

# Ergonomic risk assessment from working postures in fourth year undergraduate dental students at Mahidol University

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**Objectives:** The aim of this study was to assess ergonomic risk from working posture and observe the association between posture awareness and ergonomic risk in the fourth year undergraduate dental students at Mahidol university

**Materials and Methods:** Photographs of students during performing scaling and root planning procedure were taken. The photographs were analyzed using UTHSCSA Image Tool program. Modified Rapid upper Limb Assessment method was used to assess ergonomic risk levels. Posture awareness and reasons of their pose were recorded into questionnaires. Prevalence of ergonomic risk was calculated. The association between posture awareness and ergonomic risk was statistically analyzed using chi-square test ( $p=0.05$ ).

**Results:** All 56 dental students tend to develop musculoskeletal disorder. The data showed that 64.3% and 35.7% of students demonstrated moderate to high ergonomic risk respectively. 45% of students assumed posture awareness during their performance. There was no statistically significant association between posture awareness and ergonomic risk. ( $p=0.611$ )

**Conclusions:** The ergonomic risk of developing musculoskeletal disorder from working posture in undergraduate dental students at Mahidol university was moderate to high. Nevertheless, there was no association between posture awareness and ergonomic risk.

**Keywords:** awareness, ergonomic risk, dental students, WMSDs, working posture.

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## Introduction

Dentist is among the profession which is at risk of developing work-related musculoskeletal disorders (WMSDs). The nature of dentist-working characteristics; including repetition of working patterns, absorption of force and vibration during operation, extrinsic stress and abnormal working posture, are responsible for the occurrence of musculoskeletal pain. [1, 2] Previous studies reported that dental students, dental assistants, postgraduate students and lecturers do all suffer from WMSDs where neck, shoulder and back were the usual pain presenting area. The evaluated data demonstrated the association between

musculoskeletal pain and working-posture awareness. [3, 4] It is evident that only 35% of dental students, who knew ergonomic theoretically well, did properly organize their posture. [5, 6] It is to be addressed that WMSDs do present in dental personnel working around the dental chair and start very early in their life. Our study, therefore, quests to determine the prevalence of ergonomic risk from working posture in the fourth year dental students who are taught ergonomic theoretically during their third academic year and just start treating patients in clinical environment. This study is also report the reasons of noncompliance to the ergonomic working posture and present the relationship between posture awareness and the occurrence of ergonomic risk.

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## Materials and methods

The ethical approval received from Mahidol university (COA.No.MU-DT/PY-IRB 2017/008.1402). Fifty-six righteous fourth year dental students at faculty of Dentistry, Mahidol university who registered to study in the second semester of 2016 academic year was invited to enter the study. Students having abnormal skeletal structures (spine or neck bone) were excluded from the study.

### Working posture assessment

From 2-meter distance, working posture while performing scaling and root planing using hand instruments at the Periodontics clinic in the main clinic was recorded by a digital camera fixed to a tripod set at the waist-height of each subject. Focal direction (Camera's lens) pointed to the right side of subject and was projected parallel to the horizontal plane and perpendicular to the vertical plane. Photographs were taken randomly at 15, 20, 25, 30, 35, 40, 45 or 50 minutes after the commencement of the treatment. Each subject is not informed about date and time to be assessed. The assessment procedure did not impede the student's performance.

Photographs of working posture were processed through UTHSCSA Image Tool software<sup>®</sup> (Department of Dental Diagnostic Science at The University of Texas Health Science Center, San Antonio, Texas, USA) to reveal the angulation between parts of the upper arm, lower arm, head & neck, trunk, and leg & foot which were further assessed using Modified Rapid Upper Limb

Assessment (RULA) method.

### Posture awareness assessment

This was assessed through questionnaires. There were 2 open-end questions acquiring whether or not subject reminds themselves about ergonomic knowledges during working and reasons for not comply with the ergonomic recommendation.

### Statistical analysis

The prevalence of ergonomic risk in dental student was described in percentage. The significant of relationship between posture awareness and ergonomic risk was calculated by SPSS version 22.0 using chi-square test at  $p < 0.05$ .

## Results

### General data (Table 1)

There were 18 male and 38 female (total of 56 subjects) participated in this observation. The average age was  $21.88 \pm 0.748$  years old.

### Working posture assessment (Table 2)

Upper arm : 55.4% of subjects demonstrated flexion at 20-45 degree.

Lower arm : 92.9% of subjects demonstrated flexion at less than 60 degree or more than 100 degree.

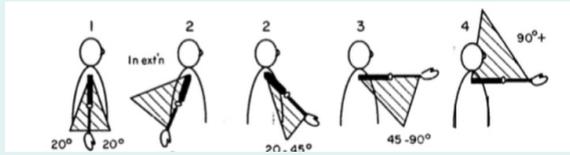
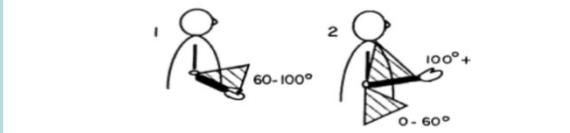
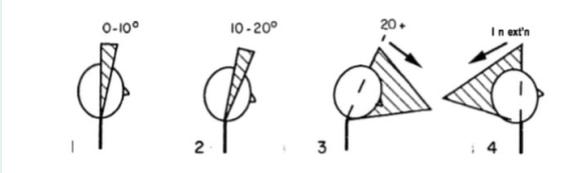
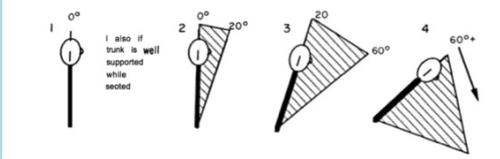
Head & Neck : 100 % of subjects demonstrated flexion at 20 degree or more.

Trunk : 78.6% of subjects demonstrated flexion at 20-60 degree.

**Table 1** General data

	N (persons)	%
Male	18	32.1
Female	38	67.9
Age (years old)	21.88±0.748	

**Table 2** Posture assessment using Modified RULA method classified by body parts.

Body part	Score	N	%	
Upper arm	1	22	39.3	
	2	31	55.4	
	3	3	5.4	
	4	-	-	
Lower arm	1	4	7.1	
	2	52	92.9	
Neck	1	-	-	
	2	-	-	
	3	56	100	
	4	-	-	
Trunk	1	-	-	
	2	44	78.6	
	3	12	21.4	
	4	-	-	
Leg	1	49	87.5	
	2	7	12.5	

Leg & foot : 87.5% of subjects demonstrated well support and balance.

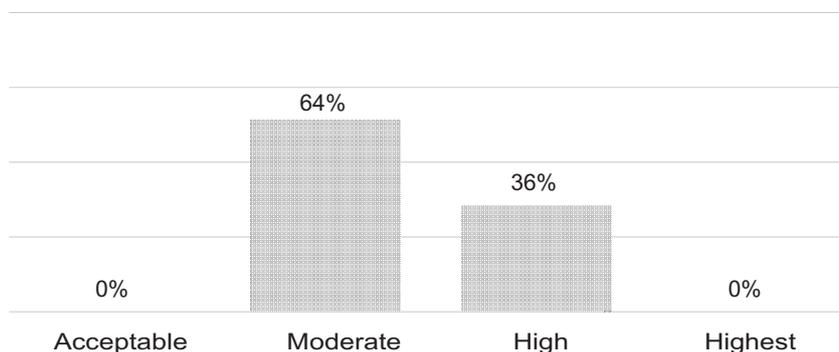
Using modified RULA method, the fourth year dental students were classified as moderate to high risk of developing musculoskeletal disorder. (Figure 1)

**Posture awareness assessment**

Three-fourth of questionnaire returned for

analysis. It was showed that 54.8% of subjects did not remind themselves about ergonomic knowledges during performing scaling and root planing (Figure 2). The reasons for not comply with ergonomic recommendation were presented here. (Figure 3)

According to the result, there was no statistically significant relationship between posture awareness and ergonomic risk. (Table 3)



**Figure 1** Percentage of the fourth year dental students at Mahidol university classified by risk of developing musculoskeletal disorder.

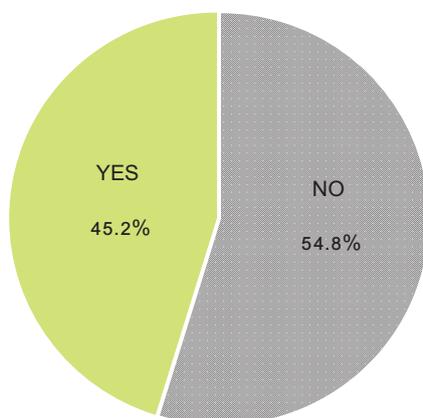


Figure 2 Percentage of the fourth year dental students at Mahidol university reporting ergonomic awareness.

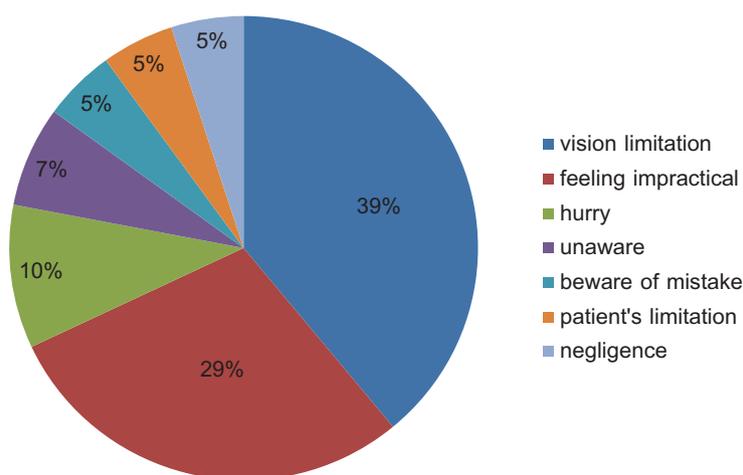


Figure 3 Percentage of the fourth year dental students at Mahidol university classified by reasons for not comply with ergonomic recommendation.

Table 3 Relationship between posture awareness and ergonomic risk

Posture awareness	Ergonomic risk		$\chi^2$	p
	moderate	high		
Yes	13	6	0.25	0.611
No	14	9		

## Discussion

This study did reveal that all the fourth year undergraduate dental students at Mahidol university were at risk of developing WMSDs. Though the prevalence of risk was consistent with other studies, the magnitude of severity of risk was

different. Our study did show less risk magnitude to the development of disorders. [7, 8] This finding is not unexpected since this study used modified RULA method which is not evaluate the wrist part. However, RULA's recommendation indicates that a kind of work which leads to moderate and high ergonomic risk level need close monitoring and modification of working environment. Figure 4 and

5 showed the example of working postures which might lead to the development of WMSDs.

Though these students have registered for ergonomic credits in their third academic year, students more than half of the class did not aware and not adjust their posture correlating with ergonomic theory during their working hours. This is consistent with other studies which generally reported operator's reluctance in postural control. [5, 9] It is quite a worried situation since these students were prone to injury since the early stage of their career. Almost all the dental schools notice the problem and presently include the study of ergonomics into the curriculum. However it does not seem that the situation is alleviated since it was evident that there was no correlation between the level of knowledge in ergonomic and the application in clinical situation. [6]

The reasons for not obedience to the ergonomic recommendations comprise of vision limitation, feeling impractical, hurry, unaware,

beware of mistake, patient's limitation and negligence. Precision is mandatory in achieving good to perfect dental works. It might be generally true that the apprentices, like dental students, would have difficult time dealing with the tasks. In most clinical situations, due to inexperience in working with instruments (especially mouth mirror) and manipulation of patient's position, ergonomic postures may impede their vision. Thus, it is unavoidable not to comply with recommendations in order to finish their work as best and fast as possible. The authors would like to express our appreciation if there is more practice in laboratory and increase the effort to strictly focus on exercise the appropriate ergonomic working postures not just the completeness of the final work. In clinical practice, the requirement on performing ergonomic working postures along with the complete works under the facilitation of instructors might encourage students to practice a healthier working environment.



Figure 4 Moderate ergonomic risk working postures to develop WMSDs

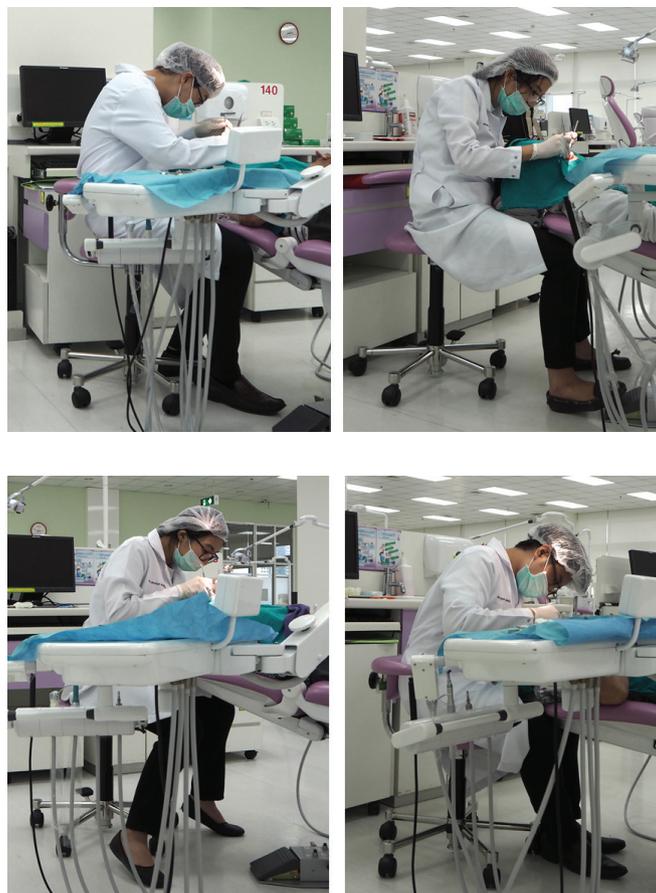


Figure 5 High ergonomic risk working postures to develop WMSDs

## Conclusion

This study demonstrated the primary information about the ergonomic risk in undergraduate dental students at Mahidol university. The ergonomic risk of developing musculoskeletal disorder from working posture was moderate to high but there was no association between posture awareness and ergonomic risk. Hopefully, this report might urge every associated sectors to be conscious the important of ergonomic awareness and be part to motivate dental students to perceive ergonomic concept as early as possible.

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**Competing interests :** None declared

**Ethical approval :** The Faculty of Dentistry/Faculty of Pharmacy, Mahidol University Institutional

Review Board No. COA.No.MU-DT/PY-IRB2017/008.1402

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