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## Endodontsko liječenje geminiranog prvog lijevog gornjeg pretkutnjaka: prikaz slučaja

### *Endodontic Treatment of a Geminated Maxillary Left First Premolar: a Case Report*

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#### Sažetak

Morfološke nepravilnosti zuba izazov su svakom specijalistu endodonticije. Kako bi ih se uspješno lociralo i tretiralo, treba biti svjestan svih anatomskih varijacija korijenskih kanala. Svrha ovog prikaza jest opisati nekirusko liječenje prvog lijevoga maksilarnog premolara s geminacijom. Dvadesetogodišnja pacijentica poslana je na endodontski tretman prvog lijevoga maksilarnog premolara. Nakon kliničke i radiološke obrade specijalist endodonticije je dijagnosticirao nekrozu pulpe s kroničnim apikalnim parodontitisom te geminaciju zuba. Korijenski kanali obrađeni su instrumentima ProTaper Universal™ – za bukalni kanal odabran je F3, a za palatalni F4. Nakon toga osušeni su sterilnim papirnatim pointom i napunjeni tehnikom hladne lateralne kondenzacije gutaperkom ProTaper te punilom AH-plus. Na kontrolnom pregledu nakon dvanaest mjeseci zub je bio asimptomatičan i na radiološkoj slici nije se vidjela periapikalna radiolucencija. Treba istaknuti da se čak i kod zuba s iznimno kompleksnom morfologijom korijenskih kanala može postići adekvatno cijeljenje bez komplikacija, ako se odaberu uobičajene endodontske metode bez kirurških zahvata.

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#### Ključne riječi

korijenski kanal, liječenje; zubna pulpa, nekroza; periapikalni granulom; udvajanje; pretkutnjak

#### Uvod

Morfološke nepravilnosti zuba izazov su u endodontskom tretmanu. Kako bi se uspješno locirale i tretirale, treba biti svjestan svih anatomskih varijacija korijenskih kanala (1). U tom slučaju klinički i radiološki pregled te dijagnoza morfoloških nepravilnosti, poput geminacije, omogućuju potpun uvid (2).

Geminacija je formiranje dvaju zuba iz jednog caklinskog organa (3). Njezina incidencija iznosi 0,47 posto, bez obzira na spol (4). Dakle, to je rijetka anomalija, a nastaje kada se podijeli zametak jednog zuba. Češće zahvaća mliječne zube, ali može nastati u objema denticijama, obično u području inciziva (5).

Ta razvojna anomalija vrlo se često zamjenjuje s fuzijom. Diferencijalna dijagnoza potvrđuje se radiografski. Ako je riječ o fuziji, krune zuba povezane su caklinom i/ili dentinom, ali postoje dva korijena ili dva korijenska kanala u jednom korijenu. Autori mnogih studija ističu da fuzije mogu nastati između zuba u normalnom zubnom nizu ili između zuba u normalnom zubnom nizu i prekobrojnog zuba. Pritom struktura najčešće predstavlja dvije krune, potpuno ili djelomice odvojene, s jednim korijenom ili jednim korijenskim kanalom u geminaciji (6).

Geminacija je najčešće asimptomatska i ne zahtijeva tretman. No, problem je u estetici, oštećenju parodontnog liga-

#### Introduction

Morphological aberrations in teeth present challenges to root-canal treatment. In such cases, an awareness of the possible anatomical variations is essential to localize and successfully treat the entire root-canal system (1). Clinical and radiographic examinations as well as a diagnosis of the morphological aberration such as gemination help to gain insight into the root-canal anatomy (2).

Gemination is the attempted formation of two teeth from a single enamel organ (3); it has an incidence of 0.47% without sex predilection (4), and it is a rare anomaly that arises when the tooth bud of a single tooth attempts to divide. Geminations more frequently affect the primary teeth, but it may occur in both dentitions, usually in the incisor region (5).

This developmental anomaly is most often confused with fusion. However, a differential diagnosis can be made radiographically. In cases of fusion, the crowns are united by enamel and/or dentine, but there are two roots or two root canals in a single root. It has been suggested that there may be fusion between the teeth of the normal series or between one of the normal series and a supernumerary tooth. In contrast, the structure most often presents two crowns, either totally or partially separated, with a single root and one root canal in gemination (6).

menta i karijesu koji potiče nekrozu pulpe (7). Geminirani zubi moraju biti endodontski tretirani i zbog ranijeg pogrešnog pristupa liječenju. Svrha ovog prikaza jest opisati nekirurški tretman prvih lijevih maksilarnih geminiranih premolara.

### Prikaz slučaja

Dvadesetogodišnja pacijentica upućena je na endodontski zahvat prvog lijevoga maksilarnog premolara. Anamneza nije upućivala na ranije bolesti. Mjesec dana prije toga bila je hitno primljena na pregled i obradu fistule iznad prvoga lijevog premolara. Kliničkim pregledom uočena je fistula veličine 0,5 x 0,5 centimetara. Bila je mekana na prekusiju i palpaciju (slika 1a.). Toplinskim testom i trepanacijom potvrđena je nevitalna pulpa. Uspoređujući lijevu i desnu maksilarnu premolarnu regiju pronađena je velika kruna zuba u maksilarnoj premolarnoj regiji na lijevoj strani (slika 1b.). Ostali zubi u gornjoj čeljusti nisu pokazivali znakove upale pulpe ni perkutorno ni nakon testiranja osjetljivosti, osim prvoga lijevog premolara. Na osnovi kliničkog i radiološkog pregleda dijagnosticirana je nekroza pulpe, kronični apikalni parodontitis i geminirani zub (slika 2.).

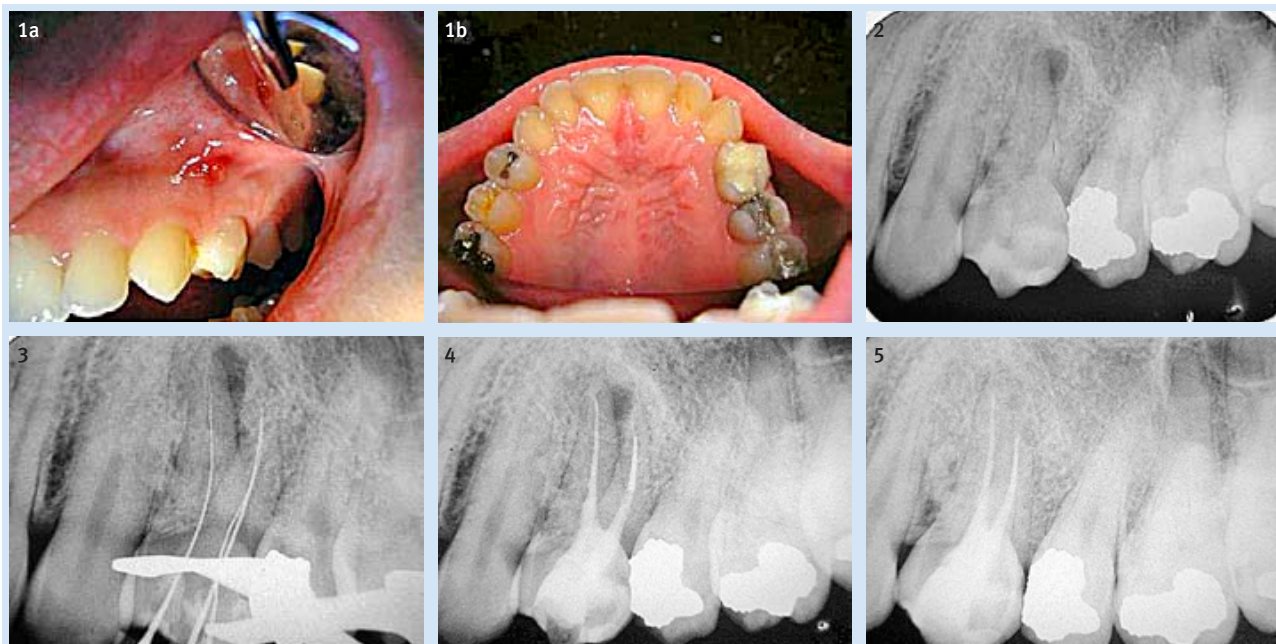
Na retroalveolarnoj periapikalnoj radiološkoj slici vidjele su se dva odvojena korijenska kanala te jedna velika kruna zuba. Vertucci (8) je klasificirao anatomije korijenskih kanala u osam skupina. U ovom slučaju geminirani zub svrstan je u

Gemination is generally asymptomatic and does not require treatment. However, there could be poor esthetics, periodontal destruction or caries leading to pulp necrosis (7). Also, these teeth may require endodontic treatment because of the earlier wrong approach to dental treatment. The purpose of this case report was to describe a nonsurgical treatment of a maxillary left premolar with gemination.

### Case report

A 20-year-old female patient was referred for endodontic treatment of her maxillary left first premolar. Her medical history was non-contributory. One month earlier, she had undergone emergency evaluation and treatment of a sinus tract above the maxillary left first premolar. In the course of clinical examination, a sinus tract was observed which measured approximately 0.5 x 0.5 cm over the maxillary left first premolar, which was tender to percussion and palpation (Figure 1A). Thermal and cavity pulp tests showed the pulp to be nonvital. A large crown was observed in the left maxillary premolar region when compared with the right maxillary premolar (Figure 1B). All maxillary teeth responded normally to pulpal sensitivity testing and percussion, except the maxillary left first premolar. Based on the clinical and radiographic examination, pulp necrosis and chronic apical periodontitis and a geminated tooth were diagnosed (Figure 2).

A periapical radiograph showed that the tooth had two separated root canals having a single and large crown. Vertucci (8) classified root canal anatomies into eight groups



**Slika 1.** (a) Fistula; (b) Klinički izgled lijeve maksilarnog premolarne regije

**Figure 1** (A), Sinus tract stoma. (B), Clinical appearance of the left maxillary premolar region.

**Slika 2.** Predoperativni radiograf prvog lijevoga maksilarnog premolara pokazuje periapikalni proces i geminaciju

**Figure 2** Preoperative radiograph of the maxillary left first premolar showing a geminated tooth with periapical involvement.

**Slika 3.** Određivanje radne dužine

**Figure 3** Working-length determination.

**Slika 4.** Rendgenska snimka odmah nakon punjenja kanala i stavljanja ispuna

**Figure 4** Immediate postoperative periapical radiograph taken after final canal obturation and placement of a coronal seal.

**Slika 5.** Rendgenska snimka dvanaest mjeseci nakon zahvata pokazuje potpuno koštano cijeljenje bez radiolucencije u periapikalnoj regiji

**Figure 5** Twelve-month recall radiograph of the tooth showing complete bone healing and no radiolucency around the apical region.

IV. ( dva kanala). Pacijentica je obaviještena o planu terapije. Uz njezino dopuštenje zub je anesteziran primjenom 2-postotnog mepivacain hidroklorida, epinephrinom (1:100,000) i izoliran gumenom plahticom. Nakon toga je trepaniran i osiguran ulaz u korijenski kanal. Slijedila je irigacija pulpne komorice 1-postotnim hipokloritom (NaOCl) (Farmácia Roval de Manipulação, Pernambuco, Brazil) i sušenje sterilnom vaticom. Locirana su dva ulaza u korijenske kanale – bukalni i palatinalni. Pulpna komorica isprana je 1-postotnim hipokloritom, a ulazi u korijenske kanale prošireni su instrumentima ProTaper Universal SX (Dentsply–Maillefer, Ballaigues, Švicarska). Nakon toga slijedila je instrumentacija kanala pet milimetara kraće od radiološkog apeksa iglicom br. 10 C+ (Dentsply-Maillefer, Ballaigues, Švicarska). Radna dužina određena je iglicom br. 15 C+ na temelju rendgenološkoga nalaza i iznosila je 14 milimetara za bukalni i 18 milimetara za palatinalni kanal (slika 3.). Oba kanala očišćena su i oblikovana iglicama NiTi za strojnu endodonciju (ProTaper Universal™, Dentsply-Maillefer, Ballaigues, Švicarska). Primijenjena je crown-down tehnika uz konstantnu irigaciju jedan-postotnim hipokloritom i 17-postotnim EDTA-om (Biodinâmica, Paraná, Brazil). Završna preparacija korijenskih kanala obavljena je ProTaperovim instrumentom F3 za bukalni kanal i F4 za palatinalni. Kanali su osušeni sterilnim papirnatim pointima (Dentsply-Maillefer, Petropolis, Brazil). Uporabljena je pasta na bazi kalcijeva hidroksida (Calen, SS White, Rio de Janeiro, Brazil), a trepanacijski otvor ispunjen je Cavitom (3M ESPE AG, Seefeld, Njemačka). Pacijentica je naručena za tjedan dana. Kad je došla na kontrolu, klinički je uočen nestanak fistule. Uklonjena je pasta na bazi kalcijeva hidroksida i kanali su napunjeni gutaperkom ProTaper (Dentsply Maillefer, Petropolis, Brazil) i AH-plus punilom (Dentsply/De Trey, Konstanz, Njemačka) tehnikom hladne lateralne kondenzacije. Pulpna komorica očišćena je vaticama namočenima u narančino ulje (Phormula Ativa, Pernambuco, Brazil). Ponovljena snimka pokazala je da su kanali potpuno ispunjeni (slika 4.) Nakon toga kruna zuba restaurirana je svjetlosno polimerizirajućim kompozitom (TPH Spectrum, Dentsply, Rio de Janeiro, Brazil). Na kontrolnom pregledu nakon dvanaest mjeseci zub je bio asimptomatičan. Na rendgenskoj slici (slika 5.) nije se vidjela periapikalna radiolucencija.

## Rasprava

Diferencijalna dijagnoza između fuzije i geminacije je komplicirana. Najčešće se temelji na predoperativnim i poslijeoperativnim radiološkim nalazima te kliničkom izgledu zahvaćenog zuba (9). Kao pomoć u prepoznavanju fuzije i geminacije primjenjuje se prebrojavanje zuba u zubnom luku te se kruna s anomalijom broji kao jedan zub. Dijagnoza geminacije postavlja se ako postoji zub viška, a fuzije ako nedostaje jedan zub (10). Jedina iznimka od toga pravila jest ako se dogodi fuzija zdravog i prekobrojnog zuba (2, 11). Geminacija nastaje kada se djelomice podijeli zubni zametak zbog invaginacije, što na kraju rezultira potpuno ili djelomice odvojenim krunama (12). Geminirani zubi obično imaju dvije krune ili jednu veliku djelomice odvojenu, te uobičajen broj

and the root canal anatomy of geminated teeth is relevant to type IV (2 canals) classification in this case. The treatment plan was explained to the patient and, with her consent, the tooth was anesthetized with 2% mepivacaine hydrochloride 1:100,000 epinephrine and isolated using a rubber dam; an access preparation was completed, after which the pulp chamber was irrigated with 1% sodium hypochlorite (NaOCl) (Farmácia Roval de Manipulação, Pernambuco, Brazil) and dried with a sterile cotton pellet. Two canal orifices (buccal and palatal) were located. The pulp chamber was irrigated with 1% sodium hypochlorite, and coronal flaring was carried out with ProTaper Universal SX (Dentsply-Maillefer, Ballaigues, Switzerland). Exploration of the canal was carried out with the #10 C+ file (Dentsply-Maillefer, Ballaigues, Switzerland) 5 mm short of the radiographic apex. With a #15 C+ file, a working length was determined by radiograph, and was 14 mm for the buccal and 18mm for palatal (Figure 3). Both root canals were cleaned and shaped using NiTi rotary files (ProTaper Universal™, Dentsply-Maillefer, Ballaigues, Switzerland) with a crown down technique and constant irrigation with 1% NaOCl in conjunction with 17% ethylenediaminetetraacetic acid (Biodinâmica, Paraná, Brazil). The finishing of the root canals was performed up to ProTaper F3 and F4, respectively, for the buccal and palatal root canals, and dried with sterile ProTaper paper points (Dentsply-Maillefer, Petropolis, Brazil). A calcium hydroxide paste (Calen, SS White, Rio de Janeiro, Brazil) was applied, and access to the cavity was temporarily sealed with Cavit (3M ESPE AG, Seefeld, Germany). The patient returned after 1 week and the sinus tract was healed. The calcium hydroxide paste was removed, and the root canals were obturated by cold lateral condensation of ProTaper gutta-percha points (Dentsply Maillefer, Petropolis, Brazil) using an AH Plus Sealer (Dentsply/De Trey, Konstanz, Germany) and the pulp chamber was cleaned with cotton balls soaked in orange oil (Phormula Ativa, Pernambuco, Brazil). A new radiograph showed that the root filling was complete (Figure 4). Finally the crown was permanently restored with light-cured composite resin (TPH Spectrum, Dentsply, Rio de Janeiro, Brazil). At the 12-month follow-up (Figure 5), the tooth was asymptomatic and there was no radiolucency around the apical region.

## Discussion

Differential diagnosis between fusion and gemination may be difficult. It is usually based on preoperative and postoperative radiographic findings and the clinical appearance of the involved tooth (9). To help distinguish between fusion and gemination, it has been suggested that the teeth in the arch to with anomalous crowns should be counted as one. A full complement of teeth indicates gemination, while one tooth less than normal indicates fusion (10). This rule is compromised if a normal tooth fuses with a supernumerary tooth (2, 11). Gemination occurs because of a partial division of a single tooth bud through invagination, resulting in completely or incompletely separated crowns (12). Geminated teeth demonstrate two crowns or one large partial-

korijenskih kanala (13). Ovaj slučaj pokazao je atipičnost geminiranog zuba u usporedbi s ostalim slučajevima. Nije bilo prekobrojnih zuba, ali uspoređujući simetričnost zubnih supstancija, kako predlaže Hong, moglo se zaključiti da je riječ o geminiranom zubu (3). Etiologija te abnormalnosti nije poznata. U razgovorima s obitelji pacijentice nisu otkrivena nasljedna svojstva ili uzročna povezanost. Rasprostranjenost fuzije i geminacije iznosi 0,1 do 1 posto u objema denticijma, kao što je potvrđeno i u dosadašnjoj literaturi (14). Pregledano je 2439 djece u dobi od 2 do 12 godina. Pronađeno je 0,42 posto fuzija zuba i 0,08 posto geminacija. Prekobrojni zubi pojavili su se u 0,45 posto slučajeva (15). Autori studije provedene na odraslim pacijentima u Jordanu zabilježili su 0,19 posto fuzija i 0,22 posto geminacija zuba (16).

Mnogo je načina liječenja i zbrinjavanja tih zuba, ovisno o stupnju anatomske kompleksnosti (3). Opcije uključuju endodontsko liječenje, ekstrakciju s naknadnim protetičkim zbrinjavanjem, kirurško razdvajanje i endodontsko zbrinjavanje s naknadnim ortodontskim ispravljanjem (17) i kirurško uklanjanje dijela zuba (18). Neka slučajevi upućuju na to da je potrebno endodontsko zbrinjavanje ako su spojene komorice geminiranog zuba, a zub prije toga resekiran (17, 19). No, u tom je slučaju demonstrirano nekirurško zbrinjavanje preiapikalnog procesa na geminiranom zubu endodontskim postupcima s povoljnom prognozom.

Katkad je izolacija gumenom plahicom komplicirana zbog oblika i veličine krune geminiranog zuba. Kvačica je morala biti postavljena distalnije na bukalnoj strani kako bi se osigurao dodir u četirima točkama na zubu (20). U ovom slučaju to nije predstavljalo problem i odabrana je kvačica broj 204.

Najvažniji čimbenik za neuspjeh endodontskog zahvata jest nedovoljno čišćenje i širenje korijenskog kanala (20). Imajući to na umu, primijenjena je biomehanička preparacija strojnom endodoncijom ProTaper Universal™.

Ovaj slučaj jasno dokazuje da, unatoč neobičnoj morfologiji i premalo opisa u literaturi, provjereni principi endodoncije rezultiraju uspjehom. Endodont se mora koristiti naprednim radiološkim tehnikama snimanja i vizualiziranja problema kako bi mogao uspješno rješavati probleme (20). U ovom slučaju koristio se klasičnim rendgenom i klasičnim snimkama.

Uspjeh endodontske terapije ovisi o detaljnom čišćenju i potpunom brtvljenju korijenskih kanala. Kako se vidi iz ovog slučaja, geminizirani zubi predstavljaju endodontski izazov, ponajprije zbog kompleksnih sustava korijenskih kanala i njihove morfologije. Pozorna analiza radioloških snimki i modifikacije trepanacijskih otvora i pristupnih kanala pokazale su se kao osnova u prepoznavanju anatomske varijacije i uspješnog liječenja. Ovaj slučaj je to i dokazao.

ly separated crown sharing a usual number of root canals (13). Their affirmations are at odds with those observed in the present case, where a normal number of teeth was observed, and the symmetrical appearance of the tooth components involved provided sufficient evidence of gemination in accordance with Hong (3). The etiology of this abnormal tooth development is unknown. Consultation with the family members revealed no hereditary or causal link. The prevalence of fusion and gemination varied from 0.1% to 1% for both dentitions in a retrospective study that reviewed the early literature (14). 2,439 children were examined, ranging in age between 2 and 12 years and fused teeth were found in 0.42% and geminated teeth in 0.08% of the cases, whereas supernumerary teeth occurred in 0.45% (15). In another study on Jordanian adults, the occurrence of fused or geminated teeth has been reported to be 0.19% and 0.22%, respectively (16).

Several treatment modalities have been described for these teeth, all of them related to the degree of anatomical complexity (3). Treatment options include root canal treatment, extracting the tooth with prosthetic replacement, surgically separating and endodontically treating the gemination followed by orthodontic alignment (17), or surgically removing the redundant part of the tooth only (18). Some reports have demonstrated that if the pulp chambers are connected, the need for endodontic treatment of the remaining part of the tooth becomes evident after tooth resection (17,19). However, as the present case shows, non-surgical root canal treatment of a geminated tooth with periapical pathosis is preferable and often has a favorable prognosis.

In some instances, one of the first procedures of endodontic therapy, rubber dam isolation, might be complicated as a result of the anatomic size and shape of the crown, the beaks of the clamp have to be placed more distally on the buccal side to establish a 4-point contact (20). This problem was not observed in this case report where a #204 clamp was utilized for isolation.

Inadequate cleaning and shaping of the root canal is considered to be one of the most important factors for endodontic failure (20). Based on this affirmation, we chose to perform the biomechanical preparation with ProTaper Universal™ rotary system.

This case illustrates that, despite the unusual morphology and the lack of a comparative case in the literature, the use of sound endodontic principles resulted in successful treatment. The endodontist must consider the judicious use of high-end diagnostic imaging techniques for successful management of complicated cases (20). In the present clinical case, a conventional radiograph was used during all treatments.

The success of the endodontic treatment depends on thorough debridement and filling of the entire root canal system. In this respect, the endodontic therapy of geminated premolars, such as the present case, presents an endodontic challenge, particularly in light of the complexity of its root morphology. Careful interpretation of radiographs and proper modification of the convectional access opening seem to be essential for recognition and adequate treatment of such

## Zaključak

Čak i kod zuba s iznimno kompleksnom morfologijom korijenskih kanala provjereno endodontsko zbrinjavanje, bez kirurške intervencije, rezultira adekvatnim cijeljenjem bez komplikacija.

anatomical variation. This report showed that a careful clinical and radiographic examination is essential for a successful endodontic treatment of tooth with anomaly.

## Conclusions

Even in a tooth with extremely complex root canal morphology, a conventional endodontic treatment without surgical intervention can result in adequate healing without any complications.

### Abstract

Morphological aberrations in teeth present challenges to root-canal treatment. In such cases, an awareness of the possible anatomical variations is essential to localize and successfully treat the entire root-canal system. The purpose of this case report was to describe a nonsurgical treatment of a maxillary left first premolar with gemination. A 20-year-old female patient was referred for endodontic treatment of her maxillary left first premolar. Based on the clinical and radiographic examination, pulp necrosis and chronic apical periodontitis and a geminated tooth were diagnosed. The root canals were instrumented using the ProTaper Universal™ rotary system up to F3 and F4 instruments, respectively, for the buccal and palatal root canals. The root canals were dried with sterile paper points and filled with ProTaper gutta-percha points and AH Plus Sealer using a cold lateral condensation technique. At the 12-month follow-up, the tooth was asymptomatic and there was no radiolucency around the apical region. Even in a tooth with extremely complex root canal morphology, a conventional endodontic treatment without surgical intervention can result in adequate healing without any complications.

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### Key words

Root Canal Therapy; Dental Pulp Necrosis; Periapical Granuloma; Gemination; Bicuspid

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