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Knowledge, Attitude, and Awareness of Adolescents About the Emergency Management of Traumatic Dental Injuries: A Cross-Sectional Study

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Abstract

Background/Objectives: Traumatic dental injuries (TDIs) are common in adolescents and require immediate first aid to optimize outcomes, especially in cases of avulsion. Adolescents are often the first responders during school or sports activities, yet their preparedness remains unclear. This study aimed to assess the knowledge, attitude, and awareness of pre-university students in Mangalore, Karnataka, regarding the emergency management of TDIs. **Methods**: A descriptive cross-sectional survey was conducted among 400 adolescents aged 15 to 18 years from four randomly selected pre-university colleges. A structured, validated 20-item questionnaire assessed demographic characteristics and domains of knowledge (6 items), attitude (4 items), and awareness (6 items). Data was analyzed using descriptive statistics, chi-square tests, and one-way ANOVA. **Results**: Knowledge regarding dental trauma management was low, with a mean score of 2.19 ± 1.28 out of 6; only 26.3% knew that avulsed permanent teeth can be replanted and 7% identified an appropriate storage medium. Attitudes were positive, with 88.8% of the participants expressing willingness to assist an injured peer. Awareness related to preventive practices and prior exposure was moderate; mouthguard use was reported by only 11.5% of students. Knowledge scores did not differ significantly across schools ($p > 0.05$). **Conclusions**: Adolescents demonstrated favorable attitudes but inadequate knowledge of essential emergency procedures for TDIs. School-based dental first-aid training and reinforcement of preventive practices are urgently needed to improve adolescents' preparedness for managing dental trauma.

Keywords: traumatic dental injuries; adolescents; avulsion; emergency management; awareness

1. Introduction

Traumatic dental injuries (TDIs) represent a significant global oral health challenge, particularly among children and adolescents who are highly vulnerable to accidents during school and recreational activities [1]. Recent epidemiological reports estimate that between 15% and 20% of school-aged children experience trauma to permanent dentition, most commonly affecting the anterior teeth [2,3]. Indian studies similarly document a substantial burden, with TDI prevalence ranging from 12% to 30% among school-going children, and higher rates reported in urban and semi-urban regions with high participation in outdoor activities [4]. The multifactorial etiology of TDIs, including falls, collisions, road traffic accidents, and contact sports, places adolescents at increased risk. This vulnerability is heightened in older adolescents (15 to 18 years) because they have greater independence, reduced adult supervision, and increased participation in competitive physical activities [5,6].

TDIs such as avulsion and complicated crown fractures can result in pain, esthetic impairment, functional difficulty, and considerable psychological distress if not managed promptly [5]. Among

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these, the prognosis of an avulsed permanent teeth is especially time-sensitive and depends greatly on immediate and appropriate first-aid measures. The prognosis depends on immediate measures taken at the site of injury, including timely replantation, correct handling by holding the crown, minimal cleaning of the root surface, and placement in an appropriate storage medium to maintain periodontal ligament cell viability [7]. The recent International Association of Dental Traumatology (IADT 2020) guidelines emphasizes that the first few minutes after avulsion are critical and that early intervention by a bystander can markedly improve outcomes [7]. Therefore, the preparedness of individuals present at the scene, often peers or classmates, is crucial [8].

Despite the importance of prompt emergency management, existing literature suggests that awareness of dental trauma procedures remains inadequate across various stakeholder groups. Studies have assessed the knowledge of primary school teachers, parents, young physicians, and general dentists, with consistently low levels of preparedness reported [7,8,9,10]. However, research focusing specifically on adolescents, the age group most frequently present during peer-related injuries remains scarce. Limited international studies available reveal deficiencies in recognizing replantation possibilities, understanding correct root-surface handling, and identifying appropriate storage media [11]. In India, most available data focus on younger children or adult stakeholders, leaving a significant evidence gap concerning middle adolescents who are more likely to respond during school-time and sports-related injuries [2,4,12].

Understanding the preparedness of this age group is best approached through the Knowledge–Attitude–Awareness (KAA) framework [10,13]. While knowledge forms the foundation for correct first-aid actions, attitudes related to willingness to help, perceived confidence, and responsibility significantly influence actual behavior. Awareness, particularly of immediate actions and available resources, plays an equally important role in shaping appropriate emergency responses. Evaluating these elements together can guide the development of targeted school-based interventions to strengthen community-level capability in managing TDIs [13,14].

In Karnataka, and particularly in coastal districts such as Mangalore where contact sports and outdoor recreation are common among pre-university students, no data exists regarding adolescents' preparedness to handle TDIs [15,16]. Understanding the extent of their knowledge and the gaps within their attitudes and awareness is essential for designing contextually relevant training modules and preventive strategies. Therefore, this cross-sectional study aims to assess the knowledge, attitude, and awareness of adolescents aged 15–18 years in Mangalore, Karnataka, regarding the emergency management of traumatic dental injuries.

2. Materials and Methods

2.1. Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee (Reference No. 18062). Administrative permission was obtained from each participating school. Written informed assent was obtained from all students along with parental consent. Participation was voluntary, and strict anonymity and confidentiality were ensured throughout data handling and reporting.

2.2. Study Design and Setting

A descriptive cross-sectional questionnaire survey was conducted among pre-university students (15 to 18 years) from four randomly selected pre-university colleges in Dakshina Kannada district, Karnataka. Cluster random sampling was applied by generating a computer-based random selection of schools from the district list. Data were collected between September and November 2024 in classroom settings under standardized supervision.

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2.3. Sample Size Determination

The sample size was calculated considering a 95% confidence level, absolute precision of 5%, and an expected level of knowledge of 50%, which was observed in similar studies on related populations [11,12,13]. Using the single-proportion formula,

$$n = \frac{Z^2 p(1-p)}{d^2}$$

with Z = 1.96, p = 0.50, and d = 0.05, the minimum required sample was 384. To compensate for non-response, the target sample was set at 400 students.

2.4. Participants: Inclusion and Exclusion Criteria

Students aged 15 to 18 years enrolled in Class XI or XII who provided informed assent and parental consent and were able to read English or Kannada were included. Exclusion criteria included prior dental, medical, or first-aid training, absence on the day of data collection, and questionnaires with more than 20% missing responses (if any).

2.5. Questionnaire Development

A structured questionnaire consisting of 20 items was developed by adapting elements from previously published questionnaires used in studies on emergency management of dental trauma [10,11,12,13,14]. Minor linguistic and contextual modifications were made to align with regional terminology and student comprehension levels.

The questionnaire consisted of two sections. The first section collected demographic information through four items covering age, gender, class, and academic stream. The second section assessed students' knowledge, attitude, and awareness regarding the emergency management of traumatic dental injuries through sixteen closed-ended items, which included six knowledge questions, six awareness related questions and 4 attitude related questions.

2.6. Validation and Pilot Testing

Content validity was evaluated by a panel of three experts in pediatric dentistry and public health using the Content Validity Index (CVI). Items with a CVI < 0.80 were revised or removed. A pilot test was conducted among 30 students from a nonparticipating school to assess clarity, language, and administration logistics. Feedback resulted in minor modifications to wording and response options. The pilot data were excluded from final analysis. The finalized questionnaire demonstrated acceptable internal consistency (Cronbach's alpha = 0.72).

2.7. Data Collection Procedure

The survey was administered in classroom settings during designated periods. Standardized verbal instructions were provided by the investigator before distribution. Students completed the questionnaire individually in approximately 15–20 minutes. Investigator remained present to ensure standardized administration and to prevent peer influence. Completed questionnaires were collected immediately. No personal identifiers were recorded, and data were coded prior to entry.

2.8. Bias Control

Several measures were taken to minimize potential bias. Selection bias was reduced by including all eligible students within the selected class groups. To limit response bias, anonymity and confidentiality were emphasized, and teachers were not present during questionnaire administration. Recall bias was minimized by designing the survey to focus primarily on current knowledge and attitudes rather than retrospective clinical events. Additionally, social desirability bias was addressed by using neutral, non-leading wording throughout the questionnaire.

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2.9. Scoring of Knowledge, Attitude, and Awareness

Knowledge was assessed using six objective items, with responses scored as 1 for correct answers and 0 for incorrect or "don't know" responses, yielding a total possible score ranging from 0 to 6, where higher scores indicated better knowledge. Attitude and awareness items were not scored cumulatively; instead, they were analyzed descriptively using frequencies and percentages, as they reflected students' intentions and practices rather than quantifiable knowledge levels.

2.10. Statistical Analysis

Data was entered into Microsoft Excel and analyzed using SPSS version 21.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, and standard deviation) were generated for demographic variables and questionnaire responses. The Chi-square test was used to evaluate associations between categorical variables such as gender, class, and selected responses. One-way ANOVA was performed to compare mean knowledge scores between schools. Assumptions of normality and homogeneity of variance were verified prior to conducting parametric tests. All tests were two-tailed, and the level of statistical significance was set at $p < 0.053$.

3. Results

3.1. Participant Characteristics

A total of 400 students participated in the study. The age distribution ranged from 15 to 18 years, with the majority being 17 years old (57.8%). There were 211 males (52.8%) and 189 females (47.3%). The demographic details are presented in Table 1. The overall response rate was 100%, with 400 complete questionnaires included in the final analysis.

Table 1. Demographic characteristics of the participants.

Variables		N (%)
Q1. Age (Years)	15	5 (1.3%)
	16	128 (32%)
	17	231 (57.8%)
	18	36 (9%)
Q2. Gender	Male	211 (52.8%)
	Female	189 (47.3%)
Q3. Education	Class XI	60 (15%)
	Class XII	340(85%)
Q4. Stream	Arts	26 (6.5%)
	Science	72 (18%)
	Commerce	302 (75%)

3.2. Awareness Related to Dental Trauma

Figure 1 shows the response of the participants. 378 students (94.5%) reported involvement in contact sports; however, only 46 students (11.5%) used a mouthguard during sports activities. A total of 140 students (35%) had received general first-aid training, of whom 53 students (37.85%) reported that the training included topics on dental trauma.

A history of dental injury was reported by 148 students (37%), and among them, 131 students (88.51%) sought dental consultation following the injury. Table 2 summarizes the responses related to knowledge, awareness and attitude.

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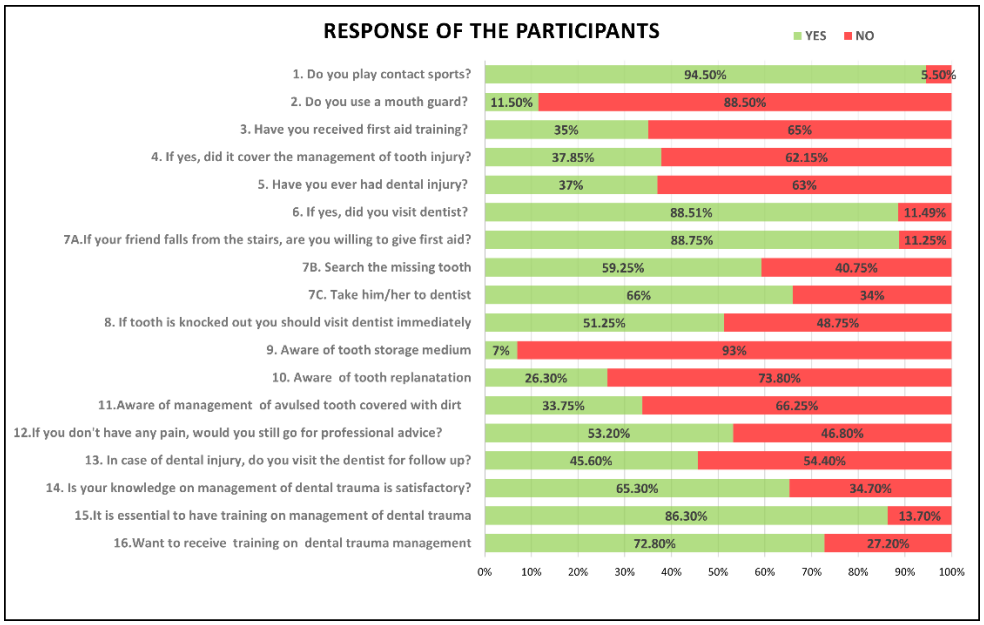

Figure 1. Graphical representation of response of the participants to questions on knowledge, awareness and attitude.

Table 2. Responses of the participants to the questionnaire.

Sl no.	Awareness Questions	Yes	No
Q5.	Do you play contact sports?	378 (94.5%)	22(5.5%)
Q6.	Do you use a mouth guard?	46 (11.5%)	354(88.5%)
Q7.	Have you received first aid training?	140 (35%)	260(65%)
Q8.	If yes, did it cover the management of tooth injury? (N=140)	53 (37.85%)	87(62.15%)
Q9.	Have you ever had dental injury?	148 (37%)	252(63%)
Q10.	If yes did you visit dentist? (N=148)	131(88.51%)	17(11.49%)
Sl no.	**Attitude Questions**	**Yes**	**No**
Q11.	During school hours, your classmate falls from the stairs. Would you like to look for any injury in the body and give first aid?	355 (88.75%)	45 (11.25%)
Q12.	If you notice that the front tooth is missing, would you search for the tooth immediately?	237(59.25%)	163 (40.75%)
Q13.	Should you take him/her to dentist?	264 (66%)	136 (34%)
Q14.	Would you like to attend an educational program on management of dental trauma?	291 (72.8%)	109 (27.2%)
Sl No.	**Knowledge Questions**	**Correct (%)**	**Incorrect (%)**
Q15.	Search for the lost tooth	237(59.25%)	163 (40.75%)
Q16.	Visit to the dentist	264 (66%)	136 (44%)
Q17.	Ideal time for the treatment	205 (51.2%)	195 (48.75%)
Q18.	An avulsed permanent tooth can be replanted	105 (26.3%)	205 (73.80%)
Q19.	Management of avulsed tooth covered with dirt.	135 (34.75%)	265(66.25%)
Q20.	Storage medium	28 (7%)	372 (93%)

3.3. Attitude Toward Emergency Management

Most participants (88.8%) stated they would assess injuries and provide first aid to a classmate who had fallen during school hours. Additionally, 59.25% of the students reported they would search for a missing tooth if avulsion was suspected, and 66% indicated they would take the injured

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classmate to a dentist. A large majority (72.8%) expressed willingness to attend an educational program on dental trauma management (Table 2).

3.4. Knowledge Regarding Emergency Management of Dental Trauma

Only 105 students (26.3%) were aware that an avulsed permanent tooth can be replanted. Awareness regarding the correct management of a soiled avulsed tooth was reported by 135 students (34.5%). Knowledge of the appropriate storage medium for transporting an avulsed tooth was low, with only 28 students (7%) identifying a suitable medium. The mean knowledge score of the participants was 2.19 ± 1.28 (maximum score: 6).

3.5. Comparison of Knowledge Scores Between Schools

The mean knowledge scores of students from the four participating schools are presented in Table 3. The scores ranged from 1.98 ± 1.25 to 2.37 ± 1.24. One-way ANOVA was used to compare the scores across schools and revealed no statistically significant difference ($p = 0.18$). Figure 2 illustrates that most students demonstrated poor knowledge (68.5%), predominantly positive attitudes (71%), and moderate awareness (44%) regarding the emergency management of traumatic dental injuries.

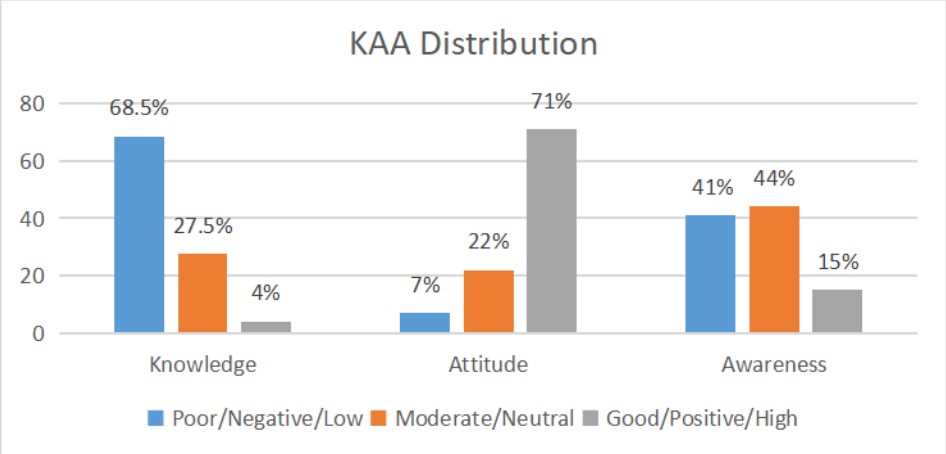

Figure 2. Distribution of Knowledge, Attitude, and Awareness Levels Among Adolescents.

4. Discussion

This study evaluated the knowledge, attitude, and awareness of adolescents regarding the emergency management of traumatic dental injuries (TDIs). The findings highlight substantial knowledge gaps despite generally positive attitudes and moderate awareness among participants.

Majority of students (94.5%) reported participation in contact sports, confirming that adolescents in this age group are regularly exposed to TDI risk. This finding is consistent with previous reports (4,5,11), which indicate that active participation in school-based and recreational sports significantly increases the incidence of dental trauma. Despite such exposure, only 11.5% of students reported using mouthguards, indicating very poor preventive awareness and practice. This mirrors global trends showing low compliance with mouthguard use, often attributed to lack of enforcement, limited awareness, and misconceptions regarding comfort and necessity [6,17]. Recent reports emphasize that custom-made mouthguards (CSMs) are the most effective for preventing sports-related dental trauma [18,19]. However, limited awareness and lack of standard guidelines hinder their use. The European Association for Sports Dentistry advocates education and mandatory CSM use in high-risk sports to reduce TDI prevalence [18].

Only 35% of the students reported receiving general first-aid training, and among these, just 37.85% had received any instruction related to dental trauma management. Similar deficits were documented by Pithon et al. [7] and Alyahya et al.[8] underscoring a global need to incorporate dental

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emergency components into school health modules. This suggests a critical curricular gap, as most first-aid education programs focus on bleeding, fractures, or cardiopulmonary resuscitation (CPR), overlooking dental injuries [20,21].

A considerable proportion (37%) of participants had experienced dental injury themselves, reflecting the high local burden of TDIs. However, 88.5% of those who sustained trauma sought dental consultation, suggesting satisfactory awareness of the need for professional management once injury occurs. These figures are encouraging when compared to other studies, where fewer adolescents reported seeking immediate dental care [3,7]. Nevertheless, in our study, prior experience with dental injury did not correspond to higher knowledge scores, implying that experiential exposure alone does not translate into better preparedness.

Adolescents exhibit varied attitudes towards traumatic dental injuries (TDIs), influenced by psychosocial factors, lifestyle, and the perceived impact on their quality of life [11,22]. Understanding this attitude is crucial for developing effective preventive strategies and interventions. Most respondents (88.8%) stated that they would provide first aid to a classmate who sustained an injury at school, demonstrating a commendable helping attitude and readiness to act. Such positive tendencies are valuable foundations for effective peer-led responses during emergencies. About 59.25% indicated they would actively search for a missing tooth if avulsion was suspected, showing basic awareness of the urgency but limited understanding of the correct procedures for handling or replantation. According to the recent IADT guidelines, immediate replantation of an avulsed permanent tooth at the site of injury offers the best prognosis, as it preserves the viability of periodontal ligament cells and minimizes root resorption or ankylosis [17,21]. Failure to perform timely replantation or to store the tooth in an appropriate medium drastically reduces the likelihood of successful reintegration, often leading to tooth loss, esthetics compromise, and long-term functional and psychological consequences [21,22,23]

A higher proportion (66%) of participants reported that they would take the injured person to a dentist, aligning with findings from Wang et al. [5] and Young et al. [11] and who noted strong intention to refer but poor procedural knowledge. Encouragingly, nearly three-fourths (72.8%) expressed willingness to attend an educational program on dental trauma management, reinforcing their receptivity to structured learning interventions. Such positive attitude trends have also been highlighted in study by Alyahya et al. [8] where parents and adolescents showed strong motivation to learn when given access to educational materials.

Although awareness and attitudes were generally favorable, factual knowledge regarding the emergency management of dental trauma was limited. The mean knowledge score was 2.19 ± 1.28 out of 6, indicating poor overall understanding (Table 3). Only 26.3% of students were aware that an avulsed permanent tooth can be replanted, which parallels findings from Saikiran et al. [2] and Dhindsa et al. [14] where fewer than 30% of adolescents recognized the possibility of successful replantation. Awareness of correct cleaning of a soiled avulsed tooth was reported by only 34.5%, revealing misconceptions such as washing under tap water or scrubbing, which can damage periodontal ligament cells. The recent IADT guidelines [17,21] recommend gently rinsing the avulsed tooth with saline or milk while avoiding any scrubbing, underscoring a significant gap in students' understanding of correct handling procedures. Figure 3 outlines the schematic representation of handling an avulsed tooth during replantation.

Table 3. Descriptive and inferential statistics of scores between the schools.

School	Mean±SD	Mode	P value
1.	1.98±1.25	3	0.18
2.	2.24±1.41	1	
3.	2.37±1.24	3	
4.	2.16±1.21	3	

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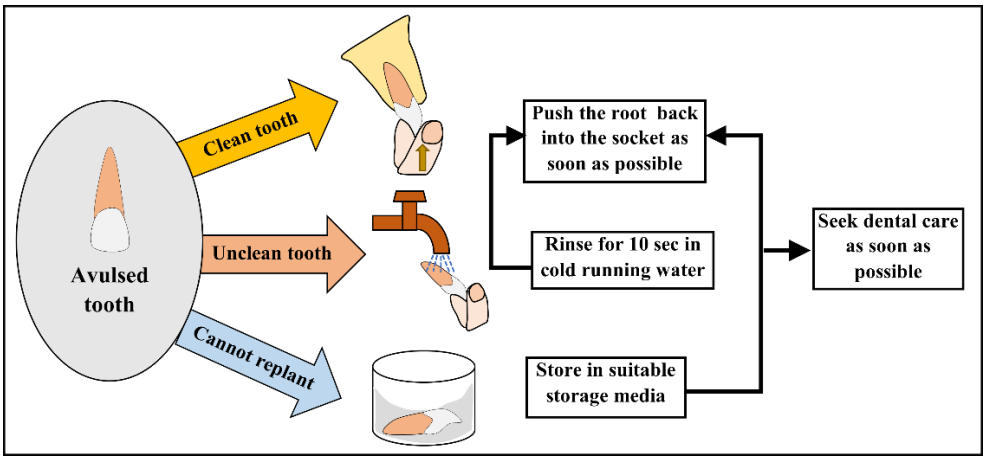

Figure 3. Schematic representation of Emergency Management of an Avulsed Permanent Tooth.

Knowledge of appropriate storage media was extremely poor, with only 7% identifying a suitable medium. This is one of the most critical deficiencies, as prognosis after avulsion is strongly dependent on maintaining root cell viability. Comparable studies among teachers, coaches, and students in India and the Middle East have reported similar findings, underscoring the universality of this knowledge gap [3,8,11,13,24]. The lack of awareness of accessible media such as milk or saline, despite their availability in most school environments, suggests inadequate dissemination of dental first-aid principles [14].

Overall, the results demonstrate that adolescents possess positive attitudes and moderate awareness but insufficient procedural knowledge (Figure 2). Given that most dental injuries among adolescents occur in schools or during sports, educational and policy-level interventions should be targeted at these settings [11]. The recent scoping review on school-based interventions for dental trauma has highlighted the importance of structured, continuous educational programs in improving knowledge, attitudes, and first-aid practices among students, teachers, and caregivers [25]. Evidence from this review indicates that baseline understanding of tooth avulsion, replantation timing, and proper handling or storage techniques is generally poor across school communities, but targeted interventions consistently produce substantial improvements in these domains. Incorporating dental first-aid training into school health curricula, organizing interactive workshops, and distributing simplified emergency flowcharts could therefore substantially enhance adolescents' competence in managing TDIs [26]. Training programs for teachers and sports coaches should likewise reinforce mouthguard use and emphasize the critical steps involved in tooth replantation and appropriate storage media. Encouraging awareness of simple, readily available storage media such as milk or saline, rather than specialized solutions like Hank's Balanced Salt Solution (HBSS), can improve practical feasibility in real-life school environments. Regular reinforcement through visual aids, peer-led demonstrations, and mock drills can also strengthen retention and confidence in handling dental emergencies [25,26,27,28].

Strengths and Limitations

The present study is one of the few from India focusing exclusively on middle adolescents (15 to 18 years), an age group often underrepresented in TDI research. Inclusion of multiple schools and an adequately powered sample size strengthen the reliability and representativeness of the findings. However, as a cross-sectional, self-reported study, it cannot establish causality, and responses may be subject to recall and social desirability bias. Additionally, the findings are limited to one district in coastal Karnataka and may not be generalizable to other regions.

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Future Directions

Future research should focus on evaluating the effectiveness of school-based dental first-aid modules, assessing long-term knowledge retention, and studying the impact of hands-on training on behavioral outcomes. Incorporating digital learning tools and gamified educational interventions may further improve engagement and learning among adolescents. Policies promoting the mandatory use of mouthguards during contact sports should also be explored as preventive measures to reduce TDI incidence.

5. Conclusions

This study revealed that middle adolescents possess limited knowledge regarding the emergency management of traumatic dental injuries, particularly in relation to tooth replantation, correct handling of avulsed teeth, and appropriate storage media. Despite these knowledge gaps, students demonstrated positive attitudes toward assisting injured peers and expressed strong willingness to receive training. The findings highlight the need for structured school-based educational interventions to improve adolescents' preparedness for dental emergencies and to promote protective measures such as mouthguard use among students engaged in contact sports.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of Manipal College of Dental Sciences, (Reference No. 18062 and date of approval: 22/04/2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

TDIs	Traumatic dental injuries
IADT	International Association of Dental Traumatology
KAA	Knowledge–Attitude–Awareness
HBSS	Hank's Balanced Salt Solution
CSM	custom-made mouthguards
CPR	Cardiopulmonary resuscitation

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