

Self-reported risk factors related to the most frequent musculoskeletal complaints among Czech dentists

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Abstract: The purpose of the study was to describe the occurrence of the most common complaints related to MSDs in Czech dentists and to assess the risk factors affecting them. A questionnaire survey of 581 Czech dentists (the response rate 72.6%) was conducted in 2011. The questionnaire ascertained general information about the respondents, their work habits and environment along with the occurrence of musculoskeletal disorders. The respondents filled out the questionnaires during the educational events organized by the Czech Dental Chamber. At least mild difficulties associated with the motoric system were reported by 96.9% of the respondents, with 66.3% of respondents reporting moderate or major difficulties. Back and neck pain followed by shoulder pain and headache were the most common complaints in our sample. According to our data: age, gender, length of practice, a history of serious MSDs, the occurrence of MSDs in blood relatives, the perception of work as psychologically demanding, and especially a perceived moderate/bad general health were significantly associated with the four most common musculoskeletal complaints. Some of the factors were found as protective. This study suggests that MSDs represent a significant burden for Czech dentists and further research is needed to elucidate this issue.

Key words: Risk factors, Musculoskeletal diseases, Dentists, Questionnaire inquiry, Czech Republic

Introduction

Dentistry is known to be a demanding profession that

requires concentration and precision. It is based on the social interaction between health care providers and their patients^{1–3}). Therefore, a healthy dentist is particularly important for a successful dental practice as well as the well-being of patients²).

Despite numerous technical advances of recent years, there is increasing evidence that dental professionals are still predisposed to a number of occupational hazards.

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These include exposure to infections, eye injuries, vibration, percutaneous exposure incidents, exposure to radiation, dental materials, noise, psychological conditions and musculoskeletal disorders^{2, 4, 5}.

It is well known that musculoskeletal diseases (MSDs) are very frequent in the present adult population and have an enormous and growing impact worldwide⁶⁻⁸). In the Czech Republic they represent the second most common cause of sick leave after upper respiratory tract diseases⁹). One of the important factors influencing the health status of people is their occupation. As far as dentists are concerned, many studies have shown that MSDs represent one of the greatest problems of dental professionals^{3-5, 10-15}). The one-year period prevalence of musculoskeletal symptoms among dentists ranged from 50 to 93%^{3, 4, 6, 10-19}), but some workers reported the one-year prevalence to be 100%^{20, 21}). Musculoskeletal disorders affect the physical, psychological and social aspects of dentists. This, in turn, has an impact on their productivity and ultimately reduces their quality of life¹). MSDs contribute significantly to sick leave, reduced productivity and quitting the profession^{6, 22}). The most common regions of pain in dentists are the neck, back and shoulders^{4, 6}).

MSDs are known to be of multifactorial etiology^{2, 23}). These disorders are due to excessive, long-term unilateral stress on muscles, tendons, joints and nerves²⁴⁻²⁶). They are associated with the specific work load in dentistry with its adverse static positions, high demands on vision, precision, fine manipulative hand movements, work with vibrating tools and work with unsupported elevated arms²⁵⁻²⁸). The load rate is multiplied by age and is also influenced by genetic predisposition^{25, 26}). Other very important aspects are the psychological demands on work and stress^{11, 13}). The lack of understanding ergonomic principles may also play its role. Recommendations on how to decrease MSDs are often only partially implemented even by the relatively motivated group of dentists^{6, 27, 29}). The main reasons that make these changes difficult include financial aspects and changing old working habits⁶).

Studies related to the MSDs among the dental profession have already been published in many countries but none have been conducted in the Czech Republic so far. The aim of our study is to describe the occurrence of the most common complaints related to MSDs in Czech dentists and to assess the risk factors affecting them.

Subjects and Methods

A cross-sectional study was conducted among Czech

dentists during the period from November 2010 to September 2011.

The questions were partly designed based on the Standardised Nordic Questionnaire³⁰); additional issues concerning specific circumstances of the Czech dental population were added by the authors. The questionnaire was designed to evaluate dentists' physical health related to musculoskeletal disorders during the past 12 months, their self-reported general health and their individual working environment and work habits. The introductory part of the questionnaire ascertained general information about the dentists. The dentists were asked about 12 most common health problems related to MSDs that occur in dentistry – i.e. pain in the cervical, thoracic and lumbar spine area; pain in the shoulders, elbow, and wrist; tingling fingers; pain in the hip and knee; headaches; varicose veins; and carpal tunnel syndrome. The intensity of health problems was assessed on a scale of 0 to 3 in which 0 meant no difficulties, 1 mild, 2 moderate and 3 major problems. The four most common complaints were analysed in detail and the results are presented in this paper.

The questionnaire was pilot tested by the authors among 20 dentists selected from the employees of the Department of Dentistry (Charles University, Faculty of Medicine in Hradec Kralove, and University Hospital Hradec Kralove) and general dental practitioners from the region Hradec Kralove. No changes were made in the questionnaire.

Questionnaires were distributed to a total of 800 dentists during their professional educational events organized by the Czech Dental Chamber that took part in various places throughout the Czech Republic. The dentists were asked to fill in the questionnaires. The purpose of the survey was explained and instructions on how to fill in the questionnaire were given. The vast majority of the completed questionnaires were returned on site during the course of the event, some of them were returned by mail at the expense of the respondents. The Ethics Committee of the University Hospital Hradec Kralove has approved the study proposal (reference number 201 306 S03P).

Statistical analysis was performed using a statistical program NCSS 2007 (NCSS, LLC., Kaysville, UT, USA) with data analysed using descriptive statistics and the χ^2 test of independence in the contingency tables and analytical methods. Logistic regression analysis was performed to evaluate the influence of the followed factors on the occurrence of musculoskeletal complaints. Prevalence odds ratios with 95% confidence intervals were calculated as measure of association. For the initial selection of potential risk factors for musculoskeletal complaints, univariate

Table 1. Occurrence of various health problems and their intensity

| Health problem | Intensity | | | |
|-------------------------|------------|------------|------------|-----------|
| | no | mild | moderate | major |
| | n (%) | n (%) | n (%) | n (%) |
| Headache | 227 (39.5) | 229 (39.8) | 101 (17.6) | 18 (3.1) |
| Neck pain | 126 (21.9) | 221 (38.4) | 185 (32.2) | 43 (7.5) |
| Upper back pain | 289 (50.3) | 130 (22.6) | 135 (23.5) | 21 (3.7) |
| Low back pain | 144 (25.0) | 195 (33.9) | 173 (30.1) | 63 (11.0) |
| Shoulder pain | 275 (47.8) | 149 (25.9) | 111 (19.3) | 40 (7.0) |
| Elbow pain | 412 (71.7) | 107 (18.6) | 46 (8.0) | 10 (1.7) |
| Wrist pain | 352 (61.2) | 138 (24.0) | 65 (11.3) | 20 (3.5) |
| Fingers pain / tingling | 342 (59.5) | 130 (22.6) | 77 (13.4) | 26 (4.5) |
| Hip pain | 344 (59.8) | 149 (25.9) | 65 (11.3) | 17 (3.0) |
| Knee pain | 358 (62.3) | 127 (22.1) | 67 (11.7) | 23 (4.0) |
| Varicose veins | 371 (64.5) | 113 (19.7) | 67 (11.7) | 24 (4.2) |
| Carpal tunnel syndrome | 491 (85.4) | 50 (8.7) | 26 (4.5) | 8 (1.4) |

logistic regression analysis was used with significance level of $p < 0.05$. Subsequently, all independent variables that showed significant associations were included in the multivariate logistic regression model. The important confounders (age and gender) were always included in each model, regardless of their significance. These analyses were carried out separately for the selected four musculoskeletal complaints. Only significant results are presented.

Results

A total of 800 questionnaires were distributed to the dentists, from which 581 were returned, which achieved a response rate of 72.6%. Out of all respondents who participated in our study, 575 answered the questions concerning MSDs. Out of those, 161 were men (28%) and 414 were women (71%). The average age of respondents was 46.4 yr (SD=13), ranging from 24 to 77 yr. Their mean dentistry career length was 21.5 yr (SD=13.3), ranging from 1 to 53 yr. The majority of them (93.4%) worked as general dental practitioners (n=535) and 6.6% worked as specialists (n=38), of which 5.7% were orthodontists (n=33) and 0.9% maxillofacial surgeons (n=5).

A total of 96.9% (n=563) of respondents reported suffering from at least one kind of musculoskeletal problem listed regardless of its intensity in the past 12 months. The remaining 18 dentists (3.1%) did not report any health problems. In terms of intensity, 66.3% of respondents (n=381) rated their difficulties as moderate or major and 33.7% (n=194) of dentists experienced problems of only mild intensity or no difficulties at all.

A statistically significant correlation with the occurrence of musculoskeletal complaints of moderate and major intensity was demonstrated in our group for the following factors: gender, age, running a private practice, a history of serious disease in or injury to the musculoskeletal system, a working time over 40 h per week, subjective assessment of their general health and the perception of work as psychologically demanding. A statistically significant number of dentists who had experienced musculoskeletal complaints of moderate or major intensity used exercise as therapy, self-medicated and sought out the help of a specialist more often than those with mild or no difficulties. They also rated more often that they had to decrease their workload both in the past year and in the past month.

On the contrary, a statistically significant association was not demonstrated for several other variables with reference to the dentists surveyed: the specialization of the dentists, the occurrence of MSDs in blood relatives, the occurrence of musculoskeletal congenital defects, regular participation in sport activities, smoking during working hours, working time less than 40 h per week, or whether they favored the right or left hand when working.

Detailed analysis concerning descriptive data and statistically significant correlation between the occurrence of musculoskeletal complaints of medium and major intensity and the risk factors are described elsewhere³¹. In this paper we concentrate more closely on the analysis of the four most prevalent complaints of Czech dentists.

The 12-month occurrence of different types of health problems and their intensity is given in Table 1. Without regarding intensity, neck pain was the most prevalent

Table 2. Univariate associations between low back, neck and shoulder pain and headache in the past 12 months and self-reported risk factors

| Self-reported risk factor | Low back pain OR (95%CI) | Neck pain OR (95%CI) | Shoulder pain OR (95%CI) | Headache OR (95%CI) |
|-------------------------------------------|-----------------------------|-------------------------|-----------------------------|------------------------|
| Gender (women) | NS | 1.67 (1.14–2.46)** | 2.01 (1.27–3.18)** | 3.57 (1.98–6.44)** |
| Age (by year) | 1.03 (1.01–1.04)** | 1.01 (1.00–1.03)* | 1.04 (1.02–1.05)** | NS |
| Age | | | | |
| 24–29 | 1.00 | 1.00 | 1.00 | NS |
| 30–49 | 1.79 (1.06–3.05)** | 1.84 (1.09–3.10)* | 1.91 (0.96–3.79)** | |
| ≥50 | 2.50 (1.54–4.08)** | 1.86 (1.15–3.00)* | 3.72 (1.99–6.97)** | |
| Length of practice (by year) | 1.03 (1.01–1.04)** | 1.01 (1.00–1.03)* | 1.03 (1.02–1.05)** | NS |
| The occurrence of MSDs in blood relatives | NS | NS | NS | 1.79 (1.19–2.69)** |
| History of serious MSD | 2.21 (1.27–3.84)** | 2.02 (1.17–3.48)* | 2.55 (1.46–4.44)** | NS |
| Reduction of work load due to MSDs | 3.23 (2.01–5.18)** | 4.41 (2.71–7.20)** | 4.87 (3.04–7.82)** | 3.14 (1.93–5.11)** |
| Sick leave due to MSDs | NS | 2.55 (1.04–6.27)* | NS | NS |
| Operation due to MSDs | 2.55 (1.14–5.66)* | NS | NS | NS |
| Psychologically demanding work | 1.89 (1.23–2.88)** | 2.90 (1.83–4.59)** | 1.83 (1.12–3.01)* | NS |
| More than 20 patients a day | 1.56 (1.11–2.20)* | 1.36 (0.96–1.92)* | 1.50 (1.03–2.20)* | NS |
| Sitting position | 0.70 (0.50–0.99)* | NS | NS | NS |
| Patient's supine position | 0.55 (0.30–1.00)* | NS | NS | 0.44 (0.18–1.06)* |
| X-ray included in the dental unit | NS | NS | NS | 1.53 (1.00–2.33)* |
| Short relaxation exercises | NS | NS | 1.99 (1.26–3.16)* | NS |
| Subjective assessment of general health | | | | |
| Satisfactory | 3.63 (2.47–5.33)** | 4.01 (2.73–5.91)** | 3.46 (2.30–5.22)** | 3.09 (2.00–4.78)** |
| Bad/very bad | 10.91 (3.63–32.76)** | 7.01 (2.69–18.23)** | 10.99 (4.35–27.74)** | 3.90 (1.61–9.46)** |

$p < 0.05$ *, $p < 0.01$ **; OR: odds ratio, CI: 95% confidence interval, NS: not significant

musculoskeletal complaint, followed by complaints of low back pain, headaches, shoulder complaints and upper back pain. However, with regards to intensity, the most common complaint of medium or major intensity reported was low back pain, followed by neck pain, upper back pain, shoulder complaints and headaches.

In Table 2, the univariate analysis for selected complaints (low back pain, neck pain, shoulder pain and headache) is summarized. The intensity of pain was dichotomized and analysed in two categories – no/mild and moderate/major.

According to this data, females were especially associated with headaches as well as increased occurrences of neck and shoulder pain, while the influence of age and the length of practice were significant for neck, shoulder and back pain but not for headache. Each additional year of age / year of practice increased the possibility of neck pain by 1% / 1%, low back pain by 3% / 3% and shoulder pain by 4% / 3%. A history of serious musculoskeletal disease was related to neck, low back and shoulder pain. Dentists who had undergone surgery for MSDs had an increased risk of low back complaints. The occurrence of MSDs in blood relatives was related to headache. Dentists who have

already had to decrease their workload due to MSDs were laden with an increased risk of all analysed complaints with odds ratios varying from 3.14 to 4.87. Working on more than 20 patients a day remains a significant factor for all of the followed problems except for headache. The perception of work as psychologically demanding increased the risk of neck, low back and shoulder pain. According to our data, perceived satisfactory/bad general health was significantly associated with musculoskeletal complaints. The sitting position had a positive effect on low back complaints and the supine position of the patient decreased the possibility of both low back pain and headache.

The results of the multivariate analyses on risk factors for the occurrence of low back, neck, shoulder and head complaints are shown in Table 3. Perceived satisfactory or bad/very bad general health was the strongest risk factor. According to multiple logistic regression analysis, gender was significantly related to all of the above mentioned complaints. Age was significantly related to shoulder pain. A history of MSDs was significantly associated with shoulder pain. The occurrence of MSDs in blood relatives increased the possibility of headache. Decreasing the workload due to MSDs was related to all of the analysed

Table 3. Self-reported risk factors and low back, neck and shoulder pain and headache in the past 12 months (multivariate analyses)

| Self-reported risk factor | Low back pain OR (95%CI) | Neck pain OR (95%CI) | Shoulder pain OR (95%CI) | Headache OR (95%CI) |
|-------------------------------------------|-----------------------------|-------------------------|-----------------------------|------------------------|
| Gender | 1.25 (0.84–1.86)* | 1.65 (1.08–2.51)* | 2.07 (1.25–3.41)** | 3.12 (1.69–5.76)** |
| Age | | | | |
| 24–29 | NS | NS | 1.00 | NS |
| 30–49 | | | 1.82 (0.87–3.84)** | |
| ≥50 | | | 2.79 (1.40–3.84)** | |
| History of serious MSD | NS | NS | 1.99 (1.04–3.84)* | NS |
| The occurrence of MSDs in blood relatives | NS | NS | NS | 1.73 (1.11–2.71)* |
| Reduction of work load due to MSDs | NS | 2.60 (1.49–4.53)** | 2.62 (1.53–4.48)** | 1.88 (1.04–3.38)* |
| Psychologically demanding work | NS | 2.39 (1.46–3.89)** | NS | NS |
| X-ray included in the dental unit | NS | NS | NS | 1.64 (1.04–2.60)* |
| Subjective assessment of general health | | | | |
| Satisfactory | 3.32 (2.22–4.95)** | 3.16 (2.06–4.85)** | 2.21 (1.41–3.46)** | 2.69 (1.63–4.43)** |
| Bad/very bad | 10.50 (3.47–31.80)** | 4.29 (1.50–12.25)** | 4.61 (1.61–13.22)** | 2.46 (0.86–7.05)** |

$p < 0.05^*$, $p < 0.01^{**}$; OR: odds ratio, CI: 95% confidence interval, NS: not significant

problems except low back pain. An X-ray included in the dental unit increased the possibility of headache. The perception of work as psychologically demanding was significant only for the neck complaint.

Discussion

In our questionnaire survey the majority of dentists (96.9%) reported an occurrence of at least one of the listed health problems during the past year and 66.3% of the sample reported difficulties of medium or major intensity. By comparing the results of our survey with the results of similar studies from other countries, it can be stated that the situation in the Czech Republic is roughly average in terms of the rate of occurrence of MSDs among dentists^{4, 6, 11, 13, 17–19}. Even though the prevalence of MSDs of medium or major intensity among dentists was quite high, sick leave for these difficulties was taken only by 4.5% (n=17) of the dentists during the past year²⁹. As most dentists work in private clinics with regular patients, sick leave may incur a considerable impact on the economics and goodwill of some dental practices⁴.

Back pain and neck pain followed by headaches and shoulder complaints were the most prevalent physical complaints of Czech dentists, which is in accordance with similar studies^{2, 3, 6, 10, 13, 15, 20, 32}.

In our study, musculoskeletal pain for all regions, excluding headache, was associated with age and length of practice. Similar results were also obtained by other authors^{1, 2, 13, 15}. In contrast, other studies among dentists showed that MSDs decreased with age and duration of

practice^{10, 33, 34}. Their findings were attributed to older practitioners treating fewer patients as a result of age or that more experienced dentists learn to adjust their work posture to avoid such problems, or that those dentists with musculoskeletal problems have left the profession^{1, 6}.

According to multiple logistic regression analysis, female dentists may be more likely to suffer from headache, back, neck and shoulder complaints than males. The gender differences in MSDs that showed women to be at a disadvantage were also reported in other similar studies^{3, 11, 13, 16, 35–37}. Akesson *et al.*¹⁶ found that not only did female dentists have higher prevalence of neck, shoulder and hand/wrist symptoms but also a greater occurrence of a combination of these symptoms, as well as a longer duration of symptoms in neck and shoulders during the past 12-month period.

There can be several reasons for these findings, i.e. the different constitution of women, higher susceptibility or lower resistance to constant strain, smaller muscle strength, women also (unlike men) pay more attention to and take better care of their health and tend to report health problems more often. Psychosocial factors and stress may also play some role^{1, 16, 36, 38, 39}.

The number of patients treated a day appeared to be another significant factor in our study. Working on more than 20 patients a day increased the risk of all of the mentioned problems except for headache, however, this can be heavily influenced by the dentist, who is usually able to plan the number of patient appointments in advance.

Other very important aspects in relation to MSDs are the psychological demands of work and stress^{1, 7, 11, 20}.

Stress amongst dentists is thought to result from many sources, including job satisfaction, business income, working hours, as well as staff/patient interactions⁴⁾. Approximately three quarters of the respondents considered their work to be psychologically demanding. This fact was significantly related to neck, low back and shoulder pain. Several complementary mechanisms have been suggested in an attempt to explain how psychosocial stress can result in musculoskeletal tension and disorders and/or aggravate the effects of a high physical load^{40, 41)}. A central notion is that stress causes an increase in muscle tension similar to that caused by a physical load, especially in the area of the neck, shoulders and upper limbs^{11, 39, 41–44)}.

On the contrary, some of the analysed factors in our study had a positive effect and therefore, can be seen as protective. The sitting position had a positive effect on low back complaints and the supine position of the patient decreased the possibility of both low back pain and headache. This can be due to better loading of the musculoskeletal system during work in the sitting position on the reclined patient^{24, 27)}.

Perceived satisfactory or bad/very bad general health was the strongest risk factor. Even though 68.0% of dentists in our study rated themselves as being in good or very good general health, a comparable percentage of them (66.3%), however, reported at least one of the listed ailments at medium or major intensity. Subjective perceptions and feeling healthy about oneself are important factors that affects the quality of life of individuals⁴⁵⁾, but this feeling should not lead to an underestimation of the primary symptoms of MSDs. Long-term pain, muscle stiffness, loss of grip strength and restrictions of movement cannot simply be taken for granted as inevitable in the profession of dentistry²⁹⁾. In addition, the feeling of being generally healthy even in the presence of certain health problems contributes to the individual perception of pain intensity. The profession of dentistry has been chosen as an independent occupation, it is relatively well-paid and accompanied by a high social status and in addition, doctors can expect good prospects after their active work years have been completed. These positive factors can certainly at least partially compensate for the existing health problems and lead to a subjective perception of overall good health.

The study design was cross-sectional and as such it has its limitations. First of all, it is the representativeness of the sample and the ability of respondents to give correct answers. Although in terms of age and sex the sample of respondents cannot be considered representative (there

were significantly more women and the age of our sample was significantly lower than in the entire population of dentists in the Czech Republic), we consider the results of the survey important, as this is the first study of its kind in the country. Questionnaire inquiry is an inexpensive and suitable method, but it can introduce some recall bias. Perhaps more accurate results would be obtained by performing physical examinations and assessments, but these methods are time-consuming and expensive. Possible selection bias may be present in this study. It may be that those dentists who chose to participate did so because they had experienced musculoskeletal pain, which would strengthen the results.

High numbers of musculoskeletal problems should make practitioners actively concerned about their early diagnosis and treatment. Further research is required to elucidate the causes of MSDs among dentists and subsequently it is necessary to focus on appropriate preventive interventions that can help to reduce the prevalence of these problems. Studies have shown that physical disorders may present early in the dental career^{46–48)}. It is therefore important that the education in and the application of ergonomic principles should begin early on, beginning with students of dentistry, and continue throughout the life-long postgraduate education of working dentists.

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