ORIGINAL ARTICLE

Prevalence and Associated Risk Factors of Work-Related Musculoskeletal Disorders Among Oral Health Personnel in Zambia

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ABSTRACT

Background: Musculoskeletal disorders (MSDs) are a major occupational health concern among healthcare professionals, including oral health personnel, due to prolonged static postures, repetitive movements, and awkward working positions. This study aimed to determine the prevalence and associated risk factors of MSDs among oral health personnel in Zambia, identifying significant associations between body regions, work activities, and MSD presentation.

Methods: A cross-sectional survey using a quantitative approach was conducted. Convenient random sampling was applied to recruit participants from the Dental Therapists and Assistants Society of Zambia (DTASZ) database. Those with valid email addresses and telephone numbers were invited to participate. Data were collected using a modified Nordic Musculoskeletal Questionnaire, yielding 130 valid responses for analysis. Logistic regression was used to identify predictors of work impairment due to MSDs.

Results: The twelve-month prevalence of MSDs was 93%, affecting all body parts across all ages and gender groups. The most affected regions were the neck (61.54%), lower back (59.23%), and wrists/hands (51.54%). Occupational risk factors included prolonged standing (41.5%), bending (37.7%), and maintaining the same posture for extended periods (59%), with all three factors having a p-value < 0.05. Recent experience of MSD symptoms (past 7 days) significantly increased the likelihood of being prevented from working (OR 2.46, p = 0.025). A dose-response trend was observed between self-reported severity of impact and functional limitation, though not all associations reached significance.

Conclusion: This study confirms a high burden of MSDs among oral health personnel in Zambia and highlights their significant effect on work performance. These findings underscore the urgent need for targeted ergonomic intervention, occupational health support, inclusion of ergonomic principles in oral health training curricula, and policy reforms to safeguard workforce health and productivity.

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INTRODUCTION

The musculoskeletal system serves as the biomedical foundation of the human body, providing structural support and enabling coordinated movement upon which all other physiological systems rely. Dysfunction in this system can adversely affect an individual's physical, mental, and social well-being, leading to reduced work performance and increased absenteeism.

Musculoskeletal disorders (MSDs) are increasingly prevalent among workers and are a leading cause of early workforce exit due to pain, limited mobility, and reduced dexterity.[3] The medical sector, particularly dentistry, has a high burden of work-related MSDs []. Oral health personnel (OHPs) often work in confined spaces, maintain awkward postures, and perform repetitive tasks for prolonged periods, factors that contribute to MSD development.[4,5]

Despite a growing dental workforce in Zambia, the dentist-to-patient ratio remains critically low (0.13 per 10,000 population),[6] placing a significant workload on practitioners and potentially increasing the risk of MSDs. However, there is limited local data on the prevalence, risk factors, and distribution of MSDs among Zambian OHPs.

The lack of research contradicts the known physical demands of dental practice. MSDs can reduce productivity, increase absenteeism, and contribute to staff turnover. Globally, MSDs are the second most common occupational disease, affecting an estimated 160 million people annually.[7] The World Health Organisation highlights the importance of addressing these disorders to support healthcare workers and performance.

This study was therefore conducted to fill this gap by determining the prevalence and associated risk factors of work-related MSDs among oral health personnel in Zambia. The findings aim to inform policy and promote ergonomic practices in dental service delivery. The objective of this study was to determine the prevalence and associated risk factors of work-related musculoskeletal disorders among oral health personnel in Zambia.

Specific Objectives

- To determine the prevalence of musculoskeletal disorders among oral health personnel in Zambia
- To establish the risk factors associated with musculoskeletal disorders among oral health personnel in Zambia.
- To determine the most affected sub-speciality with musculoskeletal disorders among oral health professionals in Zambia.

Significance of Study

The study investigated the prevalence, areas of the body most affected, sub-specialities among oral health professionals most affected, and the risk factors of MSDs specific to them. Although some studies have been conducted locally, assessing different professions and the prevalence of MSDs among workers, little is known about the prevalence of MSDs and their risk factors.

The findings will contribute to the body of knowledge currently available on the extent of MSDs and the working population in Zambia. The processes for the prevention and effective management of MSDs among Oral health personnel may then be formulated based on the outcomes of this study.

The findings of the study might be used to influence workplace policy, inform the policy formation process, improve staff retention levels, reduce absenteeism, improve mental, physical, and social well-being among workers, and overall job satisfaction.

MATERIALS AND METHODS

Study Design and Setting

This study employed a cross-sectional survey design conducted among oral health personnel in Zambia. A cross-sectional approach was chosen as it allows for data collection at a single point, providing insights into the burden of MSDs and their occupational risk factors.

Study Population and Sampling

The target population comprised oral health personnel registered/affiliated with the Dental Therapists and Assistants Society of Zambia (DTSAZ). A convenient random sampling method was applied to select participants from the DTSAZ database. Inclusion criteria required participants to be actively practising for at least one year. Individuals with pre-existing musculoskeletal conditions unrelated to work were excluded.

A total of 130 oral health personnel responded to the survey, and all responses were deemed valid for analysis

Data Collection

Data were collected using a modified Nordic Musculoskeletal Questionnaire (NMQ), a validated tool widely used to assess the prevalence and distribution of MSDs in occupational settings. To facilitate broad participation, the questionnaire was administered electronically via email and phone-based surveys. The survey captured information on demographic details, work-related activities, and MSD symptoms in various body regions over the past 12 months.

While self-reported data may be subject to recall bias, the questionnaire's structured design and the inclusion of clearly defined time frames were intended to minimise this effect.

Variables and Measurements

The study analysed both independent and dependent variables:

Independent variables: Age, gender, work activities, lifestyle, and personal factors (having children).

Dependent variables: The prevalence of MSDs, measured based on self-reported pain and discomfort in specific body regions.

Data Analysis

Descriptive statistics were used to summarise participant characteristics and MSD prevalence. Chi-square tests examined associations between MSDs and categorical variables such as age, gender, and ergonomic risk factors. Binary logistic regression analysis was performed to determine the relationship between the impact of musculoskeletal disorders and the likelihood of being prevented from normal work. Given the exploratory nature of this study, a significance level of $p < 0.05$ was used, consistent with standard practice in exploratory epidemiological research. Data analysis was performed using STATA version 17.

Ethical Considerations

This study was approved by the Research Ethics Committee, University of Lusaka, under approval number FWA00033228-244(08)/(08)/{2024}, dated 18th November 2024.

All procedures performed in this study involving human participants were per the ethical standards of the institutional and/or national research committee, and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Written informed consent was obtained from all individual participants included in the study. The study did not include any participants under the age of 18.

RESULTS

A total of 130 dental professionals participated in the study, with dental therapists comprising the largest proportion (56.15%), followed by dental surgeons (33.08%), dental technologists (6.92%), dental assistants (3.08%), and orthodontists (0.77%).

Demographic Characteristics of the Respondents

Of the 130 respondents, 85 (65.4%) were male, and 45 (34.6%) were female. The age range of the participants was 18 to 64 years, with most respondents (n = 86, 66.15%) in the 24-34 age category (Table 1).

Table 1: Gender and Age of Respondents

Variable		Number	Percentage (%)
Gender	Male	85	65.38
	Female	45	34.62
	Total	130	100
Age	18-24	6	4.62
	25-34	86	66.15
	35-44	19	14.62
	45-54	18	13.85
	55-64	1	0.77
	Total	130	100

Lifestyle Characteristics

Four respondents (3.08%) reported smoking and 46.4% reported alcohol consumption. The highest prevalence of both smoking and alcohol consumption was observed in the 25-34 age group, with 68.9% alcohol consumption and 50% of smoking occurring in this category.

Relationship between Body Mass Index and MSD prevalence

The analysis explored the association between Body Mass Index (BMI) categories and the prevalence of musculoskeletal disorders (MSDs) among oral health personnel. Out of the 113 participants included in this assessment:

- Normal-weight individuals (46.90%) accounted for the largest proportion, followed by those classified as overweight (30.97%) and obese (18.58%).
- MSD symptoms were observed across all BMI categories, but overweight and obese participants demonstrated a higher prevalence of multiple MSD symptoms compared to those with normal weight.
- Among individuals who experienced MSD symptoms in four or more body regions, the majority were either overweight (50-100%) or obese (100%), suggesting an increasing burden of MSDs with higher BMI.
- Underweight individuals were few (3,54%) and mostly reported MSD symptoms in isolated body regions, limiting further analysis of their risk.
- The Ch-square test ($\chi^2 = 203.54$, $p = 0.062$) suggests a potential relationship where BMI and MSD prevalence, though statistical significance was not confirmed at the $p < 0.05$ threshold.

Prevalence of MSD symptoms by Age and Gender Over the last 12 months.

Among the respondents, 93% of those under 35 years old reported experiencing musculoskeletal disorders (MSDs). The 25-34 age category had the highest frequency (n=81, 66.94%), with 32.23% (n=39) reporting symptoms in at least one body region in the past year. Chi-square analysis found no significant relationship between age and MSD prevalence ($p = 0.97$).

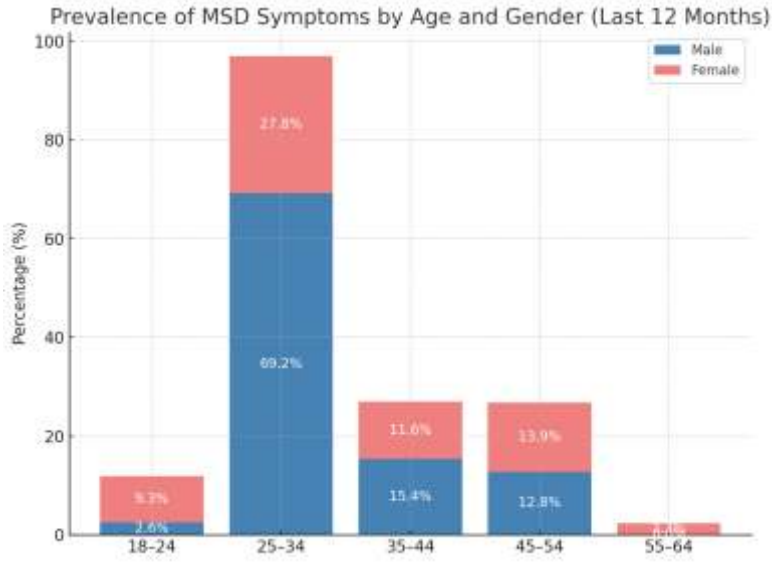

Figure 1: Prevalence of MSD symptoms by age and gender (Last 12 months)

Prevalence of Musculoskeletal Disorder Symptoms in Different Regions of the Body

Neck pain was the most frequently reported symptom in the past 12 months (61.54%), followed by lower back pain (59.23%) and wrist/hand discomfort (51.54%). In an analysis for MSD symptoms in the last 7 days, neck pain was reported by 42.5%, lower back pain by 49.35%, and wrist/hand discomfort by 52.24%. Table 3 presents the detailed distribution of MSD symptoms by body region.

Table 3: Musculoskeletal Symptoms by Body Regions

Region of the Body	Pain in the Last 12 Months	Pain in the Last 7 Days
Neck	80 (61.54%)	32 (42.5%)
Shoulders	62 (47.69%)	32 (51.61%)
Elbows	30 (23.08%)	13 (43.33%)
Wrist/Hand	67 (51.54%)	35 (52.24%)
Upper back	54 (41.54%)	29 (53.7%)
Lower back	77 (59.23%)	38 (49.35%)
Hips/thighs	32 (24.62%)	18 (56.25%)
Knees	38 (29.23%)	17 (44.74%)
Ankles/feet	34 (26.15%)	19 (55.88%)

Ergonomic Risk Factors and Work-Related MSDs

Respondents had between 1 and over 20 years of work experience. Chi-square analysis found no significant association between work experience and MSD prevalence (p = 0.32). Most respondents worked 4-6 hours per day (44.62%), while 3.85% worked over 9 hours daily

Association between ergonomic hazards and frequency of occurrence.

Chi-square analysis revealed significant associations between ergonomic risk factors and professional roles. Dental therapists reported the highest frequency of bending (Chi2 = 52.86, p = 0.01), standing (Chi2 = 50.64, p = 0.01), and maintaining the same posture for extended periods (Chi2 = 52.50, p = 0.01). The results are summarised in Tables 4 and 5.

Table 3: Association between ergonomic hazards and professional role

Activity	Most Frequent Response	Majority Profession	Statistical Significance (Chi^2, p-value)
Bending	Often (42), Always (49)	Dental Therapists	52.86, p = 0.01
Standing	Often (45), Always (54)	Dental Therapists	50.64, p = 0.01
Same Posture for Long Periods	Sometimes (38), Often (44)	Dental Therapists	52.50, p = 0.01
Awkward Postures	Sometimes (46), Seldom (24)	Dental Therapists	29.63, p = 0.02
Overstretching	Sometimes (49), Often (29)	Dental Therapists	28.59, p = 0.03
Vibrations	Never (41), Sometimes (42)	Dental Therapists	21.89, p = 0.15

Table 4: Association between ergonomic hazard and frequency of occurrence

	Chi-Square	Degrees of Freedom	P-Value
Bending	52.86	16	0.0001
Standing	50.64	16	0.0001
Awkward Postures	29.63	16	0.0200
Vibrations	21.89	16	0.1467
Overstretching	28.59	16	0.0269
Maintaining the same posture for long periods	52.50	16	0.0001

Significance = *P-value < 0.05*

Relationship between part of the body and Prevalence of MSD symptoms

A Chi-square analysis was conducted to assess the association between musculoskeletal disorder (MSD) symptoms and specific body regions among oral health personnel.

- Neck pain: A significant association was found between neck pain and its impact on work ($p = 0.001$). Among those reporting neck pain, 8.75% were unable to perform normal work, while 3.75% required time off due to pain.
- Shoulder pain: No significant association was observed ($p = 0.072$). However, 14.52% of respondents with shoulder pain required medical attention, while 77% reported that the pain did not interfere with their work.
- Ankle/foot pain: A significant association was noted ($p = 0.01$). While none of the respondents with this pain required medical attention, 14.71% reported that the pain prevented them from performing normal work.
- Lower back pain: No significant association was found ($p = 0.08$). Despite this, 16.88% of respondents with lower back pain were unable to perform normal work, and 3.9% required time off.
- Upper back pain: A significant association was observed ($p = 0.03$). None of the respondents reported that upper back pain prevented them from normal work, but 3.7% required medical attention, and one respondent needed time off.

These findings highlight variations in the impact of MSD symptoms on work-related activities across different body regions.

Duration of Pain and Its Impact on the Participants' Ability to Work

The relationship between the duration of musculoskeletal pain experienced in the past 12 months and its impact on work ability was analysed. The impact was categorised as no impact, minor, moderate, or severe.

No Pain Reported

Among the 14 participants who did not experience pain in the past year, 42.86% reported no impact on their ability to work, while the remaining 57.14% experienced some level of impact (28.57% minor, 14.29% moderate, and 14.29% severe).

Short-Term Pain (1-7 Days)

Participants who experienced pain for up to one week primarily reported minor (40.28%) or moderate (43.06%) impacts, while 11.11% experienced a severe impact. These findings suggest that short-term pain is generally manageable for most individuals.

Moderate Duration Pain (8-30 Days)

For participants experiencing pain lasting between 8 and 30 days, the majority (65%) reported a moderate impact on their ability to work, while 15% indicated a severe impact. These results highlight that as pain duration increases beyond one week, its effect on work becomes more pronounced.

Longer Duration Pain (>30 Days)

Among participants who experienced pain for more than 30 days, 57.14% reported a moderate impact, while 21.43% experienced a severe impact. Notably, none of the participants in this category reported any impact, emphasising the significant burden of prolonged pain on work performance.

Chronic Pain (Daily Pain)

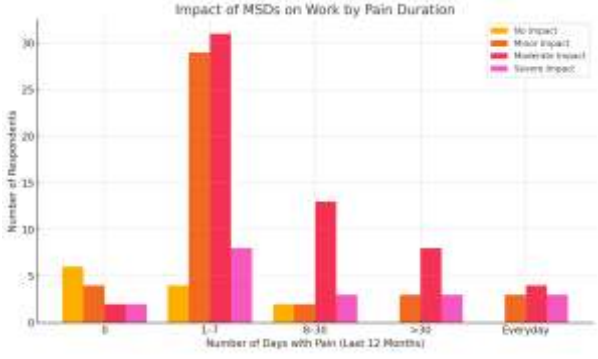

Figure 3: Impact of musculoskeletal disorders (MSDs) on work performance by number of days with pain in the last 12 months. The figure shows the distribution of self-reported work

impact levels, ranging from no impact to severe impact, across five categories of pain duration. Data reflects the responses of 130 oral health personnel. A statistically significant association was observed ($\chi^2 = 33.62$, $p = 0.0008$).

For those experiencing pain every day, 30% reported a severe impact, while 40% experienced a moderate impact. The remaining 30% reported a minor impact, with no participants indicating no impact. These findings underscore the debilitating nature of chronic pain and its persistent disruption of work.

A statistical analysis of the relationship between pain duration and work impact yielded a p-value < 0.01, indicating a highly significant association. This confirms that as the number of days with pain increases, the likelihood of a more severe impact on work also rises.

A logistic regression model was conducted to identify factors associated with being prevented from performing normal work duties due to MSDs. The model included hospitalisation due to MSDs, perceived impact on work, and whether the respondent had experienced pain in the previous seven days. The overall model was statistically significant (($\chi^2(5) = 15.12$, $p = 0.010$), with a Pseudo R^2 of 0.089, indicating that approximately 9% of the variability in work prevention could be explained by the included predictors.

Participants who experienced MSD-related symptoms in the past seven days were significantly more likely to report work prevention, with an odds ratio of 2.46 (p = 0.025, 95% CI: 1.12-5.42), highlighting the strong impact of recent pain episodes on functional ability.

Those who reported a moderate impact of MSDs on their work had 6.63 times greater odds of being prevented from working compared to those who reported no impact (p = 0.084). Although this association was only marginally significant, it suggests a meaningful trend that may warrant further exploration in larger studies.

While hospitalisation and severe impact categories showed elevated odds, these findings did not reach statistical significance. The wide confidence intervals suggest variability or possible limitations in sample size for those groups.

Overall, the model suggests that recent pain and perceived moderate impact on work are key factors associated with work disruption due to MSDs.

Table 5: Logistic Regression Analysis Predicting Functional Impairment (Being Prevented from Normal Work) Among Oral Health Personnel. *Note: Odds ratios (OR), 95% confidence intervals (CI), and p-values are reported.*

Prevented from Normal work	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
Have you been hospitalised in the last 12 months? *(ref: no)*	1	.	.	.	.	.	
Yes	2.291	3.436	0.55	.581	.121	43.345	
What impact do MSDs have on your work? *(ref: No impact)*	1	.	.	.	.	.	

Prevented from Normal work	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
Minor Impact	3.399	3.787	1.10	.272	.383	30.173	
Moderate Impact	6.626	7.248	1.73	.084	.776	56.545	*
Severe Impact	5.709	6.627	1.50	.133	.587	55.541	
Have you suffered from MSD symptoms in the last 7 days? *(ref: No)*	1	.	.	.	.	.	
Yes	2.462	.991	2.24	.025	1.118	5.421	**
Constant	.082	.086	-2.38	.017	.01	.642	**

Mean dependent var	0.362	SD dependent var	0.482
Pseudo r-squared	0.089	Number of obs	130
Chi-square	15.120	Prob > chi2	0.010
Akaike crit. (AIC)	166.997	Bayesian crit. (BIC)	184.202

**** p<.01, ** p<.05, * p<.1*

DISCUSSION

The present study investigated the prevalence of, and identified risk factors associated with, work-related musculoskeletal disorders among oral health personnel in Zambia.

MSD Prevalence Trends

This study revealed a high prevalence of work-related musculoskeletal disorders (MSDs) among OHPs in Zambia (93%), consistent with global data showing MSDs as one of the most common occupational health issues affecting health workers.[1, 3, 7, 8] Similar studies conducted in Low to Middle-Income Countries (LMICs) such as Nigeria and India have reported MSD prevalence rates ranging from 60% to 90% among dental professionals, aligning with our findings. The concentration of cases in the 25-34 age group may indicate early onset of occupational strain, likely due to lack of training in ergonomics and insufficient exposure to preventive strategies during professional education, a trend previously observed by Li *et al*. in healthcare settings.[2]

Ergonomic Risks

Dentistry is globally recognised as a physically demanding profession that requires static and awkward postures, repetitive hand movements, and sustained visual concentration.[4, 5] These occupational exposures are compounded in Zambia by systemic constraints such as outdated equipment, poor lighting, and limited ergonomic support infrastructure in public dental clinics. International literature links such factors with increased biomechanical stress and a higher incidence of MSDs among oral health workers.[5] In our context, these challenges are worsened by human resource limitations, as evidenced by the low dentist-to-patient ratio (0.13 per 10,000),[6] resulting in excessive patient loads that elevate ergonomic risk.

Profession-Specific Vulnerabilities

The burden of MSDs was more pronounced among dental therapists and technologists than among dentists. Similar findings have been reported in studies from comparable resource-constrained settings, where mid-level providers deliver the bulk of clinical services.[3, 4] Dental technologists, for instance, often engage in prolonged, seated tasks involving fine motor work with limited opportunity for posture variation.[9] Conversely, therapists report high patient volumes and longer clinical hours, both known MSD risk factors.[3] Unlike dentists, these cadres may lack autonomy in pacing their work and have limited access to ergonomic modifications, increasing their vulnerability.

Implications for Rehabilitation and Policy

The implications of these findings are both clinical and policy oriented. MSDs are known to reduce productivity, impair clinical performance, and contribute to staff attrition and early retirement.[10] Evidence from this study further underscores these concerns: respondents who experienced MSD symptoms in the past seven days were twice as likely to be prevented from performing their normal work duties (OR = 2.46, p = 0.025). Moreover, participants reporting a moderate perceived impact of MSDs on their work had nearly seven times greater odds of being functionally limited (OR = 6.63, p = 0.084), emphasising the significant role of symptom severity in shaping work outcomes.

Although hospitalisation was not statistically significant in the model, the elevated odds (OR = 2.29) point toward the cumulative burden MSDs may place on both individuals and health systems, particularly in settings with limited rehabilitative infrastructure. These findings reinforce the urgency of early intervention, targeted rehabilitation, and systematic ergonomic improvements, yet Zambia lacks localised strategies to mitigate these risks.[2, 3, 7]

Ergonomics training should be integrated into professional curricula and in-service continuing education programs.[11] Institutional investments in ergonomic dental chairs, magnification loupes, and scheduled breaks could mitigate physical strain.[4, 12] Furthermore, health system planning must consider rehabilitative support services such as physiotherapy and occupational health consultations to address the cumulative burden of MSDs.[13]

LIMITATIONS

While this study provides valuable insights into the prevalence and associated risk factors of musculoskeletal disorders (MSDs) among oral health personnel, several limitations should be acknowledged.

First, the study employed a cross-sectional design, which limits the ability to establish causal relationships between risk factors and MSD symptoms. A longitudinal approach would provide a clearer understanding of how MSDs develop over time.

Second, the study relied on self-reported data, which may introduce recall bias or response bias. Participants may have underreported or overreported their symptoms due to personal perception, memory constraints, or social desirability factors. Objective clinical assessments, such as physical examinations or biochemical analyses, could enhance the reliability of findings in future research.

Third, the sample size and selection may limit the generalisability of the findings. Although the study included a diverse group of oral health personnel, the results may not fully represent all the professionals

in different clinical settings, particularly those in rural or under-resourced areas.

Additionally, the study did not account for psychological factors, such as stress and mental health, which have been linked to MSD prevalence in healthcare workers. Incorporating these variables in future research could provide a more comprehensive understanding of MSD risk among dental professionals.

Finally, while the study examined ergonomic risk factors, it did not objectively assess posture, workstation setup, or workload intensity. Future studies could integrate observational analyses or wearable sensor technology to measure these factors with greater precision.

Despite these limitations, the study contributes important findings to the field and highlights the need for targeted ergonomic interventions to mitigate MSD risks among oral health personnel.

CONCLUSION

This study highlights the high prevalence of MSDs among oral health personnel, with the lower back, neck and shoulders being the most affected regions. Significant associations were observed between MSD prevalence and ergonomic risk factors, reinforcing the impact of prolonged awkward postures and repetitive tasks on musculoskeletal health. The findings also indicate that younger professionals and certain professional roles, such as dental therapists and assistants, may be at greater risk. However, further research is needed to confirm these trends.

Given the substantial burden of MSDs in this occupational group, targeted ergonomic interventions, workplace modifications, and structured education programs are essential to mitigate risks and improve long-term musculoskeletal health. These findings also support the integration of ergonomics into oral health training curricula to better prepare professionals for the physical demands of their work. Future research should adopt longitudinal designs and objective assessment methods to understand the progression of MSDs and evaluate the effectiveness of preventive strategies. Addressing these challenges is crucial for enhancing the well-being and productivity of oral health professionals.

Conflict of interest

The authors have no competing interests, financial or otherwise.

Funding Declaration

The authors received no funding for this study.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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