

Occupational Hazards among Dental Students-Ergonomic Aspect

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Abstract

Background: Dental students are at high risk of developing musculoskeletal disorders (MSDs). Motivation to adopt the science of ergonomics correctly is still lacking among dental students.

Methods: Dental students at Modern Sciences and Arts University were given a self-administered survey. In total, sixty-two people took part in this survey. Participants were asked to complete a structured online questionnaire containing 18 questions regarding their MSDs symptoms, intensity and frequency. The data was collected within two weeks starting from the 1st of January 2023 until the 14th of January 2023, to be analyzed and surveyed.

Results: Lower back pain was the most frequently reported musculoskeletal disorder among all dental students, while workload had a significant impact on these conditions. Female dental students experienced a greater intensity of pain and increased pain sensitivity, even though both sexes experience it in the same areas of the body. There was a direct relation between physical activity and experienced chronic pain in the lower lumbar region of the back among dental students.

Conclusions: The majority of students appear to work in environments that exacerbate musculoskeletal system disorders. It is advised to incorporate ergonomics principles into routine work and practice regular physical activity. To create a comfortable working environment; dental ergonomics should be taught to undergraduate students and strictly implemented in the clinics.

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Introduction

Dentistry is considered one of the riskiest professions ¹⁻⁶. Dentists are at high risk of developing musculoskeletal disorders (MSDs) due to the repeated movements, incorrect postural position, countering and rotating the body and increased strain on the muscles and joints ⁷⁻¹⁰. MSDs are one of the most serious hazards that can happen to each dentist during his/her career life. In Australia, more than 87% of dentists reported at least one MSD's symptom ¹¹. In Greece, it is a likewise situation with 62% of dentists reporting at least a MSD symptom ¹². The most frequent MSD disorder is lower back pain, while chronic neck pain is also accompanying 25% of the patients suffering from the lower back pain disorder ^{13,14}.

It is common to have other disorders with lower back pain, in such order: neck and shoulder pain, wrist and hand pain or both of them together. Wrist pain is more prevalent among dental clinicians and it has more chronicity rate than lower back pain^{13, 15}. Dentistry demands high psychological strength; dentists are exposed to many risk factors that are causing such high stress levels due to dealing with high load of patients and their demands, including patient's delays or the practice management^{6, 14}.

Ergonomics is an applied science that is multidisciplinary and analyses the human-technology relationship, enhancing the understanding of the human physical and mental capabilities, the limits of the human performance, biomechanical factors, and others^{15, 16}.

It is not uncommon for dentists to work in very awkward positions, where their repetitive or static movements result in excessive force on the joints and the spinal structures leaving them with disproportionate loads¹⁶. Posture is defined as the way different parts of the body are situated and the relation between them in order to permit executing a physical task¹⁷.

An article published by Pîrvu et al., in Bucharest, pointed to what is called the balanced/neutral posture as the reference posture that a dentist should take when executing his treatment. This neutral position was recommended by the ISO in 2000¹⁷.

The balanced posture is a seated position that is not strained, sitting naturally with no force applied. It is in other words a relaxed, stable and comfortable posture with minimal muscles contractions. Neutral is applied here to indicate that the joints have a neutral area of movement that is avoids joints overstraining^{17, 18}. The dentist has the freedom to move in his balanced posture with no risk or harm; it does not require the operator a rigid posture¹⁸. These movements are identified as active and passive balanced postures¹⁸.

Even though ergonomics has been growing lately to cover more aspects in the dental care profession, dental schools are still lacking the motivation to implement this science more seriously. This motivation is definitely needed especially with the increased dental health awareness between the general populations resulting in more dental work load on the dental health personnel¹².

Despite the fact that dentists are at high risk of developing MSDs and large numbers are experiencing symptoms of MSDs during their life; many of them are not motivated yet to adopt the science of ergonomics correctly^{8, 19}. In a study conducted in India, dentists showed some knowledge of the basic ergonomic factors; they were positive towards adopting a more ergonomic posture but the study concluded that their effort was not satisfactory²⁰.

Another study conducted in Romania examining dentists' awareness in the northeastern part of the country concluded that dentists' knowledge about ergonomics should be improved and accompanied with updated educational plans either in the dental school or outside¹⁶. In dental college of Brazil's São Paulo, students know the ergonomic principles but found it difficult to apply them in practice²¹. In the dental school of Valencia, Spain; undergraduate and postgraduate students of dentistry were found unfamiliar with the principles of ergonomics resulting in wrong posture during their practice²².

MSDs is a multi-factorial disease that develops due multiple of reasons²³. The prevalence of MSD is highly increasing among dentists. However, very few studies have been contacted so far concerning the field of dentistry²⁴. Symptoms of MSDs should be mentioned according to the place of their occurrence. Regarding the neck and shoulder disorders, one can experience pain and tenderness or stiffness, headache, numbness and tingling. Those symptoms can be associated with backward and upward movements or they can be persistent without any trigger²⁴. Regarding the hand and wrist disorders, one can experience pain upon grasping an object, pinching or twisting. Numbness, pain, tingling or burning sensation can also be present. The natural evolution is muscle weakness and atrophy. As the activity persists, pain usually worsens²⁴. Regarding the back disorders, pain and generalized weakness have been reported. Moreover, these symptoms are known to worsen with coughing, sneezing, sitting, driving, bending forward or any activity that requires movements of the back or the sternum. Prolapsed intervertebral disc is a very common cause²⁴.

The dental personnel is strongly advised to swift the workload from one muscle group to the other by avoiding orthostatism while working. If, however, standing is inevitable, alteration between standing and sitting is encouraged. Alternating between different feet positions enhances the re-nutrition of

the group of muscles previously used to bare the workload. Moreover, correct positioning of the patient on the dental chair in regards to the height is extremely important to avoid extra workload. Repetitive rotation of the body to reach the dental instruments should be avoided; meaning that the instruments should be in a close and accessible place²⁴.

Stress and anxiety are known triggers for psychogenic muscle tension which would further complicate the muscles already suffering from the workload. To reduce anxiety, breathing techniques as well as other psychotherapeutic interventions are available and known to be effective. Last but not least, dental professionals should seek additional education on dental ergonomics before complications occur. Ideally, this education should start from the dental school but if not, dentists should educate themselves and the members of their staff^{24, 25}.

The aim of this survey study is to evaluate the intensity, consequence and location of the musculoskeletal disorders (MSDs) among the 4th, 5th and 6th year (Intern) students in the school of dentistry in Modern Sciences and Arts University and to define the different symptoms, connections between the participant's symptoms and their physical lifestyle, their attitude and to establish sound preventive measures.

Methods:

Inclusion criteria:

The participants chosen for the study were fulltime students at the faculty of dentistry, Modern Sciences and Arts University. The students were chosen from the 4th, 5th and 6th years interns (clinical years) because of their required practical work on live patients. Before receiving the questionnaires, the students were asked if they are willing to participate in this study. The addressed group was supposed to be as unbiased as possible in order to obtain valuable and conclusive results from a diverse range of people. Race did not play a significant role.

Exclusion criteria:

Dental students from the 1st, 2nd or 3rd years at the faculty of dentistry in Modern Sciences and Arts University or students who are studying other programs were excluded. Participants who showed

uncooperative attitude to conduct this study were removed.

Study design:

The questionnaire was available in English. It was distributed online and all questionnaires were fulfilled according to the adolescent's preference and speech comprehension, including the participants' full names.

The questions were structured in a consecutive order; the evaluation started with general questions on the person's name, age and year, and gender was also highlighted in this section. The second section contained questions to identify the prevalence and causes of the MSDs, including questions on the participant's work load, i.e. the duration of practicing dentistry per day or the frequency of work per week.

In this section, the participant's attitude when experiencing any MSDs was also addressed, along with preventive measures and the performance of any physical activities. The last part of this section addressed the participant aggravating factors that can trigger or induce such symptoms. In the last section of the questionnaire, the participant awareness on MSDs was measured. The questions were formulated in a subjective matter, i.e. the amount of knowledge the participant has on MSDs and the source of such knowledge. The final question addressed the amount of time participants were intending to practice dentistry.

Participants were asked to complete a structured questionnaire containing 18 questions regarding their MSDs symptoms, intensity and frequency. The questionnaire took place online after reaching out to the students from the different online groups via Google form. The data was collected within two weeks starting from the 1st of January 2023 until the 14th of January 2023, to be analyzed and surveyed.

Results

The results of the 62 questionnaires with 18 questions each are presented in the following part. The diagrams to the corresponding questions were selected and only the most representative ones are shown. The answers were counted and are represented in a percentage proportion.

The first question was to identify the name of the participants, and then they would be asked about their year of study. The majority of the participants were students in the 6th year (Interns were 40 students exactly making 64.5% of the total respondents, followed by

students of the 5th year with 13 students making 21% and finally 9 students from the 4th year making 14.5% of the total participants).

Participants were asked about their gender. Out of the 62 participants in this questionnaire 36 of them identified them self as males (58.1%) and 26 as female (41.9%). To conclude this section, participants were asked on their consent to participate in this study, where all of the 62 accepted (100%).

The next section is to identify the MSDs symptoms and their prevalence among the students. It started by asking the students on the number of hours they practice dentistry per day; three categories were put for this question, 1-2 hours/day, 3-6 hours/day and more than 6 hours/day. Answers registered were 21 participants (33.9%), 35 participants (56.5%) and 6 participants (9.7%), respectively.

The next question was to count the number of days each participant practices dentistry per week. The vast majority of the participants fell in the category of 3-5 days per week, with 52 of them responding with a percentage of (83.9%). 9 participants indicated that they practice dentistry 1-2 days per week (14.5%), while only 1 participant was practicing dentistry more than 5 days per week (1.6%).

The following question was made to identify the prevalence of pain, discomfort, tingling or numbness in the back area, neck, shoulder, hand and/or other; participants were allowed to choose more than one answer. 2/3 of the participants indicated a pain, discomfort, tingling or numbness in the back area; that is 49 participants. Almost half said that they experienced symptoms in the neck area, with 33 participants. 23 participants had pain in the shoulders and 12 people in the hand area. Only 5 people wrote others; answers given for this were either no symptoms or pain in the legs (Figure 1) and (Figure 2).

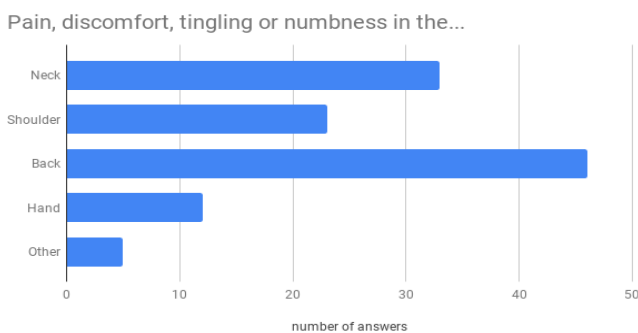


Figure 1: The areas the students reported pain.

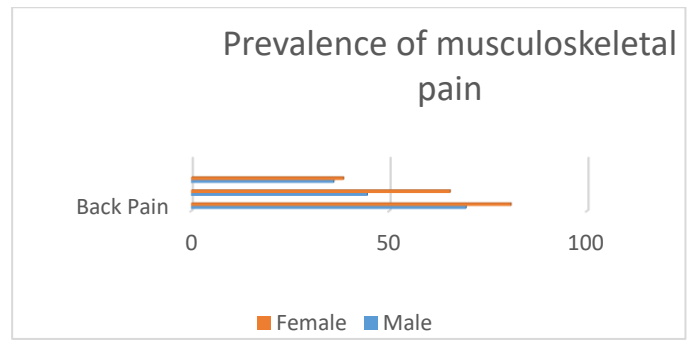


Figure 2: Comparison between males and female and the areas each is experiencing pain.

The next question asked the students about the frequency of pain, discomfort, tingling or numbness while they work. More than half of the answers indicated experiencing these symptoms occasionally; that is 32 students. 15 students said they rarely experience the symptoms and 9 said they occur frequently. 5 students said they never had such symptoms and only 1 student answered experiencing these symptoms constantly (Figure 3).

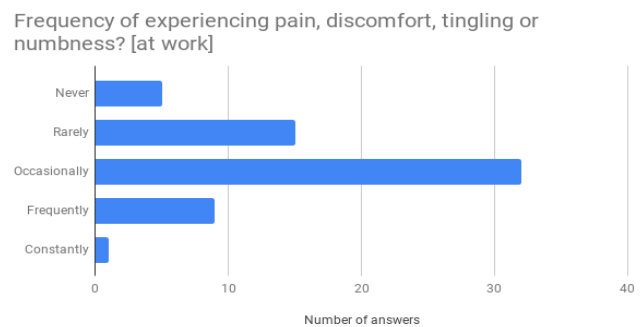


Figure 3: Frequency of pain during work (practicing dentistry).

The next question asked the students about the frequency of pain, discomfort, tingling or numbness outside of work. Less than half of the answers indicated rarely experiencing these symptoms; that is 29 students; while 19 students said they occasionally experience the symptoms. 8 students answered having these symptoms frequently and other 8 declared never having these symptoms outside work. 1 student was experiencing these symptoms constantly (Figure 4).

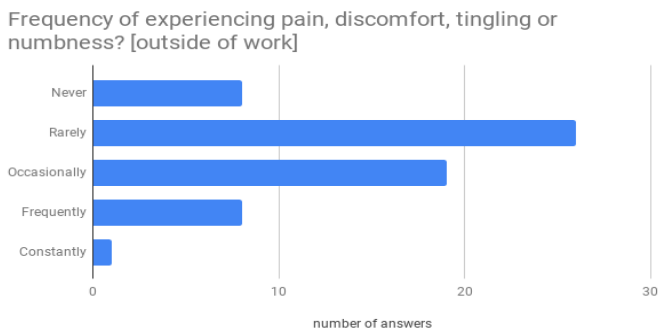


Figure 4: Frequency of pain outside work.

The next question is to rate the intensity of the pain on a scale of 1-5. Almost half of the students said the pain falls in the middle, marking 3 on the scale; that is 29 of them. Less intensity of scale 2 was chosen by 16 of them and higher intensity of scale 4 was chosen by 9 of them. The least intense pain of scale number was chosen by 4 students and the highest pain scale number 5 was chosen by 3 students only (Figure 5).

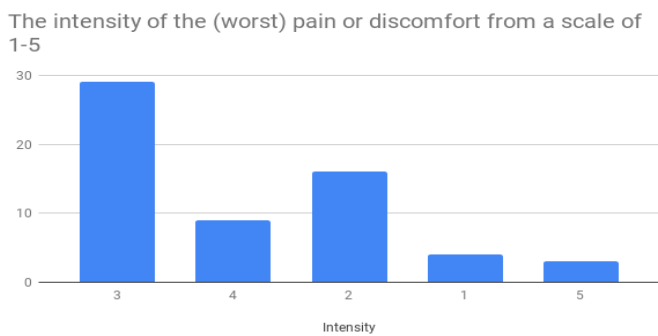


Figure 5: Intensity of pain experienced by the participants

Next group of questions is to understand the attitude the students adopt when having such symptoms. The first question of this group is to know if the student sought help when having the previous symptoms; for this question it was allowed to choose several answers. More than half of the participants did not seek any help to relieve such symptoms; that is 36 students. 11 students sought help from a physical therapist and 9 students sought help from a sports coach. The number of students that sought help from a doctor or consultation from the university’s ergonomic departments were 6 and 5 students, respectively (Figure 6).

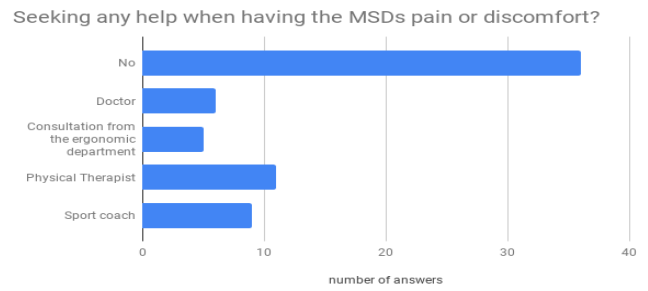


Figure 6: The participant’s actions when having MSDs.

The next question was to know what students do when experiencing MSDs symptoms. Diverse answers were put and the responses were as follows, where students were allowed to choose more than one answer. The majority chose doing physical exercises; that is 41 students; while 18 used pain killer to ease the symptoms. Medical approach such as physiotherapy or asking for medical advice marked 12 responses each. A more radical approach such as not doing anything was chosen by 10 students or taking the decision to quit working, which was chosen by 3 students (Figure 7).

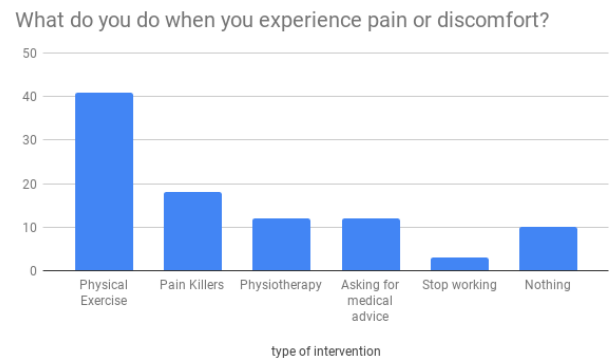


Figure 7: The attitude of the participants when having MSDs.

Next question is to understand the perception of students on the causes behind their symptoms, where more than one answer was allowed to be chosen. The majority of the students believed that accessibility inside patient mouth was the prime factor, followed by the prolonged static posture. Time pressure was also an important factor according to 28 students, followed by the long appointments, as selected by 18 students. 15 students considered that non-helpful supervisors can cause or aggravate the symptoms while the work space and work load were also marked factors by 12 and 10 students, respectively.

The next question was to report the frequency of the physical activities that students practiced in the students’ lifestyle. 21 students (34.4%) answered doing sports 3-6 hours per week while 20 students (32.8%) do sports 1-2

hours per week.

12 students (19.7%) do sports more than 6 hours per week and 8 students (13.1%) are not doing any sports or physical activity.

Last group of questions were made to measure the knowledge and awareness the students had in regards to MSDs. The first question was a simple yes or no question, on whether the students consider they have enough information regarding MSDs at work; the majority answered with yes, marked by 42 students (67.7%) while the other 20 students answered with a no (32.3%). The majority chose internet and university as their information source, with 25 and 27 students, respectively; while some put other answers such as a dentist or a physiotherapist as their source.

Last question was to measure if the students think they are well equipped with the ergonomic means to prevent MSDs. On a scale of 1-5, 1 being the least and 5 being the most; 23 students answered with number 3 (37.7%) on scale, while 22 students answered with a 2 (36.1%). 8 students answered with number 4 (13.1%) on scale; while the two extremes of 5 and 1 got 5 students and 3 students, respectively (8.2%, 4.9%).

Discussion:

The purpose of this survey was to establish the prevalence and causes of musculoskeletal disorders among dentistry students. The majority of the students that completed the study were in their sixth clinical year comprising 64.5 percent of the respondents, followed by 21 percent in their fifth clinical year and 14.5 percent in their fourth clinical year .

Students were asked to describe the symptoms of their musculoskeletal disorders where pain was most prevalent. This was then split between male and female respondents. For the female respondents, the symptoms were mainly in the back and neck and slightly less in the shoulders; whereas for the male respondents the pain in the back, neck and shoulders were fairly similar. However, literature suggests that females are more likely to experience pain than males; female dental students experience a greater intensity of pain even though both genders experience it in the same areas of the body. Literature suggests that this is due to a multitude of both biological and psychosocial factors ²⁶.

One of the biological factors that are thought to be a reason for this is the influence of gender specific

hormones impacting how men and women experience pain differently. It is believed that the female hormone progesterone is both pro-nociceptive and un-protective in nature whereas the male hormone is anti-nociceptive and protective in nature ²⁷. Also, there is evidence that suggests that there are gender related cortical differences in the transmission of pain and the processing of pain-related stimulus ²⁸.

Psychosocial factors can also affect the way in which different genders experience pain intensity. One of the greatest differences is within the coping strategies that males and females use to aid them with their pain. In terms of males, they will tend to use techniques such as distraction, problem solving and problem facing techniques in order to tackle and combat their pain, whereas females will use a variety of techniques to help with pain such as attention focus and emotion-focused techniques, positive self-talking and social support ^{29, 30}. Gender responses in terms of pain responsiveness show that females tend to catastrophize more than males ³¹. Sociocultural beliefs may also have an effect on the intensity of pain and gender due to masculinity and femininity beliefs. Expression of pain is generally seen as more socially acceptable among women, while males are less likely to report pain ³².

The questionnaire results were validated by being compared to the results of different questions in other previous surveys, as the one conducted by Ayatollahi et al. in 2012 found that musculoskeletal complications are prominent amongst dental staff as other health care professionals and that the area of the body that has the most prevalence for injury is the lower back for both male and female dental practitioners ¹. As well as being asked about the prevalence of their symptoms and location of pain, participants were also asked about the frequency in which they experienced such both inside and outside work .

From the results given by the participants, it is clear that during working hours the pain is felt more than out of working hours and this is down to the fact that dental students often have to work in uncomfortable positions, usually with their heads in a sideways position and their arms stretched outwards from their bodies. This therefore if carried out for long periods during the working day can overstrain the muscles and cause uncomfortable symptoms such as headaches, neck and shoulder pain as well as lower back pain, as mentioned by Alyahya et al. in 2018 ³³.

Students believed that there were a variety of factors that either caused or aggravated their symptoms which were

prolonged static sitting, gaining visibility, workspace, time pressure, workload, long appointments and non-helpful supervisors. In the 2018 study by Alyahya et al., it was found that each of these factors would take its toll on dentists and that an awareness of ergonomics and its importance should be taught to students from an initial stage of training in order to counterbalance these problems³³.

The dental students within this study were also asked whether they practice any sport. Although 13.1 percent said they never did any sport, 32 – 34 percent of the students practiced physical activity between 1 to six hours a week, with nearly 20 percent stating that they did more than six hours a week. The practice of physical activity is a useful and common management strategy for the treatment of chronic musculoskeletal pain³⁴. Also, the practice of fitness training and strengthening exercises can help prevent musculoskeletal pain, symptoms and intensity in areas such as the neck³⁵. Thus, dental students could benefit if they performed or took part in some physical activity for a relief from pain, intensity and symptoms. Researchers have found that reduced levels of physical activity contribute to a decreased level of functionality of muscles, which lead to chronic pain in the lower lumbar region of the back³⁶.

When an individual experiences an exaggerated or high intensity pain, this can develop a fear relating to pain, thus leading to behaviors such as fear of movement or avoiding activities such as physical activities to avoid further pain or injury³⁶. This can be reflected within the dental students' responses and results. However, when comparing these numbers to the number suffering from pain at work, it suggests that it is definitely a problem with ergonomics and posture within the workplace as opposed to injuries from activity or lack of activity that is to blame. When asked if they had any information regarding musculoskeletal disorders at work the answers were very clear, with 32 percent stating they did not but 68 percent stating that they did.

Conclusions:

1-Female dental students experienced greater intensity of pain and increased pain sensitivity.

2 -There is a direct relation between lack of practicing physical activity and chronic pain among dental students.

3 -Musculoskeletal hazards can be experienced at a very early stage at a young age .

4 -All the participants experienced some kind of musculoskeletal complains, with only a small percent seeking the advice of a professional doctor.

5 -There is more need for education in order to protect the state of health of young dentists.

Recommendations:

Regarding awareness on the hazards of musculoskeletal disorders, it is recommended that all dentistry students should be taught ergonomics from the early years of their academic learning where they would acquire the knowledge to be able to enhance the optimal access to their patient; in order to make their working practice and their posture much more comfortable. It is advised to incorporate ergonomics principles into routine work and practice regular physical activity.

Authors' Contributions

Aya A. Salama, Manuscript writing and design.

Karim A. Farid, Concepts, Design, Revision & definition of intellectual content.

All authors have read and approved the manuscript.

Informed consent

Participants accepted an informed online consent to this survey contribution.

Conflict of interest

The authors declare that they hold no competing interests.

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