgür et al[14], which indicated that invasive interventions are reserved for permanent teeth with a favorable long-term prognosis.

Despite the generally favorable healing results, our study identified numerous complications. Root resorption was reported in 13 cases, persistent mobility in 14 injuries, and 16 patients experienced continuous pain during follow-up visits. These complications were more prevalent in patients' cases presenting after 24 hours, which is consistent with the findings of Andreasen et al[5], who indicated that delayed intervention significantly increases the risk of pulp necrosis, root resorption, and compromised periodontal healing, emphasizing the importance of early intervention. Lam[6], moreover, noted that in primary dentition, higher-risk complications, such as root resorption and mobility, were more frequent in displacement injuries, especially intrusion and severe luxation. Similarly, Vieira et al[15] reported that children who received inadequate or delayed intervention were at higher risk of experiencing persistent symptoms and adverse outcomes. These findings highlight the need for early clinical intervention and follow-up visits to detect and manage these complications at an early stage.

Moreover, our data indicated that follow-up attendance was crucial in the identification and treatment of these complications. Children with permanent dentition injuries were more likely to attend their follow-up visits than those with primary teeth, consistent with the findings of Xu et al[13]. This variation may indicate a parental tendency to underestimate the significance of primary teeth, resulting in poorer compliance with regular follow-ups. These observations highlight the need for not only timely intervention but also structured follow-up and parental education to enhance the outcomes and reduce adverse sequelae in both primary and permanent dentition.

Limitations

Since this is a retrospective study, several limitations should be acknowledged. It relies on existing electronic health records, which may have introduced inaccuracies or missing data, which might limit further complete analysis, particularly regarding the cause of injuries, location of injuries, time of presentation, and dental anxiety. Additionally, the study was conducted at a single health care center (King Abdulaziz Medical City (KAMC) and King Abdullah Specialized Children Hospital (KASCH), National Guard Health Affairs (NGHA), Riyadh, Saudi Arabia), so the findings may not be generalized to Riyadh or other regions of Saudi Arabia. Also, the institutional prevalence could not be calculated due to a lack of access to total pediatric visits. Finally, variability in follow-up attendance and compliance, and the lack of long-term follow-up, may have led to underestimation of long-term complications.

Recommendations

Despite the limitations, the study highlights several opportunities for improving the management of traumatic dental injuries (TDIs) in the pediatric population. First of all, implementing a standardized documentation protocol, including dental trauma assessment and dental anxiety scale in the system, would enhance the quality of the data in regard to diagnoses, management, and future follow-ups. Additionally, conducting a prospective study across Saudi Arabia would provide more comprehensive and accurate results.

Conclusion

This study provides valuable insights into the patterns and management of traumatic dental injuries (TDIs) in the pediatric population within a tertiary healthcare setting. Despite the inherent limitations of a retrospective design, including incomplete records and a lack of long-term follow-up, the findings emphasize the need for improved documentation and standardized protocols. Establishing a unified system for dental trauma assessment and incorporating tools such as dental anxiety scales could enhance both clinical care and research quality. Furthermore, future prospective, multicenter studies across Saudi Arabia are essential to achieve a more accurate understanding of TDIs, their risk factors, and long-term outcomes. Ultimately, addressing these gaps may contribute to optimizing prevention strategies, timely interventions, and overall oral health care for children.

Disclosures

Ethics Committee Approval: The study was approved by the King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia Ethics Committee (no: 00000178125, date: 24/06/2025).

Informed Consent: Not applicable.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Peer-review: Externally peer-reviewed.

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