Analysis of treatments performed at a university dental trauma service in southern Brazil

Análise dos tratamentos realizados em um serviço universitário de trauma dental no sul do Brasil

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Abstract

This retrospective observational study aimed to analyze cases assisted at the Dentoalveolar Trauma Clinic of the School of Dentistry of the Federal University of Rio Grande do Sul (FO-UFRGS) from March 2015 to March 2018, according to the treatments performed on traumatized permanent teeth and the results after one year of follow-up. The sample was based on information collected from clinical records of 92 patients, referring to a) data before treatment, b) data on the diagnosis and proposed treatment, and c) data on the follow-up period. Descriptive and inferential statistical analyses were performed. Most patients were male (56.5%) and aged six to 11 (30.4%) and older than 18 (29.1%) years. The prevalent cause of trauma was falling, and 59% of patients were first assisted within 24 hours. The most frequent traumas were enamel and dentin fractures with and without pulp exposure (6.3%), lateral luxation (1.4%), and avulsion (1.9%). Endodontic treatment was usually performed on traumatized teeth (7.2%). Of the 92 patients, 58 returned for maintenance visits with a mean follow-up of one year. Most patients had successful treatments. Prompt care and patient follow-up were essential for the good prognosis of traumatized teeth.

Keywords: tooth; dental trauma; public health; aftercare.

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Introduction

Dental trauma represents damage to the tooth surface and adjacent structures due to a fall or accident. It corresponds to 5% of all causes by which the general population seeks dental care[1,2]. According to the type of accident and affected structures, tissue damage may be mild, moderate, or intense. Dental trauma can cause irreparable tooth damage, complicating the treatment and causing undesirable sequelae during follow-up.

The prevalence of dental trauma in the literature varies from 15% to 35.5%. These numbers can be explained by the variability of dental treatment access in different countries and the diversity of methodologies used in the studies[4]. In 2020, the International Association of Dental Traumatology (IADT) updated the guidelines for diagnosis, treatment plans, and follow-up of traumatic dental injuries (TDI). This update showed crown fractures as the most common traumatic lesions in permanent dentition[5].

First aid after trauma is critical in reducing complications regarding tooth preservation, cost reduction, and treatment time for patients and dentists. Early treatment allows dentists to control and reduce the likelihood of complications from the injury. Late treatment usually requires more complex interventions, including orthodontic and surgical treatment[4-6]. When patients are not promptly treated, the prognosis becomes unfavorable and may lead to outcome variables such as pulp necrosis, ankylosis, dentin resorption, and root canal obliteration, potentially compromising teeth maintenance in the oral cavity. Therefore, clinical and radiographic follow-ups will monitor undesirable outcomes that may occur days, months, or years after trauma[7].

Trauma in children on deciduous or mixed dentition periods has different outcomes. The younger the child at the time of most severe trauma, the higher the potential for permanent disturbance to the dental germ[8]. However, outcomes are more predictable in adults and children with an established permanent dentition[8].

There are late effects on pulp tissues after trauma, which requires monitoring the traumatized tooth for at least one year to prevent new complications[3]. Pulp necrosis, sinus tract, enamel color changes, occlusal misalignment, and gingival bleeding may be observed[9,10].

Clinical and radiographic follow-ups are required in these cases to confirm pulp necrosis or root resorption development over time and define adequate treatment measures[11]. The maintenance interval should be based on the type of the trauma, injury severity, and patient age. Depending on the type and severity of trauma, the case must be followed up from two weeks to five years or until permanent tooth eruption, constantly adjusting the intervals according to patient's needs[7,12].

The present study aimed to analyze the cases assisted in a Dentoalveolar Trauma Care Center at FO-UFRGS from March 2015 to March 201, regarding the treatments performed on permanent teeth and the outcomes on traumatized teeth.

Methodology

The present cross-sectional retrospective study was approved by the Dental School Research Board and the Research Ethics Committee of the Federal University of Rio Grande do Sul (UFRGS – Porto Alegre, Brazil) (CAAE 81357117.0.0000.5347). The research protocol complied with Resolutions 466/2012 and 510/2016 from the Brazilian National Health Council.

All records of patients assisted at a clinic specialized in dental trauma from March 2015 to March 2018 were revised.

The data was collected with a form especially prepared for the research, without patient identification data. The medical records data were typed in a spreadsheet (Excel™, Microsoft Office, Microsoft Corporation, Redmond, WA, USA).

A single examiner evaluated the records and extracted the data. The collected information was grouped as:

a) before-treatment variables such as patient age and sex, cause of trauma, history of trauma, and time elapsed until care provision;
b) diagnosis and proposed treatment variables (type of trauma, the number of affected teeth, and treatments performed);
c) follow-up variables (outcome after treatment, the number of maintenance visits, and procedures performed in maintenance visits).

For the statistical analysis, the chi-square test was used to determine associations between variables, and the analysis was performed with the SPSS software version 22 (IBM SPSS Statistics for Windows, Version 22.0, Armonk, NY: IBM Corp.). The statistical significance was set at 5%.

Results

The data were collected from 92 dental records of patients treated between March 2015 and March 2018. A total of 30.4% of patients were older than 18 years, 29.1% were six to 11 years old, 21.7% were 12 to 18 years old, and 8.7% were zero to five years old. Of the patients assisted, 56.5% were male and 43.5% female.

Among the causes of trauma, 42.4% of patients reported falls, 13% experienced some type of violence, and 7.6% reported trauma due to sports practice. Events such as "hitting the face with the knee", "hitting the bicycle seat", and "hitting the face on a glass surface" represented 28.3% of the reports. This information was not included in 8.7% of dental records. There were no associations between sex and the cause of trauma and age and trauma etiology (Chi-square test; P> 0.05).

A rate of 92.4% of patients reported not having any history of trauma. However, 4.3% reported previous trauma involving the same tooth. A total of 39.1% of patients received first aid less than one hour after trauma, and 15.2% of these received immediate care.

Table 1 shows the number of traumatized teeth considering age group and the time until the first visit. Most patients had one traumatized tooth (48.91%) and were older than six years. About 59.78% of patients were assisted within 24 hours after trauma.

Table 1 – Number of traumatized teeth per patient considering patient age and time until the first visit

	Number of teeth					Number of data	Number of patients
	1	2	3	4	5		
Age group							
0 to 5 years	4	1	1	1	0	1	8
6 to 11 years	16	14	2	3	0	1	36
12 to 18 years	10	3	4	2	1	0	20
> 18 years	15	6	3	3	1	0	28
Total	**45**	**24**	**10**	**9**	**2**	**2**	**92**
Time until assistance							
Immediate	5	5	2	2	0	0	14
≤ 1 hour	6	7	5	4	0	0	22
≤ 24hour	8	7	2	1	1	0	19
Up to 1 week	4	0	1	2	0	0	7
Up to 1 month	3	1	0	0	0	1	5
Up to 6 months	8	1	0	0	1	0	10
Up to 1 year	1	0	0	0	0	0	1
1 year or +	4	3	0	0	0	0	7
No data	6	0	0	0	0	1	7
Total	**45**	**24**	**10**	**9**	**2**	**2**	**92**

Source: the authors.

The initial diagnostic screening evaluated 1104 teeth, showing dental and supporting tissue traumas in 27.1% (150) of upper teeth and 3.07% (17) of lower teeth, comprising 167 traumatized teeth (15.1%). Upper central incisors were most frequently affected. The most common injuries were enamel and dentin fractures with and without pulp exposure (6.3%), lateral luxation (1.3%), and avulsion (1.9%) (Table 2).

Table 2 – Distribution of trauma in hard tissues and supporting structures per tooth

	Upper Teeth						Lower Teeth						Total
	13	12	11	21	22	23	43	42	41	31	32	33	
Trauma to hard tissues													
Infraction	0	0	1	1	0	1	0	0	0	0	0	0	**3**
Enamel fracture	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Enamel-dentin fracture	1	7	27	25	8	1	0	0	1	0	0	0	**70**
Without pulp exposure	1	5	8	8	3	0	0	0	0	0	0	0	25
With pulp exposure	0	2	19	17	5	1	0	0	1	0	0	0	45
Crown-root fracture	0	0	4	3	0	0	0	0	1	0	0	0	**8**
Root fracture	2	1	2	3	1	0	0	1	0	1	2	0	**13**
Alveolar fracture	0	0	0	0	0	0	0	1	1	1	1	0	**4**
Trauma to supporting structures													
Concussion	0	0	1	1	0	0	0	0	0	0	0	0	**2**
Subluxation	0	2	2	4	2	0	0	0	0	0	0	0	**10**
Intrusive luxation	0	0	5	4	1	0	0	0	1	0	0	0	**11**
Extrusive luxation	0	0	4	3	1	0	0	0	0	0	0	0	**8**
Lateral luxation	1	4	4	5	2	0	0	0	0	0	0	0	**16**
Avulsion	0	1	3	11	1	0	0	1	2	1	1	0	**21**
Not recorded	88	77	39	32	76	90	92	88	86	89	88	92	**937**
Total teeth													**1104**

Note: not recorded= teeth without history of trauma.

Source: the authors.

After the initial screening, endodontic treatments, restorations, or semi-rigid splinting were the most frequent interventions in traumatized teeth. There was a low frequency of medication prescriptions (Table 3).

Table 3 – Treatments proposed and implemented

Treatment proposed	Upper teeth						Lower teeth						Total
	13	12	11	21	22	23	43	42	41	31	32	33	
No treatment	88	77	39	32	76	90	92	88	86	89	88	92	937
Monitoring	1	3	9	6	5	0	0	0	0	0	1	0	25
Bonding	0	1	3	0	0	0	0	0	0	0	0	0	4
Endodontic treatment	0	6	28	30	6	0	0	1	2	1	0	0	74
Semi-rigid temporary stabilization	1	3	5	9	3	1	1	1	1	1	1	0	27
Rigid temporary stabilization	0	1	1	5	1	0	0	0	0	0	0	0	8
Replanting	0	0	0	2	0	0	0	0	0	0	0	0	2
Pain killer	0	0	0	1	1	0	0	0	0	0	0	0	2
Pain killer + ATB	1	1	2	2	1	0	0	0	0	0	0	0	7
Extraction	0	0	3	2	0	0	0	0	0	0	0	0	5
Restoration	2	5	15	20	0	0	0	1	1	1	0	0	45
Occlusal adjustment	0	0	0	1	6	0	0	0	0	0	1	0	8
No data	0	1	1	1	1	1	0	1	2	0	1	0	9
Total treatments implemented													**216**

Note[1]: ATB – Antibiotics.

Note[2]: Some teeth received more than one treatment.

Source: the authors.

The average follow-up time for patients was one year (29.3%), with adherence of 58/92 patients, and 25% had two to five appointments. Ninety of the treated teeth did not require additional treatment, even were indicated for extraction, two had pulp necrosis, three showed canal lumen obliteration, and eight experienced color changes (Table 4).

Table 4 – Clinical and radiographic findings of follow-up visits

Outcome	Upper teeth						Lower teeth						Total
	13	12	11	21	22	23	43	42	41	31	32	33	
No changes	*88*	77	39	32	76	90	92	88	86	89	88	92	937
Maintained element	1	10	31	33	12	1	0	3	3	1	3	0	90
Necrosis	0	0	0	2	0	0	0	0	0	0	0	0	2
Canal obliteration	0	1	1	1	0	0	0	0	0	0	0	0	3
Color changes	0	1	3	4	0	0	0	0	0	0	0	0	8
Ankylosis	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction	*0*	0	4	2	1	0	0	0	0	0	0	0	7
Sinus tract	0	0	1	1	0	0	0	0	0	0	0	0	2
Apical injury	0	1	1	2	0	0	0	0	0	0	0	0	3
Insertion loss	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	4	11	10	2	0	0	0	1	0	0	0	19
No data	2	2	4	4	2	1	0	1	2	0	1	0	15

Source: the authors.

Complete extra- and intra-oral physical examinations (45%) and radiographic investigations (30%) were often performed in the follow-up visits. An additional dental intervention (restoration replacement, tooth whitening, retainer bonding, endodontics, etc.) was performed in 11% of traumatized teeth.

Discussion

Dental trauma can cause severe damage to permanent and deciduous dentitions. Dentists must be updated and act according to international guidelines such as the American Association of Endodontists (AAE) and the International Association of Dental Traumatology (IADT)[15] to offer the best treatment to patients. Prompt clinical diagnosis and treatment are vital for preserving dental structures and supporting tissues[1], allowing a favorable prognosis[14]. Moreover, post-trauma follow-up is essential to monitor structure behavior over time because trauma resolution is always uncertain.

The present study included a higher number of male patients. Previous studies in the literature detected more injuries in men than in women[16-18]. An explanation for men experiencing more dental trauma could be the practice of more aggressive sports, more violent behavior, and traffic accidents[13-15]. Some authors also verified that not using mouthguards during sports doubles the chances of avulsion and fractures[16-18].

The most frequently reported cause of trauma was falling (42.4%), especially from one's height. Younger patients fell more from their height, which could occur because they are school-aged and practice various activities and games that increase the risk of accidents. Patients older than 18 years often fell from a ladder or window or were pushed. This finding agrees with previous studies showing several young adult patients with trauma caused by falls[16].

Another factor to consider is the constant use of cell phones. Stavrinos *et al.*[19] (2009) indicated that preadolescents tend to behave more distractedly when using a cell phone. Nasar and Troyer[20] (2013) and Basch *et al.*[21] (2014) also observed similar results. Basch *et al.*[21] (2014) add that headphones are a distraction factor and can cause accidents when crossing the street, for example.

A total of 39.1% of patients reported receiving first aid less than one hour after trauma. This first assistance may or may not have occurred at the university service. According to the literature, the time between trauma and the first visit is essential for a reasonable case prognosis[6,18,22,23]. The first 60 minutes after trauma are paramount, and patients who take longer to be assisted are already at risk of experiencing consequences from trauma. The longer the time, the higher the chances of sequelae[4,7,24]. Patients were seen promptly, which may have helped reduce damage and sequelae from the injury. About 15.2% of patients received immediate care. Hence, the first control measures were applied minutes after the event. Wagle *et al.*[23] (2014) indicated that patients who sought dental care were assisted in

a shorter time than those who received first aid in hospital emergencies.

Most dental records indicated trauma that affected hard tooth structures, prevailing enamel and dentin fractures with pulp exposure, followed by root and crown-root fractures. The most common traumas to supporting structures were avulsion and lateral luxation. Such findings agree with previous studies in which enamel fractures and luxation occurred more than other injuries[6,7,13,25]. It is noteworthy that because this is an evaluation of medical records, students may have underreported dental traumas such as cracks and concussions, potentially due to late and non-immediate care. Therefore, some traumas may not have been verified.

Most traumas occurred in the teeth of the anterior maxilla, and elements 11 and 21 experienced the most trauma. According to the literature, maxillary teeth, especially incisors, were also the most affected. These teeth are the first to absorb the impact of a fall. There is an increasing chance of trauma to these teeth in some conditions, such as severe overjet and difficulty in lip sealing[2,16,26,27,28].

More severe traumas were initially treated in other locations, so few antibiotics and analgesics were prescribed at the university dental trauma service. According to the IADT guidelines[12], there is little evidence connecting the use of antibiotics to improved prognosis in dislocated or fractured teeth. Avulsion cases, in which the tooth is replanted, showed a positive effect for periodontal and pulp repair related to antibiotics[28]. When necessary, amoxicillin was the antibiotic of choice. The literature shows that penicillin has been recommended as a first-line antibiotic because it works in a broad spectrum[18,29] due to the low occurrence of adverse effects[29]. The IADT recommends tetracycline as the first-choice antibiotic. However, due to potential permanent teeth discoloration, amoxicillin can be prescribed to replace tetracycline for one week after the traumatic accident or at clinical discretion[28].

Regarding the outcomes, most patients had no complications, and their teeth remained functional. Bücher *et al*.[30] (2013) reported a low rate of complications after trauma treatment and related it to the fact that they followed the recommendations of the IADT, which increases the likelihood of a favorable outcome and a low rate of patients with dental complications. Two teeth had necrosis, and three showed an obliterated root canal lumen the year after the trauma; these teeth were treated endodontically. This finding corroborates the literature, which found that more severe traumas can cause a higher risk of pulp necrosis that can manifest up to two years after trauma[4,7].

Patients had a mean follow-up of one year after the end of treatment. The literature shows that most studies followed-up patients for six to eight weeks and up to one year. Depending on the severity of the trauma, this period must be extended for up to five years[7].

Most patients had two to five appointments after the end of treatment, and 12 patients did not have any, probably because patients/guardians who experienced milder trauma believed they did not need additional aftercare. Some patients changed their telephone contact and did not update their registrations, making it impossible to contact them and schedule a new appointment. Studies have shown that the number of maintenance appointments should be considered according to the particularities of each case, but an average of five maintenance appointments are performed after trauma[4,25], with complete clinical examinations, radiographs of traumatized teeth, and pulp sensitivity tests. New interventions were performed when required, such as replacing restorations, cementing temporary crowns, bonding the retainer, endodontics, and tooth whitening. Several authors indicated the need for periodical pulp sensitivity tests to monitor pulp response and standardized radiographs to verify changes in apical structures[6,9,25].

Conclusions

Most patients assisted had maintenance appointments and did not experience any severe sequelae from trauma. The treatments and maintenance routines followed the IADT guidelines, which favorably contributed to maintaining traumatized teeth. The availability

of specialized referral services in dental trauma can contribute to the immediate care of patients, reducing injuries.

Resumo

O objetivo do presente estudo observacional retrospectivo foi analisar os casos atendidos na clínica de trauma dentoalveolar da Faculdade de Odontologia da Universidade Federal do Rio Grande do Sul (FO-UFRGS) no período de março de 2015 a março de 2018, de acordo com os tratamentos realizados em dentes permanentes traumatizados, assim como os resultados observados após 1 ano de seguimento. A amostra foi baseada na coleta de informações em prontuários clínicos de 92 pacientes, referentes a: a) dados anteriores ao tratamento; b) dados referentes ao diagnóstico e ao tratamento proposto; e c) dados referentes ao período de acompanhamento. Foi realizada análise estatística descritiva e inferencial. A maioria dos pacientes era do sexo masculino (56,5%), com idades entre 6 e 11 anos (30,4%) e mais de 18 anos (29,1%). A principal causa do trauma foi queda, sendo que 59% dos pacientes receberam o primeiro atendimento em 24 horas. Os traumas mais frequentes foram fratura de esmalte e dentina, com e sem exposição pulpar (6,3%), luxação lateral (1,4%) e avulsão (1,9%). O tratamento endodôntico foi frequentemente realizado nos dentes traumatizados (7,2%). Dos 92 pacientes, 58 retornaram para consultas de manutenção com um acompanhamento médio de 1 ano. A maioria dos pacientes apresentou sucesso após o tratamento. O atendimento no tempo correto, assim como o acompanhamento dos pacientes, foi fator fundamental para o bom prognóstico dos dentes traumatizados.

Palavras-chave: dente; traumatismos dentários; saúde pública; assistência de seguimento.

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