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Endodontic treatment of lower molar in a patient with paraesthesia of inferior alveolar nerve – A Case Report

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SUMMARY

Root canal (endodontic) treatment is demanding and complex procedure. A variety of difficulties can occur in different phases of endodontic procedure. Complex anatomorphological tooth structure, curved canals, close proximity of lower molars and premolars to inferior alveolar nerve make endodontic treatment even more challenging. During endodontic treatment, an inferior alveolar nerve may become traumatized and symptoms may vary from mild neurosensory dysfunction to a complete loss of sensation in the innervation area of damaged nerve.

The aim of this paper is to present a clinical case of endodontic treatment of lower second molar with C-shaped root canal in a patient with paraesthesia of inferior alveolar nerve due to endodontic origin.

Keywords: paraesthesia; C-shaped canal; Guttaflow paste

INTRODUCTION

Successful endodontic treatment implies complete removal of microorganisms and their products as well as organic and inorganic contents from root canal space. Removal of pathologically changed pulp and contaminated dentin, instrumentation and irrigation of root canal and finally, adequate tridimensional obturation of endodontic space are basic principles of endodontic treatment. Modern concepts of biological endodontic treatment include instrumentation, irrigation, medication and obturation only within the root tooth canal space, without any contact with periapical and other surrounding tissues [1]. Inadequate application of anesthetic solution, irrigation and activation of hand and mechanical instruments as well as anatomical proximity of these structures may cause perforation of mandibular canal. This can lead to extrusion of irrigation solution, obturation sealers, numbness of mandibular nerve or its branches and contamination of mandibular canal with microorganisms from infected root canal [2]. Neurological symptoms and disorders may appear as intense pain, hyperesthesia, hypoesthesia, anesthesia, dysesthesia and paraesthesia. Symptoms may differ from mild neurological dysfunction to a complete loss of sensation in the innervation area of damaged nerve [2, 3]. Paraesthesia may occur as a consequence of local endodontic or even systemic factors. Local endodontic factors may be chemical (local anaesthetics, irrigation solutions, intersession medicaments), mechanical (over instrumentation) thermal (heated gutta-percha) and pressure factors on certain structures [2, 3]. Other local factors may be trauma (jaw fractions, contusions etc.), local infections (osteomyelitis, peri-implant infections), compressive lesions (benign and malignant neoplasms and cysts), tooth impactions, iatrogenic lesions upon tooth extraction and implantation techniques (in most cases, there is a swelling which causes compression and leads to the loss of sensitivity) [4, 5]. Systemic factors that cause paraesthesia might be multiple sclerosis, sarcoid, metastatic changes, viral and bacterial infections, leukemia, lymphoma, diabetes mellitus [5, 6].

Consequences of peripheral nerve injury and prognosis depend on proper and accurate diagnosis. **Neuropraxia**, or irritation is a first degree injury and it represents only physiological block of conduction, without interruption of axon continuity. The cause of conduction interruption is probably of biochemical origin on myelin sheath level. **Axonotmesis**, second degree injury, represents an injury with the loss of axon continuity and myelin sheath. **Third degree injury** is characterized by damaged endoneurium with scarring that supports axon regeneration. In the case of **fourth degree injury**, nerve continuity is preserved even though it is maintained by scarring tissue. **Neurotmesis, fifth degree**, is an injury with a complete disruption of nerve continuity [7]. It is important to mention that early stages of neurotmesis and axonotmesis are difficult to differ. In such case, only clinical examination may show which of the two injuries will spontaneously heal and which injury requires surgical intervention. Complications of endodontic treatment greatly depend on the complexity of canal configuration. In certain situations, lower second molar may have merged roots with C-shaped canal which usually implies deeper localization of pulp space and atypical anatomical openings [8].

The aim of this paper was to present the clinical case of endodontic treatment of lower second molar with C-shaped root canal in a patient with paraesthesia of inferior alveolar nerve due to endodontic origin.

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CASE REPORT

A 38-year old female patient was referred to the Department of Restorative Dentistry and Endodontics, School of Dentistry, University of Belgrade in February 2012. The patient suffered from intense pain in the right lower lip and mental region. During the tooth drilling (#47), the pulp was exposed and upon the application of anaesthesia (Ubistesin tm forte 4%, 3M Espe, Germany), her dentist initiated endodontic treatment. After initial exploring of the canal, symptoms of sensitivity of inferior alveolar nerve in the right chin area and right half of the lip appeared. The patient was then referred to the Department of Restorative Dentistry and Endodontics, School of Dentistry, University of Belgrade.

Upon the patient's arrival at the clinic, dental examination showed the presence of temporary crown on the tooth 47 and excellent oral hygiene. At that moment, the patient suffered from severe pain in the right part of her lower lip and mandible from the tooth 47 to incisal region. The pain was intensified in response to thermal stimuli (especially to cold) and percussion test. The patient was taking 3x1 tablet of 400 mg Ibubrufen per os in order to ease the pain. Periapical radiography showed possible close contact between neurovascular bundle of the tooth 47 and inferior alveolar nerve, and possible irritation of this nerve caused by endodontic treatment. Temporary crown, filling and intersession medicament were removed. The working length was determined using apex locator followed by carefully performed endodontic treatment of C-shaped canal using manual endodontic instruments. Preparation of the apical third was performed to the size of ISO # 25. It was intermittently irrigated with 1% solution of NaOCl, heated up to the body temperature. During the procedure, the patient suffered from pain and discomfort. When the treatment was finished a medicament dressing in the form of pad soaked in chlor-phenol camphor solution was administered to the patient. Painkillers were also prescribed, if necessary. After a week, intense pain was gone and the patient suffered only from the symptoms of right inferior alveolar nerve paraesthesia (tingling sensation, mild numbness and insensitivity of lower right lip and mental region). Canal obturation was performed with Guttaflow paste and adequate gutta-percha points with improved retention characteristics (Coltene, Whaledent AG, Switzerland). Upon obturation, the patient was referred to 3D orthopantomography of appropriate region that showed good canal obturation in all dimensions. The patient kept doing check-ups in the following period. Symptoms slowly eased and relieved and finally disappeared 8 months after their first occurrence.

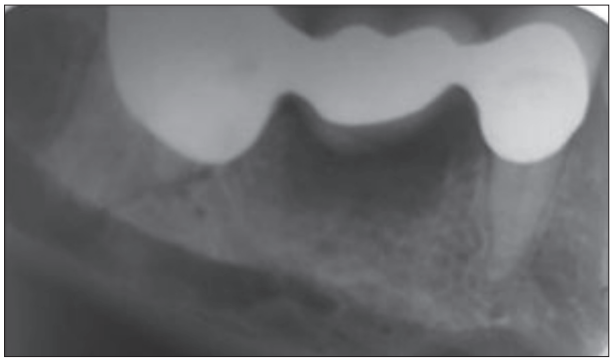

Figure 1. Preoperative radiography of the right side of the molar region of mandible
Slika 1. Preoperativna radiografija molarne regije desne strane donje vilice

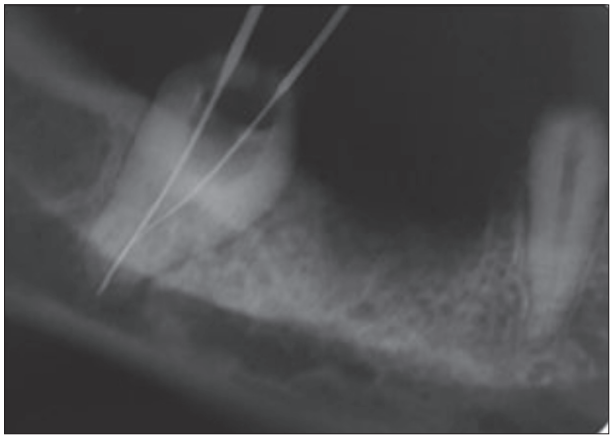

Figure 2. Periapical radiography with hand files showing close contact between neurovascular bundle of tooth 47 and mandibular nerve
Slika 2. Radiografija sa ručnim endodontskim instrumentima koja pokazuje blizak odnos neurovaskularnog snopa zuba 47 i mandibularnog kanala

Figure 3. Postoperative radiography of tooth 47 shows hermetic canal opturation
Slika 3. Postoperativna radiografija zuba 47 koja pokazuje dobru opturaciju

DISCUSSION

Treatment of the tooth that caused neurosensory dysfunction depends on the type and severity of injury. The most common injuries of inferior alveolar nerve occur during surgical interventions, especially extraction of lower wisdom teeth and poorly planned implant placement [9, 10, 11]. Many authors reported occurrence of paraesthesia caused by endodontic treatment of root canal [5, 12–15]. Almost all of the materials used in endodontic treatment are neurotoxic at some level and can cause various inflammatory reactions that can lead to cell damage, ulceration, hemolysis and necrosis in contact with periapical tissues [4, 5, 6, 16]. Irrigation solutions (NaOCl and EDTA) can

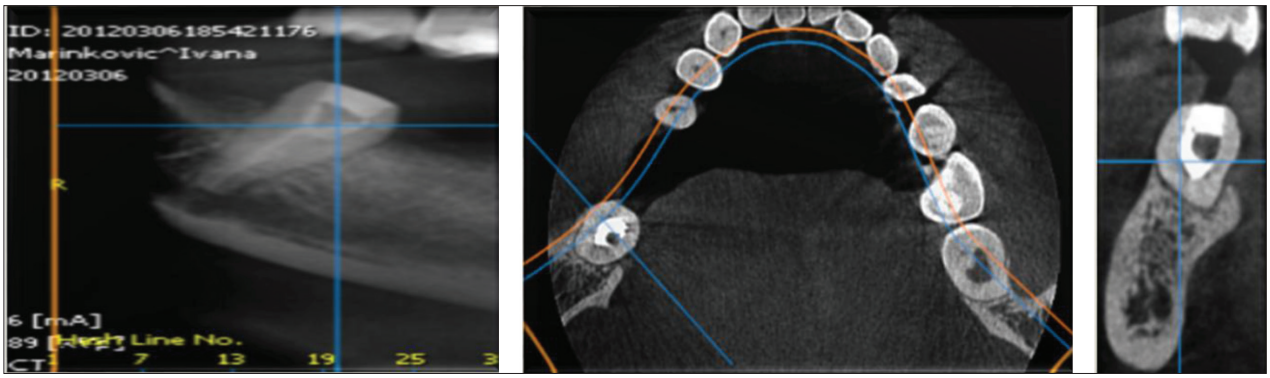

Figure 4. 3D OTP shows adequate tridimensional opturation of endodontic space of tooth 47 with characteristic C-shape
Slika 4. 3D OTP na kojoj se vidi trodimenzionalna opturacija zuba 47 sa karakterističnim c-oblikom komore pulpe

reach mandibular canal and cause chemical nerve damage [17, 18]. NaOCl is an endodontic irrigant of choice since it has excellent antimicrobial effect and ability to dissolve tissue. It is cytotoxic even in low concentrations and causes protein denaturation, releases chlorine gas and draws fluids osmotically into periapical space [12]. Ethanol, irrigant as well, may cause oversensitivity of apical tissue since it has very strong dehydration potential [12]. Hulsmann and Hahn studied the application of different concentration of NaOCl (3% and 5,25%) for irrigation during endodontic treatment of mandibular premolars and molars and found in some cases paraesthesia combined with sensitivity dysfunction in lower lip [19]. They determined that toxicity of this irrigant caused chemical damage to neurovascular bundle [19]. An adequate irrigation technique with the application of small pressure and use of special needles with lateral perforations will decrease the possibility for periapical irritation. Damage of inferior alveolar nerve may also be caused by inadequate instrumentation of root canals of lower molars and premolars, mechanical irritation of apex or even separated instrument in mandibular canal [11, 16, 20]. $Ca(OH)_2$ as an intersessional medicament and a strong base that may cause nerve damage even though such cases are rarely described in literature. [2] The literature most often describes compression syndrome caused by extrusion of endodontic sealers beyond apex [12, 14]. Experimental studies confirmed the role of eugenol and paraformaldehyde in neurotoxic reactions [1, 4, 12]. Kozam and Trowbridge reported in 1977 that eugenol has neurotoxic effect that can cause paraesthesia of inferior alveolar nerve. Eugenol causes chemical destruction of axon by protein coagulation [21, 22]. Canal sealers, AH 26 and AH 26 plus, also have cytotoxic potential [23]. AH 26, a synthetic resin, together with formaldehyde causes tissue necrosis and inflammation [12]. Ehrmann was the first to report paraesthesia case caused by overfilling with N2 paste [11]. Gutta-percha is the material of choice for root canal obturation. It is inert material but it may cause paraesthesia if mechanically irritates the nerve [24]. Vertical condensation technique and other obturation techniques that require heated gutta-percha may also cause nerve damage [24]. Block anesthesia of inferior alveolar nerve may as well cause paraesthesia. Injury is mostly provoked by nerve damage with injection needle, compression effect or even combination of the two [14].

It is very important to understand variations of anatomorphologicgal characteristics of certain teeth groups since deviations from the average morphological characteristics are most common reasons for failure of endodontic treatment. One of the most interesting anatomical variations is C-shaped root and canal system. The shape and number of roots are defined by Hertwig's epithelial sheath that bends in horizontal dimension below cementoemanel junction and fuses in the center leaving the openings of the canals. C-shaped root may be formed due to constant deposition of cement over time [8]. Studies on lower second molar have shown high incidence of C-shaped roots and canals (10-31,5%) in Japanese, Chinese, Hong Kong Chinese, Lebanese and Thai populations [8]. Clinical recognition of C-shaped canals is based on definition of observable criteria (anatomy of the floor of pulp chamber and persistent haemorrhagia or pain when separate canal orifices are found). Pulp chamber in teeth with C-shaped canals may be large in occlusoapical dimension with low bifurcation. Sometimes, the canal can be calcified thus masking its C-shape configuration.

Nerve recovery after its damage depends on the severity of damage and rapidity of cause removal. Often, after the removal of cause, symptoms of paraesthesia continue to exist since the injury was not just mechanical but chemical as well. Endodontic material can spread to periapex in four different ways (through the nerve bundle, by drainage through lymphatic vessels, periapical capillary system and diffusion between the bones and mucosal membrane toward soft tissues) [2, 25]. The anatomy of lower jaw favors diffusion of endodontic material, especially in the posterior area of lower jaw due to trabecular properties of cancellous bone that facilitates diffusion of different materials into the surrounding tissues. Special attention should be paid to the distance between anatomical openings of mandibular molars and mandibular canal. According to one study, this distance varies from 1 and 4 mm in the case of first lower molar, while it is less than 1 mm with second and third molar [25]. Cone Beam computed tomography- modern diagnostic method could help with therapy planning and prevention of paraesthesia occurrence as a complication of endodontic therapy [1].

Adequate endodontic treatment of the tooth that caused neurosensory dysfunction is important with additional application of cold packs, analgesics, antibiotic therapy,

nonsteroidal anti-inflammatory drugs, synthetic corticosteroids (dexamethasone), proteolytic enzymes (which disintegrate coagulum), vitamin B complex, vitamin C (it has antioxidative action which reduces ischemic effects), and adenosine thriphosphate that regenerates tissues for restoring nerve function [15, 16]. It is important to diagnose paraesthesia as soon as possible and remove potential causes of this dysfunction, preferably within 48 hours [12, 27]. Surgical treatment includes extraction of causal tooth, apicoectomy and surgical removal of foreign body [27].

Based on the patient history and clinical findings, nerve damage in our study was classified as second-degree damage by Seddon: recognized axonotmesis manifested by paralysis of motor and sensitive nerve function. Due to the close connection between anatomical opening and mandibular canal, endodontic hand instrument most probably injured the axon and myelin sheath while NaOCl caused chemical irritation. Healing occurred spontaneously after adequate endodontic treatment and disinfection of root canal that was of utmost importance. Healing conditions were improved by low concentration of NaOCl used as an irrigant and the use of Guttaflow paste for final obturation.

The key to successful endodontic treatment of complex canal configurations is to know dental anatomy and apply adequate instrumentation and obturation techniques. This case report shows, apart from properly conducted endodontic treatment, positive features of guttaflow paste that is the sealer of choice in cases of close relation between the tooth apex and mandibular canal.

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Endodontska terapija donjeg molara kod pacijenta sa parestezijom donjeg alveolarnog nerva – prikaz slučaja

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KRATAK SADRŽAJ

Endodontska terapija kanala korena zuba je težak i kompleksan zahvat, pa su zato česti i problemi u različitim fazama endodontskog postupka. Komplikovana anatomomorfološka struktura zuba, povijenost kanala, blizak odnos donjih molara i premolara i alveolarnog nerva dodatno komplikuje endodontsku proceduru. Tokom realizacije endodontske terapije može doći do traume donjeg alveolarnog nerva, a simptomi oštećenja alveolarnog nerva mogu da variraju od blage neurosenzorne disfunkcije do potpunog gubitka senzacija u predelu inervacionog područja oštećenog nerva.

Cilj ovog rada je bio da se na jednom slučaju iz kliničke prakse predstavi endodontski postupak lečenja kanala korena donjeg drugog molara, karakterističnog c-oblika, kod pacijenta sa parestezijom donjeg alveolarnog nerva endodontskog porekla.

Ključne reči: parestezija; c-oblik kanala; guttaflow pasta

UVOD

Uspešna endodontska terapija podrazumeva obradu kanalnog sistema, sa potpunim uklanjanjem mikroorganizama i njihovih produkata, kao i organskih i neorganskih komponenata iz prostora kanala korena. Uklanjanje patološki promenjene pulpe i kontaminiranog dentina, instrumentacija i irigacija kanala korena, i na kraju adekvatna trodimenzionalna opturacija endodontskog prostora predstavljaju osnovne principe endodontskog zahvata. Savremeni koncepti biološke endodontske terapije podrazumevaju instrumentaciju, irigaciju, medikaciju i opturaciju isključivo u okviru prostora kanala korena, bez kontakta sa periapeksnim i drugim okolnim tkivima [1]. Neadekvatna aplikacija anestetičkog rastvora, irigacija i aktivacija ručnih i mašinskih instrumenata, ali i anatomska bliskost ovih struktura, mogu usloviti perforaciju mandibularnog kanala. To može dovesti do potiskivanja irigacionih rastvora, opturacionih silera, lediranja mandibularnog nerva ili njegovih grana, ali i kontaminacije mandibularnog kanala prodorom mikroorganizama iz inficiranog kanala korena [2]. Neurološki simptomi i smetnje koje se javljaju mogu se ispoljiti u vidu intenzivnog bola, hiperestezije, hipoestezije, anestezije, dizestezije i parestezije. Simptomi mogu da variraju od blage neurosenzorne disfunkcije do potpunog gubitka senzacija u predelu inervacionog područja oštećenog nerva [2, 3]. Parestezija može nastati kao posledica lokalnih, endodontskih, ili pak sistemskih faktora. Lokalni endodontski faktori mogu biti hemijski (lokalni anestetici, rastvori za irigaciju, interseansni medikamenti), mehanički (instrumentacija preko vrha korena), termički (zagrejana gutaperka) i faktori koji svojim pritiskom deluju na određene strukture [2, 3]. Ostali lokalni faktori mogu biti traume (prelomi vilica, kontuzije itd.), lokalne infekcije (osteomijelitis, periimplantne infekcije), kompresivne lezije (benigne i maligne neoplazije i ciste), impakcije zuba, jatrogene lezije nakon ekstrakcije zuba i implantoloških tehnika (najčešće se radi o otoku koji je vršio kompresiju i uslovio gubitak senzibiliteta) [4, 5]. Sistemske faktore nastanka parestezije mogu usloviti multipla skleroza, sarkoidoza, metastatske promene, virusne i bakterijske infekcije, leukemija, limfomi, dijabetes melitus [5, 6].

Posledice povreda perifernih nerava, kao i prognoza njihovog izlečenja uslovljene su pravilnom, tačnom dijagnozom. **Neuropraksija,** ili iritacija, povreda prvog stepena, predstavlja samo fiziološki blok sprovođenja, bez prekida kontinuiteta aksona. Uzrok prekida sprovođenja je verovatno biohemijske prirode na nivou mijelinskog omotača. **Aksonotmeza,** povreda drugog stepena, predstavlja tip povrede sa prekidom kontinuiteta aksona i mijelinskog omotača. Povredu **trećeg stepena** karakteriše oštećenje endoneurijuma sa ožiljnim promenama kroz koje akson regeneriše. Kod povrede **četvrtog stepena** kontinuitet nerva je fizički očuvan, ali se održava samo ožiljnim tkivom. **Neurotmeza, peti stepen,** povreda je sa potpunim prekidom kontinuiteta nerva [7]. Važno je napomenuti da se neurotmeza i aksonotmeza u ranim fazama ne mogu razlikovati. U tom slučaju jedino klinička ispitivanja mogu ukazati koja će se od ovih povreda spontano oporaviti, a koja povreda zahteva hirurišku intervenciju. Komplikacije endodontske terapije povećava komplikovanost kanalne konfiguracije. U pojedinim slučajevima donji drugi molar može imati spojene korenove, pri čemu se onda javlja c-oblik kanala, koji najčešće uslovljava dublju lokalizaciju komore pulpe i atipične anatomske otvore [8].

Cilj ovog rada je da se na jednom slučaju iz kliničke prakse predstavi postupak terapije kanala korena drugog donjeg molara, karakterističnog c-oblika, kod pacijenta sa parestezijom donjeg alveolarnog nerva koja je uzrokovana endodontskom terapijom.

PRIKAZ SLUČAJA

Pacijentkinja starosti 38 godina javila se na Kliniku za bolesti zuba i endodonciju Stomatološkog fakulteta Univerziteta u Beogradu u februaru 2012. godine, po uputu svog stomatologa. Pacijentkinja je imala simptome intenzivnog bola u predelu desne strane donje usne i mentalnog predela. Tokom brušenja zuba (47) eksponirana je pulpa i stomatolog je posle aplikacije anestezije (Ubistesin tm forte 4%, 3M ESPE, Germany) započeo endodontski tretman. Posle ispitivanja inicijalne prohodnosti kanala javili su se simptomi nadraženosti donjeg alveolarnog nerva u predelu brade desne strane i odgovarajuće polovine usne. Pacijentkinja je upućena na Kliniku za bolesti zuba i endodonciju Stomatološkog fakulteta u Beogradu.

Po prijemu pacijenta na kliniku, stomatološkim pregledom su utvrđeni prisusutvo privremene krunice na zubu 47 i odlična oralna higijena. Pacijentkinja je u tom trenutku imala intenzivan

bol u predelu desne strane donje usne i predela mandibule od zuba 47 pa do incizalnog dela. Bol se intenzivirao na termičke nadražaje (posebno na hladno), kao i na perkusiju zuba u toj regiji. Pacijentkinja je *per os* unosila 3 × 1 tabletu ibubrufena od 400 mg da bi smanjila intenzitet bola. Po urađenoj dentoalveolarnoj rendgengrafiji ovog predela posumnjalo se na mogućnost bliskog kontakta neuraovaskularnog snopa zuba 47 i mandibularnog nerva, te na moguću provokaciju ovog nerva izazvanog endodontskim tretmanom. Uklonjena je privremena krunica, privremeni ispun i uložak dezificijensa. Radna dužina je utvrđena elektrodontometrijskim postupkom i potom je usledila veoma pažljiva endodontska obrada kanala c oblika ručnim endodontskim instrumentima. Preparacija apeskne trećine kanala korena je urađena do veličine ISO #25, uz stalnu irigaciju 1% rastvorom NaOCl, zagrejanog na temperaturu tela. Sve vreme rada pacijentkinja je osećala bol i neprijatnost. Posle završene obrade kanala korena I aplikacije medikamentnog uloška u vidu vatice natopljene u rastvor hlorfenolkamfora pacijentu su ordinirani analgetici po potrebi. Nakon nedelju dana intenzivan bol je nestao i pacijent je imao samo simptome parestezije donjeg desnog alveolarnog nerva, u vidu peckanja, blagog trnjenja i neosetljivosti u predelu desne strane donje usne i mentalnog predela. Tada je izvršena opturacija kanala guttaflow fast pastom i ogovarajućim gutaperka kočićima sa poboljšanim retencionim karakteristikama (Coltene, Whaledent AG, Switzerland). Nakon opturacije pacijentkinja je upućena na 3D ortopantomografsko snimanje odgovarajućeg predela, gde je potvrđena dobra opturacija kanala u svim dimenzijama. Pacijentkinja je u narednom vremenskom periodu dolazila na kontrolne preglede. Simptomi su se polako smanjivali i smiravali da bi svi nestali tačno osam meseci od njihove pojave.

DISKUSIJA

Terapija zuba uzročnika neurosenzitivnih disfunkcija zavisi od vrste i težine povrede. Iako su najčešće povrede donjeg alveolarnog nerva usled hirurških intervencija, posebno donjih umnjaka, i loše isplanirane implantološke intervencije [9, 10, 11], mnogi autori iznose podatke o parestezijama koje su uzrokovane endodontskom terapijom kanala korena [5, 12–15]. Skoro svi materijali koji se koriste u endodonciji imaju neurotoksični efekat u određenom stepenu i mogu uzrokovati različite inflamatorne reakcije, koje dovode do oštećenja ćelija, ulceracije, hemolize i nekroze u kontaktu sa periapeksnim tkivima [4, 5, 6, 16]. Rastvori za irigaciju (NaoCl i EDTA) mogu dospeti do mandibularnog kanala i izazvati hemijsko oštećenje nerva [17, 18]. NaOCl je irigans izbora zbog svog odličnog antimikrobnog i organolitičnog efekta. On je citotoksičan i u niskim koncentracijama i izaziva denaturaciju proteina, oslobađanje gasa hlora i osmotsko izbacivanje fluida u periapsne prostore [12]. Etanol kao irigans može uzrokovati prenadraženost apeksnog tkiva zbog svog jakog dehidratacionog potencijala [12]. Hulsmann i Hahn su pratili primenu različite koncentracije NaOCl (3% i 5,25%) tokom irigacije mandibularnih premolara i molara i uočili pojavu parestezije kombinovane sa disfunkcijom senzibiliteta na donjoj usni [19]. Utvrdili su da toksičnost ovog irigansa izaziva hemijska oštećenja neurovaskularnog snopa [19]. Svakako, adekvatna tehnika irigacije sa primenom malog pritiska i korišćenjem specijalnih igala sa lateralnim perforacijama smanjiće mogućnost iritacije periapeksa. Oštećenje donjeg alveolarnog nerva može nastati i neadekvatnom instrumentacijom kanala korena donjih molara i premolara, mehaničkom iritacijom apeksa ili pak zalamanjem instrumenta u mandibularnom kanalu [11, 16, 20]. $Ca(OH)_2$ kao interseansni medikament, kao jaka baza može izazvati oštećenje nerva, iako je to jako retko prikazano u literaturi [2]. U literaturi je najčešće opisana pojava kompresivnog sindroma nastalog prebacivanjem endodontskih silera za opturacije [12, 14]. U eksperimentalnim studijama je potvrđena uloga eugenola i paraformaldehida kod neurotoksičnih reakcija [1, 4, 12]. Kozam i Trowdridge su još 1977. godine dokazali neurotoksični efekat eugenola kao uzročnika parestezija donjeg alveolarnog nerva. Koagulacijom proteina eugenol uzrokuje hemijsku destrukciju aksona [21, 22]. Kanalni sileri, AH 26 i AH 26 plus, takođe mogu imati citotoksični potencijal [23]. AH26, kao sintetska smola, zahvaljujući formaldehidu, izaziva nekrozu tkiva i inflamaciju [12]. Ehrmann je prikazao slučaj parestezije uzrokovane prepunjavanjem N2 pastom [11]. Gutaperka, kao materijal izbora u endodontskom tretmanu, kao inertan materijal, uzrokuje paresteziju [24] samo ukoliko mehanički nadraži nerv. Najčešće tehnika vertikalne kondenzacije i druge opturacione tehnike koje zahtevaju zagrejani gutaperka poen mogu usloviti oštećenje nerva [24].

Blok anestezija donjeg alveolarnog nerva takođe može biti uzrok nastanka njegove parestezije. Povreda najčešće nastaje hemoragijom zbog lediranja nerva injekcionom iglom, kompresivnim efektom ili pak kombinacijom oba [14].

Veoma je važno poznavati varijacije anatomomorfoloških karakteristika određenih grupa zuba, jer su odstupanja od prosečnih morfoloških karakteristika jedan od češćih uzroka neuspeha endodontskog tretmana. Jedna od najzanimljivijih anatomskih varijacija je sigurno c-oblik korena i kanalnog sistema. Oblik i broj korenova je određen Hertvigovom epitelijalnom membranom koja se savija u horizontalnoj dimenziji ispod cementnogleđne granice i spajajući se u centru ostavlja otvore kanala. c-oblik korena može biti formiran zbog konstantne depozicije cementa tokom vremena [8]. Studije na donjem drugom molaru pokazuju veliku incidenciju c-oblika korena i kanala (10–31,5%) kod Japanaca, Kineza, Hongkong Kineza, Libanske i Thai populacije [8]. Kliničko prepoznavanje c-oblika kanala bazira se na definisanju vidljivih kriterijuma (anatomiji poda pulpne komore, perzistentnoj hemoragiji ili bolu kada se pronađu odvojeni ulazi kanala). Pulpna komora kod zuba sa c-oblikom kanala može biti prostrana u okluzoapikalnoj dimenziji sa malom bifurkacijom, a nekad kanal može biti kalcifikovan, čime se može maskirati ova konfiguracija.

Oporavak nerva zavisi od težine njegovog oštećenja, ali i od brzine uklanjanja uzroka koji je to oštećenje izazvao. Često i posle uklanjanja uzroka perzistiraju simptomi parestezije jer povreda nije samo mehanička nego i hemijske prirode. Endodontski marerijali mogu dospeti do periapeksa na četiri različita načina (preko nervnog snopa, drenažom kroz limfne sudove, periapikalnim kapilarnim sistemom i difuzijom između kosti i sluzokože kroz membranu prema mekim tkivima) [2, 25]. Sama anatomija donje vilice favorizuje difuziju endodontskih materijala, posebno u zadnjoj oblasti donje vilice zbog trabekularne građe spongiozne kosti, koja olakšava širenje različitih materijala u okolna tkiva. Posebnu pažnju treba obratiti na udaljenost između anatomskih otvora mandibularnih molara i mandibularnog kanala. Prema jednoj studiji ovo rastojanje varira između 1 i 4 mm u slučaju prvog donjeg molara, dok je manje od 1

mm za drugi i treći donji molar [25]. Cone Beam kompjuterizovana tomografija, kao savremena dijagnostička metoda, može pomoći u izradi dobrog plana terapije i u preventivi nastanka parestezija kao komplikacija endodontske terapije [1].

Terapija zuba uzročnika neurosenzitivnih disfunkcija uz adekvatan endodontski tretman zahteva primenu hladnih obloga, analgetike, antibiotsku terapiju, nesteroidne antiinflamatorne lekove, sintetske kortikosteroide (dexamethasone), proteolitičke enzime (razgrađuju koagulum), vitamine B kompleksa, vitamin C (antioksidativnim dejstvom redukuje efekte ishemije) i adenozin-trifosfat, koji potpomaže regeneraciji tkiva [15, 16]. Najvažnije je što pre dijagnostifikovati parasteziju i ukloniti eventualne uzročnike ove disfunkcije, poželjno je za 48 sati [12, 27]. Hirurške metode terapije podrazumevaju ekstrakciju zuba uzročnika, apikotomiju, hirurško uklanjanje stranog tela [27].

Na osnovu anamnestičkih podataka i kliničkog nalaza donji drugi molar u ovom prikazu je svrstan u drugu grupu oštećenja po Seddonovoj klasifikaciji, tj. prepoznat je kao aksonotmeza, koja se manifestuje oduzetošću motorne i senzibilne funkcije nerva. Usled bliske veze anatomskog otvora i mandibularnog kanala najverovatnije je endodontski ručni instrument izazvao povredu aksona i mijelinske ovojnice, a NaOCl koji je korišćen kao irigans izazvao hemijsku iritaciju. Izlečenje je nastalo spontano, adekvatnim endodontskim tretmanom, sa dezinfekcijom kanala korena, koja je od suštinskog značaja. Povoljne uslove za izlečenje svakako su pomogli i niska koncentracija NaOCl kao irigansa i izbor gutaflow paste za definitivnu opturaciju.

Ključ uspešne endodonske terpije ovakvih komlikovanih kanalnih konfiguracija je u poznavanju dentalne anatomije i primeni odgovarajućih tehnika instrumentacije i opturacije. U prezentovanom slučaju je pored korektno sprovedene endodontske terapije iskorišćeno i pozitivno svojstvo guttaflow paste, koja je siler izbora u slučajevima bliskog odnosa apeksa zuba i mandibularnog kanala.