UGROŽENOST STOMATOLOŠKOG OSOBLJA SARS-CoV-2 VIRUSOM TOKOM STOMATOLOŠKIH INTERVENCIJA

OCCUPATIONAL HAZARD FOR DENTAL STAFF EXPOSED TO THE SARS-CoV-2 VIRUS DURING DENTAL PROCEDURES

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Sažetak

Uvod: Stomatološka profesija je visokorizična profesija, sa aspektom mogućeg inficiranja, od skoro 100% u toku stomatoloških intervencija, od strane pacijenata koji su nosioci bakterijskih, virusnih i gljivičnih bolesti.

Cilj rada: Analiza svih podataka koji objašnjavaju mogućnost inficiranja SARS-CoV-2 virusom u stomatološkoj praksi.

Materijal i metode: Analizirana je literatura o zastupljenosti SARS-CoV-2 virusa, njegove karakteristike i ponašanje u spoljašnjoj sredini i u živim tkivima. Korištene su baze podataka iz biblioteka Medline, Cochrane Library, Science-Direct, EMBASE, and Google scholar, kao i drugi izvori informacija o ovom virusu.

Rezultati: SARS-CoV-2 je RNA virus, koji ima submikronsku veličinu i mogućnost da opstane u raznim sredinama. Zadržavanje virusa SARS-CoV-2 u vazduhu/aerosolu traje prosečno 3 sata, dok je poluživot ovog virusa 5 do 6 sati na nerđajućem čeliku i 6 do 8 sati na plastici. Inficirani pacijenti SARS-CoV-2 virusom razvijaju COVID-19 bolest, koja se manifestuje kroz presymptomatski, simptomatski i postsimptomatski period bolesti. SARS-CoV-2 virus može se identifikovati u aerosolu, koji stvaraju stomatološke mašine, korišćenjem kompresorskog vazduha u radu. Zaštita stomatologa i osoblja od inficiranja virusom je moguća, korišćenjem N95 respiratorne maske sa stepenom zaštite 2 i 3, koje imaju efikasnost filtracije 98%. Treba koristiti vodonepropusne zaštitne viziore ili industrijski posebno zaštitne naočare sa česticama sa efikasnošću od ≥ 98%.

Zaključak: SARS-CoV-2 virus moguće je identifikovati u aerosolu, koji stvaraju stomatološke mašine, korišćenjem kompresorskog vazduha u radu. Zaštita stomatologa i osoblja od inficiranja virusom je moguća, korišćenjem N95 respiratorne maske sa stepenom zaštite 2 i 3, koje imaju efikasnost filtracije 98%. Treba koristiti vodonepropusne zaštitne viziore ili industrijski posebno zaštitne naočare sa česticama sa efikasnošću od ≥ 98%.

Ključne reči: Stomatološka osoblje, SARS-CoV-2, rizik

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Abstract

Introduction: The dental profession is a high-risk profession, considering the aspect of a possible 100% infection from patients who are carriers of bacterial, viral and fungal diseases during dental interventions.

Aim: To perform the analysis of all data that explain the possibility of a SARS-CoV-2 virus infection in dental practice.

Material and Methods: The literature data on the presence of SARS-CoV-2 virus, and its characteristics and behavior in the external environment and in living tissues was analyzed. Databases from the Medline, Cochrane Library, Science-Direct, EMBASE, and Google scholar libraries were used, as well as other sources of literature information about this virus.

Results: SARS-CoV-2 is an RNA virus, which has a submicron size and the ability to survive in various environments. The retention of SARS-CoV-2 virus in air / aerosol lasts an average of 3 hours, while the half-life of this virus is 5 to 6 hours on stainless steel and 6 to 8 hours on plastic. Infected patients with SARS-CoV-2 virus develop COVID-19 disease, which manifests itself through presymptomatic, symptomatic and post-symptomatic periods of the disease.

Conclusion: The SARS-CoV-2 virus can be found in aerosols generated by dental equipment, which uses compressed air for its work. Protection of dentists and staff from infection with the virus is possible by wearing an N95 respiratory mask with protection levels 2 and 3, which has a filtration efficiency, i.e. retention of submicron particles with an efficiency of ≥ 98%. Waterproof goggles with a protective visor or a special industrially designed facial visor in the form of a full face mask, which has its own motor for the supply of filtered air to the mask, and which prevents the contamination of the mucous membranes of the eyes, nose and mouth from liquid or solid aerosol in the air, need to be used. Other disposable protective equipment also must be waterproof.

Key words: Dental stuff, SARS-CoV-2, risk

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**Uvod**

Stomatološka profesija je visokorizična profesija, sa aspekta mogućeg inficiranja, od skoro 100% od strane pacijenata, koji su nosioци bakterijskih, virusnih i gljivičnih bolesti, na kojima se izvodi stomatološka intervencija. Stomatološko osoblje, standardno, može biti izloženo i ugroženo sledećim patogenim mikroorganizmima i virusima: *Mycobacterium tuberculosis*, bakterijama grupe *Streptococcus* i *Staphylococcus*, *cytomegalovirusom* (CMV), herpes virusom tipa 1 i 2, virusom hepatitis B i C, kao i drugim patogenim izazivačima različitih bolesti.

Način prenošenja ovih mikroorganizama i inficiranje stomatološkog osoblja, od strane oboleleg pacijenta, dešava se preko: direktnog kontakta sa krvlju, pljuvačkom ili preko drugog infektivnog bilskog izvora; indirektnim putem, preko kontaminiranih instrumenata, radnih površina nameštaja u ordinaciji ili preko kontamirane opreme; preko kontakta sa infektivnim kapljicama iz konjuktive oka, oralne i nazalne služokože, koje sadrže patogene mikroorganizme i viruse i koje se izbacuju u spoljašnju sredinu (na kratku razdaljinu) pričanjem, kijanjem ili kašljanjem; inhalacijom patogene koji borave u vazduhu u dužem vremenskom periodu.

U ovom trenutku, od poslovnog je interesa razmotriti neke činjenice koje se odnose na pandemiju novog korona virusa, koju je proglasila Svetska zdravstvena organizacija krajem prošle godine, kao i na masovno zaražavanje stanovništva novim korona virusom. S obzirom na ove dramatične zdravstvene događaje, odluka o proglašenju vanrednog stanja u Republici Srbiji, zbog epidemije korona virusa, doprinela je tome da se stomatološke intervencije sprovode u specifičnim i veoma otežavajućim okolnostima za stomatološke zdravstvene radnike i pacijente, kojima je potreban stomatološki tretman.

**Biology of the coronavirus**

In people, the coronavirus causes colds which have the usual symptoms of a cold of the upper respiratory tract, affecting the nasal cavity, and sometimes spreading to the pharynx, larynx and the sinuses. Sa druge strane, SARS-CoV-2 virus, koji je izazivać masovne/globalne virusne infekcije, ima sličnosti sa druga dva korona virusa –beta korona virusom (SARS-CoV-1) i virusom srednjeistočnog respiratnog sindroma (MERS-CoV).
Ovi virusi imaju sposobnost da izazovu tešku pneumoniju i otkazivanje respiratorne funkcije pluća i na kraju dovedu do smrti pacijenta6.

SARS-CoV-2 virus, novi tip koronavirusa, koji ima sposobnost da izazove teški akutni respiratorni sindrom, sa mogućim smrtnim ishodom, dobio je početni naziv 2019-nCoV8, da bi ubrzo dobio i zvaničan naziv koji označava “teški akutni respiratorni sindrom izazvan koronavirusom 2“ (eng. severe acute respiratory syndrome coronavirus 2/ CORONA VIRUS 2 (SARS-CoV-2))8, koji izaziva korona virus bolest (COVID-19)9. Značajno je istaći da SARS-CoV-2 pripada RNK virusima10 i da ima sličnosti sa koronavirusom SARS-CoV-1.

Dimenzije SARS-CoV-2 virusa manje su od 1 mikrona i iznose 125nm, odnosno 0,125µm11,12. Ova submikronska dimenzija SARS-CoV-2 virusa značajno smanjuje mogućnosti zaštite od transmisije virusana stomatološko osoblje, u toku svakodnevnog rada.

Ways of coronavirus transmission

The SARS-CoV-2 virus is less than 1 micron, and is 125 nm or 0.125 µm11,12. This submicron size of the SARS-CoV-2 virus significantly reduces the possibility of protection against virus transmission in dental staff during their daily work.

Coronavirus (SARS-CoV-1) is a type of virus that can infect bats, civets of the genus viverida that are similar to mongooses, and people, in whom it causes severe acute respiratory syndrome (SARS)13,14. This virus attacks human epithelial cells in the lungs15,16, which it enters by binding to ACE2 receptors (angiotensin-converting enzyme)15,16. ACE2 receptors are also found in the kidneys, heart and endothelial cells, and their main role is the regulation of the renin-angitensin system (RAS)17. Recent findings indicate that ACE2 reacts with transmembrane protease-serine 2 (TMPRSS2), responsible for the activation of the viral “S” protein SARS-CoV-2, which reacts with the surface ACE2 enzyme almost identically to the SARS virus; activated viral material SARS-CoV-2 enters the cytoplasm of an infected person, and the process of virus replication takes place through cellular host mechanisms15,16,18,19,20.

There are still disagreements over how the current coronavirus (SARS-CoV-2) is transmitted; through large respiratory droplets as an influenza virus, or through a fine water mist called aerosol, as in the case of rubella18. However, the SARS-CoV-2 virus is thought to spread to humans primarily through respiratory droplets which occur when a person infected with the SARS-CoV-2 virus
SARS-CoV-2 virusom energično govori, kašlije ili kija i na taj način izbacuje sekret, tj. respiratorne kapljice u vazduhu i to nekoliko metara u daljinu; smatra se da je minimalna sigurna razdaljina ≥ 1.8 m – 2 m.

Takođe se smatra da je virus, koji aerosoliziran u vazduh, ipak potencijalna opasnost i može da opstane u vazduhu, kada se sprovode neke aktivnosti, kao npr. pevanje ili prilikom intubacija/ekstubacije pacijenata u toku opšte anestezije, kada virus može da se zadrži u vazduhu i do 3 sata.2

Zabrinjavajuća je činjenica da je pokazana mogućnost izolovanja SARS-CoV-2 RNA iz krvi i fecesa; njegovo prisustvo dokazano je i na kartonu, plastici i nerđajućem čeliku. Poslednja istraživanja pokazala su zadržavanje virusa SARS-CoV-2 u vazduhu/aerosolu u trajanju do prosečno 3 sata; poluživot ovog virusa bio je 5 do 6 sati na nerđajućem čeliku i 6 do 8 sati na plastici.23

Dokazano je prisustvo SARS-CoV-2 RNA virusa i na nekim drugim predmetima, što izaziva oprez u stručnim krugovima i upućuje na razmatranje i ovakvog načina širenja virusa.

**Uticaj kliničkih manifestacija covid-19 bolesti na stomatološki tretman**

U svakodnevnom stomatološkom radu postoji velika mogućnost transmisije SARS-CoV-2 virusa, s obzirom na to da stomatološki instrumenti i stomatološka oprema koji se koriste, kao što su nasadni instrumenati (turbine, kolenjaci i nasadnici), ultrazvučni skidači zubnih naslaga, ultrazvučni aparat za hirurgiju koštanog tkiva, itd., stvaraju jedva vidljive, fini vodeni oblaci odnosno izmaglicu, koja može da sadrži infekтивне честице. Korišćenjem ovih instrumenata, kao nemovna posledica javlja se i stvaranje velikih kapljica vode, pljuvačke, krvi, mikroorganizama, virusa kao i drugog mogućeg zaraznog materijala. U toku izvođenja stomatoloških intervencija, nije samo ugrožen stomatolog, koji vrši tretman, već i drugih osoba u neposrednoj okolini tokom tretman, kao što su pacijenti i stomatolozi. Smanjivanje mogućnosti širenja virusa može se ostvariti kroz primenu bezbednosnih razreda, putem konzultacije sa stručnjacima i informovanja pacijenata.

**Impact of the clinical manifestations of the covid-19 disease on dental treatment**

In everyday dental work, there is a great possibility for the transmission of the SARS-CoV-2 virus, considering the fact that the dental instruments and equipment used, such as handpieces (turbines, contra-angle handpieces and straight handpieces), ultrasonic dental plaque removers, ultrasound devices for bone tissue surgery, etc., create a barely visible, fine water cloud or haze, which may contain infectious particles. When using these instruments, an inevitable consequence is the creation of large droplets of water.
Još veća opasnost je i moguća pojava aerosola, koji može da sadrži infektivni patogeni mikroorganizam. Poznata je činjenica da hirurške maske koje nosi osoblje u toku opisanih intervencija uglavnom štiti mukozu usne šupljine i nosa od kapljica koje dolaze do zaštitne maske; medicinski problem je to što nema sigurne zaštite od udisanja iz vazduha stvorenih kontaminiranih oblaka, odnosno aerosola, koji potencijalno sadrži virus26. Sadašnja saznanja o COVID-19 bolesti nam govore da postoje tri nivoa kliničkog stanja zaraženog pacijenta, koji može da bude istovremeno i stomatološki pacijent. Standardizovane su faze razvoja COVID-19 bolesti, koja se razvija kroz preasymptomatski period, simptomatski period i postsimptomatski period27. Najveća opasnost od transmisije i zaražavanja SARS-CoV-2 virusom stomatološkog osoblja, tokom izvođenja stomatoloških intervencija, su pacijenti sa SARS-CoV-2 virusom, koji su u asimptomatskoj i ili preasymptomatskoj fazi razvoja bolesti COVID-1928. Inkubacioni period COVID-19 bolesti traje prosečno 5 do 6 dana, mada ima podataka o tome da traje i 14 dana29. Viruletnost SARS-CoV-2 virusa omogućava to da 1 dan do 3 dana pre ispoljavanja svih simptoma bolesti COVID-19 pacijent bude infektivan i 40% do 50%; transmisija virusa sa zaražene osobe na zdravu osobu nastaje u toj prvoj i nemoj fazi bolesti, odnosno asimptomatskoj ili preasymptomatskoj fazi bolesti22,30. Smatra se da 97,5% pacijenta, koji su u simptomatskoj fazi razvoja COVID-19 bolesti, može razviti simptome bolesti i to 11,5 dana od SARS-CoV-2 infekcije31. Simptomi COVID-19 bolesti su: povišena telesna temperatura, kašalj, bol i suvoća u grlu, malaksalost, bolovi u mišićima, gubitak apetita, mučnina, povraćanje, gubitak daha (kratak udisaj čula)22,33,34,35,36. Laboratorijske analiza pojedinih krivih i biohemijskih vrednosti karakterišu se specifičnim odstupanjima kao što su: povišena vrednost d-dimera, laktat dehidrogenaze, C-reaktivnog proteina, feritina i prisutnost limfopenija; nije retko da bolesnici imaju normalnu vrednost prokalcitonina; kod teških slučajeva COVID-19 bolesti nastaje leukocitoza sa limfopenijom, produženo protrombinsko vreme i znatno povećanje vrednosti enzima jetre, laktat dehidrogenaze, C-reaktivnog proteina, d-dimera, interleukina-6, C-reaktivnog proteina i prokalcitonina32,37,38,39,40. An even greater danger is the possible appearance of an aerosol that may contain an infectious pathogenic microorganism. It is a well-known fact that surgical masks worn by staff during the described interventions generally protect the mucosa of the oral cavity and nose from the droplets reaching the protective mask; the medical problem is that there is problematic protection against inhalation from the formed contaminated clouds in the air or aerosols that potentially contain the virus26. Current knowledge of the COVID-19 disease tells us that there are three levels of clinical conditions of an infected patient who may be a dental patient at the same time. The stages of development of the COVID-19 disease that develops through the preasymptomatic period, symptomatic period and post-symptomatic period are standardized27. Patients with the SARS-CoV-2 virus that are in the asymptomatic and/or preasymptomatic development phase of the COVID-19 disease represent the greatest threat of transmission and infection with the SARS-CoV-2 virus to dental staff during dental interventions28. The incubation period of the COVID-19 disease lasts an average of 5-6 days, although there are data that it lasts 14 days.29 The virulence of the SARS-CoV-2 virus allows the patient to be infectious 1-3 days before the manifestation of all symptoms of the COVID-19 disease, and 40-50% of the virus transmission from an infected person to a healthy person occurs in this first silent phase of the disease, i.e. in the asymptomatic or preasymptomatic phase of the disease22,30. It is believed that 97.5% of the patients who are in the symptomatic phase of the COVID-19 disease develop symptoms 11.5 days after the SARS-CoV-2 infection31. The symptoms of the COVID-19 disease are: fever, cough, painful and sore throat, muscle weakness and pain, loss of appetite, nausea, vomiting, loss of smell and taste, shortness of breath32,33,34,35,36. Laboratory analyses of individual blood and biochemical values are characterized by specific deviations, such as: elevated d-dimer value, lactic dehydrogenase, C-reactive protein, ferritin and lymphopenia presence; it is not uncommon for patients to have normal procalcitonin levels; severe cases of the Covid-19 disease involve the occurrence of leukocytosis with lymphopenia, prolonged prothrombin time and a significant increase in liver enzymes, lactic dehydrogenase, C-reactive protein, d-dimer, interleukin-6, C reactive protein and procalcitonin32,37,38,39,40.
Mogući način transmisije SARS-CoV-2 virusa u stomatološkoj praksi

Čekaonice su prva mesta na kojima postoji rizik od prenosa virusa sa zaraženog pacijenta na stomatološko osoblje. Zbog toga se preporučuje minimalni broj pacijenata u čekaonicima sa obavезнim razmakom većim od 1,8 m do 2 m. Potrebno je da se u čekaonicima nalazi minimalni broj nepotrebnih stvari, a treba ukloniti iz ordinacije časopise, igračke, knjige, itd. Po potrebi, pacijente prvo treba intervjuisati preko telefona, kako bi se utvrdilo da li su bili u kontaktu sa mogućim zaraženim osobama, da li imaju ili imali simptome i znake COVID-19 bolesti, odnosno treba da postoji dužnost pacijenata da daju takve informacije po dolasku u stomatološku ordinaciju.

Osoblje stomatološke ustanove u toku radnog dana mora biti, iako nije u kontaktu sa pacijentima, u radnoj, čistoj odeći, a ova radna odeća menja se svakodnevno. U toku celokupnog radnog vremena, stomatološko osoblje u ordinaciji mora nositi hiruršku masku, a u toku celokupnog radnog vremena, stomatološko osoblje u ordinaciji mora nositi hiruršku masku. Ukoliko je potrebno da se maska dodiruje, onda se prvo i posle takve manipulacije treba izvršiti antiseptičko pranje ruku razređenim alkoholom u koncentraciji od 70% do 75%. Zaštita ruku od kontaminacije virusom uobičajeno se sprovodi pomoću 2 para jednokratnih rukavica; kada se iz bilo kog razloga potencijalno kontaminiraju ili oštete spoljašnje rukavice, onda se prvo i posle takve manipulacije treba izvršiti antiseptičko pranje ruku razređenim alkoholom u koncentraciji od 70% do 75%. Zaštita ruku od kontaminacije virusom uobičajeno se sprovodi pomoću 2 para jednokratnih rukavica; kada se iz bilo kog razloga potencijalno kontaminiraju ili oštete spoljašnje rukavice, onda se prvo i posle takve manipulacije treba izvršiti antiseptičko pranje ruku razređenim alkoholom u koncentraciji od 70% do 75%. Zatim se skinu spoljašnje rukavice i navuku se nove rukavice za jednokratnu upotrebu.

Possible transmission mode of the SARS-CoV-2 virus in the dental practice

Waiting rooms are the first places where there is a risk of transmitting the virus from an infected patient to the dental staff. Therefore, it is recommended that there be a minimum number of patients in the waiting room with a mandatory distance greater than 1.8 to 2 m. There should be a minimum number of unnecessary things in the waiting room, and magazines, toys, books, etc. should be removed from the office. If necessary, patients should first be interviewed by telephone to determine if they have been in contact with potentially infected persons, if they have or have had symptoms and signs of the COVID-19 disease, i.e. patients are required to provide such information upon their arrival at the dental office.

The staff of the dental institution must wear clean clothes intended for work during the working day even if they are not in contact with the patients, and the clothes intended for work are to be changed daily. During the entire working hours, the dental staff in the office must wear a face mask, i.e. a surgical mask. If it is necessary to touch the mask for any reason, hands are to be washed with an antiseptic with diluted alcohol in a concentration of 70-75% before and after such manipulation. Protection of the hands from virus contamination is usually performed with 2 pairs of disposable gloves; when, for any reason, the outer gloves are potentially contaminated or damaged, such gloves are first decontaminated with diluted alcohol in a concentration of 70-75%, then the outer (second) gloves are removed, and the decontamination is done again with alcohol on the inner (first) gloves. Finally, new disposable outer (second) gloves are put on again. Protective disposable shoe cover can also be worn over the shoes worn at work. Furthermore, dental staff who first come into contact with patients must keep a safety distance of 1.8 to 2 m from the patient, and must wear goggles or a protective visor to prevent the contamination of the conjunctiva or mucosa from droplet transmission > 5 μm, which may contain a virus that can be released into the air by an infected patient. With the described measures, the prevention of virus transmission from a known or unknown virus carrier is ensured, i.e. possible direct contact or droplet transmission of the virus, or indirect transmission of the virus from things is prevented.
Stomatološke pacijente treba razvrstati u 2 grupe: 1. grupa–pacijenti kod kojih prilikom intervencije neće nastati mašinom stvoreni aerosol; i 2. grupa–pacijenti kod kojih će prilikom intervencije nastati mašinski stvoreni aerosol.

1. grupa– pacijenti kod kojih prilikom intervencije neće nastati mašinom stvoreni aerosol

Prilikom rada sa pacijentima u 1. grupi, na kojima se sprovode stomatološke intervencije, koje ne zahtevaju upotrebu nasadnih instrumenta, koje ne mogu da proizvedu aerosol korišćenjem kompresorskog vazduh za svoj rad, primenju se sledeće zaštitne mere: nošenje respiratornih maski, koje imaju sposobnost zaustavljanja čestica veličine od 0,3µ, sa procentom efikasnosti od 95%; ove se maske različito označavaju (i ako su u karakteristikama jednake), u zavisnosti od zemlje porekla: N95 (USA kod), KN95 (Kina kod), KF94 (Korea kod), i FFP2 (EU kod i UK kod)41,42. Ove maske su za jednokratnu upotrebu i menjaju se svakih 20 do 30 minuta, ako su izložene intezivnom prskanju tečnostima, aerosolima, itd., ili posle 1 sata u normalnim "suvim" radnim okolnostima43,44. Ovaj tip maski takođe ima sposobnost da štiti od aerosola i velikih kaplji tečnosti, koje se inače stvaraju u stomatološkom radu2,45,46,47. Efikasnost zaštite ovim maskama ogleda se i u činjenici da maske zadržavaju čestice veličine od 1 µ do 5µ sa 95% uspeha2,48, što ukazuje na to da mogu da osiguraju zaštitu za stomatološko osoblje. Treba istaći da one ne pružaju takvu zaštitu ako se nepravilno stavljaju, ne adaptiraju intimno na lice i ako ih nosi osoba koja ima bradu49.

Zaštitini vizir i naočare obavezni su delovi lične zaštitne opreme stomatologa i ostalog osoblja. Poželjno je da zaštitne naočare budu vodonepropusne, a vizir ergonomski oblikovan, budući da je stomatolog u svom radu u veoma bliskom kontaktu sa licem pacijenata, pa zbog toga neadekvatne dimenzije vizira i neadekvatni oblik smetaju u stomatološkom radu. Najfunkcionalnije su kombinacije vodonepropusnih naočara i prema licu oblikovanih vizira (Slika 1).

Ostali zaštitni material za jednokratnu upotrebu obuhvata zaštitnu mantil, zaštitnu kapu, 2 para rukavica za jednokratnu upotrebu21, kao i zaštitne jednokratne navlake za obuću.

Dental patients should be divided into 2 groups: Group 1 – patients for whom there will be no machine-generated aerosol, and Group 2 – patients for whom there will be a machine-generated aerosol.

Group 1 – patients for whom there will be no machine-generated aerosol

For patients in Group 1, where dental interventions are performed that do not require the use of handpieces, which cannot produce aerosol through the use of compressed air for their work, the following protective measures are applied: wearing a respiratory face mask that has the ability to stop particles the size of 0.3 µ with an filtration efficiency of 95%; these masks are marked differently (although they are the same in characteristics), dependent on the country of origin: N95 (USA code), KN95 (China code), KF94 (Korea code), and FFP2 (EU code and UK code)41,42. These masks are disposable and changed every 20-30 minutes if exposed to intense spraying with liquids, aerosols, etc., or after 1 hour in normal "dry" working conditions43,44. This type of mask also has the ability to protect against aerosols and large droplets of fluid, which are created in dental work2,45,46,47. The effectiveness of protection with these masks is reflected in the fact that they retain particles the size of 1-5 µ with 95% success2,48, and indicates that they can provide protection for dental staff. It should be noted that they do not provide such protection if placed incorrectly, if not applied close-fitting to the face and if worn by a person with a beard49. The use of protective visors and goggles are mandatory parts of the personal protective equipment of dentists and other staff. It is desirable that the goggles be waterproof and the visor ergonomically shaped, because the dentist is in very close contact with the patient's face in the course of their work, so the inadequate dimensions of the visor and its shape interfere with dental work. Combinations of waterproof glasses and face-shaped visors are the most functional (Figure 1).

Other disposable protective materials include a disposable protective coat, a protective cap, 2 pairs of disposable gloves21, as well as protective disposable shoe covers (overshoes).
Slika 1. Vodonepropusne zaštitne naočare i prema licu anatomski oblikovani vizir

Figure 1. Waterproof goggles and anatomically shaped face visor

2. grupa – pacijenti kod kojih će prilikom intervencije nastati mašinski stvoreni aerosol

Stomatološke procedure kao što su: preparacija zuba (brušenje zuba) u protetkskim intervencijama, preparacija kaviteta zuba, restaurativna stomatologija, endodontska terapija kanala korena zuba, korišćenje ultrazvučnih skidača naslaga sa zuba, mašinsko poliranje zuba, parodontalna hirurgija, implantološke operacije, kompleksne operacije iz oralne i maksilo-facialne hirurgije predstavljaju visoko rizične intervencije. U toku izvođenja rizičnih procedura, stvara se obilje tečnosti i aerosola, uz moguću pojavu krví u aerosolu, koji se potpomognuti vazduhom pod pritiskom iz stomatoloških nasadnih instrumenata i mašina, šire u vazduh oko stomatološkog tima, na radni sto stomatološke mašine, na enterijer u ordinaciji, ispunjavajući radni prostor ordinacije. Zbog toga je potrebno koristiti N95 respiratorne maske sa najvećim stepenom zaštite, stepenima zaštite 2 i 3, koje imaju efikasnost filtracije, tj. zadržavanja submikronskih čestica, od ≥ 98%.

Maske se menjaju posle svakog pacijenta, posle produktnih procedura i nakon svakih 20 minuta, u visoko aerosoliziranim sredinama. Zaštita očiju i lica, odnosno mukoze očiju i nosa, mora biti urađena vodonepropusnim zaštitnim naočarima i, dopunski, zaštitnim visorom. Moguće je da se zaštita mukoze očiju, nosa i usta, odnosno kompletan lica stomatologa, uradi i industrijski posebno dizajniranim facijalnim visorom u vidu maske za celo lice, koji ima sopstveni motor za dotok filtriranog vazduha u masku i koji sprečava kontaminaciju mukozeoka, nosa i usta putem stvorenog tečnog ili čvrstog aerosola u vazduhu (Slika 2).
Poželjno je i potrebno koferdama, u cilju smanjenja mogućnosti transmisije virusa, kao i jačih stomatoloških usisnih aspiratora. Ostali zaštitni materijali za jednokratnu upotrebu obuhvataju vodonepropusne zaštitne kaljače. Svedoče o pravila za dezinfekciju i zaštitu, kao i odgovarajuća odluka, koje su takođe vodonepropusne.

Sve ove zaštitne mere odnose se i na asistente, stomatološke sestre i ostalo osoblje koje je u ordinaciji u toku rada sa pacijentima. Poželjno je da se sa pacijentima dobavlja i vodi specifične korakove protokole za dezinfekciju, kada god to bude moguće.

**Skidanje zaštitne opreme**

Posle završenog rada sa pacijentom, postupak skidanja zaštitne opreme, koji treba sprovesti disciplinovano i po određenom redosledu. Tokom postupka mora biti prisutna osoba koja je zadužena samo za ovaj postupak. Prvo se sestri, koja je učestvovala u radu, prskaju specifičnim rukavicama dezificijensom (alkohol 70% – 75%, 0,5% sveže napravljenim natrijum-hipojodob- varikom, benzalkonijum–hlorid– apsicol≥ 1%), zatim se pozadi otkopčava varikinom, benzalkonijum–hlorid– apsicol, a potom se oblažu u kontejner za oštećene (navlak) i takođe odlaze u kontejner za kontaminirani material. Zatim se skidaju jednokratne zaštitne navlake za obuću (kaljače) i takođe odlažu u kontejner za kontaminirani material. Zatim se skidaju zaštitni vizir i nacoare i prskaju dezificijensom i odlazu u kontejner za dezinfekciju. Sledi odlazak u svlačionicu, skidanje rukavica, antiseptičko pranje ruku i presvlačenje angažovanog zdravstvenog radnika u novu, čistu radnu blužu i čiste radne pantalone, dok se korišćena radna odeća odlaze u odlazu za sanitarni veš. Treba napomenuti da zdravstveni radnici koji rade sa rizičnim pacijentima menjaju radnu odeluću svakog dana. Isti postupak odnosi se na stomatologa, kao i na svakog od članova stomatološkog osoblja, koje je učestvovalo u radu. U nastavku sledi kompletna dezinfekcija ordinacije i instrumenta, po uobičajnom postupku sprečavanja infekcije putem transmisije mikroba, virusa i gljivica u zdravstvenim ustanovama.
Zaključak

Od izuzetne je važnosti sprovođenje jedinstvene doktrine zaštite stomatološkog osoblja od mogućeg zaražavanja SARS-CoV-2 virusom, kao i sprečavanje zaražavanja drugim patogenim uzročnicima bolesti, u toku izvođenja stomatoloških intervencija. Ovaj postupak je izuzetno delikatan, s obzirom na to da je stomatološka profesija najugroženija profesija, sa mogućnošću zaražavanja od 100%. Glavne zaštitne mere stomatološkog osoblja odnose se na zaštitu od mašinom stvorenog aerosola, koji može da sadrži SARS-CoV-2 virus zaraženog pacijenta. Korišćenje vodonepropusne jednokratne zaštitne opreme, zajedno sa vodonepropusnim naočarima, zaštitnim vizirima, respiratornim maskama N95, sa visokim stepenom zadržavanja submikronskih čestica, sa efikasnošću od ≥98%, kao i korišćenje vodonepropusne maske za celo lice, predstavljaju moguće sigurnosne mere u sprečavanju transmisije SARS-CoV-2 virusa na stomatološko osoblje.

Zaključak

It is extremely important to implement a unique doctrine for the protection of dental staff from possible infection with the SARS-CoV-2 virus, as well as the prevention of infection with other pathogens that cause diseases during dental interventions. This procedure is extremely delicate, considering the fact that the dental profession is the most endangered profession with the possibility of infection of 100%. The main protective measures of the dental staff are related to the protection against machine-generated aerosols that may contain the SARS-CoV-2 virus of an infected patient. The use of waterproof disposable protective equipment, along with waterproof goggles, protective visors, N95 face respirators with a submicron particle retention rate of ≥98%, and the use of a full-face waterproof mask are possible safety measures for preventing the SARS-CoV-2 transmission to the dental staff.
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