

Original article

Prevalence and Exploratory Correlates of Work-Related Musculoskeletal Symptoms Among Dentists in Western Libya: A Cross-Sectional Study

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Abstract

Dentistry involves prolonged static postures, repetitive hand movements, and constrained working positions that may contribute to musculoskeletal symptoms. Evidence from Libya remains limited. Methods: A cross-sectional survey was conducted among 96 dentists working in public and private clinics in Western Libya. Participants completed a demographic and occupational questionnaire and the Standardized Nordic Musculoskeletal Questionnaire. Twelve-month prevalence was summarized with 95% confidence intervals. Associations between symptoms in nine anatomical regions and seven demographic or occupational factors were explored using Fisher's exact tests or chi-square tests with Monte Carlo p-values, as appropriate. Odds ratios or Cramér's V were reported, and the Benjamini–Hochberg procedure was applied across 63 comparisons. Results: The most frequently reported 12-month symptoms involved the neck (76.0%; 95% CI, 66.6%–83.5%), lower back (62.5%; 95% CI, 52.5%–71.5%), and shoulders (52.1%; 95% CI, 42.2%–61.8%). Among participants reporting symptoms in these regions, 56.0%–58.3% reported limitation of normal activities or work. Several unadjusted, site-specific associations were observed for gender, age, working days, daily working hours, and predominant working position; however, none remained statistically significant after false-discovery-rate correction. Daily patient caseload was not associated with symptoms in any anatomical region. Musculoskeletal symptoms were common and frequently activity-limiting among dentists in Western Libya. The prevalence findings are robustly descriptive, whereas the subgroup associations should be considered exploratory and require confirmation in larger studies with prespecified multivariable analyses and objective ergonomic assessment.

Keywords. Dentists, Ergonomics, Musculoskeletal Symptoms, Occupational Health, Nordic Musculoskeletal Questionnaire, Libya.

Introduction

Work-related musculoskeletal disorders (WMSDs) are a major occupational health concern in dentistry. They include symptoms and conditions affecting muscles, tendons, ligaments, nerves, joints, and the spine and may develop through cumulative exposure to repetitive movements, forceful exertion, prolonged static loading, and awkward posture [1,2]. Dental work is particularly demanding because clinicians must maintain visual precision and fine motor control within a restricted operating field, often while the neck and trunk are flexed or rotated and the upper limbs are elevated. Musculoskeletal symptoms are highly prevalent among dental professionals. Systematic reviews have estimated that approximately three-quarters of dental healthcare workers experience symptoms within 12 months, with the neck, lower back, shoulders, and wrists/hands among the most commonly affected regions [3,4]. Such symptoms may reduce work capacity, increase absenteeism, impair quality of life, and contribute to early departure from clinical practice [2,5].

Studies from the Middle East and North Africa have likewise reported a substantial burden of musculoskeletal symptoms among dentists [6,7]. In Libya, a 2015 national survey reported musculoskeletal complaints in 48.2% of dentists and identified associations with full-time work, private practice, and prolonged sitting [7]. A more recent survey in Western Libya, with data collected in June to August 2025, reported a high 12-month prevalence of neck, lower back, and shoulder symptoms, and considerable limitation of normal activities among symptomatic dentists [8].

Potential correlates include gender, age, cumulative professional exposure, working hours, patient volume, static posture, and the timing and quality of rest breaks [9,10,11,12,13]. However, these factors are often examined in small samples with sparse subgroups and multiple univariate tests, which can produce unstable or false-positive findings. Additional region-specific data are therefore useful, provided that exploratory associations are interpreted cautiously. This study aimed to estimate the 12-month prevalence and anatomical distribution of self-reported musculoskeletal symptoms among dentists in Western Libya and to explore their associations with selected demographic, workload, and ergonomic characteristics.

Methods

Study design and participants

A cross-sectional survey was conducted among dentists actively working in public and private dental clinics with at least one year of professional experience in Western Libya (Tripoli, Alzawiayh, Sabratha) between February 6 and March 3, 2026. One hundred questionnaires were distributed to a convenience sample. Ninety-six questionnaires were retained for analysis, while four were excluded due to substantial missing data, yielding a usable response rate of 96.0%.

Data collection and measures

Data were collected using a self-administered questionnaire with two sections identical to the one used in a prior study [8]. The first section recorded gender, age, years of professional experience, working days per week, daily working hours, number of patients treated per day, predominant working position, and rest-break practices. The second section used the Standardized Nordic Musculoskeletal Questionnaire to assess musculoskeletal trouble in nine anatomical regions during the previous 12 months and previous 7 days, and whether 12-month symptoms had prevented normal work or activities at home or away from home [14]. The questionnaire measures self-reported symptoms and functional limitations; it does not establish a clinical diagnosis or prove that symptoms were caused by work.

Ethical considerations

Ethical approval was obtained from the Biosafety and Bioethics Committee (NBC:018.H.24.96), and all participants provided written informed consent.

Statistical analysis

Categorical variables were summarized as counts and percentages. 95% Wilson confidence intervals accompanied twelve-month prevalence estimates. Seven prespecified factors were included in exploratory inferential analyses: gender, age group, working days per week, daily working hours, patients treated per day, predominant working position, and rest-break duration. Years of experience were summarized descriptively but were not included in the 63-test family.

For two-group comparisons, Fisher's exact p-values and odds ratios (ORs) with 95% confidence intervals were reported. For factors with more than two categories, Pearson chi-square statistics, Monte Carlo exact p-values, and Cramér's V were reported. Because 63 comparisons were performed across nine anatomical regions and seven factors, p-values were adjusted using the Benjamini–Hochberg false discovery rate (FDR) procedure. Statistical significance was evaluated using the FDR-adjusted p-value at a two-sided threshold of 0.05. Unadjusted p-values below 0.05 are described as nominal or exploratory rather than confirmatory.

Results

Participant characteristics

The sample was nearly balanced by gender. Most participants were 25–35 years old (83.3%) and had 10 or fewer years of professional experience (81.3%). Three days per week was the most common work schedule (41.7%); 41.7% worked five or more days per week, and 24.0% worked six or seven days per week. Most participants worked 6–10 hours per day and treated 1–10 patients per day. A seated position was reported by 60.4%, and 86.5% reported taking a rest interval during work.

Table 1. Demographic, professional, workload, and ergonomic characteristics (n = 96)

Characteristic	n	%
Gender		
Male	46	47.9
Female	50	52.1
Age (years)		
25–30	32	33.3
31–35	48	50.0
36–40	12	12.5
>40	4	4.2
Professional experience (years)		
1–5	46	47.9
6–10	32	33.3
11–15	14	14.6
>15	4	4.2
Working days per week		
2	8	8.3
3	40	41.7
4	8	8.3
5	17	17.7
6	19	19.8
7	4	4.2
Daily working hours		
1–5	15	15.6
6–10	73	76.0
>10	8	8.3
Patients treated per day		
1–5	38	39.6

6–10	44	45.8
>10	14	14.6
Rest interval during work		
Yes	83	86.5
No	13	13.5
Predominant working position		
Seated	58	60.4
Standing	38	39.6

Prevalence and functional limitation

The neck was the most frequently affected region, followed by the lower back and shoulders. Among symptomatic participants, limitation of normal activities or work was reported by 57.5% for neck symptoms, 58.3% for lower-back symptoms, and 56.0% for shoulder symptoms. The lower proportion reporting symptoms during the previous 7 days indicates that not all participants with 12-month symptoms were symptomatic in the week before the survey; it does not by itself establish chronicity or recurrence patterns.

Table 2. Twelve-month prevalence, activity limitation, and 7-day symptoms by anatomical region

Body region	12-month symptoms, n/N (%) [95% CI]	Limited normal activities/work, n/N (%)	Symptoms in previous 7 days, n/N (%)
Neck	73/96 (76.0) [66.6–83.5]	42/73 (57.5)	44/73 (60.3)
Shoulders	50/96 (52.1) [42.2–61.8]	28/50 (56.0)	23/50 (46.0)
Elbows	20/96 (20.8) [13.9–30.0]	12/20 (60.0)	10/20 (50.0)
Wrists/hands	32/96 (33.3) [24.7–43.2]	20/32 (62.5)	11/32 (34.4)
Upper back	29/96 (30.2) [21.9–40.0]	8/29 (27.6)	9/29 (31.0)
Lower back	60/96 (62.5) [52.5–71.5]	35/60 (58.3)	24/60 (40.0)
Hips/thighs	8/96 (8.3) [4.3–15.6]	4/8 (50.0)	2/8 (25.0)
Knees	15/96 (15.6) [9.7–24.2]	4/15 (26.7)	2/15 (13.3)
Ankles/feet	14/96 (14.6) [8.9–23.0]	4/14 (28.6)	3/14 (21.4)

Laterality among participants with 12-month symptoms: shoulders-right only 12, left only 5, both 33; elbows-right only 13, left only 7, both 0; wrists/hands-right only 17, left only 0, both 15. Percentages for limitation and 7-day symptoms use the number with 12-month symptoms in the corresponding region as the denominator.

Exploratory associations

Odds ratios compare males (n = 46) with females (n = 50); OR < 1 indicates lower odds in males. No association met the FDR-adjusted significance threshold. Gender showed nominal unadjusted associations with elbow, wrist/hand, and knee symptoms, with lower odds in males than females. None remained significant after FDR correction (adjusted p = 0.313 for each).

Table 3. Association between gender and 12-month musculoskeletal symptoms

Body region	Fisher exact p	OR (95% CI)	BH-adjusted p
Neck	1.000	1.00 (0.39–2.57)	1.000
Shoulders	0.540	0.72 (0.32–1.61)	0.881
Elbows	0.025	0.28 (0.09–0.86)	0.313
Wrists/hands	0.030	0.35 (0.14–0.87)	0.313
Upper back	0.505	0.69 (0.28–1.65)	0.861
Lower back	0.208	1.80 (0.78–4.16)	0.623
Hips/thighs	0.717	0.63 (0.14–2.79)	0.954
Knees	0.024	0.22 (0.06–0.84)	0.313
Ankles/feet	0.393	0.56 (0.17–1.80)	0.853

Lower-back symptoms showed a nominal association with age group (Monte Carlo $p = 0.036$), but the association was not significant after FDR correction (adjusted $p = 0.327$). Because subgroup-specific prevalence is not shown, the direction of this association cannot be determined from the omnibus test alone.

Table 4. Association between age group and 12-month musculoskeletal symptoms

Body region	χ^2	Monte Carlo p	Cramér's V	BH-adjusted p
Neck	7.43	0.061	0.28	0.407
Shoulders	5.68	0.130	0.24	0.584
Elbows	1.71	0.679	0.13	0.954
Wrists/hands	6.89	0.074	0.27	0.425
Upper back	1.38	0.727	0.12	0.954
Lower back	8.36	0.036	0.30	0.327
Hips/thighs	0.41	1.000	0.07	1.000
Knees	2.69	0.445	0.17	0.853
Ankles/feet	0.75	0.940	0.09	1.000

Age groups: 25–30 ($n = 32$), 31–35 ($n = 48$), 36–40 ($n = 12$), and >40 years ($n = 4$). The very small oldest subgroup limits stability and interpretation.

Knee symptoms produced the smallest unadjusted p -value for working days per week (Monte Carlo $p = 0.007$), but the FDR-adjusted p -value was 0.164. This finding is exploratory, and the direction cannot be interpreted without subgroup-specific counts.

Table 5. Association between working days per week and 12-month musculoskeletal symptoms

Body region	χ^2	Monte Carlo p	Cramér's V	BH-adjusted p
Neck	10.08	0.065	0.32	0.407
Shoulders	3.68	0.615	0.20	0.946
Elbows	2.55	0.810	0.16	0.998
Wrists/hands	6.07	0.299	0.25	0.738
Upper back	2.78	0.750	0.17	0.965
Lower back	8.74	0.115	0.30	0.584
Hips/thighs	6.96	0.192	0.27	0.623
Knees	16.44	0.007	0.41	0.164
Ankles/feet	4.62	0.474	0.22	0.853

Groups: 2, 3, 4, 5, 6, and 7 days/week. Some groups contained only four participants; subgroup estimates are therefore sparse.

Hip/thigh symptoms showed a nominal association with daily working hours (Monte Carlo $p = 0.008$; adjusted $p = 0.164$). Only eight participants reported hip/thigh symptoms, making this estimate particularly unstable.

Table 6. Association between daily working hours and 12-month musculoskeletal symptoms

Body region	χ^2	Monte Carlo p	Cramér's V	BH-adjusted p
Neck	0.90	0.707	0.10	0.954
Shoulders	1.92	0.462	0.14	0.853
Elbows	0.40	0.914	0.06	1.000
Wrists/hands	1.60	0.488	0.13	0.854
Upper back	2.47	0.316	0.16	0.738
Lower back	0.68	0.723	0.08	0.954
Hips/thighs	11.10	0.008	0.34	0.164
Knees	5.50	0.061	0.24	0.407
Ankles/feet	4.17	0.124	0.21	0.584

Groups: 1–5 ($n = 15$), 6–10 ($n = 73$), and >10 hours/day ($n = 8$).

No association between daily patient caseload and symptoms in any anatomical region met either the nominal or FDR-adjusted threshold. Patient count alone may not capture procedure duration, case complexity, recovery time, or postural exposure.

Table 7. Association between patients treated per day and 12-month musculoskeletal symptoms

Body region	χ^2	Monte Carlo p	Cramér's V	BH-adjusted p
Neck	3.81	0.149	0.20	0.585
Shoulders	1.68	0.431†	0.13	0.853
Elbows	3.45	0.178	0.19	0.623
Wrists/hands	1.58	0.444	0.13	0.853
Upper back	1.34	0.545	0.12	0.881
Lower back	0.11	0.948†	0.03	1.000
Hips/thighs	0.40	0.879	0.06	1.000
Knees	2.53	0.316	0.16	0.738
Ankles/feet	0.62	0.849	0.08	1.000

Groups: 1–5 ($n = 38$), 6–10 ($n = 44$), and >10 patients/day ($n = 14$). †Asymptotic chi-square p-values are reported for shoulders and lower back because all expected cell counts for these two regions met the assumption for the chi-square approximation (all expected counts ≥ 5); Monte Carlo exact p-values are reported for the remaining regions because at least one expected cell count was <5.

Knee symptoms showed a nominal association with working position (Fisher exact $p = 0.008$; OR for seated versus standing = 0.18, 95% CI 0.05–0.62), indicating higher odds among dentists who predominantly stood. The adjusted p-value was 0.164; therefore, this result remains exploratory.

Table 8. Association between predominant working position and 12-month musculoskeletal symptoms

Body region	Fisher exact p	OR (95% CI)	BH-adjusted p
Neck	0.807	1.24 (0.48–3.20)	0.998
Shoulders	1.000	1.00 (0.45–2.21)	1.000
Elbows	0.614	0.75 (0.28–2.04)	0.946
Wrists/hands	0.377	0.64 (0.27–1.51)	0.848
Upper back	0.824	0.90 (0.37–2.18)	0.998
Lower back	0.198	0.54 (0.22–1.29)	0.623
Hips/thighs	1.000	1.10 (0.25–4.90)	1.000
Knees	0.008	0.18 (0.05–0.62)	0.164
Ankles/feet	0.236	0.43 (0.14–1.37)	0.676

Odds ratios compare seated ($n = 58$) with standing ($n = 38$); OR < 1 indicates lower odds among seated dentists. No association met the FDR-adjusted significance threshold.

Rest-break duration was not associated with symptoms in any anatomical region. Because the analysis excluded participants who reported no break, it evaluates duration among break takers and does not test whether taking a break is protective.

Table 9. Association between rest-break duration and 12-month musculoskeletal symptoms among participants reporting a break ($n = 83$)

Body region	χ^2	Monte Carlo p	Cramér's V	BH-adjusted p
Neck	3.30	0.200	0.20	0.623
Shoulders	0.89	0.721	0.10	0.954
Elbows	1.01	0.652	0.11	0.954
Wrists/hands	1.73	0.464	0.14	0.853
Upper back	0.08	1.000	0.03	1.000
Lower back	2.51	0.287	0.17	0.738
Hips/thighs	0.30	1.000	0.06	1.000
Knees	4.33	0.147	0.23	0.585
Ankles/feet	2.16	0.302	0.16	0.738

Break-duration groups: ≤ 30 , 31–60, and >60 minutes. Participants reporting no rest interval ($n = 13$) were not included in this duration analysis.

Discussion

This study found a high prevalence of self-reported musculoskeletal symptoms among dentists in Western Libya. The neck, lower back, and shoulders were the most frequently affected regions, and more than half of symptomatic participants in these regions reported that symptoms had limited normal work or activities. These descriptive findings indicate an important occupational-health burden, although the questionnaire does not establish a clinical diagnosis or prove work causation.

The anatomical pattern is consistent with international evidence identifying the cervical and lumbar spine and shoulders as major symptom sites in dental professionals [3,4,15]. The 12-month prevalence estimates for lower-back and shoulder

symptoms were also similar to those reported in the earlier Western Libyan survey [8]. Comparisons across studies should nevertheless be interpreted cautiously because sampling methods, clinic settings, participant characteristics, and questionnaire administration may differ.

The functional impact deserves attention. Among participants with wrist/hand or elbow symptoms, 62.5% and 60.0%, respectively, reported limitation of normal activities or work. Because fine motor control is central to dental practice, upper-limb symptoms may have practical consequences even when their prevalence is lower than that of axial symptoms. However, the NMQ limitation item refers broadly to normal work or activities at home or away from home and should not be interpreted exclusively as inability to perform clinical duties.

No demographic or occupational association remained statistically significant after correction for 63 comparisons. The nominal associations involving gender, age, working days, daily hours, and standing posture should therefore be viewed as hypothesis-generating. The findings may reflect true site-specific patterns, but they may also be attributable to multiple testing, sparse cells, or uncontrolled confounding. In particular, the oldest age group, the seven-day work group, and the >10-hours group were small, and only eight participants reported hip/thigh symptoms.

The absence of an association with patient caseload does not show that workload is unimportant. Patient count is a crude exposure measure and does not capture procedure type, treatment duration, instrument use, patient positioning, or recovery between cases. Similarly, the analysis of break duration was restricted to participants who reported taking a break and therefore cannot determine whether taking breaks reduces symptoms. Future studies should measure break frequency and content, posture changes, stretching, procedure duration, and objective ergonomic exposures.

The results support practical prevention efforts drawn from the broader dental-ergonomics literature, including education on neutral posture, patient and equipment positioning, task variation, magnification when appropriate, and active microbreaks [2,5]. These recommendations are justified by existing evidence and the high symptom prevalence observed here, but the present cross-sectional data cannot establish the effectiveness of any specific intervention.

This study has several limitations. Its cross-sectional design precludes temporal or causal inference. Symptoms and exposures were self-reported and are subject to recall and common-method bias. The NMQ records musculoskeletal trouble rather than clinically confirmed disorders and does not itself establish occupational attribution. The sample was restricted to Western Libya, and the recruitment procedures and clinic distribution may limit generalizability. Several exposure categories and outcome cells were small, reducing precision. Only univariate associations were reported, so confounding was not addressed. Finally, none of the 63 associations survived FDR correction. Larger studies should prespecify a smaller number of primary outcomes and predictors, report subgroup-specific prevalence, and use multivariable or penalized regression methods when sparse data are expected.

Conclusion

Self-reported musculoskeletal symptoms were common among dentists in Western Libya, particularly in the neck, lower back, and shoulders, and were frequently associated with limitation of normal activities or work. The prevalence findings support the need for ergonomic education and occupational-health monitoring. By contrast, the observed subgroup associations did not remain statistically significant after correction for multiple comparisons and should not be presented as confirmed risk factors. Larger, adequately powered studies with clearer exposure measurement, subgroup cross-tabulations, and prespecified multivariable analyses are needed to identify independent predictors of symptoms.

Conflict of interest. Nil

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