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Blood Flow Measurement by Laser Doppler Method in Orofacial Region

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SUMMARY

Laser Doppler is a noninvasive, objective, reproducible and painless method for measuring blood flow in tissue microcirculation. This method is based on the Doppler effect, the change in frequency of light reflecting from blood cells in motion. Light from helium-neon laser through optical fibers and probes is directed to the surface of the tissue in which the flow is measured. Light portion is reflected from the cells in motion and changes the frequency while another portion is reflected from the static tissue maintaining the same frequency as the initial light. The total reflected light, with changed and original frequency, reaches photo detector in the same probe where the emitter is and it is transformed into electrical impulse. In the orofacial region the laser Doppler method is used to examine blood flow in the mandible, teeth pulp and masticator muscles. A significant drawback of the laser Doppler method is its sensitivity to the ambient conditions during measuring and the fact that blood flow is measured in all blood vessels of examined microregion. Therefore, the circulation of isolated individual blood vessels can not be monitored. Laser Doppler method can give reliable indicators of blood flow in mouth tissue and method is acceptable for the patients.

Keywords: laser Doppler flowmetry; blood flow in the dental pulp

INTRODUCTION

The laser Doppler flowmetrics is a relatively new method for measuring blood flow at the level of microcirculation in the tissues and organs. Obtained results are objective, reproducible and well accepted by patients because it is noninvasive and painless.

The technique was used for the first time in 1972 by Riva et al. [1] who measured blood flow in the rabbit retina. Stern [2] used this method in 1975 to measure blood flow in the skin. The laser Doppler method was used in orofacial region to examine blood flow in the mandible [3], human dental pulp [4] and masticator muscles [5].

The method is based on a phenomenon known as the Doppler effect i.e. change in frequency of light after reflecting from blood cells in motion. Modern Doppler (Figure 1) use light of helium-neon laser directed through the optical fiber and probe (Figure 2) to the surface of tissue where the flow is examined. The wavelength of 632.8 nm was used first [4] and later it was increased to 780-820 nm [6].

When light reaches blood cells in the microcirculation, a portion is reflected from the cells in motion and thereby it changes the frequency. The other portion of light reflects from static tissue maintains the same frequency as the initial light. The total reflected light (the part with changed and the part with unchanged frequency) reaches photo detector in the same probe where emitter is being transformed in an electric impulse. Using the laser Doppler device software, the electronic impulse is expressed in perfusion units (PU) (Figure 3) representing the number of cells multiplied by their average speed. Since the red blood cells are the majority of mobile cells in the tissue, it means that perfusion units are in fact the blood velocity in the tissue. Using the laser Doppler method, the blood flow in a small volume of tissue of about 1 mm^3 can be measured [7]. One of the problems is that the results (Figure 4) are expressed in perfusion units, not in absolute units (such as ml per minute per 100 g of tissue). As a consequence the results are subjective; actually they are directly related to the type of the device used for measure-

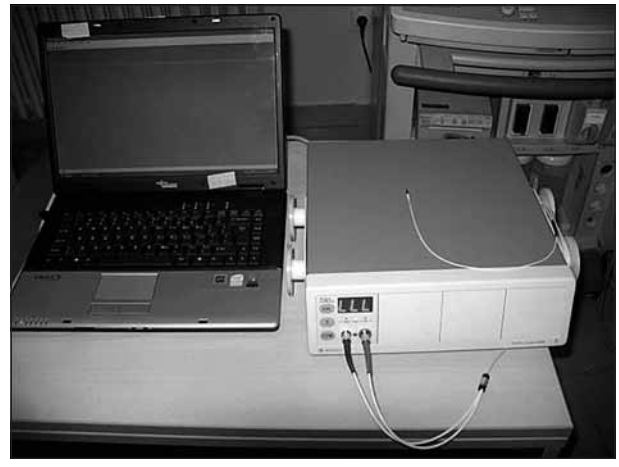

Figure 1. Laser Doppler device connected to the computer
Slika 1. Laser dopler aparat povezan s računarom

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Figure 2. Laser Doppler probe
Slika 2. Sonda laser dopler aparata

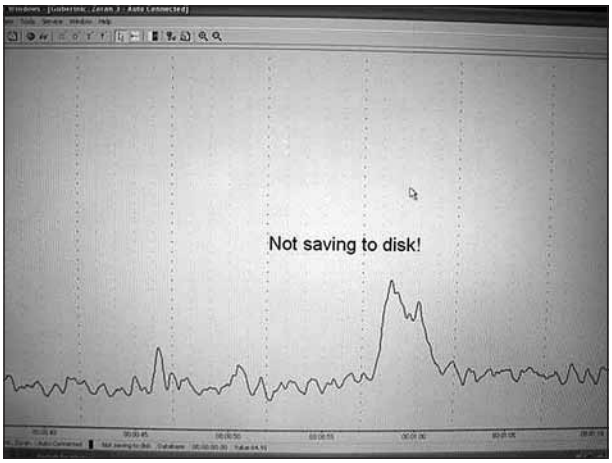

Figure 3. Monitoring the measurement
Slika 3. Praćenje merenja na monitoru računara

ment. Results obtained in perfusion units registered using different devices are not comparable [8].

It is important to mention that for repeated use of the same device, it must be calibrated before use; it is the only way to obtain valid and comparable results. Calibration is performed using suspensions of known characteristics, recommended by the manufacturer.

Flow rate results obtained by the laser Doppler method can be affected by technical conditions of the measurement such as probe design, method of gingiva isolation, position of the probe on the surface of teeth, position of the patient, room temperature as well as the properties of the device [9]. Also, the impact of stress, taking medications, age, heart rate fluctuations, teeth discoloration [10], enamel and dentin mineralization [11] or individual factors of each respondent can affect the results. In addition to these factors, the characteristics of laser beam [12, 13] and method for stabilization of a probe on the surface of tissue [9, 14-17] can affect registered signals.

The characteristics of the laser beam

The wavelength of laser beam and the size of separation between the emitter and a receiver in the probe also can affect the value of the signal. By using a laser beam with

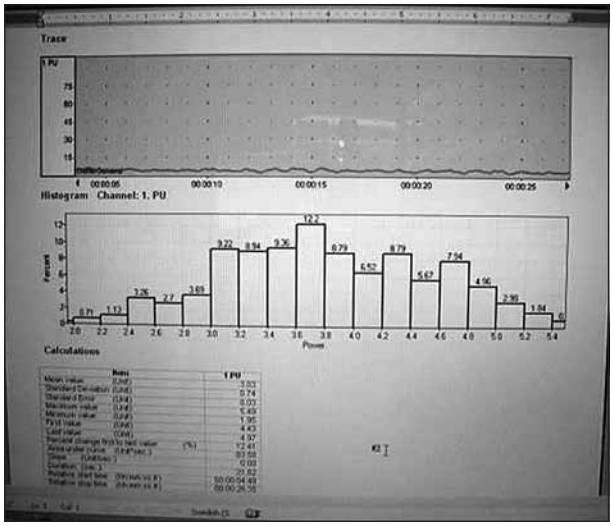

Figure 4. Graphically presented results
Slika 4. Grafički prikaz rezultata merenja

longer wavelengths, greater value of the signal is received due to deeper penetration into the tissue [12]. Greater separation between the emitter and the receiver inside the sensor causes a larger volume of tissue to be covered by the laser beam and therefore the signal will be significantly higher [13].

Stabilization of the probe

In order to stabilize the probe on the surface of tissue and to obtain the same position of the probe in repeated measurements, different techniques are used. Unlike previously used hand holding the probe (which did not fully satisfied the stability criterion) [14], to stabilize the probe on oral tissues, a splint made according to the tissue impression is used. The splints can be soft and rigid. A splint made of silicone (soft) splint (Figure 5) used to stabilize the probe sometimes can cause greater results than solid splint (Figure 6) [9]. Authors attribute this phenomenon to inadequate adaptation of silicon to the surface of teeth. Specifically, it provides another reflection of light [15] or capillary phenomenon that comes from fluids in gingival sulcus [16]. In order to get more consistent results, authors

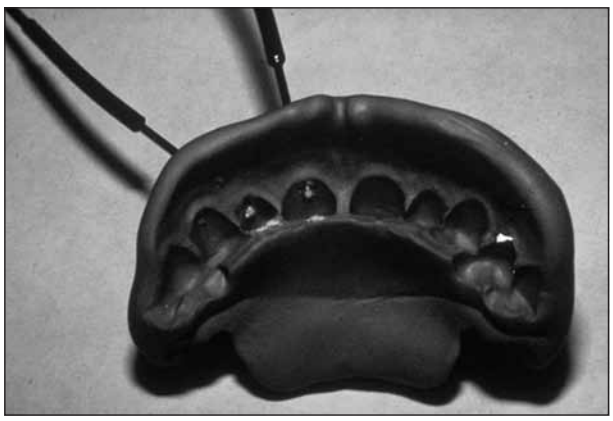

Figure 5. Soft (silicone) splint
Slika 5. Meki (silikonski) splint

Figure 6. Rigid (polyethylene) splint
Slika 6. Rigidni (polietilenski) splint

recommend the use of rigid splint [9] made usually of polyurethane, polyethylene and acrylate. Sometimes acrylic disc can be used on examined tooth [17].

USE IN OROFACIAL REGION

The laser Doppler method is used to examine tissue blood flow in the pulp, gingiva, bones, masticator muscles, oral mucosa and surgical flaps.

Measurement of blood flow in dental pulp

Blood flow in the pulp of the tooth, in order to determine its vitality, by laser Doppler method was measured for the first time by Gazelius et al. [4]. Available tests in routine clinical praxis determine the state of dental pulp by measuring a pulp response to thermal or electrical stimuli. As tooth vitality depends on its vascularization and previously mentioned tests are based on the reaction of sensitive nerve endings, it is clear that they do not give always reliable information about the vitality of teeth [18]. Thus, teeth with incompletely formed roots [19] or teeth that temporarily lost sensitive nerve function due to trauma will not respond to these tests although they have preserved vascularization. Also, sensitive nerve fibers (due to their resistance) in dental pulp necrosis show similar reaction to irreversible damage. Authors state that in 10-16%, the sensitivity tests give false positive or false negative results [20]. The laser Doppler method providing the information of the status of pulp circulation could be an alternative to existing tests.

By measuring blood flow in the pulp, the laser beam is reflected also outside of the tooth, in extracted teeth it can penetrate up to 13mm along the root depending on the wavelength [21]. Therefore, there is a possibility of contamination of the signal with the extrapulpal signal, mostly of periodontal origin (according to some authors up to 82%) [22]. Isolation of the tooth and necessarily comparison with the values of healthy control tooth is required. The most commonly recommended isolation is by rubber-dam [9] while some authors recommend isolation by periodontal paste only [23].

Position of the probe close to the gingival part of the crown gives stronger signal due to thinner hard dental tissue in gingival parts of the crown. However, more gingival positioning of the probe increases the risk of contamination of the signal by extrapulpal origin [24].

Beside the determination of the vitality of teeth, measurements of blood flow in dental pulp were done to examine: 1) vitality of deciduous teeth (sensitivity tests are not reliable in deciduous teeth) [25], 2) differential diagnosis of periapical translucency (not endodontic origin) [26], 3) reduction of blood flow in the pulp by aging [17], 4) the effects of physical activity and pulse amplification after change in flow in the dental pulp and gingiva [27], 5) the effects of systemic and local administration of various pharmacologically active substances on blood flow in the pulp and gingiva [28], 6) pulp reaction to electric [29] and thermal stimulation [30], 7) pulp circulation response to the application of orthodontic forces [31], 8) changes in the circulation of the pulp of teeth that are in osteotomic jaw segments (in order to obtain more reliable prognostic information than by conventional test sensitivity) [32], 9) state of blood flow in the pulp of traumatized teeth (as a result of damage and slow regeneration of nerves, unreliable results can be obtained in the period immediately after trauma) [15], 10) follow-up on revascularization and outcome after reimplantation of the tooth [33].

Measurement of blood flow in gingiva

Gingival flow was studied in order to: 1) compare traditional indicators of periodontal health, monitor the effects of therapy [34] and compare different methods of surgical periodontal therapy [35], 2) register changes in gingival blood flow after application of sodium lauryl sulfate [36], monitor on changes after the application of local anesthetic with vasoconstrictor [37] and different concentrations of adrenaline in retraction cord [38], 3) confirm existence of certain receptors in the gingival tissue and dental pulp [39], 4) study the impact of pulp electro stimulation [40] or stimulation after brushing teeth [41] to increase blood flow in gingiva, 5) monitor the effects on blood flow through gingiva at Le Fort I osteotomy intraoperatively [42] and postoperatively [43], 6) research scope and mechanisms of the impact of smoking on gingival flow [44].

Measuring blood flow using laser Doppler in other orofacial tissues

The laser Doppler blood flow measurement was used also in order to: 1) determine the distribution of scar tissue after cleft palate surgery [45], 2) verify vitality of sinus bone graft before placing the implants [46], 3) measurement of blood flow in buccal fat pad as a source of vascularization for sinus bone graft [47], 4) test blood supply in bones in the area provided for implants placement [48], 5) correlate changes in masticator muscle blood flow after exposure to mental stress [49], 6) compare the influence of different materials dentures are made of [50] and different load on dentures [51] on blood flow in mucosa covered by the denture, 7) monitor postoperatively the circulation

of tissue flaps used in reconstructive surgery of the head and neck region [52].

LIMITATIONS OF LASER DOPPLER METHOD

Beside many positive effects that can be achieved using the laser Doppler method, there are significant limiting factors that prevent its wide application in diagnosis, therapy and microcirculation control in orofacial region. In fact, almost always the total blood flow is measured in examined micro region; therefore it is not possible to monitor the circulation in individual blood vessels. This technique also can not be used to analyze number, quality and the diameter of blood vessels in the examined volume of tissue.

A significant drawback of the laser Doppler technique is its sensitivity to the ambient conditions (T°, vibration) as well as movements of the parts of measuring apparatus. These factors can directly affect the blood flow values obtained from the examined tissue; therefore they must be controlled during examination. Vibrations of the apparatus itself, as well as any movements in the area should be eliminated, too. In addition, a significant impact on the results may have variations in patient's blood pressure directly related to environmental conditions and measurement procedure. The duration of each measurement is an important limiting factor for use of this technique in everyday practice, as well as the high cost of equipment. In strictly controlled conditions the laser Doppler method is reliable technique for blood flow measurement in the pulp [53], however further improvements are necessary [54].

The laser Doppler method can give reliable indicators of blood flow in oral tissue. This method is not invasive and it is acceptable by patients. For accurate measurement ambient conditions should be constant and well controlled.

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Merenje protoka krvi laser dopler metodom u orofacijalnoj regiji

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KRATAK SADRŽAJ

Laser dopler floumetrija je neinvazivna, objektivna, reproduktibilna i bezbolna metoda merenja protoka krvi na nivou mikrocirkulacije tkiva. Metoda je zasnovana na promeni frekvencije svetlosti pri odbijanju od krvnih ćelija u pokretu, odnosno na Doplerovom efektu. Svetlost helijum-neonskog lasera se putem optičkih vlakana i sonde s emiterom usmerava na površinu tkiva u kojem se ispituje protok. Deo svetlosti se odbija od ćelija u pokretu, pri čemu menja frekvenciju, a drugi deo svetlosti se odbija od statičnih tkiva zadržavajući istu frekvenciju kao i upadna svetlost. Ukupna odbijena svetlost s promenjenom i nepromenjenom frekvencijom dospeva do fotodetektora, koji je u okviru iste sonde kao i emiter, i pretvara se u električni impuls. U orofacijalnoj regiji laser dopler metoda je korišćena za ispitivanje protoka krvi u mandibuli, protoka u pulpi humanih zuba i u mastikatornim mišićima. Značajan nedostatak ove metode je njena osetljivost na uticaje iz okoline, kao i činjenica da se protok krvi meri u svim krvnim sudovima ispitivane mikroregije, pa se ne može izolovano pratiti cirkulacija u pojedinačnim krvnim sudovima. Ovom metodom se mogu dobiti pouzdani pokazatelji protoka krvi u tkivima usne duplje, a pacijenti je dobro prihvataju.

Ključne reči: laser dopler floumetrija; protok krvi u pulpi zuba

UVOD

Laser dopler floumetrija je relativno nova metoda merenja protoka krvi na nivou mikrocirkulacije u tkivima i organima. Rezultati koji se ovom metodom mogu prikupiti su objektivni i reproduktibilni, a pacijenti je dobro prihvataju jer je neinvazivna i bezbolna.

Tehniku je prvi put primenio Riva (*Riva*) sa saradnicima [1] 1972. godine za merenje protoka krvi u retini kunića, a Stern (*Stern*) [2] je ovu metodu 1975. koristio za merenje protoka krvi u koži. U orofacijalnoj regiji laser dopler metoda je korišćena za ispitivanje protoka krvi u mandibuli [3], u pulpi humanih zuba [4] i u mastikatornim mišićima [5].

Metoda je zasnovana na fenomenu poznatom kao Doplerov efekat, tj. na promeni frekvencije svetlosti pri odbijanju od krvnih ćelija u pokretu. Savremeni dopleri (Slika 1) koriste svetlost helijum-neonskog lasera koja se putem optičkih vlakana i sonde (Slika 2) s emiterom usmerava na površinu tkiva gde se ispituje protok. U početku je korišćena talasna dužina lasera od 632,8 nm [4], a kasnije je ona povećana na 780-820 nm [6].

Kada svetlost prodre do krvnih ćelija u mikrocirkulaciju, jedan deo se odbija od ćelija u pokretu i pri tom menja frekvenciju. Drugi deo svetlosti koji se odbije od statičnih tkiva zadržava istu frekvenciju kao i upadna svetlost. Ukupna odbijena svetlost (deo sa promenjenom i deo sa nepromenjenom frekvencijom) dospeva do fotodetektora, koji je u okviru iste sonde kao i emiter, i pretvara se u električni impuls. Električni impuls se pomoću softvera laser dopler aparata izražava u perfuzionim jedinicama (engl. *perfusion unit – PU*) (Slika 3), koje predstavljaju broj ćelija u pokretu pomnožen njihovom prosečnom brzinom. S obzirom na to da crvena krvna zrnca čine većinu pokretnih ćelija u tkivu, to znači da perfuzione jedinice predstavljaju u stvari meru krvnog protoka u tkivu. Laser dopler metodom se meri protok u maloj zapremini tkiva – od oko 1 mm^3 [7]. Jedan od problema je u tome što se rezultati (Slika 4) prikazuju u perfuzionim jedinicama, a ne u apsolutnim jedinicima (na primer, ml u minuti na 100 g tkiva). Zbog toga se ne može izbeći subjektivnost u dobijenim rezultatima, jer je to u direktnoj vezi sa tipom aparata kojim je vršeno merenje. Rezultati dobijeni u perfuzionim jedinicama registrovani različitim aparatima se ne mogu međusobno porediti [8].

Važno je napomenuti da se pri upotrebi istog aparata on mora neposredno pre upotrebe kalibrisati, jer su jedino tako dobijeni rezultati pojedinačnih merenja validni i međusobno uporedivi. Kalibracija se vrši suspenzijama čestica u tečnosti, poznatih osobina, preporučenim od strane proizvođača.

Na vrednosti protoka dobijene merenjem laser dopler metodom utiču tehnički uslovi izvođenja merenja, kao što su: dizajn sonde, način izolacije gingive, pozicija sonde na površini zuba, pozicija pacijenta, temperatura prostorije gde se merenje obavlja i osobine samog aparata [9]. I uticaj stresa, određeni lekovi, uzrast, oscilacije srčanog ritma, diskoloracije zuba [10], mineralizacija gleđi i dentina [11], odnosno individualne osobenosti svakog ispitanika mogu uticati na rezultate merenja. Pored navedenih faktora, na jačinu registrovanog signala utiču i osobine laserskog snopa [12, 13] i način stabilizacije sonde na površini tkiva [9, 14-17].

OSOBINE LASERSKOG SNOPA

Talasna dužina laserskih zraka i veličina separacije između emitera i prijemnika u okviru sonde utiču na vrednosti signala. Korišćenjem laserskih zraka većih talasnih dužina dobijaju se veće vrednosti signala zahvaljujući dubljem prodiranju zraka u tkivo [12]. Veća separacija između emitera i prijemnika u samoj sondi utiče na to da veća zapremina tkiva bude zahvaćena laserskim snopom, pa je samim tim i signal značajno veći [13].

Stabilizacija sonde

Za stabilizaciju sonde na površini oralnog tkiva i mogućnost reprodukovanja istog položaja sonde pri ponovljenim merenjima koriste se različite tehnike. Za razliku od ranije korišćenog ručnog držanja sonde (koji nije potpuno zadovoljavao ovaj kriterijum stabilnosti) [14], danas se koriste splintovi napravljeni na osnovu uzetog otiska tkiva. Među ovim splintovima razlikuju se

meki i rigidni. Silikonski (meki) splint (Slika 5) za stabilizaciju sonde može ponekad uticati na veće vrednosti dobijenih rezultata u odnosu na čvrste splintove (Slika 6) [9]. Autori ovu pojavu pripisuju neadekvatnoj adaptaciji silikona na površini zuba. Naime, ovo omogućava novo odbijanje svetlosti [15], odnosno efekat kapilarnog fenomena, koji potiče od tečnosti iz gingivalnog sulkusa [16]. Da bi se dobili konzistentniji rezultati, autori preporučuju upotrebu rigidnih splintova [9], koji se obično prave od poliuretana, polietilena i akrilata. Ponekad se koristi i akrilatni disk na zubu koji se ispituje [17].

PRIMENA U OROFACIJALNOJ REGIJI

Laser dopler metoda je u tkivima korišćena za ispitivanje protoka krvi u pulpi zuba, za merenje gingivalnog protoka, protoka u kosti, mastikatornim mišićima, oralnoj mukozi i hirurškim režnjevima.

Merenje protoka krvi u pulpi zuba

Protok krvi u pulpi zuba radi utvrđivanja njegove vitalnosti laser dopler metodom prvi su merili Gazelijus (*Gazelius*) i saradnici [4]. Testovi koji se u svakodnevnoj kliničkoj praksi koriste za utvrđivanje stanja pulpe zuba podrazumevaju reakciju pulpe na toplotne ili električne stimuluse. Kako vitalnost zuba zavisi od njegove vaskularizacije, a prethodno pomenuti testovi se zasnivaju na reakciji senzitivnih nervnih završetaka, jasno je da se njima ne dobijaju uvek podaci o stvarnom stanju zuba [18]. Tako, na primer, zubi sa nepotpuno formiranim korenom [19] ili zubi koji su usled traume privremeno izgubili funkciju senzitivnih nerava neće reagovati na navedene testove iako im je vaskularizacija očuvana. Takođe se može desiti da senzitivna nervna vlakna (zbog svoje otpornosti) kod nekroze zubne pulpe pokazuju reakciju sličnu ireverzibilnim oštećenjima. Autori navode da u 10-16% slučajeva testovi senzibiliteta daju lažno pozitivne ili lažno negativne rezultate [20]. Laser dopler metoda, koja daje podatke o stanju cirkulacije pulpe zuba, mogla bi biti alternativa ovim testovima.

Kod merenja protoka u pulpi zuba laserski zraci se prelamaju i izvan zuba, a kod ekstrahovanih zuba prodiru i do 13 mm duž korena, zavisno od talasne dužine [21]. Zbog toga postoji mogućnost kontaminacije signala sa signalom vanpulpnog, pretežno periodontalnog, porekla (prema nalazima nekih atora, i do čak 82%) [22]. Zato je neophodna izolacija krunice zuba i obavezno poređenje vrednosti na ispitivanom sa vrednostima na zdravom kontrolnom zubu. Najčešće se preporučuje izolacija koferdamom [9], dok pojedini autori savetuju izolaciju samo periodontalnom pastom [23].

Pozicioniranjem sonde bliže gingivalnom delu krunice zuba dobija se jači signal zbog manje debljine tvrdih zubnih tkiva u gingivalnim delovima krunice. Međutim, gingivalnijom pozicijom sonde povećava se opasnost od kontaminacije signalom vanpulpnog porekla [24].

Pored utvrđivanja vitalnosti zuba, merenja protoka krvi u pulpi zuba rađena su i radi ispitivanja: 1) vitalnosti mlečnih zuba (testovi senzibiliteta nisu pouzdani kod mlečnih zuba) [25]; 2) diferencijalne dijagnoze periapeksnih rasvetljenja (koja nisu endodontskog porekla) [26]; 3) smanjenja protoka krvi u pulpi sa starenjem [17]; 4) efekata fizičke aktivnosti i pojačanja pulsa na promenu protoka u pulpi zuba i gingivi [27]; 5) efekata sistemske i lokalne primene različitih farmakološki aktivnih sredstava na protok krvi u pulpi i gingivi [28]; 6) reakcije pulpe na električnu [29] i toplotnu stimulaciju [30]; 7) odgovora cirkulacije u pulpi na primenu ortodontskih sila [31]; 8) promena u cirkulaciji pulpe zuba koji se nalaze u osteotomisanim segmentima vilica (radi dobijanja prognostičkih informacija pouzdanijih od klasičnih testova senzibiliteta) [32]; 9) stanja protoka krvi u pulpi traumatizovanih zuba (s obzirom na to da se usled oštećenja i spore regeneracije nerava testovima senzibiliteta dobijaju nepouzdani rezultati u periodu neposredno posle traume) [15]; i 10) praćenja revaskularizacije i ishoda lečenja nakon replantacije zuba [33].

Merenje protoka krvi u gingivi

Protok krvi u gingivi ispitivan je radi: 1) poređenja tradicionalnih pokazatelja parodontalnog zdravlja, tj. praćenja efekata lečenja [34] i poređenja različitih metoda hirurške parodontalne terapije [35]; 2) beleženja promena u gingivalnom protoku krvi posle primene natrijum-laurilsulfata [36], lokalnog anestetika sa vazokonstriktorom [37] i različitih koncentracija adrenalina u retrakcionom koncu [38]; 3) potvrđivanja postojanja pojedinih receptora u tkivu gingive i zubne pulpe [39]; 4) ispitivanja uticaja elektrostimulacuje pulpe zuba [40], odnosno stimulacije posle pranja četkicom za zube [41] na povećanje protoka u gingivi; 5) praćenja efekata na protok kroz gingivu kod Le For I osteotomije tokom operacije [42] i posle operacije [43]; i 6) istraživanja obima i mehanizama uticaja pušenja na protok krvi u gingivi [44].

Merenje protoka krvi laser dopler metodom u ostalim orofacijalnim tkivima

Merenje protoka krvi korišćeno je i kod: 1) utvrđivanja rasporeda ožiljnog tkiva posle operacije rascepa nepca [45]; 2) potvrde vitalnosti sinusnog koštanog grafta pre ugradnje implantata [46]; 3) merenja prokrvljenosti masnog jastučeta obraza, kao izvora vaskularizacije za koštani sinusni graft [47]; 4) ispitivanja prokrvljenosti kosti na mestu predviđenom za ugradnju implantata [48]; 5) korelacije promena u mikrocirkulaciji mastikatornih mišića sa izloženošću mentalnom stresu [49]; 6) poređenja uticaja različitih materijala od kojih su napravljene baze [50] i različitog opterećenja proteze [51] na protok krvi u mukozi pokrivenoj bazom proteze; i 7) postoperacionog praćenja cirkulacije tkivnih režnjeva koji se koriste pri rekonstruktivnim zahvatima u regiji glave i vrata [52].

OGRANIČENJA LASER DOPLER METODE

Pored niza pozitivnih efekata koji se mogu postići primenom laser dopler metode, postoje i značajni ograničavajući faktori koji sprečavaju njenu širu primenu u procesima dijagnostikovanja, lečenja i kontrole mikrocirkulacije u tkivima orofacijalne regije. Naime, uvek se meri celokupan protok krvi u svim krvnim sudovima ispitivane mikroregije, pa na ovaj način nije

moguće izolovano posmatrati cirkulaciju u pojedinačnim krvnim sudovima. Ovom tehnikom se takođe ne može analizirati ni broj, kvalitet, ali ni njihov prečnik u ispitivanoj zapremini tkiva.

Značajan nedostatak laser dopler metode je njena osetljivost na uslove u okolini u kojem se vrši merenje (temperatura, vibracije), odnosno pokrete delova merne aparature. Svi ovi faktori mogu direktno uticati na dobijene vrednosti protoka krvi u ispitivanom tkivu, pa se zato pre ispitivanja moraju staviti pod kontrolu. Moraju se neutralisati i vibracije same aparature, kao i bilo kakvi pokreti u okolini. Pored toga, značajan uticaj na dobijene rezultate mogu imati i promene krvnog pritiska ispitanika, koje su u direktnoj vezi sa uticajima iz okoline i samim postupkom merenja. Trajanje svakog pojedinačnog merenja je značajan ograničavajući faktor za upotrebu ove metode u svakodnevnoj praksi, ali i visoka cena opreme.

U strogo kontrolisanim istraživačkim uslovima laser dopler metoda je pouzdana za utvrđivanje protoka krvi u pulpi zuba [53], međutim, u uslovima svakodnevne prakse neophodna su dodatna usavršavanja ove metode [54].

Laser dopler metodom se mogu dobiti pouzdani pokazatelji protoka krvi u tkivima usne duplje. Ova metoda je zbog neinvazivnosti vrlo prihvatljiva za pacijente. Uslovi u okolini prilikom primene ove metode moraju biti konstantni i strogo kontrolisani.