







# Evaluation of Dentists' Knowledge in a Brazilian city about Managing Dental Injuries in Children According to IADT Guidelines: A Cross-Sectional Study

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## ABSTRACT

**Objective:** To evaluate the knowledge level of dentists in Mossoró, RN, Brazil, regarding dental trauma management based on the current guidelines of the International Association of Dental Traumatology (IADT). **Material and Methods:** Dentists working in Mossoró and regularly registered with the Regional Dentistry Council of Rio Grande do Norte responded to a printed or digital questionnaire investigating sociodemographic and professional profiles with 12 questions about dental trauma management. Jamovi 2.3.28.0 software assisted the statistical comparisons between subcategories relating to the participants' sociodemographic and professional profiles, with a 5% significance level. **Results:** 69 dentists participated in the study. The mean percentage of correct answers was 50.24%, including all inquiries. The lowest rates of correct answers regarded tooth intrusion and avulsion (14.5% and 31.88%, respectively). The overall median score for the proper management of dental trauma was 6.0 points, considering a maximum possible score of 12, categorizing the participants' overall knowledge as acceptable. Sex, clinical experience, postgraduate degree, primary activity sector, the number of previously treated cases, and self-reported knowledge of dental trauma did not significantly affect dentists' knowledge level. **Conclusion:** The knowledge level of dentists in Mossoró regarding dental trauma management is acceptable based on current IADT guidelines.

**Keywords:** Endodontics; Tooth; Tooth Avulsion.

## ■ Introduction

Dental trauma is a public health problem in Brazil, especially among children, with occurrence rates from 12.6 to 46%. Traumatic injuries may be physical, chemical, or mechanical, potentially affecting hard tissues (enamel, dentin, cement, alveolar bone) and/or soft tissues (pulp, gingiva, periodontal ligament). The primary causes of dentoalveolar injuries are falls, collisions with objects or people, automobile accidents, and physical violence [1].

Traumatic dental injuries (TDIs) are classified into two groups: dental hard tissue injuries and periodontal tissue injuries. Dental hard tissue injuries are fractures, such as enamel cracks, enamel fractures, enamel and dentin fractures, crown and root fractures, and root fractures, categorized according to the region affected by trauma. Periodontal tissue injuries are luxations, classified into concussion, subluxation, extrusion, lateral luxation, intrusion, and avulsion [2].

TDI treatments succeed depending on the type and severity of dental trauma, the root development stage, the time between the injury and immediate treatment, and dentists' knowledge and experience [3]. The International Association of Dental Traumatology (IADT) developed a series of guidelines providing recommendations for diagnosing and treating these injuries to guide the therapeutic conduct of professionals in TDI cases. However, despite the availability of information, studies indicate that dentists have insufficient knowledge levels of TDI management [4].

The data showed that lacking knowledge and establishing an inadequate clinical protocol may cause complications after treatment and affect the quality of life of individuals, such as impaired social interactions, low self-esteem, and nutritional deficiencies [1]. Thus, dentists must acquire updated and explicit knowledge of the diagnosis, planning, and performance of the clinical protocol for TDIs, providing patients with a satisfactory prognosis and proper quality of life after dental trauma occurrence [5].

Assessing dentists' knowledge of managing dental trauma can help improve and/or create continuing education programs and/or strategies in IDT in the health system. Therefore, the objective of this study is to evaluate dentists' level of knowledge in Mossoró, RN, Brazil, about the management of dental trauma based on current IADT guidelines [2,6,7].

## ■ Material and Methods

### Study Design and Ethical Clearance

It was a cross-sectional study reported according to PROBE (Preferred Reporting items for Observational studies in Endodontics) guidelines. The study followed the ethical principles of the Declaration of Helsinki with additional requirements from the Brazilian legislation. The Ethics Committee of the University Center of Patos (UNIFIP), PB, Brazil (Opinion Number 6.247.229), reviewed and approved the research protocol.

### Sample

The sample size calculation was based on the estimated 435 professionals registered with the CRO/RN working in Mossoró and the data from a study detecting significant differences in dentists' knowledge level according to the number of previously treated dental trauma cases [3]. A 5% significance level, 80% sample power, estimated standard deviation of 1.75, and minimum difference of 0.82 determined the need for at least 63 participants. The calculation was performed at [www.calculoamostral.bauru.usp.br](http://www.calculoamostral.bauru.usp.br) using the power calculator to determine the difference between two means with independent groups (t-test).

## Data Collection

A printed or digital questionnaire in Google Forms, adapted from previous studies [1,3], evaluated dentists' knowledge regarding dental trauma management in Mossoró, RN, Brazil. Questionnaire applications occurred between July and September 2023. The study included dentists regularly registered with the Regional Dentistry Council of the respective state (CRO/RN) who voluntarily agreed to participate in the research by signing the Informed Consent Form (ICF).

The questionnaire (Supplementary file S1) included 20 questions distributed into two sections: (1) sociodemographic and professional profiles of participants (sex, age, clinical experience, the highest postgraduation degree, work sector, primary work location, the number of previously treated dental trauma cases, and self-reported knowledge on dental trauma) and (2) knowledge of dental trauma management according to current IADT guidelines [2,6,7]. The participants provided the answers through a single restricted access with completely anonymous processing.

Twelve questions analyzed dentists' knowledge of dental trauma management in section 2, and a score system of up to 12 points compared the knowledge level with section 1 subcategories (sociodemographic and professional profiles of participants). Each of the 12 questions had a correct answer that scored one point and an incorrect answer that scored zero [1,3]. These knowledge level scores were categorized as low (0-3), acceptable (4-6), good (7-9), or very good (10-12).

## Data Analysis

The data were presented as frequencies, percentages, medians, or means  $\pm$  standard deviations. Statistical analyses occurred in Jamovi 2.3.28.0 software at a 5% significance level. The subcategories related to sociodemographic and professional profiles of participants (independent variables) were compared with the Mann-Whitney U test and the Kruskal-Wallis test for non-normal data distribution (Shapiro-Wilk test,  $p < 0.05$ ) and with one-way ANOVA for normal data distribution (Shapiro-Wilk test,  $p \geq 0.05$ ).

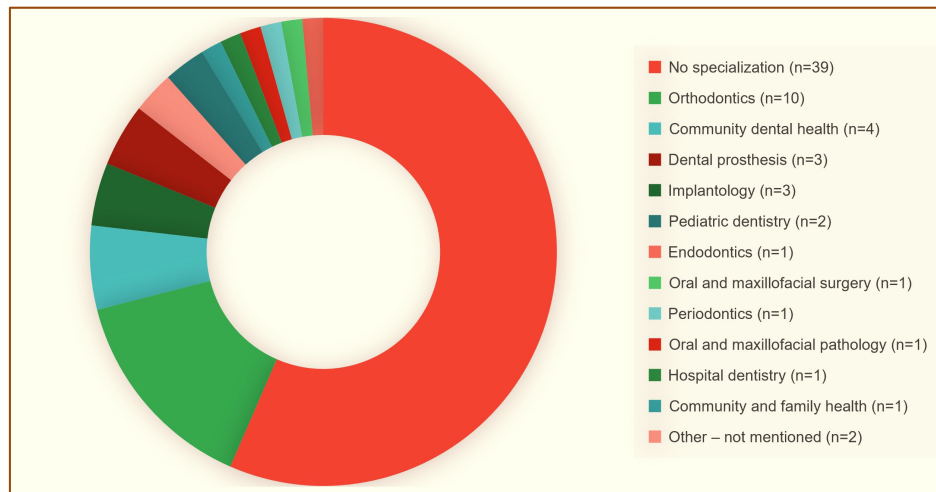
## ■ Results

Sixty-nine dentists participated in the study. Table 1 presents the sociodemographic and professional characteristics of participants. Most dentists were women (55.1%), had less than ten years of clinical experience (69.56%), and worked mainly in the private sector (62.32%). The mean age was  $34 \pm 11$  years. Only eight participants had a postgraduate degree, and 33% of the sample had a specialist degree, particularly in Orthodontics (Figure 1). Regarding the previous experience of participants with dental trauma, 44.93% reported having treated five or more cases. Almost half the dentists reported their dental trauma knowledge as good (47.82%).

**Table 1. Sociodemographic and professional profiles of participants.**

Variables	N (%)
Sex	
Male	31 (44.90)
Female	38 (55.10)
Clinical Experience	
<10 Years	48 (69.56)
10-19 Years	9 (13.04)
20-29 Years	4 (5.80)
>29 Years	8 (11.60)
Highest Postgraduation Degree	

None	11 (15.94)
Advanced Training	27 (39.13)
Specialization	23 (33.33)
Masters and/or Doctorate	8 (11.60)
Primary Work Sector	
Public	23 (33.33)
Private	43 (62.32)
Education	3 (4.35)
Previously Treated Dental Trauma Cases	
None	15 (21.74)
1 case	5 (7.25)
2-4 cases	18 (26.08)
≥5 cases	31 (44.93)
Self-Reported Knowledge of Dental Trauma	
Low	8 (11.6)
Acceptable	22 (3.88)
Good	33 (47.82)
Very good	6 (8.70)



**Figure 1. Distribution of the dentists registered by work sector.**

Table 2 shows the rate of correct answers from dentists to each of the 12 questions assessing the knowledge of dental trauma management. The mean percentage was 50.24%, considering all questions. The lowest rates of correct answers regarded dental intrusion and avulsion (14.5% and 31.88%). Sixty-three participants (91.30%) believed that fracture line extension apically was the most relevant factor in crown-root fractures besides the potential pulp exposure.

**Table 2. Percentage of correct answers of the 69 participants to the 12 questions on dental trauma management using a simbol classification system for correct answers.**

Question	Case Scenario	Correct Answers (%)
1	Tooth avulsion	22 (31.88) <sup>#</sup>
2	Storage solution for avulsed teeth	28 (40.6) <sup>#</sup>
3	Avulsion of teeth with incomplete rhizogenesis	30 (43.5) <sup>#</sup>
4	Avulsion of teeth with complete rhizogenesis	28 (40.6) <sup>#</sup>
5	Avulsion without bone fractures	33 (47.8) <sup>#</sup>
6	Root fracture	47 (68.12) <sup>&amp;</sup>
7	Intrusion	10 (14.5) <sup>*</sup>
8	Subluxation	39 (56.52) <sup>&amp;</sup>
9	Enamel or enamel/dentin fracture, subluxation, and concussion	50 (72.46) <sup>&amp;</sup>

10	Crown-root fracture	63 (91.30) <sup>†</sup>
11	Enamel/dentin/pulp fracture in teeth with complete rhizogenesis	41 (59.42) <sup>§</sup>
12	Lateral luxation with bone fracture	25 (36.23) <sup>#</sup>

<sup>†</sup> ≤ 25%; <sup>#</sup>26-50%; <sup>§</sup>51-75%; <sup>†</sup> ≥ 76%.

The overall median score for proper dental trauma management was 6.0 points (ranging from 5.0 to 7.0), categorizing overall participants' knowledge as acceptable. Table 3 shows the median or mean scores of correct answers stratified according to sociodemographic and professional profiles of participants. None of the analyzed factors significantly affected the number of correct answers. The knowledge level in all subcategories related to sociodemographic and professional profiles of participants was acceptable.

**Table 3. Median or mean scores of participants to the 12 questions about dental trauma management, stratified according to sociodemographic and professional profiles.**

Variables	Median (25%-75%) or Mean <sup>#</sup> (±SD) Scores	p-value
<b>Sex*</b>		
Male	6.0 (5.0-7.0)	0.714
Female	6.0 (5.0-7.0)	
<b>Clinical Experience**</b>		
<10 Years	6.0 (5.0-7.0)	0.838
10-19 Years	6.0 (6.0-7.0)	
20-29 Years	6.5 (4.75-8.0)	
>29 Years	6.0 (5.0-6.0)	
<b>Highest Postgraduation Degree***</b>		
None	5.55 <sup>#</sup> (±1.63)	0.631
Advanced Training	6.26 <sup>#</sup> (±1.48)	
Specialization	6.09 <sup>#</sup> (±1.31)	
Masters and/or Doctorate	5.88 <sup>#</sup> (±0.99)	
<b>Primary Work Sector**</b>		
Public	6.0 (5.0-7.5)	0.720
Private	6.0 (5.0-7.0)	
Education	6.0 (5.0-6.0)	
<b>Previously Treated Dental Trauma Cases**</b>		
None	6.0 (4.5-6.0)	0.234
1 case	6.0 (5.0-6.0)	
2-4 cases	6.0 (5.0-7.75)	
≥5 cases	6.0 (6.0-7.0)	
<b>Self-Reported Knowledge of Dental Trauma**</b>		
Low	5.0 (3.75-6.0)	0.106
Acceptable	6.0 (6.0-7.0)	
Good	6.0 (5.0-7.0)	
Very good	6.5 (5.25-7.0)	

\*Mann-Whitney U test; \*\*Kruskal-Wallis and Dwass-Steel-Critchlow-Fligner tests; \*\*\*One-way ANOVA.

## ■ Discussion

This study evaluated the knowledge level of dentists in Mossoró, Brazil, regarding dental trauma management based on current IADT guidelines [2,6,7]. The sociodemographic and professional profiles of participants showed higher participation of female dentists (55.1%) in the research. This finding resembles the one in Greece, with almost two-thirds (60.7%) of female participants [8]. Similarly, dentists' knowledge level of dental trauma in Turkey was assessed in 2018, highlighting that 235 (58.8%) of 400 professionals in the sample were women [9]. This prevalence may be due to the increase in women entering universities over the last 40 years, causing a feminization in dentistry, which until the 90s predominantly comprised male professionals [10]. Researchers showed that 79% of participants reported less than ten years of clinical experience [9]. That agrees with our findings, in which 69.56% of respondents presented less than ten years of clinical experience. Moreover,

most participants had some postgraduate degree (84.05%), especially in advanced training and specialization. However, a considerably lower percentage of dentists with some postgraduate degree (14.1%) was found, potentially justified by the professional scenario in Greece and the expressively larger sample size ( $n=448$ ) than the present study [8].

Most research participants worked in the private sector (62.32%), followed by the public and education sectors (33.33% and 4.35%, respectively), corroborating previous findings [1,3]. As for the number of previously treated dental trauma cases, a higher rate of participants (44.93%) reported having treated more than five cases, and 7.25% had treated only one case. This finding is similar to the study in southern Brazil, showing that most interviewees (35.9%) had previously treated more than five cases, and 14.1% had treated only one dental trauma. Both studies show only one dental trauma treatment as the lowest percentage. It also showed that most dentists (53%) reported their dental trauma knowledge as good, followed by acceptable (34.8%) [1]. The present research found similar results, with almost half the sample (47.82%) reporting their knowledge as good, followed by acceptable (31.88%). However, a study with Australian dentists noted a higher percentage of self-reported knowledge as acceptable (51.1%), followed by good (27.8%), which may be associated with differences in the courses taught in undergraduate and/or graduate schools in different countries [3].

Regarding dental trauma management, tooth intrusion showed a lower rate of correct answers, as only 14.5% of the sample correctly answered about the need for endodontic treatment of all intrusion of teeth with complete rhizogenesis. Also, there was a low rate of correct answers for this topic, with only 38.9% of respondents choosing endodontic treatment in all cases of intrusion of mature teeth [3]. It is worth noting that this dental injury has an unfavorable prognosis because it ruptures and smashes the neurovascular bundle, making pulp revascularization unlikely if rhizogenesis is complete. Thus, the pulp will probably become necrotic and infected, with a potential risk for tooth loss due to external inflammatory resorption, ankylosis, and replacement resorption [1,3,11]. According to current IADT guidelines, regardless of the tooth intrusion level, teeth with complete rhizogenesis must undergo root canal treatment up to two weeks after trauma to prevent external inflammatory root resorption [2].

A systematic review assessing the knowledge and management of traumatic dental injuries by dentists worldwide identified that more than 80% of professionals correctly reported the possibility of reimplanting an avulsed permanent tooth [4]. IADT guidelines indicate that immediate reimplantation at the accident site is the best treatment for tooth avulsion cases; when that is not possible, they recommend properly storing the tooth, such as in milk, saline, or the patient's saliva, in this order of preference [7]. The present study showed that only 31.88% of professionals correctly selected the immediate reimplantation of avulsed teeth at the accident site, demonstrating that most dentists incorrectly indicate late tooth reimplantation only in the dental office. This finding is inferior to a study in which 83.9% of participants correctly selected reimplantation of avulsed teeth immediately after trauma [3]. Regarding the optimal storage solution for avulsed teeth that cannot be reimplanted at the accident site, the most selected option by dentists in the present study was the patient's saliva (42.2%), followed by milk (40.16%) and saline (10.14%). Thus, less than half the participants considered milk the optimal storage, and this finding was inferior to previous studies reporting rates from 46 to 99% [3,12-15]. Most dentists in our study selected saliva as a storage solution, but considering the harmful enzymes and bacteria that may damage periodontal ligament cells, saliva should be used only when milk or saline is unavailable at the accident site and ideally for a short period [7,16].

Current IADT guidelines state that two weeks after tooth reimplantation is the best time to start the endodontic treatment of a tooth with complete root formation that was avulsed and reimplanted up to one hour

after the accident [7]. Only 40.6% of the sample correctly selected the endodontic treatment performance between seven and ten days after reimplanting an avulsed mature tooth. This finding is similar to another study [17], in which 112 (61.9%) of 181 Polish dentists affirmed managing avulsion cases according to IADT recommendations [7]. Teeth with incomplete rhizogenesis may allow spontaneous pulp revascularization and continuing root development and apical closure. Thus, starting endodontic treatment is recommended in case of clinical and radiographic evidence of pulp necrosis and infection during follow-up visits [7]. Researchers found that 82.74% of Chinese dentists correctly reported differences between treating avulsed teeth with complete and incomplete root formation [18]. The present study found that only 43.5% of the sample followed the current IADT protocol for treating avulsed immature teeth [7].

As for the immobilization time of avulsed teeth without associated bone fractures, the rate of correct answers (two weeks) was 47.8%. However, most participants indicated that they had been using a retainer for six weeks or did not know the answer (43.5 and 8.7%, respectively). A study performed in Lithuania showed half the dentists indicated retainer use for one month in tooth avulsion cases, longer than suggested by the IADT [5], which recommends a semi-rigid retainer in avulsed teeth without associated bone fractures for two weeks [7]. Immobilizing a tooth for more than two weeks may impair treatment prognosis because it favors the occurrence of tooth ankylosis or replacement resorption. Conversely, the lateral luxation of a permanent tooth with an alveolar bone fracture requires a rigid retainer for 30 days. The present study found that a little over one-third of the sample (36.23%) correctly answered the type and time of retainer use for lateral luxation of permanent teeth associated with alveolar bone fractures. Previous studies found similar results, with percentages of correct answers from 35.6 to 48% [1,3].

In subluxation cases with a negative pulp sensitivity test, 56.52% of participants reported not starting immediate endodontic treatment, agreeing with IADT guidelines [2]. The data found that 85% of participants did not perform root canal treatment if the tooth responded negatively to the pulp sensitivity test in the initial visit, a higher rate than the present study [3]. Subluxation injuries may present an initial negative response to pulp sensitivity tests that indicate temporary or permanent pulp damage. Endodontic treatment is indicated only with case follow-up and the appearance of clinical and radiographic evidence of pulp necrosis and infection [2]. As for crown-root fracture, the fracture line extension apically was the most relevant factor in establishing the treatment plan, besides the potential pulp exposure, and this conduct was assertive to almost all investigated dentists in this study (91.30%). Researchers found similar results, with 82.2% of participants correctly answering this question, corroborating the recommended IADT protocol [2,3].

Based on the methodology of previous studies [1,3] and using a classification system for the number of correct answers as low {0-3}, acceptable {4-6}, good {7-9}, or very good {10-12} for the 12 questions on dental trauma management, the dentists in Mossoró presented an overall acceptable knowledge level, with a median score of 6.0 and mean percentage of correct answers of 50.24%, considering all inquiries. These findings show that dentists in Greece have an adequate knowledge level regarding dental trauma management [8].

The present study did not find a significant association between participants' sociodemographic and professional profiles and the number of correct answers. Another study found similar results, except regarding the number of treated dental trauma cases and participants' self-reported knowledge, presenting a significant association with knowledge level [3]. The correct diagnosis and clinical protocol determine the prognosis of dental trauma treatment.







Despite the acceptable knowledge level of dental trauma management of dentists in Mossoró, there was a high failure rate for clinically managing some injuries, such as tooth intrusion and avulsion. The findings of

this research may contribute to future public health policies aimed at reducing this health problem and improving dental education and continuing professional qualification.

## ■ Conclusion

Dentists presented an acceptable knowledge level of dental trauma management based on current IADT guidelines. The sociodemographic and professional profiles of participants (sex, clinical experience, postgraduation degree, primary work sector, the number of treated cases, and self-reported dental trauma knowledge) were not significantly associated with the knowledge level of the study participants. Dental education and continuing professional education on dental trauma must improve in this population.

## ■ Authors' Contributions

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CLLC		<a href="https://orcid.org/0000-0001-5969-7170">https://orcid.org/0000-0001-5969-7170</a>	Methodology, Data Curation, Writing - Original Draft and Writing - Review and Editing.
JMCR		<a href="https://orcid.org/0000-0003-2605-1968">https://orcid.org/0000-0003-2605-1968</a>	Methodology, Data Curation, Writing - Original Draft and Writing - Review and Editing.
WAV		<a href="https://orcid.org/0000-0001-8872-2865">https://orcid.org/0000-0001-8872-2865</a>	Methodology, Formal Analysis, Writing - Original Draft and Writing - Review and Editing.
LRP		<a href="https://orcid.org/0000-0002-7599-0120">https://orcid.org/0000-0002-7599-0120</a>	Conceptualization, Methodology, Investigation, Writing - Original Draft and Writing - Review and Editing.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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## ■ Conflict of Interest

The authors declare no conflicts of interest.

## ■ Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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