

# Replantacija izbijenih trajnih maksilarnih inciziva avitalnog periodontnog ligamenta (PDL-a)

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## Sažetak

*Obrađen je slučaj u kojem su izbijeni trajni medialni incizivi s avitalnim periodontnim ligamentom i koji su prije replantacije podvrgnuti fluoridaciji kako bi se produžila resorpcija korjenova. Nakon uobičajene pripreme korjenskoga kanala Ca (OH)<sub>2</sub> pastom, izbijeni zubi tretirani su zakiseljenim fluornim preparatom 4 minute i replantirani uz imobilizaciju žičano-kompozitnim splintom tijekom deset dana. Na temelju kliničkoga praćenja (kontrolni rendgen, test pomičnosti, gingivalni indeks), dvije godine nakon replantacije klinički je nalaz uredan bez znakova nadomjesne resorpcije.*

*Ovaj slučaj potvrđuje da nakon jetkanja ortofosfornom kiselinom aktivni fluor penetracijom u cementne tubule impregnira površinu korijena zuba usporavajući nadomjesnu resorpciju. Time se produžuje vijek izbijenog zuba u ustima, što je velik napredak u liječenju izbijenih zuba s avitalnim PDL-om.*

**Ključne riječi:** avulzija, replantacija, nadomjesna resorpcija

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## Uvod

Avulzija je potpuno izbijanje zuba iz njegove alveole. Spada u najteže ozljede dentoalveolarne regije. Najčešće su izbijeni gornji trajni incizivi i to u dobnoj skupini djece od 8-10 godine (1,2,3).

Postupak s izbijenim zubom i njegova obrada znatno utječu na uspjeh replantacije.

Još je Hammer godine 1934. dokazao da je uspjeh replantacije izravno proporcionalan s očuvanjem PDL-a na korijenu zuba (4,5). Šezdesetih su godina su Andreasen i sur. te Andersson i sur. postavili pravila u postupku replantacije izbijenih zuba koja su i danas *condicio sine qua non* za uspješnost zahvata (6,7). Mnogo čimbenika ima utjecaj na uspješno cijeljenje PDL-a. U prvome redu to su

ekstraalveolarno vrijeme, medij čuvanja izbijenoga zuba i stupanj kontaminacije površine korijena. Preživljavanje PDL-a bez obzira na medij je oko 30 minuta, iako se i nakon 60 minuta na sasušenu zubu nađe vitalnih stanica PDL-a (8,9). Prijenosni mediji, poput mlijeka ili sline, produžuju vrijeme preživljavanja PDL-a (10,11).

Ako se replantacija provede u razdoblju od 30 minuta nakon avulzije, revaskularizacija pulpe i potpuno cijeljenje PDL-a može se očekivati u 34% kod zuba s nezavršenim rastom korijena, te u 8% kod zuba sa završenim rastom korijena (12,13). Što je vrijeme u kojem je izbijeni zub izvan alveole duže, znatno se smanjuju izgledi za oporavak PDL-a i revaskularizaciju pulpe te cijeljenje nastaje nadomjesnom resorpcijom (ankiloza) ili upalnom resorpcijom (14,15.). Ankilozirani zub može biti u funkciji nekoliko godina. Klinička iskustva pokazuju da se ankilozirani zubi u djece resorbiraju znatno brže nego u odraslih. Prema istraživanjima Heithersaya replantirani ankilozirani zubi budu izgubljeni u razdoblju od 2-6 godina (16,17).

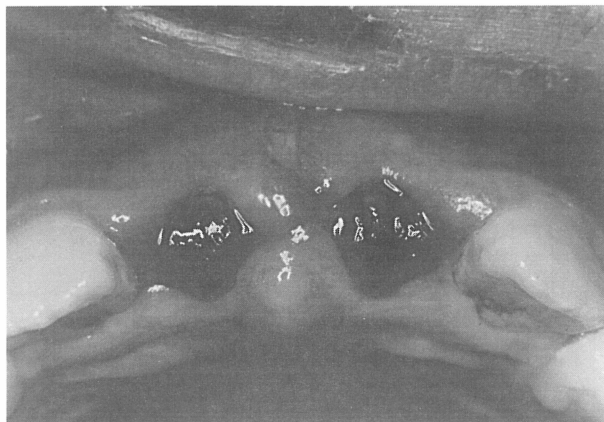
### Svrha istraživanja

Svrha ovoga rada bila je pratiti način cijeljenja replantiranih zuba s avitalnim PDL-om koji su neposredno prije replantacije tretirani zakiseljenim fluorornim preparatom kako bi se usporila nadomjesna resorpcija.

### Prikaz slučaja

Djevojčica u dobi od 8,5 godina došla je u ambulantu oralne kirurgije 72 sata pošto su joj izbijena oba medijalna inciziva. Zubi su se u tome razdoblju čuvali u suhoj i nesterilnoj gazi, te je PDL avitalan. Alveole obaju inciziva dobro su očuvane, ispunjene fibrozno organiziranim ugrušcima bez znakova frakture. Meka tkiva također su potpuno očuvana (Slika 1).

Nakon 30 minuta rehidracije u fiziološkoj otopini, učinjena je instrumentacija kanala oba zuba, pazeći da se pri instrumentaciji ne diraju i ne stružu ostatci PDL-a. Kanali su napunjeni  $\text{Ca}(\text{OH})_2$  pastom (Calcipulpe, Septodont, Saint-Maur, France).

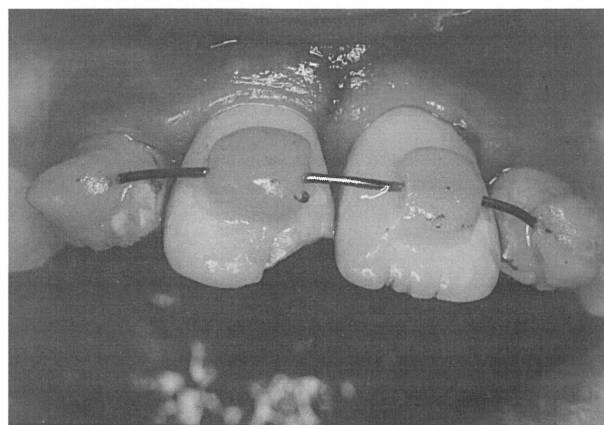


Slika 1. Alveole izbijenih zuba, tri dana nakon traume

Figure 1. Sockets of the avulsed teeth, three days following trauma

Prije same replantacije korijeni izbijenih zuba tretirani su ortofosfornom kiselinom zakiseljenim preparatom fluora pH 3,5-4, conc. natrij fluorida 1,23% (A.P.F., Protect, Butler, Chicago, USA.) 4 minute. Radi se o načinu fluoridacije kojim ortofosforna kiselina "najetka" površinu tvrdoga zubnog tkiva, pri tom oslobađajući kalcijeve i druge ione, a na njihovo mjesto ugrađuju se ioni fluora koji cementnu supstanciju korijena zuba čine otpornijom na resorpciju.

Nakon pripreme alveole učinjena je replantacija te imobilizacija žičano-kompozitnim splintom tijekom deset dana (Slika 2).



Slika 2. Replantirani maksilarni medijalni incizivi imobilizirani žičano-kompozitnim splintom

Figure 2. Replanted maxillary central incisors immobilized by wire-composite splint

Budući da je pacijentica uredno cijepljena protiv tetanusa, ordinira joj se tetanus anatoxinum TAT 0,5 cm<sup>3</sup> te antibiotik širokog spektra djelovanja tijekom deset dana.

Napravljena je i kontrolna rendgen snimka položaja zubi nakon replantacije (Slika 3).



Slika 3. Kontrolna rendgenska snimka tri dana nakon replantacije

Figure 3. Control periapical radiograph three days following replantation

Nakon deset dana skinut je žičano-kompozitni splint. Kliničkim pregledom nije se našlo znakova upalne resorpcije. Na rendgenskoj snimci, učinjenoj tri mjeseca nakon replantacije, zamjećuje se gubitak periodontne membrane u apikalnoj trećini desnoga replantiranog sjekutića uz normalan perkusivni zvuk, što možemo smatrati prolaznom nadomjesnom resorpcijom (Slika 4).

Na daljnjim tromjesečnim kontrolama redovito se je mijenjao uložak Ca (OH)<sub>2</sub> u kanalu.

Devet mjeseci od replantacije, pošto je formirana apikalna barijera, učinjeno je trajno punjenje korjenskoga kanala gutaperkinim štapićima i Diaketom, tehnikom lateralne kondezacije. U istom posjetu kompozitnim je materijalom rekonstruiran izgubljeni incizalni kut (Slika 5).

Praćenje bolesnice temeljeno je na standardnim kliničkim parametrima: indeks pomičnosti zuba, in-



Slika 4. Rendgenska snimka tri mjeseca nakon replantacije

Figure 4. Radiograph three months following replantation



Slika 5. Rendgenska snimka devet mjeseci nakon replantacije (zubi s trajnim punjenjem kanala)

Figure 5. Radiograph nine months following replantation (teeth with permanent root canal obturation)

deks stanja gingive, te kontrolne rendgenske snimke učinjene na redovitim tromjesečnim kontrolama. Test pomičnosti zuba mjeren je periotestom. To je

sofisticirani instrument koji mjeri reakciju na intermitentno djelovanje sile primijenjeno na krunu zuba. Glava za kucanje u ručnome dijelu uređaja percutira zub 4 puta u sekundi, a rezultate bilježi akcelerometar u glavi za kucanje. Dobivene periostealne vrijednosti uspoređene su sa standardnom klasifikacijom mobilnosti zuba prema Mülleru. Na prvom tromjesečnoj kontroli indeks pokretljivosti iznio je 1, a na svim ostalim kontrolama 0.

Dvadeset i četiri mjeseca od replantacije svi parametri kliničkoga praćenja daju uredan nalaz. Postoji fiziološka pomičnost zuba i normalan perkusivni zvuk. Na kontrolnoj rendgenskoj snimci ne nazlimo znakova nadomjesne resorpcije (Slika 6).



Slika 6. Rendgenska snimka dvadeset i četiri mjeseca od replantacije (nema znakova nadomjesne resorpcije)

Figure 6. Radiograph 24 months following replantation (no signs of replacement resorption)

### Rasprava i zaključak

Na žalost, zbog slabe educiranosti pacijenata i roditelja više od 50% avulzija u našoj kazuistici bu-

de replantirano nakon nekoliko sati do nekoliko dana. Traumom uzrokovani prerani gubitak zuba intrakaninoga sektora izaziva niz funkcionalnih i estetskih aberacija, od kolapsa alveolarnoga grebena do duševnih trauma. Stoga je naše stajalište da bez obzira na proteklo vrijeme od avulzije, na čuvanje zuba u neprikladnome mediju i nekrotični PDL, treba pokušati s replantacijom i sačuvati vlakna nekrotičnog PDL-a. Løe i Waerhaug dokazali su da se zub s avitalnim ostatcima PDL-a sporije resorbira nego zub s ogoljelom površinom korijena (18).

Postupkom impregnacije korijena izbijenog zuba zakiseljenim fluornim preparatom željeli smo usporiti resorpciju. Dokazano je da aktivni fluor djeluje baktericidno na površini nekrotičnog PDL-a, te da penetracijom u cementne tubule na neku ruku impregnira površinu korijena zuba usporavajući nadomjesnu resorpciju koja u takovim slučajevima nastaje u razdoblju od 6 mjeseci do godinu dana (19,20).

U protekle dvije godine tim postupkom tretirano je pet slučajeva izbijenih zuba s nekrotičnim PDL-om u djece u dobi od 8 do 12 godina. Prema svim navedenim parametrima praćenja, u razdoblju od jedne do dvije godine dobili smo vrlo dobre rezultate. U tri slučaja nema nikakvih znakova nadomjesne resorpcije nakon 18 mjeseci od replantacije. Dva slučaja pokazuju znakove nadomjesne resorpcije u apikalnoj trećini nakon dvanaest i devet mjeseci od replantacije, a replantirani zubi su u normalnoj funkciji

Dobiveni rezultati pokazuju određene prednosti ovakova postupka s izbijenim zubima nekrotičnog PDL-a što se tiče produženoga vijeka izbijenog zuba u ustima, a to je znatan napredak u terapiji te vrste avulzija.

Budući da se u 87% slučajeva avulzija događa u dječjoj dobi, kada još nije završen rast orofacijalnog skeleta niti je potpuno oblikovana trajna denticija, jako je važno što više produžiti nadomjesnu resorpciju i gubitak izbijenog zuba. Dobiveni rezultati pokazuju da se ovom metodom usporava tijekom nadomjesne resorpcije, te da se znatno produžuje vijek izbijenog zuba u ustima.

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# Replantation of Avulsed Permanent Maxillary Central Incisors with Avital Periodontal Ligament (PDL)- A Case Report and Literature Review

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## Summary

*Replantation of permanent central incisors with avital periodontal ligaments following exarticulation due to trauma is presented. The avulsed teeth were fluoridated before replantation for the purpose of deferring resorption. Following usual procedures for root canal preparation, the avulsed teeth were treated with an acidic fluoride solution for 4 minutes followed by replantation and immobilization with a wire-composite splint for a period of ten days. Based upon clinical follow-up parameters (radiographs, mobility test, gingival index) there are no signs of replacement root resorption thirty months following replantation. This case confirms that active fluoride penetrates into the cementum tubules impregnating the surface of the root and slowing down replacement root resorption. This prolongs the survival time of the avulsed tooth in the mouth which presents an advancement in the treatment of this type of avulsion.*

Key words: *avulsion; replantation, replacement resorption*

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## Introduction

Avulsion is the complete exarticulation of a tooth from its alveolar socket. It falls into the category of most serious injuries in the dentoalveolar region. Most often avulsed are the permanent upper incisors and usually in children between 8 and 10 years of age (1,2,3).

Preparation and handling of the avulsed tooth are major factors in the success of replantation.

As early as 1934, Hammer proved that the success of replantation was directly proportional to saving the PDL on the tooth root (4,5). In the 1960's Andreasen et al. and Andersson et al. described the procedural rules for replantation of avulsed teeth which today are still *condicio sine qua non* for the

success of the procedure (6,7). Many factors have an influence on the successful healing of the PDL, such as extra-alveolar time, storage medium, and the degree of contamination of the root surface (8,9).

Survival of the PDL regardless of the storage medium is approximately 30 min. Transport mediums such as milk or saliva prolong the survival time of the PDL (10,11).

The extra-alveolar period is critical as the vitality of the periodontal ligament is crucial for the long term prognosis of a replanted tooth (12,13). If replantation is performed within a period of 30 minutes after avulsion, revascularisation of the pulp and complete healing of the PDL can be expected in 34% of cases where the teeth have not yet completed root growth and in 8% where the teeth have completed root growth (14,15). The longer the period of time in which the avulsed tooth is outside the socket the less likely there will be recovery of the PDL and revascularization of the pulp; moreover, there will be healing with replacement resorption (ankylosis) or inflamed resorption.

Teeth replanted with a necrotic periodontal membrane will usually become ankylosed and resorbed within 2-6 years (16,17).

The aim of this study was to examine the healing of replanted teeth with avital PDL which were treated with an acidic fluoride preparation prior to replantation, and the type of resorption and time in which it occurred.

### Case report

A 8.5 year old girl was seen at our clinic 72 hours after avulsion of both central incisors. During this period the teeth were kept in a dry and nonsterile gauze, thus the PDL was considered avital. The alveoles of both incisors showed no signs of fracture and were healing well (Figure 1).

Following 30 minutes of rehydration in saline solution, root canals of both teeth were treated continuously so that during the procedure the remaining PDL would not be further damaged. The root canals were filled with Ca(OH)<sub>2</sub> paste ( Calcipulpe, Septodont, Saint-Maur, France). Before the actual replantation, the roots of the avulsed teeth were treated with an orthophosphoric acid in acidic fluoride

solution pH 3,5-4, conc. sodium fluoride 1.23%, (A.P.F., Protect, Butler, Chicago, USA.) for 4 minutes. This is a method of fluoridation where orthophosphoric acid "etches" the surface of hard dental tissue, during which time releasing calcium and other ions, while in their place incorporating fluoride ions which make the cementum substance of the roots more resistant to resorption.

After preparation of the socket, the replantation was completed, including immobilization with a wire-composite splint for a period of ten days (Figure 2).

As the patient had been treated for tetanus, she was prescribed tetanus anatoxinum TAT=5 cm<sup>3</sup>, as well as a wide spectrum antibiotic (Amoxicillin) for a period of ten days. A postoperative intraoral periapical radiograph was taken (Figure 3).

After ten days the wire-composite splint was removed. Clinical examination did not reveal signs of inflammatory resorption. Percussion denoted a clear sound. The radiograph did not show loss of normal periodontal ligament (Figure 4) During each following three monthly examination the Ca(OH)<sub>2</sub> in the root canal was replaced. Nine months after replantation, after formation of the apical barrier, permanent root canal treatment was performed using gutta-percha points and Diaket, utilizing the technique of lateral condensation (Figure 5). During the same visit reconstruction of the lost incisal corner using composite materials was done. Patient follow-up was based on clinical parameters such as: teeth mobility index, gingival index, signs of inflammatory resorption and radiographs taken every three months following replantation. The test for mobility was measured by periotest. This is a sophisticated instrument which measures the reaction during application of intermittent forces onto the tooth crown. The head of the instrument used for percussion is held in the hand and strikes the tooth 4 times per second and results are registered by the accelerometer in the head of the instrument. The results obtained by the periotest may vary from -8 to 50 and are compared to the standard classification of tooth mobility by Müller. At the first three monthly examination the mobility index was 1, at all other examinations it was 0.

Twenty-four months after replantation all clinical parameters showed good recovery. Physiological mobility was present, as well as normal percu-

ssion sound. Control radiographs did not show any signs of replacement root resorption (Figure 6).

### Discussion and conclusion

Unfortunately, due to poor awareness of the patient and parents over 50% of avulsions in our experience are replanted after a few hours or even a few days. Trauma induced by early tooth loss of the intercanine area causes many functional and esthetic aberrations from collapse of the alveolar ridge to psychological trauma. For this reason, we consider that, regardless of elapsed time and overall poor prognosis since avulsion, storing teeth in inadequate mediums, necrotic PDL, it is necessary to attempt replantation with the remaining necrotic fibers of the PDL. Loe and Waerhaug proved that a tooth with avital remains of the PDL undergoes resorption much more slowly than a tooth with a completely clean root surface (18).

By impregnating the root of the avulsed tooth in acidic fluoride preparation we wished to slow down the inflammatory resorption. It has been proven that active fluoride acts as a bactericide on the surface of the necrotic PDL, moreover, penetration into the cementum tubules in some way impregnates the surface of the root slowing replacement root resorpti-

on. Otherwise, replacement root resorption appears in a period from 6 months to one year (19,20).

In the last two years five cases of avulsion with necrotic PDL have been treated using this procedure in children between the ages of 8 and 12 years. While following those cases based on standard parameters of clinical follow-up (radiographs, tooth mobility test, Loe Sillnes index) we obtained very good results. In three cases there were no signs of replacement resorption after 18 months of follow-up. In two cases radiographs showed resorption, which appeared in the apical third of the root 12 and 9 months following replantation. However, the replanted teeth are in normal function.

Obtained results indicate certain advantages of this type of procedure with avulsed teeth with necrotic PDL in terms of prolonging the survival time of the avulsed tooth in the mouth, which presents recognizable advancement in the treatment of this type of avulsion.

Considering that in 87% avulsion occurs in children where the orofacial skeleton has not yet completed growth nor has the permanent dentition fully formed, it is very important to prolong replacement resorption and the loss of a tooth. The obtained results indicate that this approach should be used for the above purpose.