

Association between Trauma to Primary Incisors and Crown Alterations in Permanent Successors

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The aim of this study was to determine the prevalence of sequelae in permanent teeth that had their predecessors traumatized and investigate associated factors. The study was carried out with clinical and radiographic data from 137 patient charts of the Traumatized Patient Care Program, Federal University of Santa Catarina (Brazil), totalizing 253 teeth. Data were gathered on gender, age at the time of trauma, type of trauma, type of post-trauma sequelae, trauma recurrence and crown alteration in the permanent successors. No statistically significant associations were found between permanent successor's crown alteration and gender, age at the time of trauma, post-trauma sequelae or trauma recurrence ($p > 0.05$). Significant associations were found between severe trauma (crown fracture with pulp exposure, lateral luxation, intrusion and extrusion) in the primary incisors and permanent successor's crown alteration ($p < 0.05$). Multivariate analysis revealed an association between severe trauma to the primary incisors and permanent successor's crown alteration (OR: 4.1 – IC: 1.7–10.1). Alterations in the crown of permanent successors are associated with severe trauma to the primary incisors, as primary teeth affected by severe trauma have a fourfold greater chance of exhibiting permanent successor crown alteration in comparison to primary teeth that had minor trauma.

Key Words: dental trauma, primary teeth, dental fractures.

Introduction

Dental trauma is currently considered a public health problem, especially where the rate of dental caries has undergone considerable decrease in recent decades (1,2). In cases of alveolar-dental trauma to the primary dentition, the 1–4-year-old age group is the most affected. In this development phase, children are learning to walk and developing motor skills (3,4).

Besides the epidemiological relevance, it is essential to understand the consequences that may stem from dental trauma – the sequelae that occur in the primary teeth as well as the corresponding permanent successors (5). The prevalence of development disorders in permanent successors caused by trauma to the corresponding primary teeth ranges from 12% to 74%, partially due to the close relationship between the apex of the primary tooth and development of the permanent successor (4,6). The severity of the sequelae depends on the child's age at the time of injury, the amount of root resorption of the traumatized tooth, the type and extent of the injury and the successor's development phase at the time of injury. The types of trauma that most affect the permanent successors are intrusion and avulsion of the primary tooth (4–8).

Sequelae in the permanent tooth stemming from trauma to the primary dentition can affect the crown, root or the entire permanent successor. Sequelae that affect the crown are structural alterations associated with

hypoplasia of the enamel, dilaceration of the crown and yellow or brown coloration (9). Sequelae that affect the roots include duplication and partial or total dilaceration. When the entire bud of the permanent successor is affected, there may be alterations in the eruption process, retention or malformation of the permanent tooth (9).

Considering the prevalence of dental trauma in children, the aim of the present study was to determine the prevalence of sequelae in permanent teeth that had their predecessor traumatized and associated factors (gender, age, type of trauma, type of sequel in primary teeth and recurrence of trauma), in Florianópolis, SC, Brazil.

Material and Methods

A descriptive, retrospective study was carried out involving the analysis of patient charts of children treated at the Traumatized Patient Care Program (primary teeth) of the Trauma Clinic of the Pediatric Dentistry Department, Federal University of Santa Catarina (Brazil), between August 1998 and December 2010.

The charts were analyzed based on the inclusion criterion of trauma to primary maxillary incisors. The exclusion criteria were lack of follow up through the eruption of the permanent successor, primary teeth with caries and/or restorations, and charts with incomplete data. Thus, 137 patient charts fulfilled the eligibility criteria, totaling 253 traumatized primary teeth.

This study made a census of the charts available at the Trauma Clinic of the Pediatric Dentistry Department and because of that no calculation of sample size was made *a priori*. Based on the results of this paper (OR: 4.1; CI 95%; prevalence of 'disease' in unexposed group of 3.7%) the required sample size was 330 teeth, but only 253 teeth were available for analysis.

The following data were collected: gender; injured tooth; type of trauma categorized into: a) minor: fracture without pulp exposure, concussion and subluxation; b) severe: fracture with pulp exposure, lateral luxation, intrusion and extrusion; age of the child at the time of trauma (<48 months and ≥48 months); type of post-trauma sequelae categorized into: a) minor: mobility, crown discoloration and obliteration; b) severe: pulp necrosis; trauma recurrence (present or absent), and effects on the crown of the permanent successor (present or absent).

The data were entered in Microsoft Excel and analyzed using the SPSS program, version 17.0 (SPSS Inc., Chicago, IL, USA). The chi-square test was employed to assess associations between crown alterations in the permanent successors of traumatized primary maxillary incisors and

the other variables. Univariate logistic regression analysis was performed to estimate the effect of the independent variables on the outcome. The level of significance was set to 5% ($p < 0.05$).

Results

The prevalence of sequelae in permanent teeth due to trauma in the primary tooth was 7.9%. Table 1 displays the characterization of the sample. Table 2 presents the types of sequelae in the traumatized teeth. Table 3 presents the types of trauma in primary teeth.

Among the alterations in the permanent successor crowns, hypoplasia was found in 10 teeth (50.0%), alterations in the shape of the permanent successor and the presence of white spot lesions were found in 4 teeth (20.0%) and yellow spots were found in 2 teeth (10.0%).

A statistically significant association ($p < 0.05$) was found between crown alterations in the permanent successor and type of trauma. No statistically significant association was found between crown alterations in the permanent successor and gender, age, type of post-trauma sequelae in primary tooth and trauma recurrence (Table 4).

Table 1. Description and simple frequency of the studied variables

Variable	n*	%
Gender		
Male	80	58.3
Female	57	41.6
Age		
<48 months	204	80.6
≥48 months	49	19.4
Type of trauma		
Minor	195	77.1
Severe	58	22.9
Type of post-trauma sequelae in primary teeth		
No sequelae	78	30.84
Minor	119	47.03
Severe	56	22.13
Trauma recurrence		
Absent	210	83.0
Present	43	17.0
Permanent successor crown alteration		
Absent	233	92.1
Present	20	7.9

*Number of valid observations.

Table 2. Type of post-trauma sequelae in the primary teeth

Type of sequelae	%
Minor sequelae	
Mobility	58.00
Color alteration	23.50
Obliteration	18.50
Severe sequelae	
Pathologic resorption	75.00
Periapical lesion	25.00

Table 3. Type of trauma in the primary teeth

Type of trauma	%
Minor trauma	
Enamel fracture	6.66
Enamel and dentin fracture with pulp exposure	8.20
Concussion	25.64
Subluxation	59.48
Severe trauma	
Enamel and dentin fracture without out pulp exposure	20.68
Lateral luxation	34.48
Intrusion	44.82

Permanent teeth with sequelae had different types of trauma: subluxation – 40.0%, intrusion – 30.0%, enamel and dentin fracture with pulp exposure – 25.0%, and lateral luxation – 5.0%. Among the permanent teeth without esthetic alterations, 45.5% were cases of subluxation, 20.6% were cases of concussion, 8.6% were cases of lateral luxation, 8.6% were cases of intrusion, 6.9% were cases of enamel and dentin fracture without pulp exposure, 5.6% were cases of enamel fracture and 4.3% were cases of enamel and dentin fracture with pulp exposure.

Based on the results of the chi-square test (Table 4), the type of trauma ($p < 0.05$) was included in the univariate logistic regression. Primary teeth affected by severe trauma had a fourfold greater chance of exhibiting esthetic alterations in the permanent successors in comparison to those that suffered minor trauma (Table 5).

Discussion

The sequelae prevalence in permanent teeth by trauma in primary tooth was 7.9%, a lower prevalence comparing with other studies performed in Brazil (11.9%) (10). The highest prevalence of trauma was subluxation (45.85%). The most prevalent sequela in primary teeth after trauma was dental mobility (39.43%), and the most prevalent sequela in permanent teeth was hypoplasia (50.0%). There

were statistical associations between permanent teeth sequelae and trauma, in which primary teeth affected by severe trauma had 4 times more chance to present esthetic alterations in the permanent successor compared with teeth affected by minor traumas. There were no associations of permanent teeth sequelae with gender, age, type of sequelae in primary teeth and recurrence of trauma in primary teeth.

This is an ecological study and the information obtained in the charts were filled out by an untrained dentist from the university dental clinic, using clinical and radiographic exams. Additionally, this dentist was not calibrated, which could cause information bias. Another limitation in this study is the fact that there might be an overestimation of the prevalence of trauma in primary tooth. The analyzed charts were from patients treated in the Traumatized Patient Care Program of the Trauma Clinic of the Pediatric Dentistry Department and probably the reported cases were the more severe traumas, since some parents do not take their children to treat minor traumas. Even so the study is valid, because sequelae in permanent teeth are more frequent after severe traumas.

The highest prevalence of subluxation is due to the small thickness and the density of the alveolar bone, therefore younger children are more likely to be affected by luxation than by fracture of the dental tissue, which corroborates the findings from previous studies (11-14). In this study, and in most studies in this field, the enamel hypoplasia is a common sequela in the permanent successors (7,9,15). This is the major consequence of trauma in primary teeth of children aged 1 to 4 years, a period when the permanent successor crown is in the initial formation phase, Nolla's dental developmental stages 1-5 (16).

A statistically significant association was found between the type of trauma and crown alteration in the permanent successor, which corroborates the findings of previous studies reporting that severe trauma to the primary teeth constitute a risk to the formation of the permanent successors (8,9). In the present study, children that suffered trauma such as lateral luxation, intrusion or extrusion had a fourfold greater chance of exhibiting a crown alteration in the permanent successor. These alterations ranged from whitish or brownish coloration to the loss of structure or

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Table 4. Association between traumatized primary teeth with and without alteration in the crown of the permanent successor and variables

Variable	No crown alteration		Crown alteration		χ^2	p
	n	%	n	%		
Gender*					0.135	0.713
Male (n=80)	73	53.3	7	5.1		
Female (n=57)	53	38.7	4	2.9		
Age					1.220	0.269
<48 months	186	73.5	18	7.1		
≥48 months	47	18.6	2	0.8		
Type of trauma					12.531	<0.001*
Minor	178	70.4	8	3.2		
Severe	55	21.7	12	4.7		
Post-trauma sequelae in primary teeth					3.583	0.058
Minor	183	72.3	12	4.7		
Severe	50	19.8	8	3.2		
Trauma recurrence					0.139	0.709
Present	39	15.4	4	1.6		
Absent	194	76.7	16	6.3		

* n=137 patients.

Table 5. Univariate logistic regression analysis for crown alteration in permanent successors

Type of trauma	OR* [95% CI]	p
0 = Minor	1.0	
1 = Severe	4.1 [1.7-10.1]	0.002*

*Statistically significant if $p < 0.05$.

a change in the shape of the crown.

It is important that parents be aware of the possible alterations in the permanent dentition and primary teeth after trauma and that the child should be periodically followed up by clinical and radiographic exams. With necrosis in primary teeth, the pediatric dentist is able to avoid the worst sequelae.

Whenever the diagnosis is made, before or after the permanent tooth eruption, the treatment can only be carried out after the complete eruption of the tooth. Currently, dentistry has esthetic treatment options that address the esthetic alterations in the crown.

In conclusion, alterations in the crown of permanent successors are associated with severe trauma to the primary incisors. Primary teeth affected by severe trauma have a fourfold greater chance of exhibiting esthetic crown alterations in permanent successors in comparison with primary teeth after a minor trauma.

Resumo

O objetivo deste estudo foi determinar a prevalência de sequelas nos dentes permanentes, em crianças que tiveram o seu antecessor traumatizado e os fatores associados. O estudo foi realizado com dados clínicos e radiográficos de 173 prontuários de pacientes do Programa de Assistência ao Paciente Traumatizado, Universidade Federal de Santa Catarina (Brasil), totalizando 253 dentes. Os dados coletados foram: gênero, idade no momento do trauma, tipo de trauma, tipo de sequelas pós-trauma, recorrência de trauma e alteração na coroa dos sucessores permanentes. Não houve associação estatisticamente significativa entre alteração na coroa do sucessor permanente e gênero, idade no momento do trauma, sequela pós-trauma e recorrência de trauma ($p > 0,05$). Foram encontradas associações significativas entre trauma grave (fratura coronária com exposição pulpar, luxação lateral, intrusão e extrusão) nos incisivos decíduos e o sucessor permanente com alteração na coroa ($p < 0,05$). A análise multivariada revelou uma associação entre trauma grave nos incisivos decíduos e alteração no sucessor permanente (OR: 4.1- IC: 1,7-10,1). Alterações na coroa dos sucessores permanentes estão associadas com trauma grave nos incisivos decíduos. Dentes decíduos acometidos por trauma grave têm quatro vezes mais chance de apresentar alteração na coroa do permanente em comparação com trauma leve.

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