



The Workload of Dental Practice: Musculoskeletal Disorders among Clinical Year Dental Students

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Abstract. Prior research has examined musculoskeletal disorders in dentistry, but clinical year dental students face unique risks due to the demanding educational process, practical examinations, and psychological pressure from fulfilling graduation requirements. This study aimed to identify risk factors for musculoskeletal disorders among clinical year dental students at Prima Dental and Oral Hospital. A quantitative research design was employed, utilizing a cross-sectional study comprising 50 clinical year dental students. The data was collected through observation using the Nordic Body Map and Rapid Entire Body Assessment tools. The data was analyzed using the chi-square test. The results showed that clinical year dental students who worked more than seven hours a day and didn't exercise more than three times a week were at risk of musculoskeletal disorders. The risk was 10.141 to 11.762 times higher. Stretching and warm-up training helped clinical year dental students reduce the risk of musculoskeletal disorders and work more efficiently.

Keywords: Musculoskeletal disorder, working time, exercise routine, clinical year

1 Introduction

Dentistry is a profession that requires a combination of physical conditioning, mental health, and emotional intelligence. Dental procedures could be lengthy, necessitating high levels of concentration on the dentist's part. The work area is often confined and requires precision [10]. Additionally, dentists should maintain optimal muscle balance and proportional posture. Poor posture and repetitive movements could increase the risk of developing musculoskeletal disorders [22].

The World Health Organization (WHO) defined musculoskeletal disorders as disorders of the muscles, tendons, peripheral nerves, or vascular system that were not caused by acute incidents affecting the neck, back, shoulders, elbows, wrists, or feet [10]. The etiology of musculoskeletal disorders was multifactorial, encompassing occupational and individual risk factors [33]. Occupational risk factors include working posture, working period, and working time. Individual risk factors include age, exercise routine, and smoking habits [26]. Furthermore,

risk factors contribute to the development of musculoskeletal disorders, including genetics, a family history of such disorders, stress, which increases muscle tension and exacerbates symptoms, and certain diseases, such as diabetes and rheumatoid arthritis, which also increases the risk of musculoskeletal disorders [19].

The results of Ohlendorf's research indicated that the prevalence of musculoskeletal disorders in the neck, shoulders, and lower back is higher than in the upper and lower extremities, including the elbows, knees, and ankles. The highest value for the upper extremities was observed in the right wrist [25]. A study by Kawtharani revealed that 90.2% of 184 dentists in Saudi Arabia experienced musculoskeletal disorders and identified risk factors of musculoskeletal disorders, including older age, female sex, working time with patients, and increased working period [18]. Previous research substantiates the assertion that dentists are susceptible to musculoskeletal disorders. The study conducted by Shah demonstrated that aerobic exercise improves oxygen flow to tissues. Stretching exercises have been shown to relax muscles and alleviate muscle tension as a treatment for musculoskeletal disorders [28].

The objective of this study was to identify risk factors associated with musculoskeletal disorders among dental students in clinical school at Prima Dental and Oral Hospital. This research was crucial in determining strategies to prevent musculoskeletal disorders, which informed the development of Prima's dental and oral hospital occupational health policies and programs to improve health and performance, particularly among dental students in the clinical year.

2 Literature Review

In the United Kingdom in 2018, there were 498,000 cases of musculoskeletal disorders out of 1,354,000 cases of occupational diseases. 41% affected the upper body or neck, 40% the back, and 19% the lower body. The aforementioned musculoskeletal disorders resulted in a loss of 6.9 million working days, with an average of 14 days lost / incident [14].

Thacker's research indicated that 85% of 150 dentists in India experienced musculoskeletal disorders. The prevalence of neck pain in dentists is higher when compared to other areas because dentists have a bent neck posture during dental procedures [32]. People had different working postures. However, adopting an unergonomic working posture, typified by extended periods of bending and sitting, has been identified as a significant risk factor for the onset of musculoskeletal disorders [13]. The working period could exert a dual influence on the outcome. Long-term exposure to occupational risk factors has been demonstrated to increase the risk of musculoskeletal disorders [26]. Prolonged periods of high-intensity work without adequate rest time have caused muscle fatigue [24]. Ratushnyi reported that hectic work schedules and working more than 2 hours without rest time were strongly associated with neck and back pain [27].

The repetitive use of muscles and joints, lack of physical activity, and decreased muscle strength and endurance render muscles and joints more susceptible to injuries and musculoskeletal disorders [8]. Tekin has revealed that

individuals who exercise habits also had lower levels of musculoskeletal pain, especially in the neck, back, waist, and upper and lower extremities. Lack of physical activity will cause musculoskeletal disorders [31]. Lack of exercise routine has been demonstrated to cause weakening and stiffness of muscles and ligaments, thereby increasing the risk of musculoskeletal disorders [11]. Smuck has been reported that individuals who have ceased smoking but continue to smoke have a heightened risk of reporting more pronounced pain compared to non-smokers [29]. Smoking habit has been demonstrated to impair blood flow to muscles and slowing the removal of lactic acid, thereby increasing the risk of musculoskeletal disorders [28].

3 Methods

The study used a quantitative cross-sectional approach conducted at Prima Dental and Oral Hospital. Total sampling was employed due to the relatively small population of clinical year dental students at Prima Dental and Oral Hospital ($n=50$), ensuring comprehensive data collection from all eligible participants. The independent variables in this study were working posture, working period, working time, age, exercise routine, and smoking habits. The dependent variable was musculoskeletal disorder.

The data were collected using the Nordic Body Map and the Rapid Entire Body Assessment. The Nordic Body Map was a tool designed to assess musculoskeletal discomfort experienced by workers by inquiring about the severity of pain in specific regions, including the neck, shoulders, arms, back, waist, legs, and others [26]. The Nordic Body Map was administered through self-reported questionnaires. The total score can be categorized as followed: the score was between 0 and 20 if musculoskeletal disorder wasn't reported and the score exceeded 21 if musculoskeletal disorder was reported [34]. The Rapid Entire Body Assessment was an ergonomic method that gave a time-efficient evaluation of the operator's neck, back, arms, wrists, and legs [15]. REBA scores were determined through observational assessments conducted by trained evaluators during dental procedures. The total score can be categorized as followed: the score was 1 if lower risk, the score was between 2-3 if low risk, the score was between 4-7 if medium risk, the score was between 8-10 if high risk, and the score exceeded 11 if higher risk [20].

This study used univariate, bivariate, and multivariate data analysis. Univariate analysis identified variable characteristics. Bivariate analysis was a statistical analysis that used a chi-square test to identify the relationship between two variables. Multivariate analysis was a statistical analysis that used multiple logistic regression tests to observe the relationship between multiple independent variables and dependent variable [23]. The data was processed using SPSS.

4 Results

Figure 1 showed that most clinical year dental students at Prima Dental and Oral Hospital had a moderate risk level for their working posture (38%). Based on working for over a year (56%). They worked more than seven hours a day, six days a week (62%). Under 23 (52%). They exercised less than three times a week for less than 30 minutes a day and didn't have a smoking habit (66%). 40% of dental students at Prima Dental and Oral Hospital had musculoskeletal disorders.

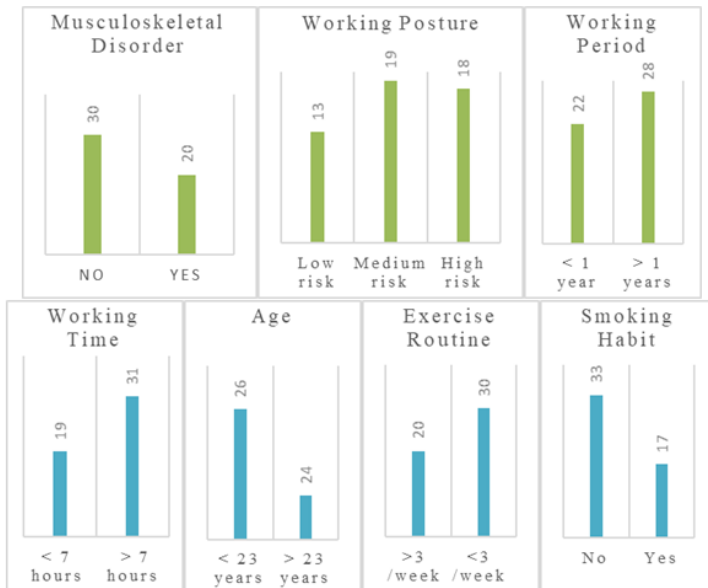


Fig. 1. Characteristics of Respondents (n=50)

The results of the Nordic Body Map, as presented in Figure 2, indicated that most clinical year dental students at Prima Dental and Oral Hospital reported musculoskeletal disorders affecting the back, waist, neck (both upper and lower), and right shoulder.

Table 1 demonstrated that the bivariate analysis utilizing cross-tabulation with a chi-square test ($p\text{-value} < 0.05$) is an appropriate statistical approach. A relationship was identified between working posture, working period, working time, age, exercise routine, and smoking habits of clinical year dental students at Prima Dental and Oral Hospital and the occurrence of musculoskeletal disorders.

Based on Table 2 the final modeling of multivariate analysis with multiple logistic regression tests showed that the variable working time with an odds ratio (OR) value of 10.141 means that clinical year dental students at Prima

Table 1. Bivariate Analysis Results

No	Variable	Musculoskeletal Disorder				<i>p-value</i>
		Yes		No		
		n	%	n	%	
1	Working Posture					0.002
	a. Low Risk	3	6	10	20	
	b. Medium Risk	4	8	15	30	
	c. High Risk	13	26	5	10	
2	Working Period					0.002
	a. < 1 year	3	6	19	38	
	b. > 1 year	17	34	11	22	
3	Working Time					0.002
	a. < 7 hours/day	2	4	17	34	
	b. > 7 hours/day	18	36	13	26	
4	Age					0.005
	a. < 23 years	5	10	21	42	
	b. > 23 years	15	30	9	18	
5	Exercise Routine					0.001
	a. > 3 times/week	2	4	18	36	
	b. < 3 times/week	18	36	12	24	
6	Smoking Habit					0.004
	a. No	8	16	25	50	
	b. Yes	12	24	5	10	

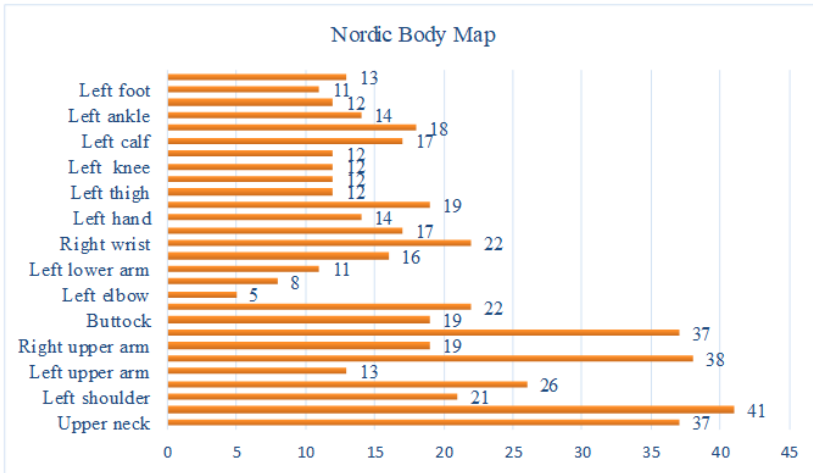


Fig. 2. Nordic Body Map (n=50)

Dental and Oral Hospital with a working time > 7 hours/day for 6 working days had a 10.141 times higher risk of musculoskeletal disorder. The variable of exercise routine with an odds ratio (OR) value of 11.762 means that clinical year dental students at Prima Dental and Oral Hospital with exercise routine < 3 times/week and < 30 minutes/day had a risk of musculoskeletal disorder 11.762 times higher.

Table 2. Multivariate Analysis Results

Variable	B	Wald	P-Wald	OR (95% CI)
Working Time	2.317	6.676	0.010	10.141 (1.750–58.779)
Exercise Routine	2.465	7.699	0.006	11.762 (2.062–67.090)
Constant	-8.523			
R Square	0.488			

5 Discussion

Most clinical year dental students at Prima Dental and Oral Hospital had complaints of musculoskeletal disorders in the back (76%), waist (74%), upper and lower neck (62% and 52%), and right shoulder (52%). Clinical year dental students were at high risk of musculoskeletal disorders due to the difficulty of the

education process, intensive theoretical and practical examinations, psychological pressure, especially when performing large amounts of dental treatment as a final graduation requirement, and didn't have much experience compared to professional dentists [5].

Clinical year dental students at Prima Dental and Oral Hospital presented with a musculoskeletal disorder, which was attributed to a non-ideal sitting position during work. Poor posture during long-term dental procedures can cause muscle fatigue and discomfort and gradually increase pain over time [35]. Static and unnatural working postures, repetitive movements, excessive exertion, sub-optimal dental unit lighting, and instruments that do not comply with ergonomic principles are also risk factors for musculoskeletal disorders [27].

Head bowing and body twisting can cause muscle tension, nerve compression, and spinal degeneration, which ultimately leads to pain. Prolonged flexion can cause stress in the muscles. The results of Aljanakh's study showed that 60.5% of 72 dentists in Saudi Arabia didn't have an awareness of work attitudes during dental procedures [2]. Sitting with the body leaning forward at an angle of 45° can cause a significant increase in the activity of the superior trapezius and longissimus muscles [7]. The same results were shown by this study that 36% of clinical-year dental students at Prima Dental and Oral Hospital had a high risk working posture, and 26% complained of musculoskeletal disorders.

The repetitive performance of the same activity over an extended period can result in the formation of habits or movements that had a detrimental impact on muscle health, potentially leading to the onset of pain and musculoskeletal disorders [16]. The working period of clinical year dental students at Prima Dental and Oral Hospital is associated with the occurrence of musculoskeletal disorders. Half of the clinical year dental students at Prima Dental and Oral Hospital had more than a year of experience, and 34% of them reported musculoskeletal disorders. Felemban's research indicated that sixth-year dental students experience a higher prevalence of musculoskeletal disorder pain compared to their fourth-year counterparts. This was attributable to the considerable psychological pressures, particularly the pressure to meet the final graduation requirements [9].

Hashim's research found that prolonged sitting or standing during work has a significant role as a risk factor in the development of work-related musculoskeletal disorders [12]. Benfaida's research concluded that working in a sitting position for hours will cause more severe lower back pain than switching sitting and standing positions [4]. There was a relationship between the working time of clinical year dental students at Prima Dental and Oral Hospital and musculoskeletal disorders. 62% of clinical year dental students at Prima Dental and Oral Hospital worked seven or more hours a day, six days a week and 36% reported musculoskeletal disorders. Ratushnyi reported that busy work schedules and working more than 2 hours without a break were strongly associated with neck and back pain [27].

Age affected not only physical health but also an individual's ability to adapt to the demands of work and daily activities [21]. A correlation has been identified between the age of clinical year dental students at Prima Dental and Oral Hos-

pital and the incidence of musculoskeletal disorders. 48% of the 24 clinical year dental students at Prima Dental and Oral Hospital were over 23 and 15 others were concerned about musculoskeletal disorders. Akbari's research showed that as age increases, the weight of fat tissue and muscle and bone density decrease, and muscle strength decreases. In addition, the mechanical strength of bones, muscles, and joints also decreases [1]. Tavakkol's research concluded that the exacerbation of age-related musculoskeletal disorders was normal due to physiological and anatomical changes in the results of this study [30].

There was a relationship between the exercise routine of clinical year dental students at Prima Dental and Oral Hospital and musculoskeletal disorders. 60% of clinical year dental students at Prima Dental and Oral Hospital exercised less than three times a week for less than 30 minutes each time and 18 others had musculoskeletal disorders. Exercise helps strengthen the muscles in the upper body, especially the neck, shoulders, and back. This increased muscle strength and flexibility helps reduce stress on joints and tissues, lowering the risk of musculoskeletal disorders [17]. It has been reported that exercise can assist in the alleviation of muscle tension and the production of endorphins, which have an analgesic effect [3]. Stretching is regarded as the most suitable form of exercise to be performed in a work setting, as it can be undertaken independently and does not necessitate specific spatial or temporal constraints [28].

The correlation between the smoking habits of clinical year dental students at Prima Dental and Oral Hospital and the occurrence of musculoskeletal disorders. A third of clinical year dental students at Prima Dental and Oral Hospital smoked more than one or two cigarettes a year. A quarter of them also had musculoskeletal disorders. Acute exposure to nicotine has demonstrated analgesic properties, whereas chronic exposure to nicotine has been shown to render pain receptors responsive, reduce pain tolerance, and increase pain awareness [29]. The presence of nicotine and other harmful chemicals in tobacco products has been demonstrated to disrupt normal blood circulation and damage blood vessels, thereby reducing the oxygen and nutrient supply to muscles, which can result in fatigue and pain [21]. This is due to a reduction in lung capacity resulting from the diminished ability of the lungs to absorb oxygen [6].

Clinical year dental students with high workloads may encounter greater difficulties allocating sufficient time for regular exercise. Conversely, dental practitioners who are physically inactive may be more susceptible to fatigue and muscle pain, which can result in decreased productivity and prolonged work hours.

6 Conclusion

A total of 40% of clinical year dental students at RSGM Prima reported experiencing musculoskeletal disorders. These individuals cited discomfort in multiple regions, including the back, waist, upper and lower neck, and right shoulder. Clinical year dental students who worked more than seven hours a day and didn't exercise more than three times a week were at risk of musculoskeletal disorders. The risk was 10.141 to 11.762 times higher.

The utmost importance is to implement effective administrative controls, which may include work attitude training with ergonomic principles, stretching or muscle warm-up exercises, and the creation of standard operating procedures (SOPs) to achieve an effective and efficient work system that maximizes rest hours. Further research should investigate occupational and individual risk factors associated with musculoskeletal disorders using more precise and accurate instruments and methodologies. Physical examination is a priority for those suffering from musculoskeletal disorders to obtain a more objective result.

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