

Musculoskeletal Disorders in Female Dentists and Pharmacists: A Cross-Sectional Study

Omid Aminian¹, Zahra Banafsheh Alemohammad¹, and Khosro Sadeghniaat-Haghighi²

¹ Center for Research on Occupational Disease, Tehran University of Medical Sciences, Tehran, Iran

² Department of Occupational Medicine, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran

Received: 29 May 2012; Received in revised form: 2 Sep. 2012; Accepted: 14 Sep. 2012

Abstract- Musculoskeletal disorders are an important occupational health problem in dentistry. Few studies have compared these disorders in dentists with other occupational groups. We assessed musculoskeletal disorders in female dentists in comparison with female pharmacists. A cross-sectional study by means of Musculoskeletal Nordic Questionnaire was performed among 191 female general dentists and 211 female general pharmacists who were at least one year in clinical practice and selected using the random sampling method. Those with a history of a traumatic event causing fracture in spinal column or extremities and connective tissue diseases excluded. The data were analyzed by univariate and multivariate logistic regression analyses. 91.6% of the female dentists and 87.7% of the female pharmacists reported having at least one musculoskeletal symptom in the previous 12 months. 12-month period prevalence symptoms of neck (OR=3.17), upper back (OR=2.19) and upper extremity (OR=1.99) had the most ORs in comparison of dentists to pharmacists. In summary, female dentists are at risk of developing musculoskeletal disorders particularly in the neck, upper back and upper extremities.

© 2012 Tehran University of Medical Sciences. All rights reserved.

Acta Medica Iranica, 2012;50(9): 635-640.

Keywords: Dentists; Musculoskeletal disorders; Occupational; Standardized Nordic Questionnaire

Introduction

Musculoskeletal disorders are identified as injuries to the human support system of muscles, tendons, ligaments, blood vessels, nerves, joints and bones. They can occur from a single or cumulative trauma and cause pain in the neck, shoulder, arm, wrist, hands, upper and lower back, hips, knees and feet (1). These disorders are an important occupational health problem for dentists (1-6). Some studies have recognized that musculoskeletal disorders contribute markedly and significantly to reduced productivity, sick leave and leaving the profession in dentistry (3,7). Several studies reported a high prevalence of musculoskeletal disorders in this particular occupational group (4,8,9). Pain in the neck, upper back, lower back and shoulders is the most prevalent musculoskeletal symptom in dental practitioners (2,4,10). Nevertheless, the range of results reported in various studies is wildly different. Female dentists missed work because of neck and back pain more than their male counterparts (10). Some studies

found that females experienced a higher pain severity than male dentists (8,11). It seems as though female gender is prone to musculoskeletal disorders (12) and musculoskeletal pain has a higher incidence in young female dentists (5).

Wide variety of causative factors including physical burden of work, ergonomics, demographic factors (8), as well as psychosocial factors (13) may be responsible for musculoskeletal symptoms in dentists (12). Distinction of these various possible risk factors to achieve a definitive causative factor for musculoskeletal disorders is very difficult, if not impossible to perform (1). The evidence on dentistry as a profession with potential risk for development of musculoskeletal disorders remains indistinct (14). Few studies have compared musculoskeletal disorders in dentists with other occupational groups (15-18) and fewer have reported musculoskeletal symptoms in pharmacists. Milerad *et al.* have shown that 26 and 23 percent of the pharmacists respectively reported symptoms of the neck and shoulders (15).

Corresponding Author: Zahra Banafsheh Alemohammad

Center for Research on Occupational Disease, Tehran University of Medical Sciences, Poursina St., Qods Ave., Enghelab Ave., Tehran, Iran, P.O.Box: 1417635471.

Tel: +98 21 88994485, Fax: +98 21 88994487, E-mail: zahra_5721@yahoo.com

Regarding the diversity of reported results and lacking for control group in dentists' musculoskeletal disorders, further research was needed to more carefully elucidate the risk and the impact of these influential disorders in this occupational group. On the other hand, little is known about the distribution of musculoskeletal disorders among Iranian dentists. Therefore, the purpose of this study was to assess musculoskeletal disorders in female dentists in comparison with female pharmacists, which were an appropriate reference group to determine relative risks.

Materials and Methods

A cross-sectional study was performed between January and November 2011 among 210 female general dentists and 250 female general pharmacists in Tehran, Iran. Pharmacists were chosen as a control group since they had a varied physical workload, but similar socioeconomic background and comparable medical knowledge. Subjects were at least one year in clinical practice after becoming qualified and recruited randomly from the lists of members of Iranian General Dentists Association and Iran Pharmacists Association who participate in congresses and retraining courses of these associations. Those that had connective tissue diseases and history of a traumatic event causing fracture in spinal column or extremities, excluded from the study. Finally, after elimination of incomplete questionnaires, 191 female general dentists compared with 211 female general pharmacists. We obtained informed consent from participants and made it clear that participation was voluntary. Approval for this study was obtained from the Research Ethics Committee at Department of Occupational Medicine, Tehran University of Medical Sciences.

Each of the participants completed a self-administered, anonymous data-gathering sheet. It included items on sociodemographic variables (age, height, body weight, dominant hand, smoking habits) and the work-related questions (duration of employment, working hours per day and working days per week). We assessed musculoskeletal disorders by means of a modified version of the "Standardized Nordic Questionnaire" (19). This questionnaire is an internationally accepted instrument to standardize evaluation of musculoskeletal disorders and consists of questions about nine anatomical areas (three on the upper extremities, three on the lower extremities and three on the spinal column). Participants were requested to report whether they had experienced pain or

discomfort in any of nine different body areas (neck, shoulder, elbow, hand, upper back, lower back, hip, knee and foot) during the last 12 months, during the last 7 days and being prevented from doing normal activities because of these symptoms during the past 12 months. We modified the original questionnaire by omitting the column related to "be visited with a physician". Many studies have utilized a modification of the Standardized Nordic Questionnaire in their surveys (17,20-22) and it seems to be an accepted method of musculoskeletal complaints assessment (1). The questionnaires were cautiously completed, supervised by a postgraduate student of occupational medicine. She explained how to complete the questionnaire for each participant individually. The participants were supposed to have understood the questions due to their academic medical education. We analyzed the data with the SPSS version 16 software. Age, working hours and duration of employment were analyzed as continuous numeric variables. Mean and standard deviation were used to describe numeric variables. Differences between the female dentists and female pharmacists in age, weekly work hours and BMI were analyzed by Student's t-test. Nonparametric Mann-Whitney test was used for "working years" and "smoking". Frequencies and percentages were used to describe the prevalence of musculoskeletal complaints. Differences in musculoskeletal disorders between the female dentists and female pharmacists were identified using the Chi-square test. We restricted the response categories to 'yes' and 'no' and constructed a simple sum score by counting the number of troubled sites in upper body (neck, shoulder, elbow, hand and upper back), lower body (lower back, hip, knee and foot) and total body area in all participants individually. The mean sum scores of troubled sites in female dentists and pharmacists were compared by Mann-Whitney test. *P*-value less than 0.05 was considered statistically significant. For each specific musculoskeletal symptom logistic regression analyses were performed, using the Backward: LR method with adjustments for body mass index (BMI), smoking (pack-year) and working years as well as for working hours per week. Variables including in this model were related to musculoskeletal complaints clinically or statistically. Due to an excellent correlation between age and years at work (Pearson's correlation coefficient = 0.93, *P*<0.001), only years at work was included in the main analyses. Adjusted odds ratios and 95% confidence intervals were calculated.

Table 1. Baseline data in female dentists and pharmacists.

| | Female Dentists | | Female Pharmacists | | P-value |
|------------------------|-----------------|--------------|--------------------|---------------|-------------------|
| | Range | Mean (SD) | Range | Mean (SD) | |
| Age (year) | 25-66 | 35.75 (8.35) | 24-74 | 36.64 (10.52) | 0.34 |
| Working years | 1-41 | 9.64 (7.74) | 1-50 | 12.16 (10.17) | 0.04 ¹ |
| working hours per week | 4-60 | 27.3 (11.11) | 6-98 | 42.73 (14.15) | 0.00 |
| Body mass index (BMI) | 14.69-35.56 | 23.37 (3.15) | 16-37.37 | 23.76 (3.47) | 0.24 |
| Smoking (pack-year) | 0-15 | 0.08 (1.08) | 0-4.5 | 0.03 (0.33) | 0.73 ¹ |

1. Mann-Whitney test

Table 2. Mean score from number of the MSDs in female dentists and pharmacists.

| Body area | Mean score in the past 12 months | | | Mean score in the past 7 days | | |
|------------|----------------------------------|-------------|---------|-------------------------------|-------------|---------|
| | Dentists | Pharmacists | P value | Dentists | Pharmacists | P-value |
| Upper body | 2.3 | 1.5 | 0.00 | 0.73 | 0.76 | 0.64 |
| Lower body | 1.2 | 1.3 | 0.52 | 0.36 | 0.72 | 0.00 |
| Total body | 3.5 | 2.8 | 0.00 | 1.09 | 1.48 | 0.01 |

Results

A total of 191 female dentists and 211 female pharmacists were assessed in the present study (90.9% and 84.4% response rate respectively). There were no significant differences between these two groups in the baseline data, except for the working years and the mean weekly work time (Table 1). 175 dentists (91.6%) and 185 pharmacists (87.7%) reported having at least one musculoskeletal symptom during the past 12 months. This difference did not reach statistical significance ($P=0.199$). During the past seven days, 91 dentists (47.6%) and 127 pharmacists (60.2%) reported

symptoms from at least one anatomical region (OR=0.598, $P=0.012$).

We compared the mean sum scores of troubled sites in female dentists and pharmacists; ranging from 0 to 5 in upper body segment, 0 to 4 in lower body segment, and 0 to 9 in total body area (Table 2).

With regard to the 12-month period prevalence of each symptom in the logistic regression analysis, occupation (dentist vs. pharmacist) was the only variable that remained in the model statistically significant; while we considered the following regions as dependent variables in the model: neck, shoulder, hand, upper back and upper extremity as a whole (shoulder, elbow or hand), which adjusted ORs are shown on Table 3.

Table 3. Prevalence of musculoskeletal symptoms experienced by female dentists and pharmacists during the past 12 months by body site

| | Dentists (n=191) | Pharmacists (n=211) | Adjusted OR (95% CI) ¹ |
|-----------------|------------------|---------------------|-----------------------------------|
| | n (%) | n (%) | |
| Neck | 126 (66) | 80 (37.9) | 3.17 (2.10-4.79)* |
| Shoulder | 98 (51.3) | 82 (38.9) | 1.63 (1.09-2.43)* |
| Elbow | 22 (11.5) | 13 (6.2) | 1.85 (0.89-3.84) |
| Hand | 96 (50.3) | 72 (34.1) | 1.92 (1.28-2.88)* |
| Upper extremity | 140 (73.3) | 122 (57.8) | 1.99 (1.30-3.05)* |
| Upper back | 98 (51.3) | 69 (32.7) | 2.19 (1.46-3.29)* |
| Lower back | 106 (55.5) | 112 (53.1) | 1.20 (0.75-1.92) |

1. Adjusted OR (95%CI) = Odds ratio with 95 percent confidence interval, calculated by logistic regression analyses, adjusting for BMI, smoking (pack/year), working years and working hours per week.

* $P<0.05$

Table 4. Prevalence of musculoskeletal symptoms experienced by female dentists and pharmacists during the past 7 days by body site

| | Dentists (n=191) | Pharmacists (n=211) | Adjusted OR (95% CI) ¹ |
|-----------------|------------------|---------------------|-----------------------------------|
| | n (%) | n (%) | |
| Neck | 45 (23.6) | 41 (19.4) | 1.26 (0.78-2.04) |
| Shoulder | 33 (17.3) | 38 (18) | 0.93 (0.56-1.57) |
| Elbow | 5 (2.6) | 6 (2.8) | 1.29 (0.30-5.61) |
| Hand | 35 (18.3) | 35 (16.6) | 0.94 (0.51-1.73) |
| Upper extremity | 59 (30.9) | 63 (29.9) | 0.94 (0.57-1.55) |
| Upper back | 22 (11.5) | 40 (19) | 0.56 (0.32-0.99)* |
| Lower back | 34 (17.8) | 55 (26.1) | 0.62 (0.38-1.01) |

1. Adjusted OR (95%CI) = Odds ratio with 95 percent confidence interval, calculated by logistic regression analyses, adjusting for BMI, smoking (pack/year), working years and working hours per week.

* $P < 0.05$

Musculoskeletal symptoms that interfered with daily activities were most commonly at the neck (13.6%), lower back (12.6%), hands (12%) and shoulders (8.4%) in female dentists. There were no significant differences in the prevalence of these symptoms among the female dentists and pharmacists except for upper extremities (any of the shoulders, elbows or hands) as a whole (OR=2.06, $P=0.015$). Logistic regression analysis indicated that working years was the only risk factor that interfered with daily activities in neck (OR=1.074, $P=0.006$) and shoulder (OR=1.075, $P=0.016$) in female dentists but not pharmacists.

The female pharmacists reported significantly higher "7 day period prevalence" of upper back than the female dentists did (Table 4).

Discussion

The present study showed that a large majority of the female dentists reported musculoskeletal disorders, which was in line with previous studies on dentists (11,12,17). There were no significant differences in basic demographic data between the female dentists and pharmacists in our study; furthermore, the socioeconomic background and medical knowledge of dentists and pharmacists is similar which may regulate the psychosocial demand as a risk factor of musculoskeletal disorders. Working years and working hours per week, which differed significantly between these two groups, were adjusted in statistical analysis.

91.6 percent of female dentists reported symptoms at least in one anatomical region during the previous year. This was similar to the recent study by Kierklo *et al.* (9) in 2011 (92 percent) as well as by Leggat *et al.* (4) in

2006 (87.2 percent). However it was higher than which reported in an earlier study in Thailand (78 percent) (8). Akesson *et al.* reported symptoms from at least one anatomical region in 69% of female dentists in the last 7 days, which was higher than our results (17).

The number of musculoskeletal pain sites is considered an important dimension in symptom reporting (23). The numbers of troubled sites in total body and upper body segment were significantly more in dentists than in pharmacists during the past 12 months (Table 2). In both groups, mean scores in the past 7 days were much lower than in the past 12 months and in upper, lower and total body area were lower in female dentists. It might be due to the hardening process as mentioned in a previous study among female dental personnel by Akesson *et al.* (17). The female dentists probably get used to symptoms of long duration in different anatomical regions, as they have to live with them. Therefore, they might deny that these symptoms exist.

The high frequency of 12-month period prevalence of neck complaints found among the female dentists in this study was similar to that found in some previous studies (4). In a recent study by Abiodun-Solanke *et al.*, the prevalence of neck pain was 80.6% in female dentists, which was higher than our results (10). On the other hand, one that reported by Kierklo *et al.* and Alexopoulos *et al.* were lower than ours (9,24). According to a recent review, dentists reported 26 to 73% period prevalence of neck symptoms over the previous 12 months (25). We found that neck pain was the most common symptom that interfered with daily activities. Leggat *et al.* also reported that musculoskeletal symptoms interfered with a dentist's

daily activities most commonly at the neck (4). 30% of their female dentists had neck symptoms that interfered with daily activities, which was almost two times as many of our result. In this study, the female dentists reported symptoms of the neck and upper extremities more than the female pharmacists did during the past 12 months. This is supported by a study in Stockholm by Milerad *et al.* (15).

The second most frequent symptom in female dentists was in low back region similar to some other studies (4). However, in comparison to pharmacists, there was no significant difference in the prevalence of this symptom. Some changes like shift from standing to seated position may have altered risk from the lower back to the upper body area (25). In the present study, the female dentists reported symptoms of the upper back more often than the female pharmacists did during the past 12 months. Many risk factors such as static and awkward posture and work practices, particularly those with isometric contractions of the trapezius muscle might to be considered (1).

This study was a questionnaire-based cross-sectional study and one of the limitations of questionnaire-based studies is that what people report may differ from their real situation. However, given the subjective nature of symptoms, self-report methods are the best, if not the only possible approach and most of the studies on musculoskeletal disorders in dentists have this kind of design. We could only evaluate the association between variables, but not cause-effect relationship due to cross-sectional design. Another limitation of this study was that we could not evaluate those who had left their profession due to musculoskeletal symptoms. Therefore, the problem might be higher within these occupational groups than shown here.

While the results of the present study have offered some interesting findings, further research in this case is still required. Future research may benefit from including questions that are more specific related to clinical practice. These may help elucidate more subtle statistical associations between musculoskeletal disorders and variables such as manual tasks or the use of vibrating devices. Progression over time of musculoskeletal disorders is also unknown, so longitudinal studies investigating the natural course of these disorders can overcome this limitation of the cross-sectional design. In summary, the finding from this study underline that the female dentists, are at risk of developing musculoskeletal disorders particularly in the neck, upper back and upper extremities.

Acknowledgements

This study was a part of a postgraduate thesis and has been supported by the Tehran University of Medical Sciences (TUMS). The authors wish to thanks Dr. Fateme Esfahani and Dr. Mohammad Hashem Hosseini for their invaluable help.

References

1. Hayes M, Cockrell D, Smith DR. A systematic review of musculoskeletal disorders among dental professionals. *Int J Dent Hyg* 2009;7(3):159-65.
2. Puriene A, Janulyte V, Musteikyte M, Bendinskaite R. General health of dentists. Literature review. *Stomatologija* 2007;9(1):10-20.
3. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. *Ind Health* 2007;45(5):611-21.
4. Leggat PA, Smith DR. Musculoskeletal disorders self-reported by dentists in Queensland, Australia. *Aust Dent J* 2006;51(4):324-7.
5. Harutunian K, Gargallo-Albiol J, Figueiredo R, Gay-Escoda C. Ergonomics and musculoskeletal pain among postgraduate students and faculty members of the School of Dentistry of the University of Barcelona (Spain). A cross-sectional study. *Med Oral Patol Oral Cir Bucal* 2011;16(3):e425-9.
6. Al-Ali K, Hashim R. Occupational health problems of dentists in the United Arab Emirates. *Int Dent J* 2012;62(1):52-6.
7. Crawford L, Gutierrez G, Harber P. Work environment and occupational health of dental hygienists: a qualitative assessment. *J Occup Environ Med* 2005;47(6):623-32.
8. Chowanadisai S, Kukiattrakoon B, Yapong B, Kedjarune U, Leggat PA. Occupational health problems of dentists in southern Thailand. *Int Dent J* 2000;50(1):36-40.
9. Kierklo A, Kobus A, Jaworska M, Botulinski B. Work-related musculoskeletal disorders among dentists: A questionnaire survey. *Ann Agric Environ Med* 2011;18(1):79-84.
10. Abiodun-Solanke IM, Agbaje JO, Ajayi DM, Arotiba JT. Prevalence of neck and back pain among dentists and dental auxiliaries in South-western Nigeria. *Afr J Med Med Sci* 2010;39(2):137-42.
11. Marshall ED, Duncombe LM, Robinson RQ, Kilbreath SL. Musculoskeletal symptoms in New South Wales dentists. *Aust Dent J* 1997;42(4):240-6.
12. Lindfors P, von Thiele U, Lundberg U. Work characteristics and upper extremity disorders in female dental health workers. *J Occup Health* 2006;48(3):192-7.

Musculoskeletal disorders in female dentists

13. Huang GD, Feuerstein M, Sauter SL. Occupational stress and work-related upper extremity disorders: concepts and models. *Am J Ind Med* 2002;41(5):298-314.
14. Garbin AJ, Garbin CA, Moimaz SA, Baldan RC, Zina LG. Dental practice and musculoskeletal disorders association: a look at the evidence. *Arch Environ Occup Health* 2011;66(1):26-33.
15. Milerad E, Ekenvall L. Symptoms of the neck and upper extremities in dentists. *Scand J Work Environ Health* 1990;16(2):129-34.
16. Alexandre PC, da Silva IC, de Souza LM, de Magalhaes Camara V, Palacios M, Meyer A. Musculoskeletal disorders among Brazilian dentists. *Arch Environ Occup Health* 2011;66(4):231-5.
17. Akesson I, Johnsson B, Rylander L, Moritz U, Skerfving S. Musculoskeletal disorders among female dental personnel: Clinical examination and a 5-year follow-up study of symptoms. *Int Arch Occup Environ Health* 1999;72(6):395-403.
18. Kerosuo E, Kerosuo H, Kanerva L. Self-reported health complaints among general dental practitioners, orthodontists, and office employees. *Acta Odontol Scand* 2000;58(5):207-12.
19. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sorensen F, Andersson G, Jorgensen, K. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon* 1987;18(3):233-7.
20. Anton D, Rosecrance J, Merlino L, Cook T. Prevalence of musculoskeletal symptoms and carpal tunnel syndrome among dental hygienists. *Am J Ind Med* 2002;42(3):248-57.
21. Mehrdad R, Dennerlein JT, Haghighat M, Aminian O. Association between psychosocial factors and musculoskeletal symptoms among Iranian nurses. *Am J Ind Med* 2010;53(10):1032-9.
22. Nordin NA, Leonard JH, Thye NC. Work-related injuries among physiotherapists in public hospitals: a Southeast Asian picture. *Clinics (Sao Paulo)* 2011;66(3):373-8.
23. Tschudi-Madsen H, Kjeldsberg M, Natvig B, Ihlebaek C, Dalen I, Kamaleri Y, Straand J, Bruusgaard D. A strong association between non-musculoskeletal symptoms and musculoskeletal pain symptoms: results from a population study. *BMC Musculoskelet Disord* 2011;12:285.
24. Alexopoulos EC, Stathi IC, Charizani F. Prevalence of musculoskeletal disorders in dentists. *BMC Musculoskelet Disord* 2004;5:16.
25. Morse T, Bruneau H, Dussetschleger J. Musculoskeletal disorders of the neck and shoulder in the dental professions. *Work* 2010;35(4):419-29.