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Correspondence concerning this article should be addressed to Dr. Mohd Nazri Shafei; Community Medicine Department, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kelantan, Malaysia / Email: drnazri@kb.usm.my

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Prevalence and Associated Factors of Back Pain among Dental Personnel in North-Eastern State of Malaysia

Razan Abdul Samat (1), Mohd Nazri Shafei (1) *, Nor Azwany Yaacob (1), Azizah Yusoff (2)

1) Community Medicine Department, School of Medical Sciences, Universiti Sains Malaysia, Kelantan, Malaysia

2) School of Dental Sciences, Universiti Sains Malaysia, 16150 Kelantan, Malaysia

* Corresponding author

ABSTRACT

Introduction: Dentistry is a high risk profession for developing back pain because high visual demands result in prolonged and affixed as well as uncomfortable postures.

Aim and Objectives: This study was conducted to determine the prevalence of back pain and its associated factors among government dental personnel in North-Eastern State of Malaysia.

Methods: A cross sectional study was conducted among 350 dental personnel including dentists, dental nurses, technicians and dental surgery assistants in all government dental clinics in North-Eastern State of Malaysia. The research tools used for the study consisted of a proforma on socio-demographic and occupational characteristics, a validated Branson Posture Assessment Instrument (BPAI) and direct observations on the respondents while they performed their daily routine. Descriptive statistics consisting of mean and standard deviation as well as percentages were calculated for numerical and categorical data respectively. Multiple logistic regression analysis was carried out to determine the factors associated with back pain.

Results: A large majority of the respondents were female (79.1%) and Malays (98.0%). The age of respondents ranged from 22 to 56 years old. The prevalence of back pain was 44.9% (95% CI: 39.65, 50.07) with the highest prevalence found among dental technicians [52.4% (95% CI: 40.05, 64.71)]. After controlling for potential confounders, the significant risk factors associated with back pain were poor posture (OR 3.52; 95% CI: 2.22, 5.59) and being a dental auxiliary (OR 3.63, 95% CI: 1.81, 7.30).

Conclusion: The prevalence of back pain among dental personnel in North-Eastern State of Malaysia was relatively high. The significant risk factors associated with it were poor posture and being a dental auxiliary. Innovations for an ergonomically friendly dental equipment would probably improve the work practice and therefore the health of dental personnel.

Keywords: Dentistry, Prevalence, Back pain, Posture, Instrument

Introduction

Dental sector has seen significant technical advancements in recent years. However, occupational health problems remain¹. Dental personnel face many hazards that include infectious bioaerosols, toxicity from dental materials, contact dermatitis, noise-induced hearing loss and recently an epidemic of musculoskeletal disorder². The musculoskeletal disorders are characterized by the presence of discomfort, disability or persistent pain in the joints, muscles, tendons and other soft parts^{3, 4}. They are caused or aggravated by repeated movements and prolonged awkward or forced body postures⁵.

Historically, researchers have established that back pain is one of the most common problems among dental personnel⁶⁻⁹. Indeed, dentists have been included among the professionals with a high incidence of back pain because the nature of their work requires them to fully use their mental and physical abilities⁵. They need a high level of precision and control as they have to look closely and intensely into someone's mouth and work with very fine tools in a confined space for a prolonged period of time. They also need to have a good visual acuity, psychomotor skills and manual dexterity as well as the ability to maintain occupational postures for an extended period. Many abnormal positions and uncomfortable postures incurred by a dental personnel during an average work day have a huge impact on the body. Failure to adapt to or contend with the working environment predisposes them to develop back pain¹.

The prevalence of back pain among dentists has been reported to range from 38%¹⁰ to 80%¹¹. It is cited as the most common and troublesome occupational health problem reported by dental personnel in the United States¹² and claims approximately 40% of all

compensations in the country¹³. Similarly, a study from Nigeria reported that 77% of dentists complained of back pain³ and a Lithuanian study found that it was 50%¹⁴. In Saudi Arabia, 54% of dentists and dental auxiliaries complained of neck pain and 74% complained of back pain¹². Another study among 68 dentists in Nepal revealed that back pain was the most common complaint affecting almost 80% of the study population¹¹. It was reported that 54% of dental practitioners experienced low back pain in both Belgium and Australia^{2, 15}.

Several risk factors are associated with the development or exacerbation of musculoskeletal disorders including back pain in the workplace. They can either be of individual origin or related to the workplace such as physical, biomechanical and psychosocial¹⁶.

A cross sectional study in Norway, for instance, showed that obesity is associated with low back pain^{17, 18}. It is also more common in males between the ages of 35 and 55 years old¹⁹. The main occupational risk factors are lifting and handling of patients, harmful working habits and postures^{8, 10, 20-23}, prolonged sitting in poorly designed chairs⁸, inadequate equipment, improper workplace design and inadequate work organization²³. Psychosocial risk factors at work which include perceived high pressure on time and workload, low job control, job dissatisfaction, monotonous work and low support from co-workers and management can also lead to back pain²⁴. Other primary occupational risk factors are vibration¹³, cold temperature and extrinsic stress²⁵ as well as repetitive movement of arms and hands¹⁵.

Repetitive or static awkward body posture resulting from excessive bending (forward and lateral) and twisting (trunk rotation or torsion) will increase the spinal stress and disproportionate loading of spinal structures.

Risk is likely to be increased with the speed of the trunk motion and the deviation from the normal spinal posture as well as the intensity and duration of the exposure. Rapid twisting can generate shear or rotational forces on the lower back resulting in trauma²⁶.

In Malaysia, limited information is available regarding back pain among dental personnel. Research on occupational health status among dental personnel is also rare. This study was conducted to determine the prevalence of back pain and its associated factors among government dental personnel in North-Eastern State of Malaysia. Identifying these factors is important especially in strategizing its prevention and control.

Methodology

Study design and respondents

A cross sectional study was conducted from March until June 2010 among dental personnel (dentists, dental nurses, dental technicians and dental surgery assistants) who worked in government dental health clinics in North-Eastern State of Malaysia. The reference and source population in this study were government dental personnel in North-Eastern State of Malaysia.

The sample size was calculated using a single proportion formula. With expected prevalence, P of 0.73¹², precision, Δ set at 0.05 and Z value of 1.96 for 95% CI, the required sample size after considering 10% non-response rate was 332 respondents.

Based on personal communication, there were 485 dental personnel at 38 dental clinics in North-Eastern State of Malaysia. Hence, all government dental health personnel in the state were included. The study criteria consisted of working experience of at least 12

months duration, without any significant medical conditions such as congenital musculoskeletal disorders, rheumatoid arthritis, scoliosis or any surgery involving the spine and was not pregnant during data collection. Dental officers or auxiliaries with more than 70% involvement in administrative work were excluded from the study.

Research Tools

A proforma on socio-demographic and occupational characteristics was used. The questions consisted of occupational history, psychosocial factors, workplace factors, physical risk factors and history on back pain. Respondents were asked if they experience any pain or discomfort at upper and lower back for one day or more in the last 12 months. Respondents were considered as having back pain if they had any pain, ache or discomfort from the bottom of the neck and extends to the lower back, including gluteal regions with or without radiating pain into the legs in the past 12 months which lasted for one day or longer^{27,28}.

Branson's Posture Assessment Instrument (BPAI) was also used in the study. It was validated by Branson and colleagues and incorporates a grading scale to measure body posture²⁹. The instrument examines various check points such as the hips, trunk, head and neck, shoulders and wrist to determine how far a body part deviates from 90° axes. It is a reliable method to examine posture over a period of five minutes²⁹.

Following BPAI scales, a trained investigator observed the respondents for a five-minute period while they performed their daily tasks. The final BPAI numerical score was derived from a mathematical calculation that multiplies the values for each category at each time interval. Posture scores that ranged from

10 to 40 were considered acceptable, scores ranging from 41 to 80 were considered compromised and scores ranging from 81-194 were considered harmful. Intra-class correlation coefficient was calculated and it had good agreement between the two observers (ICC=0.95, P -value < 0.001). In this study, those who scored ≥ 41 from BPAI (categorized as either compromised or harmful posture) were considered as having poor posture and the remaining as good posture.

Ethical consideration

This study was approved by the Research Ethics Committee of the School of Medical Sciences, Universiti Sains Malaysia on 15th November 2009 (Ref.: USMKK/PPP/JEPeM[218.4(2.3)]). The study was also registered with the National Medical Research Registration of Malaysia. A detail explanation about the study was given to the respondents and observation did not begin until they had agreed to a written informed consent. The confidentiality of the data was strictly maintained by limiting access to the data only to the researchers.

Statistical analysis

Data were entered and analyzed using Predictive Analytics Software (PASW) 18. Continuous variables were described using mean (SD) or median (IQR) whereas the categorical data was shown as frequencies (%). The prevalence of back pain was calculated as the percentage of respondents diagnosed to have back pain denominated by all study respondents. Both univariable and multivariable analysis were conducted to determine the associated factors for back pain. All independent variables were analyzed using both forward and backward stepwise variable selection methods to obtain a preliminary model. All variables with the P -value < 0.25 were initially included in the multivariable

analysis. Then, the inclusion of variables in the model was based on the P -value, which was less than 0.05. With all significant and important variables accounted for, a preliminary main-effect model was obtained. Multicollinearity problem was checked using correlation matrix and standard error. All possible first order interactions were checked. Significant and meaningful interactions were included in the model. Then, preliminary final model was obtained. The significance of the model was tested by applying likelihood ratio test with maximum likelihood estimate.

Fitness of the model was tested using Hosmer-Lemeshow goodness of fit test, the classification table and receiver operator characteristic (ROC) curve. The final model was determined by enter method. The adjusted odds ratio was estimated with 95% confidence interval. P -value of less than 0.05 was taken to be statistically significant.

Results

A total of 420 dental personnel were identified but 350 were eligible and participated in the study giving a response rate of 83.3%. Some of the reasons for excluding the 70 dental personnel from the study include those who were attending refresher courses, inability to provide time for observation, direct refusals and those on annual leave. The majority of the respondents were Malays (98.0%) within the age group of 22 to 56 years old. Table 1 shows the socio-demographic characteristics of the respondents.

On the basis of body mass index (BMI) as classified by WHO (1998), 10 (2.9%) respondents were underweight and 193 (62.8%) of them were either overweight or obese. Most of the dental personnel involved in the study were dental surgery assistants

(37.7%). Table 2 shows the occupational characteristics and work related activities of the respondents. There was only a small percentage of dental personnel who were doing part-time job in other clinics (11.0%).

A large majority of the respondents were satisfied with their job (93.4%) and almost all of them received support from their employers (97.4%) and peers (98.6%). Table 3 describes the characteristics of the respondents' workplaces. In general, more than 80% of them claimed to have carried out repetitive tasks, experienced abnormal posture and been involved in excessive movements while carrying out their tasks.

In general, the dental personnel involved in the study were divided into four categories, that is the dental officers, dental staff nurses, dental technicians and dental surgery assistants. Table 4 shows the distribution of the prevalence of back pain among dental personnel according to job categories. The overall prevalence of back pain among them was 44.9% (95% CI: 39.65, 50.07) with dental technicians recording the highest prevalence at 52.4% (95% CI: 40.05, 64.71). From observations of posture while working using BPAI, 48.9% of them fell under the acceptable group while the other 51.1% fell under the compromised group. No respondents were observed to have fallen into the harmful category.

Table 5 shows the adjusted independent variables that were statistically significant as predictors for back pain. It is clear that being a dental auxiliary and poor posture while working (as measured by BPAI) were significantly associated with back pain. In contrast, socio-demographic characteristics, repetitive task, prolonged sitting and excessive movement were not significantly associated with back pain.

Discussion

This study shows that the prevalence of back pain among dental personnel in Northern-state of Malaysia was about 45%. The finding is comparable to that of Sweden (43%)³⁰ and some other Asian countries such as Thailand (50%)³¹ and Hong Kong (43%)³² but differ markedly from 28% prevalence reported in Finland²². A host of factors may be attributed to the similarities and differences between countries but being a middle income country, Malaysia seems to share similar characteristics as Thailand and Hong Kong, two similarly developed economies and societies. Compared to some lesser developed countries, however, the finding seems quite comforting. For instance, Nepalese dentists practicing in universities, government clinics and private practice showed a worse of prevalence at 80%¹¹ while 74% of dentists, dental assistants, dental technicians and dental hygienists in Saudi suffered from back pain¹². In contrast to all this, the prevalence of back pain among dentists in Finland was much less at 28%²⁵. Indeed the prevalence of back pain among dental personnel varied widely from one study or country to another depending probably on the level of economic development, standard of living, population characteristics and assessment methods. It must be noted that there was a marked difference in the prevalence of back pain between different categories of dental personnel involved in this study: dental technicians showed a prevalence of 52% followed by dental surgery assistants at 48%, dental staff nurses at 44.8% and dentists at 28%. Why did they differ? Dental technicians fabricate prostheses and dental appliances such as dentures, crowns, bridges and orthodontic appliances in dental laboratories. There were many steps involved in making these prostheses. Most of the procedures required dental technicians to sit in abnormal body postures for several hours a day and work in a fixed working position

using a continuous repetitive motion. Trimming prostheses was also a procedure that required technicians to flex their spine excessively and maintain the position for a prolonged period of time. All this could easily lead to wrist ache, lower backache and neckache. During the last few years, demand for cosmetic prostheses was also on the rise, particularly from the aging population³³. The increase in the workload of dental technicians far outweighs those of other dental personnel thus exposing them to greater risk of developing back pain.

In contrast, dentists had the lowest prevalence of back pain among the four job categories. Just like most countries, one needs to complete at least five years of tertiary education to qualify as a dentist in Malaysia. Their level of education definitely far outstrips those of other dental personnel and this made them much more aware of ergonomic hazards at the workplace compared to the former. Indeed, they may even prevent back pain by practicing good posture while treating patients³⁴.

This study also shows that compromised posture based on BPAI was associated with back pain. In particular, those with compromised posture had about 3.5 times the odds of experiencing back pain compared to those with acceptable posture. The risk seems to lie in the impact of work positions on the body posture. As shown by a self-reported study in Greece, for example, the strenuous posture adopted by dentists was associated with low back pain⁶. In the same manner, Wunderlich *et al.* (2010) also found that back pain was closely related to abnormal body posture and a high amount of isometric spine loads³⁵. A study in Lithuania also concluded that inconvenient working posture increased the risk for back and neck pains¹⁴.

It is interesting to report that being a dental auxiliary in Malaysia was associated with a higher risk of back pain compared to dentists. This finding does not seem to follow other experiences, particularly those from lesser developed countries. For instance, the prevalence of back pain was higher among Saudi Arabian dentists compared to their dental assistants, dental technicians and dental hygienists¹². At the very least, the present study is contradicted by Moen and Bjorvatn (2010) who found that there was no difference in the risk of developing back pain between dentists and dental staff¹⁰. In this regard, North-eastern state of Malaysia is quite unique in the sense that there seems to be a heavier burden of strenuous work on the lower rung workers in government dental clinics.

Socio-demographic variables such as age and gender were not found to be associated with back pain. This is consistent with the study in Alberta which showed that there was no association between back pain and age⁷. In this instance, it may be reasonable to assume that both younger and older dental personnel have similar types of postural problems. Conversely, age was found to be a significant factor for back pain in a study by Leggat *et al.* (2007). They reported that back pain was more common among younger Australian dentists². This finding could be attributed to work inexperience and inadequate knowledge in dental procedures among the younger dentists. Knowledge about the scope of ergonomics and prophylaxis, as well as health and safety measures at the workplace are important to prevent the risk of developing back pain³⁶. Pertaining to non- association between gender and back pain, the current study finding was consistent with that of Al Wazzan *et al.* (2001)¹² and Shrestha *et al.* (2008)¹¹.

Similarly, body mass index (BMI) was not found to be associated with back pain in this study. This seems to be consistent with several previous studies^{12, 37, 38}. However, a study by Heuch *et al.* (2010) on dental students in Norway reported that a high BMI was significantly associated with an increased prevalence of low back pain¹⁷. Overweight makes the muscles highly loaded and this causes rapid development of fatigue at work³⁹.

Finally, it is to be noted that lack of adjustable chair and table as well as the absence of arm and foot rests or simply poor ergonomics were not associated with back pain. This is in stark contrast to a report on possible health hazards at workplaces in Ohio, United States that found poor dental chair ergonomics was related to back pain among dentists⁴⁰. In addition to this, self-reports on repetitive tasks, prolonged sitting and excessive movements were also not associated with back pain. Again this is contradicted by a study by Benoist and Lenoir (2010) who found that heavy physical jobs including lifting, twisting and repetitive tasks were associated with acute back pain⁴¹.

It must be stated here that causal inferences cannot be drawn from the results of this cross-sectional study. It is common knowledge that causal relationships need to be evaluated by a cohort study. Another limitation of this study was the reliance on self-reported data. This allowed the possibility for individuals with symptoms to overestimate their exposure, thus inflating risk estimates. A healthy worker effect may also pose a limitation to this study as dental personnel who had left work due to back pain were not included in the study. Similarly, observation on the actual practice at work was carried out once for every respondent and the particular observation may not represent the actual daily work of the respondents. Also, a video recording would have been a better alternative to direct

observation because it would reduce the level of awareness of being observed among the respondents.

Conclusions

There was a high prevalence of back pain among dental personnel in North-Eastern State of Malaysia. Poor posture and being a dental auxiliary were associated with back pain. Dental personnel who adopted poor posture while working had about 3.5 times the odds of experiencing back pain compared to those with acceptable posture. To improve the situation, it is recommended that all preventive and ergonomic strategies as well as specific therapeutic programs should be carried out to tackle the identified risk factors for back pain.

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Table 1: Socio-demographic characteristics of respondents (n=350)

Variable	Mean (SD)	n (%)
Age (year)	36.3 (7.56)	
Sex		
Male		73 (20.9)
Female		277 (79.1)
Race		
Malay		343 (98.0)
Chinese		5 (1.4)
Indian		2 (0.6)
Marital status		
Married		319 (91.7)
Single		25 (7.1)
Divorced		6 (1.7)
Income per month (RM)	3606.8 (1744.11)	
Level of education		
Secondary school		79 (22.6)
STPM/Certificate/Diploma		220 (62.9)
Degree and above		51 (14.6)

Table 2: Occupational characteristics and work related activities of respondents (n=350)

Variable	Mean (SD)	n (%)
Job Category		
Dentist		50 (14.3)
Dental Nurse		105 (30.0)
Dental Technician		63 (18.0)
Dental Surgery Assistant		132 (37.7)
Duration of Work (Years)	11.4 (6.70)	
Duration Of Work Per Day (Hours)	9.0 (2.48)	
Duration Of Work Per Week (Days)	5.0 (0.29)	
Use of Dental Equipment (Years)	11.5 (7.42)	
Use of Dental Equipment Per Week (Hours)	27.2 (13.41)	
Duration of resting time per day (Minutes)	60.8 (16.38)	
Previous Job		
None		318 (90.7)

Factory Operator	16 (4.6)
Business	2 (0.6)
Clerk	10 (2.9)
Farmer	2 (0.6)
Part Time Teacher	2 (0.6)

Table 3: Workplace characteristics of respondents (n=350)

Variable	n (%)
Had adjustable chair	281 (80.3)
Had adjustable table	77 (22.0)
Had arm rest	147 (42.0)
Had foot rest	60 (17.1)
Performed repetitive tasks	300 (85.7)
Had prolonged Sitting	248 (70.9)
Had excessive movement	291 (83.1)

Table 4: Prevalence of back pain among 350 dental personnel according to job categories

Job Category	n	Presence of Back pain	
		n (%)	95 % CI
Dental Officer	50	14 (28.0)	15.55, 40.45
Dental Staff Nurse	105	47 (44.8)	35.25, 54.27
Dental Technician	63	33 (52.4)	40.05, 64.71
Dental Surgery Assistant	132	63 (47.7)	39.21, 56.25
Total	350	157 (44.9)	39.65, 50.07

Table 5: Associated factors for back pain using multiple logistic regressions (n=350)

Variable	Crude OR	95% CI	Adj OR ^a	95% CI ^b	Wald stat	P-value
Job category						
Dentist	1.00					
Dental auxiliary	2.34	1.21, 4.52	3.63	1.81, 7.30	13.12	<0.001
Posture	1.00					
Good	2.84	1.83, 4.39	3.52	2.22, 5.59	28.56	<0.001
Poor						

Hosmer and Lemeshow test P-value = 0.898; Area under Receiver Operating Characteristics (ROC) curve = 0.73; No outlier by Cook's test and Leverage value