Self-reported prevalence and risk factors of musculoskeletal pain in Thai dental students

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Abstract

Purpose: The aim of this study was to investigate the self-reported prevalence and risk factors of musculoskeletal pain amongst fifth year dental students of Naresuan University, Thailand.

Methods: Sixty eight dental students were recruited. A modified Nordic Musculoskeletal Questionnaire was conducted to assess the prevalence of the site of pain. Rapid Upper Limb Assessment (RULA) and personal factors questionnaire were provided to evaluate risk postures during their clinical work and to ascertain the personal factors related to musculoskeletal pain, correspondingly.

Results: 83.82% and 100% of the dental students reported at least one musculoskeletal pain in the past seven days and twelve months, respectively. The high prevalence regions included neck (82.35%), upper back (60.29%), right hand and wrist (48.53%), and lower back and right shoulder (each 47.06%). The 95.6% of dental students had a highest risk level of the RULA score. There was a significant association between gender and right shoulder pain along with BMI and low back pain ($p<0.05$).

Conclusions: From the results of both high prevalence and risk levels of musculoskeletal pain from poor working posture, we can thereby suggest adoption of better working postures and prevention strategies like exercises to decrease the risk of musculoskeletal problems.

Keywords: Musculoskeletal pain, Dental students, Risk factor

Introduction

Musculoskeletal disorders(MSDs) are work related diseases commonly experienced by the dental professionals. This may be due to that their clinical performance is restricted to a certain area and involves a high visual demand which usually necessitates adoption of unusual posture. Along with it, a repeated, precise movement[1] and a prolonged static posture is also required. These factors compromise dental professionals to be grouped highly associated with work-related MSDs[2,3]. Musculoskeletal pain is one of the most common symptoms of MSDs[4]. A study conducted using questionnaire method revealed a prevalence of MSDs in more than 50 percent[5,6] of dental professionals. Depending on both the size of study population and the country, the sites of musculoskeletal pain are prevalent mostly at the neck, shoulder, hand and wrist[7,8]. The study of prevalence of MSDs amongst the dental professionals in Thailand is relatively few, showing the dental professionals have a higher prevalence of musculoskeletal pain reaching up to a 78%[9]. MSDs may result in reduced work productivity[10], increased sick leave and medical care seeking or having to abandon the professional career if the symptoms become chronic[11].

While many studies are reportedly performed among dentists, few studies are conducted in dental students. Yet, from those few studies in dental students, a very high prevalence of musculoskeletal pain of 76.2%, 81% and 92% found in India[12], Iran[13] and Malaysia[14], respectively, indicating the possibility that students develop ergonomic problems starting from their clinical training period and could intensify later in the future if not investigated and corrected. However, MSDs are attributed to not only ergonomically poor posture but also to other risk factors like gender[15], age[16], BMI[17], smoking[18], alcohol consumption[19], sleep and rest[20], exercise[21] and usage of electronic devices[22].

Given the few literature reviews and considering the high prevalence of musculoskeletal pain among the dental students, it seems that further research is needed in this area. Especially in Thailand, there haven't been any reported investigations in dental students. Hence, we conducted this study to investigate 1) the prevalence of musculoskeletal pain at various body sites, 2) the risk of musculoskeletal pain from awkward working posture, and 3) the individual risk factors associated with musculoskeletal pain in dental students, so as to find the cause and ways to prevent musculoskeletal pain amongst the dental students.

Methods

Participants: We included the 5th year dental students, who are involved in both the periodontics and operative clinical departments, as these two departments are the only department which consists of high consistent frequency of clinical training every week at the faculty of dentistry, Naresuan University. Inclusion criteria of the student were:

1. The students should be exposed to clinical setting for at least 12 months.

2. The students should not have any history of diagnosed musculoskeletal disorder caused by factors other than clinical practice.

Ethical clearance for this study was obtained from the Naresuan University Human Ethics Committee. All subjects were given details of the study and provided a written informed consent forms prior to their participation. The total number of students who were eligible for this study was 68 students.

Questionnaire on prevalence of musculoskeletal pain

The questionnaire was adapted and modified from Nordic Musculoskeletal Questionnaire[23] to define pain on various body sites like neck, left and right shoulder, upper and lower back, left and right elbow, left and right hands/wrists, hips and legs, knees, and ankles/ feet in the previous 7 days and the last 12 months before the survey. The questionnaire is divided into two parts: 1) the subjects were asked to identify the body region where they suffered from musculoskeletal pain, the intensity of symptoms were evaluated using the Verbal Rating Scale (VRS) and the duration of pain[24] over the previous 7 days before the survey were asked accordingly. 2) Resemble to the 7 days period, the subjects were again required to specify the site of pain in the last 12 months before the survey, but the level and duration of pain were not asked to prevent recall bias.

Evaluation of risk from working posture by Rapid Upper Limb Assessment (RULA)

The assessment of body posture is divided into two parts: the first part includes the upper as well as lower arm and wrist while the second part includes neck, trunk and legs. Level of muscular use and force were also assessed. Based on the results of the posture analysis, the action levels were divided into four levels[25]:

Level 1: a score of 1 or 2 indicates that posture is acceptable if it is not maintained or repeated for long periods.

Level 2: a score of 3 or 4 indicates that further investigation is needed and changes may be required.

Level 3: a score of 5 or 6 indicates that investigation and changes are required soon.

Level 4: a score of 7 and above indicates that investigation and changes are required immediately.

Without informing the subjects before and, a video was recorded of them in both the periodontics and operative clinical departments to avoid the students from behaving artificially while the videos were being recorded. The videos were taken 10 minutes after the clinical procedures started, hence allowing the students to become comfortable in their postures. A sequential video for different parts of the body were carried out (adapted from[26]). Before the actual evaluation, the four observers were trained in evaluating RULA with an ergonomic specialist. The accuracy of each observer was tested by Kappa statistic and a kappa value of 1.00 was obtained, indicating that all four observers were in complete agreement[27].

Questionnaire on individual risk factors of musculoskeletal pain

The questionnaire on individual risk factors apart from the work posture of musculoskeletal pain includes gender, body mass index (BMI), medical disease, alcohol consumption, smoking, exercise, part time job, sleep and rest, and usage of electronic devices like computer, tablets and smart phones.

Statistical methods

A descriptive statistic was used to: explore the prevalence of musculoskeletal pain in both the periods of 7 days and 12 months; prevalence of chronicity of MSD; risk action levels from RULA and individual risk factors of musculoskeletal pain. Median was used to indicate level of pain in the previous 7 days before the survey and a Mode was used to indicate the postural analysis score from RULA. To compare the association between the various other risk factors of musculoskeletal pain and prevalence of musculoskeletal pain in the last 12 months, a Chi-square test was used at a 95% confidence interval. All data analyses were conducted using SPSS V.20.0.

Results

The prevalence of musculoskeletal pain at least one part of the body region in the 7 days period from clinical practice was found in 57 students (83.82 %).The most complaints were found at the neck 45 students (76.27%), right shoulder and lower back 24 students (40.68%), upper back 23 students (38.98%), left shoulder 22 students (37.29%), right hand/wrist 13 students (22.03%), ankle/feet 7 students (11.86%), right elbow, hips and legs 5 students (8.47%), left hand/wrist 4 students (6.78%), and knee and left elbow 2 students (3.39%) respectively (Fig. 1). As for the 12 months period, all the 68 students (100%) reported prevalence of musculoskeletal pain from clinical practice in atleast one part of the body region. The most complaints were reported at the neck 56 students (82.35%), upper back 41 students (60.29%), right hand/wrist 33 students (48.53%), right shoulder and lower back 32 students (47.06%), left shoulder 28 students (41.18%), ankle/feet 11 students (16.18%), left hand/wrist 10 students(14.71%), hips and legs 9 students (13.24%), knees 4 students (5.88%), right elbow 3 students (4.41%), and left elbow 2 students (2.94%) respectively (Fig. 1).

The median of pain intensity (VRS) of each body regions in the 7 days period are as follows: neck 4.50, left shoulder 4.00, right shoulder 4.00, upper back 4.00, lower back 4.00, left elbow 2.50, right elbow 2.00, left hand/wrist 3.00, right hand/wrist 4.00, hips and legs 5.00, knees 2.00 and ankle/feet 3.00 accordingly. A chronic pain intensity were reported lasting for more than 90 days[28] in the various parts of the body as follows:

neck 19 out of 45 students (42%), left shoulder 7 out of 22 students (31.7%), right shoulder 10 out of 24 students (41.8%), upper back 8 out of 23 students (34.7%), lower back 9 out of 24 students (34.6%), left elbow 1 out of 2 students (50%), right elbow 1 out of 5 students (20%), right hand/wrist 3 out of 13 students (23.1%), hips and legs 2 out of 5 students(40.0%), knees 1 out of 2 students (50.0%) and ankles/feet 1 out of 7 students (14.3%). There was no report of chronic pain at the left hand/wrist region.

From the assessment of working posture by using RULA method in the periodontics and operative clinical department, a risk action level of 3 was found in 3 students (4.4%) and a risk action level of 4 was reported for the rest 65 students (95.6%). Furthermore, a high mode value of various body region's working posture was reported in both departments (Table 1).

From the individual risk factors of musculoskeletal pain questionnaire, 20 students were male (29.40%), and 48 students were female (70.60%). 45 students (66.20%) were under normal BMI baseline, 15 students (22.10%) had lower BMI and 8 students (11.80%) had higher BMI. Eight students (11.80%) had medical problems like asthma, allergy and gastric ulcer while the rest 60 students (88.20%) were reported to be without any medical problems. Only one student (1.50%) consumed alcohol on a daily basis, 20 students (29.40%) consumed alcohol sometimes, and the rest 47 students (69.10%) did not consume any alcohol. One student (1.50%) used to smoke but ceased while the rest 67 students (98.50%) did not ever smoke. 33 students (48.50%) exercised and 35 students (51.50%) did not exercise. 58 students (85.30%) worked part time and the rest 10 students (14.70%) did not work part time. 35 students (51.48%) used electronic devices like tablets and smartphones 1-3 hours per day and 33 students (48.52%) used tablets and smartphones for more than 4 hours per day. 27 students (39.70%) gets enough sleep and rest and 41 students (60.30%) did not get enough sleep and rest. Statistical analysis revealed no significant association between the individual risk factors of musculoskeletal pain and the 5 highest prevalence of musculoskeletal pain (i.e. neck, upper back, right hands/wrists, lower back, and right shoulder, respectively) in the last 12 months period ($p>0.05$) except gender and BMI. We found a significant association of gender and BMI with right shoulder and lower back pain, respectively ($p<0.05$) (Table 2).

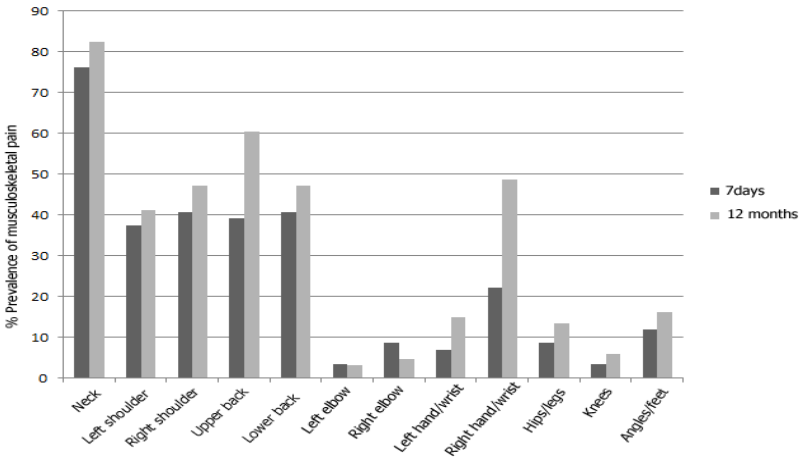

Fig. 1: Self-reported prevalence of musculoskeletal pain on various body sites in the 7 days & the last 12 months

Table 1: Mode value, minimum point, maximum point & total score of work postures of each body region assessed by RULA in the operative (O) & periodontics (P) department

Statistics/ Point	Work postures of body region assessed by RULA										
	Right upper arm (O/P)	**Left upper arm (O/P)**	**Right lower arm (O/P)**	**Left lower arm (O/P)**	**Right wrist (O/P)**	**Left wrist (O/P)**	**Right wrist twist (O/P)**	**Left wrist twist (O/P)**	**Neck (O/P)**	**Trunk (O/P)**	**Ankle/feet (O/P)**
Mode	1/2	2/2	3/3	3/2	4/4	3/4	1/1	1/1	5/5	3/3	2/2
Minimum point	1/1	1/1	2/1	1/1	2/2	2/2	1/1	1/1	4/4	2/2	1/1
Maximum	4/4	4/4	3/3	3/3	4/4	4/4	1/1	2/1	5/5	4/4	2/2

point											
Total score	6	6	3	3	4	4	2	2	6	6	2

Table 2: Relationship between the various factors associated with 5 highest prevalence of musculoskeletal pain in body regions in the past 12 months before survey

Risk factors	Highest prevalent body regions				
	Neck	Upper back	Right hand/wrist	Lower back	Right shoulder
	χ^2	χ^2	χ^2	χ^2	χ^2
Gender	0.505[a]	0.408[b]	0.154[b]	0.154[b]	0.019[b]*
BMI	0.147[c]	1.000[c]	0.441[c]	0.044[c]*	0.324[c]
Medical problem	0.569[a]	0.095[a]	0.095[a]	2.803[a]	0.290[a]
Alcohol consumption	0.599[c]	0.088[c]	0.676[c]	0.676[c]	0.676[c]
Exercise	0.246[b]	0.478[b]	0.230[b]	0.819[b]	0.478[b]
Part time job	0.242[a]	0.368[a]	0.464[a]	0.287[a]	0.293[a]
Computer usage	0.454[b]	0.151[b]	0.819[b]	0.230[b]	0.797[b]
Rest	0.208[a]	0.887[a]	0.187[a]	0.123[b]	0.726[b]

χ^2 is the Chi-square. * Significant statistical value (p<0.05).

a. Exact significance from Fisher's Exact Test.
b. Asymptomatic significance from Pearson Chi-square.
c. Monte Carlo significance from Pearson Chi- square.

Fig. 2: Work posture assessed by RULA. (A) Position of neck with more than 20°flexion. (B)Bending and twisting of neck. The mode value of neck assessment is 5 out of 6. (C) Position of trunk with 0°-20°flexion. (D)Side-bending of trunk. The mode value of trunk assessment is 3 out of 6.

Fig. 3: Work posture assessed by RULA (A) Position of right wrist making an extension of more than 15°. (B) Inner deviation of wrist. The mode value of right wrist assessment is 4 out of 4. (C) Position of right upper arm less than 20°with raised shoulder or(D)Abducted arm. The mode value of right upper arm assessment is 2 out of 6.

Discussion

The reports of prevalence of musculoskeletal pain from clinical practice of dental students in both the 7 days period (83.82%) and 12 months period (100%) were in agreement with that of a study conducted by Khan and Yee Chew in 2013 where a prevalence of 93%[14] was reported, Movahhed et al. in 2013 reported 81.6%[13] and Madaan andChaudhariin2012 reported81%[12]. However, the comparison between the studies has their limitation because the definition of origin of musculoskeletal pain is not clear accompanied by a difference in the subject population.

In the current study, after considering the intensity as well as duration of musculoskeletal pain in the previous 7 days, the students mostly reported to have a medium level of that could be tolerated. In addition, chronic musculoskeletal pain were also reported, thus, it could be concluded that lack of correction and prevention of the musculoskeletal pain could affect the students in their clinical practice in the future. When comparing the prevalence of musculoskeletal pain in atleast one body site in the past 12 months, the studies investigated in dentists revealed a prevalence of 62%[7], 73%[29] and 87.2%[5] while the dental students in the current study reported a higher prevalence of 100%. Moreover, when comparing the risk action level of musculoskeletal pain from work posture by the RULA method between dentists from other studies and dental students from the current study, dental students still had higher action level of risk with 4.4% constituting action level 3 and 95.6% consisting action level 4, while the dentists reported 62% with action level 2, 34% with action level 3 and 4% with action level 4[29]. These differences in the dentists and the dental students could be probably attributed to the reason that less experienced dentists were more likely to suffer from musculoskeletal pain than their more experienced counterparts as the experienced dentists are probably better at adjusting their working position and techniques in order to avoid musculoskeletal problems compared to their less experienced counterparts[5,30]. In addition, experienced workers tend to have a higher ratio of type 1 muscle fibers than the less experienced ones, making them able to endure both long working hours and fatigue[31].

The musculoskeletal pain in the dental students was more prevalent on the neck, upper and lower back, right hand/wrist, and left and right shoulder. A chronic pain was also reported. And when considering the site of pain and the work posture risk level from RULA, neck constituted a mode of 5 out of 6(Table 1) suggesting that most of the students flex their neck for more than 20°, and they bend or twist their neck (Fig. 2A, B) to improve vision and access to the oral cavity, thus indicating that abnormal posture and working in a strained position could be the cause for the high prevalence of neck pain[12,13]. The trunk region reported a mode of 3 out of 6 (Table 1), owing to most students twisting, side-bending and flexing their trunk to 0°-20°(Fig. 2C, D). Studies have shown that back pain in dentists are caused mostly by over-flexion of the thoracic spine[32], while the lower back pain could be caused by sitting in a strained position for a prolonged period of time[33] and sitting without an appropriate back rest(Fig. 2A, C, D) which could result in back muscles to function more[34]. In the current study, most of the dental students were observed to be sitting in a strained position for a prolonged duration and did not use the back rest during their clinical practice which could cause back muscle fatigue and that could be the

reason for the prevalent back pain. The right wrist had a high mode of 4 out of 4(Table 1) owing to the students being right handed, extending their wrists upwards for more than 15° and deviating their wrists while working (Fig. 3A, B). The periodontics and operative clinical works demands a high precision and repeated motion of the right hand/wrist and since some areas of the oral cavity are difficult to gain and maintain, they require the wrist to be held in awkward positions for prolonged period, thus easily resulting in pain[35]. From the assessment of the right and left upper arm in the operative clinical department, a mode of 1 and 2 out of 6 were reported while a mode of 2 and 2 out of 6 were reported from the periodontics clinical department. Upper arm score 1 indicated that the position of the student's upper arm was less than 20° and score 2 indicated upper arm to be positioned less than 20° along with elevated shoulder or abducted arm (Fig. 3C, D). Abducted arm and raised shoulder causes imbalance in the working posture[13] and holding a static awkward posture for a long periods can lead to chronic muscular fatigue[36], which inevitably leads to musculoskeletal pain.

Statistical analysis revealed no significant association between the personal risk factors of musculoskeletal pain and the 5 highest prevalence of musculoskeletal pain in the last 12 months period ($p>0.05$)(Table 2). However, there was a significant association of gender and BMI with right shoulder and lower back pain, respectively ($p<0.05$). An association of female with right shoulder musculoskeletal pain was observed which could probably be reasoned with the female gender reflecting a higher energy cost in generating the required force as demonstrated by Snook and Ciriello[37] when a range of tasks were performed. Similarly, Rising et al., in 2005 reported a significant association of female gender with shoulder pain ($p=0.004$)[30]. The relationship of lower back pain with BMI of the current study is in accordance with a study investigated by Kumar et al., in 2013 where a high prevalence of musculoskeletal pain at neck, hand/wrist and lower back were reported in dentists with higher than normal BMI[38]. Similarly, Hershkovich et al., in 2013 presented an association between the lower back pain and high BMI ($p<0.001$) in adolescents but a clear pathophysiology is yet to be studied[39].

When compared with the previous other studies, most of the dental students in the current study reported a high prevalence of musculoskeletal pain including chronic pain which could be attested with observation of poor working posture in those students. Even though the students had already enrolled and studied the ergonomic course for dentistry yet they lack awareness regarding the above stated problems. The data from this research can be an important data to implement a further strong ergonomic course where the students can be specifically taught the correct posture and adoption of correct use of environment around them during clinical practice and create awareness about the ergonomically induced problems. Few instances of adoption of correct posture and usage of environment around them to prevent musculoskeletal pain are as follows[40]:1) Neck and back pain: rest the back against the back rest of the chair to maintain the low back curve. Adjust the chair so the hips are slightly higher than knees and distribute weight evenly by placing feet firmly on the floor. Practice using mouth mirror instead of going for a direct vision so as to prevent flexion, twisting and side-bending of both the cervical and trunk. Position instruments within easy reach, and if the operatory design requires the dental student to turn to retrieve instruments or hand pieces, the student should swivel the chair to face the area squarely instead of twisting the trunk. 2) Right hand/wrist and shoulder: position the patient to a suitable height to prevent elevation of the shoulders and abduction of the arms which could lead to prolonged static muscular tension in the neck and shoulders.

The current study also revealed that 48.50% students exercised and the rest 51.50% did not exercise. Even though the values were almost quite equal, yet those who did not exercise were slightly higher than the ones who exercised. Hence, making the students to understand the importance of exercise and encouraging them to exercise regularly[13,21] might be another way to prevent musculoskeletal pain. However, in order to exercise one should take into consideration of one's physical fitness and efficiency. Therefore, measurement of efficiency and physical fitness of the dental students should also be further studied to design and promote exercise efficiently.

Conclusions

This study was first investigated in a small population of dental students in Thailand. However, the results showed both high prevalence at neck, back and right hand/wrist regions and risk levels of musculoskeletal pain from poor working posture, regarding ergonomics problems in dental students. We can thereby suggest adoption of better working postures and prevention strategies like exercises to decrease the risk of musculoskeletal problems in the dental students, and large scale population in further studies are necessary to help implement the above stated strategies.

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