

Prevalence and Risk Factors for Musculoskeletal Disorders in Dentists

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SUMMARY

Introduction Working in dental practice requires clear working field and easy access to all parts of oral cavity. For this reason, dentists often take non-physiological positions during treatment increasing the risk for musculoskeletal disorders. The aim of this study was to determine the prevalence of musculoskeletal disorders in dentists with different work experience in Novi Sad.

Material and Methods The study included 89 dentists. Data related to musculoskeletal disorders was collected using a questionnaire. Potential risk factors for musculoskeletal disorders were detected and analyzed.

Results Out of 89 dentists, 32 (36%) were male and 57 (64%) were female. Musculoskeletal disorders were detected in 62 dentists (69.7%). 50% of dentists reported pain during first three years of work in the office, while others noted these problems later. 49 dentists (77.8%) reported increasing pain during the day. Of the total respondents, 76.2% had pain in neck, 71.4% reported discomfort in the upper part of their back, 68.3% in the region of shoulder, and 65.1% complained for pain in lower back. Lower prevalence of pain was found in the region of wrists and hands, hips, knees, ankles and elbows. Statistical analysis did not show significant difference between observed risk factors.

Conclusion The prevalence of musculoskeletal disorders in examined dentists in Novi Sad was 69.7%. It was higher in male compared to female respondents. Most dentists had musculoskeletal disturbances in the region of neck, shoulders and upper back.

Keywords: back pain; ergonomic measures; musculoskeletal pain; neck pain

INTRODUCTION

Ergonomics is word of Greek origin: *ergo* means “to work”, and *nomos* means “natural laws or systems” [1]. Therefore, ergonomics is defined as a science that studies “man in relation to his work environment and adaptation of devices and general conditions that should fit the individual so he could give a maximum of effective working” [1].

Long dental interventions require good concentration, clear working field and good access to all parts of oral cavity. They require demanding positions during work where dentists are in high risk of developing musculoskeletal disorders [1, 2, 3]. These problems affect muscles, joints, tendons, ligaments and nerves from foot to neck. Symptoms range from discomfort, weaker or stronger pain to more serious medical conditions that result in different social and economic consequences. These are reduced quality of dental services, frequent absence from work or even quitting the profession [2, 4]. Some studies have found that musculoskeletal disorders are the most common reason for early retirement of dentists [5].

Most common symptoms are pain in back, where the most affected parts are lumbar and cervical spine [2, 6], followed by neck and shoulders. In addition, dentists may also experience discomfort and pain in hands. Factors contributing to the pain in back and neck are: spine shape, aging, weak muscles, exercise or lack of exercise, types of movements performed, techniques of elevating items and mechanical load [2]. Aggravating factors are: excessive tilting and turning neck, leaning forward from waist, lifting shoulders and

associated tilting back and neck [2, 6]. First studies on this topic that have been conducted in 1980 [2] suggested high prevalence of back pain among dentists. Thus, in Denmark 60% of the investigated dentist had pain in their back, the percentage was 62.2% in Toronto, and Australia 59% [2].

The aim of this study was to determine the prevalence of musculoskeletal disorders in dentists with different work experience in Novi Sad.

MATERIALS AND METHODS

The study included 89 dentists from Novi Sad. In order to collect data about the prevalence of musculoskeletal disorders among clinicians the “Standardized Nordic questionnaire for the analysis of musculoskeletal symptoms” was used [4, 6]. In addition to the standardized questionnaire, a few more questions were added [2, 4, 6]. These questions were related to gender of examined dentists, age, work experience, work conditions (such as the length and frequency of interventions), number of treated patients per day, working hours, body position during work, position in relation to patient, sitting or standing position during work, mostly performed procedures (endodontic treatment, cavity preparation and filling placement, tooth extractions, oral surgery and therapeutic procedures in the field of dental prosthetics or orthodontics), having breaks during work or work without breaks, presence of musculoskeletal disorders and history of these problems. Questions are formulated in order to determine conditions in which respondents work.

All collected data was analyzed using SPSS version 14.0 (SPSS Inc., Chicago, IL, USA). Obtained results were expressed as percentages and frequencies [4, 6].

RESULTS

Out of 89 dentists surveyed, 36% were male and 64% female. Of male dentists, 75% had musculoskeletal disorders, while in female, the percentage was lower (66.7%), but with no statistically significant difference. In males, the highest percentage of complaints was registered in neck (83%), upper back (75%) and shoulders (70%) while the lowest percentage was in the region of elbows (25%) and feet (12%). In women, the highest percentage of complaints was also noted in neck (71.8%), followed by the upper back (69.2%) and shoulders (66.7%). The least discomfort was in the region of feet (20%) and elbows (7%) (Table 1).

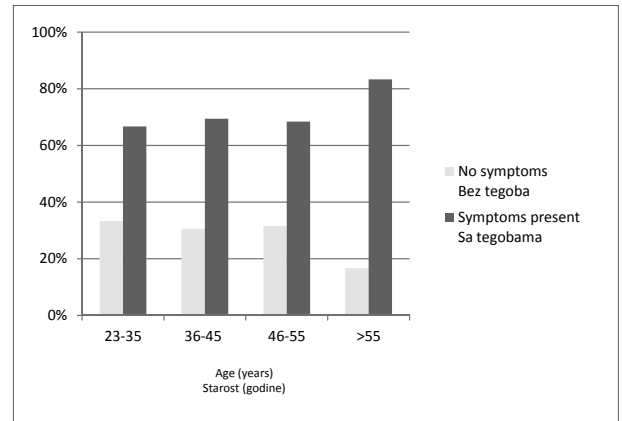
Discomfort in musculoskeletal system had 69.7% of respondents. In male respondents, pain was present in 75% of cases while in women it was 66.7%. There was no statistically significant difference in the occurrence of pain between male and female respondents. In young adults (25-35 years) symptoms were present in 67% of cases, similar results were observed in the age group 36-45 years, as well as in the category of 46-55 years. Dentists older than 56 years complained in 80% of cases (Graph 1). However, there was no statistically significant difference in the occurrence of musculoskeletal pain in patients of different age.

One half of respondents noticed musculoskeletal pain in the first three years of employment. Dentists with 10 years, 10 to 20 years, and more than 20 years of work experience showed symptoms in 60% of cases. There was no statistically significant difference in the occurrence of musculoskeletal pain in patients with different work experience (Graph 2).

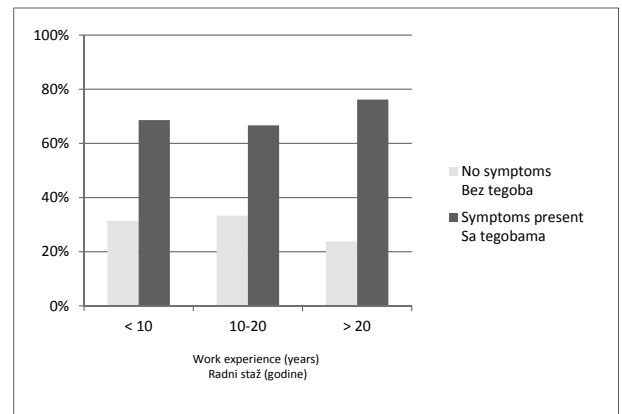
Table 1. Pain in different body parts in male and female dentists
Tabela 1. Učestalost bola u različitim delovima tela u odnosu na pol stomatologa

Body parts Delovi tela	Male Muškarci		Female Žene	
	No pain Bez bola	Pain Sa bolom	No pain Bez bola	Pain Sa bolom
Neck Vrat	12 (16.7%)	20 (83.3%)	29 (28.2%)	28 (71.8%)
Shoulders Ramena	15 (29.2%)	17 (70.8%)	31 (33.3%)	26 (66.7%)
Elbows Laktovi	26 (75.0%)	6 (25.0%)	54 (92.3%)	3 (7.7%)
Wrists/hands Ručni zglobovi/šake	20 (49.5%)	12 (50.5%)	38 (51.3%)	19 (48.7%)
Hips Kukovi	24 (66.7%)	8 (33.3%)	46 (71.8%)	11 (28.2%)
Upper back Gornji deo leđa	14 (25.0%)	18 (75.0%)	30 (30.8%)	27 (69.2%)
Lower back Donji deo leđa	15 (29.2%)	17 (70.8%)	33 (38.5%)	24 (61.5%)
Knees Kolena	25 (70.8%)	7 (29.2%)	47 (74.4%)	10 (25.6%)
Ankles/feet Gležnjevi/stopala	29 (87.5%)	3 (12.5%)	49 (79.5%)	8 (20.5%)

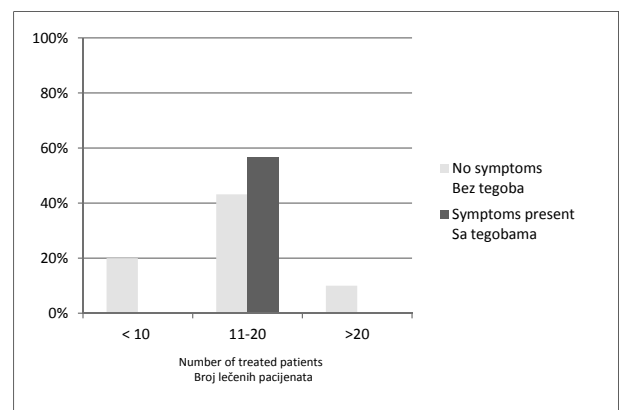
Most dentists surveyed (77.5%) worked five days a week. Number of working hours per day ranged from 1 to 12 hours. Of the total respondents, 28.1% had a working time of 8 hours per day and 20.2% of dentists worked 6 hours per day. The most common positions of dentists were on “8 hours” (61.8%) and “10 hours” (15.7%). The highest percentage (95%) of dentists who reported problems were in the group of those who had more than 20 patients (Graph 3).



Graph 1. Pain in respondents of different age
Grafikon 1. Učestalost bola kod ispitanika različite starosti



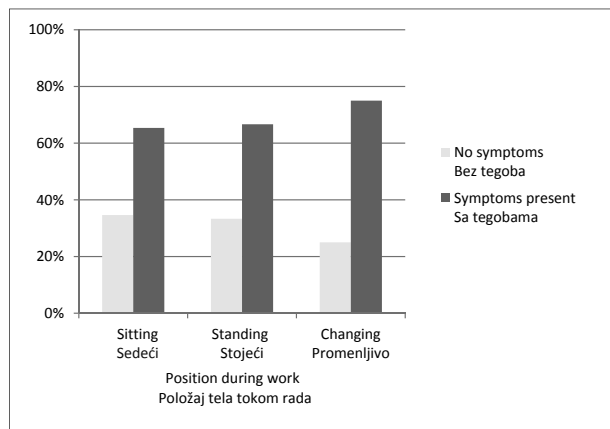
Graph 2. Pain in respondents according to work experience
Grafikon 2. Učestalost bola kod ispitanika u zavisnosti od dužine radnog staža



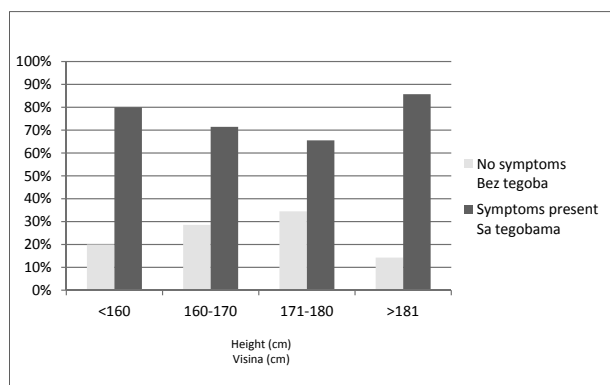
Graph 3. Pain in respondents according to the number of treated patients per day
Grafikon 3. Učestalost bola kod ispitanika u zavisnosti od broja dnevno lečenih pacijenata

Of the total number of dentists, 29.2% were mostly seating during work, and they complained in 70% of cases. 30.3% of dentists were working in standing position and they reported similar number of complaints (70%). However, most dentists (40.4%) changed their position during work and they had complaints in the highest percentage (about 80%) (Graph 4).

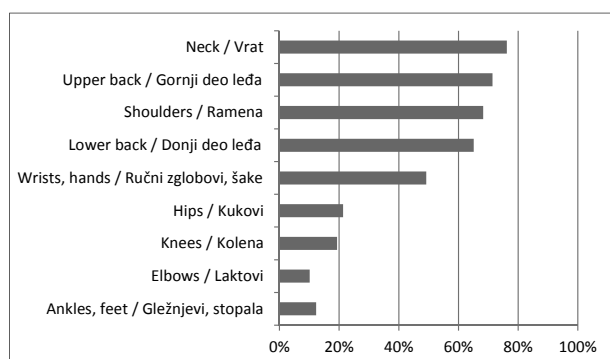
The most frequent intervention was cavity preparation and restoration placement (61.4%). Breaks during work had 62.9% of respondents, while 37.1% of dentists performed therapeutic procedures without any break. 65.2% dentists had an assistant whereas 34.8% worked without an assistant.



Graph 4. Pain in respondents according to the position during work
Grafikon 4. Učestalost bola kod ispitanika u odnosu na položaj tela tokom rada



Graph 5. Pain in respondents according to their height
Grafikon 5. Učestalost bola kod ispitanika u odnosu na njihovu telesnu visinu



Graph 6. Pain in different body parts of respondents (%)
Grafikon 6. Prevalencija bola u pojedinim delovima tela stomatologa (%)

Average height of investigated dentists was 173.87 cm, with a standard deviation of 10.26 cm. The median was 172; meaning that 50% of respondents had height of 172 cm or less, and 50% had 172 cm or more. The percentage of dentists that had painful symptoms was approximately the same (75%) at different heights. T-test showed no statistically significant difference in the occurrence of muscular and skeletal pain in patients of different heights (Graph 5).

According to the standardized Nordic questionnaire, the greatest number of dentists (76.2%) had pain in neck, shoulders (68.3%), and wrists (49.2%) while the lowest prevalence of pain was in elbows (12.3%) (Graph 6).

DISCUSSION

Standardized Nordic questionnaire for the analysis of musculoskeletal symptoms used in the present study is an internationally recognized evaluation questionnaire [4, 6]. The prevalence of musculoskeletal pain among dentists was 62%. Similar prevalence was found in Denmark (59.4%), while slightly higher prevalence was obtained in Taiwan (92.4%) and Southern Iran (80%) [3, 4, 6].

Some authors have shown that the occurrence of pain in dentists is related to their work experience, age, and number of treated patients per day. It can also be related to dentists' height [3, 4]. The current study showed that number of treated patients per day is an important risk factor for the occurrence of pain.

In the present study, 76.2% of dentists had pain in neck, 71.4% in upper back and 68.3% in shoulders. These results differ from results of the study conducted in Taiwan, which showed the highest prevalence of pain in shoulders 75.1%, followed by 71.6% in neck and lower back 66.5% [4].

Research conducted among dental hygienists showed that it takes about 6 years of work experience to start feeling symptoms in upper extremities. This could be explained by the influence of microtrauma that causes changes even before an individual has symptoms [7].

Some researchers have shown that most dentists work in sitting position, on the right side of the patient, where the patient's mouth is the center while dentist may be in the position on "8 hours" or "11 hours" in relation to the center. From an ergonomic standpoint, dentists should work in the position on "12 hours" in relation to the patient. This position, in addition to the consideration that it is the most ideal, reduces the need for lifting arms and shoulders and allows enough approximation to the patient without mechanical obstacles posed by dental chair [8]. The most convenient dental chairs are with narrow backrest which reduces need for exaggerated hand lifting and tilting of therapist [8].

Kilpatrick (1971) showed that dentists who have an assistant are up to 16-17% more efficient and have significantly reduced stress and fatigue [5]. Benefits of working with an assistant are: faster and more efficient intervention as well as preservation of health of dentists. Working with an assistant means that dentist would be able to

take physiologically favorable posture during work with no need to turn body when grasping dental instruments and materials.

An usual posture that one dentist takes during work is extreme flexion of head and neck with shoulders bent forward. This position may cause shortening of sternocleidomastoid, scalene, serratus anterior and pectoralis minor muscles, while middle and lower fibers of trapezoid muscle can be elongated to adapt to this condition. Such muscle imbalance may play a role in the onset of chronic non localized pain [9, 10]. Another muscular imbalance is present in shoulders, caused by exaggerated strengthening of deltoid and supraspinatus muscles. These muscles are in many cases overdeveloped in dentists, because of frequent positions with elevated arms at some distance from the body. Such muscle imbalance can cause irregular movements in shoulder joint accompanied by tendon pain [11]. Muscular imbalance between abdominal muscles and lower part of back can cause more problems. Repeated tilting to the patient with bent back can cause fatigue in superficial extensors of the lower part of back, while deep abdominal muscles (transversus abdominis and obliquus abdominis muscles) may become weak [11].

For prevention of musculoskeletal disorders in dentists, ADA (American Dental Association) recommended stretching wrists and fingers, particularly between the thumb and forefinger. During dental treatment, elbows and/or forearms should be resting on chair, to stabilize dentist's hand [1]. Main body and shoulder muscles are designed to provide solid and stable base for arm movements. Strengthening of these muscles is the main purpose of Pilates. Pilates is an exercise program that may contribute to musculoskeletal health of dentists. It considers the use of light loads and large number of repetitions. Muscle strengthening exercise should be performed three times a week, with a break of one day between workouts. Exercising should begin with a minimum number of training and repetition that will increase over time [2].

An ideal position to work in office would be: neck flexion 0-10 degrees without rotation and tilting to the side, shoulders relaxed to the side, elbows in the level of patient's mouth and in flexion of about 90 degrees, while the lower part of back supported by abducted feet rotated outward. Feet should lie on the floor [10].

From the standpoint of ergonomics, dentist's chair is essential in the office [14]. The chair should maintain body of dentist in neutral position. The backrest with its convexity should maintain natural lumbar lordosis when sitting; therefore it is called lumbar support. Lumbar support should be about 20 cm in height and thickness of 3-5 mm, convex from top to bottom; to mimic natural lordosis of dentist's back. If thicker, it could cause increased pressure on lumbar vertebrae. On the other hand, large backrests must not cause pressure on the chest part of the spine and should not push it forward. All backrests that exceed lower edge of scapula may reduce benefits of lumbar supporters; therefore, they should be about 6 cm below the lower edge of scapula. Wide backrest should be avoided because they may interfere with the movement of spine as well as lateral movements of arms and shoulders

[14]. Chairs for therapists without backrests are also considered ergonomic because when sitting in these chairs, pelvis is approximately in neutral position, as in saddle or while standing. Such position of pelvis helps to balance the spine in various movements; however, this chair design allows increasing pressure on peritoneal region [14]. Many studies have confirmed that armrests are used in the prevention of pain in neck, shoulders and lower back by reducing muscle activity, especially of upper fibers of trapezoid muscle of dominant hand. Armrests should be highly adjustable to support the dentist in neutral position. Well adjusted armrests can prevent pain in neck and shoulders. Armrests reduce activity of rhomboid, and thoracic and cervical part of erector spinae muscles [14, 15]. Due to the nature of their work, dentists cannot always maintain adequate contact with lumbar supporters and must tilt slightly forward for good view of certain surfaces of teeth. Pressure on discus between vertebrae is the strongest in this position, therefore it is very important that dentist learns how to properly stabilize and protect lower back with his muscles- primarily transverse abdominal muscles. When used properly, these muscles by their action reduce pain in lower back [14].

Besides location, other risk factors are length and duration of intervention. It has been shown that even low level of load if it lasts for long time can cause muscle fatigue and chronic pain [2]. Some studies suggest a break of 10 minutes during an intervention [4]. A number of short breaks during working hours (not longer than 5 seconds) are much more comfortable and provide complete recovery of tired muscles. During these micro-pauses tensed muscles get more blood and time to recover [10]. Since static positions must be avoided it would be good from time to time to adjust backrests and seat, so that the load is transmitted from tissue to tissue and micro trauma minimized [5].

Dentistry involves handling small instruments, vibrating instruments and performing repetitive actions [1, 10]. It is proved that there is a clear difference in the effort of right and left hands, dominant and non-dominant hand during dentists' work. Work using dominant hand requires extremely fine motor coordination since manual and electrical instruments are used with this hand. In addition, sometimes this hand is holding syringe, saliva ejector and mirror. Non-dominant hand is mainly used to assist - get clear working field, control the movements of tongue and cheeks, or take liquid out of oral cavity. This requires static and sometimes very strong hand grasp so that both hands are exposed to static load, although with different roles [16]. When choosing hand instruments, larger diameter of handles should be chosen, because in this way the pressure is transferred to larger group of muscles [16].

CONCLUSION

The prevalence of musculoskeletal disorders in surveyed dentists in Novi Sad was 69.7%. They were more pronounced in males than females. Most of respondents reported musculoskeletal disorders in neck, shoulders, and

upper of back. Since the prevalence of musculoskeletal disorders was high, it is necessary to implement better training of dentists and dental students about causes and methods for prevention of these problems.

NOTE

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Prevalencija i faktori rizika za pojavu bola u mišićno-skeletnom sistemu stomatologa

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KRATAK SADRŽAJ

Uvod Rad u stomatološkoj praksi zahteva pregledno radno polje i dobar pristup svim delovima usne duplje. Zbog toga stomatolozi često zauzimaju nefiziološke položaje tokom rada, čime su izloženi povećanom riziku za nastanak mišićno-skeletnih tegoba. Cilj ovog rada bio je da se utvrdi prevalencija mišićno-skeletnih tegoba kod stomatologa s različitim dužinom staža na teritoriji Novog Sada.

Materijal i metode rada Ispitivanjem je obuhvaćeno 89 stomatologa. Podaci u vezi s mišićno-skeletnim tegobama prikupljeni su upitnikom. Analizirani su mogući faktori rizika za nastanak ovih tegoba.

Rezultati Od ukupnog broja anketiranih stomatologa, 32 su bili muškarci (36%), a 57 su bile žene (64%). Mišićno-skeletne tegobe zabeležene su kod 62 stomatologa (69,7%). Kod 50% stomatologa bol se javio tokom prve tri godine rada u ordinaciji, dok su kod ostalih tegobe nastale nakon tog perioda. Kod 49 stomatologa (77,8%) bol se pojačavao tokom radnog dana. Kod 76,2% stomatologa ustanovljene su tegobe u predelu vrata, kod 71,4% tegobe u gornjem delu leđa, kod 68,3% tegobe u predelu ramena, a kod 65,1% tegobe u donjem delu leđa. Niža prevalencija bola je zabeležena u predelu ručnih zglobova, šake, kukova, kolena, gležnjeva i laktova. Statističkom analizom nije utvrđena značajnost posmatranih faktora rizika.

Zaključak Prevalencija mišićno-skeletnih tegoba kod novosadskih stomatologa je 69,7% i veća je kod muškaraca nego kod žena. Najveći broj ispitanih stomatologa imao je mišićno-skeletne tegobe u predelu vrata, ramena i gornjeg dela leđa.

Cljučner eći: mišićno-skeletne tegobe; bol u vratu; bol u leđima; ergonomske mere

UVOD

Reč „ergonomika“ potiče od grčkih reči *ergo*, što znači „raditi“, i *nomos*, koja podrazumeva prirodne zakone ili sisteme [1]. Stoga je ergonomika definisana kao nauka koja proučava „čoveka u odnosu na njegovo radno okruženje, odnosno adaptaciju uređaja i uopšte uslova koji treba da odgovaraju pojedincu kako bi on mogao biti maksimalno radno efikasan“ [1].

Česte dugotrajne stomatološke intervencije zahtevaju dobru koncentraciju, pregledno radno polje i dobar pristup svim delovima usne duplje. Ovo, naravno, podrazumeva i zahtevne položaje tela terapeuta tokom rada, zbog čega su stomatolozi izloženi visokom riziku od nastanka mišićno-skeletnih tegoba [1, 2, 3]. Ove tegobe pogađaju mišiće, zglobove, tetive, ligamente i nerve od stopala do vrata. Simptomi variraju od nelagodnosti, slabih, odnosno jakih bolova, do težih zdravstvenih stanja koja izazivaju socijalne i ekonomske posledice. One podrazumevaju smanjen kvalitet stomatoloških usluga, česta odsustvovanja s posla ili čak napuštanje profesije [2, 4]. Neke studije navode mišićno-skeletne poremećaje kao najčešće razloge prevremenog penzionisanja stomatologa [5].

Najčešći simptomi su bolovi u leđima, gde su prvenstveno pogođeni lumbalni i cervikalni deo kičme [2, 6], a zatim slede vrat i ramena. Pored toga, stomatolozi mogu osetiti i tegobe u vidu bola u rukama. Faktori koji doprinose bolu u leđima i vratu su: oblik kičmenog stuba, starenje, slabi mišići, vežbanje, odnosno izostanak vežbanja, vrste pokreta koji se izvode, tehnike podizanja predmeta i mehanička opterećenja [2]. Otežavajući faktori su: preterano naginjanje i okretanje vrata, naginjanje napred iz struka, podizanje ramena i udruženo naginjanje i leđa i vrata [2, 6]. Prva istraživanja na ovu temu, započeta oko 1980. godine [2], govore u prilog visokoj prevalenciji bola u leđima među stomatolozima. Tako je u Danskoj 60%

ispitvanih stomatologa imalo bolove u leđima, u Torontu 62,2%, a u Australiji 59% stomatologa [2].

Cilj ovog rada je bio da se utvrdi prevalencija mišićno-skeletnih tegoba kod stomatologa s različitim dužinom radnog staža na teritoriji Novog Sada.

MATERIJAL I METODE RADA

Istraživanje je obuhvatilo 89 stomatologa koji rade na teritoriji Novog Sada. U ovom istraživanju korišćen je „Standardizovani nordijski upitnik za analizu mišićno-skeletnih simptoma“ radi prikupljanja podataka o prevalenciji mišićno-skeletnih simptoma kod stomatologa [4, 6]. Kao dodatak ovom upitniku postavljeno je još nekoliko pitanja [2, 4, 6]. Ona su se odnosila na: pol ispitanih stomatologa, starost i dužinu radnog staža, uslove u kojima rade (trajanje i učestalost intervencija), broj pacijenata dnevno, dužinu radnog vremena, položaj tela za vreme rada, položaj stomatologa u odnosu na pacijenta, sedeći ili stojeći položaj za vreme rada, najčešće primenjivane terapijske postupke (endodontski tretman, preparacija kaviteta i postavljanje ispuna, ekstrakcija zuba, oralnohirurške intervencije, terapijski zahvati iz oblasti stomatološke protetike ili ortopedije vilica), pravljenje pauza tokom rada, postojanje mišićno-skeletnih tegoba i istoriju ovih tegoba. Pitanja su formulisana i postavljena kako bi se ustanovili uslovi pod kojim ispitanici rade.

Svi prikupljeni podaci su analizirani primenom SPSS, verzije 14.0 (SPSS Inc., Chicago, IL, USA). Dobijeni rezultati su izraženi u frekvencijama i procentima [4, 6].

REZULTATI

Od ukupno 89 ispitanika, 36% stomatologa je bilo muškog, 64% ženskog pola. Među muškarcima 75% je imalo mišićno-skeletne tegobe, a među ženama 66,7%, ali ova razlika nije bila statistički značajna. Kod stomatologa muškog pola najveći procenat tegoba

zabeležen je u predelu vrata (83%), potom u gornjem delu leđa (75%) i ramenima (70%), a najmanji u predelu laktova (25%) i stopala (12%). Kod stomatologa ženskog pola najveći procenat tegoba bio je takođe u predelu vrata (71,8%), potom u gornjem delu leđa (69,2%) i ramenima (66,7%), dok su najmanje tegoba žene osećale u predelu stopala (20%) i laktova (7%) (Tabela 1).

Tegobe u mišićno-skeletnom sistemu imalo je 69,7% ispitanika. Bol je zabeležen kod 75% muškaraca i 66,7% žena, ali razlika nije bila statistički značajna. Među mladim stomatolozima (25–35 godina) tegobe su zabeležene u 67% slučajeva, a slične vrednosti su uočene i u starosnoj grupi 36–45 godina, odnosno 46–55 godina. Kod stomatologa starijih od 56 godina tegobe su registrovane u više od 80% slučajeva (Grafikon 1). Statistički značajne razlike u pojavi mišićno-skeletnog bola kod ispitanika različite životne dobi nije bilo.

Polovina ispitanika je mišićno-skeletni bol osetila u prve tri godine po zaposlenju. Kod stomatologa sa radnim stažom do 10 godina, onih sa stažom između 10 i 20 godina, kao i onih koji rade duže od 20 godina, tegobe su uočene u više od 60% slučajeva. Nije utvrđena statistički značajna razlika u pojavi mišićno-skeletnog bola kod ispitanika s različitim dužinom radnog staža (Grafikon 2).

Većina stomatologa (77,5%) radila je pet dana u nedelji. Broj radnih sati dnevno varirao je od jednog sata do 12 sati. Osam sati dnevno radilo je 28,1% stomatologa, a šest sati dnevno 20,2% ispitanika. Najčešće pozicije tokom rada u odnosu na pacijenta bile su pozicija na „8 sati“ (61,8%) i „10 sati“ (15,7%). Čak 95% stomatologa s tegobama bilo je u grupi onih koji su imali više od dvadeset pacijenata dnevno (Grafikon 3).

Tokom rada je pretežno sedelo 29,2% stomatologa, a kod njih su zabeležene tegobe u skoro 70% slučajeva, dok je tokom rada 30,3% stomatologa stajalo, a procenat registrovanih tegoba među njima bio je isti (70%). Ipak, najviše stomatologa (40,4%) menjalo je način rada i kod njih su tegobe zabeležene u većem procentu (oko 80%) (Grafikon 4).

Najčešći zahvati bili su preparacija kaviteta i postavljanje ispunja (61,4%). Pauze tokom rada pravilo je 62,9% stomatologa. Sa asistentom je radilo 65,2% stomatologa.

Prosečna visina ispitivanih stomatologa bila je 173,87 cm, sa standardnom devijacijom od 10,26 cm. Medijana je bila 172 cm. Procenat stomatologa sa bolnim tegobama bio je približno isti (75%) kod ispitanika različite visine. Studentov t-test nije pokazao statistički značajnu razliku u pojavi mišićno-skeletnog bola kod ispitanika različite visine (Grafikon 5).

Prema standardizovanom nordijskom upitniku, najveći broj ispitivanih stomatologa osetio bol u vratu (76,2%), potom u ramenima (68,3%) i ručnim zglobovima (49,2%), dok je najmanja prevalencija bola bila u laktovima (12,3%) (Grafikon 6).

DISKUSIJA

Standardizovani nordijski upitnik za analizu mišićno-skeletnih simptoma je međunarodno priznat upitnik za procenu stepena mišićno-skeletnih tegoba [4, 6] i primenjen je u našem istraživanju. Prevalencija mišićno-skeletnog bola među ispitanim stomatolozima bila je 62%. Slična stopa prevalencije utvrđena je u Danskoj (59,4%), dok su nešto veće stope prevalencije zabeležene u Tajvanu (92,4%) i Južnom Iranu (80%) [3, 4, 6].

Neki autori su pokazali da na pojavu bola utiču dužina radnog staža, starost stomatologa, odnosno broj primljenih paci-

jenata u toku dana. Na prevalenciju bola takođe može da utiče telesna visina stomatologa [3, 4]. U našem istraživanju se pokazalo da je broj dnevno lečenih pacijenata važan faktor rizika za pojavu bola.

Bol u vratu osećalo je 76,2% ispitanika naše studije, bol u gornjem delu leđa 71,4%, a bol u ramenima 68,3% stomatologa. Ovi rezultati se razlikuju od nalaza istraživanja urađenog u Tajvanu, gde je najveća prevalencija bola bila u ramenima (75,1%), zatim u vratu (71,6%) i donjem delu leđa (66,5%) [4].

Istraživanje izvedeno među dentalnim higijeničarima pokazalo je da je potrebno oko šest godina radnog staža da bi došlo do ispoljavanja simptoma u gornjim ekstremitetima. Ovo bi se moglo objasniti sporim uticajem mikrotraume koja izaziva promene i pre nego što pojedinac oseti simptome [7].

Pojedina istraživanja pokazuju da većina stomatologa danas radi u sedećem položaju, desno od pacijenta, gde su usta pacijenta centar, a stomatolog može biti u poziciji na „8 sati“ ili „11 sati“ u odnosu na taj centar. S ergonomskog stanovišta, stomatolozima bi trebalo da rade u poziciji na „12 sati“ u odnosu na pacijenta. Ovakav položaj, pored toga što se smatra neutralnim, smanjuje potrebu za podizanjem ruku i ramena i dozvoljava dovoljno približavanje pacijentu, bez mehaničke prepreke koju predstavlja sedište stomatološke stolice [8]. Najpogodnije su stomatološke stolice s užim naslonom za leđa pacijenta, koji smanjuje potrebu za velikim podizanjem ruku i velikim naginjanjem terapeuta pri radu [8].

Kilpatrick (*Kilpatrick*) je 1971. godine dokazao da su stomatolozi koji imaju pomoć asistenta i do 16–17% radno efikasniji i da su kod njih značajno smanjeni stres i zamor [5]. Prednosti rada s asistentom su brža i efikasnija realizacija intervencije, kao i očuvanje zdravlja stomatologa. Rad uz pomoć asistenta omogućava stomatologu da zauzme fiziološki povoljniji položaj tela pri radu, a istovremeno se smanjuje potreba za okretanjem tela stomatologa pri uzimanju instrumenata i materijala sa stomatološkog stočića.

Uobičajeni položaj stomatologa pri radu je ekstremna fleksija glave i vrata sa ramenima povijenim napred. To može uzrokovati skraćivanje *m. sternocleidomastoideus*, *m. scalenus*, *m. serratus anterior* i *m. pectoralis minor*, dok srednji i donji snopovi *m. trapezius* mogu biti izduženi adaptacijom na to stanje. Ovakva mišićna neravnoteža može igrati ulogu u nastanku nelokalizovanog hroničnog bola [9, 10]. Drugi tip mišićne neravnoteže postoji u ramenima, izazvan je preteranim jačanjem *m. deltoideus* i *m. supraspinatus*. Ovi mišići su veoma razvijeni kod stomatologa zbog čestog položaja s podignutim rukama, koje su udaljene od tela. Ovakva mišićna neravnoteža može uzrokovati nepravilne pokrete u ramenom zglobu praćene bolovima u tetivama [11]. Mišićna neravnoteža između trbušnih i mišića donjeg dela leđa, koja se često javlja kod stomatologa, može praviti dodatne tegobe. Ponavljano naginjanje ka pacijentu s povijenim leđima može uzrokovati premor u površnim ekstenzorima donjeg dela leđa, dok duboki trbušni mišići (*m. transversus abdominis* i *m. obliquus abdominis*) teže slabljenju [11].

Američko stomatološko udruženje (*American Dental Association – ADA*) je radi sprečavanja nastanka mišićno-skeletnih tegoba kod stomatologa preporučila često istezanje zglobova i prstiju, naročito predela između palca i kažiprsta. Tokom rada lakat i/ili podlaktica treba da budu oslonjeni na stolicu, čime se obezbeđuje stabilizacija ruke terapeuta [1]. Glavni mišići trupa

i ramenog pojasa su predviđeni da pruže čvrst i siguran oslonac s kojeg ruke mogu da se pokreću. Jačanje ovih dubokih mišića je osnova pilatesa. Pilates je program vežbanja koji može mnogo da doprinese mišićno-skeletnom zdravlju stomatologa, a podrazumeva korišćenje lakog opterećenja i veliki broj ponavljanja. Vežbe jačanja mišića trebalo bi izvoditi tri puta nedeljno s pauzom od jednog dana između treninga. Treba početi s malim brojem treninga i ponavljanja, pa ih vremenom povećavati [2].

Idealni položaj za rad u ordinaciji bio bi: vrat u fleksiji od 0 do 10 stepeni bez rotacije i naginjanja na stranu, ramena koja su opuštena sa strane, laktovi u visini usta pacijenta i u fleksiji od oko 90 stepeni, a donji deo leđa poduprt blago razmaknutim nogama, rotiranim spolja. Stopala bi trebalo celom površinom da budu na podu [10].

Sa stanovišta ergonomike, stolica za stomatologa je najbitnija u ordinaciji [14]. Stolica treba da održava telo stomatologa u neutralnom položaju. Naslon za leđa bi trebalo svojim konveksitetom da održi prirodnu lumbalnu lordozu pri sedenju, pa se zbog toga naziva i lumbalni podupirač. Ovaj lumbalni podupirač trebalo bi da bude visine oko 20 cm, debljine 3–5 mm, konveksan od vrha do dna, da bi na taj način oponašao prirodnu lordozu leđa stomatologa. Ukoliko bi bio deblji, mogao bi da proizvede povećan pritisak na lumbalne pršljenove. Kada su u pitanju veliki nasloni za leđa, gornji kraj ovih naslona ne sme da uzrokuje pritisak na grudni deo kičme i da ga na taj način potiskuje napred. Svi nasloni koji prelaze donju ivicu lopatice mogu umanjiti koristi od lumbalnog podupirača tako što prenose pritisak na lopatice, a trebalo bi da budu oko 6 cm ispod donje ivice lopatice. Široke naslone za leđa treba izbegavati jer mogu ometati kretnje kičme i lateralne pokrete ruku i ramena [14]. Stolicе za terapeute bez naslona za leđa se takođe smatraju ergonomskim, jer je prilikom sedenja u ovakvim stolicama karlica u približno neutralnom položaju, kao u sedlu ili prilikom stajanja. Ovakav položaj karlice pomaže kičmi da balansira pri različitim pokretima, ali ovakav dizajn stolice ipak povećava pritisak na peritonealnu regiju [14]. Mnoga istraživanja potvrđuju da nasloni za ruke pomažu u sprečavanju nastanka bola u vratu, ramenima i donjem delu leđa, jer smanjuju aktivnost mišića, posebno gornjih snopova trapezijusa dominantne ruke. Nasloni za ruke bi trebalo da budu visoko podesivi i da pruže podršku stomatologu u neutralnom položaju. Dobro podešeni nasloni za ruke sprečiče razvoj bola u vratu i ramenima. Nasloni za laktove smanjuju aktivnost romboideusa, i grudnog i cervikalnog dela *m. erector spinae* [14, 15]. Zbog prirode posla, stomatolozi ne mogu uvek održati odgovarajući kontakt s lumbalnim podupiračem stolice i moraju se naginjati lagano napred, da bi na taj način omogućili pregled određenih površina zuba. Pritisak na diskuse između pršljenova je najjači u ovom položaju, te je veoma važno da stomatolog nauči kako da na odgovarajući način stabilizuje i zaštiti donji deo leđa svojim mišićima – prvenstveno transverzalnim trbušnim mišićima. Kada se pravilno koriste, ovi mišići svojim dejstvom smanjuju bol u donjem delu leđa [14].

Osim položaja, još jedan faktor rizika je dužina intervencije. Dokazano je da i nizak stepen opterećenja koji dugo traje može izazvati zamor mišića i hronični bol [2]. Neke studije predlažu pauze od deset minuta tokom intervencije [4]. Veći broj kraćih pauza tokom radnih sati (ne dužih od pet sekundi) su mnogo praktičnije i pružaju potpun oporavak zamorenim mišićima. Tokom ovih mikropauza napeti mišići dobijaju više krvi i vremena da se oporave [10]. S obzirom na to da se statični položaji moraju izbegavati, bilo bi dobro s vremena na vreme prilagođavati naslon i sedište, kako bi se opterećenje prenosilo s tkiva na tkivo i na taj način minimalizovala mikrotrauma [5].

Klinička stomatologija podrazumeva rukovanje malim vibrirajućim instrumentima i ponavljanje radnji [1, 10]. Dokazano je da tokom rada stomatologa postoji jasna razlika u naporu leve i desne ruke, odnosno dominantne i nedominantne ruke. Rad dominantnom rukom zahteva krajnje finu motornu koordinaciju, jer ovom rukom radimo kako s ručnim, tako i s mašinskim instrumentima. Pored toga, ponekad ovom rukom držimo puster, sisaljku i ogledalce. Nedominantna ruka se mahom koristi za asistenciju: da bi se dobilo pregledno radno polje, da bi se kontrolisali pokreti jezika i ekartirao obraz, isisavala voda iz usne duplje i sl. Ovo zahteva statičan i ponekad veoma snažan stisak ruke, tako da su obe ruke izložene statičkom opterećenju, ali s drugačijim ulogama [16]. Pri odabiru ručnih instrumenata trebalo bi uzeti one koji imaju drške većeg prečnika, jer se na taj način pritisak prenosi na veću grupu mišića [16].

ZAKLJUČAK

Prevalencija mišićno-skeletnih tegoba kod novosadskih stomatologa je 69,7%. Ove tegobe su izraženije kod muškaraca nego kod žena. Najveći broj ispitanika ima tegobe u vratu, ramenima i gornjem delu leđa. S obzirom na ovakav nalaz, potrebno je vršiti bolju edukaciju stomatologa i studenata stomatologije o uzrocima nastanka i načinima prevencije pojave ovih tegoba.

NAPOMENA

Rezultati prikazani u ovom radu su deo istraživanja realizovanog u okviru projekta pod nazivom „Istraživanje i razvoj metoda modeliranja i postupaka izrade dentalnih nadoknada primenom savremenih tehnologija i računarnom podržanih sistema“ (TR035020), koji je finansiralo Ministarstvo prosvete, nauke i tehnološkog razvoja Republike Srbije.

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Zahvaljujemo Ljiljani Knežević na pomoći pri statističkoj obradi podataka i svim stomatolozima koji su pristali da učestvuju u istraživanju.