Prevalence of musculoskeletal pain in dental students and associated factors

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Aim: The objective of this research was to evaluate the prevalence of painful symptoms among dental academics, as well as their associated factors.

Methods: A cross-sectional study was carried out at a public higher education institution, and the study population (n = 303) included undergraduate students who studied at least one subject that included clinical activities. For data collection, two self-administered questionnaires were delivered to the participants, the first of which consisted of sociodemographic variables, academic life, harmful habits, physical activity practice, and general health. The validated Nordic Musculoskeletal Questionnaire was used to identify musculoskeletal symptoms, the need to seek health resources, and to assess whether the disorders interfered with the work activities of academics.

Results: The presence of pain in the past 12 months was observed in 199 participants (82.6%). Several variables, including gender, number of courses performed, physical activity, and general health status, had an association with painful symptoms in at least one area of the body (GA) over the past 12 months. In addition, variable general health was associated with pain symptoms in any area of the body (DG) over the past seven days.

Conclusion: There was a high prevalence of musculoskeletal symptoms, especially in the upper limbs, and there were associations between muscular pain and the number of disciplines studied and between muscular pains and the general health of the students.

Keywords: Dentistry. Musculoskeletal disorders. Occupational health. Students. Pain.
Introduction

Musculoskeletal disorders are common morbidities in dental practice and are characterized by persistent pain and/or discomfort in the musculoskeletal system, including joints, ligaments, tendons, nerves, and structures that support the limbs; these disorders may present as inflammatory or degenerative conditions that occur either alone or by cumulative trauma, causing painful symptomatology in different parts of the body. In addition to pain, they include complaints such as tingling, numbness, weight, and early fatigue; thus, these diseases contribute to the inability of the professional from his job, and even their withdrawal from the position.

Among occupational diseases in health workers, musculoskeletal disorders affect approximately 63% to 93% of dentists, and their early onset is a very common problem for these professionals. A career in dentistry requires clinical care to be carried out in a restricted area (the mouth); thus, the professional remains in the same position for a long time, requiring extreme precision and strength of the movements of the hands and wrists, often repetitively. The necessity of this positioning during the work activity can increase the risk of developing Work-Related Osteomuscular Disorders (DORT). These disorders arise from the interplay of many factors, including a lack of knowledge surrounding the need for correct ergonomic posture, work posture associated with repetitive movements, long working hours, and a lack of physical activity and muscle strengthening.

Although the prevalence of musculoskeletal problems among dental surgeons is high (63% to 93%), there are few studies focused on this profession. In a study carried out in academics in Brazil, it was found that an incorrect posture was assumed during the execution of work. In another study, there was an increased risk of the development of musculoskeletal disorders and painful or chronic conditions due to the professional attitudes during the execution of the work.

Therefore, this study aimed to evaluate the prevalence of pain symptoms among dental students, as well as their association with other factors.

Materials and methods

This was a cross-sectional study involving dentistry students enrolled at the University, who attended at least one course that included clinical activities in its teaching plan. During the collection period (September 2013 to November 2013), 303 students were enrolled who met this criterion. Students who had any congenital physical impairment involving the upper or lower limbs were excluded, as were pregnant women, infants, and those who did not consent to participate in the study.

An explanation of free and informed consent was attached to the questionnaire in order to clarify any questions regarding the voluntary participation in the research. This study was approved by the Araçatuba School of Dentistry Committee for Ethics Research - UNESP, and followed all national and international regulations (CAAE: 18569513.2.0000.5420)

Each participant responded to two self-administered questionnaires, which were delivered at the end of the theoretical lectures so as not to disrupt the teaching activities.
The questionnaires were distributed to the participants by previously trained graduate students, who explained and clarified doubts, thus avoiding errors in the completion and understanding of the questionnaire.

The first questionnaire consisted of a series of questions about socio-demographic variables (gender, age, and marital status); academic life (number of subjects taken); harmful habits (use of tobacco, alcohol, and other drugs); the performance of physical activities (what, how long, frequency, and monitoring by a specialist); and general health. Further information on weight and height were collected in order to calculate the body mass index (BMI). An individual was considered obese when their BMI was \( \geq 30 \) kg/m\(^2\), overweight when the BMI was between 25 and 29.9 kg/m\(^2\), and normal when the BMI was between 20 and 24.9 kg/m\(^2\).

In the second questionnaire, a Portuguese adaptation of the Nordic Musculoskeletal Questionnaire, assessed musculoskeletal disorders\(^{10}\). This questionnaire has been validated, and has a reliability ranging from 0.88 to 1, according to the Kappa coefficient\(^{11}\). The questionnaire is used internationally and is accepted for the assessment of musculoskeletal disorders. It consists of questions on nine areas of the body divided into three areas of the upper extremities, three of the lower extremities, and three of the spine. The questionnaire assesses symptoms of pain in the neck, shoulder, elbow, forearm, wrist/hand/finger, dorsal, lumbar, hip/thigh, knee, and ankle/foot. The participants report if they have had any experience of pain or discomfort in any of the nine areas of the body during the past 12 months or 7 days, and whether they sought professional help for these pains. Positive pain symptoms were identified when pain or discomfort was reported in at least one of the body areas. The students who reported pain or discomfort were also asked whether they were using drugs to relieve the pain and/or discomfort, and if so, were asked to indicate which drug was used.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 21.0. Descriptive statistics were used to characterize the sample (gender, age, marital status, BMI, courses taken, harmful habits, physical activity, general health problems, use of medications, and symptoms of pain). In order to verify the association between pain symptoms and the variables studied, a response of “yes” was given when at least one positive was reported in any area of the body for each question of the Nordic Musculoskeletal Questionnaire. Thus new variables were obtained as follows: Symptoms in the last 12 months in any area of the body (GA), impairment of normal activities as a result of this problem in any area of the body in the past 12 months (GB), consultation with a health professional because of this condition in the past 12 months (GC), and symptoms in past 7 days concerning any area of the body (GD). The Fisher’s exact chi-square test and the likelihood ratio were used to determine the association between variables.

**Results**

Following completion of the questionnaire, 241 students were obtained for participation in this study. The average age of the subjects was 22.31 years (SD ± 1.97), and the majority of the respondents (62.7%) were women. Regarding marital status, 97.9% of the respondents were single. Regarding the number of clinical disciplines
studied, the average was 12 (SD ± 4.25). The BMI analysis of the students showed that 62.7% were in the normal range, 14.5% were considered overweight, 5.4% were classified with obesity, and no less than a disorder 17.4% were considered underweight. In terms of unhealthy habits, the majority of students did not use alcohol, tobacco, or other drugs (Table 1).

Physical activity was reported as routine for 59.8% of the undergraduate students, with most of the practiced activities being classified as resistance (weight training or some type of contact sport) (54.2%); these activities were practiced on average 4 times per week or more, and were mostly supervised by professionals. Although only a few students reported having been diagnosed with a general health issue in the past 12 months (n = 24), 33.3% of these were diagnosed with problems related to musculoskeletal disorders. Regarding the use of medication to control pain, 44.4% reported using painkillers, anti-inflammatories, or a combination of these drugs to eliminate symptoms of pain (Table 2).

Table 1. Sociodemographic variables of undergraduate students of Araçatuba Dental School- Unesp. Araçatuba, 2013.

| Variables          | n   | %   |
|--------------------|-----|-----|
| **Genre**          |     |     |
| Female             | 151 | 62.7|
| Male               | 90  | 37.3|
| **Age**            |     |     |
| 19 years           | 4   | 1.7 |
| 20 a 24 years      | 209 | 86.7|
| 25 a 29 years      | 27  | 11.1|
| 32 years           | 1   | 0.4 |
| **Marital status** |     |     |
| Married            | 4   | 1.7 |
| Single             | 236 | 97.9|
| No information     | 1   | 0.4 |
| **BMI**            |     |     |
| Underweight        | 42  | 17.4|
| Normal weight      | 151 | 62.7|
| Overweight         | 35  | 14.5|
| Obesity            | 13  | 5.4 |
| **Subjects**       |     |     |
| Less than 12       | 124 | 51.5|
| 12 or more         | 117 | 48.5|
| **Harmful habits** |     |     |
| Alcohol            | 81  | 33.6|
| Tobacco            | 2   | 0.8 |
| No habit           | 158 | 65.6|
### Table 2. Variables related to physical activity, general health and medication use by undergraduate students of Araçatuba Dental School- Unesp. Araçatuba, 2013.

| Variables                                      | n   | %   |
|------------------------------------------------|-----|-----|
| Do you do any type of physical activity?       |     |     |
| Yes                                            | 144 | 59.8|
| No                                             | 97  | 40.2|
| What activity?                                 |     |     |
| Resistive                                      | 78  | 54.2|
| Aerobic                                        | 33  | 22.9|
| Both                                           | 32  | 22.2|
| No information                                 | 1   | 0.7 |
| How Long?                                      |     |     |
| Less than 6 months                             | 38  | 26.4|
| From 6 to 12 months                            | 42  | 29.2|
| From 12 to 24 months                           | 13  | 9   |
| More than 24 months                            | 48  | 33.3|
| No Information                                 | 3   | 2.1 |
| How many times a week?                         |     |     |
| Once                                           | 7   | 4.9 |
| Twice                                          | 19  | 13.2|
| Three times                                    | 47  | 32.6|
| Four times or more                             | 70  | 48.6|
| No Information                                 | 1   | 0.7 |
| Do you have guidance of a professional to do physical activity? |     |     |
| Yes                                            | 91  | 63.2|
| No                                             | 53  | 36.8|
| Has a problem of general health diagnosed in the last 12 months? |     |     |
| Yes                                            | 24  | 10  |
| No                                             | 217 | 90  |
| What general health problem?                   |     |     |
| WMSD                                           | 8   | 33.3|
| Other                                          | 16  | 66.7|
| Medicine use?                                  |     |     |
| Yes                                            | 107 | 44.4|
| No                                             | 134 | 55.6|
| What Medicine?                                 |     |     |
| Analgesic                                      | 36  | 33.6|
| Anti Inflammatory                              | 11  | 10.3|
| Combination                                    | 15  | 14  |
| Other                                          | 43  | 40.2|
| No information                                 | 2   | 1.9 |
The presence of pain in the past 12 months was observed in 199 participants (82.6%). More than half of the respondents reported neck pain (51.5%), while 48.1% had upper back pain, 38.6% had pain in the wrist/hand, and 49.8% reported pain in the lumbar region. Musculoskeletal pain in the lower extremities (hips/thighs, knees, calves/legs, ankles/feet) was reported by less than 30% of the respondents (Table 3).

**Table 3.** Associations between body regions and musculoskeletal symptoms according to the dimensions of the Nordic Musculoskeletal Questionnaire.

| Body Area     | Symptoms in the last 12 months | Impediment to the normal activities because of perform this problem over the past 12 months | Consultation with a professional in the area of health because of this condition in the past 12 months | Symptoms in the last 7 days |
|---------------|--------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------|
|               | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  | Yes  | No  |
| Neck          | 124  | 117 | 48.5 | 18  | 7.5  | 223 | 92.5 | 15  | 6.2  | 226 | 93.8 | 51  | 21.2 | 190 | 78.8 |
| Shoulder      | 102  | 139 | 57.7 | 14  | 5.8  | 227 | 94.2 | 14  | 5.8  | 227 | 94.2 | 42  | 17.4 | 199 | 82.6 |
| Upper Back    | 116  | 125 | 51.9 | 11  | 4.6  | 230 | 95.4 | 23  | 9.5  | 218 | 90.5 | 48  | 19.9 | 193 | 80.1 |
| Elbow         | 18   | 223 | 92.5 | 1  | 0.4  | 240 | 99.6 | 3   | 1.2  | 238 | 98.8 | 4   | 1.7  | 237 | 98.3 |
| Wrist/Hand    | 93   | 148 | 61.4 | 17  | 7.1  | 224 | 92.1 | 12  | 5.0  | 238 | 95.0 | 24  | 10.0 | 217 | 90.0 |
| Lower Back    | 120  | 121 | 50.3 | 20  | 8.3  | 221 | 91.7 | 28  | 11.6 | 213 | 88.4 | 52  | 21.6 | 189 | 78.4 |
| Hip/haunch    | 41   | 200 | 83.6 | 5   | 2.1  | 236 | 97.9 | 5   | 2.1  | 236 | 97.9 | 13  | 5.4  | 228 | 94.6 |
| Knee          | 66   | 175 | 72.6 | 17  | 7.1  | 224 | 92.9 | 17  | 7.1  | 224 | 92.9 | 26  | 10.8 | 215 | 89.2 |
| Ankle/foot    | 55   | 186 | 77.2 | 8   | 3.3  | 238 | 96.7 | 6   | 2.5  | 235 | 97.5 | 8   | 3.3  | 233 | 96.7 |

Regarding the impairment of activities, 25% of the students reported that pain interfered with task performance in the past 12 months. In Table 3, the frequency and percentage of students who had some impairment due to pain, and the respective areas, can be observed in detail. Only a small number of students sought medical advice or treatment for pain or symptoms that they reported in the past 12 months (28.2%). Regarding the painful symptoms in the past 7 days, nearly half of the students (48.5%) reported pain in at least one area of the body (Table 3).

The analysis of the association between the socio-demographic variables and the general variables of each of the Nordic questions demonstrated an association between pain symptoms in the past 12 months in at least one area of the body (GA) and sex; GA and the number of courses taken; GA and the practice of physical activity and general health; and GA and between pain symptoms in the last 7 days in any area of the body (GD) and general health (Table 4).

**Discussion**

Work associated musculoskeletal disorders have a high prevalence among dental surgeons; given the impairment on work and normal activities, research in this field has increased worldwide.
In the United States, since 1995, posture training activities undertaken during working hours are presented in the curricula of the courses of dentistry. Since occupational problems can affect students of dentistry, it is necessary to include these activities in the curriculum.

In this study, a high prevalence of painful symptomatology was observed in the study population; indeed, high pain rates have been previously reported by dentists of both sexes, with early onset. These indexes were also high when only the students who already perform activities clinical practices were analyzed.

Table 4. Associations between sociodemographic variables and the variables of the Nordic Musculoskeletal Questionnaire. Araçatuba, 2013.

| Variable                  | GA     | GB     | GC     | GD     |
|---------------------------|--------|--------|--------|--------|
|                           | Yes    | No     | p      | Yes    | No     | p      | Yes    | No     | p      | Yes    | No     | p      | Yes    | No     | p      |
| Gender                    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Female                    | 131    | 66     | 48     | 0.027  | 37     | 63     | 114    | 0.992  | 43     | 63     | 108    | 0.907  | 79     | 68     | 72     | 0.129  |
| Male                      | 68     | 34     | 22     |        | 22     | 37     | 68     |        | 25     | 37     | 65     |        | 38     | 33     | 52     |        |
| Marital status            |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Married                   | 3      | 1.5    | 1      | 2      | 0.539* | -      | -      | 4      | 2.2    | 0.575* | 2      | 3      | 2      | 1      | 0.318* | 2      | 2      | 2      | 1.000* |
| Singles                   | 195    | 99     | 41     | 98     |        | 59     | 100    | 177    | 98     |        | 66     | 97     | 170    | 99     |        | 115    | 98     | 121    | 98     |
| BMI                       |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Normal                    | 126    | 63     | 25     | 60     | 0.308**| 39     | 66     | 112    | 62     | 0.934**| 47     | 70     | 104    | 60     | 0.292**| 73     | 62     | 78     | 63     | 0.252***|
| Overweight                | 29     | 15     | 6      | 14     |        | 8      | 14     | 27     | 15     |        | 10     | 15     | 25     | 15     |        | 19     | 16     | 16     | 13     |
| Obesity                   | 8      | 4      | 5      | 12     |        | 3      | 5      | 10     | 5.5    |        | 4      | 5      | 9      | 5      |        | 3      | 2.6    | 10     | 8.1    |
| Underweight               | 36     | 18     | 6      | 14     |        | 9      | 15     | 33     | 18     |        | 7      | 10     | 35     | 20     |        | 22     | 19     | 20     | 16     |
| Subjects                  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Less than 12              | 109    | 55     | 15     | 36     | 0.025  | 30     | 51     | 94     | 52     | 0.915  | 37     | 54     | 87     | 50     | 0.564  | 67     | 57     | 57     | 46     | 0.079  |
| 12 or more                | 90     | 45     | 27     | 64     |        | 29     | 49     | 88     | 48     |        | 31     | 46     | 86     | 50     |        | 50     | 43     | 67     | 54     |
| Physical Activities       |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Yes                       | 126    | 63     | 18     | 43     | 0.014  | 38     | 64     | 106    | 58     | 0.401  | 39     | 57     | 105    | 61     | 0.634  | 68     | 58     | 76     | 61     | 0.616  |
| No                        | 73     | 37     | 24     | 57     |        | 21     | 36     | 76     | 42     |        | 29     | 43     | 68     | 39     |        | 49     | 42     | 48     | 39     |
| Harmful Habits            |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Alcohol                   | 71     | 36     | 10     | 24     | 0.158  | 21     | 36     | 60     | 33     | 0.75   | 20     | 29     | 61     | 36     | 0.356  | 39     | 34     | 42     | 34     | 0.932  |
| No habit                  | 127    | 64     | 31     | 76     |        | 38     | 64     | 120    | 67     |        | 48     | 71     | 110    | 64     |        | 77     | 66     | 81     | 66     |
| Health                    |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Yes                       | 23     | 12     | 1      | 2      | 0.089* | 9      | 15     | 15     | 8      | 0.118  | 16     | 24     | 8      | 4.6    | 0      | 19     | 16     | 5      | 4      | 0.002  |
| No                        | 176    | 88     | 41     | 98     |        | 50     | 85     | 167    | 92     |        | 52     | 77     | 165    | 95     |        | 98     | 84     | 119    | 96     |
| Medicine                  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
| Yes                       | 86     | 43     | 21     | 50     | 0.421  | 30     | 51     | 77     | 42     | 0.251  | 34     | 50     | 73     | 42     | 0.273  | 56     | 48     | 51     | 41     | 0.293  |
| No                        | 113    | 57     | 21     | 50     |        | 29     | 49     | 105    | 58     |        | 34     | 50     | 100    | 58     |        | 61     | 52     | 73     | 59     |

x² Test
* Fischer's test
** Likelihood ratios
In a study using the RULA methodology, we found a high risk for the development of musculoskeletal disorders and, especially, in the upper limbs, of the students who were performing preclinical activity\textsuperscript{11}.

In the present study, when the individual body areas were analyzed, the upper body (neck, shoulder, and upper back) was found to be the most affected by pain. These are commonly the most affected areas in both dentistry professionals and students\textsuperscript{13}. Among the possible pathologies are the degeneration of the intervertebral discs of the cervical region, such as the scapulohumeral periarteritis or bursitis, and physiological muscular contracture\textsuperscript{4}. These lesions on the upper limbs often result in a temporary or permanent incapacity to work\textsuperscript{2}.

Another region with a high prevalence of pain among students in this study was the lumbar area of the spine, however, the prevalence was lower than other studies. Lower back pain is among one of the main chronic health complaints, leading to the need for medical care and also to absenteeism\textsuperscript{14}. In a study of students from the first to the last year of graduation in dentistry (n = 154), 95 (62.5\%) of the students complained of lower back pain\textsuperscript{15}.

However, when analyzed, the lower body was found to be affected to a lesser extent, and the majority of the discomfort or pain in these areas is due to the fact that students do not work with their feet supported on the floor\textsuperscript{11}. A good sitting position, with a support base of the expanded body, avoids potential changes in the circulatory system, such as varicose veins, edema, pain, and inflammation, which may occur as a result of muscle compression of the lower extremities which impedes venous return\textsuperscript{7}.

Despite the high prevalence of pain among students, there were few reports of impairments of normal activities because of pain and/or discomfort. Consequently, the search for a health professional to treat or minimize the problems was also low.

An association was found between pain symptoms (GA) and the number of disciplines studied, with a smaller number of disciplines being associated with a greater complaint of pain. This is likely due to the fact that the discipline of vocational guidance is given clinical disciplines concomitantly; This complicates the application of ergonomic knowledge in the practices of pre-clinical activities, which is reflected in their performance in clinical practice\textsuperscript{11,13}.

It is important to highlight the fact that students who are starting their clinical and pre-clinical activities focus on developing the proposed activities and are not aware of their posture during the execution of the work. This reinforces the need for ever-present ergonomic guidance during pre-clinical and clinical training so that the student receives constant information about the mistakes that they make and to ensure that they are promptly corrected\textsuperscript{11}.

In a study conducted by Botta et al.\textsuperscript{16}, it was possible to verify that the students understanding was limited in relation to the risk factors that contribute to the musculoskeletal disorders; this can be explained by a lack of knowledge of ergonomics. Thus, the integration of preventive-educational programs and ergonomic training in the university dentistry curriculum is essential not only for the expansion of knowledge, but also to allow for the early diagnosis of musculoskeletal disorders. In addition, monitoring
and/or advising of the ergonomic habits of future professionals, particularly in the initial phase of their clinical activities, is pertinent to the adoption of an adequate postural awareness, considering that these students are developing their manual skills, and are best placed to avoid future musculoskeletal damages\textsuperscript{16,17}.

Just over half of the students interviewed stated that they performed physical activities, and the habit of exercising, essentially aerobics and stretching, is considered to be an ergonomic preventive means. The high prevalence of musculoskeletal pain is associated with the long working hours and the sedentary lifestyle of these professionals. Studies have shown that because of the ability to increase oxygen flow, improve cardiovascular/musculoskeletal function and help reduce muscle tension due to incorrect posture, these physical activities may be relevant in reducing pain symptoms in work-associated musculoskeletal disorders related to work\textsuperscript{18-22}. Thus regular physical activity is suggested and is included in the curricula of undergraduate programs for the prevention of muscular disorders, especially back pain\textsuperscript{15}.

The present study demonstrated an association between the pain symptoms in the past year (GA) and the past 7 days (GD), and general health. Indeed, in some previous studies, dentists have presented with poor general health\textsuperscript{7,23,24}. It is important to emphasize that musculoskeletal pain can affect other areas of life, not just the performance and limitations of work activities. Indeed, in a study conducted in Brazil with teaching professionals who had musculoskeletal symptoms, it was shown that these pains correlated with the quality of life of the professionals\textsuperscript{23,25}.

The majority of the existing epidemiological studies involving dentistry students are cross-sectional and use different methods of identification and classification of painful symptomatology, which makes it difficult to compare existing studies. In addition, they present with the characteristic limitations of cross-sectional studies including an increase in the possibility of bias and not allowing for causal inference; however, they do provide essential evidence for future research in the field of ergonomics. Another possible limitation of this study is associated with the use of self-administered instruments that only show the students’ occupational health at a specific moment in time\textsuperscript{7,24,25}.

In the current study, the subjects had a high prevalence of musculoskeletal symptoms (82.6%), especially in the upper limbs. We demonstrated an association between muscular pain and the number of disciplines studied, as well as between muscular pains and the general health of the students.

Thus, it is necessary to begin measures to reduce and prevent musculoskeletal disorders early, while students are still in training, since the correction of bad posture habits is easier at this early stage.

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