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ZNAČAJ PROTETSKIH KRUNA U ZAŠTITI ENDODONTSKI LEČENIH ZUBA

THE IMPORTANCE OF CROWN PROTECTION OF ENDODONTICALLY TREATED TEETH

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Sažetak

Uvod: Oboljenja pulpe i periapikalnog tkiva, koja zahtevaju endodontsko lečenje, često su praćena velikim defektom krunice zuba, prouzrokovanim karijesom. Uprkos dobro sprovedenom endodontskom tretmanu, endodontski lečeni zubi su skloni frakturama. Stoga, nameće se pitanje restauracije zuba nakon kvalitetno sprovedenog endodontskog tretmana. Krunice predstavljaju dentalne nadoknade od keramike ili metal-keramike, koje, pored funkcije uspostavljanja morfologije zuba, imaju i funkciju zaštite zuba sa većim defektom krunice.

Cilj rada bio je sagledavanje faktora koji mogu dovesti do frakture endo-dontski lečenih zuba

Zaključak: Prilikom donošenja odluke o restauraciji endodontski izlečenog zuba krunicama potrebno je sagledati više faktora, među kojima su gubitak tvrdog zubnog tkiva, struktura tkiva endodontski lečenih zuba, sile kojima su izloženi zubi u usnoj duplji, instrumenti i materijali korišćeni tokom endodontskog tretmana, kao i estetika endodontski lečenog zuba. Protetska rekonstrukcija krunom pokazala se kao značajna u zaštiti bočnih endodontski lečenih zuba, dok je zbrinjavanje prednjih zuba krunicama indicirano kod zuba sa velikim oštećenjima i estetskim nedostacima koji se ne mogu sanirati drugim konzervativnim postupcima.

Cljučne reči: endodoncija, endodontski lečeni zubi, protetske nadoknade, kočiči

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Abstract

Introduction: Diseases of the pulp and periapical tissue, which require endodontic treatment, are often accompanied by a large tooth crown defect caused by caries. Regardless of well-performed endodontic treatment, endodontically treated teeth are prone to fractures. This raises the issue of tooth restoration after quality endodontic treatment. Crowns represent dental restorations, made of ceramics or metal-ceramics, which, in addition to establishing the morphology of the teeth, also have the function of protecting teeth with a larger crown defect.

The aim was to review the factors that could lead to the fracture of endodontically treated teeth.

Conclusion: When deciding whether to restore an endodontically treated tooth with crowns, it is necessary to consider several factors, among which are the loss of hard tooth tissue, the structure of the endodontically treated teeth, the forces to which the teeth are exposed in the oral cavity, the instruments and materials used during the endodontic treatment, as well as the aesthetics of the endodontic treated teeth. Prosthetic reconstruction with a crown proved to be significant in the protection of posterior endodontically treated teeth, while treatment of the front teeth with crowns is indicated for the teeth with major damage and aesthetic defects that cannot be repaired by other conservative procedures.

Key words: endodontics, endodontically treated teeth, prosthetic restorations, posts

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Uvod

Endodontski tretman predstavlja klinički postupak u stomatologiji koji se sprovodi sa ciljem lečenja zuba sa obolelom pulpom ili periapeksom, a podrazumeva ekstripaciju sadržaja kanala korena, hemijsko-mehaničku obradu kanala, kao i hermetičku opturaciju kanalnog sistema, što za krajnji cilj ima očuvanje funkcionalnosti i integriteta zuba¹. Oboljenja pulpe i periapikalnog tkiva često su praćena većim defektom krunice zuba, prouzrokovanim karijesom². Ređe su situacije u kojima je potrebno endodontsko lečenje zuba sa intaktnom krunom. To može biti slučaj kod zuba koji se moraju endodontski tretirati zbog neodontogenih cista ili luksacija usled traume^{3,4}. Endodontski tretirani zubi imaju brojne karakteristike po kojima se razlikuju od vitalnih zuba. Uprkos dobro sprovedenom endodontskom tretmanu, endodontski lečeni zubi su skloni frakturama⁵, što ujedno predstavlja čest uzrok njihovog prevremenog gubitka⁶. Ova činjenica nameće pitanje restauracije i zaštite zuba nakon kvalitetno sprovedenog endodontskog tretmana. Krunice predstavljaju dentalne nadoknade od keramike ili metal-keramike, koje, pored funkcije uspostavljanja morfologije zuba, imaju i funkciju zaštite zuba sa većim defektom krunice⁷.

Cilj ovog rada bio je da se izvrši pregled faktora koji mogu dovesti do frakture endodontski lečenih zuba, kao i analiza preporuka za preveniranje ovih faktora protetskim zbrinjavanjem endodontski lečenih zuba krunicama.

Gubitak tvrdog zubnog tkiva

Prisustvo većih defekata zubnog tkiva nameće niz problema koje je potrebno sagledati tokom restauracije. Za izvođenje adekvatne konzervativne restauracije zuba, zidovi kaviteta treba da budu dovoljne debljine da bi izdržali pritisak izazvan funkcijom žvakanja. U slučaju da su zidovi previše istanjeni, potrebno ih je skratiti i uključiti u kavitet, kako ne bi došlo do njihovog pucanja prilikom delovanja sila iz različitih pravaca⁸. Manja količina zubne supstance uslovljava goru retenciju materijala za restauraciju⁹. Gubitak svake pojedinačne površine zuba umanjuje njegovu mehaničku sposobnost za oko 20%¹⁰. Podaci iz literature ukazuju na to da gubitak marginalnih bridova najviše utiče na gubitak mehaničke otpornosti zuba, tako da mezio-okluzo-distalni (MOD) kavitet smanjuje mehaničku otpornost zuba za 63%, dok endodontska terapija zuba sa ovim kavitetom umanjuje mehaničku otpornost za 82%¹⁰.

Introduction

Endodontic treatment is a clinical procedure in dentistry, which is carried out with the aim of treating teeth with diseased pulp or periapex, and involves extirpation of the contents of the root canal, chemical-mechanical processing of the canal as well as hermetic obturation of the canal system, which has the ultimate goal of preserving the functionality and integrity of the tooth¹. Diseases of the pulp and periapical tissue are often accompanied by a larger defect in the crown of the tooth caused by caries². Situations in which endodontic treatment of teeth with an intact crown is needed are rarer. This may be the case in teeth that must be endodontically treated for non-odontogenic cysts or luxations due to trauma^{3,4}. Endodontically treated teeth have numerous characteristics that distinguish them from vital teeth. Regardless of well-performed endodontic treatment, endodontically treated teeth are prone to fractures⁵, which is also a frequent cause of their premature loss⁶. This fact raises the issue of tooth restoration and protection after quality endodontic treatment. Crowns represent dental restorations, made of ceramics or metal-ceramics, which, in addition to establishing the morphology of the teeth, also have the function of protecting teeth with a larger crown defect⁷.

The aim of this paper was to review the factors that could lead to the fracture of endodontically treated teeth, as well as recommendations for the prevention of these factors by prosthetic treatment of endodontically treated teeth with crowns.

Loss of hard dental tissue

The presence of major dental tissue defects imposes several problems, which must be considered during the restoration. In order to perform an adequate conservative tooth restoration, the cavity walls should be thick enough to withstand the pressure caused by the chewing function. In the event that the walls are too thin, it is necessary to shorten them and include them in the cavity, so that they do not crack during the action of forces from different directions⁸. A smaller amount of tooth substance results in a worse retention of the restoration material⁹. The loss of each individual surface of the tooth reduces its mechanical ability by about 20%¹⁰. Data from the literature indicate that the loss of marginal ridges has the greatest effect on the loss of the mechanical resistance of the tooth, so that the MOD cavity reduces the mechanical resistance of the tooth by 63%, while the endodontic therapy of the tooth with this cavity reduces the mechanical resistance by 82%¹⁰.

Struktura endodontski lečenih zuba

Nakon endodontskog tretmana, zub gubi svoju biološku aktivnost. U takvom zubu više ne postoji pulpno tkivo sa ćelijama, nervnim vlaknima i krvnim sudovima koji inervišu i vaskularizuju zub¹¹. Neka istraživanja pokazala su da dentin ovakvih zuba postaje krh i slabiji od dentina vitalnih zuba¹², mada pojedini autori tvrde da ovakva razlika u čvrstoći nije značajna¹³. Studija Sedgleya i Messera¹⁴, koja je ispitivala mehaničku otpornost endodontski lečenih zuba, pokazala je da je dentin vitalnih zuba bio za 3,5% čvršći od kontralateralnih zuba na kojima su izvršeni endodontski tretmani. Mogući razlog slabljenja dentina endodontski lečenih zuba predstavlja dehidracija dentina nakon endodontskog tretmana. Prema Helferu i sar.¹⁵, dentin avitalnih zuba ima 9% manje vode vezane za kolagena vlakna nego dentin vitalnih zuba. Još jedan razlog manje otpornosti dentina depulpiranih zuba opisali su Lagutin i sar.¹⁶, navodeći da je u dentinu ovih zuba zabeležena manja količina kalcijuma i fosfata nego kod vitalnih zuba, a da je količina kiseonika u dentinu avitalnih zuba bila veća.

Sile kojima su zubi izloženi

Zubi su u usnoj duplji izloženi različitim silama¹⁷. Stoga, nameće se pitanje o mogućnosti endodontski lečenih zuba da izdrže te sile¹⁸. Pored fizioloških sila, prilikom mastikacije, usled formiranja nefizioloških promena u usnoj duplji, može doći i do pojave patoloških sila. Gubitak zuba i loši aproksimalni kontakti dovode do toga da zubi menjaju položaj, naginjući se ka bezubim prostorima, što izaziva neželjene prevremene kontakte, koji predstavljaju izvor patoloških sila¹⁷. Karijes, odnosno faktor koji može dovesti do gubitka zuba ili formiranja loših kontakata, češći je kod pacijenata koji već imaju endodontski lečene zube¹⁹. U studiji Caplana i sar.²⁰, objavljeno je da je rizik za ekstrahovanje kod zuba bez ijednog aproksimalnog kontakta ili sa samo jednim aproksimalnim kontaktom do tri puta veći nego kod endodontski lečenih zuba koji imaju dva aproksimalna kontakta.

Instrumenti i materijali korišćeni u toku endodontskog tretmana zuba

Kvalitetna endodontska terapija zahteva adekvatnu mehaničku i hemijsku obradu kanalnog sistema zuba. Tokom obrade kanala korena dolazi do mehaničkog uklanjanja parakanalnog sloja dentina.

Structure of endodontically treated teeth

After endodontic treatment, the tooth loses its biological activity. In such a tooth, there is no more pulp tissue with cells, nerve fibers and blood vessels that innervate and vascularize the tooth¹¹. Some studies have shown that the dentin of such teeth becomes brittle and weaker than the dentin of vital teeth¹², while some authors claim that this difference in strength is not significant¹³. A study by Sedgley and Messer¹⁴ that investigated the mechanical resistance of endodontically treated teeth showed that the dentin of vital teeth was 3.5% stronger than the contralateral teeth, on which endodontic treatments were performed. A possible reason that leads to the weakening of the dentin of endodontically treated teeth is dehydration of the dentin after endodontic treatment. According to Helfer et al.¹⁵ the dentin of vital teeth has 9% less water bound to collagen fibers compared to the dentin of vital teeth. Another reason for the lower resistance of the dentin of depulped teeth was described by Lagutin et al.¹⁶, who stated that the dentin of these teeth had a lower amount of calcium and phosphate compared to vital teeth, while the amount of oxygen in the dentin of vital teeth was higher.

Forces to which the teeth are exposed

Teeth in the oral cavity are exposed to various forces¹⁷. Therefore, the question arises about the ability of endodontically treated teeth to withstand these forces¹⁸. In addition to physiological forces, pathological forces may also occur during mastication due to the formation of non-physiological changes in the oral cavity. Tooth loss and poor proximal contacts cause the teeth to change position, leaning towards toothless spaces, which causes unwanted premature contacts that are a source of pathological forces¹⁷. Caries, that is, a factor that can lead to tooth loss or the formation of poor contacts, is more common in patients who already have endodontically treated teeth¹⁹. A study by Caplan et al.²⁰ reported that teeth with no or only one proximal contact have up to three times the risk of being extracted than endodontically treated teeth with two proximal contacts.

Instruments and materials used during endodontic treatment of teeth

Quality endodontic therapy requires adequate mechanical and chemical treatment of the tooth canal system¹.

Ovo dovodi do istanjenja zidova kanala korena, čineći zub podložniji frakturama²¹. Danas sve zastupljenija mašinska obrada kanala korena može dovesti i do mikropukotina u korenskom dentinu^{22,23}. U novijim studijama dolazi se do zaključka da obrada kanala korena instrumentima veće koničnosti i većeg dijametra smanjuje otpornost lečenog zuba na vertikalne frakture²⁴.

Slabljenje zidova kanala korena uzrokovano je i upotrebom rastvora za irigaciju, koji rastvaraju parakanalni dentin²⁵. Rastvori za irigaciju i medikamenti koji se tokom endodontskog tretmana koriste za dezinfekciju i medikaciju kanala korena reaguju sa mineralima iz dentina, što uzrokuje smanjenje modula elastičnosti²⁶ i mikrotvrdoće dentina²⁷. Helatni rastvori ispoljavaju efekat na nekolagene proteine i vezuju kalcijum iz tvrdih zubnih tkiva, što dovodi do erozije dentina i smanjenja njegove tvrdoće. Istraživanja pokazuju da koncentracija rastvora za irigaciju EDTA, koji se koristi za ispiranje kanala tokom endodontskog tretmana, kao i vreme izloženosti kanala korena ovom irigansu, mogu imati uticaj na smanjenje otpornosti endodontski lečenih zuba²⁸ na frakturu.

Značaj opturacije kanala korena opisan je u eksperimentalnoj studiji, u kojoj je potvrđeno da zubi čiji su kanali obrađeni, ali nisu opturirani imaju najmanju otpornost na frakturu²⁹. Podaci iz literature ukazuju na značajno veću otpornost zuba na vertikalnu frakturu kada su kanali punjeni silerom GuttaFlow sa česticama gutaperke, u poređenju sa punjenjem uz pomoć pasta AH plus, Dia-ProSeal i MTA Fillapex³⁰. Muraleedhar i sar.³¹ su istakli da su zubi čiji su kanali opturirani pastom AH plus pokazali veću otpornost na frakturu prilikom aplikacije vertikalne sile od zuba čiji su kanali punjeni pastom BioRoot RCS i MTA Fillapex. U studiji Lertchirakarna i sar.³² najveću otpornost na vertikalnu frakturu pokazali su zubi opturirani silerom Ketac-Endo, nakon čega slede AH Plus i Tubli-Seal.

Estetika endodontski lečenih zuba

Prema podacima iz literature, diskoloracija je kod endodontski lečenih zuba česta pojava. Razna oboljenja pulpe, kao i greške u izvođenju pojedinih faza endodontskog tretmana, mogu dovesti do prodora elemenata krvi i produkata razgradnje pulpnog tkiva u dentinske kanaliće, što rezultuje pojavom diskoloracija.

During root canal treatment, there is a mechanical removal of the paracanal layer of dentin, which leads to thinning of the root canal walls, making the tooth more susceptible to fractures²¹. Nowadays, the increasingly common mechanical treatment of root canals can lead to microcracks in root dentin^{22,23}. Recent studies have shown that root canal treatment with instruments of greater taper and diameter reduces the resistance of the treated tooth to vertical fractures²⁴.

Weakening of the walls of the root canal is also caused by the use of irrigants which dissolve paracanal dentin²⁵. Irrigants and medications, used during endodontic treatment for disinfection and medication of the root canal, react with minerals from the dentin, which causes a decrease in the modulus of elasticity²⁶ and the microhardness of the dentin²⁷. Chelating agents exert an effect on non-collagenous proteins and bind calcium from hard dental tissues, which leads to dentin erosion and a decrease in its hardness. Research shows that the concentration of EDTA irrigant, which is used to rinse the canals during endodontic treatment, as well as the time of exposure of the root canal to this irrigant can have an effect on reducing the fracture resistance of endodontically treated teeth²⁸.

The importance of root canal obturation was described in an experimental study, where it was confirmed that teeth whose canals were processed but not obturated had the lowest resistance to fracture²⁹. Data from the literature indicate a significantly higher resistance of teeth to vertical fracture when the canals are obturated with GuttaFlow sealer with particles gutta-percha compared to AH plus, Dia-ProSeal and MTA Fillapex³⁰. Muraleedhar et al.³¹ concluded that teeth whose canals were obturated with AH plus sealer showed greater resistance to fracture when vertical force was applied compared to teeth whose canals were obturated with sealer BioRoot RCS and MTA Fillapex. In the study by Lertchirakarn et al.³², teeth obturated with Ketac-Endo sealer showed the highest resistance to vertical fracture, followed by AH Plus and Tubli-Seal.

Aesthetics of endodontically treated teeth

Data from the literature point out that discoloration is a common occurrence in endodontically treated teeth. Various diseases of the pulp, as well as errors in the performance of certain stages of endodontic

Promena boje zuba može biti izazvana i materijalima koji se koriste prilikom medikacije ili opturacije kanalnog sistema^{33,34}.

Iako ovakav estetski problem nije u direktnoj vezi sa mehaničkom otpornosti zuba, u situacijama u kojima tehnika izbeljivanja ne daje željene rezultate, jedina mogućnost postizanja adekvatnog estetskog rešenja jeste protetsko zbrinjavanje krunicama³³.

Diskusija

Prilikom donošenja odluke o restauraciji endodontski izlečenog zuba neophodno je sagledati više faktora. Potrebno je uzeti anamnezu i izvršiti klinički pregled, ispitati stanje u usnoj duplji i u obzir uzeti ceo stomatognatni sistem³⁵. Nekada finansije pacijenta mogu biti prepreka za adekvatnu restauraciju zuba. Studija Lockera i sar.³⁶, sprovedena na odrasloj kanadskoj populaciji, pokazala je da finansijske barijere imaju negativan efekat na izbor procedura lečenja u stomatološkoj praksi.

Retrospektivna studija koju su sproveli Aquilino i sar.³⁷, predočila je da endodontski lečeni zubi zaštićeni krunama imaju šest puta duži vek trajanja od endodontski lečenih zuba bez krune. Veliki broj studija ističe značaj zaštite endodontski tretiranih zuba protetskim krunicama³⁸. Stavropoulou i sar.³⁹ su, prateći podatke iz literature, zaključili da je uspešnost desetogodišnjeg opstajanja endodontski lečenih zuba zaštićenih krunicom iznosila $81\% \pm 12\%$, za razliku od endodontski tretiranih zuba restaurisanih kompozitom, amalgamom ili cementom, kod kojih je desetogodišnje opstajanje bilo $63\% \pm 15\%$. Ista studija bavila se i uspešnošću petogodišnjeg opstajanja zuba, koje je sa krunama iznosilo $94\% \pm 2\%$, a bez kruna $63\% \pm 19\%$. Studija Klesa i sar.⁴⁰, koja je trajala dvadeset osam godina i obuhvatila 18082 pacijenta, pokazala je da su endodontski lečeni zubi zaštićeni krunicama zahtevali značajno manje naknadnih restaurativnih procedura od lečenih zuba bez krunica. U studiji Zadika i sar.⁶ izvršena je analiza faktora koji dovode do ekstrakcije endodontski lečenih zuba i pritom je zaključeno da čak 85% od 547 ekstrahovanih zuba nije bilo zaštićeno krunicom. Guo i sar.⁴¹ došli su do saznanja da je kod endodontski tretiranih zuba sa cervikalnim defektom, zbog kojeg su bili ojačani krunom ili kočićem, vek trajanja bio isti kao kod intaktnih zuba.

Bočni zubi su izloženi mnogo većim silama nego prednji zubi⁴². U brojnim studijama navodi se da endodontski tretirani molari češće podležu ekstrakcijama od drugih grupa zuba³⁷.

treatment, can lead to the penetration of blood elements and pulp tissue breakdown products into the dentin canals, which results in the appearance of discoloration. Tooth discoloration can also be caused by materials used during medication or obturation of the canal system^{33,34}. Although this aesthetic problem is not directly related to the mechanical resistance of the teeth, in situations where the whitening technique does not give the desired results, the only possibility of achieving an adequate aesthetic solution is prosthetic treatment with crowns³³.

Discussion

When making a decision on how to restore an endodontically treated tooth, there are several factors to consider. It is necessary to take an anamnesis and perform a clinical examination, examine the condition of the oral cavity and take into account the entire stomatognathic system³⁵. Sometimes the patient's finances can be an obstacle in the adequate restoration of the teeth. A study by Locker et al.³⁶ performed on an adult Canadian population showed that financial barriers have a negative effect on the choice of treatment procedures in dental practice.

A retrospective study by Aquilino et al.³⁷ showed that endodontically treated teeth protected by crowns have 6 times longer lifespan than endodontically treated teeth without crowns. A large number of studies emphasize the importance of prosthetic protection of endodontically treated teeth with crowns³⁸. Stavropoulou et al.³⁹, following data from the literature, concluded that the ten-year survival rate of endodontically treated teeth protected with crowns was $81 \pm 12\%$, in contrast to endodontically treated teeth restored with composite, amalgam or with cement, where the ten-year survival was $63 \pm 15\%$. The same study also looked at the five-year tooth survival rate, which with crowns was $94 \pm 2\%$, while without crowns it was $63 \pm 19\%$. A 28-year study by Kless et al.⁴⁰, conducted on 18,082 patients, showed that endodontically treated teeth protected by crowns required significantly fewer subsequent restorative procedures than treated teeth without crowns.

The study by Zadik et al.⁶ dealt with the analysis of factors that led to the extraction of endodontically treated teeth, where it was concluded that out of 547 extracted teeth, 85% of them were not protected by a crown.

Goodacre i sar.³⁸ su u svojoj studiji preporučili zaštitu endodontski lečenih bočnih zuba krunicama u cilju preveniranja frakture usled delovanja mastikatornih sila, koje teže da odvoje kvržice na okluzalnoj površini. Kod prednjih zuba pak krunice nisu neophodne i treba ih postavljati samo ukoliko postoje velike restauracije ili onda kada je neophodno zadovoljiti estetske zahteve pacijenata. Rezultati do kojih su došli Nagasiri i sar.⁴³ ukazali su na neophodnost postavljanja krunice kod endodontski lečenih molara, osim u situacijama u kojima su ovi zubi potpuno netaknuti, tj. onda kada postoji samo pristupni kavitet. Petogodišnja šansa za opstajanje endodontski lečenih molara bez krune u pomenutoj studiji iznosila je 36%. Klinička studija Tikku i sar.⁴⁴, koja je trajala dvadeset pet godina, pokazala je da je fraktura endodontski tretiranih bočnih zuba, ukoliko nisu zaštićeni krunicom, samo pitanje vremena.

U slučajevima značajne destrukcije zubne krune, radi uspostavljanja adekvatne restauracije, pored protetskog zbrinjavanja krunicama, indikovana je i primena intraradiksnog ojačanja⁴⁵. Ovo se može ostvariti uz pomoć industrijskih kočica ili livenih nadogradnji⁴⁶. Na ovaj način poboljšava se efikasnost prenosa sila na koren zuba, što se pominje u studijama koje ističu da ne postoji značajna razlika u stepenu opstanka implantata i endodontski lečenih zuba ojačanih krunama i kočicima⁴⁷. Iako postoje navodi o tome da kočici mogu poboljšati otpornost endodontski lečenih zuba na frakturu, sama preparacija za kočic oslabljuje koren zuba⁴⁸, tako da je važno da se kočici koriste samo onda kada nije moguće uspostaviti retenciju na neki drugi način⁵. Metalni kočici preporučuju se u slučajevima većeg nedostatka krunice zuba, dok je za fiberglas kočice neophodno postojanje dela krunice zuba, potrebnog za retenciju kočica preko adhezivnog sistema⁴⁶. U većem broju studija beleže se češće frakture korena kod zuba ojačanih metalnim kočicima nego kod onih ojačanih fiberglas kočicima⁴⁶. Krutost materijala, korozija, decementiranje, koncentracija sila i mikropropuštanje⁴⁹ predstavljaju razloge za neuspeh metalnih kočica.

Novije analize ističu značaj endokruna – monobloka koji prilikom restauracije bočnih zuba za pomoćnu retenciju koristi prostor pulpne komore devitalizovanih zuba.

Guo et al.⁴¹ found that in endodontically treated teeth with a cervical defect, for which they were reinforced with a crown or post, the lifespan was the same as in intact teeth.

Posterior teeth are exposed to much greater forces than anterior teeth⁴². Numerous studies report that endodontically treated molars undergo extractions more often compared to other groups of teeth³⁷. Goodacre et al.³⁸ in their study recommend protecting endodontically treated posterior teeth with crowns to prevent fracture due to the action of masticatory forces that tend to separate the cusps on the occlusal surface, while in the front teeth, crowns are not necessary and should only be placed if there are large restorations or when it is necessary to meet the aesthetic requirements of patients. The results of Nagasiri et al.⁴³ indicated the necessity of crown placement in endodontically treated molars, except in situations where these teeth are completely intact, i.e. when there is only an access cavity. The 5-year chance of survival of endodontically treated molars without a crown, in the mentioned study, was 36%. A twenty-five-year clinical study by Tikku et al.⁴⁴ shows that the fracture of endodontically treated posterior teeth, if they are not protected by a crown, is only a matter of time.

In situations where there is a significant destruction of the dental crown, in order to establish an adequate restoration, in addition to prosthetic care with crowns, the application of intraradicular reinforcement is indicated⁴⁵. This can be achieved with the help of industrial post or cast post⁴⁶. In this way, the efficiency of force transmission to the root of the tooth is improved, which is reflected in studies that point out that there is no significant difference in the degree of survival of implants and endodontically treated teeth reinforced with crowns and posts⁴⁷. Although there are reports that posts can improve the fracture resistance of endodontically treated teeth, the post preparation itself weakens the root of the tooth⁴⁸, so it is important that posts are used only when retention cannot be established by any other means⁵. Metal posts are recommended when there is a greater lack of the crown of the tooth, while for fiber glass post it is needed that tooth have a part of the crown which is necessary for the retention of the post through the adhesive system⁴⁶. A greater number of studies have recorded more frequent root fractures of teeth reinforced with metal posts than those reinforced with fiber glass posts⁴⁶.

U prilog ovim nadoknadama idu i novije tehnologije, kakva je CAD/CAM tehnologija, zahvaljujući kojoj su olakšani uzimanje otisaka i izrada endokruna.

U takvim situacijama preporučuju se redovne kontrole na kojima bi se pratilo mikrocurenje i eventualno sproveda pravovremena adekvatna intervencija, koja bi sprečila decementiranje endokrone. Neophodno je pravilno oceniti indikacije za postavljanje ovakvog vida nadoknade, budući da su brojna istraživanja pokazala da se endokrone nisu uspešno održavale na zubima sa restauracijama neadekvatno pripremljenim za ove nadoknade⁵⁰⁻⁵².

Zaključak

Protetska rekonstrukcija krunom pokazala se kao značajna u zaštiti bočnih endodontski lečenih zuba, dok je zbrinjavanje prednjih zuba krunicama indikovano kod zuba sa velikim oštećenjima i estetskim nedostacima, koji se ne mogu sanirati drugim konzervativnim postupcima. Prilikom donošenja odluke u vezi sa restauracijom endodontski izlečenog zuba potrebno je sagledati više faktora; treba proceniti koliki je gubitak zubnog tkiva i sile kojima će zub biti izložen u ustima, kao i instrumente i materijale koji će se koristiti tokom endodontskog tretmana kanalnog sistema zuba. U situacijama u kojima postoji značajan gubitak zubnog tkiva treba razmotriti opciju dodatnog ojačanja postavljanjem kočica.

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Reasons for the failure of metal posts are material stiffness, corrosion, decementation, concentration of forces and microleakage⁴⁹.

Newer analyzes highlight the importance of the endocrown—a monobloc that, during the restoration of posterior teeth, uses the space of the pulp chamber of devitalized teeth for auxiliary retention. Newer technologies, such as CAD-CAM technology, facilitate the taking of impressions and the production of endocrowns. In such situations, regular controls are recommended to monitor microleakage and possibly implement a timely and adequate intervention, which would prevent decementation of the endocrown. It is necessary to properly assess the indications for placing this type of restoration because numerous studies have shown that endocrowns were not successfully maintained on teeth with inadequately prepared restorations for endocrowns⁵⁰⁻⁵².

Conclusion

Prosthetic reconstruction with a crown proved to be significant in the protection of posterior endodontically treated teeth, while treatment of front teeth with crowns is indicated for teeth with major damage and aesthetic defects that cannot be repaired by other conservative procedures. When making a decision on how to restore an endodontically cured tooth, it is necessary to consider several factors. It is needed to assess the amount of tooth tissue loss, the forces to which the tooth will be exposed in the mouth, but also the instruments and materials that will be used during the endodontic treatment of the tooth canal system should be taken into account. In situations where there is significant loss of tooth tissue, the option of additional reinforcement by placing posts should be considered.

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