Original Article

Prevalence of Musculoskeletal Disorders and Posture Analysis Using RULA Method in Shiraz General Dentists in 2010

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Abstract

Background and Aim: The prevalence of musculoskeletal symptoms in dentists is high although relatively few studies have been conducted in this profession. This study was undertaken to investigate the prevalence of musculoskeletal symptoms and to assess the risk of these symptoms among general dentists in Shiraz, Iran.

Materials and Methods: In this descriptive cross-sectional study, the Nordic standard questionnaire and a demographics questionnaire were filled out by 160 general dentists in their offices. Furthermore, the photos of dentists' working postures were taken during dental treatment and the most repetitive postures were selected and assessed by Rapid Upper Limb Assessment (RULA) method. The data were analyzed by SPSS version 16.0 software.

Results: A large number of dentists (139 cases) reported musculoskeletal symptoms in at least one region of their musculoskeletal systems during the past 12 months. Neck (105 cases), shoulders (80 cases), upper back (76 cases), wrist/hand (63 cases), and lower back (55 cases) were the most commonly affected regions among the dentists. A significant difference was observed between men and women only in the wrist/hand (p>0.05). The results of posture analysis showed that all dentists' postures fell into action level 2 and 3.

Conclusion: The results of this study revealed that the prevalence of musculoskeletal symptoms in dentists was high and the risk levels were intermediate to high. Therefore, it is recommended that an appropriate training program be implemented to improve dentists' awareness regarding musculoskeletal symptoms.

Key Words: Musculoskeletal disorders, dentists, RULA, Shiraz, Iran

Introduction

Musculoskeletal disorders (MSDs) are defined as abnormalities in muscles, bones, joints, nerves, and blood vessels, where certain professions and work-related factors increase their risk [1]. The Working environment plays a major role in the development of musculoskeletal symptoms, although many of these disorders can be avoided or at least reduced by considering ergonomics principles [2]. Dentists are forced to assume uncomfortable, asymmetric and static postures due to the small and limited work area (the oral cavity). The head bent forward

and rotated with open arms kept out from the body. Maintaining this position every day, in the long-term, can leads to excessive stress being exerted onto muscles and joints, particularly those of the neck, shoulders and back, followed by feeling of pain and discomfort in these areas. In previous studies, a high prevalence of MSDs has been reported among dentists, and areas most commonly involved included neck, shoulders, and back [3-6]. MSDs can affect performance of the dentists in different ways such as limiting the number of patient visits per day, reduced control and dexterity (when doing delicate work), and the kind dentist-patient relationship [6, 7]. This study aims to investigate the prevalence of symptoms of MSDs and to assess the risk of these symptoms among general dentists in Shiraz.

Materials and Methods

In this cross-sectional study, 160 general dentists were randomly selected, and included in the study. Dentists with less than one year of practical experience and with a history of accidents and diseases that could affect the musculoskeletal system were excluded from the study.

Questionnaires were used to collect the required data on occupational and demographic variables and the data related to the prevalence of MSDs. The first questionnaire contained questions related to personal details (age, height, weight, gender, and marital status), job tenure, work pattern (average hours of work per day, average number of patient visits per day, breaks between visits), and history of accidents or diseases that affect musculoskeletal system. The Nordic Questionnaire [8] was used to examine reported cases of MSDs among the study population during the past 12 months, which had been validated in previous study [9]. It should be noted that symptoms of MSDs in this study are defined as discomfort, pain, fatigue, swelling, sensory disorders, limited range of motion and loss of motor control in neck, shoulders, wrists/hand, lower and upper back, and foot. Questionnaires were completed in an interview at the dentists' offices. To determine the risk of MSDs,

Rapid Upper Limbs Assessment (RULA) method was used, which is a method for assessing the risk of MSDs in upper extremities, introduced by McAtamney and Corlett in 1993 [10]. In this study, postures of dentists were photographed, and the most repeated postures were selected for analysis. A and B Scores for assessing combined effects of postures of arm, forearm, wrist/hand and neck, trunk and foot were extracted from relevant tables, respectively. Then, scores of muscular action and repeated motion were added to score A, and score of the force exerted was added to score B. Using these scores (A and B), the grand score would be extracted from relevant table, and based on the grand score, action levels were determined. In the RULA method action levels, based on the results of posture analysis, are divided in four levels:
1. Level 1 (acceptable)
2. Level 2 (further investigation and ergonomic interventions may be required)
3. Level 3 (further investigation and ergonomic interventions may be required soon)
4. Level 4 (further investigation and ergonomic interventions are required immediately)
Data were analyzed using SPSS, version 16.0 on a personal computer. Descriptive statistics were used for the action levels. To determine the relationship between symptoms of MSDs and studied variables chi-square test was used. Furthermore, multiple regression analysis was used to determine the effect of occupational and demographic variables on the prevalence of MSDs symptoms. A p value less than 0.05 was considered statistically significant.

Results

The dentists' demographic characteristics, job tenure, and work patterns are shown in table 1. Of the participating dentists, 97 subjects (60.6%) were men with the mean age of 41±7 years, and 63 subjects (39.4%) were women with the mean age of 36±8 years. Eighty dentists (50%) stated they did not take a break between visits, and the rest took 4.2-minute (on average) breaks between visits. All 160 participants completed questionnaires, but 143 (89.3%) dentists took part in posture assessment.

Table 1. Demographic characteristics, job tenure, and work pattern of dentists (n=160)

Variable	Mean	Standard deviation	Min	Max
Age (years)	39/01	7/75	24	57
Height (cm)	17/06	9/04	150	187
Weight (kg)	73/18	11/95	45	102
Body Mass Index (BMI)	25	3/06	16/25	33
Job tenure (years)	11/96	6/68	1	28
Work hours per day	6/4	2/15	3	12
Number of visits per day	9/5	6/2	5	30
Breaks between visits [*] (min)	4/2	6/03	0	30

* For dentists that had a break between the visits (minute)

Table 2 shows the prevalence of self-reported symptoms of MSDs during the past 12 months based on gender, daily working hours, and breaks between visits. One hundred and thirty nine dentists (86.8%) including 93.6% women and 82.5% men reported discomfort and pain in at least one area in the musculoskeletal system in the past 12 months. The areas most frequently involved were neck in 105 dentists (65.6%), the shoulders in 80 (50%), the upper back in 76 (47.5%), the wrist/ hand in 63 (39.4%), and the lower back in 55 (34.4%). Although, the prevalence of symptoms in the neck, shoulders, upper back, and lower back was higher in men than in women, these differences were not statistically significant. Conversely, the prevalence of symptoms of MSDs in the wrist/ hand area was significantly more in women than in men (p<0.001). Dentists that worked more than 7 hours per day, compared with the other group, had the highest prevalence of symptoms in the lower back, upper back, and shoulders, among these the difference in the prevalence of symptoms in the lower back was significant (p=0.01). Conversely, the prevalence of symptoms in the neck and wrist/ hand areas in dentists that worked fewer than 7 hours per day was significantly more than that in dentists that worked more than 7 hours per day (for the neck, p=0.03 and for the wrist/hand, p=0.002). Additionally, statistical analysis revealed that there is no significant relationship between the prevalence of symptoms in different areas of musculoskeletal system and job tenure, age, and Body Mass Index (BMI). The prevalence of MSDs in the lower back and upper back in dentists that take a break between visits was less compared to the dentists who did not. This difference in the upper back area was significant (p=0.009). Furthermore, the prevalence of symptoms in the wrist/hand in dentists that rest between visits was significantly more than those that did not rest (p=0.03).

Table 3 presents occupational and demographic variables that have main roles in the developing of symptoms of MSDs in dentists. It should be mentioned that this table is the result of multiple logistic regression analysis, in which, the effect of confounding factors has been eliminated to clarify which variables in the model have real influence on the development of the symptoms in different parts of the musculoskeletal system.

As seen in Table 3, some occupational and demographic variables have significant correlations with the prevalence of symptoms of MSDs (p<0.05). Over 7 hours of work per day is the main variable in the prevalence of symptoms in the neck. Female gender and weighing more than 80 kg were the main variables in the prevalence of symptoms in the wrist/hand. None of the variables inserted in the model had any significant correlation with the prevalence of symptoms in shoulders, upper back, or lower back.

RULA analysis of the captured postures of 143 dentists revealed that grand score for the right and the left side of the body were 4.38±0.71 and 4.35±0.72, respectively, with no significant difference. All postures of participants were found to be in action levels 2 and 3. This meant that postures needed corrections and ergonomic interventions.

Table 2. Frequency of MSDs in dentists based on work hours per day, gender, and rest between visits (n=160)

Body areas	Working hours per day			Gender				Breaks between visits		
	7 hours or less	More than 7 hours (n=59)	P-v *	Male N=97	Female N=63	Total N=160	P-v *	Yes N=80	No N=80	P-v *
Neck	72(71/3%)	33(55/9%)	0/03	58/1	41/9	65/6	0/2	57(71/2%)	48(60%)	0/09
Shoulders	46(45/5%)	34(57/6%)	0/09	65	35	50	0/1	40(50%)	40(50%)	0/5
Wrist/hand	49(48/9%)	14(23/7%)	0/002	33/3	66/7	39/4	<0/001	37(46/2%)	26(32/5%)	0/03
Lower back	28(27/7%)	27(45/8%)	0/01	69/1	30/9	34/4	0/07	24(30%)	31(38/8%)	0/15
Upper back	47(46/5%)	29(49/2%)	0/4	61/8	38/2	47/5	0/4	30(37/5%)	46(57/5%)	0/009

Table 3. Effective variables in developing MSDs in different body areas in dentists (n=160)

Body areas	Remaining variables in the model			
	Variables	OR*	CI 95%	P-v
Neck	More than 7 hours of work per day	3/34	1/4-7/95	0/006
Wrist/hand	Gender-female	3/52	1/43-8/66	0/006
	Weight 80 kg and higher	4/56	1/36-15/3	0/014

* Odds ratio

Discussion

In this study, the prevalence of self-report symptoms of MSDs and risk assessment of these disorders in general dentists in the city of Shiraz were investigated. None of the dentists reported history of accidents or diseases that could have affected musculoskeletal systems.

Pain in the neck, followed by shoulders, upper back, wrist/hand, and lower back were the most common reported complaints, which was in line with results reported by Alexopoulos et al. [7] and Shrestha et al. [6]. In the present study, 86.8% of dentists reported pain in at least one part of the musculoskeletal system, which was in agreement with observations of Smith and Leggat [11] with 87.2%, and Arabi et al. [12] with 87.7%.

The prevalence of low back pain in Shiraz dentists was 34.4%, the same as other cases reported in some countries such as Denmark, U.S., Australia (New South Wales and Queensland) [11, 13, and 15]. But less than that of Saudi Arabian dentists (73.5%) [5]. Low back pain is the most common symptom among Greek dentists with 46%, and

Australian dentists with 64% [7, 15], while in this study; low back pain had the least prevalence. In previous studies, a high prevalence of neck pain had been reported in dentists, due to awkward postures that dentists adopted during work [16-18]. Rundcrantz et al. [18] reported neck pain in 44-48% male and 61-62% female dentists. Niemi et al. [19] observed that only 10% of young male dentists and 21% of young female dentists suffered neck pain. In these studies [18, 19] the population were different; in the first, the population consisted of dentists, but in the second, it was dentistry students that were investigated. In the present study, the prevalence of neck pain was compatible with those reported in Saudi Arabia with 54.5%, Denmark 65%, and Australia (Queensland) 57.5% [5, 11, and 13]. Although the prevalence of neck pain was more in men, this difference was not significant, and was in agreement with results of Mollis et al [2], and Shrestha et al [6]. In this study, the prevalence of symptoms of MSDs between male and female dentists was statistically significant only in wrist/hand (33.3% of men and 66.7% of

women). This finding agreed with the findings of Smith and Leggat [11] in which many female dentists had pains in wrist/hand. In some studies, it has been reported that prevalence of symptoms in neck, upper back, and shoulders is higher in young experienced dentists [20-21]. In this study, as in the study by Marshal et al. [15], no significant difference was found in the prevalence of musculoskeletal symptoms between age and job tenure groups.

Present study showed that the symptoms in the lower back was significantly more prevalent in dentists working more hours per day than in those working fewer hours. This finding shows the role of duration of exposure to MSDs risk factors that previously mentioned in other studies [22, 23]. An interesting finding in this study is that the prevalence of symptoms in the neck and the wrist/hand was significantly higher in dentists that worked fewer hours than in those working more hours per day (71.3% against 55.9% for neck, and 48.5% against 23.7% for wrist/hand), although previous studies have shown that with increasing exposure time to MSDs risk factors, the possibility of disorders also increases [22, 23]. Maybe, the prevalence of symptoms in the neck and wrist/hand had caused limitations for the dentists that had to reduce work hours per day. Further study is required to prove this hypothesis.

Moreover, the results of this study revealed that taking a rest between visits could have a protective role against the development of symptoms in the upper back in that the prevalence of symptoms in this site was significantly less in dentists that rested between visits than in those that worked non-stop (37.5% against 57.5%). The reverse was observed with the wrist/hand area. Dentists resting between visits had more complaints than those not resting. As explained above, this could have been due to the pain experienced by the dentists that forced them to work less and take a break between visits.

The multiple regression analysis showed that out of all variables entered into the model, only "more than 7 hours of work per day" for the neck pain, and "female gender" and "weight over 80 kg" for the wrist/hand pain were effective factors of the model. This observation could indicate the influence of confounding factors in the observed relationship between the prevalence of symptoms in different areas and other variables (identified in Bivariate tests), and only variables "working hours", "gender", and "weight" had a real effect on the neck and wrist/hand areas.

Postures analysis with RULA method showed that all dentists' postures were in action levels 2 and 3, indicating the need for corrections and ergonomic interventions. In the study by Nasle Seraji et al. [24], REBA (Rapid Entire Body Assessment) method was used for evaluation of dentists' postures, and reported dentists working conditions in the moderate to high risk levels.

Given the cross-sectional nature of this study, and also, the data collection method (self-report), the findings must be taken with care. Self-report method has inherent drawbacks such as difficulties in recollection of complications. However, we attempted to lessen this effect by limiting reporting time to the past 12 months.

Conclusions

There was a high prevalence of symptoms of MSDs among male and female dentists in Shiraz. The high prevalence and the results of posture analysis revealed a high risk of developing the symptoms (risk levels 2 and 3). Furthermore, the number of work hours per day, female gender, and weight were influential factors on the development of symptoms in the neck and wrist/hand regions.

Acknowledgements

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40