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Work-related Musculoskeletal Disorders among Dental Students of Different Academic Levels

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Abstract:
Objectives: To estimate the prevalence of musculoskeletal symptoms among dental students in different levels of their pre-clinical and clinical training.

Materials and Methods: A total of 255 dental students were randomly selected. An interviewer guided questionnaire was used to gather information pertaining to demographics, medical history, and self-reported pain using standardized Nordic questionnaire for the analysis of musculoskeletal symptoms in various body regions. After applying the study’s exclusion criteria, 191 female students were included; 80 from the preparatory year, 63 from pre-clinical years, and 48 from the final clinical year; all underwent a physical examination for the musculoskeletal system to assess muscle weakness, limitation of movement, pain upon movement, and any other related abnormalities.

Results: 87.3% of the pre-clinical students and 95.8% of final clinical year students reported symptoms of musculoskeletal disorders (MSDs) in one or more body regions. The highest prevalence of symptoms was reported in the shoulders (46.1%), neck (37.2%), lower back (36.6%), and upper back (31.4%), and it was higher among both pre-clinical and final clinical years in comparison with preparatory years.

Conclusion: The prevalence of MSDs increased among dental students during their pre-clinical training even before going to clinics. Application of ergonomics needs to be emphasized in the early levels of dental school.

Key Words: Dental students, ergonomics, occupational health, work-related musculoskeletal disorders

Introduction
Work-related musculoskeletal disorders (WMSDs) refer to musculoskeletal disorders (MSDs) which develop or made worse due to the inadequate work environment. WMSDs can affect many parts of the musculoskeletal system including upper back, lower back, neck, shoulders, and extremities and can have significant impact on the person’s profession and quality of life.

Many work-related factors contribute to developing WMSDs including increased working hours, inadequate breaks, and working in one position for prolonged periods. Such conditions were reported to predispose MSDs such as increased disk pressure, degenerative changes within the lumbar spine, and muscle ischemia.

Dentists often work in a restricted field which requires high concentration and good vision. They often take awkward postures, use repetitive hand and wrist movements, and spend extended periods of time in static positions. Many studies have reported high prevalence of WMSDs among dentists which ranged between 82.9% and 100% and were commonly reported in neck region, upper limbs, upper and lower back, and shoulders.

The risk of developing WMSDs in the dental field can be minimized by applying ergonomics principles. Ergonomics is an applied science concerned with workers and their relationship to their occupational environment. Lately, ergonomics has become popularly implied and adopted to maintain the health of workers and improve the overall performance. Work-related hazards can be reduced effectively using a comprehensive approach which includes educating workers with proper postures and techniques, adopting and applying suitable ergonomic strategies, and use of ergonomic equipment.

In the literature, the focus has been centered for a long time on WMSDs and application of ergonomics among dentists, but recently more studies have investigated the early manifestation of WMSDs among dental students. These studies reported a high percentage of WMSDs among dental students during their clinical practice and concluded that even undergraduate dental students are at high risk of developing WMSDs. Many dental students complained of pain after their clinical sessions and manifested early signs and symptoms of WMSDs similar to those reported by dentists.

Before treating real patients, dental students have to be adequately trained for dental procedures on a manikin. Habits developed during pre-clinical training usually continue with
students as they proceed with their clinical training. Thus, pre-clinical training is usually conducted in units and environment simulating that applied in actual clinical practice. However, the work environment set-up in the pre-clinical training might not always fulfill ergonomic requirements and often is overlooked by educators and investigators.20

Although the high prevalence of WMSDs among dentist and dental students is evident in the literature, how early WMSDs start to manifest and whether pre-clinical students are also at high risk is not thoroughly investigated and established yet. In a study by Corrocher et al. (2014) on the postures of a group of pre-clinical dental students, the reported risk for developing MSDs was high (64.7%).21 Therefore, the aim of the current study was to estimate the prevalence of musculoskeletal symptoms among dental students in different levels of their academic life starting from their non-clinical years going through pre-clinical years and ending by their final clinical year.

Materials and Methods
This quantitative observational study was approved by the ethics committee and research committee of Riyadh Colleges of Dentistry and Pharmacy (USRP/2013/95) and took place in the female campus of the college of dentistry. In compliance with codes of research ethics, a written informed consent form was obtained and signed by all research participants. The study involved an interviewer guided questionnaire and physical examination to investigate the prevalence of WMSDs among participants.

An interviewer guided questionnaire was conducted between February and April 2014 for 255 female dental students aged 17-25 from various academic levels. Participants were selected through simple random sampling from three different student populations; students of the preparatory year (as a control group), students of pre-clinical years, and students of the final clinical year. The sample size was determined to achieve 0.90 power analysis assuming α = 0.05.

Before conducting interviews, the validity of the questionnaire was tested on 15 dental students to obtain informal feedback and examine the flow of questions; modifications on the questionnaire were made accordingly.

The questionnaire contained two parts. The first part included questions on the socio-demographic-behavioral items; including academic level, age, marital status, number of children, any previous degree obtained, any medical problems, history of diagnosed musculoskeletal diseases, history of trauma, heavy sports, and regular exercise habits. The second part included questions about any experienced pain after the practical/clinical session, duration, and methods to relief the pain. It also included self-assessment of musculoskeletal symptoms using standardized Nordic questionnaire (Table 1).22

According to the research exclusion criteria, 64 participants were excluded. Exclusion criteria included history of rheumatoid, trauma in the last 12 months, disease or surgery of neck, shoulder, lower back, hand, or knees, congenital MSD, performing heavy sports, current or previous pregnancy, past study in a major reported to affect the musculoskeletal system (e.g., nursing, computer science).

Physical examination and assessment of musculoskeletal system was the second part of the study and was done by a trained physiotherapist. The 191 dental students included in the study (80 from preparatory years as a control group, 63 from pre-clinical years, and 48 from the final clinical year) were examined for the range of movement (limitation of pre-clinical dental students, the reported risk for developing MSDs was high (64.7%).21 Therefore, the aim of the current study was to estimate the prevalence of musculoskeletal symptoms among dental students in different levels of their academic life starting from their non-clinical years going through pre-clinical years and ending by their final clinical year.

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of movement in flexion, extension, side bending, lateral rotation, abduction, adduction, and radial/ulnar deviation), muscle power grade, pain upon movement, and tenderness for the following regions: Neck, shoulder, back, elbow/forearm, and wrist/hand. In addition, any spinal deformities or musculoskeletal abnormalities were reported.

Statistical analysis
A descriptive and proportional descriptive statistics (tables, graphs, percentages) were performed. Pearson chi-squared test was used to evaluate the goodness of fit and association for categorical groups. Data were analyzed using Statistical Package for Social Sciences software (SPSS v20.0; IBM Corp.). The level of statistical significance was set at <0.05.

Results
The investigation was carried out on 191 students of different academic levels; 80 from preparatory years (control group), 63 from pre-clinical years, and 48 from the final clinical year.

About 55 students (87.3%) from pre-clinical years group and 46 (95.8%) from the final clinical year group reported symptoms of MSDs during the last 12 months in one or more body regions in comparison with 59 students (73.8%) from the preparatory years group. The self-reported pain among the three different levels is illustrated in Table 2, whereas pain of the neck, hands/wrists, upper back and lower back regions were the most common in both clinical and pre-clinical students (P < 0.05). Moreover, higher percentage of pre-clinical students (47.6%) and final clinical year students (58.3%) reported pain in the shoulder region than the preparatory year’s students (37.5%) although the difference was not statistically significant.

Many of students also reported pain in various body regions in the past 7 days. Significantly more pre-clinical students (27%) reported pain in the Hands/wrists region (P = 0.001). Both pre-clinical and final clinical year’s students reported significantly high percentages (17.5% and 18.8%, respectively) of pain in the upper back region (P = 0.000).

In addition, 52 students (82.5%) from the pre-clinical years and 45 students (93.8%) of the final clinical year reported to experience pain after their practical sessions. However, 45 students of the pre-clinical years’ group and 37 students of the final clinical year group reported that this pain subsides within 3 h after their practical session.

Physical examination revealed only very few students from all levels had limitation on movement or tenderness of any of the examined parts (<3 students). Likewise, scores of muscle power grade for the examined body parts were found within the normal range in the majority of our sample.

On the other hand, more students complained of pain during movement (Table 3). Pain on movement of the shoulder and back were reported significantly more among pre-clinical and final clinical year students (P < 0.05).

Large numbers of students in all levels were found to have rounded shoulders according to the physical examination. However, it was highest among pre-clinical year students (69.8%) in comparison with preparatory year students (41.2%) and final clinical year students (35.4%). The difference was statistically significant (P = 0.000).

Discussion
The current study investigated the prevalence of WMSDs among a group of undergraduate female dental students in their pre-clinical and clinical levels by comparing them to their counterparts in the preparatory years. The findings of the study indicated that dental students start developing signs and symptoms of WMSDs early during their pre-clinical training which concur with the findings of Corrocher et al. (2014), who found that pre-clinical dental students might be at high risk of developing WMSDs.

The findings of our study revealed that during the 12 months proceeded the investigation; the prevalence of self-reported symptoms of MSDs was increasing as students advance from preparatory years into pre-clinical and subsequently clinical years. The possible causes could be increasing the working hours, nature of work, work environment, and working load in the pre-clinical and clinical years. This finding was in

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<th>Table 2: Summery of reported symptoms of MSDs during the last 12 months among various body regions.</th>
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<td>Ankles/feet</td>
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*P<0.05; MSDs: Musculoskeletal disorders

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<th>Table 3: Reported pain on movement at different body regions.</th>
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*P<0.05
agreement with other studies that reported high percentage of dental students had musculoskeletal pain, especially after their clinical session.\textsuperscript{14,15}

The present study highlighted the affected body regions by WMSDs as reported by clinical and pre-clinical dental students. The higher prevalence of MSDs symptoms among pre-clinical and clinical years’ students was found in the shoulders, neck, back, hands, and wrist regions when compared with preparatory year students. Similar studies reported the high prevalence of muscular pain in the upper body parts among dental professionals which are mostly due to wrong posture and repetitive movements.\textsuperscript{13,16-18} Many students in the current study reported pain in neck and upper back in the past 7 days as well, which can indicate that the pain is of continuous nature.

Rounded shoulders are one of the conditions that are classified as postural abnormalities, and it is a common condition even among healthy subjects.\textsuperscript{23} The higher percentage of rounded shoulders among pre-clinical years’ students could indicate they do not take proper posture during their practical sessions either due to lack of knowledge or inadequacy of the work environment for proper ergonomics.

Although significant results were obtained from the current study, some limitations have to be reported. The preparatory year students were used as the control. However, the heavy study load and exams for dental students even in early years could make them not an ideal representation of the normal population. This could explain the relatively high prevalence of reported MSDs symptoms among them. Moreover, since the study was conducted in a female campus, the whole sample population was female and no male students were included. However, previous studies failed to show difference in prevalence of WMSDs between male and female dental students or dentists.\textsuperscript{6,21}

\textbf{Conclusion}

In this study, subjective and objective methods were utilized to estimate the prevalence of musculoskeletal symptoms among dental students in different levels of their academic life. Within the limitations of the study, it was concluded that the prevalence of musculoskeletal symptoms reported by dental students was unexpectedly high even before they start clinical years. Symptoms reported in the neck, shoulders, lower back, upper back, hands, and wrists increased as students proceeded to pre-clinical then clinical years. Ergonomics should be taught early as part of the dental curriculum, and its application should be emphasized from the early pre-clinical levels.

\textbf{Acknowledgment}

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