

## Prevalence and Associated Factors of Musculoskeletal Symptoms in the Neck, Shoulder, Hands and Wrists among Thai Endodontists

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### Abstract

The aims of this study are to investigate self-reported prevalence of musculoskeletal symptoms and the association between prevalence of musculoskeletal symptoms with certain individuals, work-related physical and psychosocial factors among Thai endodontists. A questionnaire was mailed to 232 Thai endodontists. The questionnaire consists of four parts include personal data, professional data, musculoskeletal data and psychosocial factors. Data were analysed using chi-square, Mann-Whitney U test and logistic regression at a significant level of  $P < 0.05$ . A total of 200 participants returned questionnaires at an 86 % response rate. After excluding the samples who work as an endodontists for less than 50 %, 84.9 % of Thai endodontists reported at least one musculoskeletal disorders (MSDs). The prevalence of disorders was highest in the neck (55 %) and right shoulder (48 %). Being less than 35 years old ( $P = 0.005$ ), having less than 5 years of work experience ( $P = 0.001$ ) and having a high physically demanding job ( $P = 0.047$ ) were factors associated with MSDs complaint. Having a previous history of symptoms (OR:2.230, 95%CI:1.06-4.70) and not being in a regularly straight back position (OR:2.629, 95%CI:1.206-5.731) had a significant correlation with present neck pain. The group of endodontists that use magnification had less prevalence of MSDs. In conclusion, a high prevalence of Thai endodontists that reported MSDs were associated with young endodontists and having a highly physically demanding job. The most prevalent region is neck pain, related with previous symptoms and awkward posture. Interventions aimed at reducing the MSDs occurrence in endodontists should focus on younger endodontists to prevent pre-symptoms and to decrease the prevalence of disorders.

**Keywords:** Endodontist, Magnification, Musculoskeletal disorders, Occupational disease

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## Introduction

The definition of the term musculoskeletal disorders (MSDs) is injuries and disorders that affect the human body movement which denotes health problems of the locomotor apparatus. MSDs include all forms of ill-health ranging from light, transitory disorders to irreversible, disabling injuries.<sup>1</sup> Many studies have shown that dentists have a high frequency of MSDs such as pain at the neck, back and shoulder (Table 2).<sup>2-5</sup>

Dentist is another career which is at risk of occupational health problem especially MSDs.<sup>6-8</sup> The characteristics of dental operation are static postures and long-duration work times. Prolonging the same body position induces muscles to constantly contract as a cause of MSDs, which found that 64-78 % of dentists have this problems.<sup>9</sup> The MSDs interfere with some daily and working activities such as dental practice, body movement, exercise and often are causes of absent practice.<sup>7</sup> Moreover, these frequently turn to be the cause of premature retirement for some dentists.<sup>10</sup> Although there are several innovations of dental units and equipment which were built to make comfortable work environment and reduce the risk of MSDs in dentistry, musculoskeletal complications among dentists is highly prevalent.<sup>3,11</sup> Most dentists indicated having at least one symptom of musculoskeletal diseases in the past year.<sup>2</sup>

Endodontic treatment requires repetitive precise movement with a long duration in each case. In addition, this specialty frequently uses magnification i.e. loupe and microscope, which can improve the posture during treatment.<sup>11,12</sup> Therefore, using magnification may decrease the incidence of MSDs. In Thailand, there was no research done to specifically explore the musculoskeletal disorders in endodontists. Moreover, no study has investigated the association of MSDs with previous symptoms and psychosocial factors specific in endodontists.

To increase data and knowledge of musculoskeletal problem in endodontists, the purpose of this study was to investigate the self-reported prevalence of musculoskeletal

symptoms in the neck, back, hands and wrists among Thai endodontists and to investigate the association between prevalence of musculoskeletal symptoms with certain individual, work-related physical and psychosocial factors.

## Materials and Methods

A cross-sectional study survey on musculoskeletal symptoms in endodontics was conducted from May to July 2017 amongst ordinary members of the Thai Endodontic Association, dentists who completed a postgraduate program in endodontics and practice in Thailand. The Yamane method<sup>13</sup> were used to determine the sample size from a given population. The sample size calculated by Yamane T's formula was 232 samples ( $P=0.05$  and 552 members). Randomization was performed by using excel random function. Self-administered questionnaire was forwarded to the 232 samples and returned by mail. The data were analyzed from endodontists who did endodontic work for more than 50 % of their overall treatment. This study was approved by the Ethics Review Committee for Research, Faculty of Dentistry, Chulalongkorn University (HREC-DCU 2017-003).

The questionnaire consisted of four parts: (1) personal data of the participants, (2) professional data of the participants, (3) information on the prevalence of musculoskeletal disorders. Musculoskeletal complaints were measured using the standardized Nordic questionnaire for the analysis of musculoskeletal symptoms and (4) work-related psychosocial factors using the Thai Job Content Questionnaire.<sup>14</sup>

### Statistical analysis

Data were analyzed using the SPSS program version 22. Chi-square was used to determine the significant differences in the prevalence of MSDs during 12 months with categorical variables. Any factors with a  $P<0.05$  in the Chi-square analysis were eligible for addition to the modeling procedures. A multivariate logistic regression analysis was performed to evaluate influence of factors

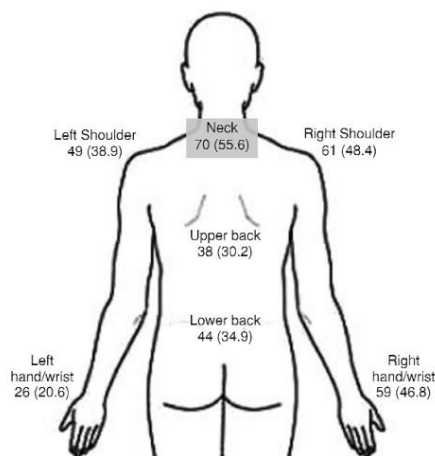
on the occurrence of musculoskeletal complaints. The level of significance was set at  $P < 0.05$ .

## Results

The questionnaire survey was completed by 200 samples (86 % response). Of these, 74 samples were excluded because of systemic disease influenced MSDs, pregnancy, and endodontic work less than 50 % of their work. The results analysis was based on 126 endodontists.

The age of endodontists ranged from 25 to 71 years with a mean of 39.6 years, 34 samples were male (27 %) and 92 samples were female (73 %). The average data of BMI was  $21.6 \text{ kg/m}^2$  and endodontics work experience was 11.9 years. Twenty and 36 samples frequently used a loupe and microscope, 17.5 % and 28.6 %, respectively.

The majority of endodontists (84.9 %) reported at least one MSDs in the past 12 months. The number and percentages of endodontists who reported MSDs complaints in each body part were shown in Figure 1. Neck and right shoulder pain was two of the most prevalent musculoskeletal complaint, reported by 55.6 % and 48.4 % of the participants with 4.5 and 4.2 pain intensity respectively. Both regions had a significant correlation between previous symptoms and prevalence of pain in 12 months ( $P = 0.034$ , OR:2.230, 95%CI:1.06-4.70 and  $P < 0.001$ , OR:4.41, 95%CI:2.01-9.71).



**Figure 1** Number and percentage of endodontists who reports MSDs complaints in past 12 months in each body part. Body part in grey box was the most prevalence area.

A physically demanding job was only one work-related psychosocial domain which had a significant difference between MSDs complaints and no complaints ( $P = 0.047$ ). The other domains, such as decision latitude, psychological demands, social support, job security and work hazards were not significant.

### Association of variable with MSDs complaints in past 12 months

Multivariate logistic regression analysis revealed that age and endodontics work experience were two associated factors increased the MSDs complaints in the past twelve months (shown in Table 1). Being less than 35 years old (OR:5.45, 95%CI:1.50-19.74) and having less than 5 years of endodontics work experience (OR:14.644, 95%CI:1.886-113.685) were factors that had a significantly higher difference between the groups of MSDs complaints and no complaints.

Other factors in personal and profession data include gender, weight, high, BMI, type of employment, number of work days, work characteristics, number of treatments per day, length of appointment, number of patients per day, clock-related posture during practice, using magnification, rotary instrument, ultrasonic and air-motor devices had no significant associated between MSDs complaints and no complaints.

After investigating specific data in neck pain using multivariate logistic regression analysis of the most prevalent MSDs, it was found that the prevalence of neck pain is associated with a group of dentists who are not regularly in the straight back position (OR:2.629, 95%CI:1.206-5.731).

**Table 1** Data of MSDs complaints in past 12 months and associated factors increase MSDs.

Variable	MSDs complaints in past 12 months N (%)		p-value
Age	≤35years	54 (94.7 %)	0.005*
	>35years	53 (76.8 %)	
Endodontics work experience	≤5 years	48 (98.0 %)	0.001*
	>5 years	59 (76.6 %)	

## Discussion

Most Thai dentists and endodontists indicated at least one symptom of musculoskeletal diseases in the past year. In this study, 84.9 % of endodontists reports at least one MSDs in the past twelve months

which is higher than Greek endodontists.<sup>15</sup> Most dentists (78 %) in the southern part of Thailand and 60-90 % in other specialties reported MSDs.<sup>2-5</sup>

**Table 2** Lists studies that investigated whether dentist had experienced musculoskeletal pain in the past 12 months.

Author	Country	Samples	% MSDs	2 Most region	Associated factors increase MSDs
Zarra and Lambrianidis 2014	Greece	Endodontists	61	Neck and low back	Awkward posture during practice and number of patient per day
Hodacova <i>et al.</i> 2015	Czech Republic	Dentist	97	Back and neck	Female, more year of practice, history of serious MSDs and perceived bad/ very bad general health
Legget and Smith 2006	Australia	Dentist	87	Neck and low back	Younger dentist and less experienced dentists
Alexopoulos <i>et al.</i> 2004	Greece	Dentist	62	Low back and neck	Physical load
Chowanadisai <i>et al.</i> 2000	Thailand	Dentist	78	Back and neck	Less year clinical practice and full time workload
Finsen <i>et al.</i> 1998	Denmark	Dentist	66	Neck and shoulder	Prolong work posture and high static muscle load
Marshall <i>et al.</i> 1995	Australia	Dentist	64	Neck and low back	Work for longer period

Endodontists in this study reported the most prevalent MSDs compliant of body parts are neck pain and right shoulder, which is a different tendency than with a previous study which showed the highest complaints were lower back and neck area.<sup>15</sup> Endodontics work need to maintain their head in a specific position for a long duration in each case (time average data from this study was about one hour per case) in a limited area. Therefore, being in the forward-head posture for a long time also increases force on the upper neck muscles.<sup>11</sup>

In the forward-head posture, the neck extensor muscle was shortened. The center of gravity was then moved forward, and the muscle balancing ability was reduced.<sup>16,17</sup> This stress and strain can affect ischemia and pain in the overworked neck muscles.<sup>18</sup> This can cause headaches and chronic pain in the neck, shoulders and interscapular muscles.<sup>12</sup>

Endodontists who have five years or less of work experience had a higher prevalence of MSDs according to a previous study that showed a negative correlation of years working with musculoskeletal pain.<sup>2,6,19</sup> The

dentist who had more experience might be better able to adjust their working postures and technique to prevent MSDs pain. The present pain may be accumulative pain; therefore, in this study, a correlation was found between previous symptoms and prevalence pain.<sup>20</sup> Perceived muscular tension can predict future neck-shoulder symptoms<sup>21</sup>, therefore the prevention before disease occurs is important. According to these results, an endodontic training program should include interventions such as providing awareness about operation postures and using magnification to improve positions in a dental student endodontics course to decrease the prevalence of disorders in younger endodontists.

The present pain may be accumulative pain since musculoskeletal pain is chronic symptom among dental students. The most prevalent types of pain and previous history also complaints pain at neck and shoulder.<sup>22</sup> The results of neck and shoulder pain correlating with previous symptom corresponds with findings of a study with computer office workers that have static postures and repetitive tasks.<sup>20</sup> Another study also found that perceived muscular tension predicted future neck-shoulder symptoms.<sup>21</sup> Therefore, prevention before the disease occurs is important by adjusting the posture of both the endodontist and the patient into ergonomics.

In this study, 86 % females reported MSDs more frequently compared with males (82 %). In general, dentists also found female dentists reported MSDs more frequently compared with males.<sup>2,4,5</sup> This may be due to a greater willingness by females to report symptoms because of a lower pain threshold and greater interest for her health.<sup>4</sup>

This study found no significant associations between BMI with MSDs similar with a previous study.<sup>15</sup> Having a BMI greater than 25 kg/m<sup>2</sup> falls within the overweight range and is associated with increased lower back pain and lumbar disc degeneration particularly.<sup>23</sup> In this survey, only a few endodontists were highly overweight which could cause MSDs to the affected participants.

Endodontists in this study who had more frequent

use of loupe (77.3 %) and microscope (77.8 %) had less prevalence of MSDs. Because of applying the loupe, the working distance allows an optimal posture to be maintained. Dental Operating microscopes improved the most neutral postures by keeping operators in healthier postures and give the highest magnification systems with the greatest operating detail.<sup>12</sup>

The psychosocial work environment was measured by the Job Content Questionnaire adjusted from Karasek instrument<sup>24</sup> analysis in Thai version.<sup>14</sup> In this study, it was found that a physically demanding job has a significant correlation with prevalence of MSDs in 12 months. Endodontists who have a high score of physical job demand also have high prevalence of MSDs complaints. Almost every participant in this study complained of at least one MSDs in a year. This is similar when compared with nurses that a highly demanding physical job significantly increased the risk of MSDs.<sup>25</sup> Physical demands at work are considered a critical determinant for progressing MSDs including frequently stated occupational risk factors such as high muscular loads, restricted postures, and repetitive movements<sup>26</sup> which is similar in endodontics work that requires repetitive precise movement and has long duration in each case may increase the prevalence of MSDs complaint. Prolonged static posture in long duration be rise up musculoskeletal pain.<sup>11</sup>

In this study, almost half of the endodontists reported MSDs at wrist and hand which is higher than dentists (10-44 %).<sup>2,3,15</sup> Carpal tunnel syndrome is a specific musculoskeletal problem, which has also been investigated in dental professionals. Using hand-files for mechanical instrument root canal over long hours and repeated motion that can predispose endodontists to Carpal tunnel syndrome. Endodontics rotary instrument help to reducing the need for hand-filing and decreasing time for shaping of root canals.<sup>27,28</sup>

Overall analyzed data received from questionnaire, which the participants might not confirmed diagnosis, severity and cause of symptom by physician. To specific MSDs from endodontic work, this study analysed the

data from endodontists who have endodontic work more than 50 % of their overall treatment. However, the symptoms may co-influence from other causes such as office syndrome, carry heavy belongings, type and frequency of exercise or using a mobile device. A prospective research design is required to establish the causal relationship between exposure and outcome. Moreover, to clearly confirm MSDs diagnosis, further studies should assess posture at work using observation and physical examination.

## Conclusion

High prevalence of endodontists reports at least one MSDs in the past 12 months, which was highest in the neck, significant correlation with previous symptoms and associated with endodontists who have not regularly in straight back position. According to these results, in order to prevent MSDs endodontists should give awareness about operation postures and using magnification to keep straight back position especially in younger endodontists.

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