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PROGRAMA DE PÓS-GRADUAÇÃO EM ODONTOLOGIA

GABRIELA CAMPOS MESQUITA

Avulsão Dental - Desempenho de serviço público de trauma, conhecimento profissional e fatores determinantes de sucesso.

Tese apresentada à Faculdade de Odontologia da Universidade Federal de Uberlândia, como requisito parcial para obtenção do Título de Doutor em Odontologia na Área de Concentração de Clínica Odontológica Integrada

Uberlândia, fevereiro de 2019

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Uberlândia, fevereiro de 2019

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ATA

Ata da defesa de TESE DE DOUTORADO junto ao Programa de Pós-graduação em Odontologia da Faculdade de Odontologia da Universidade Federal de Uberlândia.

Defesa de: Tese de Doutorado COPOD
Data: 27/02/2019
Discente: **Gabriela Campos Mesquita (11513ODO005)**
Título do Trabalho: ***Avulsão dental - desempenho de serviço público de trauma, conhecimento profissional e fatores determinantes de sucesso***
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As **quatorze horas** do dia **vinte e sete de fevereiro de 2019** no Anfiteatro Bloco 4L Anexo A, sala 23 Campus Umuarama da Universidade Federal de Uberlândia, reuniu-se a Banca Examinadora, designada pelo Colegiado do Programa de Pós-graduação em janeiro de 2019, assim composta: Professores Doutores: Priscilla Barbosa Ferreira Soares (UFU); Márcio Teixeira (UFU); Júlio César Franco de Almeida (UNB); Daniele Lucca Longo (UniRV); e o orientador(a) do(a) candidato(a) **Carlos José Soares.**
Iniciando os trabalhos o(a) presidente da mesa Dr. Carlos José Soares apresentou a Comissão Examinadora e o candidato(a), agradeceu a presença do público, e concedeu ao Discente a palavra para a exposição do seu trabalho. A duração da apresentação do Discente e o tempo de argüição e resposta foram conforme as normas do Programa.
A seguir o senhor(a) presidente concedeu a palavra, pela ordem sucessivamente, aos (às) examinadore (as), que passaram a argüir o(a) candidato(a). Finalizada a argüição, que se desenvolveu dentro dos termos regimentais, a Banca, em sessão secreta, atribuiu os conceitos finais.
Em face do resultado obtido, a Banca Examinadora considerou o(a) candidato(a) (A)provado(a).
Esta defesa de Tese de Doutorado é parte dos requisitos necessários à obtenção do título de Doutor. O competente diploma será expedido após cumprimento dos demais requisitos, conforme as normas do Programa, a legislação pertinente e a regulamentação interna da UFU.
Nada mais havendo a tratar foram encerrados os trabalhos às 18 horas e 05 minutos. Foi lavrada a presente ata que após lida e achada conforme foi assinada eletronicamente pela Banca Examinadora.

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SUMÁRIO

RESUMO

RESUMO

Avulsões dentárias são lesões traumáticas graves que acometem principalmente crianças e jovens e cujo prognóstico é dependente de medidas tomadas por pessoas leigas as quais socorreram a vítima após o acidente. Este trabalho visa conhecer as características epidemiológicas e de manejo dos dentes de casos de avulsão, investigar o nível de conhecimento apresentado por pessoas leigas envolvidas diretamente com o grupo de risco e avaliar os fatores determinantes do prognóstico do tratamento deste tipo de injúria. Para isto, três objetivos específicos foram apresentados. Objetivo 1: Avaliar por meio de análise de prontuários, a epidemiologia e detalhes do manejo dos dentes em casos de avulsão atendidos em um serviço especializado em traumatologia dental. Objetivo 2: Determinar, por meio da aplicação de questionários, os fatores relacionados ao nível de conhecimento acerca da avulsão dental apresentado por pais, professores de ensino fundamental, educadores físicos e graduandos em Letras, Pedagogia e Educação Física. Objetivo 3: Investigar por meio de revisão da literatura a influência exercida por fatores relacionados ao paciente e manejo do dente sobre o prognóstico da avulsão, utilizando o relato de casos clínicos como exemplo de condutas clínicas baseadas em evidências científicas. Frente ao objetivo 1, encontrou-se que a maioria das vítimas de avulsão pertencem às faixas etárias de 6-10 (31,2%) e 11-15 (26,9%), sendo que indivíduos de sexo masculino (58%) foram mais acometidos do que o do feminino (42%). O principal fator etiológico foram as quedas de bicicleta (31,2%). Pacientes buscaram tratamento no mesmo dia do acidente em 88,2% dos casos, no entanto, 36,7% dos dentes não foram reimplantados. Apenas um dente foi reinserido imediatamente em seu alvéolo. Grande parte dos dentes foi mantida em meio seco (30,2%) enquanto 8,6% foram armazenados em leite. Quanto ao objetivo 2, verificou-se que o nível de conhecimento apresentado pelos entrevistados estava independentemente associado à sua idade e ao grupo de indivíduos ao qual pertenciam. Idades superiores a 45 anos relacionaram-se aos mais altos níveis de conhecimento (65,2%). Professores do ensino fundamental apresentaram os maiores níveis de conhecimento (65,1%) enquanto graduandos em Letras, demonstraram os menores (10,3%). Em relação ao objetivo 3 constatou-se que a ocorrência de reabsorções radiculares é um desfecho

comumente encontrado em casos de avulsão. A idade do paciente e o tempo extralveolar, em especial o período em que o dente foi mantido em meio seco, possuem grande influência sobre o prognóstico da avulsão. Quanto mais novo o paciente, mais rápida a progressão de reabsorções e mais agravada é a manifestação das suas sequelas. Através da realização deste trabalho, foi possível concluir que a grande maioria dentes avulsionados é manejada incorretamente e que as pessoas as quais se relacionam diretamente com o grupo de risco não possuem informações suficientes para lidar com casos de avulsão de maneira adequada. Sendo assim, o grupo de risco composto por crianças e adolescentes torna-se exposto à sérias sequelas derivadas da avulsão, já que sua idade e o inadequado manuseio dos dentes avulsionados estão diretamente ligados ao desenvolvimento de quadros de reabsorção.

Palavras-chave: Avulsão Dentária, Traumatismo Dentoalveolar, Epidemiologia, Pesquisa de Conhecimento, Revisão de Literatura.

ABSTRACT

ABSTRACT

Dental avulsions are serious injuries that affect children and adolescents. Its prognosis is dependent on measures taken by lay people who have assisted the victim after the accident. This study aims to investigate the epidemiological characteristics and management details of avulsion cases, the level of knowledge presented by lay people directly involved with the risk group and to evaluate the factors that impact treatment prognosis of this type of lesion. Therefore, three specific objectives were presented. Objective 1: To access, through the analysis of patient's records, the epidemiology and teeth management details of avulsion cases attended at a specialized dental trauma service. Objective 2: To investigate the factors related to the level of knowledge about dental avulsion presented by parents, elementary school teachers, physical educators and undergraduate Linguistics, Pedagogy and Physical Education students, by means of a questionnaire-based survey. Objective 3: To investigate the influence of factors related to the patient and to the management of the avulsed tooth on the prognosis of replantation, using case reports as examples of scientific-based clinical conducts. Regarding objective 1, it was found that the majority of avulsion victims belong to 6-10 (31,2%) e 11-15yrs (26,9%) age groups. Male individuals (58%) were more affected than females (42%). The main etiological factor was bicycle falls (31.2%). Patients sought treatment on the same day of the accident in 88.2% of the cases, however, 36.7% of the teeth were not replanted. Only one tooth was immediately reinserted into the alveolus. Most of teeth were kept in dry medium (30.2%) while 8.6% were stored in milk. In relation to objective 2, it was found that the level of knowledge presented by the participants was independently associated with their age and with the interviewed group that they belonged to. Ages above 45 years were related to the highest levels of knowledge (65.2%). Primary school teachers presented the highest level of knowledge (65.1%) while undergraduates in Letters, the lowest one (10.3%). Regarding objective 3 it has been observed that root resorptions are a common outcome in avulsion cases. The patient's age and the extralveolar time, especially the period in which the tooth was kept in a dry medium, have a great influence on the prognosis of avulsion. The youngest the patient, the faster the progression of root resorptions and the more serious is the manifestation of their sequelae. According

to the present study, it was possible to conclude that the great majority of avulsed teeth are incorrectly handled and that the people who are directly related to the risk group do not have sufficient information in order to proper to handle avulsion cases. Thus, the risk group composed of children and adolescents is exposed to serious sequelae derived from avulsion, since their age and the inadequate handling of their teeth are directly related to the development of root resorptions.

Keywords: Avulsion, Dental Trauma, Epidemiology, Knowledge, Literature Review.

INTRODUÇÃO E REFERENCIAL TEÓRICO

1. INTRODUÇÃO E REFERENCIAL TEÓRICO

O total deslocamento de um dente em relação ao seu alvéolo é chamado de avulsão dental (1). Dentre os tipos de traumatismos dentoalveolares a avulsão figura entre os mais severos e constitui um dos principais motivos que levam à busca por tratamento dentário emergencial (2-5). Devido à sua posição anteriorizada, os incisivos superiores são os dentes mais acometidos por este tipo de injúria (6). Além da sintomatologia dolorosa que advém do trauma, a perda de função e os danos à estética do sorriso afetam a qualidade de vida do paciente, prejudicando aspectos comportamentais e sociais (5, 7).

Em face de acidentes envolvendo avulsão, as condutas a serem observadas em relação aos dentes decíduos e permanentes são distintas (1, 8). Dentes decíduos não devem ser reimplantados de modo a não lesar o germe do seu sucessor (8). Dentes permanentes, no entanto, devem ser reinseridos no alvéolo o mais prontamente possível para que as células do ligamento periodontal não sofram ressecamento e percam sua viabilidade (1, 9). O não-reimplante de dentes permanentes causa o afinamento do rebordo alveolar e a perda do contorno gengival, além de possibilitar o deslocamento dos dentes adjacentes criando dificuldades para a realização do tratamento reabilitador (10, 11).

No entanto, a reinserção do dente no alvéolo não garante a longevidade do dente acometido (9, 12). Reabsorções radiculares externas são sequelas comumente observadas em casos de avulsão (13, 14), sendo que a Reabsorção Radicular Externa por Substituição e a Reabsorção Radicular Externa Inflamatória são os tipos mais frequentemente associados à perda de dentes reimplantados (15). Para que ocorram as reabsorções radiculares externas é necessário um dano considerável às estruturas do ligamento periodontal (fibras do ligamento e cemento radicular) e também possivelmente à dentina (15, 16).

A Reabsorção por Substituição acontece quando o tecido dentário é gradualmente substituído por osso. Nestas situações, devido ao próprio trauma ou à ação de clastos destinados a remover os tecidos periodontais danificados, a camada de cemento a qual protege a dentina é perdida (16). As células do ligamento periodontal por terem sofrido prejuízos irreparáveis devido ao impacto sofrido ou, principalmente, por terem sido malconservadas durante o período

extra alveolar, têm sua capacidade regenerativa comprometida (16-18). Deste modo, não acontece a diferenciação celular em cementoblastos e fibroblastos, portanto, formação de novas fibras e cemento secundário é impedida (16). Por outro lado, a dentina exposta à ação direta dos osteoblastos torna-se parte do processo de remodelação óssea e vai sendo gradativamente transformada em tecido alveolar (15) o que levará a perda de elemento dental, eventualmente (13). Em pacientes adultos, apesar de indesejado, este processo garante a manutenção da altura e espessura ósseas, o que favorece a futura inserção de implantes dentais ou a confecção de próteses (10, 19, 20). No entanto, para pacientes cujo desenvolvimento dentofacial não tenha sido completado, a ocorrência de Reabsorção por Substituição torna-se especialmente deletéria pois o dente fusionado ao osso passa a impedir o crescimento adequado da crista alveolar, alterando o desenvolvimento dos maxilares (11, 13, 20, 21).

A Reabsorção Inflamatória é o resultado da associação entre remoção da proteção oferecida cemento radicular à dentina e a contaminação bacteriana presente no interior do canal radicular derivada da necrose da polpa ou de fraturas concomitantes (22, 23). As bactérias e seus subprodutos, desta forma, passam livremente através dos túbulos dentinários e infectam o periodonto, estimulando uma reação inflamatória que culminará na reabsorção de tecido dental e também de osso alveolar (15, 22-24).

Além de características individuais como idade (22, 25) e perfil imunológico do paciente (26, 27), o prognóstico da avulsão é dependente de medidas tomadas por pessoas leigas que auxiliaram a vítima após o acidente, manejando o dente acometido (25). O reimplante tardio e a manutenção do dente em meio seco ou inadequado, dentre outros fatores, estão relacionados à perda da viabilidade e capacidade regenerativa das células periodontais, favorecendo o desenvolvimento processos de reabsorção (28, 29).

Crianças e adolescentes, além de serem os indivíduos nos quais as sequelas da avulsão se manifestam de maneira mais agravada, de modo a inclusive prejudicarem o seu crescimento craniofacial (21), constituem as faixas etárias mais propensas a sofrerem traumatismos dentoalveolares (2, 4). De fato, ao menos 25% dos indivíduos desde a idade escolar até a adolescência foram ou serão vítimas algum tipo de trauma dental (2). A escola e o lar comumente estão configurados dentre os locais onde estes acidentes acontecem com maior

frequência (2, 30, 31). Desta forma, é importante que pessoas envolvidas diretamente com o público infantil, em especial os pais (32), professores (33, 34) e educadores físicos (35), tenham informações e capacidade suficientes para lidar com casos de avulsão, de modo que possam através da realização do reimplante imediato ou do correto manejo do dente avulsionado, contribuir para o melhor prognóstico possível (36, 37). Sendo assim, a detecção do nível de conhecimento destes indivíduos é crucial para o planejamento de ações informativas eficientes.

Atividades como andar de bicicleta e brincadeiras infantis vigorosas frequentemente encontram-se entre os principais fatores etiológicos da avulsão dental (3, 5). No entanto, é sabido que as características epidemiológicas dos casos de traumatismos dentários variam de acordo com a comunidade analisada, já que refletem sua realidade e costumes (2). Desta forma, políticas públicas que visem informar sobre a métodos de prevenção e os primeiros-socorros a serem aplicados em situações de avulsão dentária devem ser embasadas em diagnósticos epidemiológicos regionais para que surtam o efeito esperado sobre o comportamento da sociedade (2-4).

Frequentemente, os profissionais da odontologia não se encontram preparados para oferecer a terapia adequada a este tipo de injúria (38). O tratamento da avulsão envolve uma abordagem multidisciplinar e a escolha das condutas clínicas, bem como a determinação do prognóstico são diretamente influenciadas pelo manejo do dente avulsionado e por particularidades inerentes ao paciente (1, 10), tais como sua idade (22) e perfil imunológico. O adequado conhecimento acerca dos possíveis desfechos clínicos relacionados à avulsão dental permite que o clínico controle as expectativas dos pacientes e familiares, provendo uma visão realista sobre o quadro e dividindo a responsabilidade quanto ao sucesso do reimplante dental (39). Desta maneira, uma investigação detalhada a respeito dos fatores que influenciam o sucesso do reimplante dentário, exemplificada por meio de relato de casos clínicos, faz-se importante para o embasamento das condutas clínicas tomadas pelo cirurgião dentista.

Frente ao exposto, o presente trabalho tem como objetivo conhecer as características epidemiológicas dos casos de avulsão e os condutas de manejo dos dentes acometidos, além de investigar o nível de conhecimento de pessoas

diretamente envolvidas com o grupo de risco e investigar a relação entre fatores influenciadores e o prognóstico de dentes reimplantados.

OBJETIVOS

2. OBJETIVOS

Objetivo Geral

Avaliar o desempenho de atendimento público de pacientes acometidos por avulsão dental, o reflexo do conhecimento de pessoas envolvidas com o público acometido e os fatores determinantes no sucesso de tratamento de avulsão dental.

Objetivos específicos

Objetivo específico 1

Capítulo 1 - *A 12-Year Retrospective Study of Avulsion Cases in a Public Brazilian Dental Trauma Service.*

Este estudo avaliou as características epidemiológicas e o manejo dos casos de avulsão de dentes permanentes atendidos em no serviço público de traumatismo dentário da Faculdade de Odontologia da Universidade Federal de Uberlândia no período de dezembro de 2005 a agosto de 2016.

Objetivo específico 2

Capítulo 2 - *Dental Avulsions – Knowledge of professionals and non-professionals involved with children and adolescents.*

Este estudo teve como objetivo investigar os fatores associados ao nível de conhecimento dos diferentes grupos de indivíduos de Uberlândia, MG, Brasil, que estão ou estarão envolvidos diretamente com crianças e adolescentes que constituem o perfil de sujeitos mais susceptíveis à avulsão.

Objetivo específico 3

Capítulo 3 – *Influence factors on tooth Avulsion Outcomes – literature review and case reports.*

O objetivo deste estudo foi explorar os principais fatores associados a cada um dos possíveis desfechos de reimplante de dentes avulsionados, utilizando os 3 relatos de casos para exemplificar os principais protocolos aplicados no serviço de traumatismo da FOUFU utilizados para tratar a avulsão dentária, minimizando efeitos de reabsorção radicular.

CAPÍTULOS

3. CAPÍTULOS

Serão apresentados três capítulos correspondente aos artigos científicos desenvolvidos de acordo com os objetivos específicos propostos.

CAPÍTULO 1

3.1 CAPÍTULO 1

Artigo publicado no periódico Brazilian Dental Journal – Qualis/ CAPES: A2

Title: A 12-year retrospective study of avulsion cases in a public Brazilian dental trauma service.

Short title: Retrospective study of avulsion cases

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A 12-Year Retrospective Study of Avulsion Cases in a Public Brazilian Dental Trauma Service

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This study assessed the epidemiological characteristics and management of the permanent teeth avulsion cases attended in a Brazilian dental trauma service from December 2005 to August 2016. A retrospective study was conducted of case records of 93 patients involving 139 avulsed teeth. Data included sex, age, trauma etiology, location of the accident, number and position of avulsed teeth, and presence and type of associated traumatic lesions. Management of the avulsed teeth was addressed as: time elapsed until teeth were retrieved from the accident's location; teeth's cleaning method and storage media; time elapsed until seeking treatment and replantation. The majority of the patients were children from 6-10 (31.2%) and 11-15 years old (26.9%). Male patients were more affected than female. Bicycle accident was the main etiological factor (31.2%). In 56 (60.2%) cases, traumatic lesions to neighboring teeth were present. In 55 (59.1%) cases, lesions to adjacent soft tissues were reported. In 82 (88.2%) cases, patients requested treatment at the same day of the accident. Sixty-four teeth (46.0%) were immediately retrieved and 28 (20.1%) were not found. Forty-two teeth (30.2%) were kept dry. Only one tooth (0.7%) was immediately replanted at the accident's site, while 51 teeth (36.7%) were not replanted. Numerous avulsed teeth were inappropriately managed and immediate replantation was not frequent. Public policies must be created to raise awareness towards the particularities of avulsion cases.

Key Words: tooth avulsion, dental trauma, retrospective study.

Introduction

Dental trauma is considered an important Public Health matter (1). The Word Heath Organization has encouraged research in this field because of its high prevalence (1,2). Dental trauma frequently causes severe implications on patients' quality of life due to pain, loss of function and esthetics (3). The main causes of these injuries are involved with falls, sports activities, bicycle or traffic accidents (4) and violence (4), which vary depending on the community (6). It is known that schoolchildren are greatly affected by dental trauma (7). Traumatic injuries are one of the main reasons that lead young people to emergency dental services (5,6).

Amongst the types of dental injuries, avulsion is one of the most severe and its clinical prognosis is very contingent on first-aid measures and agility to seek dental care (8,9). The success of the treatment is extremely dependent on how the avulsed teeth were managed prior to replantation (8). Ideally, avulsed teeth should be immediately replanted (10). The rupture of the blood supply causes deterioration in different levels of the pulp and periodontal ligament (PDL) cells (11). The longer the tooth stays out of the socket, the worse the prognosis become. Furthermore, physical damage to the periodontal cells due to careless manipulation, contamination of the avulsed teeth and their maintenance in inappropriate storage media may also jeopardize cells viability, impairing periodontal healing and the long-term survival of the replanted teeth (8,11). The inflammatory process induced by the presence of necrotic PDL cells, result in the activation of clasts, which end up exposing the cementum layer or even the dentin. Additionally, the lack of viable fibroblasts causes the periodontal healing process to fail. Therefore, the unprotected dental tissue is gradually replaced by bone (12).

The loss of teeth due to non-replantation or caused by root resorption favors the thinning of the alveolar crest and the migration of the adjacent teeth, leading to the need for future surgery, orthodontic and prosthetic interventions (13). Moreover, dental ankylosis caused by avulsions impairs the proper development of the maxillary/alveolar bone structures by the lack of stimulation for bone growth (13). Restricted bone development may lead to dental-skeletal disharmony in growing patients, which results in esthetic implications and rehabilitation difficulties (13). It is essential that lay people, especially those who

deal directly with children, know how to proceed in case of avulsion (9,14). However, studies have demonstrated that parents, caretakers and teachers often do not have enough information in order to provide the correct first-aid measures in dental trauma situations particularly in avulsion cases (9,14).

There is a scarcity of studies focused on the epidemiology of dental trauma (5,6), especially regarding avulsion, in despite of the magnitude of the physical and psychological sequelae caused by its occurrence (3). The planning of public policies and treatment guidelines for avulsion requires epidemiological knowledge of specific characteristics regarding each community (4-6). The evaluation of groups at risk, as well as their habits and conducts in relation to the management of avulsed teeth provide important information that will allow the correct development of treatment protocols and regional prevention actions (3-6). Therefore, the aim of this study was to assess the epidemiological aspects and the management performed for avulsed teeth of patients treated at a public dental trauma Brazilian service.

Material and Methods

This study was approved by the Human Research Ethics Committee (Protocol #1.516.162) and was carried out based on the clinical records of patients treated at the Dental-Trauma Clinic conducted at the Hospital of the Federal University of Uberlândia, Brazil. This dental center constitutes the only regional public service specialized in dental traumatic injuries and provides endodontic, periodontal, orthodontic and restorative care to children, teenagers and adults. The public attended at the service is predominantly composed by middle and low-income patients from the Triângulo Mineiro region (35 municipalities, estimated population of 1.628.466 inhabitants) in which the city of Uberlândia (approximately 669.672 inhabitants) is inserted.

From more than 1200 patients attended at the service from December 2005 to August 2016, a cross-sectional evaluation was conducted based on clinical data of all 93 individuals involved with permanent teeth avulsion. Demographic and clinical information were gathered from the patients' records, which were filled by trained graduate and undergraduate students who received extensive information regarding dental trauma in accordance to the current classification of traumatic injuries and treatment guidelines (8,15). The examiners training and calibration process consisted in lectures and clinical explanations given by the Dental Trauma Clinic coordinators contemplating the classification of traumatic lesions and methods of diagnosis. Then, the students were divided into pairs and each team was asked to clinically exam selected patients ("calibration patients"). The exam results were only analysed after the two participants of the team reached a consensus. In case of discrepancies within each team and inter-teams, further theoretical information and clinical demonstrations were given and another set of "calibration patients" were examined. The training process was only completed after all teams could correctly identify all injuries presented by "calibration patients".

All patient's examinations, procedures and data organization were performed under rigorous supervision of Operative Dentistry, Periodontics and Endodontics' professors. The collected data included age, sex, trauma etiology, location of the accident, number and position of avulsed teeth. The presence of associated traumatic lesions such as soft tissue injuries and bone fractures was confirmed by cautious clinical investigation, palpation and radiographic exams.

Details of the management of the avulsed teeth were addressed as following: time elapsed until teeth were retrieved from the accident's site; location where the teeth were found; method used for teeth cleaning; storage media used for maintain the teeth before replantation; time elapsed until seeking treatment and time elapsed until teeth replantation.

Records of patients that had incomplete information regarding the accident or avulsed tooth management were not excluded and the missing information was recorded as "not informed". Data was collected and organized by one investigator and evaluated by means of descriptive analysis (frequency distribution).

Results

From the total of patients attended at the Dental-Trauma Clinical Service, 93 (7.75%) experienced avulsion of permanent teeth. The majority of patients involved with avulsion were male (58.1%). It was found that the number of patients who suffered avulsion decreased as the individual age increased. Children from 6-10 years were the most affected group totaling 29 (31.2%) patients of which 14 (48.3%) were girls and 15 (51.7%) were boys. Teenagers from 11-15 years, 17 (68.0%) males and 8 (32.0%) females, represented 26.9% of the total cases. The age group 16-20 was composed of 73.3% of male and 26.7% female individuals, representing 15 (16.1%) avulsion cases. Seven (53.8%) women and 6 (46.2%) men constituted the 21-30 age group. Two females (33.3%) and 4 males (66.7%) were between 31-40 years-old. The age group of 41-50 (5.4% of all cases) was constituted by 4 (80%) women and 1 (20%) man.

Figure 1 shows the distribution of avulsed teeth according to the dental arch and type. Most of the permanent avulsed teeth were central maxillary incisors.

Regarding the number of teeth involved, 64 patients (69%) had one avulsed tooth, 20 patients (22%) had two teeth, 6 patients (6%) had three avulsed teeth and 3 patients (3%) had 4 or more avulsed teeth.

The distribution of associated traumatic lesions to adjacent primary and permanent teeth is shown in Figure 2.

Thirty-seven patients (39.8%) suffered exclusively avulsion, while 56 patients (60.2%) had other types of traumatic lesions to neighboring teeth. The most common lesions to adjacent teeth were dental fractures of enamel and dentin (without periodontal involvement). From the total of 139 avulsed teeth (93 patients), 16 teeth (16 patients)

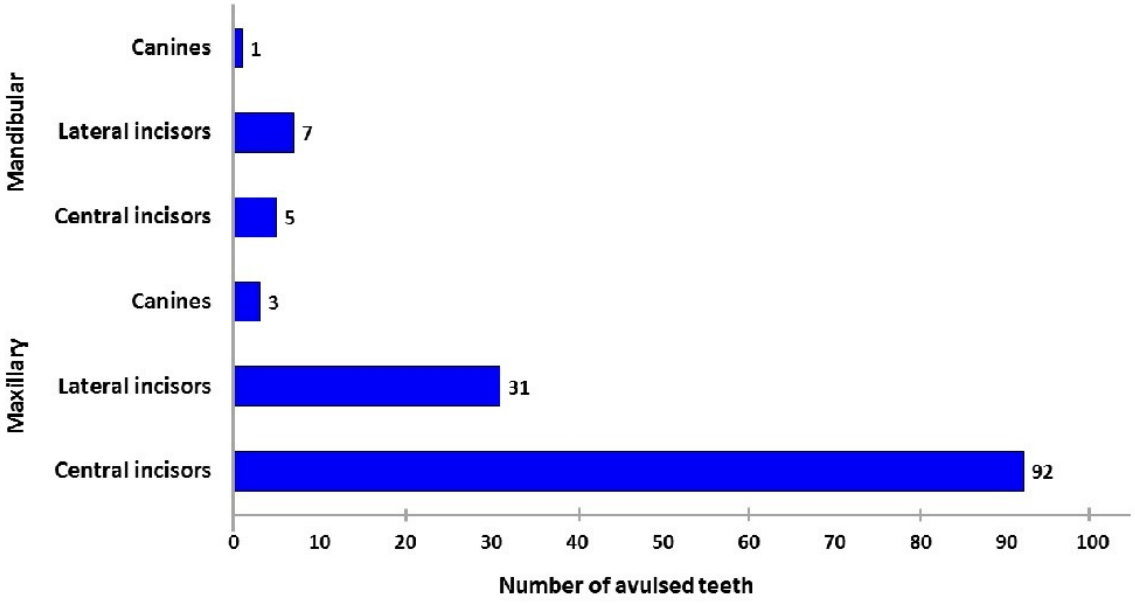

Figure 1. Distribution of avulsed permanent teeth.

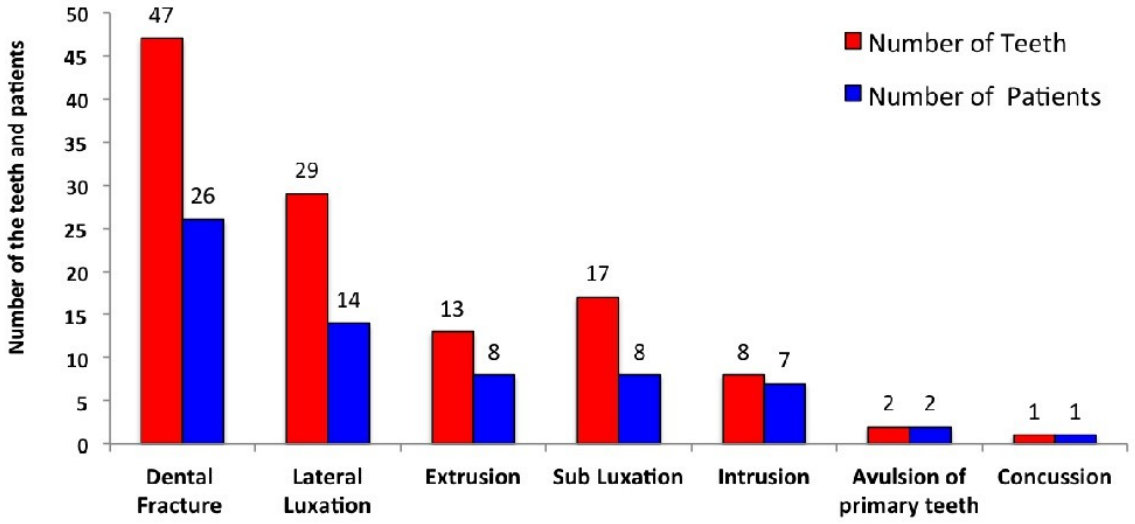

Figure 2. Associated traumatic injuries to neighboring teeth.

also sustained dental fractures.

The distribution of type and location of adjacent soft-tissue lesion and bone fractures is shown in Table 1. Associated soft tissue injuries were present in 55 cases (59.2%). Cuts were the most frequent type of soft-tissue injury and the lips were the most commonly affected areas. The majority of patients did not sustain any associated bone fractures.

Regarding the etiology of the incidents, it was found that bicycle and motorcycle accidents were the main causes of avulsion. The distribution of etiologic factors according to patients' gender is shown on Table 2.

Regarding the location where the accident took place it was found that 49 accidents (52.7%) happened in traffic lines, 23 (24.7%) at home, 3 (3.2%) at school, 5 (5.4%) at the countryside, rodeos or rural festivals, 3 (3.2%) at the park or gym, 3 (3.2%) at the pool or water slide, 3 (3.2%) at work and 4 (4.3%) happened in other/not informed locations. The findings regarding the location where avulsed teeth were found are displayed in Figure 3. A great number of teeth were found on the asphalt or on the floor. The complete distribution of cleansing substances and storage media are shown on Table 3. Regarding the cleaning procedures, it was found that numerous teeth were not cleaned by any means and were maintained in non- ideal conditions.

Eighty-two (88.2%) avulsion patients received dental care on the same day of the accident, 5 (5.4%) on the next day, 2 patients (2.2%) received it between 2 to 7 days and other 2 patients (2.2%) from 8 to 14 days. Two patients (2.2%) took more than 15 days to seek and receive specialized dental assistance. The time elapsed until teeth were retrieved from the accident site and the time elapsed from the accident moment until replantation

Table 1. Distribution of associated bone fractures and soft tissue lesions

Bone fractures and soft tissue lesions	Number of patients (%)
Soft tissue injuries	
Abrasion	8 (8.6)
Contusion	2 (2.2)
Cut	45 (48.4)
No reported lesions	38 (40.8)
Area of soft tissue lesion	
Buccal Mucosa	2 (2.2)
Face	3 (3.2)
Gums	6 (6.5)
Hard Palate	2 (2.2)
Lips	30 (32.3)
Maxillary labial frenulum	1 (1.1)
Multi-location (Lips/ Face/ Intraoral tissues)	11 (11.8)
No reported lesions	38 (40.8)
Bone fractures	
Alveolar bone fracture	10 (10.8)
Mandibular fracture	2 (2.2)
Nose fracture	1 (1.1)
No reported lesions	80 (86.0)

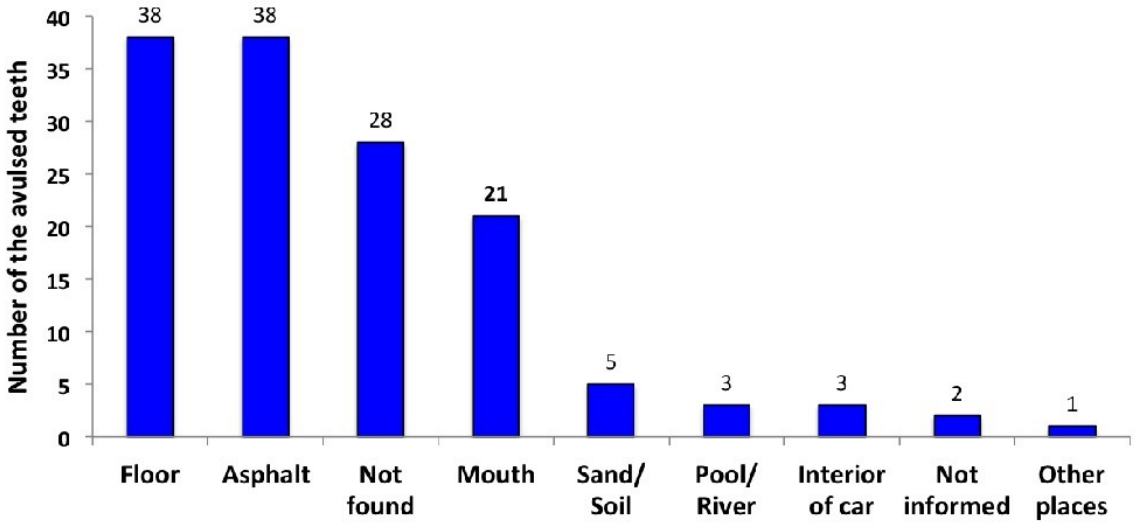

Figure 3. Local where the avulsed teeth where retrieved..

of avulsed teeth are shown in Table 4. Most teeth were recovered shortly after the trauma, but only one tooth was immediately replanted.

Discussion

In this study, the observed rate of avulsion was around 7.75%. Prevalence cross-sectional surveys of several populations focused on dental trauma indicate that avulsion of permanent teeth comprehend up to 1% of all injuries (16). However, in retrospective studies based on patients attended at medical or dental emergency wards, pediatric services and specialized dental trauma clinics, such as the present study, the rate of avulsion ranges from 5.87% to 37% (3-6). This indicates that avulsion cannot be overlooked since this severe injury represents a significant portion of the traumatic lesions cases that led patients to require treatment.

Current results reveal that children and teenagers presented the highest incident rates of avulsed teeth. This corroborates with a previous retrospective study that found the highest frequencies of dental trauma for this age group (5). The lower frequency of avulsion rates presented in groups above 21 years of age are probably due to the fact that adults are less physically active than youngsters and tend to get involved in less risky situations (17).

In this study it was found that avulsion affected more men (58.1%) than women (41.9%), which is in agreement with several epidemiological reports on general dental trauma (5,18) and other studies which are focused on avulsion (3,17). This is probably due to the fact that men have a greater tendency to engage in more energetic activities than women (5,17). Several studies focused in younger children (up to 5 years old) often demonstrate that the difference between traumatic incident rates of boys and girls are not statistically significant because both male and female children of this age are usually involved in the same social activities and games (19) and their psychomotor abilities are analogously developed (20). On the other hand, studies focused on age groups over 10 years old (7) show higher dental trauma incident rates for male patients. This may be attributed to the fact boys with this age tend to be more enthusiastic over physical outdoors activities while girls show a more quiet and mature demeanor (21). Therefore, it is fair to say that as boys and girls grow older, their activities and recreation choices start to differ from each other. Boys' vigorous behavior make them more prone to dental trauma, thus tooth avulsion.

Most of the patients suffered avulsion of only one tooth (69%), followed by the avulsion of two teeth (22%), which is consistent with previous findings (17,18). In agreement with several studies (2,5,17), it was found that maxillary central incisors (66.2%) were the most affected teeth followed by maxillary lateral incisors (22.3%) (5). This can be attributed to their frontal position, which is susceptible to impact. Furthermore, maxillary incisors may be protruded or not sufficiently covered by the lips, which contributes to their propensity to trauma (2).

In the current study, avulsion of primary teeth was accounted as a "lesions to neighboring teeth" because treatment protocols and management of avulsed permanent and primary teeth are not comparable. Avulsed primary teeth cannot be replanted under any circumstances (15), in opposition to permanent teeth, which replantation should be performed as soon as possible (8). Due to the profile of the public service involved in this study, patients who only suffered avulsion of primary teeth without the implication of any permanent teeth were not included.

Table 2. Etiologic factors and percentage of male and female patients per type of accident

Etiologic factors	Total (%)	Female (%)	Male (%)
Aggression (Fight/ Violence)	5 (5.4)	2 (40.0)	3 (60.0)
Bicycle	29 (31.2)	8 (27.6)	21 (72.4)
Car accident	3 (3.2)	1 (33.3)	2 (66.7)
Collision	1 (1.1)	0 (0.0)	1 (100.0)
Domestic accident	2 (2.2)	0 (0.0)	2 (100.0)
Epileptic fits / seizures	1 (1.1)	0 (0.0)	1 (100.0)
Fainting/ Dizziness/ Drunkenness	1 (1.1)	1 (100.0)	0 (0.0)
Fall off from roof, stairs, wall	2 (2.2)	0 (0.0)	2 (100.0)
Fall out from horse / bull riding	2 (2.2)	0 (0.0)	2 (100.0)
Fall out of bed / sofa / bunk bed	1 (1.1)	1 (100.0)	0 (0.0)
Horse/ Bull Kick	3 (3.2)	0 (0.0)	3 (100.0)
Motorcycle accident	11 (11.8)	4 (36.4)	7 (63.6)
Other situations	2 (2.2)	1 (50.0)	1 (50.0)
Playing (recreation)	6 (6.5)	5 (83.3)	1 (16.7)
Running over (hit by vehicle)	7 (7.5)	6 (85.7)	1 (14.3)
Skating/ Roller skating/ Scooter riding	1 (1.1)	0 (0.0)	1 (100.0)
Sports (soccer, basketball, etc.)	2 (2.2)	0 (0.0)	2 (100.0)
Stumbling/ sliding/ misstep	12 (12.9)	9 (75.0)	3 (25.0)
Work accident	2 (2.2)	1 (50.0)	1 (50.0)

In a retrospective study conducted in 2011 it was found that in 98% of the cases were associate lesions to adjacent teeth, soft tissues or bone injuries were present (17). In the present study, each of these injuries was accounted separately. Dental fractures of enamel and dentin (without periodontal involvement) and lateral luxations were the most common lesions to neighboring teeth, while concussion was found in just one case. Associated injuries to neighboring soft tissues were sustained by 59.1% of the patients and the lips were the most affected areas (3).The majority of patients did not suffer any bone fractures (86.0%), which is consistent with a study carried on Piracicaba, Brazil, which found that most of avulsion patients did not sustain facial bone fractures (3).

Generally, the epidemiological studies focused on dental trauma subdivide the etiological factors into falls, collisions with objects or people, traffic accidents, sports and violence (5,18). However, "collisions" and "falls" include numerous situations (7). For example, falling from walls, beds, fainting or even stumbling would be accounted as "falls". The causes of dental trauma are peculiar to each community as they reflect the habits of its population (2,5,6). Therefore, in this study the etiologic categories were scrutinized in order to provide a more detailed analysis, since there is no standard classification of dental trauma causes in the literature (17). Bicycles accidents were the main cause of teeth avulsion affecting 31.2% of the patients, of which 72.4% were male and 27.6% female. This is in agreement with previous studies (3,22), which also demonstrate that bicycle accident victims had a threefold greater chance of suffering teeth avulsion (4). Bicycles are a low-cost transportation and are available to children and teenagers. As bicycle riding is generally not seen as a hazardous activity, the use of helmets is not common. Furthermore, bicycle helmets do not have face-guards, leaving the cyclists' lower-face unprotected (22). Other important factor that could explain the high prevalence of bicycle accidents is the poor conditions of the public traffic lines in the community involved in this study. The competition between cars and bicycles exposes children and teenagers to accidents.

Previous studies focused on dental trauma show rates of "falls" ranging from 9.1% to 72.4% (2,5,18). In avulsion studies this rate range from 19% to 22% (3,17). In the present study, the incident rates of the set of the categories that correspond to "falls" is consistent with the general numbers of "falls" found in the literature (3,17). Accidents involving farming animals were also reported in this study. Although the economy of the city involved in this study is based in mostly urban activities, it serves as a health care reference to neighboring rural locations.

It is known that the prognosis of avulsed teeth depends on a series of the procedures that are generally conducted by lay people who assist the patient on the site of the accident (9,14,23). Immediate treatment is

Table 3. Cleansing substance and storage media in which teeth were maintained

	Total	%
Tooth cleaning procedures		
Not informed	17	12.2%
Other substances	1	0.7%
Saline Solution	11	7.9%%
Teeth not found	28	20.1%
Teeth were not cleaned	57	41.0%
Water	25	18.0%
Storage media		
Alcohol	1	0.7%
Dry	42	30.2%
Ice	2	1.4%
Immediately replanted	1	0.7%
Inside the mouth	14	10.1%
Milk	12	8.6%
Not informed	3	2.2%
Saline solution	25	18.0%
Teeth not found	28	20.1%
Teeth were discarded	1	0.7%
Water	10	7.2%

Table 4. Time elapsed until teeth retrieval and time elapsed until teeth replantation

Time elapsed until tooth retrieved	Total	%	Time elapsed until replantation	Total	%
Immediately	64	46.0%	Immediately replanted	1	0.7%
<30 min	16	11.5%	<30 min	7	5.0%
30 min - 1 h	15	10.8%	30 min - 1 h	20	14.4%
1-2 h	1	0.7%	1-2 h	28	20.1%
>2 h	13	9.4%	2-4 h	16	11.5%
Teeth no found	28	20.1%	4-6 h	6	4.3%
Not informed	2	1.4%	>6 h	9	6.5%
-	-	-	Teeth not replanted	51	36.7%
-	-	-	Time not informed	1	0.7%

crucial to the long-term survival of the avulsed teeth (8). However, few information can be found in the literature in relation to the time elapsed between the accident and dental assistance (3). In this study, the majority (88.2%) of patients received dental treatment in the same day of the accident. However, 5.4% of the patients waited until the following day, and 6.5% for longer periods, which is consistent with previous findings (3). Besides the immediate esthetic problem, avulsion accidents involve bleeding and pain, which compels most of the victims and the people who assist them to promptly require help (14). Nonetheless, the reason why several individuals refrain from rapidly seeking assistance is that lay people are often not aware of the possibility of dental replantation and the implications caused by extended extra-oral time on the prognosis of avulsed teeth (23).

In this study, it was found that 64 teeth (46.0%) were retrieved immediately after the accident and 16 (11.5%) were found up to 30 min. A large number of the teeth were found in places such as asphalt, floor and soil, indicating that they might have been dirty or contaminated. However, amongst the 111 retrieved teeth, 57 (51%) were not cleansed by any means. Avulsed teeth must be washed briefly (maximum 10 seconds) under cold running water before their immediate replantation or storage in appropriate media (8), otherwise contaminants may jeopardize periodontal ligament cells viability. The lack of general knowledge regarding tooth-cleaning procedures demonstrated in the present study is consistent with previous findings (23). Although the majority of teeth was retrieved in a timely manner, a significant quantity of teeth was not properly cleaned nor their replantation was promptly carried out. Twenty-eight avulsed teeth were not recovered after the accident; however, the number of non-replanted teeth totaled 51. This indicates that incorrect management precluded the replantation of 23 teeth. This can be attributed to the insufficient knowledge regarding avulsion cases. A previous study demonstrated that 86% of children's parents and caretakers would clean an avulsed tooth and take it to professional evaluation, which may take a long time, instead of promptly replant it (9). This indicates that people are unaware of how crucial it is to keep the tooth in the alveolar socket, especially once bleeding and painful symptoms are controlled (9).

If the replantation is not immediately performed, it should be ideally carried out up to 20 to 30 min from the accident moment in order to achieve better periodontal healing (24). The longer it takes to replant the tooth, the worse prognosis become. In fact, it is stated that after 60 min of dry extra-oral time, the periodontal ligament cells are no longer viable and the establishment of root resorption is more expected (8). The most appropriated way to maintain the viability of periodontal ligament cells is to conserve the tooth in an adequate storage media. Bovine milk, Hank's balanced salt solution, pH- adjusted coconut water and soymilk are examples of storage medias that have the ability to preserve cells (11). In the present study, it was found that 42 (30.2%) teeth were kept dry. Only 12 (8.6%) teeth were stored in milk, whereas a significant number of teeth were kept in tap water or saliva (inside the mouth), which have poorer nutriment properties and are not as capable to maintain cell viability, especially in warm environments (25). This shows that despite of the efforts in finding and storing the teeth in order to perform replantation, the population is not adequately educated about the ideal storage medium (9).

The present study has analyzed patients' records filled by graduate and undergraduate students who collaborated at a dental trauma service throughout a period of 12 years. These records were carefully designed by experienced professors for the collection of data regarding dental trauma and avulsion, in order to minimize the possibility of subjective insert of information and facilitate tabulation. Furthermore, patients' examination and data organization were permanently supervised by the research team. Records with incomplete information were not excluded and the missing information was registered as "not informed" since dental trauma victims and people who assist them often fail to acknowledge, remember and report the all the details of avulsed tooth management. Even if they were not provided with the complete information regarding the accident, dentists handle this type of injury based on clinical evidences.

This study intended to provide a detailed assessment of avulsion cases in a major dental trauma service. Previous studies focused exclusively on epidemiology (2), individual characteristics or presence of associated lesions (3,5). In the present study, all these aspects were observed alongside with the investigation of accident's details and the management of the avulsed teeth. As a result of this analysis a complete set of data became available to be used as reference for the creation of effective informative programs and the allocation of financial resources.

It was concluded that in despite of the best efforts of the lay people who assisted avulsion victims, a great number of avulsed teeth are incorrectly managed, which jeopardized the prognosis or often prevent replantation. It is evident that public educational policies must be implemented in order to provide information regarding dental avulsion. Furthermore, preventive programs based on epidemiological characteristics of each community should be created. The combination of prevention and educational actions is expected to diminish the avulsion accident rates and improve the long-term prognosis of replanted teeth.

Resumo

Este estudo avaliou as características epidemiológicas e de manejo dos casos de avulsão de dentes permanentes atendidos em um serviço de trauma dental de dezembro de 2005 a agosto de 2016. Foi realizado um estudo retrospectivo de 93 casos, envolvendo 139 dentes avulsionados. Os dados incluíram sexo, idade, etiologia do trauma, localização do acidente, número e posição dos dentes avulsionados e presença e tipo de lesões traumáticas associadas. O manejo dos dentes foi abordado de modo a analisar: o tempo decorrido até que os dentes fossem recuperados do local do acidente; Método de limpeza dos dentes e meios de armazenamento; Tempo decorrido até a busca por tratamento e reimplante dental. A maioria dos pacientes eram crianças de 6-10 (31,2%) e 11-15 anos (26,9%). Os pacientes do sexo masculino foram mais acometidos que do feminino. O acidente de bicicleta foi o principal fator etiológico (31,2%). Em 56 (60,2%) casos, ocorreram lesões traumáticas aos dentes vizinhos. Em 55 (59,1%) casos foram relatadas lesões de tecidos moles. Em 82 (88,2%) casos, os pacientes solicitaram tratamento no mesmo dia do acidente. Sessenta e quatro dentes (46,0%) foram imediatamente recuperados e 28 (20,1%) não foram encontrados. Quarenta e dois dentes (30,2%) foram mantidos secos. Apenas um dente (0,7%) foi imediatamente reimplantado no local do acidente, enquanto 51 dentes (36,7%) não foram reimplantados. Numerosos dentes avulsionados foram manejados de forma inadequada e o reimplante imediato não foi frequente. Devem ser criadas políticas públicas para a conscientização da população sobre as particularidades dos casos de avulsão dental.

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CAPÍTULO 2

3.2 CAPÍTULO 2

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TITLE: Dental Avulsions – Knowledge of professionals and non-professionals involved with children and adolescents.

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TITLE: Dental Avulsions – Knowledge of professionals and non-professionals involved with children and adolescents.

ABSTRACT:

Purpose: This study aimed to investigate the factors associated with the level of knowledge of different groups of individuals from Uberlândia, Brazil, who are or will be directly involved with children and teenagers who may be subject to avulsion. A cross-sectional study involving 245 individuals was performed. A questionnaire was answered by schoolteachers, physical education professionals, members of the general population and undergraduate students in Languages/Linguistics, Physical Education and Pedagogy. Data were analyzed using a score (0 to 36) created from the sum of the scores received in 36 questions (right answers = 1 and wrong = 0). Bivariate and multiple logistic regression models were generated to evaluate the relationship between the level of knowledge dichotomized by the median and the covariates: age, sex, interviewed group, first aid and dental emergency training and having witnessed dental trauma situations. The estimation of the crude and adjusted Odds Ratio (IC 95%) revealed that the interviewed group and age were independently associated with the level of knowledge about avulsions. Individuals between 36-45 years of age have a 0.378 (95% CI 0.152-0.943) chance of having thorough knowledge compared to people over 45 years. Undergraduates in Languages/Linguistics have 0.076 (95% CI 0.018-0.322) chance of having thorough knowledge compared to schoolteachers (P> 0.05). The level of individual knowledge regarding dental avulsions is insufficient and is independently associated with age and interview group.

KEYWORDS: Tooth Avulsion, Dental Trauma, Knowledge.

INTRODUCTION

One-third of all preschool children and one-quarter of schoolchildren and teenagers have experienced dental trauma.[12,24] In fact, traumatic dentoalveolar injuries (TDI) are one of the main reasons that lead children and adolescents to require emergency dental services.[12,17,26,39] Due to its alarming prevalence, dental trauma may outweigh dental caries as the main oral health problem in

youngsters.[8,34] Studies have indicated that the upper maxillary incisors are the most affected teeth.[10] The damage to the smile's esthetics and the loss of function have a negative impact on patients' quality of life,[3,11,16] thus diminishing their confidence and self-esteem.[27]

Avulsion is the most serious type of dental trauma,[2] and although it can affect both primary and permanent teeth, the first aid procedures for each type of dentition are different. Replantation of primary teeth should not be performed to avoid harming their permanent successors.[26] However, avulsed permanent teeth should be promptly replanted or at least maintained for as short a period as possible in an appropriate storage medium to preserve the viability of periodontal cells if immediate replantation is not feasible.[5] The measures taken by people who assist the victim immediately after an accident have a great influence on the prognosis of the avulsed tooth's treatment.[5,19,31]

Children spend a large part of their day at home or in school, where they engage in sports and other recreational activities, which explains the great number of traumatic accidents that occur in these locations.[27,35,37,24] Due to the severity of the sequelae that may derive from the mishandling of avulsion, parents, caretakers, coaches, physical educators and schoolteachers must be able to perform adequate first aid procedures for this type of dental trauma.[6,34] To favor the development and implementation of effective public educational policies and preventive interventions focused on this group of people, their current level of knowledge and responsiveness towards avulsion has been determined.[6,34] However, previous investigations focused on each group separately using different questionnaires to verify the level of knowledge.[6,22] Therefore, it seems appropriate that the same instrument should be used to assess laypeople and non-dental professionals from the same community who deal or will address youngsters on a daily basis to allow the comparison of different groups and the description of the population's level of knowledge about avulsion.

Personal characteristics, such as age,[38] gender,[7,32] having witnessed a dental trauma situation,[15,32] and that have received first aid training,[32] have been associated with high levels of knowledge about traumatic dental injuries and avulsion.[32,38] Additionally, the effect of having previous dental emergency training on the individual level of knowledge of TDI has been investigated.[9]

The aim of the present study is to describe the level of knowledge of people involved with children and teenagers exposed to the need for action in avulsion cases in the community of Uberlândia, MG, Brazil. We also aimed to identify the personal characteristics associated with the level of knowledge. The null hypothesis is that the professional group, age, sex, previous first aid and dental trauma emergency training and having witnessed a dental trauma situation have no influence on the individual's chance of presenting a high level of knowledge regarding avulsion.

MATERIALS AND METHODS

The Ethics Committee of the Federal University of Uberlândia approved this study (protocol number: CAAE 16533713.7.0000.5152). A questionnaire was distributed to 245 interviewed members of the general population (n=59), schoolteachers (n=43), physical education trainers/coaches (n=50), senior undergraduate students in Education (n=36), Languages/Linguistics (n=29) and Physical Education (n=28) of the city of Uberlandia, Minas Gerais state, Brazil, which has 700.000 inhabitants.

A 36-item objective questionnaire was developed by professors of Operative Dentistry, Periodontics and Endodontics who implemented and have been directing the Dental Trauma Clinical Service of the Federal University of Uberlândia since 2005, which has seen more than 1200 patients and serves as a public dental care reference for adjacent smaller cities and rural areas. The questions, which were formulated with appropriate lay vocabulary, were based on the current guidelines regarding the management of TDI and avulsion.[5,25] The survey was carried out by a trained interviewer and contemplated the possibility of replantation of primary and permanent avulsed teeth; ideal cleaning procedures and storage media; timing of seeking dental care and performing replantation; self-perception of coaches and teachers' abilities and responsibilities concerning the management of avulsed teeth/assistance to the victim and knowledge regarding the usage of mouth guards (Figure 1).

The data were analyzed using a score (0 to 36) created from the sum of each right answer= 1 and wrong answer = 0. The median (score = 26) was used as the reference to dichotomize the level of knowledge: scores less than or equal to 26 were recorded as low levels of knowledge, and scores above 26 were

recorded as high knowledge. Bivariate and multiple logistic regression models were performed to evaluate the association between the level of knowledge and the following covariables: age, sex, interviewed group, report of previous contact with dental trauma situations, and prior training on first aid maneuvers and on dental emergencies. Initially, logistic regression models were performed separately for each covariable. Then, the covariables that presented p-value <0.20 were included in a multiple logistic regression model, according to the Forward Stepwise (Wald) method. The crude and adjusted Odds Ratio (CI 95%) were estimated as well as the P-values.

RESULTS

The general level of knowledge regarding each covariate and the crude and adjusted Odds Ratio are shown in Table 1. The null hypothesis was rejected because age and the interviewed group were both independently associated with the level of knowledge regarding dental trauma and avulsion situations.

The highest level of knowledge was demonstrated by schoolteachers (65.1%), followed by undergraduate Physical Education students (60.7%). The group with the lowest rate of high knowledge was Languages/Linguistics students, who presented a 0.076 (CI 95% 0.018- 0.322) chance of having a high level of knowledge in relation to the schoolteachers. Concerning age groups, it was found that the highest level of knowledge was demonstrated by people above 45 years old (65.2%). Individuals aged 36-45 years presented a 0.378 (CI 95%, 0.152-0.943) chance of demonstrating a high level of knowledge compared to those over 45 years of age.

Although women had a 1.291 (0.750-2.223) chance of demonstrating a high level of knowledge about avulsion in relation to men, no statistical significance was found among them. Additionally, having received first aid training, dental trauma training or having witnessed dental trauma situations were not independently associated with the chance of demonstrating a high level of knowledge.

DISCUSSION

The present study revealed that laypeople’s general level of knowledge regarding TDI and avulsion is low and discrepant because schoolteachers

demonstrated a 65.1% rate of knowledge and Languages/Linguistics students presented a 10.3% rate of knowledge. The association between age and interviewed group with the level of knowledge about avulsion has been confirmed. No association between having witnessed previous TDI situations, having first aid or dental emergency training and the investigated level of knowledge was verified.

Dental trauma in growing patients compromises both psychological and physical well-being and demands prolonged and expensive treatments that may persist throughout adult life.[6] The absence of teeth may cause the thinning of the alveolar crest and adjacent tooth migration.[23] Ankylosis caused by the replantation of teeth managed under non-ideal conditions may prevent the correct development of the alveolar structures in young individuals, leading to infraposition and discrepancies between vertical and horizontal bone growth.[25] Therefore, it is crucial that parents and professionals who deal with children and adolescents have sufficient knowledge on how manage avulsed teeth, which will allow them to take the proper actions that contribute to a better prognosis. The present study showed that schoolteachers demonstrated the highest level of knowledge because 65.1% of the individuals correctly answered 26 or more questions, which corresponded to at least 72% of the 36-item questionnaire. Previous findings indicate that having witnessed a dental trauma situation and having many years of professional experience are factors associated with high levels of knowledge of TDI in schoolteachers.[15] It is possible that the proximity that these individuals have with many children repeatedly throughout the years can sharpen their perspicacity in regard to identifying youngsters' needs and handling accidents. However, the lack of legitimate training leads schoolteachers to rely on their own feelings and hunches instead of validated information.[33]

Linguistics undergraduates demonstrated the worst results. The topic of “Dental Trauma” is not addressed during schoolteachers’ professional education.[33] However, Pedagogy undergraduates may be more sensitive in regard to dental traumatic injuries since their training is intrinsically centered on dealing with children and teenagers, who are more prone to dentoalveolar injuries than adults.[20,40] Therefore, it is likely that they reach out for more information regarding youngsters’ oral health issues and talk to experienced schoolteachers about this subject. In contrast, those who majored in academic disciplines such

as Languages/Linguistics are not as focused on the behavioral aspects of children's abilities as are those who majored in Pedagogy. Therefore, they might not adequately develop as much responsiveness towards accidental emergency situations that occur in the school environment. Physical Education students and Physical Educators/Coaches presented a 0.636 and 0.879 chance, respectively, of demonstrating a high level of knowledge regarding avulsion in comparison to schoolteachers, which paralleled these groups' results and yielded no significant difference. The statistical similarity between physical educators and schoolteachers, who demonstrated the highest level of knowledge, is relatively reassuring. In the literature, there is an understanding that numerous accidents that occur in school occur during sports activities.[6,7,15,37,40] Several authors aimed to verify the level of knowledge of physical education students,[18] professors,[22] and professional physical educators,[7] regarding dental trauma and avulsion because they may be the nearest adults if an accident occurs during sports practice or competitions. These previous findings revealed that the gap between the necessity of knowledge about avulsion and the proper training on how to address it has not been fulfilled in Physical Education faculties.[7,22] In fact, these studies have shown that a great number of these individuals are not aware of the possibility of permanent tooth replantation or of the importance of diminished extra-oral time and ideal storage media.[22] Reportedly, physical educators and sports coaches' main concern in the case of a knocked out tooth is to stop alveolar bleeding instead of performing immediate replantation,[9] which is an understandable maneuver because many of these individuals have received life-support training. However, this procedure would jeopardize the prognosis of avulsion.[9]

In the present study, it was found that 49.2% of the members of the general population presented an adequate level of knowledge regarding avulsion. This group was composed of people aged 18-60 and included a great number of parents among other individuals (data not shown). Previous studies demonstrated that laypeople have a low level of knowledge towards dental traumatic injuries (especially avulsion), which presents a serious problem.[19,30] Most of the parents and caretakers would keep an avulsed tooth and seek immediate dental aid; however, the great majority would keep it dry, wrapped in paper or in inadequate liquid media such as ice, saline solution or alcohol.[28,29]

These findings indicated that even though parents' best intentions are to save the avulsed tooth, they lack the information and proficiency to perform the correct intervention.

Although the association between age and a high level of knowledge about avulsion is not always observed,[30,34] the present study demonstrated that 36- to 45-year-old individuals had a 0.378 (p=0.037) chance of having high knowledge when compared to those older than 45. However, the results of people 18-35 and older than 45 years were not significantly different. This can be attributed to the fact that individuals younger than 35 years of age may be more proactive in regard to acquiring information. On the other hand, people older than 45 have more life experience, which might have enhanced their sensibility and capability to rationalize when facing stressful situations.

In this study, it was found that sex was not independently associated with the level of knowledge regarding avulsion.[21,30,36] Having witnessed a dental trauma situation (P=0.066), having training in general first aid measures (P=0.173) and in dental emergencies (P=1.77) also had no significant influence the chance of having a high level of knowledge regarding avulsion management. This could be because few general first aid training courses cover dental trauma.[2] Information about dental injuries is usually not included in educational first aid materials.[19] A previous study reveals that among 45 evaluated first aid manuals, only 19 had information about dental trauma and just 10 had information regarding avulsion management.[14] First aid manuals should not be considered as a sole reference for capacitating non-dental professionals. It is imperative that first aid training programs include dental trauma and avulsion management information.[19,34]

Studies have revealed that although most parents believe that it is very important to have information regarding dental trauma, they have never received any sort of dental emergency training.[19,30] In fact, in cases of dental trauma, both parents and schoolteachers would base their actions on their intuition instead of scientific evidence.[29,33] The efficiency of several methods of providing information to laypeople such as parents and schoolteachers has been previously investigated.[1,2] A 30-minute lecture immediately increased schoolteachers' level of knowledge regarding avulsion from 39% to 97%.[1] Although lectures are very effective and interactive, as the lecturer may answer questions from the audience,

they are often restricted to a limited number of listeners. Therefore, sequential and frequent lectures would be necessary in order to reach out to a broader population, which would increase costs and demand resources.[1] Leaflets are an economic alternative since they are not expensive to print and can be handed out to a large number of individuals. Although they contain only essential information, it has been proven that leaflets were able to raise parents' general knowledge regarding avulsion from 46% to 74%.[2] The Internet is also an immediate source of information that can be accessed at any instant, and it is one of the best vehicles to educate people about avulsion.[4] Currently, a massive number of individuals have smartphones, allowing them to reach out for information regardless of the location. Numerous web sites and apps focused on dental trauma are available for consultation and download.[13] Furthermore, placing instructional posts on Instagram and Facebook as well as educational videos on YouTube have been considered valid alternatives of spreading knowledge.[4] However, internet users must independently verify the source of their information because it is almost impossible to regulate the legitimacy of the content that is posted online.[13]

Another factor that contributes to the lack of responsiveness of individuals to dental trauma is the fear that they might be held responsible for an unfavorable outcome.[19] Even if they know what procedures to use, they choose to refrain from assisting a victim, especially if there are other people present at the site, revealing a social-psychological phenomenon called "bystander effect".[19] This study presents the limitation of having surveyed a convenience sample of one Brazilian city. However, the level of knowledge of 245 relevant individuals from different groups of people who are involved with children and teenagers and could assist them in cases of avulsion was evaluated.

Overall, the level of knowledge found in this study was unsatisfactory. Since the interviewed group and age were independently associated with the knowledge regarding avulsion, it is clear that public policies must be adequate for each population, using different approaches and communication assets. Because of the severe sequelae entailed by avulsion in growing patients, no efforts must be spared to inform laypeople of how to handle this type of accident.

The level of knowledge of people who deal directly with children and teenagers regarding avulsion varies according to age and profession. Specific

training regarding dental trauma and avulsion must be included in the professional education of future physical educators and schoolteachers. Continuing instructional programs on dental trauma using various communication vehicles must be implemented to increase the general level of knowledge regarding dental trauma and avulsion.

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TABLES:

Table 1: Display of the level of knowledge according to the covariables and Odds Ratio estimation.

Covariables	High knowledge	Crude OR (CI 95%)	P-value	Ajusted OR (CI 95%)	P-value
Age (n=237)					
>45 years (n=46)	65.2%	1			
36-45 years (n= 37)	40.5%	0.364 (0.149-0.889)	0.027	0.378 (0.152-0.943)	0.037
18-35 years (n=154)	48.1%	0.493 (0.249-0.978)	0.043	0.605 (0.263-1.393)	0.238
Sex (n=241)					
Male (n=77)	45.5%	1			
Female (n=164)	51.8%	1.291 (0.750-2.223)	0.357		
Interviewed group (n=245)					
Schoolteachers (n=43)	65.1%	1		1	
Trainers / Coaches (n=50)	52.0%	0.580 (0.251-1.341)	0.203	0.636 (0.245-1.649)	0.352
Physical Education students (n=28)	60.7%	0.828 (0.309-2.215)	0.707	0.879 (0.290- 2.663)	0.820
Education students (n=36)	52.8%	0.599 (0.242-1.482)	0.267	0.626 (0.233-1.680)	0.352
Languages/Linguistics students (n=	10.3%	0.062 (0.016-0.238)	<0.001	0.076 (0.018-0.322)	<0.001
General population (n=59)	49.2%	0.518 (0.231-1.162)	0.111	0.495 (0.214-1.145)	0.100
First aid training (n=237)					
Yes (n=127)	54.3%	1			
No (n=110)	45.5%	0.700 (0.420-1.170)	0.173		
Dental trauma training (n=238)					
Yes (n=8)	75.0%	1			
No (n=230)	49.6%	0.328 (0.065-1.657)	0.177		
Witnessed dental trauma situations (n=236)					
Yes (n= 68)	60.3%	1			
No (n=168)	47.0%	0.585 (0.330-1.036)	0.066		

Figure 1: Questionnaire.

Research project - Management of dental avulsion

Personal Profile:

Individual code: _____ **Age:** ( ) 18-35 ( ) 36-45 ( ) >45. **Sex:** ( ) F ( ) M

Schooling: _____ **Profession**: _____

- Have you ever received first aid training? ( ) Yes ( ) No.
- Have you ever received dental emergency training? ( ) Yes ( ) No.
- Have you ever witnessed an accident involving dental trauma? ( ) Yes ( ) No.

_____

1. The teeth are held in position in the dental arch and do not fall when chewing. How are teeth attached to the dental arch?

( ) Fibers ( ) Cartilage ( ) Bone.

2. Do you think that a tooth can be completely removed from the mouth in an accident (avulsion)?

( ) Yes ( ) No.

3. Do you think that if a tooth is accidentally knocked out (avulsed) it can be put back in place (replanted) so the person can chew and smile like he or she did before the accident? ( ) Yes ( ) No.

4. Do you think that primary teeth should be replanted after being knocked out?

( ) Yes ( ) No.

5. Do you think that permanent teeth should be replanted after being knocked out? ( ) Yes ( ) No.

6. If the tooth fell on the floor what would you do?

( ) I would clean the tooth ( ) I would not clean the tooth.

7. If you had to clean the tooth, how would you do it?

( ) Wash it with soap and water ( ) Scrub it with disinfectant solution

( ) Wash it with water without scrubbing it ( ) Wash it with alcohol

( ) Wash it with disinfectant solution without scrubbing it ( ) Brush the tooth

8. How would you scrub/brush the tooth?

( ) With a toothbrush ( ) With a soft sponge ( ) I would not scrub/brush the tooth.

9. How would you hold the tooth in order to clean it?

( ) Hold it by its crown ( ) Hold it by its root.

10. When should the tooth be replanted after avulsion?

( ) Immediately ( ) As soon as the bleeding stops ( ) Within the first six hours

( ) Within the first 60 minutes ( ) Whenever the victim visits a dentist.

11. If you cannot or choose not to immediately replant the avulsed tooth, what should be done?

( ) Immediately take the victim and the tooth to a dental office or emergency room.

( ) Schedule an appointment with the dentist.

Indicate which conditions you consider would be appropriate for storing avulsed teeth as they are transported to the dentist's office:

12. Wrap the tooth in paper: ( ) Yes ( ) No.

13. Wrap the tooth in a tissue or handkerchief: ( ) Yes ( ) No.

14. Wrap the tooth in gauze or cotton: ( ) Yes ( ) No.

15. Maintain the tooth in alcohol: ( ) Yes ( ) No.

16. Maintain the tooth in filtered water: ( ) Yes ( ) No.

17. Maintain the tooth in tap water: ( ) Yes ( ) No.

18. Maintain the tooth on ice: ( ) Yes ( ) No.

19. Maintain the tooth immersed in disinfectant solution or bleach: ( ) Yes ( ) No.

20. Maintain the tooth inside the victim's mouth: ( ) Yes ( ) No.

21. Maintain the tooth in the child's hand: ( ) Yes ( ) No.

22. Maintain the tooth in milk: ( ) Yes ( ) No.

23. Maintain the tooth in fruit juice: ( ) Yes ( ) No.

24. Maintain the tooth in saline: ( ) Yes ( ) No.

25. Maintain the tooth in coconut water: ( ) Yes ( ) No.

26. Do you think that an avulsed tooth can stay out of the oral environment for longer periods if it is maintained in proper conditions other than dry?
( ) Yes ( ) No.

27. Dental trauma is common in groups of children and teenagers. Do you think that schoolteachers and/or physical educators play an important role in reducing the damage that occurs after a school accident involving avulsion?
( ) Yes ( ) No.
28. Do you believe that an avulsed tooth is "lost" and there is nothing one can do to save it? ( ) Yes ( ) No.
29. Do you believe that knowing the ideal moment to perform emergency procedures in an avulsion case is crucial to the success of tooth's replantation?
( ) Yes ( ) No.
30. Are dental traumatic injuries considered emergency situations?
( ) Yes ( ) No.
31. Should information regarding dental emergencies be included as a topic in schoolteachers and physical educators/coaches' professional training?
( ) Yes ( ) No.
32. Do you consider that the immediate intervention of schoolteachers and physical educators in avulsion cases can have a positive influence on the success of the treatment?
( ) Yes ( ) No.
33. Do you consider that schoolteachers and physical educators can take action in situations such as an accident involving avulsion?
( ) Yes ( ) No.
34. Is it advisable for teachers to avoid taking any action in these situations due to legal considerations?
( ) Yes ( ) No.
35. After receiving adequate training, is it possible that schoolteachers and physical educators can improve their contribution in performing dental trauma emergency procedures?
( ) Yes ( ) No.
36. Should the use of mouth guards be compulsory when practicing sports in which there is contact between participants?
( ) Yes ( ) No.

Thank you for your participation.

CAPÍTULO 3

3.3 CAPÍTULO 3

Artigo a ser enviado ao periódico Dental Traumatology – Qualis/ CAPES: A2

Influence factors on tooth avulsion outcomes – literature review and case reports

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Running title: Review of outcomes of avulsed teeth.

Keywords: dental trauma, avulsion, ankylosis, case report, outcomes.

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Conflict of Interest Statement

The authors confirm that they have no conflict of interest.

Influence factors on tooth Avulsion Outcomes – literature review and case reports

Abstract

Background/aim: Avulsion is a severe dental lesion and its prognosis depend on individual and circumstantial factors regarding the patient and the management of the avulsed tooth. The aim of this study is to investigate the role of each influence factor on the outcomes of avulsion and to demonstrate treatment protocols via case reports.

Review: The younger the patient, the quicker replacement and inflammatory resorptions progress due to rapid bone turnover rate and wide dentinal tubules. A dry-time of 15 min is already associated with resorption. Milk is an accessible and effective storage media. Concurrent lesions to the avulsed tooth may facilitate the inflow of bacteria contribute to resorption. Systemic antibiotics cannot prevent or arrest inflammatory resorption but they can better patient's general condition. Calcium hydroxide must only be inserted after healing process has commenced to avoid replacement resorption but not after 20 days otherwise inflammatory resorption may occur. Semi-rigids splints are recommended for up 14 days if no bone fractures are present. Immunologic characteristics such as atopy influence the onset of resorption types.

Case reports: 3 cases of resorption were presented, patients were one adult and 2 children, one younger and one older than 10yrs, all teeth were kept in non-ideal storage medias up to 1 hour. The younger the patient, the more impactful ankylosis became regarding maxillary development.

Conclusion: The occurrence of root resorption should be expected in replantation cases. Parents and clinicians must bear realistic expectations towards replantation cases in younger patients.

Introduction

Amongst the types of dentoalveolar traumatic lesions, avulsion is certainly one of the most severe. The first-aid conducts differ greatly in relation to victim's age and type of dentition. Although it is a controversial subject (1), current guidelines do not advise the replantation of primary teeth due to the possibility of damaging its permanent successor (1, 2). However, for immature and mature permanent teeth, replantation is undoubtedly the treatment of choice (3).

The replantation of the avulsed tooth on the alveolus does not assure its long-term survival. Unfortunately, External Root Resorption (ERR) is a very common cause of replanted teeth loss. This sequel can be observed as: surface resorption, inflammation derived resorption or as a substitution of dental tissue by bone (4). Some key factors are intrinsically linked to the installation and progression of ERR such as: patient's age and stage of root formation (5), cleaning methods, handling of the avulsed tooth (6), extra-alveolar time (7), storage media (8), systemic antibiotic therapy and moment of pulp extirpation (5). Additionally, splinting and even the patients' compliance has been indicated as relevant elements for root resorption (7).

It is known that the majority of avulsed teeth are not immediately replanted (9). Furthermore, most teeth that are brought to replantation have not been correctly handled nor kept in favorable storage media (9, 10), which may favor the manifestation of undesired sequelae. Upper incisors are the most affected teeth and the age group at risk is comprised predominantly of growing patients (9). The bone growth stimulus provided by the presence of fully functional teeth is essential to the correct maxillary development (11, 12). Teeth affected with root resorption, however, may cause the growth arrestment in cases of replacement resorption or cause the loss of bone structure to infection in cases of inflammatory resorption (13, 14).

Despite of the existence of several studies dedicated to elucidate the differences between the types of ERR, their progression and the causes of occurrence, clinicians are often unaware of their characteristics and may be consequently unprepared to identify this kind of lesion and also to inform the patient about the outcomes and prognosis (15). Thus, the aim of the present study is to explore the key factors associated the possible outcomes of

reimplantation, using case reports as examples of how these factors and the clinical protocols may affect the prognosis of the avulsed teeth.

The Avulsion Lesion and the onset of resorption

When a tooth is knocked-out of its socket, serious injuries to the pulp and supporting tissues are presented (3). The neurovascular bundle is ruptured and therefore the pulp's blood supply is ceased (3, 5). If the tooth is immature, and some important protocols are used, the revascularization may take place. However, in closed-apex mature teeth this process is not possible and the pulp will eventually become necrotic (16). Tooth avulsion also leads to damage to the alveolar bone, to the root dentin (17) and periodontal structures, including the epithelial rests of Malassez, cementoblasts, pre-cementum and cementum (18). After the replantation of the avulsed tooth without the periodontal protection, the root surface becomes exposed to the clasts and macrophages meant to remove deteriorated cells and cementum (18) in order to initiate healing process. Once this mechanism is activated, the prognosis of the avulsed tooth is ultimately defined by a series of factors that influence whether the reimplantation will be fully successful or if External Root Resorption (ERR) will take place (7). Several studies subdivide the possible outcomes for tooth avulsion in accordance to the type and magnitude of the structural healing and presence of bacteria as: periodontal healing, surface resorption, replacement external root resorption and inflammatory external root resorption (13, 14, 19).

Periodontal healing (PH)

Periodontal healing is established when a full regeneration of the periodontal ligament (PDL) takes place. It occurs as a balance of both alveolar healing process (remodeling) and PDL regeneration (maintenance or creation of new cementum). It is established when, after the removal of the damaged tissue, cementoblasts and fibroblasts recruited from the neighboring tissue are able to repopulate the damaged area (4, 20). Clinically, the periodontal healing is associated with the tooth normal mobility and normal percussion sound, absence of infra-position or extrusion, fistula, edema or painful symptoms (4). Radiographically, normal PDL space and lamina dura can be verified, also there are no signs of resorption (4, 14, 21). Histologically, a normal PDL appearance is

observed, with periodontal fibers connecting a sound cement to the alveolus with the limited presence of inflammatory cells (22).

Surface resorption (SR)

Surface resorption, also called Repair-related resorption (4) is characterized by root cavitation, which were repaired by new cementum (23). Damaged cells, debris and injured dental tissue are removed by osteoclasts; if the affected area is restricted to small parts of the root in the absence of bacterial contamination, the resorbed area can be repopulated with cementoblasts, generating new cementum (23). The radiograph images show a root surface cavitation or apical shortening surrounded by normal periodontal ligament space and lamina dura (4, 21). The clinical findings consist of normal percussion tone, correct tooth position and normal mobility without symptomatology (21). Surface resorption differs from periodontal healing because the latter happens without root cavitation (21). Histologically, studies demonstrate in cases of healed surface resorption, there are no inflammatory cells left at the resorption cavities on the root surface (22).

Replacement External Root Resorption (RERR)

External Root Resorptions are caused by the denudement of the root surface of its protective cementoblasts layer. The mineralized portion of the root becomes exposed to the action of activated bone remodeling cells derived from the bone marrow (24). When an avulsed tooth is not replanted immediately or is handled under non-ideal conditions (i.e. extended dry-time, inadequate storage media and aggressive cleaning methods) the PDL cells may be destroyed or suffer dehydration and lose viability, furthermore, the cementum and pre-cementum layer may be damaged beyond repair (24-26). Therefore, the periodontal cells are not able to reestablish cementum and the exposed dental tissue becomes part of the bone remodeling process; in other words, osteoclasts will ultimately consume mineralized root dentin and osteoblasts will substitute it by bone tissue (18).

Dental ankylosis, which is the absence of physiological tooth mobility, happens once the periodontal space is lost and dental tissue is fused to alveolar bone (4, 18). Dental ankylosis may be transient in cases where less than 20% of

the root is affected, since the ankylosed area may be resorbed by the healing cells in response to the continuing functional stimulus allowed by the use of semi-flexible splints (18). Cases which presented transient dental ankylosis, mild root resorption and normal periodontal healing may be still classified as surface resorption. However, if a larger portion of the root is involved, dental ankylosis tends to become permanent as the healing process goes on and the dental structure is gradually replaced by bone (18). For classification purposes, authors classify dental ankylosis and replacement resorption as synonyms (6, 21, 27).

Replacement resorption occurs in the absence of bacterial contamination (5, 27). Clinically, the tooth is immobile and presents a high/ metallic sound to percussion, which is very different from the sound of non-involved teeth (4, 13). The abnormal sound and the absence of tooth mobility may already be detected in early stages of resorption, even before the identification of radiographic signs can be possible due to the lingual/labial position of some ankylotic areas (14). In RERR cases the radiographs normally show the absence of the PDL space, the fusion between tooth structures and alveolar bone, and the absence of radiolucent areas (14, 21).

Inflammatory External Root Resorption (IERR):

Inflammatory resorption is the result of the combination of two occurrences: firstly, the massive damage or loss of PDL and cementum cells caused by the traumatic forces, inadequate tooth management or the healing process of surface resorption (28); secondly, the presence of bacteria inside the root canal (14, 18, 21). Without one of these occurrences, structural damage and contamination, IERR does not take place.

The denudement of dentin tubules caused by the trauma or by initial inflammatory response, triggered by the inviable PDL remnants, allow bacteria and their products to flow freely from the root canal to the periodontal area (28). This aspect amplifies the inflammation causing both bone and dental tissue to be resorbed (14, 23, 29). The root surface presents areas of lateral resorption that progresses towards the root canal, accompanying the dentin tubules direction. The PDL area presents large number of Howship lacunae and active odontoclasts (5, 30). At early stages were the patient does not present acute

periodontitis or abscess, an absence of painful symptomatology may be verified (28).

On fully installed cases, the patient often presents pain. The tooth shows exacerbate mobility and may become extruded (4) since granulation tissue is developed around the surface of the tooth (20). Edema and fistulae may be present as results of the infection-related inflammation. The radiograph images display radiolucent bowl-shaped cavities (13) on the root length and analogue resorption areas in the neighboring bone tissue (4, 28). The immunologic profile of IERR displays high levels of TNF-α, a pro-resorptive cytokine that activates clasts in response to bacterial contamination, which is also found in periapical endodontic lesions confirming IERR's infection-related origins (29).

Age as an influence factor:

Several studies investigated the correlation between patients age and the onset and progression of the types of root resorption (5, 7, 13, 21). In cases of inviable PDL cells, some authors describe that avulsed teeth of patients aged 8-16 is expected to be resorbed within 3-7 years (13), other studies indicate that this period can be of 1-5yrs after replantation (18). Whereas for older age groups, teeth are expected to last for decades or even the patients' whole lifetime (13, 18).

If no contamination is presented, the progression of replacement resorption tends to be faster in younger patients because of the accelerated bone remodeling and turnover rate (13). This is confirmed by the comparison of the immunologic profile of both younger and older patients affected with RERR regarding the expression of IL-4 (29, 31). This cytokine is related to an antiresorptive effect since it inhibits osteoclast differentiation (29, 31). Older patients display higher levels of IL-4 when compared to younger ones, which corroborates with the fact that as age increases, the rate of RERR decreases (29). Since RERR is more expected to happen in younger patients, the infraposition of the replanted tooth derived from the ankylosis is also more frequent in this age group. Inflammatory root resorption is also expected to progress more rapidly in younger patients due to the large width of their dentinal tubules which allow bacteria and toxins to move freely towards the PDL area (5, 32).

Dry- time - influence on outcomes:

The period that the tooth spends out of the socket is of major influence to its prognosis (29). More specifically, the period that the tooth remains dry, prior to be stored in wet media or replanted, is the best prognosticator of the onset of resorption (27). Current guidelines report that if the total dry time was lesser then 60 minutes and the tooth was stored in a physiological or osmolality balanced media (HBSS, milk, saline, saliva) the PDL cells may still be viable, yet damaged (3). Cells in this situation could still elicit a full recovery of the periodontal tissue, therefore they should not be mechanically removed prior to replantation (3). Nonetheless, the International Association of Dental Traumatology (IADT) states that no cell viability is found if the total dry-time exceeds 60 minutes (13), and if the tooth has been maintained in such condition, the treatment if choice should include the removal of the non-vital soft tissue (3).

However, recent studies advocate that the time limit in which cells become completely non-viable is far lesser (17, 25, 33). Barbizan et al. (2015), in animal models, found that a period of 20 minutes of dry-time resulted in effects which were as negative as the ones yielded by 60 or 90 minutes (33). Donaldson & Kinirons (2001), assessed the relation of resorption and dry-time each 5 minutes until total dry-time reached 60 min. They found that the dry-time limit of 15 min was the turning point, being significantly associated with the presence of root resorption. All superior time limits were also found to be related to this outcome while time limits of 5 and 10 min were not associated with resorption (25). In addition, the possibility of resorption grows if the tooth is kept dry for more than only 5 min; for every 10 minutes dry, the tooth has the root resorption risk raised by almost 30% (17). Legally, however, authors point out that after 5 minutes, tooth replantation should be considered as “delayed” in order to better predict or justify the possible outcomes (34). These findings indicate that unless dry -time is minimum, or preferably none, the occurrence of resorption should be widely expected.

Storage medias as influence factors:

Hank’s Balanced Salt Solution (HBSS) has been described in the literature as a reliable media specifically developed for cell maintenance, however it’s not readily available for common use, therefore, alternative more accessible

substances have been analyzed (8). Recently, a systematic review was dedicated to investigate which is the most recommended storage media for avulsed teeth based on laboratorial studies (35). Authors report that although milk (whole, skimmed, baby formula, goat milk, and others) is still widely recommended, for the past 17 years, other natural products have been suggested as suitable storage medias: green tea extract, propolis, coconut water, aloe vera, egg white, royal jelly, rice water, soya milk and cranberry juice amongst others (35).

There is an abundance of *in vitro* (36, 37) and *in vivo* (38, 39) researches regarding storage medias. A review carried out by Poi et al. reported that milk is the best storage medium aside from manufactured and specialized medias such as HBSS™ and Viaspan™(8). On the other hand, due to the variability of parameters used in the studies, a review pointed out that the literature cannot establish the best storage media for replanted teeth via animal models (40). Few crossectional studies are dedicated to verify the exclusive correlation of the medias and the period of storage (apart from the dry-time) with resorption. Petrovic at al., found no influence on the possible outcomes (functional healing, inflammatory and replacement resorption) in relation to the storage media (7).

As a matter of fact, determining the extent of the influence of storage medias is difficult since retrospective studies often dichotomize the storage conditions into dry and wet, although wet medias include a variety of substances (saliva, saline, milk, etc.). Also, patients commonly maintain their tooth dry for a portion of time and then immerse them in a chosen storage media for another period (13, 14).

Concurrent lesion to the same tooth

Any major traumatic lesion which has the power to sever pulp's bloody supply and damage PDL is likely to result in External Root Resorption. However, the literature indicates that the presence of associated crown fractures facilitates the inflow of bacteria to the root canal causing the process of necrosis to progress more rapidly which favors the installment of inflammatory External Root Resorption, especially in immature teeth (25, 28).

Furthermore, dental trauma may result in the loss of the protective extracellular matrix that covers the small areas of exposed dentine present at the

cementum-enamel junction (CEJ) (41). Without the normal protective matrix, the CEJ dentine proteins become a target to the immunologic system. This process is called External Cervical Resorption and can be also triggered by the surgical manipulation of the cervical region of the affected tooth, for example: trans-surgical crown restorations, (41, 42). This particular type of resorption may progress in order to surround the pulp; however, it does not affect it since clasts only adhere to mineralized tissues. Also, its progression does not depend on endodontic contamination (41). Therefore, it is fair to speculate that even in cases where revascularization of immature properly managed avulsed teeth is attempted, this outcome may be installed if there is harm to the CEJ.

Systemic Antibiotics and Corticosteroids

Current guidelines are not emphatic regarding the administration of systemic antibiotics since there is no consensus to enforce their usage to prevent resorption (3). The immediate prescription of antibiotic has been indicated to hinder the installment of IERR (43). However, Andreasen et al. examined the outcomes of the replantation of 400 teeth and found no relationship between the use of antibiotics and the development of full periodontal healing (14). Nonetheless, if IERR process has already taken place, systemic antibiotics will not be able to arrest the process, instead, intracanal medicaments should be used for this purpose (28, 43). On the other hand, if the IERR process is accompanied by systemic signs and symptoms such as fever, general discomfort and cellulitis, antibiotics must be prescribed (28). In this case, patients' general condition can be improved by when the antibiotic therapy is administered, but no local effects on the resorption site will take place (28).

Systemic corticosteroid prescription is not common in avulsion cases. However, it was proven that the intramuscular administration of Dexamethasone yielded inferior results when compared to its topical use regarding IERR and periodontal healing rates (44).

Intracanal medication

Endodontic pastes which combine antibiotics and corticosteroids such as Ledermix ® are available worldwide, however not in Brazil. The literature reveals that Ledermix, when inserted into the root canal within a 3 weeks period from replantation, allows surface resorption to take place at ¼ of the cases but impedes the overall development of IERR (45). The corticosteroid component present in the mixture is responsible for its antiresorptive effect since it diminishes the exacerbation of the inflammatory response, limiting the clastic activity and thus allowing the healing processes to happen in a less destructive and more favorable way (45, 46). Aside from reportedly causing the discoloration teeth (28, 46), Bryson et al. showed that this mixture is more effective than calcium hydroxide in controlling IERR (23).

On the other hand, calcium hydroxide pastes are still the medicament of choice in cases of replantation. The compounds have the advantages of inducing tissue mineralization and having powerful antimicrobial properties (46). However, it does not show anti-inflammatory effects, related to the controlling of clasts, as the corticosteroid/antibiotic pastes do (23, 28).

Current guidelines indicate that calcium hydroxide must only be inserted in the root canal after the healing process has been initiated, in a period of 7-10 days from replantation. (3, 46). This substance has the power to increase environment's pH thus promoting necrosis of bacteria, clasts and, unfortunately also of reparative cells (22, 47). If the tooth is denuded from its protective cementum and PDL, the early insertion of calcium hydroxide will rapidly increase periodontal pH since hydroxyl ions will flow freely from dentinal tubules. High pH will inhibit the proper attachment of PDL fibroblasts which impairs full periodontal healing to take place. Therefore, it is known that the early endodontic insertion of calcium hydroxide shifts the healing balance towards RERR which is the repairment of the damaged dental and periodontal tissues by bone (23, 28).

If both calcium hydroxide and Ledermix ® are available for use, a protocol which consists of immediately inserting the corticosteroid/ antibiotic paste (in order to benefit from its anti-inflammatory effect) and posteriorly using CH which due to its mineralizing and antimicrobial properties is a reportedly good alternative (28, 46, 48). Endodontic therapy and intracanal dressings are effective for the

prevention and arrest of IERR. However, they are unable to impair the development or to treat RERR cases (18, 28).

In order to succeed in neutralizing the bacteria and toxic byproducts that cause IERR, it is important that intracanal medications such as calcium hydroxide, are carefully placed throughout the root length and that the vehicles chosen to be mixed with calcium hydroxide have adequate solubility (49).

Time of pulp extirpation

The timing of pulp extirpation has been described as a crucial factor for the long term-survival of replanted teeth, especially if the root is fully developed and the possibility of revascularization is not present. However, the exact moment to initiate endodontic treatment is still a controversy (50, 51). Two things should be considered: the tooth should bel left undisturbed for a minimum of time in order to allow the periodontal fibers to heal and reconnect; on the other hand, this period is not supped to be long enough to permit that the necrotic toxins initiate the IERR process (18, 50).

Early pulp removal and calcium hydroxide placement are efficient procedures to prevent IERR, however they increase the risk of RERR. A period of 20 days until pulp extirpation is related to the onset of IERR (52). On the other hand, a period of 10-14 days is considered safe prior to the initiation of canal intervention in order to prevent the installment of IERR (51). However, current guidelines specify that closed apex replanted teeth should have endodontic treatment commenced from 7 to 10 days post replantation (3), in order to allow time for the periodontal ligament cells to heal (18). Within 10 days, periodontal cells should be reattached and the pulpal contamination due to necrosis should be minimum if present (18). Delayed pulp extirpation increases the risk of onset of IERR and its magnitude (5). A study conducted by Bastos et al. revealed that patients older than 16 years of age (complete root growth) had the risk of developing resorption increased by 1,2% for IERR and 1,1% for RERR for each day that passed from replantation to root canal treatment (5). Even if the pulp is timely extirpated, the late onset of IERR can be triggered by the unsuccessful decontamination of the root canal, reinfection due to deficient obturation or to intra-root post fixation (14).

For immature teeth, if revascularization is being attempted, close observation should be carried out. If any sign of pulp necrosis appears, pulpectomy should be performed immediately (7). However, the early stages of bacterial onset in the root canal may be hard to detect and while dentists and patients hope for revascularization to occur, an IERR process may be already in development (7). Petrovic et al., reported that 4 out of 6 immature teeth with the possibility of revascularization, actually developed IERR (7). Once IERR has been established in opened-apex teeth, it will progress quickly because the dentine tubules are wide (favoring the flow of bacteria) and there is less mineralized tissue to be reabsorbed (21).

Splinting

The use of semi-rigid splinting is advocated for replanted teeth (53). They are made of small diameter (up to 0,5mm) orthodontic wires or nylon lines (53). When the alveolar bone is fractured the use of a rigid splinting (0.9 mm orthodontic wire) is initially recommended in order to provide a more stable retention and favor bone healing (53). The use of rigid splints impairs tooth's physiological movement, which favors ankylosis (18). Furthermore, the maintenance of splints for long periods of time also contributes to the fusion of tooth structure to the alveolar bone if there is significant damage to cementum. Ideally, if no bone fracture is present semi-rigid splints should be kept in place for up to 7-14 days (3, 52, 53). If there are bone fractures, rigid splints should be maintained for 4 to 8 weeks (53). In spite of influencing the risk of RERR, splinting time does not affect the prevalence or the magnitude of IERR (5).

Immunologic characteristics

In order to investigate genetic predispositions to developing replacement or inflammatory resorptions in case of avulsion, the connection between the presence of biomarkers and the outcomes of replanted teeth was examined (29, 54, 55). Although the aforementioned relationship between age and the expression of antiresorptive, Interleukin 4 (IL4) may influence the mechanisms of root resorption (29, 31), the genomic variations of this cytokine, also referred as single nucleotide polymorphisms, had no association with the installment of neither IERR or RERR (56).

Atopy is the individual predisposition towards being hypersensitive to allergens, therefore atopic patients have a predominant T-helper 2 lymphocyte (Th2) immunologic profile and an increased humoral response (20, 55). Being atopic has an advantageous effect against resorption of replanted teeth over 1-year period since these patients' anti-inflammatory cytokine response is exacerbated (55). Non- atopic patients possess a balance between Th2 and T-helper 1 lymphocyte profiles, Th1 cells produce proinflammatory cytokines which are related to innate/cellular immune response (20, 55). Over a 5 years period, it was demonstrated that non-atopic patients loose fewer teeth due to IERR while atopic patients loose fewer replanted teeth due to RERR (20).

Patient's compliance

The post-replantation treatment requires multiple visits and interventions in attempt to minimize and control the numerous unfortunate outcomes that may derive from trauma. As the tooth become stable or sings of acute inflammation disappear, authors state that patients start losing interest in treatment after the period of 2 months, only returning to the dental care if pain or other unpleasant symptoms are present once again (7). For younger patients, wide intervals between appointments are even more harmful then for adults since youngster's bone turnover rate cause infraposition due to RERR to advance quickly (13). Also, the progression of IERR in these patients is faster do to dentinal tubules diameter. Kenny and Casas, reported that clinicians should to inform parents and patients of all aspects related to treatment costs and time commitment in order to increase the sense of responsibility and to avoid unrealistic expectations regarding the possible outcomes of avulsion (34).

Case Reports

CASE #1

A Fifty-one-year-old female patient was attended at the Dental Emergency Service at the Federal University of Uberlandia after suffering avulsion and replantation of the right maxillary central incisor. The patient, after slipping and falling from her own height noticed that her lip had been cut and her tooth had been knocked-out. She immediately stored the incisor in tap water and sought for

dental care. The tooth was replanted approximately 40 minutes from the accident. A semi-rigid splint was confectioned using composite resin and a 1mm nylon fishing line. Antibiotics (amoxicillin 500mg / 3 times a day) were prescribed and then she was referred to the Dental Trauma Clinic for further treatment. After 15 days from the accident the endodontic treatment was initiated, root canals were neutralized with 2,5% sodium hypochlorite, canals were instrumented and filled with Ultracal XS™ (Ultradent, Indaiatuba, SP, Brazil). No signs of edema and fistula were observed. Since the tooth still presented a small degree of mobility which was uncomfortable to the patient, the splint was maintained for one more week, and removed after this period. After 1 month from the root canal access, the tooth was again instrumented and irrigated, the medication was renewed but the obturation was not carried out since the patient complained of a minor discomfort during instrumentation at the foraminal length. There was no spontaneous pain, swelling of fistula, therefore no systemic medication was prescribed.

Thirty days later, after the patient reported no unpleasant symptoms, the root canal was obturated using gutta-percha cones and AH PLUS sealer (Dentsply, Rio de Janeiro, RJ, Brazil) by using the lateral condensation technique. At one-month follow-up appointment horizontal and vertical percussion tests resulted in no painful symptoms, however they revealed a dull sound, compatible with ankylosis. The PDL space showed a small area of discontinuity at the distal portion of the root, suggesting ankylosis. No fistula, edema or discomfort were reported.

After 3 months, the same signs and symptoms were verified, including the apparent small area of ankylosis that could be seen without progression in the radiographic examination. The 6-months follow up showed absence of mobility, normal tooth color, no pain, edema or fistula, regular gingival contour. The sound to percussion was characteristic of an ankylosed tooth. The patient reported no discomfort, the radiographs revealed that the area of PDL space discontinuity had progressed. At the 1 year follow up there were no signs of infection or pain, the tooth was immobile and the percussion tone was highly metallic. The resorption area on the distal portion of the medium third of the root enlarged and in the apical region a PDL could not be radiographically detected. The crown color remained normal (Fig.1). According to the patient, the tooth is fully functional.

CASE #2

A 11 year-old boy was attended at the Dental Emergency of the Federal University of Uberlandia after experiencing avulsion of the right lateral incisor. He claimed that after getting out of a pool, he slipped on the wet floor bumping his face against the ground. The tooth was immediately found, rinsed in tap water and stored in chlorinated pool water for 1 hour until the replantation moment. Then, a semi-rigid splint was made using composite resin and a 1mm thick stripe taken from a saline solution bottle and left undisturbed for 10 days. Dipyrone was prescribed (40 drops /3x day for 3 days). Patient was then referred to the to the Dental Trauma Clinic of the Federal University of Uberlandia. Initial and subsequent radiographic examinations revealed the presence of a supernumerary tooth located between the patient's maxillary central incisors. The patient and his family were informed, but they demonstrated no interest in removing the supernumerary tooth.

The endodontic treatment was initiated after 15 days from the accident. Root canals were instrumented, sanitized with 1,0% sodium hypochlorite, paper dried and filled with Ultracal XS™ (Ultradent, Indaiatuba, SP, Brazil). Endodontic access was sealed with composite resin (Filtek Z350, 3M Espe, St. Paul, MN, USA). No edema, fistula or pain were present. After 1 month the root canal was obturated using gutta-percha and AH PLUS sealer (Dentsply, Rio de Janeiro, RJ, Brazil) using the lateral condensation technique.

Patient failed to attend the 1 and 3-month follow up appointments. After 6 months from endodontic obturation the patient returned, no painful symptomatology or sings of periodontitis were reported. Tooth color was normal and a dull sound to percussion was verified. The neighboring teeth presented vitality. The medium third of the root presented signs of ankylosis since the bone seems to be invading the root and de PDL space is discontinued.

At the one-year follow-up patient demonstrated no pain or signs of infection. Sound to percussion was indicative of ankylosis and the radiographs revealed the stagnation of the resorptive process. Patient reported being asymptomatic at the 18- months follow-up. Tooth coloration had normal appearance. Percussion yielded a dull sound and the tooth was immobile. Radiographic exams revealed that PDL discontinuity seemed to be located mainly in the mesial mid-section of the root.

Two-years follow-up clinical findings were similar to the previous consultation. Altered tone to percussion and immobility suggest ankylosis. The radiographic exams confirmed resorption. In comparison with adjacent teeth, the replanted right lateral incisor presented a mild vestibularization and infraocclusion which were not detected by the patient or his family members (Fig.2).

CASE #3

An 8-year-old boy was reported at the Dental Emergency of the Federal University of Uberlandia with avulsion of the upper left central incisor while playing at a trampoline. The tooth was immediately retrieved, rinsed in tap water and kept immersed in milk for 60 minutes prior to replantation. No systemic antibiotics were prescribed. The tooth was replanted, a composite resin splint was made and the patient was referred to the Dental Trauma Clinic.

After 13 days of the tooth replantation, as the tooth had no altered mobility, the splint was removed. During the same session, sensitivity tests were conducted yielding positive results for all upper incisors, including the avulsed one, which led to the hope of revascularization. Seven days later, the sensitivity test was repeated, however, the tooth responded negatively, so the endodontic treatment was immediately commenced. A calcium hydroxide powder and saline solution were mixed and the paste was inserted into the root canal using a Lentulo carrier (Dentsply Maillefer, Rio de Janeiro, RJ, Brazil). The root canal aperture was sealed with glass ionomer cement Maxxion R (FGM, Joinvile, SC, Brazil) and the patient was schedule for an appointment at the following month. The patient, however only returned after 60 days presenting no signs of inflammation or infection. As no mineralized barrier was detected, the medication was renewed.

Finally, after 1 month, the formation of a mineralized apical barrier was confirmed (Fig. 2), then the endodontic obturation was carried out using gutta-percha cones and AH PLUS sealer (Dentsply Maillefer, Rio de Janeiro, RJ, Brazil) by using lateral condensation. At this point, the tooth had no mobility and during percussion, it was noticed that the tooth yielded a dull sound.

Patient failed to attend the 1 month follow up, returning after 60 days from obturation. Pain, edema, fistulae and crown color alterations were not observed. No infraposition was identified at this point, however the tooth did not present

physiological mobility, an ankylosis suggestive sound was yielded during percussion tests. The radiographic exam showed no periodontal ligament space at the apical third and a loss of toot structure was detected at the distal portion of the medium third (Fig.3) Patient's family was informed that the tooth needed to be closely monitored, nonetheless, 6 and 9 nine months visits were missed. Adjacent teeth presented normal responses to vitality tests.

At the one-year follow-up, there was no signs of infection or inflammation. Tooth color was normal and no discomfort or functional alteration were reported. Percussion tests resulted in highly acute sounds and tooth mobility was absent. During clinical examination infraposition was verified, however, it has gone unnoticed by the patient and his family. The radiographic examinations demonstrated a loss of dentin in the distal portion of the medium third, which was substituted by bone tissue (Fig.3). Patients' family was instructed that orthodontic, surgical and prosthetic procedures could be required to avoid bone discrepancies due to ankylosis and that infraposition and adjacent teeth tilting tended to become worse if untreated. At the 18-month follow-up patient's family demonstrated more interest in reparative treatment. Clinical exams confirmed the absence of mobility. The tone to percussion was metallic, tooth coloration remained normal and no signs of infection were noticed. Infraoclusion caused cervical and incisal lines to be disarranged. Although anterior or posterior crossbite were not present, a transversal discrepancy could be perceived as well as the presence of a gothic palate. A Cone-Beam Computed Tomography (CBCT) was conducted and results showed external root resorption at the apical portion of the affected tooth, were an inflammatory-like lesion was also found. Ankylosis was confirmed along the root length. The left maxillary canine eruption axis is dislocated indicating that it will turn out to be impacted while the right canine seems to be in the correct eruption path (Fig.4). Due to these findings, a multiprofessional approach was planned, discussed with patient's family and initiated.

Discussion

Three cases of ankylosis were reported. In all of them, teeth were replanted within 60 minutes, however, stored in non-ideal medias. Patients

presented different ages: one adult, one child older and another younger then the age of 10yrs.

In face of the lack of the viability of periodontal cells and damage to the cementum, the authors agree that the onset of replacement resorption (ankylosis) is the best possible scenario for the patient (6, 26). The replanted tooth will eventually be lost, however, the alveolar crest height and thickness will be maintained, preserving the quantity of bone required for future placing of dental implants and the gingival aspects that will improve the esthetic prognosis of prosthesis (11,12). On the other hand, tooth ankylosis represents a challenge for the treatment of growing patients (26). When the ankylosis is diagnosed earlier than the age of 10yrs or before the growth spurt, the infraposition of the ankylosed tooth may increase rapidly (12) causing the alveolar crest to be defective and the adjacent teeth to tilt since interdental fibers are still connecting them to the replanted tooth (12). In these cases, the avulsed tooth does not accompany the vertical development of the face and dentition, therefore, impairing normal growth, as seen in the reported cases.

Several protocols such as, osteotomy surrounding the tooth, surgical dislodgement and repositioning (57), orthodontic traction after luxation (58), osteogenic distraction (59), have been proposed to treat ankylosed teeth in growing patients aiming to conserve tooth's structure as intact as possible. Other treatment options include the removal of the affected tooth and the management of the edentulous space such as auto transplantation followed by re-anatomization of teeth, orthodontic space closure by using fixed appliances (57). Prosthetic bridges fixation and implant insertion are viable alternative for adults ankylosis cases, however not for children and young adolescents (60).

In order to maintain alveolar heights for future rehabilitation procedures, decoronation is a widely advocated technique (11, 12, 60, 61). It consists of the removal of the tooth's crown using a diamond bur under saline irrigation, the endodontic filling is removed and root canal is rinsed and left to be filled with blood, a mucoperiosteal flap is positioned over the alveolus and then sutured (11). This procedure allows a new periosteum to develop on top of the alveolar ridge; the eruption of the neighboring teeth grants the bone apposition on top of the interdental septum due to the stimulus provided by the traction of periodontal and gingival fibers (11). Therefore, the bone height can be normalized without the

growth arrestment caused by the ankylosed tooth (11). This technique presents itself as a viable measure for rehabilitating teenagers who underwent reimplantation and suffered ankylosis. The possibility of decoronation serves as an encouragement to the replantation of all avulsed teeth, even the ones with inviable of PDL remnants (11, 12). On the other hand, the replantation of all teeth, including those kept under unideal circumstances is not a consensus. A study conducted in 2005 reported that clinicians often neglect the fact that a replanted tooth is fated to ankylosis because it is a sequela that will not be manifested immediately. Also, they do not wish to be guilty of not trying to save a tooth, despite of its background (34). The authors imply that, before replanting a tooth, clinicians should provide realistic information regarding the prognosis of replantation in relation to tooth's storage conditions and patient's age in order to be preserved from legal implications that may follow unfavorable outcomes (34). In addition, parent's must be aware of the subsequent financial costs and approximate treatment duration (number of dental appointments) that will follow from replantation (34, 62).

The current study presented 2 scenarios were extra-alveolar time was of 1 hour. On the case #2 featured an 11-year-old boy whose tooth was maintained in chlorine solution, a non-ideal solution, which resulted in a mild- infraposition due to ankylosis. On the other hand, a younger patient (8-years-old) featured on Case #3 had the tooth stored for the same period of time in milk, which is the most advocated media to this purpose, however severe ankylosis was also installed. Amongst other aspects, the combination of exceeding extra-oral time and age seems to be of major importance when it comes to establishing replanted teeth's prognosis. Adults outcomes tend to be more favorable then youngsters. On the case report #1 featured a mature woman whose tooth was only replanted after 40 minutes, which is within the maximum time limit advocated by the IATD, however, it was maintained in tap water which is not a osmolality balanced media (3). Clinical examination confirmed ankylosis, nonetheless, its impact on the facial development was not significant.

Clinicians, parents and patients must be realistic regarding the prognosis of the avulsion outcomes. A recent metanalysis showed that 51% of the replantation cases resulted in RERR, 23% in IERR and 13,3% in surface resorption (19). Therefore, it is reasonable to expect some root resorption when

dealing with replanted teeth. The relation of influence factors and the onset of surface, inflammatory or replacement root resorptions, is however, not sufficiently known by professionals (15). In fact, clinicians often tend to avoid treating trauma involved teeth since their management require specific theoretical and practical knowledge, which may not be common to their clinical routine (15).

Conclusion

The occurrence of root resorption should be expected in replantation cases. The presence or absence of several influence factors may determine which type of root resorption may be developed. The age of the patient is crucial to the prediction of the prognosis. Parents and clinicians must bear realistic expectations towards replantation cases in younger patients.

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Figure Legends

Figure 1: First clinical case description: A. Radiography of obturation; B. Radiography of 1 month of follow-up; C. Radiography of 3 month of follow-up; D. Radiography of 6 month of follow-up; E. Radiography of 1 year of follow-up; F. clinical image of the any alteration of periodontium and also teeth without any dental color alteration.

Figure 2: Second clinical case description. A. semi-rigid splinting made with plastic strip extracted from saline bottle; B. Radiography after replantation; C. Radiography of obturation; D. Radiography of 6 month of follow-up; E. Radiography of 1 year of follow-up; F. Radiography of 1.5 year of follow-up; G. clinical image of the any alteration of periodontium and also teeth without any dental color alteration.

Figure 3: Third clinical case radiographies sequence. A. Radiography after replantation; C. Radiography of endodontic file limitation the penetration by apical mineralized barrier; D. Radiography of 6 month of follow-up; E. Radiography of 1 year of follow-up; F. Radiography of 1.5 year of follow-up; G. clinical image of the any alteration of periodontium and also teeth without any dental color alteration.

Figure 4: Third clinical case postoperative tomography after 1.5 year of follow-up; A. axial slices image of replanted tooth; B. 3D reconstruction of CBCT images showing healing process; C. axial view of 3D reconstruction of CBCT images of replanted central incisor; D. Frontal view of 3D reconstruction of CBCT images of replanted central incisor; E. clinical image of the any normal periodontium and dental color, however demonstrating the necessity of orthodontic intervention.

Figures

Figure 1:

Figure 2:

Figure 3:

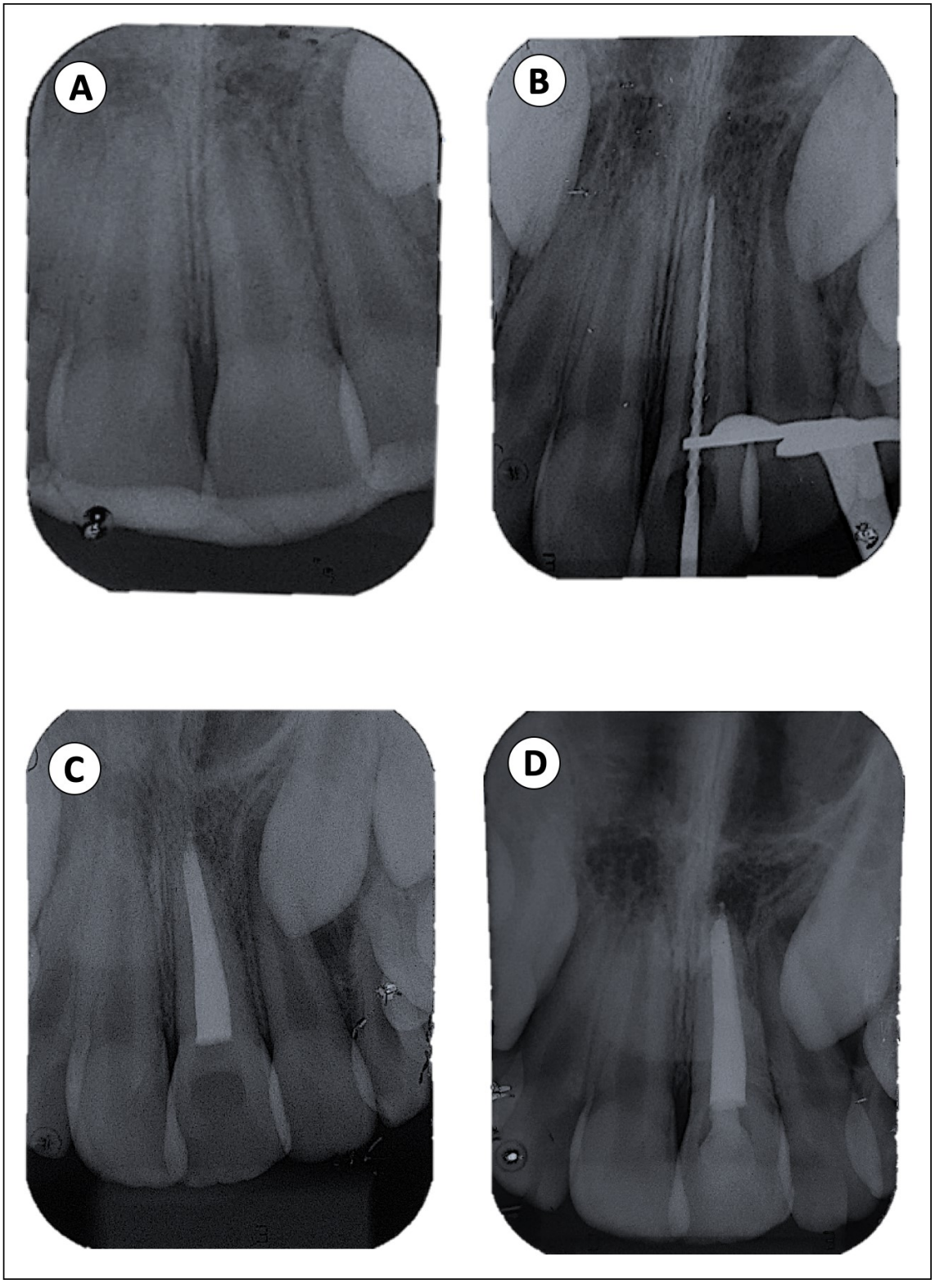
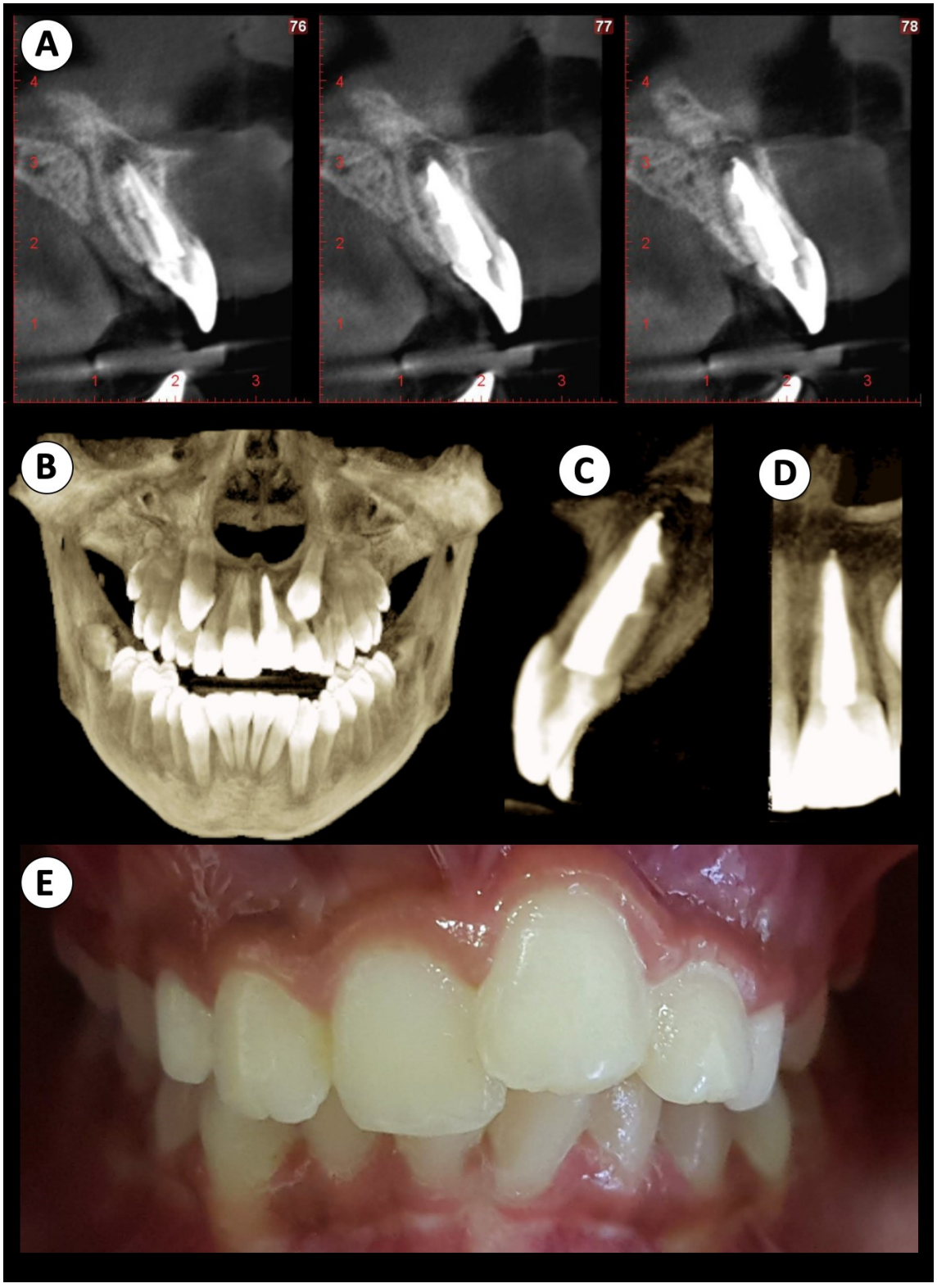


Figure 4:



CONCLUSÕES

4- CONCLUSÕES

Dentro das limitações metodológicas impostas pelo delineamento deste trabalho que envolveu a realização de um levantamento epidemiológico acerca das particularidades dos casos de avulsão atendidos em um serviço público especializado, a verificação do nível de conhecimento apresentado por pessoas envolvidas com o grupo de risco e a análise dos fatores influenciadores para o sucesso do reimplante dental, concluiu-se que:

- Crianças e adolescentes jovens constituem o grupo de risco para a ocorrência de avulsões dentárias e que grande maioria dos dentes avulsionados não são imediatamente reimplantados e tampouco manejados corretamente.

- O nível de conhecimento das pessoas as quais se relacionam diretamente com o grupo de risco varia de acordo com sua idade e profissão. Grande parte dos indivíduos expostos à necessidade de ação frente a casos de avulsão não possuem informações suficientes para lidar com este tipo de acidente de maneira adequada.

- Reabsorções radiculares são desfechos comumente encontrados em casos de reimplante de dentes avulsionados e o seu impacto é especialmente prejudicial às crianças em fase de desenvolvimento.

- O grupo de risco composto por crianças e adolescentes torna-se exposto à sérias sequelas derivadas da avulsão, já que sua idade e o inadequado manuseio dos seus dentes pelas pessoas que os rodeiam estão diretamente ligados ao desenvolvimento de quadros de reabsorção.

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5- REFERÊNCIAS

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ANEXOS

6.1- Anexos relacionados ao Capítulo 1

6.1.1- Aprovação pelo Comitê de ética em pesquisa

UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Avaliação Epidemiológica dos casos de avulsão dentária atendidos na clínica de traumatismo da faculdade de odontologia da UFU.

Pesquisador: Carlos José Soares

Área Temática:

Versão: 2

CAAE: 49799515.0.0000.5152

Instituição Proponente: Universidade Federal de Uberlândia/ UFU/ MG

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.516.162

Apresentação do Projeto:

Os pesquisadores pretendem realizar um estudo epidemiológico relacionado com o trauma sofrido e as particularidades do manejo do dente referentes aos casos de avulsão dentária atendidos na Clínica de Traumatismo Dentoalveolar da FOUFU. Neste sentido, segundo os pesquisadores, ainda há na literatura insuficientes estudos que discorram sobre a epidemiologia do trauma dental e por isso, a importância da realização deste projeto. O estudo será baseado na análise de 74 prontuários dos pacientes acometidos por avulsão dentária atendidos no serviço da Clínica de Traumatismo Dentoalveolar da FOUFU e visa coletar um conjunto de informações que sirvam como embasamento e direcionamento na formulação de ações preventivas e informativas direcionadas ao público acometido e seus familiares no que diz respeito ao traumatismo dentoalveolar; e também para orientar as autoridades em relação à eficiente alocação de recursos e serviços para o tratamento destes tipos de injúria.

Objetivo da Pesquisa:

Conhecer as características dos casos de avulsão dentária atendidos na Clínica de Traumatismo Dentoalveolar da FOUFU no que diz respeito ao perfil dos pacientes (gênero e idade), número e posição dos dentes acometidos, etiologia e características do trauma sofrido, lesões adjacentes e

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manejo do dente avulsionado.

Avaliação dos Riscos e Benefícios:

Riscos: Segundo os pesquisadores existe o risco da identificação do sujeito de pesquisa, porém a equipe se compromete a tratar os dados dos pacientes de maneira sigilosa.

Benefícios: Os pesquisadores referiram como benefícios desta pesquisa, a contribuição para a ampliação do conhecimento acerca de avulsões dentárias, do perfil dos pacientes acometidos e das características do trauma. Estas informações poderão embasar ações educativas e preventivas direcionadas ao público específico.

Comentários e Considerações sobre a Pesquisa:

Pesquisa de relevância social.

Considerações sobre os Termos de apresentação obrigatória:

Foram encontrados na plataforma Brasil todos os documentos requeridos de acordo com as normas estabelecidas, entretanto, os pesquisadores solicitaram dispensa do TCLE. Este pedido foi justificado em que a realização do trabalho de pesquisa será baseada nas informações contidas nos prontuários dos pacientes acometidos por avulsão dentária da Clínica de Traumatismo Dentoalveolar da UFU, as quais foram coletadas no momento da anamnese feita para a admissão do paciente para tratamento no período de 2005 a 2014.

Recomendações:

Não há

Conclusões ou Pendências e Lista de Inadequações:

As pendências apontadas no parecer consubstanciado número 1.450.026, de 14 de Março de 2016, foram atendidas.

De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.

O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Considerações Finais a critério do CEP:

Data para entrega de Relatório Final ao CEP/UFU: Maio de 2017.

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OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa e os Termos de Consentimento Livre e Esclarecido, assinados pelo sujeito de pesquisa.
b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.
c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução CNS 466/12, não implicando na qualidade científica do mesmo.

Orientações ao pesquisador :
• O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma via original do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.
• O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS 466/12), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.
• O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS 466/12). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.
• Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e).

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Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_597696.pdf	09/04/2016 10:35:45		Aceito
Outros	RESPOSTA_PENDENCIAS_PROJETO_EPIDEMIOLOGICO_ABRIL_2016.docx	09/04/2016 10:35:11	Gabriela Campos Mesquita	Aceito
Projeto Detalhado / Brochura Investigador	EPIDEMIOLOGICO_PROJETO_CORRIGIDO_PENDENCIAS_ABRIL_2016docx.docx	09/04/2016 10:33:14	Gabriela Campos Mesquita	Aceito
Outros	PlanilhaColetaDadosEpidemiologicosProntuarios.xlsx	02/10/2015 02:22:18	Gabriela Campos Mesquita	Aceito
Outros	EpidemiologicoAutorizacaoInstituicao.jpeg	30/09/2015 23:00:20	Gabriela Campos Mesquita	Aceito
Folha de Rosto	EpidemioFolhaDeRosto_Submetido.pdf	30/09/2015 22:46:57	Gabriela Campos Mesquita	Aceito
Declaração de Instituição e Infraestrutura	Epidemio_DeclaracaoInstituicaoCopartic ipante.jpeg	30/09/2015 22:40:50	Gabriela Campos Mesquita	Aceito
Declaração de Pesquisadores	Epidemio_TermoEquipe.jpeg	30/09/2015 22:39:39	Gabriela Campos Mesquita	Aceito
Outros	LinkCurriculoLattes.docx	30/09/2015 22:39:05	Gabriela Campos Mesquita	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

UBERLANDIA, 19 de Abril de 2016

Assinado por:
Sandra Terezinha de Farias Furtado
(Coordenador)

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6.2. Anexos Relacionados ao Capítulo 2

6.2.1 Aprovação pelo Comitê de Ética em Pesquisa

UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Atendimento à pacientes com Traumatismo Dento-Alveolar no município de Uberlândia - conhecendo a realidade em busca de alternativas para melhor prognóstico (Interface Extensão-Pesquisa-Ensino)

Pesquisador: Alfredo Júlio Fernandes Neto

Área Temática:

Versão: 2

CAAE: 16533713.7.0000.5152

Instituição Proponente: FACULDADE DE ODONTOLOGIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 397.231

Data da Relatoria: 13/09/2013

Apresentação do Projeto:

Os traumatismos dento-alveolares representam, atualmente, um problema mais preocupante que as cáries. Os índices de cárie têm sido cada vez menores no Brasil. O trauma na cavidade bucal ocorre frequentemente e abrange 5% de todas as lesões de pessoas que procuram tratamento odontológico. Nas crianças pré- escolares esse índice figura em torno de 18% de todos os traumas. A hipótese deste trabalho é que a maioria das pessoas que presenciam estes acidentes com avulsão dentária não estão preparadas para prestar os primeiros socorros às vítimas por não terem conhecimento dos procedimentos a serem executados imediatamente após o acidente. Dessa forma, esta pesquisa busca conhecer a realidade epidemiológica quanto aos traumatismos dento-alveolares em parte da cidade de Uberlândia através de questionários destinados ao público leigo, a estudantes de odontologia e a cirurgiões dentistas.

Objetivo da Pesquisa:

Primário: Conhecer a realidade epidemiológica quanto aos traumatismos dento-alveolares em parte da cidade de Uberlândia, principalmente sobre a Avulsão dentária.

Secundários: Diagnosticar através de questionários específicos o conhecimento de parte da

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comunidade, de parte dos profissionais envolvidos na educação e de parte dos cirurgiões dentistas a cerca do tema "Avulsão", após traumatismo dentário. Esse conhecimento permitirá a elaboração de manual de normas e condutas para os diferentes tipos de traumatismos dento-alveolares, especialmente a avulsão dentária (baseado nas diretrizes internacionais propostas pela International Association for Dental Traumatology) e, posteriormente, permitirá a realização de ações de educação para a saúde em parte da cidade de Uberlândia e região, bem como parte da população e de profissionais envolvidos na educação como professores e educadores físicos.

Avaliação dos Riscos e Benefícios:

Segundo os pesquisadores:

Riscos: identificação do indivíduo. Compromete-se a manter sigilo da pessoa que responder aos questionários, codificando-os.

Vulnerabilidade: alunos dos cursos de odontologia serão alocados no estudo. Compromete-se a manter liberdade de ir e vir.

Benefícios: Parte da população da cidade de Uberlândia poderá ser beneficiada pelos dados epidemiológicos desta pesquisa com relação ao conhecimento da comunidade sobre a avulsão dentária e os produtos que ela terá como consequência, que serão: elaboração de uma cartilha informativa sobre conduta em casos de avulsão, palestras nos locais de aplicação dos questionários, possibilidade de melhora no prognóstico dos casos de traumatismo dento-alveolar uma vez que os primeiros socorros poderão ser executados de forma apropriada.

Comentários e Considerações sobre a Pesquisa:

Metodologia: estudo epidemiológico com a aplicação de dois diferentes formatos de questionários (o primeiro destinado ao público leigo e o segundo destinado a alunos de odontologia e cirurgiões dentistas).

Critérios de inclusão: Serão incluídos na pesquisa os indivíduos de ambos os sexos, com faixa etária entre os 18 e 60 anos de idade, que aceitarem espontaneamente participar da mesma e que se enquadrarem aos grupos determinados.

Critérios de exclusão: indivíduos que não se enquadrem na faixa etária proposta na pesquisa, que se recusarem a responder o questionário, e que não se enquadrarem em algum dos grupos determinados na pesquisa.

Análise de dados: análise qualitativa indicando o maior ou menor nível de conhecimento dos participantes a respeito dos procedimentos avaliados.

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Considerações sobre os Termos de apresentação obrigatória:
Termos adequados.

Recomendações:
não há.

Conclusões ou Pendências e Lista de Inadequações:
TCLE adequado.
Esclarecido ao nome Aletheia Morais Rocha como responsável por obter os formulários dos alunos da FOUFU, não se aplicando a vulnerabilidade, já que esta é aluno de pós doutorado.
O critério de escolha dos locais de aplicação dos questionários foi de ter o interesse em participar da pesquisa. Declaram que codificarão, não havendo risco de identificação.

As pendências apontadas no parecer 345.727 foram atendidas.

De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.
O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

Considerações Finais a critério do CEP:
Data para entrega de Relatório Final ao CEP/UFU: março de 2014.

OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa

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e os Termos de Consentimento Livre e Esclarecido, assinados pelo sujeito de pesquisa.
b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.
c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução 466/12/CNS, não implicando na qualidade científica do mesmo.

Orientações ao pesquisador :
¿ O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma cópia do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.
¿ O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.
¿ O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária ¿ ANVISA ¿ junto com seu posicionamento.
¿ Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e). O prazo para entrega de relatório é de 120 dias após o término da execução prevista no cronograma do projeto, conforme norma.

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6.3 - Release para Imprensa

Modalidade: Pesquisa Científica. **Assunto:** Tese defendida no Programa de Pós-Graduação em Odontologia – Faculdade de Odontologia, UFU.
Autores: Gabriela Campos Mesquita, Profa. Dra. Priscilla Barbosa F. Soares e Prof. Dr. Carlos José Soares (Orientador Responsável).

A avulsão dental é o total desprendimento de um dente da boca causado por um acidente. É um problema muito e que gera sérios transtornos ao paciente acometido, tais como dificuldades de fala, mastigação e que devido à falha estética prejudica a vontade de sorrir. No intuito de fornecer embasamento necessário para a elaboração de políticas públicas que informem a população sobre a prevenção e os primeiros socorros a serem oferecidos à vítima, os pesquisadores da Clínica de Traumatismo Dentoalveolar da Faculdade de Odontologia da Universidade Federal de Uberlândia, realizaram uma pesquisa que envolveu a coleta de dados de pacientes atendidos ao longo de 12 anos no serviço, um levantamento do nível de conhecimento que membros da comunidade têm sobre o problema e uma revisão bibliográfica.

Os resultados mostraram que crianças e adolescentes de 6 a 15 anos constituem aproximadamente 60% do público atingido e que grande parte dos acidentes são causados por quedas de bicicleta. A pesquisa revelou ainda que embora a conduta ideal seja a recolocação imediata do dente em seu lugar, em apenas 0,7% dos casos isso não aconteceu. Caso não seja possível reimplantar o dente de imediato, é necessário que este seja prontamente imerso em leite para evitar seu ressecamento e que o paciente receba tratamento o mais rapidamente possível. No entanto, revelou-se que mais de 30% dos dentes foram mantidos a seco e que em 6.5% dos casos, a vítima só procurou ajuda depois de 6 horas.

O estudo mostrou ainda que pessoas as quais estão rotineiramente em contato com crianças tais como pais, professores de ensino fundamental e professores de educação física, assim como indivíduos que se preparam para futuramente lidar com crianças tais como estudantes de Letras, Pedagogia e Educação Física têm níveis de conhecimento discrepantes em relação à avulsão. Quando questionadas sobre quais as melhores medidas a tomar frente a estes casos, 65% dos professores e 49% dos pais acertaram a maioria das

perguntas enquanto apenas 10% dos graduandos em letras apresentaram um bom nível de conhecimento sobre o assunto.

Os pesquisadores advertem que o manuseio inadequado de um dente avulsionado, como a sua manutenção por períodos superiores a 20 minutos em meio seco ou a imersão em água, saliva ou soro por tempo prolongado pode prejudicar a longevidade do dente, mesmo depois de reimplantado na boca. Dentes conservados de maneira errada podem sofrer reabsorções no futuro prejudicando especialmente crianças e adolescentes, já que o correto desenvolvimento da arcada dentária poderá ser comprometido.

Sendo assim, é importante que em casos de avulsão o dente seja reinserido imediatamente. Caso isto seja impossível, ele deverá ser mantido no leite e a vítima prontamente encaminhada ao dentista. A Clínica de Traumatismo Dentoalveolar funciona nas dependências do Hospital Odontológico da UFU e há mais de 15 anos oferece um serviço gratuito e especializado a pacientes de Uberlândia e Região.

Contato: Secretaria PPG Odontologia, Fone: (34) 32258115