MUSCULOSKELETAL DISORDERS AMONG DENTISTS IN SAUDI ARABIA

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ABSTRACT

The objective of the study was to find out the prevalence and distribution of musculoskeletal symptoms among dentists in Saudi Arabia. Furthermore, to find possible correlations between these symptoms and working positions and actions. A questionnaire about musculoskeletal symptoms in different parts of the body was completed by 140 dentists (63 male, 77 female) from the public dental service clinics in Dammam and Riyadh cities. Also, a physical ergonomic examination was carried out during visiting the work places of 60 freshly graduated dentists in King Saud University College of Dentistry, Dammam Central Hospital and the Military Hospital in Al-Khobar. The following aspects were investigated: the sitting work posture, the clock-related working position, the use of dental mirror, active neck mobility and support of the left arm. The descriptive data were analyzed and chi-square test was used for statistical significance (P<.05). Eighty-three of the responding dentists had pain or discomfort from the neck, shoulders, lower back or head. Younger dentists had more symptoms than the older dentists. The female dentists had a significantly higher frequency of pain, headache and weakness than their male counterparts. Pain and headache were the most commonly reported symptoms. The dentists who use the mirror more often had less pain or discomfort in the upper locomotor system than those who do not. The analysis of the ergonomic examination showed that the most frequently used postures were posture 1 (the whole back bent, the seat straight) and posture 3 (straight lower and upper back, the neck bent, the seat straight) (46.7% and 40.0% respectively). Dentists who used posture 1 have more neck ache (25%) and lower back pain (57.1%) than those who used posture 3. No significant difference was found between male and female dentists in regard to the presence of pain (P>.05). The 10 o’clock position was the most frequently used working position by the dentists. Most of dentists supported their left arm over the left side of the head of the patient. It can be concluded that the prevalence of musculoskeletal symptoms among dentists in Saudi Arabia is high. A correlation between back pain and different work actions was observed in this investigation.

Key words: Musculoskeletal disorders, Occupational health, Dentists in Saudi Arabia, Working positions.

INTRODUCTION

Occupational health hazards are common in many sectors and are on the increase. Musculoskeletal disorders (MSDs), which are problems of musculoskeletal system, are significant and costly workplace problems affecting occupational health, productivity and the careers of the working population. Musculoskeletal diseases, including pain, weakness and parasthesia, are reported to be associated with wide range of occupations. Nearly 2 million workers suffer from musculoskeletal disorders each year. These problems are caused by repetitive, awkward, or stressful motions. Dental personnel had an increased risk of developing such disorders.

Physically unfavorable load is probably an essential factor in the emergence of symptoms in the upper locomotor system. However, it should be indicated that other factors can contribute to the development and

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the experience of pain and discomfort. Later investigations indicated that causes in the psychic working environment such as work satisfaction, the level of appreciation, self-confidence, anxiety and worry about the future can also influence the experience of pain and discomfort. Rundcrantz et al. 10 emphasized that dissatisfaction with work, demand of performance, anxiety, psychosomatic sickness (headache, insomnia, stomach trouble) and concern about the future, can be strong contributing factors in pain and discomfort perception. He concluded that these factors together may give rise unsatisfactory personal harmonity, which probably increases the risk of pain and discomfort.

The physical load among dentists seems to put them at risk for the occurrence of musculoskeletal disorders. Muscular imbalance, neuromuscular inhibition, and pain and dysfunction may frequently be observed among oral health care providers. Repeated unnatural, deviated or inadequate working postures, forceful hand movements, inadequate equipment or workplace designs and inappropriate work patterns are likely to be the particular risk factors. However, MSDs are not an avoidable part of the oral health care providers’ professional lives 11-13.

The high frequency of musculoskeletal disorders probably reflects the specific work load in dentistry, with high demands on vision and precision and fine manipulative hand movements and work with unsupported, elevated arms. The symptoms might impair work capacity and the future possibility to stay in the profession. Studies have shown that active leisure and several psychosocial work factors strongly influence good general health and well-being. Physical tasks influence musculoskeletal disorders more than active leisure and psychosocial work factors 14-17.

The possible pathophysiological mechanism of occupational stress on the neck and shoulders has been reviewed by Hagberg 18. A mechanical origin for cervical disc degeneration and osteoarthrosis is reported for a few occupational groups. However, a mechanical origin for osteoarthrosis is debatable. A work posture involving elevated arms may accelerate degeneration of shoulder tendons through impairment of circulation due to static tension and humeral compression against the coracoacromial arch. Furthermore, work tasks with repetitive arm movements may evoke shoulder tendinitis or tendo-vaginitis, probably due to friction. The three possible routes to neck-shoulder muscular pain are mechanical failure, local ischemia and energy metabolism disturbance. The high frequency of symptoms from the neck, shoulders, and upper extremities of the dentists was probably related to their difficult work positions with cervical flexion and rotation, abducted arms, and repetitive precision-demanding handgrips 18.

A high proportion of dental practitioners suffer from backache 19, 20. A dentist would have approximately 50% chance for partial or complete premature retirement due to ill health. Data collected in the 1940’s revealed that more than 65 percent of dentists suffered backache 21. Ever since, many major changes have occurred in dentistry such as: a change to “sit-down” technique; improved design of most dental equipments and increased utilization of motion- economy principles, e.g., four-handed dentistry. Chronic musculoskeletal pain appears early in dental careers, with more than 70 percent of dental students of both sexes reporting pain by their third year 22, 23. MSD was shown to interfere with daily activities in some cases, while a considerable proportion of dentists had also sought medical attention for their symptoms 24, 25. The dentists in the Public Dental Service were found to have a high prevalence of pain and discomfort in the locomotor system. Female dentists had a higher prevalence of pain and discomfort. Younger dentists had pain and discomfort in the neck, shoulders and headaches than older dentists. Male dentists, who positioned their patient carefully to gain a direct view, suffered less from headache. Furthermore, dentists who used the mirror reported less headache and pain and discomfort in the shoulders. The ergonomic examination showed that dentists without symptoms applied a wedge cushion under the upper part of the patient’s back to obtain an optimum view. Specialists, both with and without cervico-brachial symptoms, were more satisfied with their personal control over their work and the stimulation from their work than were general practitioners. Physiotherapy with a psychosomatic approach and individual ergonomic instruction gave better relief from pain and discomfort and an increased feeling of mental well-being than did ergonomic instruction only. Personal harmony and age had the highest value for explaining the number of painful sites in the muscu-
The frequency of lower extremity complaints was low, and only a few of these complaints were considered work-related.27

Basic operating posture is considered an important occupational health issue for oral health care clinicians. It is generally agreed that the physical posture of the operator, while providing care, should be such that all muscles are in a relaxed, well-balanced, and neutral position. Postures outside of this neutral position are likely to cause musculoskeletal discomfort.28 Ergonomics is the application of a body of knowledge addressing the interactions between man and the total working environment, such as atmosphere, heat, light and sound, as well as all tools and equipment of the workplace. Work related musculoskeletal injuries, caused by poor posture, have been discussed in human dentistry for several years. Neglect of ergonomic principles brings inefficiency and pain to the workplace. An ergonomically deficient workplace may not cause immediate pain, because the human body has a great capacity for adapting to a poorly designed workplace or structured job. However, in time, the compounding effect of job and/or workplace deficiencies will surpass the body’s coping mechanisms, causing the inevitable: physical symptoms, emotional stress, low productivity, and poor quality of work.29, 30

Since 1992 the Occupational Safety and Health Administration (OSHA) has been preparing Federal legislation concerned with ergonomic hazards in at-risk workplaces.31 Ergonomics is the study of people at work to understand the complex relationships among people, machines, job demands, and work methods. As long as stress is kept within reasonable limits, work performance will be satisfactory and the worker’s health and well-being will be maintained. However, if stress is excessive, undesirable outcomes may result in the form of accidents and injuries. A variety of musculoskeletal injuries and disorders can be caused by physical stress in the work environment. Because of the high medical and compensation costs associated with these problems, it becomes essential in many manufacturing situations to implement programs for controlling physical stress. An important part of any control program is job evaluation.32, 33

The epidemiologic data regarding MSDs have been obtained from many countries and societies.14, 16, 34, 35 There is no sufficient information about the spread of such disorders in Saudi Arabia.36 The purpose of this research was to study the prevalence and distribution of symptoms of MSDs among dentists in Saudi Arabia. Also, the relationship between these symptoms and work sitting postures of newly-graduated dentists was to be identified.

MATERIALS & METHODS

I. Questionnaire

In the first part of the investigation, 300 questionnaires concerning analysis of musculoskeletal symptoms in different parts of the body were randomly distributed in the Public Dental Service Clinic in Dammam and Riyadh cities. The questionnaire, as shown in table 1, was adopted and modified from forms in previous studies.10, 19 Only 46.7% of dentists (140: 63 male, 77 female) responded by answering the questionnaire.

II. Ergonomic Examination

In the second part of the study, physical examination was carried out during visiting the work places of 60 freshly graduated dentists in KSU Dental College, Dammam Central Hospital and the Military Hospital in Khobar. After the physical examination was carried out, the dentists were asked if they have any of musculoskeletal symptoms. All dentists were asked to examine the distal surface of the left maxillary first molar. The following aspects were investigated:

A. The sitting work postures

The sitting position of the dentist while working on a simulated case was registered according to Fig 1.

B. The clock-related working position

With the mouth of the patient as the center of a circle, the dentist’s working positions are described according to the figures on a clock dial (Fig 2). Consequently, twelve o’clock corresponds to the dentist sitting behind the head of the patient.

C. The use of dental mirror

D. Active neck mobility (The mobility was graded as normal, moderately restricted and very restricted).
Musculoskeletal Disorders among Dentists in Saudi Arabia

A. The whole back bent the seat straight B. Straight lower and upper back, the neck bent, the seat straight C. The whole back bent, the seat forward tilted D. Straight lower and upper back, the neck bent, the seat forward tilted.

Fig 1: The four sitting work positions

E. Ability to perform active mobility of the shoulders was registered using the following tests:

- The arm behind the back with the fingertips touching the opposite inferior angulus of scapula.
- The arm over the head with the hand touching the opposite ear.

F. Support of the left arm

The chi-square test was used for statistical analysis. A probability level of P<0.05 was accepted as statistically significant.

RESULTS

Results of the questionnaire

The results showed that dentists without symptoms are somewhat older than those with symptoms. They have also been in the profession for a longer time. It was found that dentists who have increased the working-hours per week showed more symptoms. No significant difference was found between male and female dentists (Table 2).

Of the 140 dentists who answered the questionnaire, 82.9% dentists (63 male and 77 female) had one or more symptoms in the musculoskeletal system, which include pain (59.3%) as the most severe symptom in the neck and shoulders region followed by headache (28.6%), then weakness (15.7%). The female dentists had a significantly higher frequency of pain, headache and weakness than their male counterparts (Table 3). Eighty-three dentists (59%) had pain and discomfort in different parts of the locomotor system during the previous 12 months. The highest percentage of dentists had pain and discomfort in the neck (67.9%) followed by the lower back (52.1%). The symptoms were most pronounced among female dentists (Table 4). The dentists who reported symptoms during the previous seven days had the highest frequency of pain and discomfort in the neck, shoulders, lower back region and/or headache.

When the operating position of the dentist in relation to the patient was described as clock face with the patient’s mouth as the centre of the dial, 67.9% of the dentists reported using a position between 10 and 12 o’clock. Dentists who used 9 o’clock position reported more symptoms (76.5%), while dentists who used 10 o’clock position reported the lowest symptoms (48.3%). Only 17 dentists with symptoms from neck and lower back used position 12 o’clock.

Participants were asked to indicate how long they worked without taking a 10- minute break. Respondents were categorized according to the length of time
Please answer by putting a cross in the appropriate box - one cross for each question
(To be answered only by those who have had symptoms).

<table>
<thead>
<tr>
<th>Musculoskeletal Disorders among Dentists in Saudi Arabia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you, at any time during the last 12 months, had symptoms (ache, pain, discomfort)?</td>
</tr>
<tr>
<td><strong>Neck</strong></td>
</tr>
<tr>
<td>Shoulders</td>
</tr>
<tr>
<td>Elbows</td>
</tr>
<tr>
<td>Wrists/hands</td>
</tr>
<tr>
<td>Upper back</td>
</tr>
<tr>
<td>Lower back</td>
</tr>
<tr>
<td>One or both hips/ thighs</td>
</tr>
<tr>
<td>One or both knees</td>
</tr>
<tr>
<td>One or both ankles/feet</td>
</tr>
</tbody>
</table>

**TABLE 1. THE QUESTIONNAIRE USED IN THE STUDY**

<table>
<thead>
<tr>
<th>TABLE 2. DEMOGRAPHIC DATA OF THE DENTISTS INVOLVED IN THE STUDY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>With symptoms (mean±SD)</td>
</tr>
<tr>
<td>Male (n=45)</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Years in profession</td>
</tr>
<tr>
<td>Working hours per week</td>
</tr>
</tbody>
</table>
### Table 3. Frequently Reported Symptoms

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Total (n=140)</th>
<th>Male (n=63)</th>
<th>Female (n=77)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Pain</td>
<td>83</td>
<td>59.3</td>
<td>36</td>
</tr>
<tr>
<td>Headache</td>
<td>40</td>
<td>28.6</td>
<td>8</td>
</tr>
<tr>
<td>Numbness</td>
<td>11</td>
<td>7.9</td>
<td>5</td>
</tr>
<tr>
<td>Weakness</td>
<td>22</td>
<td>15.7</td>
<td>4</td>
</tr>
<tr>
<td>Pins &amp; Needles</td>
<td>5</td>
<td>3.6</td>
<td>1</td>
</tr>
</tbody>
</table>

### Table 4. Musculoskeletal Pain and Discomfort in Different Parts of the Body During the Past 12 Months Among Male and Female Dentists

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Total (%)</th>
<th>Male (%)</th>
<th>Female (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>59</td>
<td>57.1</td>
<td>61</td>
</tr>
<tr>
<td>Neck</td>
<td>67.9</td>
<td>66.7</td>
<td>68.8</td>
</tr>
<tr>
<td>Shoulder Right</td>
<td>25</td>
<td>30.2</td>
<td>20.8</td>
</tr>
<tr>
<td>Shoulder Left</td>
<td>5</td>
<td>7.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Shoulder Both</td>
<td>16.4</td>
<td>3.2</td>
<td>27.3</td>
</tr>
<tr>
<td>Lower back</td>
<td>52.1</td>
<td>52.4</td>
<td>51.9</td>
</tr>
<tr>
<td>Elbow Right</td>
<td>2.9</td>
<td>3.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Elbow Left</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Elbow Both</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wrist/Hand Right</td>
<td>14.3</td>
<td>11.1</td>
<td>16.9</td>
</tr>
<tr>
<td>Wrist/Hand Left</td>
<td>1.4</td>
<td>3.2</td>
<td>0</td>
</tr>
<tr>
<td>Wrist/Hand Both</td>
<td>3.6</td>
<td>0</td>
<td>6.5</td>
</tr>
<tr>
<td>One or both hips/thighs</td>
<td>3.6</td>
<td>4.8</td>
<td>2.6</td>
</tr>
<tr>
<td>One or both knees</td>
<td>7.1</td>
<td>1.5</td>
<td>11.6</td>
</tr>
<tr>
<td>One or both feet/ankles</td>
<td>0.7</td>
<td>0</td>
<td>1.3</td>
</tr>
</tbody>
</table>

### Table 5. Correlation of Symptoms with Working Without a 10-Minute Break (n=22)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Number of dentists with pain</th>
<th>Posture</th>
<th>Pain (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percentage</td>
<td>Neck</td>
</tr>
<tr>
<td>Pain</td>
<td>19</td>
<td>86.4</td>
<td>25</td>
</tr>
<tr>
<td>Neck</td>
<td>17</td>
<td>77.3</td>
<td>21</td>
</tr>
<tr>
<td>Shoulder</td>
<td>10</td>
<td>45.5</td>
<td></td>
</tr>
<tr>
<td>Lower back</td>
<td>18</td>
<td>81.8</td>
<td></td>
</tr>
</tbody>
</table>

### Table 6. The Presence of Symptoms in Relation to the Most Frequently Used Sitting Postures as Shown in the Figure #1
they worked before taking a 10-minute break into periods of one hour duration. The most commonly selected time period was of 1-2 hours duration (Table 5). It was found that increasing the length of working time without 10-minute break for more than 3 hours is usually associated with increased pain and discomfort (86.4%), lower back pain (81.8%), and neck pain (77.3%). Eighty-nine percent of the sample reported that they practice four-handed dentistry, with 57% complaining of one or more of the musculoskeletal symptoms. The symptoms had been decreased with dentists who used the dental mirror all the time. According to the patient position, about 72.1% dentists use the supine position as the preferred patient position. Sixty-eight percent of them had pain in the neck and shoulders.

Results of the Ergonomic Examination

During the examination of the left maxillary first molar by 60 recently graduated dentists (30 female, 30 male), the results showed that the most frequently used postures were posture 1 (46.7%) and posture 3 (40.0%) in both groups (Fig 2). Dentists who used posture 1 have more neck ache (25%) and lower back pain (57.1%) than those who used posture 3 (Table 6). No significant difference was found between male and female dentists in regard to the presence of pain (P>.05). The 10 o’clock position was the most frequently used working position by the dentists. Most of dentists used the dental mirror during the examination of the left maxillary first molar. Most of dentists supported their left arm over the left side of the head of the patient.

Moderate restricted mobility was found only in a few dentists without significant differences between groups and restriction was most common during flexion of the neck. However, no significant difference was found between dentists with and without pain and discomfort concerning the neck mobility. All dentists were able to perform the active mobility tests of the shoulders without difficulty.

DISCUSSION

The dentists were asked to note the occurrence of pain and discomfort over the past twelve months and the previous seven days. The questionnaire gives answers only with respect to the occurrence of symptoms and not to the frequency and intensity of pain and discomfort. Furthermore, the results are based on a visit to the workplace of 60 newly-graduated dentists and on a structural interview.

The investigation showed that the frequency of headache and also pain and discomfort in the neck, shoulders and lower back, was relatively high. This corresponds with earlier investigations from different parts of the world. Only 24 dentists, out of the 140 who answered the questionnaire, were completely without pain and discomfort in the locomotor system. The female dentists had a significantly higher frequency of pain, headache and weakness than their male counterparts. This could be explained because female usually has lower threshold of tolerance than male. Furthermore, the results showed that the frequency of pain and discomfort had tendency to decrease with age and with the number of year in practice. The low occurrence of pain and discomfort among older dentists may be due to the “healthy workers effect” and due to the ignorance of ergonomics in the new dental curriculum. In addition, older dentists have been taught to more frequently use the dental mirror for directly inaccessible areas in the patient’s mouth. While older dentists are more specialized with less load of patients, younger dentists are mainly practicing general dentistry or enrolled in postgraduate training that put them under more pressure. Instead of using the dental mirror, younger dentists work more often with a direct view and with the use of wedge cushion to improve the view. However, there was no correlation between the frequency of symptoms and the age. It appeared from the results that the dentists who position their patients in a appropriate position for direct view had a significantly lower frequency of pain. In agreement with previous study the results showed that dentists who usually use the dental mirror in positions where a direct view is difficult had significantly less pain and discomfort.

In regard to the ergonomic examination, the left maxillary first molar was chosen because it is difficult to obtain a direct view in such area from the mouth without bending the neck into an unfavorable way. The direct view may be improved by putting the wedge cushion under the upper part of the back of the patient. Also, it is important to support the arms to reduce the static work of the muscles of the neck and shoulders. If
the dentist works with direct vision, it is probably appropriate for him to sit in the 9 o’clock position when working in the upper jaw to reduce the stress on the neck. In the working position 11 or 10 o’clock, the dental mirror should be used to reduce the load on the neck.

The appearance of musculoskeletal symptoms among dental students, even after a relatively short clinical training period, suggests that ergonomics should be covered in the educational system to reduce risks to dental practitioners. Valachi et al. showed that there are deficiencies in operator position, posture, flexibility, strength and ergonomics. Education and additional research are needed to promote an understanding of the complexity of the problem and to address the problem’s multifactorial nature. A comprehensive approach to address the problem of MSDs in dentistry represents a paradigm shift in how operators work. New educational models that incorporate a multifactorial approach can be developed to help dental operators manage and prevent MSDs effectively. Physiological changes that accompany these disorders can be related to practices used by today’s operators—primarily being seated for prolonged periods. Studies associated such postures with increased disk pressures and spinal hypomobility, which are factors that may lead to degenerative changes within the lumbar spine and low back pain or injury. There is a relationship shown between prolonged, static (motionless) muscle contractions and muscle ischemia or necrosis. Weak postural muscles of the trunk and shoulder may lead to poor operator posture. As muscles adapt by lengthening or shortening to accommodate these postures, a muscle imbalance may result, leading to structural damage and pain. A significant number of today’s dental operators experience musculoskeletal pain and are at risk of developing serious MSDs. A thorough understanding of the underlying physiological mechanisms leading to these problems is necessary to develop and implement a comprehensive approach to minimize the risks of a work-related injury.

Work-related musculoskeletal disorders are of serious concern to many organizations, including industry, insurance, and health care. They are also of immediate concern to the workers and their families who are adversely affected by these disorders. Work-related musculoskeletal disorders are a substantial source of economic drain to these organizations. Sources of this drain include economic losses incurred from lost or decreased productivity as well as medical treatment and indemnity costs. Therefore, it is within the best interest of these organizations to prevent work-related musculoskeletal disorders from occurring, before they manifest into serious issues of medical, social, and economic concern. The dental teams need functionally designed dental equipment and proper training in ergonomic methods. Therefore it is useful to take again a closer look at the preventive measures that can contribute to less physical and psychological strain in the daily practice. The use of ergonomic design and appropriate selection of hand tools can reduce exposure to cumulative trauma. Remember, tissues of each individual have a threshold of resistance, and if that threshold is crossed too many times by a defective or ill-fitting tool, pathologic changes can occur. The proper tool design, rotating work schedules, work pacing, scheduling, and exercise programs can, in combination, improve productivity and promote human wellness. Although there have been considerable advances in dental equipment, the introduction of such technology has often been piecemeal and “rushed to market.” As a result there has been insufficient attention paid to ergonomic considerations and a systematic approach to dental ergonomics have not yet emerged.

Dentists can recognize and identify their own postures, practicing positions, and the equipment usage patterns that are associated with increased risks of experiencing musculoskeletal pain and discomfort. Such recognition is the first critical step to avoiding or neutralizing ergonomic habits and work environment layouts that might otherwise unnecessarily shorten professional clinical careers. Further studies are required to identify the factors, which will reduce the prevalence of the musculoskeletal symptoms among Saudi dentists.

**CONCLUSIONS**

Within the limitations of the present research, the following conclusions can be drawn down:

1. The results suggested that the prevalence of musculoskeletal symptoms among dentists in Saudi Arabia is high.
2 Pain and headache were the most commonly reported symptoms.

3 Younger dentists had more symptoms than the older dentists. The female dentists had a significantly higher frequency of pain, headache and weakness than their male counterparts.

4 Modification of the workplace does not have an effect on the prevalence of symptoms.

REFERENCES


Musculoskeletal Disorders among Dentists in Saudi Arabia


