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PRIMENA RADIOTALASA U ORALNOJ HIRURGIJI

THE USE OF RADIOFREQUENCY ABLATION IN ORAL SURGERY

Todorović M. Kosta¹, Mitić D. Aleksandar², Tijanić R. Miloš¹, Stojanović M. Simona¹, Jovanović G. Marija³, Spasić S. Milan¹

¹ MEDICINSKI FAKULTET, KLINIKA ZA STOMATOLOGIJU, ODELJENJE ZA ORALNU HIRURGIJU, NIŠ

² MEDICINSKI FAKULTET, KLINIKA ZA STOMATOLOGIJU, ODELJENJE ZA BOLESTI ZUBA, NIŠ

³ MEDICINSKI FAKULTET, STUDENT DOKTORSKIH AKADEMSKIH STUDIJA, NIŠ

¹ MEDICAL FACULTY, CLINIC FOR DENTISTRY, ORAL SURGERY DEPARTMENT, NIŠ

² MEDICAL FACULTY, CLINIC FOR DENTISTRY, DEPARTMENT FOR TOOTS, NIŠ

³ MEDICAL FACULTY, STUDENT OF DOCTORAL ACADEMIC STUDIES, NIŠ

Sažetak

Uvod: Aparati koji koriste elektromagnetno zračenje u vidu visokofrekventnih radiotalasa sve češće nalaze primenu u mnogim granama medicine, a u poslednje vreme i u oralnoj hirurgiji. Rade na istom principu kao i elektrokauteri, s tom razlikom što elektrokauteri koriste talase frekvencije od 300kHz do 500kHz, a radiotalasni aparati talase frekvencije 4MHz. To im omogućava daleko manju dubinu prodiranja energije, manju destrukciju i ograničeno lateralno oštećenje tkiva, bez opekotinskog efekta. Zarastanje rana je brže, formiranje ožiljaka je manje, a kozmetički efekat je izraženiji. U toku godinu dana na Odeljenju za oralnu hirurgiju primenjivanje radiotalasni aparat kod mnogih oralnihirurgijskih intervencija. Sečenje tkiva bez dodira, simultano, sa izrazitim hemostatskim efektom ili čista koagulacija sprovode se vrlo jednostavno i uspešno. Aparat je testiran prilikom rada na mekim tkivima kože i sluzokože. Pravilnim i stručnim rukovanjem izbegavaju se eventualni štetni efekti. Kod pacijenata sa srčanim pejsmejkerom treba biti posebno obazriv i pridržavati se protokola. Ukoliko pacijent ima ugrađene dentalne implantate kontraindikovano je njihovo dodirivanje u toku rada aktivnom elektrodom.

Zaključak: Radiotalasna hirurgija ima niz prednosti u odnosu na konvencionalnu hirurgiju u određenim indikacionim područjima.

Ključne reči: visokofrekventni radiotalasi, hirurgija, koagulacija

Corresponding author:

Lecturer, Todorović Kosta, DDS, MSD, PhD

Vojvode Tankosića 11/7 18000 Niš

+38163415514

E-mail kostatodorovic@yahoo.com

Abstract

Introduction: Appliances that use electromagnetic radiation in the form of high frequency radioablation are increasingly applied in many branches of medicine and in recent times in oral surgery. They work on the same principle as the electrocauteries, with the difference that the electrocauteries use wave frequencies from 300kHz to 500kHz and the radiolayers use the frequency of wavelengths of 4MHz. This allows them a far lower energy penetration depth, less destruction and limited lateral tissue damage, without burning effect. Wound healing is faster, scarring is less, and cosmetic effect is more pronounced. During one year at the Department of Oral Surgery, a radiotherapeutic appliance is used in many oral surgery interventions. Treatment of non-contact tissues simultaneously with a hemostatic effect or pure coagulation is performed very easily and successfully. The appliance is tested when working on soft tissue of the skin and mucous membranes. With proper and professional handling any adverse effects are avoided. Special attention should be paid to patients with cardiac pacemaker and adhere to the protocol. If patient has dental implants, touching them is contraindicated while working with active electrode.

Conclusion: The radiowave surgery has advantages in relation to conventional surgery with respect on indication areas.

Key words: radiofrequency ablation, surgery, coagulation

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Uvod

Primena toplote za zaustavljanje krvarenja poznata je još iz neolitskog perioda. Stari Egipćani (3000 g. pre n.e.) opisali su upotrebu usijanih metalnih instrumenta za lečenje čireva i tumora dojki. Hipokrat (469-370) je koristio toplotu da ukloni tumor na vratu. Rimljani su već uveliko zagrevali različite metalne instrumente i kontrolisali krvarenje¹. U slične svrhe kroz istoriju je korišćeno vrelo ulje, pa čak i barut (sagorevanje u tkivu), koji je pronađen u Kini u 13. veku. Sa pojavom električne struje, sredinom osamnaestog veka, prvi put je opisano njeno korišćenje za zagrevanje instrumenata kojima je vršena koagulacija². Ubrzo su se razvili termokauteri čiji se radni deo sastojao od žice koja se pomoću struje zagrevala do usijanja i tako zaustavljala krvarenje. Termokauteri se uveliko koriste i danas, naročito u stomatologiji i sastavni su deo većine stomatoloških aparata. Otkriće naizmjenične struje vrlo brzo uticalo je na razvoj elektrohirurgije. Jedan od najbitnijih parametara naizmjenične struje je frekvencija. Ona označava broj promena smera struje u jednoj sekundi. Otkriveno je da naizmjenična struja niske frekvencije prolaskom kroz ljudsko telo izaziva kontrakciju mišića, dok naizmjenična struja visoke frekvencije ne izaziva kontrakciju mišića, već prouzrokuje zagrevanje tkiva. Tako se vrlo brzo razvila diatermija (grčki: dia-kroz, therme-toplota), koja se zasniva na povećanju toplote određenog dela tela zbog otpora tkiva na prolaz visokofrekventne struje. Kada visokofrekventna struja protiče preko velike površine efekat zagrevanja tkiva je mali i ostaje u nivou fizioloških granica (40–45°C). Ovi aparati našli su primenu u fizikalnoj medicini. Međutim, kada je gustina visokofrekventne električne struje koncentrisana na male tačkaste površine, efekat zagrevanja je veliki (250–600°C), što omogućava sečenje i koagulaciju tkiva. Ovakvi aparati našli su primenu u hirurgiji. Villiam T. Bovie 1920. godine konstruisao je prvi elektrohirurški aparat³. Od tada se elektrohirurgija ubrzano razvija i danas je zastupljena u većini hirurških ustanova.

Radiotalasi su vrsta elektromagnetnog zračenja. Predstavljaju deo elektromagnetnog spektra odmah iznad infracrvenog zračenja, talasne dužine od 0,3 metra do nekoliko kilometra, frekvencije od 3Hz do 300GHz. Dobijaju se pomoću generatora naizmjenične električne struje.

Introduction

The application of heat in order to stop the bleeding is known from the Neolithic period. Ancient Egyptians (3000 BC) described the use of metal instruments for the treatment of the ulcers and breast tumor. Hippocrates (469-370 BC) used the heat to remove the tumor from the neck. The Ancient Romans, had already warmed the various metal instruments for the control of bleeding¹. Hot oil, and even gunpowder (combustion in tissue), found in China in the 13th century were used for similar purposes throughout history. In the mid-eighteen century, with the appearance of electricity, for the first time its use for heating instruments to perform coagulation was described². The thermo-cauteries were developed soon; their working part made of wire was heated to candescence and used to stop the bleeding. Thermocauteries are widely used today, especially in dentistry and are integral part of most dental devices. The discovery of alternating currents quickly affected the development of electrosurgery. One of the most important parameters of alternating power is the frequency. It indicates the number of power changes in one second. It was discovered that alternating current frequencies, by moving through the human body, cause muscle contraction, while alternating high frequency current does not cause muscle contraction, but tissue warming. Thus, the diathermia (Greek: Through, Therme – heat) was rapidly developed; it was based on increasing the heat of a particular part of the body due to the resistance of the tissues to the high-frequency power pass. When the high frequency flows over a large surface the effect of warming tissue is small and remains within the physiological range (40–45°C). These appliances have been used in physical medicine. However, when the density of high frequency electricity is concentrated on small dotted surfaces, the heating effect is large (250 – 600°C), which enables cutting and coagulation of tissues. These appliances have been used in surgery. William T. Bovie 1920. constructed the first electrosurgical appliance³. Since then, electrosurgery has been rapidly evolving and is now represented in most surgical institutions.

Radio waves are a kind of electromagnetic radiation. They are part of an electromagnetic spectrum immediately above infrared radiation, wavelengths of 0.3 to a few kilometers, frequencies from 3Hz to 300GHz. They are obtained using the alternating power generator.

Standardni aparati za elektro-kauterizaciju koriste radiotalase frekvencije od 300kHz do 500kHz⁴. Elektrokauteri se sastoje od dve elektrode, katode i anode, od kojih je jedna pasivna i dovodi se u kontakt sa površinom tela, a druga aktivna i hirurg je drži u ruci kojom manipulira. Prilikom kontakta aktivne elektrode sa tkivom, uspostavlja se strujno kolo pri čemu se elektromagnetna energija pretvara u toplotnu energiju kojom se ostvaruje koagulacija i sečenje tkiva. Znači termički efekat prisutan je samo oko aktivne elektrode, gde je gustina struje najveća. Ona može biti različitog oblika. Tanke oštre aktivne elektrode stvaraju struju velike gustine i prema tome visoku temperaturu. Služe za sečenje tkiva. Aktivne elektrode veće površine stvaraju struju manje gustine i prema tome nižu temperaturu. Služe za koagulaciju. Struja dalje protiče kroz tkivo do pasivne elektrode, koja ima znatno veću površinu, čime se smanjuje gustina struje i neželjeni termalni efekti nisu prisutni. Dubina prodiranja toplotne energije na nivou aktivne elektrode iznosi više od 1 mm⁵. To prouzrokuje destrukciju ćelija, šire lateralno oštećenje tkiva, sporije zarastanje rana i formiranje većih ožiljaka. U toku rada vrlo je bitno ostvariti dobar direktan kontakt pasivne elektrode sa pacijentovom kožom. Pritom, ona privlači oslobođenu energiju i vraća je ponovo u aparat, što znači da se najbolji efekat postiže ako je pasivna elektroda što bliže operisanoj regiji⁶. Primena klasičnih aparata za elektrokauterizaciju daje nejednake i nedovoljno kontrolisane rezultate. Osim toga ipak postoji opasnost od opekotina.

Za razliku od elektrokaautera radiotalasni aparati koriste radiotalase frekvencije od 4MHz. Pri njihovom radu elektromagnetna energija u kontaktu sa tkivom ne pretvara se u toplotnu energiju, već se toplota generiše u samom tkivu, tj. apsorbira u vodenoj komponenti ćelije izazivajući njeno isparavanje⁷. Aktivna elektroda ne mora da ostvari prislan odnos sa tkivom (radi se simultano), jer funkcioniše kao antena, a ne kao elektroda⁸. Ona ostaje hladna, nema dima ili ga ima vrlo malo. Može biti različitog oblika (igla, kuglica, pločica, omča). Krvni sudovi apsorbiraju ćelijsku plazmu, tako da nema ostataka nekrotičnog tkiva. Dubina prodiranja energije radiotalasa iznosi manje od 0,02 mm, što prouzrokuje manju traumu ćelija, minimalno lateralno oštećenje tkiva bez opekotina, brže zarastanje rana i formiranje manjih ožiljaka⁹. Savremeni radiotalasni aparati imaju veći broj različitih talasnih oblika sa različitim efektom dejstva na tkiva. U toku rada pasivna elektroda ne zahteva direktan kontakt sa pacijentovom kožom. Može da deluje i preko tanke tkanine (pantalone, suknja) tako da je dovoljno da

Standard appliances for electro-cauterization use radio waves frequency of 300kHz to 500kHz⁴. Electrocauteries consist of two electrodes, a cathode and an anode, one of it is passive and is brought into contact with the surface of the body, while the other is active and the surgeon is holding it in his hand which he moves. During the contact of the active electrode with the tissue, an electric circuit is established, whereby electromagnetic energy is converted into heat energy that achieves coagulation and tissue cutting. So the thermal effect is present only around the active electrode, where the density of the current is greatest. It can be of different shapes. Thin sharp active electrodes create a high density current and therefore a high temperature. It is used to cut tissue. Active electrodes of large surfaces create currents of less density and therefore lower temperatures. They serve for coagulation. The current flows further through the tissue to the passive electrode, which has a much larger surface area, which reduces the density of the current and unwanted thermal effects are not present. The depth of penetration of thermal energy at the level of the active electrode is more than 1 mm⁵. This causes cell destruction, spreads lateral tissue damage, slower healing of the wounds and the formation of larger scars. During work, it is important to have a good direct contact of the passive electrode with the patient's skin. In addition, it attracts freed energy and returns it back to the appliance, which means that the best effect is achieved if the passive electrode is as close as possible to the operating region⁶. Application of conventional electrocautery appliances gives unequal and insufficiently controlled results. In addition, there is a risk of burns. In contrast to electrocautery, radio waves appliances use radio frequencies of 4MHz. In their work electromagnetic energy in contact with tissue does not turn into heat energy, but heat is generated in the tissue itself, i.e. is absorbed into the aqueous cell component causing it to evaporate⁷. The active electrode does not have to achieve a close relationship with the tissue (it works simultaneously) because it functions as an antenna rather than an electrode⁸. It stays cold, there is no or very little smoke. It can be of a different shape (needle, ball, tile, loop). Blood vessels absorb cell plasma, so there are no remains of necrotic tissue. The depth of penetration of radio waves of energy is less than 0.02 mm, causing a smaller cell trauma, minimal lateral damage to the tissue without burns, faster healing of the wound and the formation of smaller scars⁹.

Modern radiowave apparatuses have a number of different waveforms with a different

pacijent samo sedne ili se nasloni na elektrodu. Vrlo je bitno ne postavljati pasivnu elektrodu u blizinu srca (ventrikularna fibrilacija). Treba je postaviti bliže hirurškom polju¹⁰. Primena radiotalasnih aparata daje predvidljive i kontrolisane rezultate, kao i veliku terapijsku sigurnost. Opasnosti od opekotina gotovo da nema.

Kod radiofrekventog aparata može se, kao i kod elektrokauteza, primeniti metoda koagulacije pincetom. Postupak se sastoji u hvatanju krvnog suda pincetom, zatim se aktivnom elektrodom dodiruje pinceta i aktivira aparat. Pinceta tada služi kao produžetak aktivne elektrode, a koagulacija se odvija na mestu dodira instrumenta i krvnog suda.

Aparat za radiotalasnu hirurgiju po dimenzijama je vrlo sličan elektrokautezu. Često se isporučuje sa prikladnim i vrlo korisnim postoljem, nije težak, jednostavan je za upotrebu i lako prenosiv. Može uspešno da se koristi kako u hirurškim salama tako i u ambulantom oralne hirurgije.

Autori su primenjivali radiohirurški aparat RWSU 70 – PROXIMA medical technology, snage 70W, frekvencije 4MHz, sa nožnim komandovanjem. Aparat je korišćen za sečenje i koagulaciju tkiva u toku sprovođenja različitih oralnih hirurških procedura na mekim tkivima u periodu od godinu dana. Sve hirurške intervencije urađene su na Odeljenju za oralnu hirurgiju Klinike za stomatologiju Medicinskog fakulteta u Nišu.

Radioaparat poseduje tri moda režima rada (pure cut, blend cut i soft coag) čijim jednostavnim odabirom prilagođavamo karakter delovanja na nivou aktivne elektrode.

Pure Cut (sečenje) – Monopolarni talasni oblik gde elektrohirurški generator proizvodi kontinuiranu struju i napon, bez prekida. Sečenje (isparavanje, vaporizacija) se sprovodi tankim elektrodama u obliku igle ili noža. Igla ima vrlo malu površinu kroz koju struja velike gustine napušta elektrodu i prelazi u tkivo. Dok se aktivna elektroda približava tkivu, vazdušni jaz je sve kraći i u jednom trenutku varnica iz elektrode prelazi u tkivo u vidu veoma uske udarne zone. Usled trenutnog zagrevanja tečnosti ćelija tkivo isparava i javlja se efekat sečenja. Radi se simultano i tkivo se aktivnom elektrodom skoro ne dodiruje.

Blend Cut (sečenje-koagulacija) – Monopolarni talasni oblik gde elektrohirurški generator proizvodi struju i napon nekontinuirano, sa prekidima.

effects on the tissue. During the operation, the passive electrode does not require direct contact with the patient's skin. It can also work through thin fabrics (trousers, skirts) so that it is enough for the patient to sit or lean on the electrode. It is very important not to place a passive electrode near the heart (ventricular fibrillation). It should be placed closer to the surgical field¹⁰. The use of radio wave appliances provides predictable and controlled results, as well as great therapeutic safety. There is almost no risk of burns.

In the case of a radio wave appliances, as with electrocautery, tweezers coagulation method can be applied. The procedure consists of capturing the blood vessel with tweezers, and then the active electrode touches the tweezers and activates the apparatus. The tweezers then serve as an extension of the active electrode, and the coagulation takes place at the point of contact of the instrument and the blood vessel.

The appliance for radio wave surgery by dimensions is very similar to electrocautery. It often comes with a convenient and very useful stand, not heavy, easy to use and easily portable. It can be successfully used in surgical room and in oral surgery ambulance.

The authors used the radiosurgical appliance RWS 70 - PROXIMA medical technology, 70W power, 4MHz frequency, with foot control. The apparatus was used to cut and coagulate the tissues during the implementation of various oral surgical procedures on soft tissues over a period of one year. All surgical interventions were done at the Department of Oral Surgery at the Clinic for Dentistry at the Medical Faculty in Niš.

The radio appliance has three modes of work (pure cut, blend cut and soft coag), whose simple selection adjusts the character of the action at the level of the active electrode.

Pure Cut (cutting)-Monopolar wave form where the electro-surgical generator produces continuous current and voltage, without interruption. Cutting (evaporation, vapor-ization) is carried out by thin electrodes in the form of a needle or knife. The needle has a very small surface through which the high density current leaves the electrode and passes into the tissue. As the active electrode approaches the tissue, the air gap is shorter and, at one point, the spark from the electrode passes into the tissue in the form of a very narrow impact zone.

Efekat koagulacije zavisi od trajanja pauze umetnute u signal. Duže trajanje pauze znači veći efekat koagulacije i obrnuto. Odnos trajanja signala i trajanje pauze u signalu izražen je u procentima i može biti 75% i 50%.

Ukoliko bi se koristio veći mod za sečenje tkiva to bi zahtevalo korišćenje većeg napona, što bi prouzrokovalo veća termalna bočna oštećenja tkiva.

Soft Coag (koagulacija i koagulacija prskanjem–bezkontaktni fenomen)–Monopolarni talasni oblik gde elektrohirurški generator proizvodi struju i napon sa najviše prekida. Odnos trajanja signala i trajanja pauze za kontaktnu koagulaciju je od 50%, a za koagulaciju prskanjem (fulguracija) i do 6%. Kako ima najduže trajanje pauze u signalu za istu izlaznu snagu ova vrsta moda zahteva vrlo visoke napone i time povećava verovatnoću neželjenih efekata. Vršni se elektrodama u obliku manjih ili većih kugli. Dodirivanjem tkiva povećava se površina sa koje struja napušta elektrodu i prelazi u tkivo. Smanjuje se gustina struje što prouzrokuje postepeno zagrevanje ćelijskih tečnosti, dehidraciju i isušivanje ćelija koje još uvek zadržavaju svoj oblik. Temperatura iznosi od 70 do 80°C i pojavljuje se beli koagulum. To znači da je koagulacija dobro obavljena. Aktivna elektroda mora biti u dovoljno dugom kontaktu (sekunde ili deo sekunde) sa tkivom, radi postizanja efekta koagulacije i isušivanja. Dalje zagrevanje tkiva dovodi do karbonizacije tkiva i krvi na elektrodama. Nagomilani materijal na elektrodama povećava otpor, zbog čega se povećava napon zarad održanja iste izlazne snage. Čiste elektrode zahtevaju manji napon za prenos iste snage na tkivo. Naša iskustva pokazuju da radiotalasna hirurgija predstavlja alternativnu varijantu konvencionalnoj hirurgiji sečenja mekih tkiva, s obzirom da je minimalno invazivna metoda, vrlo precizna, atraumatska, bez napora i bez dodira - simultana, sa hemostatskim efektom i čistim operativnim poljem. Znatno manje krvarenje u toku rada skraćuje vreme trajanja hirurških zahvata, što rezultira lakšim i bržim postoperativnim oporavkom.

Za razliku od elektrokautilera, koji daje veliki lateralni morbiditet rane, radiotalasna

Due to the instantaneous heating of the liquid in the cells, the tissue evaporates the effect of cutting is appeared.

This is done simultaneously so the tissue is nearly not touched by the active electrode.

Blend Cut (cutting-coagulation) is a monopolar waveform where electrosurgical generator creates electricity and voltage, discontinuously, with stops. The effect of coagulation depends on the duration of pause imported in the signal. Longer duration of the pause means larger effect of coagulation and vice versa. Ratio between the duration of the signal and pause inside the signal is displayed in percentage and it can be 75% and 50%.

If we were about to use larger mode for cutting tissue, it would require more voltage, which would cause bigger thermal lateral tissue damage.

Soft Coag (coagulation and coagulation spraying-non-contact phenomenon) is a monopolar waveform where electrosurgical generator creates electricity and voltage with most stops. Ratio between the duration of signal and duration of pause for contact coagulation is 50%, and for spraying coagulation (fulguration) goes up to 6%. As it has the longest duration of pause in signal for the same form of power, this type of mode requires very high voltage, thereby increasing the probability of adverse effects. It is performed by electrodes in shapes of smaller or larger globes. By touching the tissue, the area where the current leaves electrode is increased and transferred into the tissue. The density of electricity is decreased, which causes warming up of cellular fluids, dehydration and drainage of cells which still maintain their shape and form. Temperature goes from 70 to 80°C and white coagulum is formed. This means the coagulation is performed well. The active electrode has to be in sufficiently long contact (one second or half of second) with the tissue, for maintaining of effect of coagulation and dehydration. Further heating of the tissue causes carbonification of the tissue and the blood on the electrodes. Piled material on electrodes increases resistance, which increases voltage for maintaining the same source of power. Clean electrodes require lower voltage for transferring the same amount of power on tissue. Our experience shows that radiofrequency (radio wave) surgery is an alternative to conventional surgery in methods

hirurgija izvanrednom preciznošću i minimalnim oštećenjem tkiva pruža veliku sigurnost naročito kada se radi u blizini osetljivih anatomskih struktura, kao što su nervi, krvni sudovi, estetske zone i sl.

Talasni oblik „blend cut” naročito je pogodan za rad u dobro vaskulariziranim anatomskim regijama kao što su glava i vrat, uključujući i usnu duplju. Pokazuje veliku prednost kod incizija, ekscizija i cirkumcizija tkiva. Za to služe specijalni radni dodaci u obliku igala različite dužine, oblika i promera. Naročito je pogodan za uklanjanje benignih tumorskih lezija gingive i mekih tkiva usne duplje, kao i svih vrsta mekotkivnih cističnih promena. Talasni oblik „soft coag” i kuglični radni nastavci različite veličine idealni su za zaustavljanje krvarenja iz mekih tkiva, gingive, periodoncijuma, a delimično i iz koštanih tkiva.

Na koži radiofrekventna hirurgija je svrsishodna za uklanjanje furunkula i karbunkula, posebno srednje trećine lica, radi sprečavanja širenja infekcije prema kavernoznom i sagitalnom venskom sinusu. Pogodna je za uklanjanje nevusa, bradavica, fibroma, hemangioma, keratoza, kao i sitnih kapilara kože lica. Uklanjanje promena postiže se rezom koji je lagan, bez pritiska i simultan. Zarastanje rana je brzo, a stvaranje ožiljnog tkiva je minimalno. Zbog toga se na koži postiže idealan kozmetički rezultat.



Slika 1. Frenulektomija radio nožem
Picture 1. Frenectomy with radiofrequency knife



Slika 2. Postoperativni nalaz
Picture 2. Postsurgical appearance

of cutting soft tissues, as it is minimally invasive, very precise, atraumatic, without effort and without touch - simultaneous, with haemostatic effect and clean operative field. There is significantly less bleeding during surgery which decreases the duration of procedures and results in easier and faster postoperative recovery.

As opposed to electrocautery, which gives large lateral morbidity to the wound, radio wave surgery with outstanding precision and minimal tissue damage brings greater security, especially when it is done near sensitive anatomical structures, like blood vessels, nerves and aesthetical zones.

Waveform „blend cut“ is particularly convenient for working in very well vascularised anatomical regions like head and neck regions including oral cavity. It shows great precision in performing incisions, excisions and circumcisions of the tissue. Special working supplements like needles different in size, shape and girth are used for this purpose. Further, it is particularly effective in removing benign gingival tumor lesions, and lesions of soft tissues in oral cavity, as well as all the types of cystic lesions. Wave form „soft coag“ and globular working installments of different size are ideal for stopping bleeding from soft tissues, gingival tissues, periodontal and partly bone tissues.



Slika 3. Rana u zarastanju
Picture 3. Wound during healing process



Slika 4. Radio frekfentni nož
Picture 4. Radiofrequency knife

Sam efekat koagulacije radiotalasnim aparatom u mnogome zavisi od sadržaja vode u tkivu, tj. što je veći procenat vode, veći je otpor i koagulacija je slabija. Voda isparava, koagulacija tkiva i otpor rastu do tačke u kojoj ono ne provodi električnu struju. Iz tog razloga vrlo je bitno da polje rada u trenutku koagulacije bude maksimalno suvo. To se postiže dobrom sinhronizacijom rada oralnog hirurga i njegovog asistenta. Različite vrste tkiva imaju različitu otpornost na proticanje električne struje. Za tkiva sa većom otpornošću potreban je veći radni napon i obrnuto. Zbog toga je vrlo važno pravilno odabrati aktivnu elektrodu i mod rada kako bi se u što kraćem vremenu delovanja postigao optimalni rezultat.

Važno je napomenuti da radiotalasni aparat može svojim radom destabilizaciju aktivnosti srčanog pejsmejкера. Iz tog razloga je potrebno pasivnu elektrodu postaviti što dalje od pejsmejкера. Posle hirurške procedure obavezna je kontrola rada pejsmejкера.

Kad god je moguće u takvim situacijama treba primeniti bipolarnu metodu koagulacije. Struja u tom slučaju ne prolazi kroz telo pacijenta ka pasivnoj elektrodi, već od jednog kraja bipolarne pincete ka drugom, uspostavljajući strujno kolo i sledstvenu koagulaciju.

Ukoliko pacijent ima ugrađene dentalne implantate kontraindikovano je njihovo dodirivanje u toku rada aktivnom elektrodom.

Komplikacije su najčešće posledica nestručnog rada i nepridržavanja principa rada. Ogljedaju se u stvaranju opekotina i većem lateralnom oštećenju tkiva što prouzrokuje dugotrajnije i bolnije zarastanje rana i formiranje većih ožiljaka.

On the skin, radiofrequency surgery is used for removing of furunculus and carbunculus, especially in the middle third of the face, to prevent spreading of infections towards the cavernous sinus, and sagittal venous sinus. It is suitable for removing of nevi, papillomas, fibromas, haemangiomas, keratoses and small capillaries of the face. Removing of these is done with the incision which is light, without pressure, and simultaneous. Healing of the wound is fast, and the creation of scar tissue is minimal. Because of that, we have ideal cosmetic results on the skin.

The effect of coagulation with radiowave device depends on the amount of water in the tissue, which means that when the percentage of water is larger, so is the resistance, and then the coagulation is weaker. The water evaporates, coagulation of the tissue and resistance are rising up to the point in which electricity is not transferred. For this reason, it is very important that the working area (field) is absolutely dry in the moment of coagulation. It is achieved with good synchronicity of work between oral surgeon and his assistant. Different types of tissues have different resistance for the transmission of electricity. For tissues with higher resistance we need bigger working voltage and vice versa. Because of that, it is extremely important to pick adequate active electrode and working mode so that we can have optimal results in shorter time of duration.

It is important to notice that radiowave device with its effect can destabilize the activity of the heart's pacemaker. For this reason, it is necessary to put passive electrode farther from it. After the surgical procedure, it is necessary to control how the pacemaker works.

Always when it is possible in that situation bipolar method should be used. Electricity does not pass through the body, but from one end of bipolar tweezers to the other end, making electricity circuit and coagulation.

If patient has dental implants, touching them is contraindicated while working with active electrode.

Complications are often caused by bad practice, or avoiding principles of working with this appliance.

This may cause burns, lateral tissue damage, that lead to long lasting wound healing and making great scars.

Zaključak

Radiotalasna hirurgija ima niz prednosti u odnosu na konvencionalnu hirurgiju:

- Simultana incizija i koagulacija
 - Jednostavnost izvođenja uz skraćenje vremena operacije
 - Rad u blizini osetljivih anatomskih struktura i inficiranom tkivu
 - Minimalno lateralno oštećenje tkiva
 - Manji postoperativni bol i otoci
 - Bolje i brže zarastanje rana
 - Minimalno stvaranje ožiljnog tkiva
 - Mnogostrana upotreba zbog velikog broja raspoloživih elektroda
 - Pouzdanost procedure
- Odsustvo opasnosti od opekotina pasivnom elektrodom

Conclusion

The radio wave surgery has the many advantages in relation to conventional surgery:

- Simultaneous incision and coagulation
 - Ease of performance by shortening the time of operation
 - Work near sensitive anatomic structures and infected tissue
 - Minimal lateral tissue damage
 - Smaller postoperative pain and swelling
 - Better and faster healing of wounds
 - Minimal creation of scar tissue
 - Multiple use due to large number of available electrode
 - Reliability of procedures
- No risk of burns by a passive electrode

LITERATURA / REFERENCES

1. Major RH. History of medicine volumes I and II. Springfield: ed: Charles C. Thomas; 1954.
2. Stillings D. John Wesley: philosopher of electricity. *Med Instrum.* 1973; 7:307.
3. Cushing H, Bovie W. Electrosurgery as an aid to the removal of intracranial tumors. *Surg Gynecol Obstet.* 1928; 47:751-84.
4. Feldman L, Fuchshuber P, Jones D. The SAGES Manual on the Fundamental Use of Surgical Energy (FUSE) Springer Science+Business Media, LLC 2012.
5. Massarweh N, Cosgriff N, Slakey P. Electrosurgery: History, Principles, and Current and Future Uses. *Surgery.* 2006; 202 (3) 520-530.
6. Gallagher K, Dhinsa B, Miles J. Electrosurgery. *Surgery.* 2010; 29 (2) 70-72.
7. Cavaliere M, Mottola G, Iemma M. Comparison of the effectiveness and safety of radiofrequency turbinoplasty and traditional surgical technique in treatment of inferior turbinate hypertrophy. *Otolaryngol Head Neck Surg.* 2005;133:972-978.
8. Porter MW, Hales NW, Nease CJ, Krempl GA. Longterm results of inferior turbinate hypertrophy with radiofrequency treatment: a new standard of care? *Laryngoscope* 2006;116:554-557.
9. Leong SC, Eccles R. Inferior turbinate surgery and nasal airflow: evidence-based management. *Curr Opin Otolaryngol Head Neck Surg* 2010;18:54-59.
10. Lin HC, Lin PW, Friedman M, Chang HW, Su YY, Chen YJ, et al. Long-term results of radiofrequency turbinoplasty for allergic rhinitis refractory to medical therapy. *Arch Otolaryngol Head Neck Surg* 2010;136:892-895.