

Burden of Musculoskeletal Disorders among Recent Dental Graduates in Saudi Arabia: A National Survey

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ABSTRACT

Introduction: Musculoskeletal Disorders (MSDs) are one of the most prevalent occupational hazards affecting dental professionals.

Aim: To assess the prevalence and associated risk factors of MSDs among recent dental graduates in Saudi Arabia and evaluates their practice of ergonomics as well as the impact of MSDs on their daily activities.

Materials and Methods: This cross-sectional study was carried out among all dental interns (n=1552) who graduated from dental schools in Saudi Arabia in the academic year 2018-2019. Data was collected between January 2019 to March 2019 through online survey via SurveyMonkey™. Through the questionnaire, data about participants' demographics, symptoms of MSDs in the previous 12 months, preventive ergonomic working practices, effects of MSDs on their daily activities, and coping strategies were collected. Descriptive statistics, including mean±Standard Deviation (SD) were computed for continuous variables, while frequencies and percentages were computed for categorical variables.

Results: In total, 889 dental interns participated in this study (response rate of 57.3%). A total of 54.3% of the participants experienced symptoms of MSDs in atleast one body part in the previous 12 months. The neck (41%), shoulder (37%), and lower back (31.9%) were the most affected regions. Female interns demonstrated a significantly higher risk of presenting with MSDs than male participants (OR: 2.3, CI: 1.7, 3.1). Alternative therapy was the most reported strategy for dealing with pain (44%, n=190). In total, 58.2% of the interns who presented with MSDs had their daily activities affected (n=251).

Conclusion: MSDs are significant health problems among recent dental graduates in Saudi Arabia affecting the daily activities of the majority of those affected. Females were at higher risk of developing MSDs than males. To prevent this issue, dental school authorities should develop and implement strategies to ensure effective integration of ergonomics education in dental school curricula.

Keywords: Dental education, Dental students, Dentists, Ergonomics, Occupational health

INTRODUCTION

In the last decades, there has been increasing awareness of occupational hazards associated with healthcare professions. According to the World Health Organisation (WHO), approximately 59 million healthcare workers around the world are exposed to hazardous occupational environments, which could lead to an increase in the incidence of disease and injury, negatively affecting their physical and psychological well-being [1].

In particular, dental professionals are at high risk of developing occupational health problems. Dentists are predisposed to multiple health hazards, including potential exposure to infectious diseases, percutaneous incidents, eye injuries, hearing loss, allergic skin reactions, radiation exposure, psychological problems, and MSDs [2,3].

According to the WHO, MSDs can be defined as "Disorders of the muscles, tendons, peripheral nerves, or vascular system not directly resulting from an acute or instantaneous event (e.g., slips and falls)" [4]. MSDs constitute a major occupational health problem for dental practitioners. In a systematic review, the prevalence of musculoskeletal pain among dentists worldwide ranged between 46% to 93%. The affected areas were predominantly shoulders, upper limbs, upper and lower back, and the neck region [5].

Several studies suggest that multiple and complex factors contribute to the high prevalence of MSDs among dental professionals [5]. These factors include awkward body postures, repetitive hand and wrist motion, long working hours spent in static positions, frequent use of vibrating tools, and high work intensity [6]. Additional contributing factors include a high number of scheduled patients and the time spent on each one, frequent forward and sideways body bending in search of better visibility [5,7], and increased Body

Mass Index (BMI) (overweight and obesity) [8] as it is associated with increased mechanical demands and forces across the joints [9,10]. MSDs negatively impact dental practitioners' daily lives, potentially affecting general health and well-being. Consequently, they can contribute to more frequent sick leaves, reduced work quality and productivity, and premature retirement [3,11].

Comprehensive ergonomic strategies have been suggested to reduce the incidence of MSDs. Ergonomics is defined as "a set of multidisciplinary knowledge applied to the organisation of labor activities and elements that make up a job." Ergonomics in the dental field aims to improve the working environment to make it healthier, safer, and more comfortable, in order to prevent health problems and increase productivity [12]. Healthy ergonomic practices should be adopted by dental professionals early during their undergraduate clinical training. By offering adequate ergonomic education and training, dental schools can better prepare their students for safer work-based practices.

Identifying the current state of ergonomic education at dental schools by evaluating the extent of MSDs and ergonomic awareness is important, especially among recent dental graduates. To our knowledge, a paucity of data exists on MSDs in this specific population. To address this gap in the literature, a national survey was conducted among recent dental graduates in Saudi Arabia, with the following objectives: (1) assessing the prevalence of MSDs; (2) determining possible risk factors; (3) evaluating their ergonomic practice; (4) and evaluating the impact of MSDs on their daily activities. The findings of this study would provide valuable information for educators and dental school authorities, as the foundation for early interventions to improve the quality of life of future dentists.

MATERIALS AND METHODS

This was a cross-sectional, nationwide study carried out among recent dental graduates (interns) in Saudi Arabia. The study was approved by Institutional Review Board (Ref. No. 18/0679/IRB; Approval of Research Project No. E-18-3372) and the College of Dentistry Research Center (CDRC NO.IR 0293) at King Saud University.

Inclusion criteria: All dental interns who graduated from public or private dental schools in Saudi Arabia in the 2018-2019 academic year (n=1552) were invited to voluntarily participate in the study.

Exclusion criteria: Interns with scoliosis, kyphosis, those at risk of lumbar degenerative disc disease, and those with a history of lower extremity muscle tear or disc hernia surgery were excluded from the study. In addition, female interns who were in the third trimester of pregnancy were also excluded.

Data Collection

Data was collected between January 2019 to March 2019 using a self-administered, anonymous, online questionnaire through SurveyMonkey™ [13]. The survey link was e-mailed to the intern coordinators of all dental schools in Saudi Arabia, with request to forward it to the dental interns of their schools. Together with the link to the survey, respondents received a description of the survey's purposes, and they were assured about the confidentiality of the data collected. Next, intern coordinators were asked to send reminder e-mails to the interns two weeks after the initial e-mail message, followed two weeks later by a third e-mail to ensure greater participation.

Survey Description

The survey was written in English and included 30 closed-ended questions. For evaluations of the musculoskeletal complaints, a revised form of the Standardised Nordic Musculoskeletal Questionnaire (SNQ) was used [14]. It is a validated instrument for evaluating the prevalence of MSDs that has been used for the same purpose in several professions and various medical fields. The instrument assesses general and regional musculoskeletal symptoms such as ache, pain, discomfort, or numbness. First, respondents were asked if they suffered from any musculoskeletal symptoms over the last 12 months. For those who answered yes, a human body diagram with nine symptom sites (cervical, shoulders, upper back, elbows, low back, wrist/ hands, hips/thighs, knees, and ankle/feet) was presented for them to identify the area where they had MSDs symptoms.

Additionally, the study investigators developed questions based on previous publications [15,16] to gather data on: (1) participants demographic and background information; (2) ergonomic working practices; (3) the effect of musculoskeletal symptoms on daily activity; and (4) coping strategies to improve the musculoskeletal symptoms. The first section was designed to collect background information from study participants including the following: age, sex, height, weight, pregnancy status (for females only, if the answer was yes, they were required to specify in which trimester), handedness, weekly exercise frequency, and type of dental school they attended (private versus government).

The second section was designed to collect information on participants' ergonomic working practices: posture awareness, performing stretching exercises after finishing from dental work, performing dental procedures with magnifying loupes, avoiding excessive bending and twisting for better access to or visibility within the oral cavity, and positioning the chair to maintain an ergonomic posture. Those questions presented three response categories (very often, occasionally, never). Participants who presented with MSDs were instructed to answer the last section of the survey in which they were asked about: (1) whether the MSDs affected their daily routines and activities; and (2) coping strategies to improve the musculoskeletal symptoms, including seeking medical attention,

medications, alternative therapy (e.g., acupuncture, massage, physiotherapy, applying hot packs, etc.), or taking a sick leave.

Survey Validation

The content validity of the survey was established through feedback from experts in occupational medicine, survey design, statistics, and dental public health. The face validity of the questionnaire was confirmed by ten dental interns who were excluded from the study, each of them assessed the clarity of the questions and the duration to complete the survey. Modifications were applied based on feedback from face and content testing.

STATISTICAL ANALYSIS

Data were analysed using SAS software version 9.4 (SAS Institute Inc., Cary, NC, USA). Descriptive statistics, including means±standard deviation, were computed for continuous variables, while frequencies and percentages were computed for categorical variables. Simple and multiple logistic regressions were used to determine if any of the independent variables (age, gender, weight status, dominant hand, exercise, types of dental school, and ergonomics working practices) were associated with the overall MSDs prevalence. Then, variables with a p-value <0.25 in the bivariate analysis were exported into the final multivariate model. Results were considered statistically significant for p-values ≤0.05.

RESULTS

A total of 889 interns completed the survey, yielding a response rate of 57.3%. Eight female participants were excluded because they were in the third trimester of their pregnancy. Eighty-seven interns were excluded due to medical problems, including scoliosis, disc hernia surgery, lumbar degenerative disc disease, kyphosis, and a history of muscular tear of lower members. The total number of interns included in the analysis was 794. No questions presented over 5% of missing values. The participants' average age was 24.8 years. The majority of participants were females (54.8%, n=435), majority attended undergraduate education in public dental schools (65.2%, n=518), [Table/Fig-1].

Variables	Frequency	Percentage (%)
Age (mean±SD)	24.8±1.2	-
Gender		
Male	359	45.2
Female	435	54.8
Weight status		
Less than healthy (BMI <18.5)	51	6.4
Healthy (18.5 ≤BMI ≤25)	477	60
Overweight (25 <BMI ≤30)	196	24.7
Obese (BMI >30)	70	8.8
Dominant hand		
Right	703	88.5
Left	78	9.8
Both	13	1.6
Exercise		
Never	386	48.6
Less than two times a week	119	15
Two to three times a week	175	22
Four or more times a week	114	14.4
Type of dental school		
Government	518	65.2
Private	276	34.8

[Table/Fig-1]: Background sample characteristics for dental interns in Saudi Arabia (n=794).

BMI: Body mass index

Musculoskeletal Symptoms

In total, 54.3% of participated dental interns (n=431) experienced symptoms of MSDs in atleast one body part in the previous 12 months. The most commonly affected region was the neck (41%, n=325), followed by shoulders (37%, n=293), and lower back (31.9%, n=253) [Table/Fig-2].

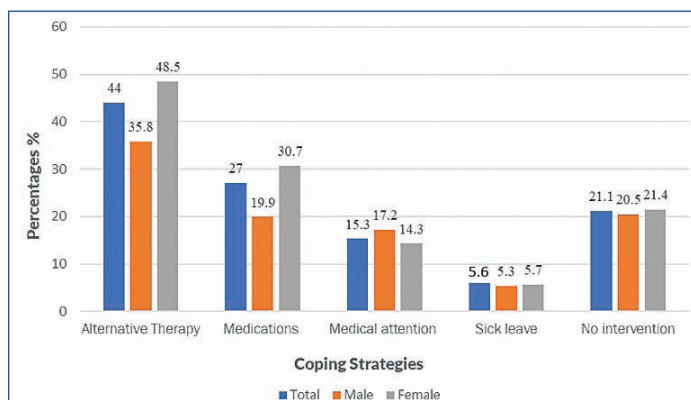
Area	Total N=794 n (%)	Female N=435 n (%)	Male N=359 n (%)	Chi-square Female/Male p-value
Neck	325 (41.0)	216 (49.7)	109 (30.4)	<0.0001
Shoulder	293 (37.0)	210 (48.3)	83 (23.1)	<0.0001
Upper back	187 (23.6)	135 (31.0)	52 (14.5)	<0.0001
Elbow	100 (12.6)	69 (15.9)	31 (8.6)	0.0023
Wrist/hand	200 (25.2)	141 (32.4)	59 (16.4)	<0.0001
Lower back	253 (31.9)	151 (34.7)	102 (28.4)	0.06
Thigh	87 (11.0)	58 (13.3)	29 (8.1)	0.02
Any site	431 (54.3)	280 (64.4)	151 (42.1)	<0.0001

[Table/Fig-2]: The prevalence of MSDs in terms of body regions for all participants, stratified by gender.

p-value <0.05 considered significant

When stratified by gender, more females than males reported MSDs in atleast one body region (64.4% versus 42.1%, respectively). The largest gender variation in the prevalence of MSDs was found for the shoulders (48.3% for females versus 23.1% for males) [Table/Fig-2].

Among the participants who experienced musculoskeletal symptoms, sick leave was taken by 5.56% (n=24), medication was taken by 27% (n=116), and medical attention was sought by 15.3% (n=66). Alternative therapy (e.g., acupuncture, massage, physiotherapy, hot packs, etc.) was the most reported strategy for dealing with pain (44%, n=190, [Table/Fig-3]). In total, 58.2% of the interns who presented with MSDs had their daily activities affected (n=251).



[Table/Fig-3]: Coping strategies to improve the musculoskeletal symptoms for all study participants, stratified by gender.

Ergonomic Working Practices

Participants' ergonomic practices were evaluated through questions about posture awareness, performance of stretching exercises after work, use of dental loupes, avoiding excessive body bending and twisting, and maintenance of ergonomic postures during clinical work. Only 102 (12.9%) of dental interns frequently avoided excessive bending and twisting during work [Table/Fig-4]. The majority reported occasional awareness of their posture while undertaking clinical procedures (61.8%, n=488), occasional performance of stretching exercises after finishing dental work (50.8%, n=401), and occasional positioning of the chair to maintain an ergonomic posture (62.5%, n=494). Only 12.4% (n=98) of the participants reported frequent use of dental loupe during clinical work.

Factors Associated with MSDs

[Table/Fig-5] presents the bivariate and multivariate association between MSDs prevalence and selected sample characteristics using

Variables	Never N (%)	Occasionally N (%)	Very often N (%)
Are you aware of your posture while undertaking clinical procedures?	131 (16.5)	488 (61.8)	171 (21.7)
In a regular working day, how often do you perform stretching exercises after finishing from dental work?	258 (32.7)	401 (50.8)	131 (16.5)
In a regular working day, how often do you perform your dental procedures with magnifying loupes?	482 (61)	210 (26.6)	98 (12.4)
In a regular working day, how often do you avoid excessively bending and twisting yourself for better access to or visibility within the oral cavity?	228 (28.9)	460 (58.2)	102 (12.9)
In a regular working day, how often do you position your chair to maintain an ergonomic posture?	144 (18.2)	494 (62.5)	152 (19.2)

[Table/Fig-4]: Ergonomics working practices among dental interns in Saudi Arabia*.

*4 participants had missing data related to ergonomics working practices questions

Variables	MSDs			
	Crude OR	95% CI	Adjusted OR	95% CI
Gender				
Male (reference)	-		-	
Female	2.5	1.9, 3.3**	2.3	1.7, 3.1**
Type of dental school				
Governmental (reference)	-		-	
Private	1.5	1.1, 2.1**	1.3	0.9, 1.8
Avoiding excessive bending or twisting				
Never	1.6	1.02, 2.6**	1.6	1, 2.6
Occasionally	0.9	0.6, 1.3	1	0.6, 1.5
Very often (reference)	-		-	

[Table/Fig-5]: Bivariate and multivariate logistic regression models for factors associated with MSDs among dental interns in Saudi Arabia.

**Statistically significant at alpha=0.05; OR: Odds ratio; CI: Confidence interval

logistic regression models. Bivariate analyses showed that gender, type of dental school, and avoiding excessive bending and twisting during work were significantly associated with MSDs in the evaluated sample. None of the other background or working practice factors showed a statistically significant association with the prevalence of MSDs.

After controlling for other co-variables, only gender remained statistically significantly associated with the prevalence of MSDs. Female interns demonstrated a 2.3 times higher risk of presenting with MSDs as compared to male participants {Confidence interval (CI): 1.7, 3.1}.

DISCUSSION

This study investigated the prevalence of MSDs among dental interns who graduated from public and private dental schools in Saudi Arabia. In total, 54.3% of the participants suffered from work-related MSDs in the previous 12 months. When compared to dental students from other countries, MSDs prevalence in Saudi Arabia was higher than in the United States (46%) [17], and lower than in Colombia (80%) [18]. The observed differences in MSDs prevalence between these studies and the current results can be attributed to differences in the levels of education of the study participants, the depth of ergonomic training, and accessibility to an ergonomic working environment. The overall high prevalence of MSDs among recent dental graduates suggests that dental professionals exhibit an increased risk for developing these work-related conditions, which is evident from the early stages in their professional careers.

In the present study, the most frequently involved body sites were the neck (41%), the shoulders (37%), and the lower back (31.9%). This in accordance with most studies examining MSDs according to body region, as highlighted in the systematic review by Lietz J et al., [19]. The prolonged static load resulting from sustained muscle activity in the sternocleidomastoid or trapezius muscles has been

described as the primary contributing factor for neck pain among dental professionals [8]. The relatively high prevalence of shoulder pain among study participants can be explained by the frequent shoulder overload caused by prolonged arm elevation and frequent forward-leaning of the body while sitting or standing [20]. The third most affected area was the lower back, which can be linked to the overload of the spine during clinical work. When dentists sit down, they tend to bend their heads excessively; thus, the rest of the body tends to assume awkward positions. When standing during dental clinical work, the lumbar spine tends to twist in unnatural postures [20].

Gender was found to be the most significant risk indicator for work-related MSDs in the present study. This finding is in line with those of previous studies [21,22] that reported a higher prevalence of work-related MSDs in female dental students than in male ones. Smaller body size, lower muscle tone, higher stress levels, and psychosocial factors are likely to explain the higher risk for MSDs in females [23,24]. Female dental students and practitioners should aware of this finding to implement ergonomics principles during clinical work from an early stage in their careers to prevent MSDs.

The extent to which MSDs can affect dental professionals was evident in this study, with 66 participants who reported MSDs required medical attention, and 58.2% having their daily lives affected by these conditions. In a survey from India, where most participants demonstrated under 10 years of practice, medical consultations due to MSDs were required by 41-47% of the sample, and sick leave was taken by 30% of the participants in the previous 12 months [25]. Despite the lower rate of sick leave observed in the present study (5.56%) when compared to the study from India (30%) [25], the current findings are alarming given that the participants just started their clinical careers.

Results from the present study suggest that dental students should be mindful of their body positioning during patient treatment before starting their career as dental professionals, and the development of MSDs early in life can raise serious concerns about physical health and career longevity. The working habits of dental professionals are formed during the first graduate years. Hence, creating awareness about ergonomics early during undergraduate training is important. A systematic review by Lietz J et al., found that ergonomic education was effective in decreasing work-related MSDs and improvement of working posture among dental professionals [26].

Therefore, dental students should be educated on the incorporation of different preventive measures to their clinical routine to decrease the risk of developing MSDs, such as dynamic sitting, avoidance of prolonged static postures or excessive twisting motions, regular practice of physical exercise, and periodic breaks and stretching. Additionally, students' working posture and compliance with ergonomic recommendations should be continually monitored and evaluated during their studies. Currently, whether dental schools provide sufficient ergonomic education in their graduate curriculums is unknown. Therefore, future research should explore the extent of ergonomic education received by undergraduate dental students.

Limitation(s)

The cross-sectional study design, limits causal inferences. Another limitation is the potential selection bias, as individuals experiencing MSDs might be more likely to take part in the survey, thus resulting in an overestimation of the prevalence of these conditions. The use of a self-reporting survey is another limitation of the study, which could potentially lead to recall bias. Despite the shortcomings, to the best of our knowledge, our study is the first to report the national prevalence of MSDs among recent dental graduates in Saudi Arabia. The large sample size and the uniformity of the sample indicate the generalisability of the findings. Furthermore, the large sample size and the relatively high participation rate (57%) indicate a reduced risk of non response bias, supporting the validity of the study. Finally, a well-validated tool (the modified version of the SNQ) was used to

measure MSDs prevalence among study participants, reducing the risk for misclassification bias.

CONCLUSION(S)

The results of this study suggest that MSDs are prevalent health problems among recent dental graduates in Saudi Arabia impacting the daily activities of the majority of those affected. The neck, shoulders, and lower back were found to be the most frequently affected regions. Females were at higher risk of developing MSDs than males. Healthy ergonomic practices were not frequently performed by the majority of surveyed participants. The high prevalence of musculoskeletal symptoms in recent graduates suggests that ergonomics should be included in the dental curriculum to reduce the risk of work-related MSDs. These findings can be used to increase dentists' awareness of their physical health and MSDs and to decrease occupational health hazards associated with the practice of dentistry.

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