

**Original article**

## **Ergonomic evaluation of working postures and work-related musculoskeletal problems among dental students**

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### **ABSTRACT**

**Background:** Ergonomics is the art and science that fits individual's job to the work culture that it enhances human efficiency and well-being. The purpose of the study is to assess the knowledge and awareness among dental students regarding their working postures and work-related musculoskeletal problems during their clinical practice.

**Aim:** To evaluate the working postures and work-related musculoskeletal problems among undergraduate dental students in Khammam.

**Methods:** A cross sectional study was carried out in which second year, third year, fourth year and intern dental students participated. A questionnaire with 22 questions was used to evaluate their working postures and work-related musculoskeletal problems. SPSS version 23 was used to perform descriptive statistics and Chi-square tests on the data. A p-value <0.05 was used to evaluate statistical significance.

**Results:** A total of 275 students took part, with 220(80%) of them being females and 55 being males (20%).In this study, interns had more knowledge and awareness about working postures, followed by fourth year, third year, and second year dental students. The work-related musculoskeletal problems were experienced mostly by interns, followed by fourth year, third year and second year students.

**Conclusion:** Dental students are susceptible to development of musculoskeletal issues due to lack of consciousness regarding accurate working posture. Thus, ergonomic education of the dental students must be focused in all the educational institutions and practically should be a part of the dental curriculum.

**Keywords:** Ergonomics, working postures, work-related musculoskeletal problems, dental students.

### **INTRODUCTION:**

Musculoskeletal disorders (MSD) are common occupational ergonomic hazard and occur due to prolonged faulty posture. The musculoskeletal health of dental professionals has been the subject of several research international, and the focal point of those studies has been at the pain experienced by the practitioner, because their work place is narrow and performance of dental treatment results in a very inflexible working posture<sup>1</sup>.

Among occupational diseases in health workers, musculoskeletal disorders affect approximately 63-93% of dentists. On an average, 2 out of 3 dental professionals experience occupational pain. The most common site of muscular pain is in back, neck, shoulder and hands. In addition to pain, they experience other symptoms such as tingling, numbness, early fatigue and loss of coordination and movement which account for the most common reasons (29.3%) for early retirement age in dentists worldwide<sup>[2,10]</sup>

Recently, 'ERGONOMICS' has become a very popular term. The term has been used with most professions, but increasingly in the dental profession. It is a discipline that studies workers and their relationship to their working environment. This includes many different concepts, such as 'how dentists position themselves and their patients while working in clinical practice', 'how they utilize the dental equipment', 'how work areas are designed' and 'how all of these impact the health of dentists'<sup>3</sup>.

Dentist's work demand high precision and stagnant working posture, distorted posture and repetitive movements which could lead to work-related musculoskeletal disorders [WMSDs]<sup>4</sup>. In dental practice, working postures is considered to be the main factor of work-related musculoskeletal disorders<sup>[14]</sup>.

Till now, the focus has been mainly centered for a long time on work-related musculoskeletal disorders and application of ergonomics among dentists, but recently more studies have investigated the early manifestation of work-related musculoskeletal disorders among dental students<sup>5</sup>. These studies reported a high percentage of WMSDs among dental students during their clinical and preclinical practice and concluded that even undergraduate dental students are at high risk of developing WMSDs. Many students mainly complained of pain after their clinical and preclinical sessions and manifested early signs and symptoms of WMSDs similar to those reported by dentists.

The goal of current study is to evaluate the working postures and work-related musculoskeletal problems among dental students in different levels of their academic life starting from their preclinical years and ending by their final clinical year. The purpose of the study is to determine the knowledge and awareness of the undergraduate dental students regarding their working postures and work-related musculoskeletal problems during their clinical practice.

**AIM:** To evaluate the working postures and work-related musculoskeletal problems among undergraduate dental students in Khammam.

#### **OBJECTIVES:**

- 1) To evaluate the working postures among undergraduate dental students based on their year of study and gender.
- 2) To assess work-related musculoskeletal problems undergraduate dental students based on their year of study and gender.

#### **METHODOLOGY**

A cross-sectional study was conducted. The Institutional Ethics Research Committee approved the study to be ethical. A total of 275 dental students of second year, third year, fourth year and Interns were included. The pilot study was conducted on group of students to assess the validity and reliability of study. The respondents who took part in the pilot study did not take part in the main study. The questionnaire was put through its paces in a pilot study.

The questionnaire is divided into two sections. The first section contains demographic information such as name, age, gender and year of study. The second section consists of 22 questions that were designed using earlier research.

Out of 22 questions, 15 questions are related to knowledge and awareness of dental students regarding working postures, whereas the other 7 questions are related to work-related musculoskeletal problems among them.

The purpose of the study was explained to the students, who were then invited to participate on the condition of anonymity. In google forms, an online questionnaire was designed and a link was created. A social media platform was used to distribute the link to the students. The students were given a week to complete the survey. Participants were instructed to choose one answer from a list of options offered for each question.

Data collection, compilation and analysis was done as per standard statistical procedures. The data from the completed surveys was tabulated in excel files, and statistical analysis was done with SPSS version 23. A p-value of <0.05 was taken as statistically significant.

### RESULTS:

Questionnaires were sent to 400 students, and 275 completed them, yielding a response rate of 68.75%. Out of 275 participants, majority of them belonged to 21-22 years age group, with a mean age of 21.5±2.29 years. Most of the participants (80.00%) are females, in the present study and most of the participants are second year students (26.91%), followed by fourth year students(26.55%), third year students(24.00%) and interns(22.55%) [Table 1]

On comparison of knowledge of dental students towards ergonomics and work postures, when they were asked 'Are you familiar with the ergonomic posture to perform clinical procedures in your dental practice?' 163(59.27%) answered 'Yes' and 112(40.73%) answered 'No'. Out of the students who answered 'Yes', majority are females(60.45%) followed by males(54.55%) with P value 0.4250, and according to year of study, majority are interns(82.26%), followed by fourth year students(64.38%), third year students(50.00%), and second year students(43.24%) [Table 2] with statistical significance.

When they were asked, 'What is the position of your feet while working?' 168(61.9%) students answered 'flat on the floor', 58(21.09%) answered toes touching the floor, 49(17.82%) answered 'feet on the legs of the stool'. Among females,64.09% answered 'flat on the floor' and among males 49.09% answered 'flat on the floor' with P value 0.4250 and according to year of study, majority of the students who answered 'flat on the floor' are interns(80.65%), followed by fourth year students (73.97%), followed by second year students(42.95%), and third year students(45.45%) [Table 3] with statistical significance.

When the students were asked regarding the posture they follow while working in clinical practice, most of them chose 'option2'[figure2] which is the correct ergonomic posture and only few students chose 'option1'[figure1]. Out of them, majority are females with 64.09%, males with 49.09% with P value 0.0840, interns with 93.55%, fourth year students with 90.41%, third year students with 86.36%, and second year students with 81.08% [Table 4] with statistical analysis.

On comparison of work-related musculoskeletal problems among them, majority of the students experienced neck pain, back pain, shoulder pain and fingers/hand pain (37.82%), followed by only back pain (20.36%), only neck pain (14.18%), finger/hand pain (7.27%), shoulder pain (6.18%), whereas 14.18% experienced no pain at all. According to the gender, majority of the females (38.64%) and male (34.55%) experienced all types of pain.

According to year of study, neck pain is mostly experienced by fourth year students(20.55%), back pain by second year students(21.62%), finger/hand pain by third year students(9.09%), shoulder pain by interns (14.52%), and all

types of pain by third year students (45.45%) and no pain experienced by second year students(28.38%) [Table 5] with statistical significance.

**FIGURE 1 : INCORRECT WORKING POSTURE**



**FIGURE 2 : CORRECT WORKING POSTURE**



**TABLE 1: DEMOGRAPHIC PROFILE OF RESPONDENTS**

Demographic profile	No. of respondents	Percentage of respondents
Age in years		
19-20years	54	19.64
21-22years	152	55.27
>=23years	69	25.09
Mean age	21.5	
SD age	2.29	
Gender		
Male	55	20.00
Female	220	80.00
Year of study		
II BDS	74	26.91
III BDS	66	24.00
IV BDS	73	26.55
Interns	62	22.55
Total	275	100.00

**TABLE 2 : COMPARISON OF KNOWLEDGE OF DENTAL STUDENTS TOWARDS WORKING POSTURES ACROSS GENDER AND YEAR OF STUDY**

Are you familiar with the ergonomic posture to perform clinical procedures in your dental practice?	Gender			Year of study				
	Males	Females	P-value	II years	III years	IV years	Interns	P-value
Yes	30 (54.55%)	133 (60.45%)	0.4250	32 (43.24%)	33 (50.00%)	47 (64.38%)	51 (82.26%)	0.0001
No	25 (45.45%)	87 (39.55%)		42 (56.76%)	33 (50.00%)	26 (35.62%)	11 (17.74%)	

**TABLE 3 : COMPARISON OF KNOWLEDGE OF DENTAL STUDENTS TOWARDS WORKING POSTURES ACROSS GENDER AND YEAR OF STUDY**

What is the position of your feet while working?	Gender			Year of study				
	Males	Females	P-value	II years	III years	IV years	Interns	P-value
Flat on the floor	27 (49.09%)	141 (64.09%)	0.0840	34 (45.95%)	30 (45.45%)	54 (73.97%)	50 (80.65%)	0.0001
Toes touching the floor	17 (30.91%)	41 (18.64%)		20 (27.03%)	16 (24.24%)	13 (17.81%)	9 (14.52%)	
Feet on the legs of the stool	11 (20.00%)	38 (17.27%)		20 (27.03%)	20 (20.30%)	6 (8.22%)	3 (4.84%)	

**TABLE 4: COMPARISON OF KNOWLEDGE OF DENTAL STUDENTS TOWARDS WORKING POSTURES ACROSS GENDER AND YEAR OF STUDY**

Which of the following postures do you follow while working in clinical practice?	Gender			Year of study				
	Males	Females	P-value	II years	III years	IV years	Interns	P-value
Option 1	6 (10.91%)	28 (12.73%)	0.7140	14 (18.92%)	9 (13.64%)	7 (9.59%)	4 (6.45%)	0.1360
Option 2	49 (89.09%)	192 (87.27%)		60 (81.08%)	57 (86.36%)	66 (90.41%)	58 (93.55%)	

**TABLE 5: COMPARISON OF WORK-RELATED MUSCULOSKELETAL PROBLEMS ACROSS GENDER AND YEAR OF STUDY**

If you have experienced pain, which type of pain do you frequently experience during dental practice?	Gender			Year of study				
	Males	Females	P-value	II year	III year	IV year	Interns	P-value
Neck pain	5 (9.09%)	34 (15.45%)	0.0950	9 (12.16%)	8 (12.12%)	15 (20.55%)	7 (11.29%)	0.0070
Back pain	15 (27.27%)	41 (18.64%)		16 (21.62%)	13 (19.70%)	15 (20.55%)	12 (19.35%)	
Finger/Hand pain	8 (14.55%)	12 (5.45%)		5 (6.76%)	6 (9.09%)	6 (8.22%)	3 (4.84%)	
Shoulder pain	3 (5.45%)	14 (6.36%)		3 (4.05%)	2 (3.03%)	3 (4.11%)	9 (14.52%)	
All of the above	19 (34.55%)	85 (38.64%)		20 (27.03%)	30 (45.45%)	27 (36.99%)	27 (43.55%)	
No pain experienced	5 (9.09%)	34 (15.45%)		21 (28.38%)	7 (10.61%)	7 (8.59%)	4 (6.45%)	

## DISCUSSION:

In dentistry, ergonomics plays a main role throughout a professional's life which makes it mandatory to inculcate it right from the start of the course. n. Åkesson et al. observed that the work posture of dentists plays an important role as a risk factor for the development of work-related musculoskeletal disorders<sup>17</sup>. Students must be encouraged towards adoption of an ergonomic work posture during professional training in order to reduce the risk of the development of musculoskeletal problems. Nevertheless, dental students frequently neglect to adopt this posture.<sup>[6,7]</sup>

In present study to determine the knowledge and awareness of dental students regarding the working postures and work-related musculoskeletal problems, Out of 275 students, 163 are familiar with the ergonomic posture to perform clinical procedures in dental practice, most of them being females. According to the year of study, interns are more familiar with the ergonomic posture followed by fourth year students, third year students and second year students, which indicates that the knowledge regarding ergonomic posture increased with increasing clinical experience.

Changing positions while performing clinical procedures is necessary rather than following a static working posture in order to reduce the risk of WMSDs among dental students. In this study majority of the students(183) reported to change their positions sometimes during clinical practice, 70 students reported to change their positions 'most of the time', whereas 31 students reported to never change their positions during clinical procedures.

Kanteshwari K et al(2011) conducted a study to analyze the awareness level of dental practitioners concerning the correctness of various postures involved in carrying out dental procedures, and estimate the correlation that exists between correct /incorrect postures and occurrence of musculoskeletal disorders. They found out that less than 50% of the respondents indicated awareness regarding ergonomic posture of which 70% had musculoskeletal pain<sup>[8]</sup>. The end result of this study is in agreement with current study done where, 70-80% of the respondents indicated awareness regarding ergonomic postures. Among dental students 68.73% reported to be suffering from work-related musculoskeletal pain. Thus, it can be concluded that awareness regarding ergonomic postures could be a contributory factor in reducing the risk of musculoskeletal pain among dental students.

A significant finding of this study is that prevalence of musculoskeletal pain changes with duration of work during the clinical practice among dental students. Majority of Interns and fourth year students reported of musculoskeletal pain due to increased duration of work in the clinical practice, whereas few students from third year and second year reported of musculoskeletal pain due to decreased duration of work in the clinical practice.

We found a total of 28.36% prevalence of back pain among the participants. Second year students (21.62%) reported a higher prevalence of back pain than fourth year students(20.55%), third year students(19.70%) and interns(19.35%).The prevalence of other pains is neck pain(14.18%), shoulder pain(6.18%), and finger/hand pain (7.27%). Usually, such pains are slow to appear and ignored until they become chronic and permanent in nature and difficult to treat, but these symptoms can appear early in dental professional's careers, and even as early as during educational training. Various remedies are followed by the dental professionals in order to reduce the risk of WMSDs such as aerobic exercises, acupuncture, remedial massage, and others.<sup>[11,12]</sup>

In order to avoid these problems, functionally designed dental equipment and proper training in ergonomic methods should be available for all the dental students<sup>[13]</sup>.

### CONCLUSION:

This study suggests an excessive occurrence musculoskeletal pain among dental students and clearly indicates that it is necessary to begin measures to reduce and prevent MSDs early, while the students are still in training. The results of this study identifies certain risk factors for the development of musculoskeletal pain which are lack of awareness about correct working postures and ergonomic principles, prolonged static postures, inadequate operating stools<sup>[15]</sup>. This results in development of musculoskeletal problems of multifactorial origin. Therefore, dental professionals need to carefully consider adoption of appropriate strategies and procedures in order to minimize the impact of these occupational health hazards on their professional life<sup>[16]</sup>.

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