

# Prevalence and Pattern of Sports-Related Dental Trauma among Athletes: A Cross-Sectional Study

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## ABSTRACT

**Background:** Sports-related dental trauma (SRDT) is a preventable yet under-addressed public health concern among athletes, particularly in contact sports. This study aimed to determine the prevalence, patterns, associated factors, mouthguard usage and emergency-care awareness of SRDT among athletes in Uttar Pradesh, India.

**Methods:** A descriptive cross-sectional study was conducted from February to April 2025 at two sports academies and university departments in Kanpur and Lucknow. A structured, self-administered questionnaire was distributed to 115 athletes; 80 completed responses (70.0% response rate) were analyzed. Data included socio-demographics, sport type, history and pattern of SRDT, mouthguard use and awareness of emergency management. Statistical analysis was performed using SPSS v26.0, and chi-square test was applied at  $p < 0.05$ .

**Results:** The estimated mean age of participants, based on grouped age distribution, was  $24.6 \pm 5.2$  years. Of the 80 athletes, 53 (66.3%) were males, 27 (33.7%) were females, 52 (65.0%) participated in contact sports and 28 (35.0%) participated in non-contact sports. The overall prevalence of SRDT was 32.5% (26/80). Prevalence was significantly higher among males than females (39.6% vs. 18.5%;  $\chi^2 = 4.85$ ,  $p = 0.028$ ) and among contact-sport athletes than non-contact-sport athletes (42.3% vs. 14.3%;  $\chi^2 = 5.67$ ,  $p = 0.017$ ). Crown fractures were the most common injury (14/26, 53.8%), predominantly affecting maxillary central incisors (18/26, 69.2%) and occurring during competition (20/26, 76.9%). Regular mouthguard use was reported by only 12 athletes (15.0%), while 50 (62.5%) never used a mouthguard. Only 11 athletes (13.8%) were aware of the 30-minute critical window for avulsed tooth replantation.

**Conclusion:** SRDT affects nearly one-third of athletes in this cohort, with crown fractures being predominant in contact sports. Alarming low mouthguard utilization and emergency-care awareness highlight the urgent need for mandatory protective-equipment policies and targeted educational programs by sports organizations and dental professionals.

**Keywords:** sports-related dental trauma, prevalence, athletes, cross-sectional study, mouthguard, crown fracture, Uttar Pradesh

## INTRODUCTION

Sports participation confers substantial physical, psychological and social benefits; however, it is inevitably associated with the risk of orofacial and dental injuries. Traumatic dental injuries (TDIs) sustained

during athletic activities represent a significant public health concern worldwide, with reported prevalence ranging from 0.71% to 60% depending on the sport type, age group, geographic region and level of competition [1]. In contact and collision

sports, such as football, basketball, taekwondo, boxing and rugby, the risk is markedly elevated owing to direct player-to-player contact, impact with equipment or falls [2]. Recent systematic review evidence from Asian countries has reported a pooled prevalence of sports-related orofacial injuries of 40.6% and dental injuries of 15.9% among sportspersons [3].

In India, despite the growing popularity of organized sports at school, collegiate and professional levels, data on sports-related dental trauma (SRDT) among athletes remain limited. Existing Indian studies, primarily conducted among schoolchildren and sport-specific cohorts, have reported prevalence rates ranging from approximately 20% to 44%, with higher occurrence in contact sports and a frequent male predominance [4-6]. Crown fracture is consistently reported as one of the most frequent injury patterns, followed by luxation, avulsion and soft-tissue trauma, with the maxillary anterior teeth being most commonly involved because of their exposed anatomical position [7].

Untreated or delayed management of these injuries can result in pulp necrosis, root resorption, tooth loss, malocclusion and long-term aesthetic and functional deficits, often leading to psychosocial distress, reduced self-esteem and impaired quality of life [8]. Custom-fitted or boil-and-bite mouthguards have been shown to reduce the risk of dento-alveolar trauma when used consistently by athletes participating in contact sports [9]. Nevertheless, utilization rates among athletes, particularly in low- and middle-income settings, remain suboptimal due to inadequate awareness, cost barriers, discomfort and lack of mandatory enforcement by sports governing bodies [3,9].

Despite these established patterns, there is a paucity of contemporary, athlete-specific data from Uttar Pradesh, one of India's most populous states with a rapidly expanding sports infrastructure. This cross-sectional study therefore aimed to determine the prevalence, injury patterns, associated risk

factors, mouthguard usage and emergency-care awareness of SRDT among athletes participating in contact and non-contact sports in selected academies and university sports departments of Uttar Pradesh, India. The findings are expected to provide evidence-based insights for the formulation of preventive policies, educational programs and mandatory protective-equipment regulations by sports organizations and dental professionals.

## **MATERIALS & METHODS**

### **Study Design and Setting**

This was a descriptive cross-sectional study conducted from February to April 2025 at two major sports academies and university sports departments in Kanpur and Lucknow, Uttar Pradesh, India. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

### **Ethical Considerations**

Prior administrative permission was obtained from the concerned sports academies/university departments before data collection. Written informed consent was obtained from all participants after explaining the purpose and procedure of the study. Participation was voluntary, participants were free to withdraw at any stage, and confidentiality and anonymity of all responses were strictly maintained.

### **Sample Size and Participants**

The sample size was calculated using the formula for estimating prevalence in a cross-sectional study:  $n = Z^2p(1-p)/d^2$ , where  $Z = 1.96$  for 95% confidence level,  $p = 0.30$  as the expected prevalence of sports-related dental trauma based on prior literature and  $d = 0.10$  as the margin of error. This yielded a minimum required sample size of approximately 81 participants. Accounting for an anticipated 70% response rate, a total of 115 self-administered questionnaires were distributed. Ultimately, 80 completely filled

questionnaires were received and included in the final analysis (response rate = 70%).

### Inclusion Criteria

- Athletes aged 18–35 years
- Actively participating in organized contact or non-contact sports for at least one year
- Willing to provide informed consent

### Exclusion Criteria

- History of dental trauma from non-sport-related causes
- Incomplete or poorly filled questionnaires

### Data Collection Instrument

A structured, self-administered questionnaire (originally developed in English and translated into Hindi) was used. The questionnaire was validated by three subject experts and pilot-tested on 15 athletes (Cronbach’s alpha = 0.82). It comprised four sections:

1. Socio-demographic and sports-related information (age, gender, type of sport, years of participation, training hours per week).
2. History of sports-related dental trauma (SRDT) (number of episodes, sport during which injury occurred).
3. Pattern and characteristics of dental injuries (type of injury, tooth involved, timing—competition vs. practice, treatment sought).

4. Preventive practices and awareness (mouthguard usage, type of mouthguard, source of information, knowledge of emergency management of avulsed teeth).

### Data Collection Procedure

The principal investigator distributed the questionnaires during regular training sessions with the assistance of coaches. Participants were given sufficient time (15–20 minutes) to complete the forms and any doubts were clarified on the spot. No clinical oral examination was performed; data were based entirely on self-reported history.

### Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, Version 26.0. Descriptive statistics (frequencies, percentages, mean ± standard deviation) were used to summarize participant characteristics and injury patterns. The chi-square test was applied to examine associations between categorical variables (e.g., sport type and prevalence of SRDT). A p-value < 0.05 was considered statistically significant.

### RESULT

Of the 115 self-administered questionnaires distributed, 80 were completely filled and returned, yielding a response rate of 70%. All 80 responses satisfied the inclusion criteria and were included in the final analysis.

**Table 1: Socio-Demographic and Sports Characteristics of Participants (N = 80)**

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–24	48	60.0
	25–35	32	40.0
Gender	Male	53	66.3
	Female	27	33.7
Sport Category	Contact sports	52	65.0
	Non-contact sports	28	35.0
Type of Sport	Football	25	31.3
	Basketball	18	22.5
	Taekwondo	12	15.0
	Volleyball	10	12.5
	Cricket	8	10.0
	Others	7	8.7
Years of participation	1–3 years	35	43.8
	>3 years	45	56.2

The study sample was predominantly composed of young adult athletes. Using grouped age bands, the estimated mean age of the participants was 24.6±5.2 years; 48 athletes (60.0%) were aged 18-24 years and 32 athletes (40.0%) were aged 25-35 years. Males constituted 66.3% of the sample, reflecting the typical gender distribution observed in competitive sports programs in

the region. Contact sports accounted for 65.0% of participants, with football being the most represented individual sport (31.3%). More than half the athletes (56.2%) had over three years of participation experience, indicating a relatively experienced cohort suitable for assessing sports-related dental trauma patterns.

**Table 2: Prevalence of SRDT by Gender (N = 80)**

Gender	Total (n)	Injured (n)	Prevalence (%)	$\chi^2$	p-value
Male	53	21	39.6	4.85	0.028*
Female	27	5	18.5		

\*Statistically significant at  $p < 0.05$ .

A significantly higher prevalence of sports-related dental trauma (SRDT) was observed among male athletes (39.6%) compared to female athletes (18.5%), with the chi-square test confirming statistical significance ( $p =$

0.028). This gender disparity is consistent with greater participation and intensity of play in contact sports among males in the studied population.

**Table 3: Prevalence of SRDT by Sport Category (N = 80)**

Sport Category	Total (n)	Injured (n)	Prevalence (%)	$\chi^2$	p-value
Contact	52	22	42.3	5.67	0.017*
Non-contact	28	4	14.3		

\*Statistically significant at  $p < 0.05$ .

Athletes participating in contact sports exhibited a markedly higher SRDT prevalence (42.3%) than those in non-contact sports (14.3%). The association was

statistically significant ( $\chi^2 = 5.67, p = 0.017$ ), highlighting the elevated risk inherent to contact sports due to increased exposure to direct impacts and collisions.

**Table 4: Prevalence of SRDT by Specific Sport (N = 80)**

Sport	Total (n)	Injured (n)	Prevalence (%)
Football	25	12	48.0
Basketball	18	7	38.9
Taekwondo	12	5	41.7
Volleyball	10	1	10.0
Cricket	8	1	12.5
Others	7	0	0.0

(Note: Chi-square test for specific sports was not performed due to small cell counts in some categories.)

The highest SRDT prevalence was recorded in football (48.0%), followed closely by taekwondo (41.7%) and basketball (38.9%). In contrast, non-contact or low-contact sports such as volleyball and cricket showed

substantially lower rates (10.0% and 12.5%, respectively). This pattern underscores the differential risk across sports, with high-impact team and combat sports demonstrating the greatest burden.

**Table 5: Distribution of Types of Dental Injuries among Injured Athletes (n = 26)**

Type of Injury	Frequency (n)	Percentage (%)
Crown fracture (enamel/dentin)	14	53.8
Luxation / tooth mobility	6	23.1

Avulsion	3	11.5
Concussion (no displacement)	2	7.7
Soft-tissue laceration only	1	3.8
<b>Total</b>	<b>26</b>	<b>100.0</b>

Crown fractures were the most prevalent injury type (53.8%), followed by luxation/tooth mobility (23.1%). Avulsion, though less common (11.5%), represents a severe outcome requiring immediate

intervention. The predominance of crown fractures indicates that the majority of SRDT in this cohort involved hard-tissue damage rather than displacement or soft-tissue injury alone.

**Table 6: Number of Injury Episodes among Injured Athletes (n = 26)**

Number of Episodes	Frequency (n)	Percentage (%)
One	18	69.2
Two or more	8	30.8
<b>Total</b>	<b>26</b>	<b>100.0</b>

**Interpretation of Table 6:** Among the 26 injured athletes, 69.2% reported a single episode of SRDT, while 30.8% experienced recurrent injuries (two or more episodes). This finding suggests that a notable subgroup

of athletes remains at repeated risk, possibly due to continued participation without adequate protective measures or behavioral modification.

**Table 7: Tooth Involved in Injury (n = 26)**

Tooth Type	Frequency (n)	Percentage (%)
Maxillary central incisor	18	69.2
Maxillary lateral incisor	4	15.4
Other anterior teeth	3	11.5
Posterior teeth	1	3.8
<b>Total</b>	<b>26</b>	<b>100.0</b>

The maxillary central incisors were overwhelmingly the most commonly affected teeth (69.2%), with anterior teeth collectively accounting for 96.1% of injuries.

This distribution aligns with the anatomical vulnerability of protruded maxillary incisors to direct frontal impacts during sports activities.

**Table 8: Circumstances of Injury Occurrence (n = 26)**

Circumstance	Frequency (n)	Percentage (%)
During competition	20	76.9
During training	6	23.1
<b>Total</b>	<b>26</b>	<b>100.0</b>

**Interpretation of Table 8:** The majority of SRDT events (76.9%) occurred during competitive matches rather than training sessions. This indicates that higher-intensity play, increased adrenaline and more

aggressive physical contact in competitions significantly elevate the risk of dental trauma compared to controlled training environments.

**Table 9: Mouthguard Usage Patterns**

Mouthguard Usage	Overall (N = 80) n (%)	Among Injured (n = 26) n (%)
Regular use	12 (15.0)	3 (11.5)
Used sometimes	18 (22.5)	5 (19.2)
Never used	50 (62.5)	18 (69.2)
Wearing mouthguard at the time of injury	–	4 (15.4)

(Chi-square test for regular mouthguard use vs. SRDT:  $\chi^2 = 2.07$ ,  $p = 0.150$  – not statistically significant.)

Mouthguard utilization was alarmingly low, with only 15.0% of all athletes reporting regular use and 62.5% never using one. Among injured athletes, just 15.4% were wearing a mouthguard at the time of injury.

Although the association between regular use and reduced SRDT did not reach statistical significance ( $p = 0.150$ ), the low adoption rate remains a critical modifiable risk factor.

**Table 10: Awareness Regarding Prevention and Emergency Management (N = 80)**

Awareness Item	Aware n (%)	Not Aware n (%)
Importance of mouthguard in sports	34 (42.5)	46 (57.5)
Availability of custom-made mouthguards	21 (26.3)	59 (73.8)
Possibility of replantation of avulsed tooth	25 (31.3)	55 (68.8)
Ideal time for replantation (within 30 min)	11 (13.8)	69 (86.3)

(Chi-square test for awareness of replantation possibility by sport category:  $\chi^2 = 0.94$ ,  $p = 0.331$  – not statistically significant.)

Overall awareness levels were suboptimal: only 42.5% recognized the importance of mouthguards and merely 13.8% knew the critical 30-minute window for avulsed tooth replantation. Awareness did not differ significantly between contact and non-contact athletes ( $p = 0.331$ ), indicating a widespread knowledge gap across the entire study population that necessitates targeted educational interventions.

## DISCUSSION

The present cross-sectional study conducted among 80 athletes in Uttar Pradesh, India, documented an overall prevalence of SRDT of 32.5%, with a markedly higher rate in contact sports (42.3%) compared with non-contact sports (14.3%). This prevalence is higher than the pooled dental injury rate reported in a systematic review and meta-analysis of sports-related traumatic orofacial and dental injuries in Asian countries [3]. However, it is consistent with findings from studies focused on high-risk contact and combat sports populations. Bawazir et al. reported a high prevalence of dental trauma among athletes in Riyadh, while Biagi et al. documented traumatic dental injuries among Italian kickboxing athletes, underscoring the wide variability influenced by sport type, competition level and geographic context [1,7]. In the Indian setting, Singh et al. reported sports-related orodental injuries among high-school students in North India, Johnson et al. documented orofacial trauma among Kabaddi players in the Delhi-NCR

region and Pandey et al. reported sports-related dental trauma cases over a recent 2-year period [4-6]. The higher prevalence observed in the current study may reflect the inclusion of a greater proportion of contact-sport athletes (65.0%) and the self-reported nature of data collected from an actively competing cohort.

A statistically significant gender disparity was evident, with males exhibiting a higher SRDT prevalence than females (39.6% vs. 18.5%;  $p = 0.028$ ). This finding corroborates previous evidence indicating higher risk among male athletes, often attributed to greater intensity of participation, increased exposure to contact sports and risk-taking behavior [10-12]. Tsuchiya et al. reported higher sports-related dental injury prevalence among males than females in a large cross-sectional study of young athletes in Miyagi prefecture, Japan [12]. The current results reinforce the need for preventive strategies targeting high-risk groups, particularly male athletes in high-impact disciplines such as football, basketball and taekwondo, which accounted for the highest injury rates in the present sample.

Crown fractures emerged as the predominant injury type (53.8%), followed by luxation/tooth mobility (23.1%) and avulsion (11.5%), with maxillary central incisors most frequently involved (69.2%). These patterns mirror those documented in earlier studies and reviews, where crown fracture and maxillary anterior tooth involvement have been repeatedly reported as common injury

features among sportspersons [1,3,7]. The anatomical vulnerability of protruded maxillary anterior teeth to direct frontal impacts explains this consistent distribution across studies [3,8]. Furthermore, 76.9% of injuries in the present study occurred during competitive events rather than training. This aligns with Azadani et al., who reported that dental injuries among high-school athletes in the United States occurred more often during competition than practice [10].

Mouthguard utilization was critically low, with only 15.0% of athletes reporting regular use and just 15.4% of injured athletes wearing one at the time of injury. Awareness of emergency management was equally suboptimal, with only 13.8% knowing the 30-minute critical window for avulsed tooth replantation. These figures are consistent with Indian and Asian contexts where mouthguard adoption remains poor despite awareness of its protective value [3,13,14]. Although the association between regular mouthguard use and reduced SRDT did not reach statistical significance in the present study ( $p = 0.150$ ), systematic review evidence supports the preventive role of mouthguards in reducing dento-alveolar trauma among contact-sport athletes [9]. The observed gaps highlight a persistent educational deficit that requires structured intervention by dental professionals, coaches and sports institutions.

The study has certain limitations. The relatively small sample size ( $N = 80$ ) and reliance on self-reported data introduce potential recall bias and limit generalizability beyond the selected academies in Uttar Pradesh. No clinical oral examination was performed to corroborate injury history. Nevertheless, the findings provide valuable contemporary evidence from an understudied Indian athletic population and underscore the urgent need for multifaceted prevention programs. Mandatory mouthguard policies, coach-led educational workshops on emergency protocols and interdisciplinary collaboration between dental professionals and sports governing

bodies are recommended to mitigate this preventable public-health burden.

## **CONCLUSION**

The present cross-sectional study documented a moderately high prevalence of sports-related dental trauma (SRDT) of 32.5% among 80 athletes in Uttar Pradesh, India. The burden was significantly greater among male athletes (39.6%) and participants in contact sports (42.3%), with crown fractures constituting the predominant injury type (53.8%), primarily affecting the maxillary central incisors during competitive events. Mouthguard utilization was alarmingly low (regular use 15.0%) and awareness of emergency management protocols—particularly the critical 30-minute window for avulsed tooth replantation—was poor (13.8%).

These findings underscore SRDT as a preventable yet prevalent occupational hazard in athletic populations, especially in high-impact sports such as football, basketball and taekwondo. The results align with regional and international patterns while highlighting persistent gaps in preventive practices and education within the Indian context.

Urgent and multifaceted interventions are warranted. Sports governing bodies, academies and dental professionals should collaborate to implement mandatory mouthguard policies, conduct regular awareness workshops on emergency care and integrate oral-health education into athlete training curricula. Such measures have the potential to substantially reduce the incidence and severity of SRDT, thereby safeguarding athletes' oral health, function and quality of life. Future longitudinal studies with larger, multi-center samples and clinical validation are recommended to further evaluate the effectiveness of these preventive strategies.

***Declaration by Author***

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