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CASE REPORT
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SUVI NAČIN TRANSPORTA I ODLOŽENA REPLANTACIJA AVULZIRANOG ZUBA-TERAPIJA I ISHOD

DRY EXTRAORAL STORAGE AND DELAYED REPLANTATION OF AVULSED TOOTH- THERAPY AND OUTCOME

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Sažetak

Uvod: Cilj rada bio je da prikaže terapijski postupak i ishod replantacije avulziranog, stalnog centralnog, maksimalnog sekutića, nađenog na mestu velike kontaminiranosti, nakon ekstraoralnog perioda od 15 sati i suvog načina transporta.

Prikaz slučaja: Kliničkim pregledom utvrđeno je to da je koren dostigao punu dužinu, sa paralelnim ivicama, što je odgovaralo uzrastu devojčice od 8,5 godina. Nakon pažljivo uklonjenog nekrotičnog periodontalnog ligamenta sa korena, obavljen je ekstraoralni endodontski tretman. Uklonjena je pulpa, odustalo se od interseansnih medikamentoznih punjenja i pristupilo se definitivnoj opturaciji kanala korena zuba. Zub je vraćen u alveolu i urađena je imobilizacija žičano-kompozitnim splintom. Nakon replantacije, praćeno je stanje zuba. Zamenska resorpcija i dentoalveolarna ankiloza nastupile su posle devet meseci, a zatim je cervikalna inflamatorna resorpcija dovela do gubitka zuba nakon tri i po godine.

Zaključak: Postignuti rezultat može se smatrati uspehom, budući da je to vreme replantirani zub odgovorio razvojnim, funkcionalnim i estetskim zahtevima, što je posebno važno u periodu intenzivnog rasta i razvoja deteta.

Gljučne reči: avulzija, stalni zub, dug ekstraoralni period, replantacija, zamenska resorpcija

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Abstract

Introduction: The aim of this study was to present the therapeutic procedure and the outcome of replantation of the avulsed permanent central maxillary incisor, found at the site of high contamination, after an extraoral period of 15 hours and dry transport.

Case report: By clinical examination it was determined that the root reached the full length, with parallel edges, which corresponded to the age of the girl- 8.5 years. After carefully removing the necrotic periodontal ligament from the root of the tooth, extraoral endodontic treatment was performed. The pulp was removed, the multi-session intracanal medicament fillings were avoided and the definitive obturation of the root canal was performed. The tooth was returned to the alveolar socket and immobilized with a wire-composite splint. After replantation, the condition of the tooth was monitored. Replacement resorption and dentoalveolar ankylosis occurred after nine months, and then cervical inflammatory resorption led to tooth loss after three and a half years.

Conclusion: The achieved result can be considered as a success because during this time the replanted tooth met the developmental, functional and aesthetic requirements, which is especially important in the period of intensive growth and development of the child.

Key words: avulsion, permanent tooth, long extraoral period, replantation, replacement resorption

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Uvod

Avulzija zuba je teška povreda potpornih tkiva zuba sa prekidom neurovaskularnog snopa i kompletnim istisnućem zuba iz alveolarne čašice^{1,2}. Avulzija stalnog zuba čini 0,5% do 3,0% svih povreda zuba^{1,2}. Najčešće avulziran zub, u obe denticije, je maksilarni centralni sekutić³. U najvećem broju slučajeva javlja se avulzija jednog zuba⁴, udružena sa povredama tvrdih zubnih ili parodontalnih tkiva susednih zuba⁵.

Replantacija avulziranog zuba je tretman izbora, u odsustvu lokalnih i opštih kontraindikacija. Uspeh replantacije, pre svega zavisi od vremena koje je zub proveo u ekstraoralnoj sredini, kao i od aktivnosti preduzetih na mestu nezgode i neposredno nakon toga^{1,6,7}. Kako momentalna replantacija često nije moguća, čuvanje zuba u vlažnoj sredini i što brži odlazak stomatologu (< 60 min.) povećavaju izgleda za dugoročni uspeh terapije¹. Međutim, postoje slučajevi kod kojih su, zbog udaljenosti od mesta povređivanja, do mesta ukazivanja stručne pomoći i neprikladnog suvog transporta avulziranog zuba izgledi za uspeh terapije narušeni. Treba imati u vidu da je i u ovakvim slučajevima, posebno replantacija zuba kod dece u procesu intezivnog rasta i razvoja, od velikog značaja iz razvojnih, funkcionalnih, estetskih, fonetskih i psihoemocionalnih razloga. Stoga je i cilj ovog rada bio prikazati terapijski postupak i ishod replantacije avulziranog centralnog maksilarnog sekutića, nakon suvog ekstraoralnog perioda od 15 sati.

Prikaz slučaja

Prikaz slučaja je odobren od strane Etičkog odbora Klinike za dentalnu medicinu u Nišu u Srbiji (br. 20/10-2017-9 EO) uz poštovanje načela dobrovoljnosti Helsinške deklaracije.

Devojčica stara 8,5 godina, dolazi u pratnji roditelja na Kliniku za dentalnu medicinu u Nišu u Srbiji, zbog jednog izbijenog zuba i višestrukih povreda drugih zuba i mekih tkiva lica, nakon pada sa bicikla, 15 sati ranije.

Odmah nakon povređivanja, u večernjim satima, devojčica i roditelji javljaju se stomatologu u lokalnoj zdravstvenoj ustanovi, gde dobijaju savet da potraže zub. Izbijeni zub nalaze narednog dana u prašini prometne ulice, stavljaju u papirnu maramicu i dolaze na Kliniku.

Nakon uzete anamneze od roditelja i devojčice o načinu, mestu, vremenu povređivanja i opštem zdravstvenom stanju, obavljen je radiološki i intraoralni klinički pregled.

Introduction

Tooth avulsion is a severe injury of the tooth supporting tissues with interruption of the neurovascular bundle and complete displacement of the tooth from the alveolar socket^{1,2}. Permanent tooth avulsion comprises 0.5% to 3.0% of all tooth injuries^{1,2}. The most commonly avulsed tooth in both dentitions is the maxillary central incisor³. In most cases, avulsion of the one tooth occurs⁴, usually associated with injuries of hard dental or periodontal tissues of adjacent teeth⁵.

Replantation of an avulsed tooth is the treatment of choice, in the absence of local and general contraindications. The success of replantation, depends primarily on the time the tooth has spent in the extraoral environment, as well as on the activities undertaken at the place of the accident and immediately thereafter^{1,6,7}. As immediate replantation is often not possible, keeping tooth in a humid environment and going to the dentist as soon as possible (< 60 min.) increases the chances of long-term therapy success¹. However, there are cases when the chances for the success of the therapy are decreased due to the distance from the place of injury and the place where professional help is provided and inappropriate dry transport of the avulsed tooth. It should be considered that even in such cases, especially in children during the process of intensive growth and development, tooth replantation is a method of choice, and it is of great importance for developmental, functional, aesthetic, phonetic and psychoemotional reasons. Therefore, the aim of this study was to present the therapeutic procedure and the outcome of replantation of the avulsed central maxillary incisor, after a dry extraoral period of 15 hours.

Case report

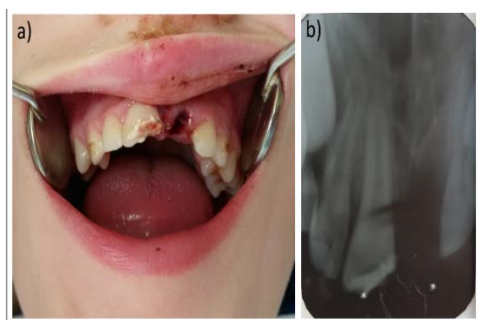
The case report was approved by the Ethics Committee of the Clinic for dental medicine, Niš, Serbia (No. 20 / 10-2017-9 EO) and it was in compliance with the principles of Helsinki Declaration.

The 8.5 year-old girl, accompanied by her parents, came to the Clinic for dental medicine, Niš, Serbia, due to one avulsed tooth and multiple injuries to other teeth and soft tissues of the face, after falling from the bicycle, 15 hours earlier.

Immediately after the injury, in the evening, the girl and her parents contacted the dentist at the local health institution, where

Utvrđeno je odsustvo levog centralnog sekutića iz alveole i utvrđena je očuvanost alveolarne kosti (Slika 1 a i b). Desni centralni sekutić imao je kosi prelom na nivou dentina bez otvaranja pulpe, u srednjoj trećini krunice i patološku pokretljivost bez dislokacije. Oba lateralna sekutića takođe su pokazivala patološku pokretljivost bez dislokacije. Test vitaliteta sva 3 sekutića^{11,12,22} bio je negativan.

Avulzirani zub imao je prelom na nivou dentina, u incizalnoj trećini krunice. Inspekcijom korena avulziranog zuba i analizom radiograma istoimenog zuba suprotne strane i susednih zuba, definisana je, orijentaciono, dentalna starost i stepen rasta i razvoja korena avulziranog zuba. Zub je imao kompletnu dužinu korena sa paralelnim ivicama, što je po Demirijanu bilo u skladu sa uzrastom devojčice⁸.



Slika 1. Klinička slika (a) i radiogram (b) avulziranog maksilarnog levog centralnog sekutića

Figure 1. Clinical finding (a) and radiograph (b) of the avulsed maxillary left central incisor

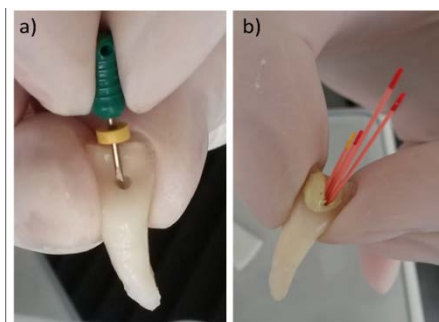
Odmah po prijemu, avulzirani zub je ispran i potopljen u 0,9% NaCl, sve do donošenja odluke da bude replantiran, bez obzira na protekli period od 15 sati, sa mesta velike kontaminiranosti i suv način transporta. Gazom natopljenom 0,9%-tnim NaCl, pažljivo su uklonjene nečistoće i nekrotična periodontalna vlakna sa korena zuba. Potom se pristupilo ekstraoralnom endodontskom tretmanu avulziranog zuba.

Držeći zub isključivo u predelu aproksimalnih površina krunice, na palatinalnoj površini napravljeni su pristupni kavitet i trepanacijski otvor. Koronarna pulpa amputirana je sterilnim svrdlom, a ostatak pulpnog tkiva je iz kanala korena ekstirpiran pomoću instrumenta po Hoedstremu (Slika 2 a). Bez mehaničke obrade kanala korena, taktilno-vizuelnom kontrolom, isključena je mogućnost zaostajanja pulpnog tkiva u kanalu.

they received advice to look for a tooth at the place of the accident. The next day, they found the avulsed tooth in the dust of a street, put it in a paper tissue and came to the Clinic.

After taking anamnesis from the parents and the girl about the way, place and time of injury and general health condition, a radiological and intraoral clinical examination was performed.

The absence of the left central incisor from the alveolar socket and the preservation of the alveolar bone were determined (Figure 1 a and b). The right central incisor had an oblique fracture at the dentin level, in the middle third of the crown, without pulp involvement and pathological mobility without dislocation was observed. Both lateral incisors also showed pathological mobility without dislocation. The vitality test was negative for all 3 incisors^{11,12,22}.



Slika 2. Ekstra oralni endodontski tretman avulziranog zuba: priprema (a) i opturacija kanala korena zuba (b)

Figure 2. Extraoral endodontic treatment of the avulsed tooth: preparation (a) and obturation of the tooth canal (b)

The avulsed tooth had a fracture at the level of the dentin, in the incisal third of the crown. By inspecting the root of the avulsed tooth and analyzing the radiograph of the corresponding tooth on the opposite side, as well as the adjacent teeth, the dental age and the degree of growth and development of the root of the avulsed tooth were defined. The tooth had a complete root length with parallel edges, which was in accordance with the age of the girl according to Demirjian⁸.

Immediately upon admission, the avulsed tooth was washed and immersed in 0.9% NaCl, until a decision was made to replant it, regardless of the elapsed period of 15 hours after being collected from a site of high contamination and a dry mode of transport. Impurities and necrotic periodontal fibers were carefully removed from the tooth root using gauze soaked in 0.9% NaCl. Afterwards, extraoral endodontic treatment of the avulsed tooth was started.



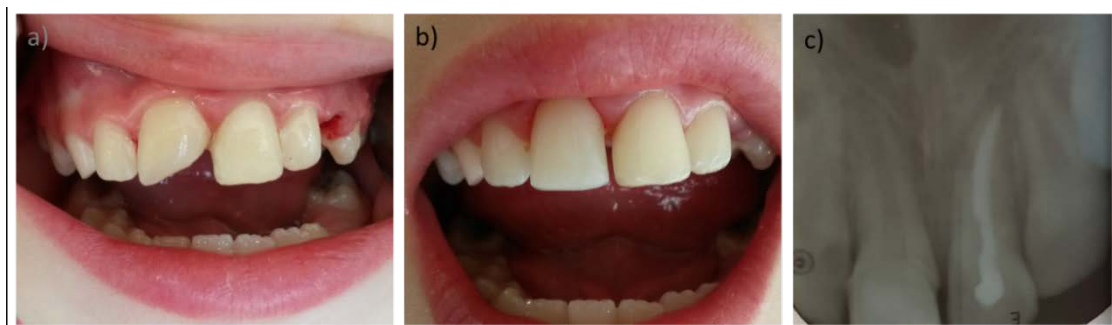
Slika 3. Izrada žičano-kompozitnog splinta na mlečnim i stalnim zubima (a) I poslednji uključen avulzirani zub (b). Žičano-kompozitni splint dve nedelje nakon traume (c)

Figure 3. Preparation of the wire-composite splint on deciduous and permanent teeth (a) and the last included avulsed tooth (b). Wire-composite splint two weeks after trauma (c)

Obilna irigacija kanala korena izvršena je 2% hlorheksidinom (Gluc-Chex 2% liquid, Cerkamed, Poland). Zidovi kanala korena su lagano, bez pritiska, osušeni papirnim poenima. Definitivno punjenje kanala obavljeno je pastom jodoform cementa (jedan deo Jodoform Prevest Den Pro Limited, India; i dva dela Cegal[®] N; normalvezujući cink-fosfatni cemet Galenika a.d. Beograd, Srbija-prah i tečnost) i gutaperka poenima (Guttapercha, #15-#40, Spident, Hand Rolled, Korea) sa koničnošću od 2%, tehnikom primene mono gutaperka poena, korigovanom akcesornim gutaperka poenima (Slika 2 b). Glavni gutaperka poen, dimenzije #40, aplikovan je širom stranom, do dentinskih ivica apeksa korena, a veliki broj akcesornih poena, dimenzije #15 i #20 u prostor preostale dve trećine dužine i širine kanala, sve do homogenizacije i vezivanja paste. Pristupni kavitet je zatvoren cink-fosfatnim cementom, čime je završena hermetička opturacija kanala korena apeksno, lateralno i koronarno. Zub je potom potopljen 20 minuta u 2% rastvor NaF. Za to vreme obavljani su priprema zuba, koji se uključuju u splint i toaleta usne duplje 3% H₂O₂ i 0,9% NaCl i obezboljeno radno polje sa 2ml anestetika Lidokain 2% adrenalin, Galenika a.d.Beograd, Srbija. Spremljena je odgovarajuća dužina fleksibilne ortodonske žice, debljine 0,25 mm (Dentaurum, Ispringen, Germany) i duplirana. Pristupilo se izradi žičano- kompozitnog splinta na mlečnim i stalnim zubima, po sledećem redosledu: 14, 53, 63, 24, 12, 22 i 11 (Slika 3 a). Zatim je uklonjen krvni ugrušak iz alveole levog centralnog sekutića, mlazom 0,9%-tnog NaCl-a, iz šprica bez igle, nakon čega je ona bila spremna za povratak i fiksaciju zuba. Uz blag pritisak prstima, bez upotrebe sile za sve vreme fiksacije kompozitom (Te-Econom[®] Plus (Ivoclar - Vivadent, Principality of Liechtenstein)), avulzirani zub uključen je

Holding the tooth in the area of the proximal surfaces of the crown, an access cavity and a trepanation opening were made on the palatal surface. The coronary pulp was amputated with a sterile bur, and the rest of the pulp tissue was extirpated from the root canal using a Hedström instrument (Figure 2 a). Without mechanical processing of the root canal, with tactile-visual control, the possibility of remaining pulp tissue in the canal is excluded.

Abundant irrigation of the root canal was performed with 2% chlorhexidine (Gluc-Chex 2% liquid, Cerkamed, Poland). The walls of the root canal were dried with paper points, lightly, without pressure. Definitive filling of the canal was done with iodoform cement paste (one part Jodoform Prevest Den Pro Limited, India; and two parts Cegal[®] N; normal binding zinc-phosphate cement Galenika ad Belgrade, Serbia-powder and liquid) and gutta-percha points (Guttapercha, # 15- # 40, Spident, Hand Rolled, Korea) with a conicity of 2%, using the technique of applying mono gutta-percha points, corrected with accessory gutta-percha points (Figure 2 b). The master gutta-percha point with dimension # 40, was applied with wider side pointing to the apex, until reaching the dentinal edges of the root apex. Additionally, a large number of accessory gutta-percha points, dimensions # 15 and # 20, were applied into the space of the remaining two thirds of the channel length and width, until full homogenization and paste binding. The access cavity was closed with zinc-phosphate cement, which completed the hermetic obturation of the root canal apically, laterally and coronally. The tooth was then immersed for 20 minutes in 2% NaF solution. During that time, teeth were prepared for the inclusion in the splint, the oral cavity was cleaned with 3% H₂O₂ and 0.9% NaCl, and local anesthesia was



Slika 4. Uklonjen žičano-kompozitni splint (a), urađene kompozitne restauracije (b) i kontrolni radiogram (c) četiri nedelje nakon traume

Figure 4. Removed wire-composite splint (a), performed composite restorations (b) and control radiograph (c) four weeks after trauma

poslednji (14, 53, 12, 11, 21, 22, 63, 24) (Slika 3 b). Potom je frakturirana površina desnog centralnog sekutića prekrivena kompozitnim zavojem (Te-Econom[®] Plus (Ivoclar - Vivadent, Principality of Liechtenstein)).

Pacijentkinji je data preporuka o ordiniranju sistemske antibiotske terapije (Benzilpenicilin Galenika A.D., Beograd, Republika Srbija, 1200 000/ 24h, 3 dana i Amoksicilin Hemofarm A.D., Vršac, Republika Srbija, 250 mg/ 8h, još 4dana) i savetovana provera antitetanusne zaštite. Dat je savet o ishrani i načinu održavanja oralne higijene za vreme nošenja splinta i zakazan kontrolni pregled narednog dana, zbog provere prilagođenosti na novonastale uslove u ustima.

Na kontrolnom pregledu kroz 2 nedelje, splint je bio stabilan, a higijena usne duplje uredna (Slika 3 c).

Test vitaliteta desnog centralnog sekutića i oba lateralna, na prijemu negativan, sada je bio pozitivan. Ti zubi (11, 12, 22) isključuju se iz splinta, a replantirani zub ostaje još dve nedelje imobilisan.

Nakon 4 nedelje uklonjen je žičano-kompozitni splint sa preostalih zuba, avulziranog zuba i susednih zuba (14, 53, 21, 63, 24) (Slika 4 a).

Urađene su definitivne kompozitne restauracije na oba centralna sekutića i kontrolni rendgen snimak (Slika 4 b i c). Uredan radiološki i klinički nalaz, potvrdili su dobijeni anamnestički podaci, koji su negirali bilo kakve subjektivne tegobe.

Na kontrolnom pregledu, nakon 9 meseci, replantirani zub bio je u okluzalnoj ravni, ali promenjene boje, sa odsustvom pokretljivosti i visokim perkutnim tonom, a radiogram je pokazao zamensku resorpciju korena (Slika 5 a). Pacijentkinja nije imala nikakve subjektivne tegobe.

Na kontrolnom pregledu nakon 16 meseci od povrede, replantirani zub bio je u infrapoziciji u odnosu na desni centralni sekutić (Slika 5 b).

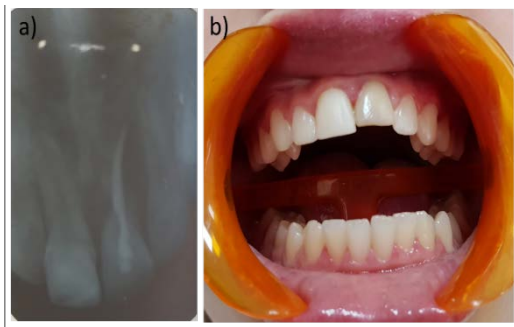
applied using 2 ml Lidocaine 2% adrenaline (Galenika a.d., Belgrade, Serbia). For fixation of the teeth an appropriate length of flexible orthodontic wire, 0.25 mm thick (Dentaurum, Ispringen, Germany) was bended and used. The wire-composite splint for inclusion of deciduous and permanent teeth was made in the following order: 14, 53, 63, 24, 12, 22 and 11 (Figure 3 a). A blood clot was then removed from the alveolar socket of the left central incisor, rising it with 0.9% NaCl using a syringe without a needle, after which it was ready for the return and fixation of the tooth. With gentle finger pressure, without the use of force for the entire time of composite fixation (Te-Econom[®] Plus (Ivoclar-Vivadent, Principality of Liechtenstein)), the avulsed tooth was included last in the splint of eight teeth (14, 53, 12, 11, 21, 22, 63, 24) (Figure 3 b). The fractured surface of the right central incisor was covered with a composite bandage (Te-Econom[®] Plus, Ivoclar-Vivadent, Principality of Liechtenstein).

A systemic antibiotic therapy was prescribed to the patient (Benzylpenicillin Galenika AD, Belgrade, Republic of Serbia, 1,200,000/24h, 3 days and Amoxicillin Hemofarm AD, Vrsac, Republic of Serbia, 250 mg/8h, for another 4 days) and checking of the antitetanus protection was advised. Additionally, the patient was advised on diet and how to maintain oral hygiene while wearing a splint, and a follow-up examination was scheduled for the next day, in order to check the adaptation to the new conditions in the mouth.

At the control examination after 2 weeks, the splint was stable, and the hygiene of the oral cavity was satisfying (Figure 3 c).

Nakon 29 meseci, na kontrolnom pregledu, pacijentkinja je bila bez subjektivnih tegoba, zub je bio nepokretljiv, u izraženijoj infrapoziciji, a radiološki nalaz pokazivao je značajnu progresiju zamenske resorpcije korena.

Posle 3 godine i 6 meseci pacijentkinja dolazi zbog luksacije replantiranog zuba. Kontrolni radiogram pokazao je izraženu cervikalnu inflamatornu resorpciju (Slika 6 a). Nakon toga, zub je ekstrahovan (Slika 6 b) i izrađen adhezivni kompozitni most u cilju daljeg očuvanja prostora (Slika 7 a i b).



Slika 5. Zamenska resorpcija vidljiva na radiogramu devet meseci nakon traume (a). Infra pozicija centralnog sekutića nakon 16 meseci od traume (b)

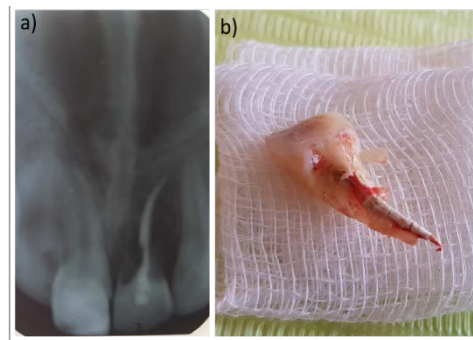
Figure 5. Replacement resorption visible on radiograph nine months after trauma (a). Infraposition of the central incisor 16 months after trauma (b)

Diskusija

Avulzija zuba najčešće se javlja kod dece u uzrastu od 7. do 9. godine², uzrasni period u kom je bila i pacijentkinja u ovom slučaju. To je period erupcije stalnih sekutića, koje u tom uzrastu karakteriše nepotpuno formiran koren i osetljivost periodontalnog ligamenta na dejstvo ekstruzivnih sila⁹. U slučaju avulzije, tok terapije, kao i prognoza, uslovljeni su stadijumom razvoja korena i apikalnog otvora, dužinom ekstraoralnog perioda i načinom transporta avulziranog zuba^{1,10,11}. Najbolja prognozaza oporavak, uz potpunu periodontalnu regeneraciju i revaskularizaciju pulpe je kod avulziranih zuba sa otvorenim apeksom, u slučaju replantacije odmah nakon traume ili najkasnije do 60 minuta nakon traume¹. U slučaju odložene replantacije zuba sa otvorenim apeksom, prognoza je gora nego kod zuba sa zatvorenim apeksom^{10,12}.

The vitality testing of the right central incisor and both lateral incisors, reported to be negative on the date of first admission, responded positively now. These teeth (11, 12, 22) were excluded from the splint and the replanted tooth stayed immobilized for another two weeks.

After 4 weeks, the wire-composite splint was removed from the remaining teeth, avulsed and adjacent (14, 53, 21, 63, 24) (Figure 4 a). Definitive composite restorations were performed on both central incisors and a control X-ray (Figure 4 b and c).



Slika 6. Cervikalna inflamatorna resorpcija vidljiva na radiogramu (a) i ekstrahovan zub (b) nakon tri godine i šest meseci

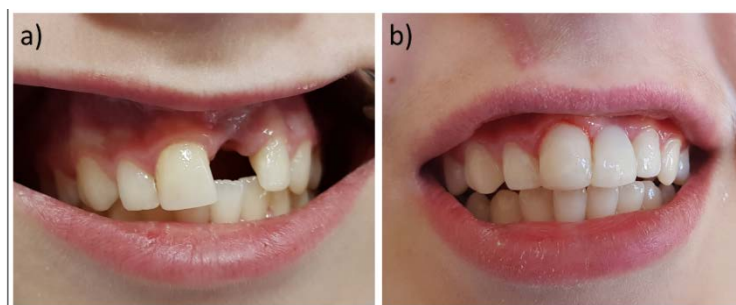
Figure 6. Cervical inflammatory resorption visible on radiograph (a) and extracted tooth (b) after three years and six months

An orderly radiological and clinical findings were confirmed by the obtained anamnestic data, excluding any subjective symptoms.

At the control examination, after 9 months, the replanted tooth was in the occlusal plane, showing the change in the color, with no mobility and high percussion tone. Additionally, replacement root resorption signs could be observed on the radiograph (Figure 5 a). The patient was symptom-free.

At the follow-up examination 16 months after the injury, the replanted tooth was in infraposition when compared to the right central incisor (Figure 5 b).

After 29 months, at the control examination, the patient was symptom free, the tooth was immobile, more pronounced infraposition could be observed. The radiological finding showed a significant progression of replacement root resorption.



Slika 7. Očuvan prostor nakon gubitka zuba (a) i izrađen adhezivni kompozitni most u cilju daljeg očuvanja prostora (b)

Figure 7. Preserved space after tooth loss (a) and an adhesive composite bridge made in order to further preserve the space (b)

U prikazanom slučaju, razvijenost korena avulziranog zuba odgovarala je G stadijumu po Demirjianu⁸, što znači da je koren dostigao punu dužinu, sa paralelnim ivicama. Bez obzira na takav status, po proceni i kliničkom iskustvu terapeuta, sproveden je plan terapije u skladu sa preporukama Anderssona i sar. za zbrinjavanje avulziranih stalnih zuba sa zatvorenim apikalnim foramenom i suvim ekstraoralnim periodom dužim od 60 minuta¹.

Pored jako dugog ekstraoralnog perioda, na visoko rizičnom infektivnom terenu, dopremljen zub u potpuno suvom okruženju bio je dodatno otežavajući činilac u ovom slučaju. Pravilan izbor medijuma za čuvanje avulziranog zuba od jako je velikog značaja, kako za očuvanje vitaliteta ćelija periodontalnog ligamenta¹³, tako i za smanjenje rizika od prevremenog javljanja komplikacija u vidu resorpcije korena. Pri izboru medijuma za čuvanje zuba prednost se daje mleku i Henkovom balansiranom slanom rastvoru¹³. Kao dobar transportni medijum pominju se i kokosova voda, propolis, probiotski rastvori, ekstrakt zelenog čaja, aloe vera i sojino mleko^{13,14}. Pijaća voda se ne preporučuje zbog neodgovarajuće osmolarnosti, jer može dodatno da doprinese oštećenju ćelija periodontalnog ligamenta i favorizuje ranu pojavu resorpcije korena^{14,15}.

S obzirom na jako dug ekstraoralni period u visokorizičnoj infektivnoj sredini (ulica), terapeut se opredelio na ekstraoralno punjenje kanala korena Jodoform cement pastom i gutaperka poenima. Pri donošenju odluke, uzeta je u obzir dostignuta puna dužina korena zuba i još uvek širok foramen. Savremena literatura preporučuje punjenje kanala korena avulziranih zuba preparatima kalcijum-hidroksida, pri čemu se, naročito kod zuba sa nekompletno zatvorenim apeksom, preporučuje upotreba bioaktivnog cementa, mineralnog trioksid agregata (MTA) u apikalnom predelu, kako bi se izbegla dodatna

After 3 years and 6 months, the patient came because of the luxation of the replanted tooth. Control radiograph showed pronounced cervical inflammatory resorption (Figure 6 a). Afterwards, the tooth was extracted (Figure 6 b) and adhesive composite bridge was made in order to further preserve the space (Figure 7 a and b).

Discussion

Tooth avulsion most often occurs in children aged 7 to 9², which corresponds to age of the patient in this case. This is the period of eruption of permanent incisors, which are at this age characterized by incompletely formed root and sensitivity of the periodontal ligament to extrusion forces⁹. In the case of avulsion, the course of therapy, as well as the prognosis, are influenced by the stage of root and apical opening development, the length of the extraoral period and the mode of transport of the avulsed tooth^{1,10,11}. The best prognosis, with complete periodontal regeneration and revascularization of the pulp, is in avulsed teeth with an open apex, in the case of replantation immediately after trauma or no later than 60 minutes after trauma¹. In the case of delayed replantation of teeth with an open apex, the prognosis is worse than in teeth with a closed apex^{10,12}.

In the case shown, the development of the root of the avulsed tooth corresponded to the Demirjian stage G⁸, which means that root reached full length, with parallel edges. Regardless of such status, according to the assessment and clinical experience of the therapist, a therapy plan was implemented in accordance with the recommendations of Andersson et al. for the care of avulsed permanent teeth with a closed apical foramen and a dry extraoral period longer than 60 minutes¹.

iritacija periapikalnog tkiva pri direktnom kontaktu sa kalcijum-hidroksidom. I pored preporuke, treba uzeti u obzir i mogući nedostatak MTA, a to je dugo vreme vezivanja i uticaj mnogih faktora okoline na tu osobinu¹⁶. Između ostalog, usled nedostupnosti pomenutog materijala, u ovom slučaju upotrebljen je jodoform cement, imajući u vidu njegova dobra antibakterijska svojstva i brzo vezivanje^{17,18}. Međutim, potrebno je uzeti u obzir i nedostatke materijala sa dodatkom jodoforma u vidu toksičnosti, koja može negativno da utiče na okolna tkiva i potencijalno ubrza pojavu resorpcije¹⁹.

U skladu sa preporukama, primenjena je i sistemska terapija antibioticima^{1,11,2}. Gomes i sar. pokazali su to da sistemska antibiotska terapija ima pozitivan efekat na reparatorne procese nakon odložene replantacije zuba, dajući pri tome prednost upotrebi amoksicilina²¹.

Kod zuba sa produženim ekstraoralnim periodom, oporavak periodontalnog tkiva kao opcija nije moguć, a samim tim i dugoročno očuvanje zuba u ustima. Resorpcija zamene, nakon ekstenzivne nekroze periodontalnog ligamenta, neminovan je ishod^{10,12}. Ostaci nekrotičnog tkiva periodontalnog ligamenta uzrokuju inflamatornu reakciju nakon koje se nastala oštećenja nadoknađuju novim tkivom-koštanim²². Kako bi se ovaj proces što više usporio, indikovano je pažljivo i potpuno otklanjanje nekrotičnih ostataka periodontalnog ligamenta sa površine avulziranog zuba¹¹, što je u ovom slučaju i učinjeno. Izvršeno je i potapanje zuba u rastvor fluorida, takođe sa ciljem usporavanja procesa zamenske resorpcije¹. Nakon 9 meseci primećeni su znaci koji su ukazivali na postojanje zamenske resorpcije. Nedostatak pokretljivosti, visok perkutorni ton i radiografski nalaz, "kao da su zub pojeli moljci", posledica su aktivnosti osteoklasta i procesa remodelacije kosti. Tvrdo tkivo zuba u kontaktu sa alveolarnom kosti resorbovano je i zamenjeno košću. Nakon 16 meseci od povrede, kao posledica dentoalveolarne ankiloze, replantirani zub je bio u infrapoziciji.

U terminalnom stadijumu radiolološki je uočena izražena cervikalna eksterna inflamatorna resorpcija, najverovatnije uzrokovana prodorom infekcije iz sulkusnog predela, koja je dovela do patološke luksacije zuba. Nedugo zatim, a 3 godine i 6 meseci nakon traume, usledio je i gubitak zuba, koji je u tom razvojnom periodu, između ostalog, uspešno ostvario ulogu fiziološkog čuvara prostora.

In addition to a very long extraoral period, in high-risk infectious surrounding, a tooth delivery in a completely dry environment was an additional aggravating factor in this case. The correct choice of medium for the preservation of avulsed tooth is of great importance, both for preserving the vitality of periodontal ligament cells and for reducing the risk of premature complications in the form of root resorption¹³. Milk and Hank's balanced saline solution are preferred when choosing a dental care medium¹³. Coconut water, propolis, probiotic solutions, green tea extract, aloe vera, soy milk are also mentioned as good transport media^{13,14}. Drinking water is not recommended due to inadequate osmolarity, because it can additionally contribute to the damage of periodontal ligament cells and favors the early appearance of root resorption^{14,15}.

Due to the very long extraoral period in a high-risk infectious environment (street), the therapist decided on extraoral filling of the root canal with Iodoform cement paste and gutta-percha points. In making the decision, the achieved full length of the tooth root and still incompletely closed foramen were taken into account. Modern literature recommends filling the root canals of avulsed teeth with calcium hydroxide, whereby, especially in teeth with incompletely closed apex, the use of bioactive cement, mineral trioxide aggregate (MTA) in the apical region is recommended in order to avoid additional irritation of periapical tissue in direct contact with calcium hydroxide. Despite the recommendation, the possible disadvantage of MTA should be taken into consideration, which is the long binding time and the influence of many environmental factors on this property¹⁶. Among other things, due to the unavailability of the mentioned material, iodoform cement was used in this case, considering its good antibacterial properties and fast binding^{17,18}. However, it is necessary to take into account the disadvantages of materials with the addition of iodoform in the form of toxicity that can adversely affect the surrounding tissues and potentially accelerate the occurrence of resorption¹⁹.

In accordance with the recommendations, systemic antibiotic therapy was applied^{1,11,20}. Gomes et al. have shown that systemic antibiotic therapy has a positive effect on reparative processes after delayed tooth replantation, giving preference to the use of Amoxicillin²¹.

Sličan rezultat postigli su i Sardana i sar. u prikazu slučaja replantacije centralnog sekutića nakon ekstraoralnog vremena od 15 sati, kod 12 godina starog pacijenta²³. U ovom slučaju, zub sa završenim rastom korena do javljanja lekaru je držan u mleku, endodontski tretman je izveden intraoralno, a kanal privremeno punjen Ca (OH)₂ pastom. Nakon 3 godine od replantacije zabeleženi su znaci izražene ankiloze i inflamatorne resorpcije. Savas i sar. Pratili su slučaj replantacije centralnog sekutića kod osmogodišnjeg pacijenta, tretiran protokolarno, nakon 27 sati suvog ekstraoralnog perioda, tokom 18 meseci⁹. Na kraju ovog observacionog perioda zub je bio čvrst i funkcionalan, 0,5mm u infraokluziji sa evidentnim znacima zamenske resorpcije i ankiloze na rendgenskom snimku. Ovi rezultati su u skladu sa rezultataima Anderssona i sar., koji su pokazali da replantacija zuba nakon produženog suvog ekstraoralnog perioda, kod dece starosti od 8 do 16 godina, dovodi do gubitka zuba usled zamenske resorpcije u periodu od 3 godine do 7 godina²⁴.

Zbog svih nepovoljnih okolnosti pre replantacije, u prikazanom slučaju, zadržavanje zuba u zubnom nizu tokom tri i po godine može se smatrati uspehom. S obzirom na avulziju mladog zuba sa nezatvorenim apeksom, treba naglasiti to da bi ishod terapije bio znatno bolji da je stručna pomoć ukazana neposredno nakon traume i da je zub bio u odgovarajućem transportnom medijumu. Iz tog razloga, u ovom periodu odrastanja i povećane vulnerabilnosti dece, neophodno je ukazati i na značaj infor-misanosti roditelja o pravilnom postupanju u ovakvim slučajevima.

In teeth with a prolonged extraoral period, recovery of periodontal tissue is not possible, and thus also long-term preservation of the tooth in the mouth. Replacement resorption, after extensive periodontal ligament necrosis, is an unavoidable outcome^{10,12}. Remains of necrotic tissue of the periodontal ligament cause an inflammatory reaction after which the damage is compensated by new bone tissue²². In order to slow down this process as much as possible, careful and complete removal of necrotic remainings of the periodontal ligament from the surface of the avulsed tooth is indicated¹¹, which was done in this case. The tooth was immersed in a solution of fluoride, also with the aim of slowing down the process of replacement resorption¹. After 9 months, signs that indicated the existence of replacement resorption were noticed. Lack of mobility, high percussion tone and radiographic findings, "as if the tooth was eaten by moths", are a consequence of osteoclast activity and bone remodeling process. The hard dental tissue is resorbed in contact with the alveolar bone and replaced with bone tissue. After 16 months from the injury, as a consequence of dentoalveolar ankylosis, the replanted tooth was in infraposition.

In the terminal stage, radiologically observed pronounced cervical external inflammatory resorption, most likely caused by the penetration of infection from the sulcus region, led to pathological luxation of the tooth. Shortly afterwards, and 3 years and 6 months after the trauma, tooth loss occurred. It can be considered that it successfully fulfilled the role of a physiological guardian of space, during that developmental period.

A similar result was achieved by Sardana et al. in a case report of central incisor replantation after an extraoral time of 15 hours, in a 12-year-old patient²³. In this case, the tooth with the completed root growth was kept in milk until reaching the doctor. The endodontic treatment was performed intraorally, and the canal was temporarily filled with Ca (OH)₂ paste. After 3 years from replantation, signs of pronounced ankylosis and inflammatory resorption were reported. Savas et al. followed for 18 months a case of central incision replantation in an eight-year-old patient, treated according to the protocol, after 27 hours of dry extraoral period⁹.

Zaključak

Očuvanje zuba u zubnom nizu replantacijom, makar i privremeno, u periodu intezivnog orofacijalnog razvoja deteta, od velikog je značaja za očuvanje lokalnog integriteta koštanih struktura, kao i pravilan nastavak orofacijalnog razvoja. Stoga, replantacija avulziranog zuba treba uvek da predstavlja terapiju izbora, čak i u jako nepovoljnim okolnostima, kao u ovom slučaju, gde je uspešan ishod opravdao odstupanje od preporuka za terapijski postupak, u datom slučaju.

At the end of this observation period the tooth was firm and functional, 0.5 mm in infracclusion with evident signs of replacement resorption and ankylosis on radiograph. These results are consistent with the results of Andersson et al. who showed that tooth replantation after a prolonged dry extraoral period in children aged 8 to 16 years leads to tooth loss due to replacement resorption within a period of 3 to 7 years²⁴.

Due to all unfavorable circumstances before replantation in the presented case, keeping the tooth in the dental arch for three and a half years can be considered a success. Considering the avulsion of a young tooth with an unclosed apex, it should be emphasized that the outcome of the therapy would be significantly better if professional help was provided immediately after the trauma and if the tooth was stored in an appropriate transport medium. For that reason, in this period of development and increased vulnerability of children, it is necessary to point out the importance of informing parents about the correct reactions in such situations.

Conclusion

Preservation of tooth in the dentition by replantation, even temporarily, in the period of intensive orofacial development of the child, is of great importance for preserving the local integrity of bone structures, as well as the proper continuation of orofacial development. Therefore, replantation of an avulsed tooth should always be the therapy of choice, even in very unfavorable circumstances, as in this case, where a successful outcome justified a deviation from the recommendations for the therapeutic procedure in a given case.

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