Musculoskeletal Disorders among Lithuanian Dentists and Oral Hygienists

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ABSTRACT

Objectives: This cross-sectional observational study aims to identify the prevalence of musculoskeletal disorders among Lithuanian dentists and dental hygienists and determine the most affected body areas.
Material and Methods: An anonymous survey was carried out from October 20, 2024, to December 5, 2024. The questionnaire was distributed online to Lithuanian specialists - dentists and oral hygienists. A total of 382 professionals were included in this survey. Chi-square test, its degrees of freedom was used for the analysis of variables.
Results: The study involved 382 participants who reported experiencing pain in the neck (65.7%), shoulders (59.7%), and lower back (58.1%) in the past 12 months, while only 4.5% did not experience any discomfort. Based on the study data, 19.4% of respondents were unable to perform their regular work due to problems related to pain in certain areas during the last 12 months. In addition, 49.5% of specialists had never consulted a physiotherapist or doctor about their condition during the past year. As many as 20.7% of respondents stated that they were completely physically inactive, and 18.1% engaged in low-intensity physical activity.
Conclusions: Overall, dentists and dental hygienists in Lithuania face a significant prevalence of work-related musculoskeletal disorders in their profession. Considering the magnitude of this issue, it is essential to implement university-level preventive education programs that provide dental professionals with comprehensive ergonomic knowledge.

Keywords: dental hygienists; ergonomics; musculoskeletal disease; questionnaire.

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INTRODUCTION

Musculoskeletal disorders (MSDs) are very common among healthcare professionals. The prevalence of MSDs among several healthcare professions was investigated. Prevalence of over 80% has been reported among physiotherapists, masseurs, nurses, midwives, dentists and surgeons [1]. The work of oral care specialists is associated with various therapeutic procedures performed in a seated, static position [2]. The dental profession requires skilful dental preparations with great precision and control. Muscles used for this purpose are at risk of becoming fatigued and causing discomfort to the dentist [3]. Also, the small and hard-to-reach working area creates discomfort for the doctor, requiring constant changes in position. Improper, asymmetrical working posture causes muscle imbalance and excessive tension. Based on a systematic literature review, it can be stated that one of the main reasons why dental professionals retire early is work associated with MSDs [4]. Dentistry is a profession where work is related to musculoskeletal system disorders, and symptoms often appear during the study years [5]. The aetiology of occupational physical disorders is studied by the science of ergonomics. Ergonomics (Greek words ergon ["work"] + nomos ["law"]) is the science that studies the psychophysiological capabilities, limits, and characteristics of human work [6]. Therefore, the work of oral care specialists is directly related to physical health impairment [7]. The World Health Organization classifies [8] representatives of this profession as people whose work is associated with MSDs. These disorders cause muscle dysfunction, joint, tendon, and nerve changes. The analysis of 2019 of the Global Burden of Disease (GBD) data showed that approximately 1.71 billion people worldwide live with musculoskeletal conditions, including low back pain and neck pain [9]. Currently, various methods have been discovered to improve the working conditions of oral care specialists and to maintain an ergonomic body position. However, Cochrane study highlighted the lack of physical, cognitive and organizational ergonomic interventions for preventing work-related musculoskeletal disorder (WMSD) in dental care practitioners [4]. Hayes et al. [10] suggests that the prevalence of MSDs in dentistry ranges between 64 to 93% among dentists, dental hygienists and dental students. The study of Rambabu and Suneetha [11], compared MSD pain among physicians, surgeons and dentists and found that dentists had the highest rates. Studies reveal that the neck, back, shoulders, wrists, and lumbar areas are most often affected [12-21]. Based on data provided by various countries, it can be stated that the prevalence of MSDs remains very high among oral care specialists [20-24]. This cross-sectional observational study aims to identify the prevalence of musculoskeletal disorders among Lithuanian dentists and dental hygienists and determine the most affected body areas.

MATERIAL AND METHODS

Study design

A cross-sectional study was conducted at the Lithuanian University of Health Sciences (LSMU), Kaunas, Lithuania from October 20, 2024, to December 5, 2024.

Materials and subjects

The protocol of present survey study was approved by the Bioethics Centre of Lithuanian University of Health Sciences (No. 2024-BEC2-978).

The Nordic Musculoskeletal Questionnaire (NMQ), which is widely recognized and frequently used in scientific research, was employed [25]. This method allows for precise assessment of MSDs in various body parts. Participants included individuals holding valid general dental practitioner and dental hygienist licenses and actively practicing their profession.

The survey was uploaded to the social network "Facebook" in the closed group "Dental professionals" and conducted anonymously from October 20, 2024, to December 5, 2024. The questionnaire consisted of short, multiple-choice, and open-ended questions.

Determination of the study sample

Paniotto's formula with 95% confidence intervals was used to find out how many specialists had to answer the questionnaire:

$$n = 1/(\Delta^2+1/N)$$

Where n is the sample size (number of specialists to be surveyed), Δ is the sample error size (the standard error is considered 5%, which we get with 0.95 probability), and N is the general size of the study population.

According to the data provided by the Lithuanian State Accreditation Service for Health Care Activities (https://vaspvt.lrv.lt/), there are currently 4188 dentists and 1842 oral hygienists with active licenses in

Lithuania. Therefore, 370 specialists were identified as the research sample.

Statistical analysis

The responses received from the respondents were summarized in Microsoft Excel® 2019 (Microsoft Corp., Seattle, WA, USA), statistical data analysis was performed using the SPSS® Statistics version 19.0 (IBM Corp.; Armonk, New York, NY, USA) for data collection and analysis. The statistical relationship of qualitative features was studied by the method of linked groups. Based on the data of the groups, chi-square (χ^2) test, number of degrees of freedom (df) and statistical significance (P-value) were calculated. Mean and standard deviation (SD) were used to analyse the data. Additionally, the Student's t-test, Kolmogorov-Smirnov test, non-parametric Mann-Whitney test, non-parametric Spearman's analysis and Kruskal-Wallis test were employed in the analysis.

To verify the statistical hypotheses conclusions, the difference in results was considered significant when $P < 0.05$.

RESULTS

A total of 382 individuals participated in the survey, of which 327 (85.6%) were women and 55 (14.4%) were men. The respondents' age was 33.9 (SD 8.9) years (min: 21; max: 66). 44.8% of specialists were under 30 years of age, 36.6% were between 31 and 40 years old, and 18.6% were over 46 years old. Based on the parametric Student's t-test, it was found that age, considering gender, did not differ significantly ($P = 0.548$) (Table 1).

Respondents worked an average of 36.9 (SD 8.4) hours per week. The variable "working hours" did not meet the normality distribution assumption, according to the Kolmogorov-Smirnov test. Based on the non-parametric Mann-Whitney test for two independent samples, it was found that men worked significantly more hours ($P < 0.001$): men 40 (min: 36; max: 45) hours; women 36 (min: 30; max: 40) hours (Table 2). Based on the non-parametric Spearman's analysis, it was found that younger respondents worked significantly more hours ($r = -0.235$, $P < 0.001$) (Table 3). The age group of ≤ 30 worked 40 (min: 35; max: 45) hours per week. Respondents aged 31 to 40 worked 36.6 (min: 30; max: 40) hours per week, while those aged ≥ 40 worked 36 (min: 30; max: 40) hours (Table 4). Based on non-parametric Kruskal-Wallis test × 2 = 15.753, lls = 2, $P = 0.001$, $^{ab}P < 0.01$.

Table 1. Respondent's characteristics (n = 382)

		Frequency	Percentage
Gender	Females	327	85.6%
	Males	55	14.4%
Age (years)	≤ 30	171	44.8%
	31 to 40	140	36.6%
	≥ 41	71	18.6%
Total		382	100%

Table 2. Working hours based on the Mann-Whitney test

		Male	Female
Median		40	38
Percentiles	25	36	30
	50	40	38
	75	45	40

Men worked significantly more hours ($P < 0.001$).

Table 3. Working hours per week based on the non-parametric Spearman's analysis

Age group	Frequency	Percentage
≤ 30	171	44.8%
31 to 40	140	36.6%
≥ 41	71	18.6%

Younger respondents worked significantly more hours ($r = -0.235$, $P < 0.001$).

Table 4. Working hours per week based on the non-parametric Kruskal-Wallis test

		Age group		
		≤ 30	**31 to 40**	**≥ 41**
Median		40^{ab}	36.5^{a}	36^{b}
Percentile	25	35	30	30
	50	40	36.5	36
	75	45	40	40

[a]The significance level is 0.05; [b]asymptotic significance is displayed. Based on non-parametric Kruskal-Wallis test × 2 = 15.753, lls = 2, $P = 0.001$, $^{ab}P < 0.01$.

When comparing age groups, a significant difference was observed at the elbows (P-value 0.002) between the ≤ 30 and 31 to 40 age groups. This difference was noted when assessing the pain experienced by specialists in the past 12 months. Respondents most frequently reported experiencing pain in the neck 251 (65.7%), shoulders 228 (59.7%), and lower back 222 (58.1%) in the past 12 months, while discomfort in other areas of the body was reported by a significantly smaller percentage of specialists (Table 5).

Table 5. Body areas where oral health professionals have felt pain in the last 12 months

Body area	Male	Female	Total	χ^2	df	P-value
	N (%)	N (%)	N (%)			
No diskomfort	6 (10.9%)	11 (3.4%)	17 (4.5%)	6.303	1	0.012[a]
Neck	27 (49.1%)	224 (68.5%)	251 (65.7%)	7.872	1	0.005[a]
Shoulders	19 (34.5%)	209 (63.9%)	228 (59.7%)	16.877	1	< 0.001[a]
Elbows	3 (5.5%)	17 (5.2%)	20 (5.2%)	0.006	1	0.937
Wrists/hands	8 (14.5%)	114 (34.9%)	122 (31.9%)	8.94	1	0.003[a]
Upper back	19 (34.5%)	159 (48.6%)	178 (46.6%)	3.75	1	0.053
Lower back	31 (56.4%)	191 (58.4%)	222 (58.1%)	0.081	1	0.776
Hips	3 (5.5%)	63 (19.3%)	66 (17.3%)	6.284	1	0.012[a]
Knees	6 (10.9%)	39 (11.9%)	45 (11.8%)	0.047	1	0.829
Ankles/feet	3 (5.5%)	21 (6.4%)	24 (6.3%)	0.075	1	0.784

[a]Statistically significant ($P < 0.05$), degree of freedom for the chi-square (χ^2).
N = number.

When comparing age groups, a statistically significant difference was observed for the response "No discomfort" (P-value of 0.007) in the age groups ≥ 41 vs. 31 to 40 and ≥ 41 vs. ≤ 30. This difference was noted when analysing specialists who were unable to work in the past 12 months due to experienced pain (Table 6).

Statistically significant differences between age groups were observed in the hip and lower back regions. Notably, respondents aged ≥ 41 reported the lowest prevalence of pain in these areas when assessing pain perception over the past 7 days (Table 7). Visits to doctors/physiotherapists correlate with the number of hours worked per week. There is no statistically significant difference between age groups (Table 8). It is noteworthy that the highest proportion of respondents 26 (47.3%) of men and 91 (28.1%) of women, reported experiencing pain only 1 to 7 times per year (Table 9).

79 (20.7 %) of the respondents stated that they are completely physically inactive, while 69 (18.1 %) of the specialists engage in low-intensity physical activity (walking, irregular home exercise, seasonal sports activities) (Table 10). Additionally, it was interesting to find out how Lithuanian dentists and dental hygienists evaluate their knowledge of ergonomics. Nearly half of the specialists (48%) rated their knowledge as good (Table 11).

DISCUSSION

Dentistry is a high-risk profession associated with MSD. Most dental professionals constantly

Table 6. Body area where pain has prevented oral health professionals from working in the last 12 months

Body area	Male	Female	Total	χ^2	df	P-value
	N (%)	N (%)	N (%)			
No diskomfort	51 (92.7%)	258 (78.9%)	309 (80.9%)	5.824	1	0.016[a]
Neck	1 (1.8%)	21 (6.4%)	22 (5.8%)	1.839	1	0.175
Shoulders	1 (1.8%)	12 (3.7%)	13 (3.4%)	0.491	1	0.483
Elbows	0 (0%)	5 (1.5%)	5 (1.5%)	0.852	1	0.356
Wrists/hands	0 (0%)	15 (4.6%)	15 (4.6%)	2.626	1	0.105
Upper back	1 (1.8%)	11 (3.4%)	12 (3.1%)	0.37	1	0.543
Lower back	1 (1.8%)	29 (8.9%)	30 (7.9%)	3.234	1	0.072
Hips	0 (0%)	3 (0.9%)	3 (0.9%)	0.509	1	0.476
Knees	0 (0%)	2 (0.6%)	2 (0.6%)	0.338	1	0.561
Ankles/feet	0 (0%)	0 (0%)	0 (0%)	-	1	-

[a]Statistically significant ($P < 0.05$), degree of freedom for the chi-square (χ^2).
N = number.

Table 7. Body area where oral health professionals experienced pain in the last 7 days

Body area	Male	Female	Total	χ^2	df	P-value
	N (%)	N (%)	N (%)			
No diskomfort	25 (45.5%)	85 (26.0%)	110 (28.8%)	8.696	1	0.003[a]
Neck	10 (18.2%)	123 (37.6%)	133 (34.8%)	7.83	1	0.005[a]
Shoulders	5 (9.1%)	99 (30.3%)	104 (27.2)	10.664	1	0.001[a]
Elbows	1 (1.8%)	8 (2.4%)	9 (2.4%)	0.081	1	0.776
Wrists/hands	3 (5.5%)	39 (11.9%)	42 (11.0%)	2.015	1	0.156
Upper back	9 (16.4%)	68 (20.8%)	77 (20.2%)	0.574	1	0.448
Lower back	18 (32.7%)	105 (32.1%)	123 (32.2%)	0.008	1	0.928
Hips	0 (0%)	29 (8.7%)	29 (7.6%)	5.278	1	0.022[a]
Knees	3 (5.5%)	8 (2.4%)	11 (2.9%)	1.523	1	0.217
Ankles/feet	2 (3.6%)	11 (3.4%)	13 (3.4%)	0.011	1	0.918

[a]Statistically significant ($P < 0.05$), degree of freedom for the chi-square (χ^2).
N = number.

Table 8. Body areas for which oral health professionals have visited doctors/physiotherapists

Body area	Male	Female	Total	χ^2	df	P-value
	N (%)	N (%)	N (%)			
Not visited	42 (76.4%)	147 (77.8%)	189 (49.5%)	18.581	1	< 0.001[a]
Neck	4 (7.3%)	86 (26.3%)	90 (23.6%)	9.464	1	0.002[a]
Shoulders	6 (10.9%)	88 (26.9%)	94 (24.6%)	6.499	1	0.001[a]
Elbows	1 (1.8%)	7 (2.1%)	8 (2.1%)	0.024	1	0.877
Wrists/hands	1 (1.8%)	21 (6.4%)	22 (5.8%)	1.839	1	0.175
Upper back	3 (5.5%)	69 (21.1%)	72 (18.8%)	7.535	1	0.006[a]
Lower back	9 (16.4%)	96 (29.4%)	105 (27.5%)	3.988	1	0.046[a]
Hips	0 (0%)	20 (6.1%)	20 (5.2%)	3.55	1	0.06
Knees	1 (1.8%)	9 (2.8%)	10 (2.6%)	0.161	1	0.688
Ankles/feet	0 (0%)	8 (2.4%)	8 (2.1%)	1.374	1	0.241

[a]Statistically significant ($P < 0.05$), degree of freedom for the chi-square (χ^2).
N = number.

Table 9. Frequency of pain experienced by respondents per year (times)

Times	Male	Female	Total
	N (%)	N (%)	N (%)
1 to 7 times	26 (47.3%)	91 (28.1%)	117 (30.9%)
8 to 30 times	13 (23.6%)	82 (25.3%)	95 (25.1%)
> 30 times	9 (16.4%)	84 (25.9%)	93 (24.5%)
Everyday	7 (12.7%)	67 (2.8%)	74 (19.5%)

No significant difference was observed when comparing age groups.
Three respondents did not answer this question.

Table 10. Physical activity and sports chosen by Lithuanian dentists and oral specialists to improve their health

Physical activity	Male	Female	Total	χ^2	df	P-value
	N (%)	N (%)	N (%)			
Not playing sports	11 (20%)	68 (20.8%)	79 (20.7%)	0.018	1	0.893
Tennis/padel	9 (16.4%)	16 (4.9%)	25 (6.5%)	10.128	1	0.001[a]
Sport in the gym	27 (49.1%)	99 (30.3%)	126 (33%)	7.541	1	0.006[a]
Pilates/joga	0 (0%)	64 (19.6%)	64 (16.8%)	12.931	1	< 0.001[a]
Classes with physiotherapist	0 (0%)	23 (7%)	23 (6%)	4.116	1	0.42
Swimming	3 (5.5%)	12 (3.7%)	15 (3.9%)	0.398	1	0.528
Low level physical activities	11 (20%)	58 (17.7%)	69 (18.1%)	0.163	1	0.686
Other activities	2 (3.6%)	14 (4.3%)	16 (4.2%)	0.049	1	0.824

[a]Statistically significant ($P < 0.05$), degree of freedom for the chi-square (χ^2).
N = number.
Three respondents did not answer.
No significant correlation with age groups according to Spearman's correlation.

Table 11. Respondents' knowledge of ergonomics

Answer	Frequency	Percentage
Very good	34	8.9%
Good	184	48.2%
Moderate	140	36.6%
Satisfactory	21	5.5%
Total	379	99.2%

No significant difference was observed when comparing age groups. Three respondents did not answer this question.

complain about pain in certain areas throughout their professional lives. Numerous repetitive, low-range motions are performed daily in dental practice, which can have a detrimental impact on the musculoskeletal system. This study examined the physical health status of dental professionals (dentists and oral hygienists) in our country related to MSD. To our knowledge, this is the first study on Lithuanian dentists using the NMQ. In this study, several parameters including number of worked hours per week, and physical activities and knowledge of ergonomic guidelines have been added in the standard questionnaire.

As a main result, this investigation revealed that the prevalence of WMSD in the past 12 months among the 382 participants (dentists and oral hygienists) was 95.5 %. Other previous studies showed a prevalence of 86.5% among 2449 dentists in Lithuania [19], of 84.9% among 323 Italian dentists [20], of 90.4% among 179 dentists in United Arab Emirates [21], of 91% among 468 Italian oral hygienists [22], of 90% among 255 dentists and dental students in Finland [23], of 85.6% among 288 dentists in China [24], of 86.9% among 290 Indian dentists, of 81.4% among 204 Brazilian dentists [18]. Other studies showed a higher prevalence, 92% among 450 dentists and dental students in Germany [26], and 96% among 581 dentists in Czech Republic [27]. Only a few studies showed lower prevalence of WMSD, namely 53.6% among 291 dentists in Georgia [28] and 42% among 390 dental students in the United Kingdom [29].

Gender is an important variable in this study when examining pain sensitivity over the past 12 months (P-value of 0.012). In other studies, musculoskeletal disorders are more commonly experienced by women [30]. In our study, 3.4% of women and 10.9% of men reported not experiencing any pain over the past year. Our results align with stereotypical gendered beliefs in the literature [31-33].

The survey covered professionals with current licenses between the ages of 22 and 66, but the largest group was those aged under 30. Despite the young age of the respondents, we found that the back, shoulders, and neck were the most painful areas These areas were the most painful for both men and women. We compared our findings with those of other similar studies around the world on site-specific (back, neck, and shoulder) pain. In the results of other researchers, the same body areas affected by musculoskeletal disorders (MSDs) can also be observed [12-21].

Interestingly, there was no statistically significant difference between physically active dental specialists and their health status. It has been established that physical activity has a particularly positive effect on stress management and WMSD prevention [7]. Previous studies have also shown that yoga reduces areas of muscle tension, induces relaxation [34] and physical exercises have a positive effect on disability caused by WRMSDs [35]. In our study, 16.8% of participants practiced yoga or Pilates as physical activity.

Half of the respondents did not visit a doctor or physiotherapist in the past 12 months, suggesting that it can be inferred that the musculoskeletal disorder-related symptoms experienced by Lithuanian oral healthcare professionals are temporary. It demonstrates a discrepancy between the prevalence of pain perception and the degree of disability resulting from WMSDs [36]. This hypothesis is supported by the information that nearly 80% of respondents do not experience any discomfort on a daily basis.

Although specialists do not experience MSDs on a daily basis, 60% of them reported at least one type of MSD in the past 7 days. Compared to a study conducted in Italy in 2021, where only 40% of professionals reported experiencing at least one type of MSD per week, the prevalence in our country is notably higher at 60% [20]. Similarly, a study conducted in Germany in 2020 found that 60% of professionals experienced at least one type of MSD per week, aligning with our country's results [26].

Only 9% of respondents rated their knowledge of ergonomics as very good. Another study states that a similar number of professionals (8.92%) are able to adhere to ergonomic principles [37]. However, this condition is not related to WMSD onset. We may speculate that the occurrence of WMSD brought the interest to study and apply the ergonomics guidelines [20].

It should be noted that a high percentage of WMSD is present in undergraduate and post-graduate students [20]. Students are nowadays very susceptible to WMSD [38]. It is reported that new technologies and lack of mobility are critical factors for WMSD occurrence in young people [20]. This emphasizes the need for awareness and adoption of appropriate ergonomic postures by dental healthcare providers

from early in their careers to minimize work-related MSD [39].

A key role must be played by universities that must teach the correct posture and the exercises to be done to prevent WMSD, in particular for future dental professionals. The study program provides only the basics of ergonomics education, but it does not teach body mechanics or preventive exercises to promote a healthy body and continuous work habits. It is essential to urgently improve the teaching of dental ergonomics by employing new pedagogical strategies, methods, and active learning methodologies. Students must acquire and understand ergonomic knowledge from the very first years of university courses [40]. Additionally, oral healthcare professionals must continuously strive to update their knowledge of ergonomics [41]. The application of precise rules and precautions contained within the ergonomics guidelines are essential to avoid the onset of WMSD in dental professionals [42]. Using new active didactic activities, students and specialists could observe, learn, and understand proper posture, avoid incorrect postural habits, and practice a healthy approach that would help prevent the occurrence of WMSDs in the dental profession.

Limitations

Although this study provides valuable insights into musculoskeletal disorders among Lithuanian dental specialists, certain limitations must be considered when interpreting the results. Firstly, the survey was distributed via the social media platform Facebook, which may have led to a higher participation rate among younger specialists. Additionally, the Nordic Musculoskeletal Questionnaire does not fully capture the extent of the issue, as the Neck Disability Index (NDI), which assesses not only pain levels but also the degree of disability, was not employed. Furthermore, the results of dental hygienists and dentists were not analysed separately, which may have affected the representativeness of the findings.

CONCLUSIONS

Dentists and dental hygienists in Lithuania face a significant prevalence of work-related musculoskeletal disorders in their profession. Considering the magnitude of this issue, it is essential to implement university-level preventive education programs that provide dental professionals with comprehensive ergonomic knowledge. Furthermore, educators should actively address students' working postures during practical training sessions. Faculty members are encouraged to regularly remind students about proper sitting postures, make necessary corrections, and foster long-term awareness and habitual ergonomic practices.

Future initiatives should emphasize both physical and cognitive ergonomic interventions. Priorities should include integrating musculoskeletal biomechanics education, promoting the adoption of preventive therapeutic mobilization techniques, and incorporating active relaxation and compensatory exercise training into university curricula.

By fostering an awareness of healthy approaches, emphasizing attention to bodily signals and needs, and applying innovative teaching methodologies, physical and mental well-being can be significantly improved. Such efforts are vital for enhancing the quality of daily professional practice and promoting a sustainable and fulfilling career in dentistry.

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