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Original Scientific Paper

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IDENTIFICATION OF RISK FACTORS ASSOCIATED WITH NECK AND LOW BACK PAIN AMONG DENTISTS IN CROATIA

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SUMMARY – Objective of work: The aim of this cross-sectional study was to evaluate neck and back pain and function among dental professionals in Croatia and identify possible etiological factors.

Materials and Methods: A self-reporting questionnaire was emailed to all registered working dentists in Croatia. It included demographic data, work tenure duration, handedness and work position along with standardized scores: the visual analogue scale (VAS), global health rating on the visual analogue scale (EQ-5D-5L-VAS), the neck disability index (NDI) and the Oswestry Disability Index (ODI). The sample included a total of 316 female and 105 male dentists.

Results: Female dentists have a significant positive prediction of moderate and severe neck pain, almost 3 times higher (OR = 2.83; 95% CI: 1.33-6.04; *P* = 0.007) than their male colleagues, but the probability of pain is reduced by sitting while working compared to standing as a reference variable with OR 0.39 (95% CI: 0.18-0.87; *P* = 0.021). Also, female dentists have a significant positive prediction of moderate and severe low back pain with OR = 2.5 (95% CI: 1.28-4.90; *P* = 0.007).

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Conclusions: In dental medicine, the female sex has a significant positive prediction for moderate or severe neck and lower back pain, with an almost threefold increase in its incidence compared to male colleagues, while sitting during work reduces neck pain 2.6 times.

Keywords: *dentists; dentistry; neck pain; spine; work*

Introduction

Musculoskeletal disorders (MSD) contribute substantially to health-related absences from work and represent the main cause of short and permanent work disability leading to a significant economic burden to society[1]. They may lead to reduced productivity, a decreased quality of work and job dissatisfaction, and an increased incidence of occupational accidents[2]. Dentistry is a demanding profession and a healthy musculoskeletal system is of utmost importance as a dentist's work requires precise hand movements using vibrating instruments while adopting static postures and performing monotonous repetitive movements over long periods of time[2].

Dentists have a higher than average incidence of musculoskeletal disorders compared to the general population. Although mechanisms leading to musculoskeletal pain are multifactorial, common risk factors include prolonged static postures, repetitive precise movements, poor positioning, poor lighting and age[3,4]. Static body posture is defined as a posture that is maintained and held for over 4 seconds[5]. These constrained postures cause muscular strain requiring high muscle endurance during task performance and isometric muscle activation. Additionally, the lack of motion impedes blood flow and tissue recovery[6]. Stationary tasks may increase the risk of musculoskeletal disorders, since the human body was not designed to maintain the same body position for extended periods of time[7]. Changing positions during work may significantly reduce musculoskeletal pain[8].

During their work, dentists usually stand on the non-dominant side which can lead to muscle imbalances exerting asymmetrical force on the spinal column, causing misalignment and decreased range of motion in one direction over the other[3]. This may lead to structural changes and chronic musculoskeletal damage resulting in pain and fatigue[9]. Additionally, specific dental procedures identified as risks include scaling and endodontic procedures[10].

The etiology of neck and back pain in dentists is most likely multifactorial and the contribution of respective risk factors may be difficult to assess. Factors such as the general health condition, years of practice, using preventive strategies, having an assistant at work and job satisfaction play a crucial role[4,11]. Studies suggest that women experience neck pain more often and that the female sex is positively correlated with the severity of musculoskeletal pain[4, 11]. Other risk factors include awkward postures, prolonged repetitive movements, intense work schedules or a fast work pace[12]. Both older and younger age groups have been associated with musculoskeletal pain, which is attributed to cumulative strain in older dentists and insufficient posture awareness and adaptation in younger ones.

The aim of this study was to evaluate neck and back pain and function among dental professionals in Croatia and identify the possible etiological factors responsible for them.

Materials and Methods

Study design

This was a cross-sectional observational study conducted using a self-reporting questionnaire sent to the e-mail addresses of all registered working dentists in Croatia (Appendix 1). The questionnaire was split into two parts. The first part included demographics, age, height, body mass, work tenure duration, left vs right handedness as a well as sitting or standing work position. Additionally, dental specialty, academic title, as well as magnification use, working hours and employment in the private vs public sector were assessed. The

second part consisted of standardized scores which included the visual analogue scale (VAS), global health rating on the visual analogue scale (EQ-5D-5L-VAS) questionnaire, the neck disability index (NDI) and the Oswestry Disability Index (ODI).

Participants

A total of 4,583 registered working dentists were identified using the national database. Informed consent was obtained from the participants and approved by the Ethics Committee of the School of Dental Medicine, University of Zagreb. We excluded dentists over 65 years of age from the initial number, as difficulties arise in ascertaining whether self-reported symptoms were due to physiological degenerative changes rather than occupational exposure. Aside from this group, we included all registered practicing dentists in Croatia willing to participate in our study (a total number of 845 dentists with available e-mail addresses reported in the initial survey for participation). The final number of participants was 421 with a response rate of 49.8%: 316 (75.1%) female dentists and 105 (24.9%) male dentists (Figure 1).

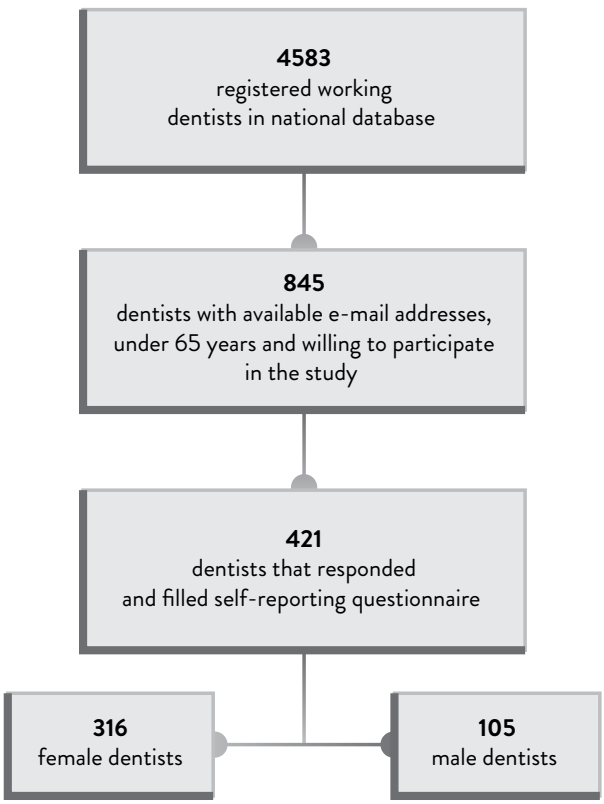

Figure 1. STROBE participant flow chart

Data analysis

The Smirnov-Kolmogorov test was used to assess the normality of data distribution and appropriate non-parametric statistical analyses were used in the evaluation of continuous data. Continuous variables were summarized as medians with interquartile ranges (IQR), while categorical variables were summarized as counts with percentages.

Continuous socio-demographic and work-related characteristics, pain and disability outcomes — including VAS neck pain, VAS lower back pain, ODI, NDI and global health rating (EQ-5D-5L VAS) — were compared between sexes using Mann–Whitney U tests. Fisher's exact test (2×2 tables) or the Fisher–Freeman–Halton exact test (2×3 or more cells) was used for categorical variables distribution analysis between sexes.

Binary logistic regression was used as a multivariate statistical analysis to model the relationship between a binary (two-outcome) dependent variable and multiple independent variables as predictors. We made two binary logistic regression models to estimate the odds of being in the moderate/severe neck pain group and the moderate/severe lower back pain group (as dependent variables) with independent predictor variables including sex, age, work tenure, dominant hand, body mass index (BMI), working position, magnification use, weekly working hours and type of working institution. All assumptions were previously checked and met, including independence of observations, lack of multicollinearity, and linearity of the logit for continuous variables. Regression results were presented as odds ratios (OR) with 95% confidence intervals (95% CI) and *P*-values. All *P*-values below 0.05 were considered significant. MedCalc® Statistical Software version 23.3.7 (MedCalc Software Ltd, Ostend, Belgium; https://www.medcalc.org; 2025) was used in all statistical procedures.

Results

A total of 421 dentists participated in this cross-sectional study, including 105 (24.9%) male and 316 female dentists (75.1%) with no between-sex difference in age distribution (male median 38.0 years, interquartile range (IQR) 32.0–47.5 years; female median 39.0 years, IQR 30.0–48.0 years; $P=0.716$). BMI was higher in men than women (male median 25.7 kg/m^2, IQR 24.2–28.3 kg/m^2; female median 22.0 kg/m^2, IQR 20.7–24.5 kg/m^2; $P<0.001$). Educational attainment distributions did not differ by sex. Right-hand dominance predominated in both sexes equally. Working posture during regular activity differed by sex with men more often reporting mostly sitting and women more often reporting a combination of sitting and standing ($P=0.002$). Male dentists reported significantly more working hours weekly ($P=0.014$), less use of magnification devices during work ($P=0.002$) and a higher prevalence of working in private practice or combination public-private practice ($P<0.001$) (Table 1).

Neck pain intensity on the visual analogue scale (VAS 0–10) was higher among females despite similar medians with distributional differences, indicating a greater symptom burden (male median 2.0, IQR 0.0–3.0, range 0.0–8.0; female median 2.0, IQR 1.0–4.0,

Table 1. Differences in socio-demographic variables and work-related factors between male and female dentists

		Male dentists (N=105)	**Female dentists (N=316)**	**Total (N=421)**	***P*-value**
Age (years)	Median (IQR)	38.0 (32.0 – 47.5)	39.0 (30.0 – 48.0)	38.0 (30.0 – 48.0)	0.716[1]
	Range	25.0 – 64.0	25.0 – 69.0	25.0 – 69.0	
BMI (kg/m2)	Median (IQR)	25.7 (24.2 – 28.3)	22.0 (20.7 – 24.5)	22.9 (21.1 – 25.8)	**< 0.001[1]**
	Range	20.2 – 36.1	15.6 – 38.1	15.6 – 38.1	
Education; N (%)	Graduate level	83.0 (79.0%)	263.0 (83.2%)	346.0 (82.2%)	0.058[3]
	MSc	5.0 (4.8%)	26.0 (8.2%)	31.0 (7.4%)	
	PhD	17.0 (16.2%)	27.0 (8.5%)	44.0 (10.5%)	
Dominant hand; N (%)	Right	99.0 (94.3%)	302.0 (95.6%)	401.0 (95.2%)	0.600[2]
	Left	6.0 (5.7%)	14.0 (4.4%)	20.0 (4.8%)	
Position during regular working time; N (%)	Mostly standing	25.0 (23.8%)	73.0 (23.1%)	98.0 (23.3%)	**0.002[3]**
	Mostly sitting	36.0 (34.3%)	59.0 (18.7%)	95.0 (22.6%)	
	Combination	44.0 (41.9%)	184.0 (58.2%)	228.0 (54.2%)	
Work tenure duration; N (%)	Less than 5 years	23.0 (21.9%)	99.0 (31.3%)	122.0 (29.0%)	0.116[3]
	5-15 years	43.0 (41.0%)	95.0 (30.1%)	138.0 (32.8%)	
	15-25 years	24.0 (22.9%)	66.0 (20.9%)	90.0 (21.4%)	
	More than 25 years	15.0 (14.3%)	56.0 (17.7%)	71.0 (16.9%)	
Weekly working hours; N (%)	<40 h	58.0 (55.2%)	222.0 (70.3%)	280.0 (66.5%)	**0.014[3]**
	40-60 h	44.0 (41.9%)	88.0 (27.8%)	132.0 (31.4%)	
	>60 h	3.0 (2.9%)	6.0 (1.9%)	9.0 (2.1%)	
Magnification during work; N (%)	No	74.0 (70.5%)	267.0 (84.5%)	341.0 (81.0%)	**0.002[2]**
	Yes	31.0 (29.5%)	49.0 (15.5%)	80.0 (19.0%)	
Type of working institution; N (%)	Public	18.0 (17.1%)	130.0 (41.1%)	148.0 (35.2%)	**< 0.001[3]**
	Private	52.0 (49.5%)	129.0 (40.8%)	181.0 (43.0%)	
	Combination	35.0 (33.3%)	57.0 (18.0%)	92.0 (21.9%)	

[1]Mann-Whitney U test; [2]Fisher's exact test; [3]Fisher-Freeman-Halton exact test

range 0.0–10.0; $P < 0.001$). Lower back pain intensity was modestly higher in females (male median 2.0, IQR 0.0–4.0, range 0.0–9.0; female median 3.0, IQR 1.0–5.0, range 0.0–10.0; $P = 0.049$). Disability related to lower back pain (ODI) was higher in females (male median 4.0%, IQR 0.0–10.0, range 0.0–62.0; female median 6.0%, IQR 2.0–14.0, range 0.0–64.0; $P = 0.001$) though the proportion with severe and moderate ODI (> 40%) was low and similar between sexes (males 1.0% [n = 1], females 1.3% [n = 4]; $P = 0.999$). Neck-related disability (NDI) was higher in females (male median 6.0%, IQR 2.0–12.0%, range 0.0–40.0%; female median 10.0%, IQR 6.0–20.0%, range 0.0–54.0%; $P < 0.001$), while severe NDI (> 40%) remained low without a significant difference between sexes (males 1.0% [n = 1], females 2.5% [n = 8]; $P = 0.461$). Self-rated global health (EQ-5D-5L, VAS 0–100) was slightly lower among females with overlapping medians, but a narrower upper IQR (male median 90.0, IQR 80.0–95.0, range 10.0–100.0; female median 90.0, IQR 80.0–91.0, range 5.0–100.0; $P = 0.009$) (Table 2).

The regression model of prediction for the group with moderate and severe neck pain in dental doctors is shown in Table 3. The model is statistically significant at $P < 0.001$ ($\chi 2 = 35.45$; df = 11), with a satisfactory Hosmer-Lemeshow test ($\chi 2 = 4.41$; df = 8; $P = 0.818$), area under the curve (AUC) of 0.70 (95% CI 0.65-0.75) and a Nagelkerke R^2 of 38.1% with 79.1% respondents correctly classified. Of all the included predictors related to the work environment and socio-demographic characteristics, female dentists have a significant positive prediction of belonging to the group with moderate and severe neck pain — almost 3 times higher (OR = 2.83; 95% CI: 1.33-6.04; $P = 0.007$) compared to male colleagues. The probability of moderate pain is reduced by sitting

Table 2. Differences in VAS pain, ODI, NDI and Global health rating (EQ-5D-5L-VAS) between male and female dentists

		Male dentists (N=105)	**Female dentists (N=316)**	**Total (N=421)**	***P*-value**
VAS neck pain	Median (IQR)	2.0 (0.0 – 3.0)	2.0 (1.0 – 4.0)	2.0 (1.0 – 4.0)	**< 0.001**[1]
	Range	0.0 – 8.0	0.0 – 10.0	0.0 – 10.0	
VAS lower back pain	Median (IQR)	2.0 (0.0 – 4.0)	3.0 (1.0 – 5.0)	2.0 (1.0 – 4.5)	**0.049**[1]
	Range	0.0 – 9.0	0.0 – 10.0	0.0 – 10.0	
ODI total score (%)	Median (IQR)	4.0 (0.0 – 10.0)	6.0 (2.0 – 14.0)	6.0 (2.0 – 14.0)	**0.001**[1]
	Range	0.0 – 62.0	0.0 – 64.0	0.0 – 64.0	
ODI categories; N (%)	Low and moderate disability index	104 (99.0%)	312 (98.7%)	416 (98.8%)	0.999[2]
	Severe disability index (ODI >40%)	1 (1.0%)	4 (1.3%)	5 (1.2%)	
NDI total score (%)	Median (IQR)	6.0 (2.0 – 12.0)	10.0 (6.0 – 20.0)	10.0 (4.0 – 18.0)	**< 0.001**[1]
	Range	0.0 – 40.0	0.0 – 54.0	0.0 – 54.0	
NDI categories; N (%)	Low and moderate disability index	104 (99.0%)	308 (97.5%)	412 (97.9%)	0.461[2]
	Severe disability index (ODI >40%)	1 (1.0%)	8 (2.5%)	9 (2.1%)	
Global health rating on a visual analogue scale (EQ-5D-5L-VAS)	Median (IQR)	90.0 (80.0 – 95.0)	90.0 (80.0 – 91.0)	90.0 (80.0 – 95.0)	**0.009**[1]
	Range	10.0 – 100.0	5.0 – 100.0	5.0 – 100.0	

[1]Mann-Whitney U test; [2]Fisher's exact test

while performing work compared to standing as a reference variable by 1/0.39 = 2.6 times (OR = 0.39; 95% CI: 0.18-0.87; *P* = 0.021), controlling for the influence of other variables in the regression model that were not significantly associated with moderate/severe neck pain.

The regression model of prediction for moderate and severe low back pain in dental doctors is shown in Table 4. The model was statistically significant at the *P* = 0.006 ($\chi 2 = 25.42$; df = 11) level with a satisfactory Hosmer-Lemeshow test ($\chi 2 = 10.90$; df = 8; *P* = 0.207), AUC 0.65 (95% CI 0.59-0.68) and a Nagelkerke R^2

Table 3. Moderate and severe neck pain intensity prediction among dentists: binary logistic regression

	OR	95% CI		*P*-value
		Lower	Upper	
Female sex	**2.831**	**1.325**	**6.048**	**0.007**
Age (years)	1.048	0.991	1.108	0.099
Work tenure duration (years)	0.859	0.475	1.554	0.615
Dominant hand: right	1.311	0.408	4.213	0.650
BMI (kg/m2)	0.996	0.923	1.075	0.914
Position during regular working time: Standing (REF.)				0.062
Sitting	**0.390**	**0.176**	**0.868**	**0.021**
Combination	0.632	0.355	1.126	0.120
Magnification during work	1.763	0.939	3.311	0.078
Weekly working hours	1.284	0.788	2.090	0.316
Type of working institution: Public (REF.)				0.533
Private institution	1.042	0.584	1.859	0.890
Combination	0.706	0.336	1.486	0.359

Table 4. Moderate and severe lower back pain intensity prediction among dentists: binary logistic regression

	OR	95% CI		*P*-value
		Lower	Upper	
Female sex	**2.510**	**1.284**	**4.904**	**0.007**
Age (years)	1.003	0.950	1.058	0.922
Work tenure duration (years)	1.170	0.662	2.067	0.589
Dominant hand: right	1.362	0.468	3.966	0.571
BMI (kg/m2)	1.013	0.943	1.089	0.717
Position during regular working time: Standing (REF.)				0.337
Sitting	1.058	0.534	2.096	0.872
Combination	0.724	0.411	1.276	0.264
Magnification during work	1.118	0.610	2.050	0.717
Weekly working hours	0.747	0.466	1.196	0.224
Type of working institution: Public (REF.)				0.202
Private institution	1.458	0.835	2.545	0.185
Combination	1.788	0.921	3.473	0.086

of 27.3% with 75.5% respondents correctly classified. Of all the included predictors related to the work environment and socio-demographic characteristics, female dentists have a significant positive prediction for moderate and severe low back pain in dental doctors, almost three times higher (OR = 2.51; 95% CI: 1.28-4.90; $P = 0.007$) than their male counterparts, controlling for the influence of other variables in the regression model.

Discussion

Neck and musculoskeletal pain are prevalent among dentists, significantly affecting their somatosensory function, mobility and overall well-being. Several studies have investigated the prevalence rates of these conditions and their impact on dental professionals. Lietz *et al.* demonstrated a high prevalence rate (> 60%) of musculoskeletal disorders among dentists with the neck and lower back being the most affected body regions[2]. In addition, specific factors contributing to neck and musculoskeletal pain in dentistry have been explored, including occupational risk factors, work duration, poor posture, differences between dental specialties and the effectiveness of various therapies. A meta-analysis by Lietz and al. reported that the three most important occupational risk factors for the prevalence of musculoskeletal pain in dentists include administrative work, which is associated with disadvantageous static sitting positions, awkward working posture and work schedules without sufficient breaks during dental procedures[2]. Furthermore, a study by Chowanadisai *et al.* examined the prevalence of MSD among 220 Thai dentists using a self-administered questionnaire. The results revealed that 78% of the participants experienced MSD during their professional careers[14]. Similarly, Ratzon *et al.* conducted a survey among Israeli dentists and found that 85% reported work-related musculoskeletal symptoms[15].

Our study identified significant negative correlation coefficients for the VAS neck score, the VAS lower back score, and ODI and NDI scores with the global health rating. This impact on global health rating may significantly affect dentists' work habits[8]. Different studies examining the most commonly affected body regions in dentists suffering from MSD have found the highest prevalence of pain in the neck and lumbar regions[2]. The results of our study have shown that 18.5% (95% CI 15.0-22.4%) of dentists suffer from neck pain, 24.9% (95% CI 21.0-29.2%) from back pain and 32.3% (95% CI 28.4-37.4%) from combined back and neck pain with a VAS score of 5 or more. Similar reports were made by Bret and Gorce *et al.* who noted 35–55% of dentists experience MSD in the lower back and upper extremity regions of the body[16]. The results of our study did not find any correlation between age, BMI, education, dominant right hand, work tenure duration in years, magnification use during work nor weekly working hours and working in private practice with the global health rating. However, our study revealed that dentists who primarily work in a sitting position had a significantly lower risk of experiencing moderate to severe neck pain compared to those who mainly stand (OR = 0.390, 95% CI: 0.176–0.868, $P = 0.021$). This means sitting was associated with a 61% reduction in the odds of neck pain, which is a statistically significant result. Although both sitting and standing postures have been associated with neck pain, the lowest prevalence of musculoskeletal pain was observed among dentists who changed their position during work[2-8]. Pejčić *et al.* argue that by combining sitting and standing positions, different muscle groups are less strained[8]. Suvarnnato *et al.* emphasize that repetitive movements combined with non-physiological posture and forceful exertions impose increased stress on the muscles of the cervical spine. These sustained muscle activations required to maintain static postures can result in muscle fatigue and imbalances, further contributing to neck pain[20]. Static postures require more than 50 percent of the body's muscles to contract to hold the body motionless while resisting gravity and the static forces resulting from these postures, and may be more taxing than dynamic forces[3]. The duration of work appears to be associated with an increased risk of developing neck and musculoskeletal pain in dental professionals. In a systematic review by Alghadir *et al.*, the authors analyzed studies investigating the relationship between work experience or years in practice and MSD among dentists. Most of the studies included in their review reported a positive correlation between longer work experience and higher prevalence rates of MSD[17]. It has also been argued that work-related musculoskeletal disorders are reported more often by

older dentists, as these disorders may be related to the cumulative effects of psychological loads and excessive repetitive movements over a long period of time[9]. Other studies report a higher prevalence of pain among younger dentists with the possible explanation being that older, more experienced dentists are better at adjusting their postures and techniques to avoid pain[13]. The results of our study showed that although male dentists reported significantly more working hours weekly and a higher prevalence of employment in private practice, female dentists had poorer results for EQ-5D-5L: the pain/discomfort domain and lower global health rating on VAS. Various occupational risk factors contribute to the development and exacerbation of neck pain among dentists. These include repetitive movements, static postures, forceful exertions, exposure to vibrations and non-physiological positions. The nature of dental work often requires repetitive motions, such as gripping dental instruments, performing dental procedures and manipulating patients' mouths[18]. These repetitive movements can lead to muscle fatigue, strain and overuse injuries in the upper extremities. Static postures that involve prolonged neck flexion and rotation are another significant occupational risk factor for neck disorders among dentists. Dental professionals often maintain non-physiological static postures during procedures, which can cause increased stress on the muscles surrounding the neck region[11]. Dentists often need to bend and twist their necks and spines to properly access the oral cavities, which can lead to muscle imbalances, joint stress and an increased risk of injury[12]. A study analyzing posture during dental work using 3D motion analysis found that dental students worked with poor posture for extended periods resulting in a high ergonomic risk, particularly in the neck region[19].

Forceful exertion during dental procedures can also contribute to neck and musculoskeletal pain among dentists. The use of forceful hand movements and repetitive gripping can cause increased muscle tension and strain in the upper extremities, including the neck region[12]. However, it is important to note that there is limited research focusing specifically on forceful exertion as an occupational risk factor for neck disorders among dentists. Exposure to vibration from dental instruments is another occupational risk factor that can contribute to neck and musculoskeletal pain among dentists. The study by Zhou *et al.* highlights that poor posture, repetitive movements and prolonged static postures during dental procedures contribute to muscle imbalances and an increased activation or fatigue in certain neck muscles. This imbalance can lead to muscle strain, tension and pain in the neck region[21]. Further supporting these findings, Ohlendorf *et al.* investigated the impact of working duration on musculoskeletal complaints among dentists and reported a higher prevalence of neck pain among those with longer working hours per week compared to those who worked fewer hours. This suggests that occupational risk factors — such as extended work shifts — may exacerbate physiological mechanisms that lead to neck disorders[22]. Interestingly, our study did not identify the correlation between weekly working hours and global health ratings. Kawtharani *et al.* emphasize that somatosensory dysfunction, including altered tactile sensitivity or proprioception, can contribute to the persistence or recurrence of neck disorders in dentistry. The disruption of the neural pathways involved in pain processing and sensory perception can lead to increased pain sensitivity and decreased sensorimotor control in the neck region[12]. Physiological factors such as poor posture, repetitive movements and prolonged static postures contribute to muscle imbalances and an increased activation or fatigue in specific neck muscles. Biomechanical aspects related to ergonomic factors further exacerbate these issues by imposing additional stress on the muscles of the cervical spine. Kinematic posture analysis performed by Hauck *et al.* observed unfavorable postures during daily dental practice. They postulated that occupational postures may be the cause of pain complaints. The authors further argued that even ideal postures — when held over a long period of time — can result in musculoskeletal disorders. The difference between types of stress (static vs dynamic) may be further analyzed to gain more complex insight into the range of motion[23].

In addition to occupational risk factors, psychosocial factors have been identified as potential contributors to the development or exacerbation of neck disorders among dentists. Several studies have examined the association between psychosocial factors and neck disorders among dentists. For instance, a study by Taib *et al.* investigated the relationship between specific physical and psychosocial factors and/or ergonomic

conditions on MSD symptoms among dentists in Malaysia. The findings revealed that, among the nine reviewed body areas, the shoulders were most often affected by symptoms of MSD (92.7%). Moreover, MSD of the neck and upper back were most likely to prevent these practitioners from engaging in normal activities (32.9%). In general, no significant differences were found in the prevalence of MSD symptoms in relation to sex, age, BMI, years in practice, the number of patients and the frequency of breaks[24].

The female sex has been listed as a risk factor for musculoskeletal disorders in some studies[4,11]. The results of our study showed that female dentists have an almost three times higher positive prediction of moderate and severe neck pain with a higher neck pain intensity on the VAS. Additionally, we discovered that women have a significant positive prediction of moderate and severe low back pain. A possible explanation includes a more sensitive perception of pain and influences of sociocultural, psychological and biological factors[11]. A study by Wijhoven *et al.* demonstrated that hormonal and reproductive factors associated both with chronic low back pain and chronic upper extremity pain in women[25]. Another possible explanation is that it may be more difficult for women to compensate for the physical strain during dental care due to differences in musculoskeletal force exertion[11].

The study has some limitations to acknowledge. This study used a self-reporting questionnaire, which has several known drawbacks, including an unwillingness to report personal information and under- or overestimating symptoms. Furthermore, dentists who are more invested in the topic or are suffering from musculoskeletal disorders may be more inclined to finish the questionnaire. The study also suffers from recall and enrollment bias which might underestimate or overestimate the actual scenarios, respectively. Also, the response rate noted in the study was 49.8%. Hence, we urge the readers to observe caution before generalizing the findings of this study.

Conclusions

Every third dentist in the country suffers from neck and back pain. We did not find any correlation between age, BMI, education, hand dominance, work tenure, use of magnification during work or weekly working hours and employment in private vs public practice with the global health rating. The female sex was associated with poorer results for EQ-5D-5L-VAS. It also demonstrated a significant positive prediction for moderate or severe neck and lower back pain — which are almost three times more frequent in female dentists. Sitting while doing work reduces neck pain 2.6 times.

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Sažetak

UTVRĐIVANJE ČIMBENIKA RIZIKA POVEZANIH S BOLI U VRATU I DONJEM DIJELU LEĐA KOD STOMATOLOGA U HRVATSKOJ

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Cilj rada: Cilj ove presječne studije bio je procijeniti bol i funkciju vrata i leđa među stomatološkim stručnjacima u Hrvatskoj te identificirati moguće etiološke čimbenike.

Materijali i metode: Upitnik za samoprocjenu poslan je e-poštom svim registriranim zaposlenim doktorima dentalne medicine u Hrvatskoj. Uključivao je demografske podatke, trajanje radnog staža, rukovanje rukom i radni položaj zajedno sa standardiziranim rezultatima: vizualnom analognom ljestvicom (VAS), globalnom ocjenom zdravlja na vizualnoj analognoj ljestvici (EQ-5D-5L-VAS), indeksom invaliditeta vrata (NDI) i Oswestry indeksom invaliditeta (ODI). Ukupni uzorak uključivao je 316 žena i 105 muškaraca.

Rezultati: Doktorice dentalne medicine imaju značajno (skoro tri puta) veću pozitivnu predikciju umjerene i jake boli u vratu (OR = 2,83; 95% CI: 1,33-6,04; $P = 0,007$) u usporedbi s muškim kolegama, dok je ta vjerojatnost smanjena sjedenjem tijekom rada u usporedbi sa stajanjem kao referentnom varijablom s OR 0,39 (95% CI: 0,18-0,87; $P = 0,021$). Također, doktorice dentalne medicine imaju značajnu pozitivnu predikciju umjerene i jake boli u donjem dijelu leđa s OR = 2,5 (95% CI: 1,28-4,90; $P = 0,007$).

Zaključci: Ženski spol kod doktora dentalne medicine gotovo trostruko povećava pripadnost skupini s umjerenom ili jakom boli u vratu i donjem dijelu leđa, dok sjedenje tijekom rada smanjuje razinu boli u vratu 2,6 puta.

Ključne riječi: *doktori dentalne medicine; dentalna medicina; bol u vratu; kralježnica; rad*