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Postoperative Pain after Primary Endodontic Treatment and Retreatment of Asymptomatic Teeth

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SUMMARY

Introduction Postoperative pain may develop after chemomechanical preparation during endodontic treatment or retreatment. It is associated with acute apical periodontitis caused by bacteria penetrated from the root canal into the periapical tissue. The purpose of this study was to evaluate the incidence of postoperative pain during endodontic treatment after intracanal medication performed with calcium hydroxide (CH) paste or 1% chlorhexidine gel (CHX).

Material and Methods The study included 22 asymptomatic teeth in both male and female patients. Fourteen teeth had the diagnosis of pulp necrosis and the other eight were retreatment cases. The root canals were prepared by crown-down technique using K files and copious irrigation with 0.5% sodium hypochlorite (NaOCl). Intracanal dressing was performed using either calcium hydroxide paste or 1% CHX gel. Each medicament was placed in the root canals of eleven randomly selected teeth. The teeth were restored with temporary filling. Postoperative pain was registered during the seven day period between two appointments. The level of pain was rated as follows: no pain, mild pain, moderate pain and severe pain (flare-up). The obtained data was analyzed using Fisher exact test. The level of significance was $\alpha=0.05$.

Results Postoperative pain was absent in 77.3% of total number of treated teeth. Severe pain (flare-up) was registered in 2 cases (9%). There was no significant difference in pain incidence between the CH paste and CHX gel group ($p=0.610$).

Conclusion Endodontic procedure used in this study which considered root canal instrumentation and irrigation followed by intracanal medication with CH and CHX resulted in low incidence of postoperative pain.

Keywords: endodontic treatment; retreatment; postoperative pain; medication

INTRODUCTION

Endodontic treatment or retreatment of an asymptomatic tooth can be complicated by postoperative pain of different intensity. According to the literature, mild to moderate pain occurs in 10-30% of cases, while severe, unbearable pain followed by swelling can be present in 1.4-16% of cases [1-4]. Mild or moderate pain usually resolves spontaneously or after the administration of analgesics and does not constitute an obstacle for the successful endodontic treatment outcome. In contrast, the severe post-operative pain, often accompanied with swelling is an emergency situation and often leads to interruption of treatment and retreatment, respectively. This complication is known in the international literature as "flare up". The "flare up" can be defined as an acute exacerbation of asymptomatic pulp and periapical infection caused by the endodontic treatment or retreatment of the root canal [4]. Severe postoperative pain requires an urgent dental visit for the elimination of symptoms, delaying the obturation and significantly prolonging the endodontic treatment or retreatment. The existence of severe pain as the complication of endodontic treatment often has a consequence that patients rather choose tooth extraction than continuation of the initiated endodontic therapy [5].

Postoperative pain is the result of acute inflammation in the periradicular tissue caused by penetration of the microorganisms from the root canal during endodontic treatment or retreatment. Stimuli may be of mechanical, chemical and microbiological nature. Overinstrumentation of the root canal through the apical foramen or extrusion of irrigants and medications in the periapical tissue can cause inflammation and pain [2]. However, the most important cause of postoperative pain are microorganisms. Inflammation of the periradicular tissue caused by microorganisms is the most common consequence of penetration of the infected content through the apical foramen in the periradicular tissue during the canal instrumentation. Pain may occur after inadequate or incomplete instrumentation of the root canal causing bacterial growth. Failure to obtain aseptic working conditions during root canal treatment and addition of new microorganisms in root canals can also contribute to the occurrence of pain [3].

Given the role of microorganisms in the occurrence of postoperative pain, a low incidence of pain could be expected after their complete elimination from the root canal. However, this is difficult to achieve even with thorough instrumentation and irrigation using sodium hypochlorite (NaOCl) in different concentrations [6]. In order to kill microorganisms that are not eliminated by instru-

mentation and irrigation, but also to prevent reinfection of the root canal between two appointments, it is important to medicate the canals. While some authors suggest that an interappointment medication has no effect on postoperative pain [7], others believe that medication can significantly reduce the risk of pain, provided that materials used as canal dressing are not toxic and their application is limited to the area of the root canal [1, 2, 8]. Medicaments used for the root canal dressing have antibacterial activity. Most commonly used medicament is calcium hydroxide (CH). Since its antimicrobial efficacy is limited, other medicaments are also in use [9]. Due to its effective antimicrobial activity against a wide range of microorganisms and relatively low toxicity, chlorhexidine (CHX) has been used in dentistry for long time. In recent years, it is widely recommended as interappointment medication during endodontic treatment and specially retreatment [10].

The aim of this study was to investigate the incidence of postoperative pain during endodontic treatment and retreatment of asymptomatic teeth after root canal medication using CH paste or 1% CHX gel.

MATERIAL AND METHODS

The research was conducted at the Clinic for Restorative Dentistry and Endodontics, University of Belgrade. The study included 22 asymptomatic teeth of different morphological groups in patients of average age 46 years who visited the clinic for the treatment or retreatment of the root canal. An informed consent was obtained from each patient in order to participate in this study. Patients were divided randomly into two groups (11 teeth), depending on the medicament used: in the first group CH paste was used while in the second group 1% CHX gel was used. Fourteen teeth were diagnosed as pulp necrosis; in twelve of them chronic apical periodontitis (CAP) was also registered. The remaining eight teeth were candidates for the retreatment and four out of eight had CAP. Distribution of teeth according to the diagnosis is shown in Table 1.

Access cavity was prepared in all teeth and coronal two-thirds of the root canals were instrumented by crown down technique using Gates-Gliden's burs. Working length was determined by Root ZX apex locator (J Morita Europe GmbH, Frankfurt, Germany) and confirmed radiographically. The apical portion of the root canal was instru-

mented using K files up to #25 or more at the working length depending on the anatomy of roots and the initial diameter of the root canal. Root canals were irrigated with 0.5% sodium hypochlorite solution in the volume of 2 ml after each instrument.

In the retreatment cases, old fillings were removed from the canal using hand files and suitable solvents. After the removal of the root canal filling, instrumentation and irrigation were performed as previously described. To remove smear layer from the root canal walls 10% citric acid was used during 1 min. The canals were irrigated with additional 5 ml of 0.5% NaOCl and dried using paper points. The canal dressing was performed by introducing the medicaments in the root canal using Lentulo spiral (up to the working length) and temporary filling was placed.

For the purpose of this study, a specific questionnaire was designed and included the patient's name, morphological group of the tooth, the diagnosis of the treated tooth and the type of interappointment medicament. Upon completion of the first session, patients were informed about the possible occurrence of pain after the procedure. Analgesics were suggested for mild to moderate pain. In case of severe pain which does not respond to analgetics or swelling, the patients were advised to immediately report to the clinic. According to postoperative symptoms the patients came for the second appointment scheduled 7 days after or earlier if severe pain and swelling occurred.

At the beginning of the second appointment, the data obtained from the patient about the presence or absence of pain between visits as well as its intensity was recorded. The intensity of pain was ranked according to the following scale: no pain, mild pain, moderate pain and severe, unbearable pain. Mild pain was defined as slight discomfort after the procedure. Moderate pain was defined as tolerable pain which disappeared spontaneously or after administration of analgesics. In case of mild to moderate pain root canals were obturated during the next visit. If severe, unbearable pain (with the possible presence of swelling) did not respond to analgesics, the patient was forced to appear to the clinic before the actual appointment for urgent treatment. In these cases, the medication was discontinued and definitive obturation was postponed [11].

The obtained data was statistically analyzed using Fisher's test for the level of significance at $\alpha=0.05$.

Table 1. Distribution of teeth according to diagnosis and medicament

Tabela 1. Distribucija zuba u skladu sa dijagnozom i primenjenim medikamentom

Medicament Medikament	Number of teeth Broj zuba	Primary endodontic treatment Primarno endodontsko lečenje		Retreatment Retretman	
		Without CAP Bez HAP	With CAP Sa HAP	Without CAP Bez HAP	With CAP Sa HAP
Calcium hydroxide (CH) Kalcijum-hidroksid (CH)	11	1	8	1	1
Chlorhexidine (CHX) Hlorheksidin (CHX)	11	1	4	3	3
Total Ukupno	22	2 (9.1%)	12 (54.5%)	4 (18.2%)	4 (18.2%)

CAP – chronic apical periodontitis
HAP – hronični apeksni periodontitis

RESULTS

Of the total 22 teeth included in this study, 17 (77.3%) of the teeth did not cause postoperative pain. Severe pain that required emergency intervention and interruption of interappointment medication occurred in 2 cases (9%), one in CH group and one in CHX group. For 2 tested teeth (9%) the occurrence of mild pain was recorded. Moderate pain occurred in 1 tooth (5%).

When CH was used as interappointment medication, 9 (81.8%) teeth were asymptomatic (no pain). Severe pain and swelling was noted in 1 (9%) case, the tooth with necrotic pulp and CAP present. Mild pain was also reported in 1 patient after retreatment of the tooth with CAP (Table 2).

Of 11 teeth where CHX was used as interappointment medication, postoperative pain was absent in 8 (72%) cases. Severe pain, but no swelling occurred in 1 (9%) patient after retreatment of the tooth with present CAP. Two patients reported mild or moderate pain after root canal retreatment (Table 2).

Analysis of the data revealed no statistically significant difference in the incidence of pain in regards to different interappointment medication ($p=0.610$).

DISCUSSION

A number of different factors during and after endodontic treatment can cause postoperative pain. Since the procedural or iatrogenic errors (canal instrumentation beyond the apical foramen, pushing the debris, irrigants or medicaments through the foramen in periradicular tissue) can be an important factor in the occurrence of postoperative pain, this survey was conducted in accordance to the standards of modern endodontic practice. The working length of the root canals was determined using Root ZX locator, whose reliability was documented in the literature [12], and then confirmed radiographically. The root canals were instrumented by crown down technique in order to prevent apical extrusion of debris by instrumentation [13]. The irrigation was conducted very carefully with low concentration of NaOCl. Interappointment medication was also

limited to the area of the root canal in order to meet the biological requirements of the endodontic therapy.

It is important to note that, despite carefully realized endodontic treatment, there is always possibility for mechanical injury of the periradicular tissue. However, if there was no infection, mechanical stimuli would cause only temporary problems in the periradicular tissue, mild inflammation and pain [14].

Since microorganisms are responsible for the occurrence of severe postoperative pain, endodontic treatment or retreatment in the current study was based on antimicrobial strategy. Upon the completion of instrumentation and irrigation the canals were subjected to interappointment medication using CH paste or CHX. Antimicrobial efficacy of CH is well known and documented in the literature [8, 15]. Its effectiveness in eliminating Gram-negative bacteria [15] often associated with symptomatic pulpitis and apical periodontitis is very important [16]. However, it was found that CH has a limited antimicrobial effect on *Enterococcus faecalis*, *Candida albicans* and *Actinomyces* [14]. On the other hand, CHX has strong antimicrobial effect on a wide range of Gram-positive and Gram-negative species including *E. faecalis* and other microorganisms resistant to the conventional medication with CH [9].

Postoperative pain between two appointments was investigated in the present study. One of the main problems in studying pain is subjective assessment and measurement of pain intensity. By designing the simple questionnaire the goal was to reduce errors in interpretation and to obtain reliable information from patients.

In 77.3% of teeth included in this study there was no postoperative pain. The obtained results indicated a low incidence of postoperative pain and they were consistent with the findings of other authors [1, 2, 3]. This finding could be attributed to the proper procedures and adequate chemomechanical instrumentation of the root canals with a maximal reduction of possibilities for the occurrence of iatrogenic or procedural errors.

In the present study, severe pain was recorded in 9% of cases. This finding is also consistent with the literature data where occurrence of severe pain was recorded in 1.4 to 16% of cases [1-4]. Although there are many factors

Table 2. Incidence of pain in treatment and retreatment cases after medication with calcium hydroxide and chlorhexidine
Tabela 2. Učestalost bola posle tretmana i retretmana zuba nakon medikacije kalcijum-hidroksidom i hlorheksidinom

Parameter Parametar		Number of teeth Broj zuba		Postoperative pain Postoperacioni bol							
				No pain Bez bola		Mild Blag		Moderate Umeren		Severe Jak	
		CH	CHX	CH	CHX	CH	CHX	CH	CHX	CH	CHX
Treatment Tretman	Without CAP Bez HAP	1	1	1	1	0	0	0	0	0	0
	With CAP Sa HAP	8	4	7	4	0	0	0	0	1	0
Retreatment Retretman	Without CAP Bez HAP	1	3	1	2	0	0	0	1	0	0
	With CAP Sa HAP	1	3	0	1	1	1	0	0	0	1
Total Ukupno		11	11	9	8	1	1	0	1	1	1

responsible for postoperative pain, the greatest responsibility belongs to the microorganisms [3]. No statistically significant difference in pain incidence between the CH and CHX group was found. The results are consistent with the findings of Gama et al. [2] who also reported no significant differences in the incidence of severe postoperative pain after administration of CH paste in combination with paramonochlorophenol camphor as compared to 0.12% CHX gel.

According to the literature, severe postoperative pain is more likely to develop after the treatment of teeth with necrotic pulp without CAP as compared to the teeth with necrotic pulp and present CAP. The authors explained this finding by the lack of space in bone and inability to relieve the pressure in cases where apical periodontium was intact which consequently caused pain [2]. The current study did not confirm such correlation. Severe pain was recorded exactly in the two teeth with present CAP. One of the reasons for this finding could be poor immune status of the patients. Also, the current research was conducted on relatively small sample and it is quite possible that a larger number of analyzed teeth would give different results.

Torabinejad et al. [17] indicated higher incidence of severe postoperative pain in retreated teeth (due to the presence of posttreatment infection) than in primary endodontic treatment. In general, it is widely accepted that the prognosis of retreatment is worse than the prognosis of primary endodontic treatment. In retreatment cases, the present microflora is usually more resistant to the conventional treatment procedures than microflora in the primary CAP. It is known that facultative anaerobic microbial species are more resistant than strictly anaerobic and that Gram-positive microorganisms are more resistant than Gram-negative. Facultative anaerobic Gram-positive bacteria are the best treated by adequate obturation. *E. faecalis*, facultative anaerobic Gram-positive bacteria is the dominant species in posttreatment CAP. This species is known for its resistance to harsh conditions and can survive in water without food up to several months. In addition to *E. faecalis* the other Gram-positive bacteria such as streptococci, lactobacilli, actinomices, *C. albicans* and others could be found in posttreatment infections. Even though the number of bacteria is significantly reduced during chemomechanical instrumentation, these types of microorganisms can significantly increase their numbers between two visits [14]. The application of interappointment medication in such cases can contribute to bacterial elimination and reduction of the likelihood for postoperative pain. The results of the current study also suggest that postoperative symptoms are more common in retreatment cases. From the total of 5 teeth that developed postoperative pain of different intensity, 4 were retreatment cases. However, there was no significant difference

in the incidence of pain depending on the type of used interappointment medicament.

CONCLUSION

Endodontic procedures applied in the current study, based on thorough instrumentation, irrigation using NaOCl and interappointment root canal medication using CH paste or CHX gel, resulted in a low incidence of postoperative pain.

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Učestalost bola posle endodontskog lečenja i ponovnog tretmana asimptomatskih zuba

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KRATAK SADRŽAJ

Uvod Postoperacioni bol je najčešća komplikacija hemomehaničke preparacije kanala korena zuba, a posledica je akutnog zapaljenja u periradikularnom tkivu nastalog usled prodora nadražaja iz kanala korena, najčešće mikroorganizama. Cilj rada je bio da se ispita učestalost bola nakon endodontskog lečenja i ponovnog tretmana asimptomatskih zuba posle medikacije kanala korena pastom kalcijum-hidroksida (CH), odnosno gelom jednog procentnog hlorheksidina (CHX).

Materijal i metode rada Tokom istraživanja ispitana su 22 asimptomatska zuba. Kod 14 zuba je dijagnostikovana nekroza pulpe, dok je kod osam zuba bilo potrebno uraditi ponovni tretman. Preparacija kanala korena je urađena *crown-down* tehnikom i K-turpijama uz obilnu irigaciju rastvorom NaOCl od 0,5%. Zubi su nasumično podeljeni u dve grupe od po 11 zuba. U prvoj grupi kanali korena su posle instrumentacije napunjeni CH pastom, a u drugoj grupi je za medikaciju kanala korišćen CHX gel. Nakon toga zubi su privremeno zatvoreni, a pojava bola je praćena do naredne posete posle sedam dana. Intenzitet bola je rangiran po sledećoj skali: bez bola, blag bol, umeren bol i jak (neizdržljiv) bol. Dobijeni podaci su statistički obrađeni primenom Fišerovog testa na nivou značajnosti od $\alpha=0,05$.

Rezultati U 17 zuba (77,3%) nije bilo postoperacionog bola. Među pacijentima koji su osećali bolove jak bol je zabeležen u dva slučaja (9%). Nisu uočene statistički značajne razlike u učestalosti bola u zavisnosti od korišćenog intrakanalnog medikamenta ($p=0,610$).

Zaključak Endodontski postupci primenjeni u ovom istraživanju, zasnovani na temeljnoj instrumentaciji uz irigaciju rastvorom NaOCl i interseansnoj medikaciji kanala CH pastom, odnosno CHX gelom, doveli su do male incidencije postoperacionog bola.

Ključne reči: endodontsko lečenje; retreatman; postoperacioni bol; medikacija

UVOD

Endodontsko lečenje, odnosno ponovni tretman (retretman) asimptomatskih zuba može se komplikovati pojavom postoperacionog bola različitog intenziteta. Prema podacima iz literature, bol koji je slabog do umerenog intenziteta javlja se u 10-30% slučajeva, dok se jak, neizdržljiv bol praćen otokom beleži u 1,4-16% slučajeva [1-4]. Slab i umeren bol najčešće prolazi spontano ili nakon primene analgetika, te nije prepreka za uspešan ishod endodontske terapije. Nasuprot tome, jak postoperacioni bol često je udružen s otokom i uglavnom predstavlja hitno stanje, koje za posledicu ima prekid započetog endodontskog lečenja, odnosno retreatmana. Ova komplikacija se u anglosaksonskoj terminologiji naziva *flare-up*, a definiše se kao akutna egzacerbacija asimptomatskih oboljenja pulpe i periradikularnog tkiva nastala usled početka ili nastavka tretmana kanala korena [4]. Jak postoperacioni bol, osim što zahteva hitnu posetu stomatologu radi otklanjanja simptoma, odlaže opturaciju, čime značajno produžava endodontsko lečenje, odnosno retreatman. Komplikovanje tretmana ili retreatmana pojavom jakog bola često pacijente opredeljuje da pre izvade zub nego da nastave započeto endodontsko lečenje [5].

Postoperacioni bol je posledica akutnog zapaljenja u periradikularnom tkivu koje nastaje usled prodora nadražaja iz kanala korena tokom endodontskog lečenja, odnosno retreatmana. Nadražaji mogu biti mehaničke, hemijske i mikrobiološke prirode. Preinstrumentacija kanala preko apeksnog foramena, odnosno ekstruzija irigansa i medikamenata u periradikularno tkivo mogu dovesti do upale i pojave bola [2]. Ipak, najznačajniji uzročnici postoperacionog bola su mikroorganizmi. Zapaljenje periradikularnog tkiva izazvano mikroorganizmima najčešće je posledica prodora inficiranog sadržaja kanala korena zuba preko apeksnog foramena u periradikularno tkivo tokom

preparacije kanala. Bol se može javiti i nakon neadekvatne, odnosno nepotpune instrumentacije, koja dovodi do promena unutar kanala i razmnožavanja određenih bakterijskih vrsta. Nepridržavanje aseptičnih uslova rada tokom endodontskog tretmana dovodi do prodiranja novih vrsta mikroorganizama u kanale korena, što može izazvati bol [3].

S obzirom na ulogu mikroorganizama u nastanku postoperacionog bola, niska incidencija bola bi se mogla očekivati nakon njihove potpune eliminacije iz kanala korena. Međutim, ovo je teško postići čak i temeljnom instrumentacijom i obilnom irigacijom rastvorima natrijum-hipohlorita (NaOCl) u različitim koncentracijama [6]. Da bi se eliminisali mikroorganizmi koji nisu uklonjeni instrumentacijom i irigacijom i sprečila ponovna infekcija kanala između poseta stomatologu, neophodna je interseansna medikacija kanala. I dok neki autori smatraju da primena interseansnih medikamenata nema uticaja na pojavu postoperacionog bola [7], drugi veruju da njihova primena može značajno umanjiti rizik od pojave bola pod uslovom da korišćeni medikamenti nisu toksični i da se njihova primena ograniči na prostor kanala korena [1, 2, 8]. Za medikaciju kanala danas se koriste različita sredstva s antimikrobnim delovanjem. Najčešće korišćeni kanalni medikament trenutno je kalcijum-hidroksid (CH). S obzirom na određena ograničenja u pogledu njegovog antimikrobnog delovanja, za medikaciju se predlažu i druga sredstva [9]. Zbog efikasnog delovanja na širok spektar mikroorganizama i relativno niske toksičnosti, hlorheksidin (CHX) se takođe dugo primenjuje u stomatologiji. Poslednjih godina se sve više preporučuje kao interseansni medikament tokom endodontskog lečenja, a naročito retreatmana [10].

Cilj rada je bio da se ispita učestalost bola nakon endodontskog lečenja i retreatmana asimptomatskih zuba posle medikacije kanala korena pastom CH, odnosno CHX gelom.

MATERIJAL I METODE RADA

Istraživanje je urađeno na Klinici za bolesti zuba Stomatološkog fakulteta Univerziteta u Beogradu. Ispitana su 22 asimptomatska zuba različitih morfoloških grupa kod pacijenata prosečne starosti od 46 godina koji su se javili na kliniku radi tretmana, odnosno retreatmana kanala korena zuba. Svi pacijenti su dali pisanu saglasnost za učesće u istraživanju. Zubi su podeljeni u dve grupe od po 11 zuba u zavisnosti od sredstva koje je korišćeno za interseansnu medikaciju: u prvoj grupi je korišćena CH pasta, a u drugoj jednoprocenatni CHX gel. Kod 14 zuba je dijagnostikovana nekroza pulpe, od kojih je kod 12 utvrđen i hronični apeksni periodontitis (HAP). Među preostalih osam zuba kod kojih je bilo potrebno uraditi retreatman HAP je utvrđen kod četiri zuba. Distribucija zuba u funkciji dijagnoze prikazana je u tabeli 1.

Kod svih zuba posle formiranja pristupnog kaviteta, koronarne dve trećine kanala su obrađene *crown-down* tehnikom uz upotrebu Gejts–Glidenovih (*Gates–Gliden*) borera. Radna dužina kanala korena je utvrđena apeks lokatorom *Root ZX (J Morita Europe GmbH, Frankfurt, Nemačka)*, a zatim radiografski potvrđena. Za preparaciju apeksne trećine kanala korišćene su ručne K-turpije do veličine 25 na radnoj dužini ili više, u zavisnosti od anatomije korena i početnog prečnika kanala. Tokom preparacije kanali su ispirani rastvorom NaOCl od 0,5%, sa po 2 ml rastvora iza svakog instrumenta.

Kod zuba kod kojih je trebalo uraditi retreatman staro punjenje je uklonjeno iz kanala ručnim turpijama uz primenu odgovarajućih rastvarača, a potom je preparacija izvedena na opisan način. Za uklanjanje razmaznog sloja sa zidova kanala posle instrumentacije korišćen je desetoprocenatni rastvor limunske kiseline tokom jednog minuta. Kanali su zatim isprani sa još 5 ml 0,5% NaOCl i osušeni papirnim poenima. Posle toga je sprovedena medikacija kanala unošenjem testiranih medikamenata u kanale lentulo spiralom (na radnu dužinu), nakon čega su zubi privremeno zatvoreni.

Za potrebe ovog istraživanja dizajniran je upitnik u koji su upisivane generalije pacijenta, morfološka grupa zuba, dijagnoza tretiranog zuba i vrsta korišćenog interseansnog medikamenta. Po završetku prve seanse pacijenti su informisani o mogućoj pojavi bola nakon intervencije. U slučaju pojave blagih i umerenih bolova savetovana je primena analgetika. U slučaju razvoja jakog bola koji ne reaguje na analgetike i eventualne pojave otoka, pacijentima je sugerisano da se odmah jave u ordinaciju. U skladu s postoperacionim simptomima pacijenti su dolazili u zakazanu drugu posetu za sedam dana, odnosno ranije ukoliko su se javili jak bol i otok.

Na početku druge posete u upitnik su beleženi podaci dobijeni od pacijenta o pojavi bola između poseta, kao i o njegovom intenzitetu. Intenzitet bola je rangiran po sledećoj skali: bez bola, blag bol, umeren bol i jak, neizdržljiv bol. Kao blag bol definisana je samo neznatna neprijatnost nakon intervencije. Umeren bol je definisan kao podnošljiv bol koji prolazi spontano ili nakon primene analgetika. Kod pojave blagog ili umerenog bola opturacija kanala korena je obavljena prilikom druge posete. Jak, neizdržljiv bol (uz moguću otok) nije reagovao na analgetike i pacijent je bio prinuđen da se javi pre zakazanog termina radi ukazivanja prve pomoći. Kod ovakvih slučajeva započeta medikacija je prekinuta, a konačna opturacija kanala korena odložena [11].

Dobijeni podaci su statistički obrađeni primenom Fišerovog (*Fisher*) testa na nivou značajnosti od $\alpha=0,05$.

REZULTATI

Od ukupno 22 ispitana zuba kod 17 zuba (77,3%) nije zabeležena pojava postoperacionog bola. Jak bol je zabeležen u dva slučaja (9%), po jedan u svakoj grupi. Kod takođe dva pacijenta (9%) javio se blag bol, a kod jednog (5%) bol umerenog intenziteta.

U grupi zuba kod kojih je kao interseansni medikament korišćena CH pasta postoperacioni bol se nije javio kod devet zuba (81,8%). Jak bol praćen oticanjem zabeležen je kod jednog pacijenta (9%), i to kod zuba s nekrotičnom pulpom i HAP. Blag bol se takođe javio kod jednog ispitanika, i to nakon retreatmana zuba sa HAP (Tabela 2).

U grupi zuba gde je kao interseansni medikament korišćen CHX gel, postoperacionog bola nije bilo u osam slučajeva (72%). Jak bol bez otoka zabeležen je kod jednog pacijenta (9%) posle retreatmana zuba sa HAP. Kod dva pacijenta je zabeležena pojava blagog, odnosno umerenog bola nakon retreatmana kanala korena (Tabela 2).

Obradom dobijenih podataka nisu uočene statistički značajne razlike u učestalosti bola u zavisnosti od korišćenog interseansnog medikamenta ($p=0,610$).

DISKUSIJA

Na pojavu bola tokom i posle endodontske terapije mogu uticati razni faktori. S obzirom na to da proceduralne, odnosno jatrogene greške (instrumentacija kanala preko apeksnog foramina, propuštanje debrisa, irigansa i medikamenata u periradikularno tkivo) mogu biti značajan faktor u nastanku postoperacionog bola, ovo istraživanje je izvedeno u skladu sa standardima savremene endodontske prakse. Radna dužina kanala korena je utvrđena lokatorom *Root ZX*, čija je pouzdanost u literaturi dokumentovana [12], a zatim potvrđena radiografski. Kanali korena su instrumentisani *crown-down* tehnikom kako bi se tokom instrumentacije kanala sprečila apeksna ekstruzija debrisa [13]. Za ispiranje kanala korena korišćen je rastvor NaOCl slabije koncentracije uz pažljivu tehniku irigacije. Sredstva korišćena za interseansnu medikaciju takođe su ograničena na prostor kanala korena kako bi se ispunili biološki zahtevi u endodontskoj terapiji.

Važno je napomenuti da je i pored pažljivo realizovanog endodontskog zahvata uvek moguća mehanička povreda periradikularnog tkiva. Međutim, ukoliko nema infekcije, mehanički nadražaji uzrokuju samo prolazne probleme u periradikularnom tkivu u vidu kratkotrajnog zapaljenja i bola [14].

Za nastanak postoperacionog bola jakog intenziteta najodgovorniji su mikroorganizmi, zbog čega su endodontsko lečenje i retreatman u ovom istraživanju bazirani na antimikrobnoj strategiji. Po završetku instrumentacije i irigacije, kanali su podvrgnuti interseansnoj medikaciji CH pastom, odnosno CHX gelom. Antimikrobna efikasnost CH je dobro poznata i dokumentovana [8, 15]. Značajna je njegova efikasnost u eliminaciji Gram-negativnih bakterija [15], koje se često dovode u vezu sa simptomatskim oboljenjima pulpe i apeksnog periodoncijuma [16]. Međutim, utvrđeno je da CH ima ograničeno

antimikrobno delovanje na *Enterococcus faecalis*, *Candida albicans* i *Actinomyces* [14]. CHX pokazuje snažan antimikrobni efekat na širok spektar Gram-pozitivne i Gram-negativne mikroorganizme uključujući i *E. faecalis*, ali i druge mikroorganizme rezistentne na konvencionalnu medikaciju CH [9].

U ovom istraživanju praćen je osećaj bola između poseta stomatologu. Jedan od glavnih problema prilikom proučavanja bola je pacijentova subjektivna procena intenziteta, odnosno merenje bola. S tim u vezi pokušano je da se jednostavno dizajniranim upitnikom umanjí mogućnost grešaka u interpretaciji i dobiju što relevantniji podaci od pacijenata.

U 77,3% zuba obuhvaćenih ovim istraživanjem nije bilo postoperacionog bola. Dobijeni rezultati ukazuju na nisku incidenciju bola i u skladu su s nalazima istraživanja drugih autora [1, 2, 3]. Ovakav nalaz bi se mogao pripisati adekvatno sprovedenim hemomehaničkim procedurama, odnosno kvalitetnom čišćenju i oblikovanju kanala korena uz maksimalno smanjenje mogućnosti za nastanak proceduralnih i jatrogenih grešaka.

U ovom istraživanju jak bol je utvrđen u 9% slučajeva. Ovaj nalaz je u skladu s podacima iz literature, gde je pojava jakog bola zabeležena u 1,4-16% slučajeva [1-4]. Iako je za pojavu postoperacionog bola odgovorno mnogo faktora, smatra se da najveća odgovornost pripada mikroorganizmima [3]. U ovom istraživanju nisu uočene statistički značajne razlike u pojavi jakog bola u zavisnosti od korišćenog interseansnog medikamenta. Dobijeni rezultati su u skladu s nalazima Game (*Gama*) i saradnika [2], koji takođe nisu našli značajne razlike u incidenciji jakog postoperacionog bola nakon primene CH paste u kombinaciji s kamfornim paramonohlorfenolom u odnosu na CHX gel od 0,12%.

Prema podacima iz literature, jak postoperacioni bol se češće razvija nakon tretmana zuba s nekrotičnom pulpom bez HAP u odnosu na zube s nekrotičnom pulpom i HAP. Ovakav nalaz autori objašnjavaju nedostatkom prostora u kosti i nemogućnošću smanjenja pritiska u slučaju očuvanog apeksnog paradoncijuma, što dovodi do pojave bola [2]. U našem istraživanju nije uočena ova korelacija. Jaki bolovi ustanovljeni su upravo kod zuba sa HAP. Razlog za to, između ostalog, može biti i loše imunološko stanje organizma. Takođe, ovo istraživanje je izvedeno na relativno malom uzorku, pa je moguće da bi na većem broju analiziranih zuba i rezultati bili drugačiji.

Torabinedžad (*Torabinejad*) i saradnici [17] su ukazali na veću incidenciju jakog bola kod zuba gde je urađen retreatman kanala korena (usled posttretmanske infekcije) nego kod primarnih endodontskih tretmana. Uopšte se smatra da je prognoza retreatmana lošija u odnosu na primarno endodontsko lečenje. U slučajevima gde je potrebno uraditi ponovni tretman, zastupljena mikroflora je otpornija na konvencionalne terapijske postupke nego što je to mikroflora u primarnom HAP. Poznato je da su fakultativne anaerobne vrste mikroorganizama mnogo otpornije od striktno anaerobnih, kao i da su Gram-pozitivni mikroorganizmi otporniji od Gram negativnih. Dakle, Gram-pozitivne fakultativno anaerobne bakterije najbolje podnose teške ekološke uslove stvorene hemomehaničkom preparacijom kanala korena. Jedna od njih je i *E. faecalis*, dominantna vrsta u posttretmanskom HAP, koja je poznata po svojoj izuzetnoj otpornosti na teške uslove, a može preživeti u vodi i bez hrane i do nekoliko meseci. Osim ove, u posttretmanskim infekcijama izolovane su i druge Gram-pozitivne bakterije, kao što su streptokoke, laktobacili, aktinomices, *C. albicans*. Čak i kada je hemomehaničkom preparacijom njihov broj značajno smanjen, ove vrste mikroorganizama mogu između poseta značajno uvećati svoj broj [14]. Zato primena interseansnog medikamenta u ovakvim slučajevima može doprineti njihovoj eliminaciji i značajno smanjiti mogućnost pojave postoperacionog bola. Rezultati dobijeni u ovom istraživanju takođe pokazuju da su postoperacioni simptomi češći kod ponovo tretiranih zuba. Od ukupno pet zuba kod kojih je došlo do razvoja bola različitog intenziteta, kod četiri je izveden retreatman. Međutim, ni ovde nije bilo značajnih razlika u incidenciji bola u zavisnosti od vrste korišćenog interseansnog medikamenta.

ZAKLJUČAK

Endodontski postupci primenjeni u ovom istraživanju, zasnovani na temeljnoj instrumentaciji uz irigaciju rastvorom NaOCl i interseansnoj medikaciji kanala CH pastom, odnosno CHX gelom, doveli su do male incidencije postoperacionog bola.