Original Article

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# Evaluation of Dentistry Faculty Preclinical Students' Approach to Ergonomics and Occupational Diseases in Dentistry

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## Abstract

**Aim:** The prevalence of musculoskeletal disorders caused by non-ergonomic work practices in dentistry is notably high. Alarmingly, these symptoms can manifest even in students who have not yet begun clinical practice. This study aims to assess the ergonomic awareness and knowledge of occupational diseases among preclinical dental students and to raise awareness before they enter their professional careers.

**Methods:** The cross-sectional prospective survey study included 447 students who were in the preclinical period in 2023-2024. A structured questionnaire was administered, consisting of sections pertaining to demographic information, health status, habits, awareness, risk factors, and clinical symptoms.

**Results:** Evaluation of awareness factors revealed that 56.2% of participants demonstrated an awareness rate exceeding 50%. Furthermore, awareness levels increased significantly from the first to the third year of study ($p<0.001$). No statistically significant difference was observed for awareness and risk factors in terms of gender.

**Conclusion:** The findings indicate that preclinical dental students have insufficient awareness of ergonomic risks and occupational diseases. Integrating ergonomic knowledge into the early stages of dental education could enhance self-awareness, help prevent occupational disorders, and support the long-term ability of dentists to sustain their professional practice.

**Keywords:** Ergonomic, occupational diseases, dental students

## Introduction

The increasing emphasis on the value of the individual has given rise to occupational ergonomics, a discipline focused on designing working and living environments that align with human characteristics. This discipline explores the interplay between individuals, their work, and their environment, culminating in the science of ergonomics (1). The application of ergonomic principles in the workplace fosters a harmonious relationship between individuals and their roles while safeguarding their physical and psychological well-being and ensuring occupational safety. Moreover, it addresses health concerns, mitigates workforce attrition, alleviates fatigue and stress, and minimizes the risk of occupational accidents and illnesses. Ergonomics holds particular significance in dentistry, a profession identified as potentially hazardous in the Occupational Safety and Health Administration (2). Dentists face numerous occupational hazards that contribute to work-related illnesses. These challenges include the stress inherent in a profession requiring high levels of concentration and precision, repetitive and physically demanding movements in confined spaces, prolonged use of high-precision tools that strain the musculoskeletal system, and sustained postures during procedures (3,4).

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While dentists prioritize the oral and dental health of their patients, they often neglect their own posture and ergonomic needs. It is recognized that musculoskeletal diseases are more prevalent among dentists in comparison to the general population (5). Incorporating ergonomic principles in dentistry empowers dental practitioners and their teams to perform their duties without compromising their physical health, thereby improving patient outcomes. The primary objective of ergonomics in dentistry is to preserve musculoskeletal health and promote mental well-being by reducing stress and fatigue. This is achieved through the optimization of equipment design and the working environment for dental professionals (1). A fundamental aspect of dental ergonomics is maintaining appropriate working postures during procedures. Musculoskeletal disorders represent the most prevalent category of occupational injuries arising from the disregard of ergonomic principles. These disorders are notably common among dentists and contribute significantly to early retirement decisions (6). Importantly, these conditions are also observed among dental students in training (7). The early onset of symptoms in students who have yet to encounter the rigors of clinical practice underscores the importance of raising awareness about ergonomic work practices.

In this study, we hypothesized that ergonomic awareness and understanding of occupational diseases are inadequate among preclinical dental students. In light of these considerations, the primary objective of this study is to raise awareness among preclinical dental students, while the secondary aim is to provide guidance to educational programs. By providing dental students with knowledge of potential risks and effective coping strategies, they can raise awareness and reduce the likelihood of developing occupational injuries, enabling them to pursue long and healthy careers.

## Material and Methods

### Compliance with Ethical Standards

Ethical approval for this structured survey study was obtained from the Non-Interventional Ethics Committee of Sivas Cumhuriyet University (approval no.: 2024/04-02, date: 18.04.2024). The study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

### Study Design and Population

This survey was administered to preclinical students (1st, 2nd, and 3rd-year) at the Faculties of Dentistry at Lokman Hekim and Sivas Cumhuriyet Universities. Participation was voluntary and confidentiality was strictly maintained. Prior to the commencement of the survey, all participants were provided with comprehensive information about the study, and informed consent was obtained through a consent form.

The structured questionnaire, which was developed based on a review of the extant literature, consisted of the following sections:

1. Demographic information
2. Health status
3. Habits
4. Awareness
5. Risk factors
6. Clinical symptoms (Tables 1, 2).

The target population included students aged 20-35 years in the preclinical period. Exclusion criteria included pregnant individuals, those with a history of musculoskeletal surgery, and those with rheumatic, neuromuscular, or genetic muscle and bone disorders. Furthermore, participants who declined to participate in the study or provided unreliable answers (i.e., selecting the same option in all answers or providing inconsistent answers in questions measuring similar concepts) were excluded from the study (Figure 1).

### Statistical Analysis

Data were analyzed using IBM SPSS Statistics 23.0 software (IBM Corp. Released 2012). IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). In the present study, the total population size was determined, and a minimum of 441 subjects should be included in the study when the sample size was calculated with a 95% confidence interval and a 3% margin of error (8). The analysis began by determining whether the dataset met the requisite assumptions, and non-parametric tests were employed due to the non-normal distribution of the data.

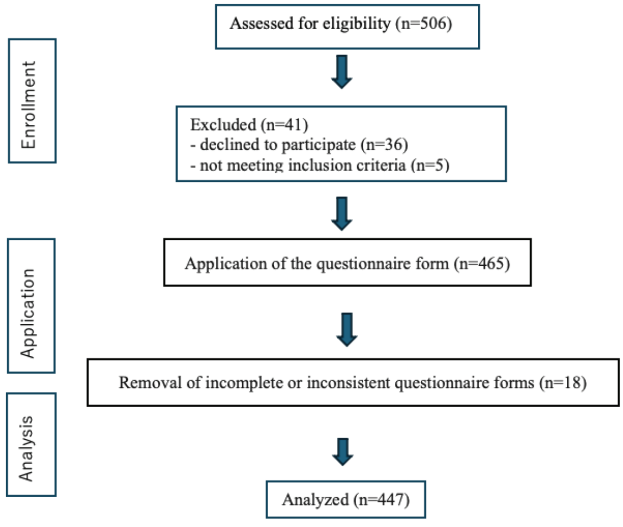


**Figure 1.** Flowchart of the study

- Normality test: The Kolmogorov-Smirnov test was employed to evaluate the normality of data distribution.
- Categorical data analysis: Cross-evaluations of categorical data were conducted using the chi-square test.
- Awareness and risk scales by class and body mass index (BMI): General means were calculated using a Kruskal-Wallis test.
- Gender-based comparisons: The Mann-Whitney U test was used to compare the mean awareness rates and risk scales between male and female participants.
- Combined variable analysis: As the data were numerically transformed rather than categorical, a general linear model with analysis of covariance (ANCOVA) was used to assess the combined effects of the variables.

A p-value of <0.05 was considered the threshold for statistical significance in all tests.

## Results

### Scale Reliability Assessment

The general reliability score of the awareness scale was assessed using the Kuder-Richardson 20 (KR-20) reliability coefficient, which was calculated to be 0.767. Since this value exceeds the commonly accepted threshold of 0.7, the scale was deemed to be reliable. Similarly, the risk scale's reliability was evaluated using Cronbach's alpha coefficient, which was determined to be 0.825. This value indicates that the scale is reliable in its current form and that its items are consistent with the overarching structure.

### Results on Demographic Information, Health Status, and Habits

The study included 447 students, with a mean age of 20.47±1.85 years. Among the participants, 62.2% (n=278) were female, and 37.8% (n=169) were male. Based on the BMI classification system, the majority (70.7%) were categorized as having a normal body weight. Most participants (96%) reported no chronic illnesses, and 88.1% did not take regular medication.

Regarding lifestyle habits, 63.8% of participants did not engage in regular exercise, while the majority did not smoke (74.7%) or consume alcohol (77.9%). Right-handedness was predominant, with 91.1% of respondents indicating they typically write with their right hand. Notably, 60.6% of participants reported not employing any stress management strategies. A majority (73.6%) believed that musculoskeletal disorders are the most common occupational diseases associated with non-ergonomic work in dentistry. A very low proportion of students (4%) thought that the wrist would be affected by non-ergonomic work. The results of the study indicated that 13.9% of respondents believed that symptoms of occupational illness manifested within the first five years of employment, while 38% indicated that this occurred within the subsequent six to ten years.

### Results for the Awareness Section

The findings revealed that while the majority of students were familiar with the term "ergonomics" (69.4%), they lacked knowledge of its application in dentistry (61.1%). Over 50% of participants reported that they were unable to work according to a clockwise schedule (59.3%), despite being aware of the existence

**Table 1. Demographic information, health status and habit sections**

| | | | |
|---|---|---|---|
| **SECTION 1: DEMOGRAPHIC INFORMATION** | | | |
| Age | | | |
| Gender | ☐ Female | | ☐ Male |
| What grade are you in? | ☐ 1 | ☐ 2 | ☐ 3 |
| **SECTION 2: HEALTH STATUS** | | | |
| What is your height? | | | |
| What is your weight? | | | |
| Do you have a chronic illness? | ☐ Yes | | ☐ No |
| Do you take any medication regularly? | ☐ Yes | | ☐ No |
| Have you had any musculoskeletal surgery? | ☐ Yes | | ☐ No |
| **SECTION 3: HABITS** | | | |
| Do you exercise regularly? | ☐ Yes | | ☐ No |
| Do you smoke? | ☐ Yes | | ☐ No |
| Do you drink alcohol? | ☐ Yes | | ☐ No |
| Which hand do you use for writing? | ☐ Right | | ☐ Left |
| Is there a method you use for stress management (breathing exercise, yoga, etc.)? | ☐ Yes | | ☐ No |

of occupational diseases (65.1%). A significant proportion (86.4%) demonstrated a lack of understanding regarding four-handed dentistry. Furthermore, 57% were unaware of specific occupational illnesses associated with their profession, and 71.8% exhibited limited knowledge about carpal tunnel syndrome.

Despite these gaps, 52.3% were aware of the correct working posture for clinical settings. Most participants (79.9%) acknowledged the role of ergonomics in occupational diseases and workplace accidents, while 85.5% agreed that ergonomics impacts work efficiency and performance. Additionally, 84.6% perceived a link between ergonomics and anthropometry. Overall, 56.2% of participants achieved an awareness rate exceeding 50% (n=251).

Statistical analysis revealed a significant increase in awareness rates from the first to third grade. The proportion of participants with a level of awareness of 50% or higher increased from first to third grade (36.2%, 47.3%, and 89.1%, respectively) (Pearson chi-square,

**Table 2. Awareness, risk factors and clinical symptoms section**

| **SECTION 4: AWARENESS** | | | | | |
|---|---|---|---|---|---|
| Have you heard the term ergonomics before? | ☐ Yes | ☐ No | | | |
| Do you have any information about ergonomics in the dental profession? | ☐ Yes | ☐ No | | | |
| Do you know the working position according to the clock dial? | ☐ Yes | ☐ No | | | |
| Do you know the occupational diseases specific to the dentistry profession? | ☐ Yes | ☐ No | | | |
| Do you know about four-handed dentistry? | ☐ Yes | ☐ No | | | |
| Do you know about the most common musculoskeletal diseases in the dental profession? | ☐ Yes | ☐ No | | | |
| Do you know the correct working posture when you go to the clinic/patient care? | ☐ Yes | ☐ No | | | |
| Do you know what carpal tunnel syndrome is? | ☐ Yes | ☐ No | | | |
| Does ergonomics affect work accidents and occupational diseases? | ☐ Yes | ☐ No | | | |
| Does ergonomics affect work efficiency and performance? | ☐ Yes | ☐ No | | | |
| Are ergonomic conditions affected by the anthropometric characteristics of the individual? (Anthropometry: It is a science based on systematic techniques that dimension the physical properties of the human body with the principles of measurement). | ☐ Yes | ☐ No | | | |
| **SECTION 5: RISK FACTORS** | | | | | |
| | **Strongly Disagree** | **Disagree** | **No opinion** | **I agree** | **Strongly Agree** |
| The standing patient treatment position is ergonomic | | | | | |
| A high body mass index influences the occurrence of occupational discomfort. | | | | | |
| Regular exercise helps to prevent occupational discomfort that may occur due to work that is not suitable for ergonomics. | | | | | |
| Long working hours or insufficient rest periods are ergonomic risk factors. | | | | | |
| Noise and vibration of the tools used are ergonomic risk factors. | | | | | |
| Repetitive movements are ergonomic risk factors. | | | | | |
| Long-term use of unsuitable gloves is an ergonomic risk. | | | | | |
| Besides physical factors, psychosocial factors and personal characteristics are factors in occupational accidents. | | | | | |
| Sound insulation in the working environment is an ergonomic risk factor. | | | | | |
| **SECTION 6: CLINIC SYMPTOMS** | | | | | |
| What are the most common occupational disorders due to non-ergonomic work in dentistry? | ☐ **Hearing disorders** ☐ **Vibration syndrome** ☐ **Musculoskeletal disorders** ☐ **Visual impairments** | | | | |
| In which region does pain occur most frequently due to non-ergonomic work in dentistry? | ☐ **Neck** | ☐ **Waist** | ☐ **Back** | ☐ **Wrist** | |
| What is the percentage of dentists reporting at least one musculoskeletal disease symptom at some point in their lives? | ☐ **25%** | ☐ **55%** | ☐ **85%** | ☐ **98%** | |
| Occupational disease symptoms are reported more frequently in which years of working life? | ☐ **1-5 years** | ☐ **6-10 years** | ☐ **7-15 years** | ☐ **16-20 years** | |

p<0.001). The mean awareness scores also increased significantly across grades (Kruskal-Wallis, p<0.001).

When analyzed by gender, 56.8% of females and 55.0% of males achieved awareness levels above 50%. This difference was not statistically significant (Pearson chi-square, p=0.709). Similarly, the mean awareness scores for females (54.77±24.57) and males (54.43±23.78) did not differ significantly (Mann-Whitney U test, p=0.721). BMI-related comparisons revealed no significant differences in awareness rates or mean scores across categories (Kruskal-Wallis, p>0.05) (Table 3).

### Results for the Risk Factors Section

Regarding risk factors, 45.9% of students lacked knowledge about the ergonomic implications of outpatient care. Most participants (77.7%) identified elevated BMI as a risk factor for occupational diseases, and 79.6% recognized regular exercise as a preventive measure. A large proportion (84.5%) identified extended working hours and insufficient rest periods as ergonomic risk factors. Furthermore, 59.4% considered improper glove use to be a potential ergonomic hazard.

Psychosocial factors and personal characteristics were recognized as contributors to occupational diseases by 81.7% of participants. Additionally, 58.3% identified the sound and vibration of tools as ergonomic risks, and 47.7% viewed inadequate sound insulation as a hazard. Repetitive movements were cited as risk factors by 59.7% of students.

No statistically significant differences were found between the average risk scale scores by grade (Kruskal-Wallis, p=0.117) (Table 4). No statistically significant differences were observed in mean risk scores by gender, although females scored higher (3.81±0.52) than males (3.62±0.79) (Mann-Whitney, p=0.162). The results regarding the evaluation of the participants' risk scale general score averages according to BMI are not statistically significant (Kruskal-Wallis, p=0.224) (Table 3).

Using a General Linear Model-ANCOVA analysis, the combined effects of variables on the total mindfulness scale scores were statistically significant [F(21,419)=12,160, p<0.001]. Independent variables with marginal significance included grade, BMI, and alcohol use. Awareness scores increased significantly with academic grades. Higher levels of awareness were demonstrated by obese participants and those who consumed alcohol (Figure 2).

When adjusted for gender and grade, no significant differences in awareness scores were observed in the first grade. However, males in the second grade and females in the third grade demonstrated higher scores (Table 5). A positive correlation was identified between awareness and risk scores within the normal weight group (n=316, r=0.184, p=0.001).

## Discussion

The human body is not anatomically designed to maintain a fixed position for prolonged periods. Resting periods allow for the repair of damaged tissues. However,

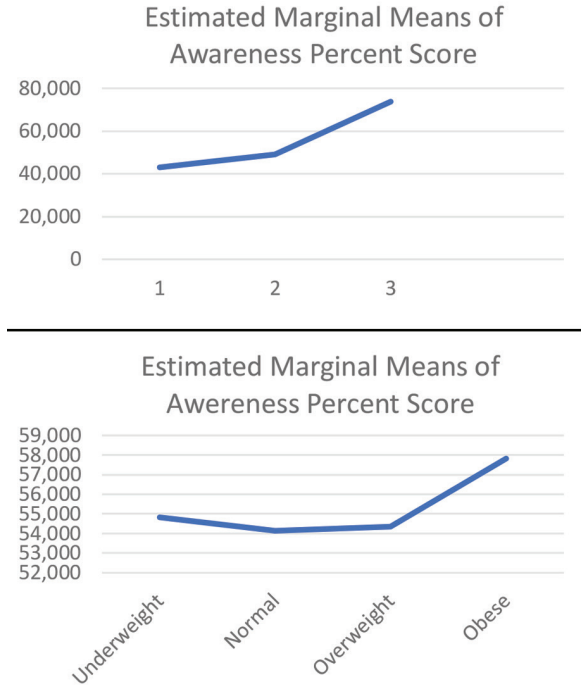


**Figure 2.** Line graph of corrected awareness total percentage scores according to grades (right) and line graph of corrected awareness total percentage scores according to BMI categories (left)
*BMI: Body mass index*

**Table 3. Mean ± SD and median values of awareness and risk factors sections according to BMI categories**

| BMI category | N | Mean ± SD for awareness section | Median for awareness section | Mean ± SD deviation for risk factors section | Median for risk factors section |
|---|---|---|---|---|---|
| Underweight | 40 | 52.50±25.17 | **50.00** | **3.65±0.48** | **3.72** |
| Normal | 316 | 54.60±24.42 | **55.05** | **3.76±0.63** | **3.88** |
| Overweight | 69 | 55.86±24.51 | **54.54** | **3.65±0.80** | **3.81** |
| Obese | 22 | 55.37±20.21 | **53.24** | **3.82±0.43** | **3.83** |
| **Total** | 447 | 54.64±24.25 | **54.39** | **3.74±0.64** | **3.85** |

SD: Standard deviation, BMI: Body mass index

| Table 4. Mean ± SD and median values of awareness and risk factors sections according to grades | | | | | |
|---|---|---|---|---|---|
| **Grade** | **n-%** | **Mean ± SD for awareness section** | **Median for awareness section** | **Mean ± SD for risk factors section** | **Median for risk factors section** |
| 1 | 163-36.5% | 43.44 ±20.05 | **43.57** | 3.77±0.58 | **3.84** |
| 2 | 146-32.7% | 47.69 ±21.58 | **48.79** | 3.64±0.74 | **3.79** |
| 3 | 138-30.9% | 75.23 ±17.87 | **77.96** | 3.80±0.57 | **3.90** |
| **Total** | **447** | 54.64 ±24.25 | **54.54** | 3.74±0.64 | **3.85** |
| SD: Standard deviation | | | | | |

| Table 5. The mean awareness percentage scores by gender and grade arrangement in the general linear model | | | |
|---|---|---|---|
| **Gender** | **Grade** | **Mean** | **Standard error** |
| Female | 1 | 40.333 | 8.352 |
| Female | 2 | 44.666 | 8.481 |
| Female | 3 | 77.558 | 8.232 |
| Male | 1 | 45.729 | 7.396 |
| Male | 2 | 53.441 | 7.278 |
| Male | 3 | 70.000 | 7.260 |

dentists are often required to work in uncomfortable postures for extended durations, primarily due to inadequate rest intervals, a situation that significantly increases their risk of developing occupational injuries (9). A study published in 2025 stated that dentists are at great risk due to inappropriate posture and long working hours. In accordance with our results, 76.2% of the participating dentists were found to have poor dental ergonomic practices (4). This study's findings reveal that 61.1% of students lacked knowledge of ergonomics in dentistry. Even when working in ergonomically optimal positions, dentists must maintain static postures that involve the contraction of more than 50% of their muscle groups to counteract gravitational forces. Over time, this can lead to cumulative trauma, muscle imbalances, prolonged repetitive muscle contractions, discomfort, and functional limitations (4,10). The most common symptoms reported among dentists include neck, shoulder, waist, and back pain (11,12). These symptoms may take a considerable amount of time to manifest, and as a result, they are often overlooked until they become chronic and irreversible (13).

The financial implications of work-related musculoskeletal disorders are substantial. These conditions contribute to human resource shortages, high treatment costs, and temporary or permanent work-related deficiencies. work-related musculoskeletal disorders are a major factor driving the early retirement of dentists (14,15). In many industrialized nations, these disorders are considered a significant public health issue, accounting for one-third of all health-related absenteeism (16). A study conducted in our country found that the most negative aspect of the dental profession, as reported by practitioners, was the development of health problems over time, with a prevalence rate of 43% (17). An examination of the general and occupational health of dentists highlights that occupational musculoskeletal diseases are a serious issue, often leading to sick leave and, in severe cases, abandonment of the profession (18). While treatments such as exercise, heat application, and pharmacological therapies are available, preventive measures taken before disease onset are the most effective strategy (19).

Numerous studies have shown that musculoskeletal disorders in dental students typically begin during their academic training (7,20). The prevalence of these disorders among dental students is notably high (21,22). Furthermore, research indicates that although dental students may possess theoretical knowledge of ergonomics, they often fail to apply this knowledge in clinical practice (23,24).

To address this issue, it is recommended that ergonomic patient care habits be cultivated during the earliest stages of education. Early adoption of proper practices can prevent the need for later correction of incorrect posture, a process that is both challenging and time-intensive. With these considerations in mind, the present study aimed to assess the level of ergonomic awareness and knowledge related to occupational diseases among dental students in the preclinical phase. Additionally, it sought to enhance their understanding of these topics before transitioning to clinical practice.

A significant proportion demonstrated limited awareness of critical aspects of dental practice. For instance, 59.3% were unaware of how to work according to a clock-face schedule, 86.4% were unfamiliar with the concept of four-handed dentistry, and 57% displayed limited understanding of occupation-specific musculoskeletal diseases. These results are supported by studies reporting that students actively working in the clinic have a higher awareness of dental ergonomics than students in the preclinical period (24,25). This finding highlights the potential to increase awareness by incorporating occupational ergonomics into the curricula of preclinical students who have yet to begin practical training.

The majority of respondents (79.9%) recognized the role of ergonomics in occupational diseases and work-related accidents. Similarly, 85.5% perceived ergonomics as a factor influencing work efficiency and performance. When all these factors are considered, 56.2% of participants achieved an awareness level exceeding 50%. However, a very low proportion of the students thought that the wrist area would be affected by non-ergonomic work. Furthermore, in support of these data, the majority of the students did not know about carpal tunnel syndrome. These results can be explained by the fact that information about ergonomics and occupational diseases is included at the end of the education curriculum.

The study found a statistically significant positive correlation between students' academic grades and their awareness levels, as measured by percentages and average scores. Our results are in agreement with other studies, which reported that the higher the academic grade of dentistry students, the higher their awareness of pain complaints (24,26). It can be posited that the increase in awareness may be attributed to simulation practice involving patient models, particularly during the 2nd year, and the incorporation of clinical observation elements in the 3rd year of the program. These results suggest that integrating ergonomics into the curriculum and enhancing students' clinical observation skills positively impacts awareness levels.

No statistically significant difference was observed in awareness percentages or means based on gender. However, second-grade males and third-grade females exhibited higher awareness levels. This trend could reflect an overall increase in awareness as students advance academically, combined with the predominance of females in the sample (62.2%).

Similarly, no significant differences in awareness percentages or means were observed across BMI categories. Nevertheless, participants in the obese group had higher average awareness scores. The finding may suggest that increased BMI heightens sensitivity to ergonomic considerations due to movement restrictions and challenges in maintaining proper working conditions. A study published in 2024 reported that BMI was associated with musculoskeletal disorders in dental assistants (26). However, there is also a study reporting that the distribution of BMI is unequal and that BMI is not associated with MSD symptoms (27).

No statistically significant differences were identified in the general risk scale means across academic grades or BMI categories. The absence of a statistically significant difference in risk scale responses among participants who had not yet transitioned to practical applications may be attributed to the fact that the questions pertained more to the potential challenges encountered during the implementation of patient care. The observation that the general risk scale averages are higher in females may reflect the higher physical endurance of males and the more meticulous approach of females to their work environments, potentially enhancing their awareness (28). In addition, many studies have reported that females are more susceptible to musculoskeletal disorders than males (24,27,29).

A significant positive correlation was identified between awareness and risk factors among participants with normal weight, likely reflecting greater knowledge of risks as overall awareness increases; 70.7% of the participants were of normal weight, which may have influenced this finding. Notably, alcohol users demonstrated higher awareness scale averages in this study. Although some studies suggest that alcohol use may be a risk factor for musculoskeletal pain and are consistent with our findings, there is a lack of information on the effect of alcohol use on ergonomic awareness (30). Therefore, given that only 22.1% of participants reported alcohol use, further research with larger samples is needed to draw definitive conclusions.

### Study Limitations

Two universities, one public and one foundation, were included in line with accessibility and collaboration opportunities. This study's findings are limited by its focus on preclinical students from two academic faculties, limiting the generalizability of the results. Despite these limitations, the study is useful in raising awareness of ergonomics and occupational musculoskeletal disorders among dental students before they enter clinical practice. It will also provide guidance for the development and organization of training programs. Future research should include more diverse samples and longitudinal studies to better understand the development of ergonomic awareness and its long-term impact on occupational health.

## Conclusion

In the absence of an ergonomic work environment, dentists are often compelled to perform tasks that surpass their physical capabilities, inevitably resulting in health complications. It is, therefore, imperative for dental students to be thoroughly aware of the ergonomic risk factors inherent in their workspaces before commencing their clinical placements. These risks can be mitigated by designing work environments that align with ergonomic standards, ensuring that tools and equipment meet appropriate ergonomic criteria, and implementing a well-structured work plan alongside a balanced time schedule.

Given that ergonomic education is typically introduced during the later stages of dental training in

our country, it is essential to integrate this training into the early phases of the clinical patient care curriculum. Early exposure to ergonomic principles will enable students to adopt healthy work habits from the outset of their professional careers, thereby preventing the onset of occupational diseases. Furthermore, this proactive approach will contribute to reducing early retirement rates and the necessity for medical interventions over the long term, ultimately enhancing the efficiency, professional satisfaction, and well-being of dental practitioners.

The findings of this study emphasize the value of embedding ergonomic awareness and education into the foundational stages of dental training. By fostering heightened awareness during the formative years of their education, students will be better equipped to safeguard their health, maintain career longevity, and achieve greater job satisfaction in their future practice.

### Ethics

**Ethics Committee Approval:** Ethical approval for this structured survey study was obtained from the Non-Interventional Ethics Committee of Sivas Cumhuriyet University (approval no.: 2024/04-02, date: 18.04.2024).

**Informed Consent:** Prior to the commencement of the survey, all participants were provided with comprehensive information about the study, and informed consent was obtained through a consent form.

### Footnotes

### Authorship Contributions

Concept: S.A., Design: S.A., Data Collection or Processing: S.A., I.S.A., Analysis or Interpretation: S.A., I.S.A., Literature Search: S.A., I.S.A., Writing: S.A.

**Conflict of Interest:** No conflicts of interest were declared by the authors.

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## References

1. International Ergonomics Association. What is ergonomics (HFE)? Available from:s URL: https://iea.cc/about/what-is-ergonomics/ (IEA2018). Accessed: 5, 2023.
2. Occupational safety and health. Dentistry. Available from:s URL: https://www.osha.gov/dentistry. Accessed April 17, 2025.
3. Çelik Ç, Tuncer D. The evaluation of perceived sources of stress in dental faculty students. J Dent Fac Atatürk Uni. 2016;25:184-94. Turkish.
4. Setiawati F, Hapsari EM, Khairinisa S, Novrinda H, Adiatman M, Darwita RR. Factors related to dental ergonomics practice among indonesian dentists. Int J Dent Hyg. 2025;23:346-52.
5. Ohlendorf D, Naser A, Haas Y, et al. Prevalence of musculoskeletal disorders among dentists and dental students in Germany. Int J Environ Res Public Health. 2020;17:8740.
6. Moodley R, Naidoo S, Wyk JV. The prevalence of occupational health-related problems in dentistry: a review of the literature. J Occup Health. 2018;60:111-25.
7. Moosa UK, Bhayat A. The ergonomic knowledge and practice of dental students in a tertiary institution in South Africa. Int J Dent. 2022;2022:4415709.
8. Yamane T. Temel örnekleme yöntemleri. Ankara: Literatür; 2001.
9. Sachdeva A, Bhateja S, Arora G. Ergonomics in dentistry: a comprehensive review. Journal of Dental Research and Review. 2020;7:32-35.
10. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. J Am Dent Assoc. 2003;134:1344-50.
11. Labib B, Hassona Y, Abdalrahim MS, Jum''ah A, Alduraidi H. Work-related musculoskeletal pain among Jordanian dentists: prevalence and associated demographic, physical, and psychosocial factors. J Back Musculoskelet Rehabil. 2025. Epub ahead of print.
12. Kholinne E, Azalia X, Rahayu EP, Anestessia IJ, Agil N, Muchtar. The prevalence and risk factors of musculoskeletal disorders among Indonesian dental professionals. Front Rehabil Sci. 2025;6:1513442.
13. Diaz-Caballero AJ, Gómez-Palencia IP, Díaz-Cárdenas S. Ergonomic factors that cause the presence of pain muscle in students of dentistry. Med Oral Patol Oral Cir Bucal. 2010;15:e906-11.
14. World Health Organization. Global strategy on occupational health for all: the way to health at work, recommendation of the second meeting of the WHO Collaborating Centres in Occupational Health, 11-14 October 1994, Beijing, China. Available from:s URL: https://www.who.int/publications/i/item/global-strategy-on-occupational-health-for-all-the-way-to-health-at-work Accessed May 31, 1995.
15. Al-Emara Z, Karaharju-Suvanto T, Furu P, Furu H. Musculoskeletal disorders and work ability among dentists and dental students in Finland. Work. 2024;78:73-81.
16. Work Organization and Stress. Preventing musculoskeletal disorders in the workplace. Available from:s URL: https://www.who.int/publications/i/item/preventing-musculoskeletal-disorders-in-the-workplace Accessed June 23, 2003.
17. Subaşı N, Topbaşı N, Ülker G, Tahtacı T, Aydemir N, Çilingiroğlu N. Dimension of musculo-skelatal system pain and its effect on health related life quality among dentists in an oral-dental health center. Hacettepe Dişhemkimliği Fakültesi Dergisi. 2005;29:42-50.
18. Lietz J, Kozak A, Nienhaus A. Prevalence and occupational risk factors of musculoskeletal diseases and pain among dental

professionals in Western countries: a systematic literature review and meta-analysis. PLoS One. 2018;13:e0208628.

19. Anshasi RJ, Alsyouf A, Alhazmi FN, AbuZaitoun AT. A Change management approach to promoting and endorsing ergonomics within a dental setting. Int J Environ Res Public Health. 2022;19:13193.
20. Shirzaei M, Mirzaei R, Khaje-Alizade A, Mohammadi M. Evaluation of ergonomic factors and postures that cause muscle pains in dentistry students' bodies. J Clin Exp Dent. 2015;7:e414-8.
21. McLaren W, Parrott L. Do dental students have acceptable working posture? Br Dent J. 2018;22:59-67.
22. Ergan M, Ercan S, İnce Parpucu T, Başkurt F, Başkurt Z. Ergonomics-related musculoskeletal problems, kinesthesia and burnout levels of dental students: gender-specific differences. Ergonomics. 2024;7:37-48. Turkish.
23. Garcia PPNS, Gottardello AC, Presoto CD, Campos JADB. Ergonomic work posture in undergraduate dentistry students: correlation between theory and practice. J Educ Ethics Dent. 2015;5:47-50.
24. Tysiąc-Miśta M, Kruplewicz M, Grzyb A, Dziedzic A, Tanasiewicz M. The knowledge and attitude of undergraduate dental students toward dental ergonomic principles in occupational health. Healthcare (Basel). 2024;12:1566.
25. İnce Parpucu T, Ercan S, Başkurt F, Başkurt Z. Ergonomics knowledge and behavior in dentistry students. Journal of TOGU Health Sciences. 2023;3:341-53. Turkish.
26. Aljanakh M. Musculoskeletal disorders among dental assistants: a cross-sectional study. BMC Musculoskelet Disord. 2024;25:64.
27. Sangalli L, West-Pelak E, Knecht-Sabres L, et al. Sex and academic stage differences in work-related musculoskeletal disorders pain among dental students. A cross-center cross-sectional study. Cranio. 2025:1-17.
28. Bartolomei S, Grillone G, Di Michele R, Cortesi M. A Comparison between male and female athletes in relative strength and power performances. J Funct Morphol Kinesiol. 2021;6:17.
29. Acıpınar Ş, Koçkanat A. Evaluation of knowledge levels and awareness of dentists working in Sivas province about ergonomics. NEU Dent J. 2025;7:77-86.
30. Kirsch Micheletti J, Bláfoss R, Sundstrup E, Bay H, Pastre CM, Andersen LL. Association between lifestyle and musculoskeletal pain: cross-sectional study among 10,000 adults from the general working population. BMC Musculoskelet Disord. 2019;20:609.