

## ORIGINAL ARTICLE

# Musculoskeletal Disorders in Dentists

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## ABSTRACT

Musculoskeletal disorders commonly experienced by dental professionals can affect their health and well-being. The main aim of this study was to determine the prevalence of musculoskeletal disorders among dentists in Iran. A cross sectional study was carried out in Rasht, northern Iran. Participants were dental workers who completed structured questionnaire on the topic of musculoskeletal disorders related to their job. The first part of the questionnaire was self-administered regarding their demographic information and job satisfaction. The second part was the Nordic Musculoskeletal Questionnaire (NMQ) for determining the site of pain, if any. The severity of pain was assessed by using Visual Analog Scale (VAS). The third section was RULA questionnaire (Rapid Upper Limb disorder Assessment) to determine the awkward posture during their work and eventually the need to improve the condition. A total of 92 dentists responded to the questionnaire. Seventy three percent of participant dentists had musculoskeletal pain. The common painful sites of the body were as follows: neck (43.4%), back (35.8%), and shoulder and wrist (each 25%). Direct inspection was a risk factor for neck pain (OR: 35.34,  $p < 0.001$ ). This study revealed a relatively high prevalence of musculoskeletal pain among dentists. The severity of pain was related to higher action level of the RULA score; indicating that dentists with higher RULA scores needed to adopt better working posture.

**Keywords:** RULA, Musculoskeletal pain, Dentist, Nordic questionnaire

## INTRODUCTION

Dental professionals are commonly exposed to a variety of occupational hazards such as chemical, biological and legal as well as ergonomic, which create musculoskeletal disorders (MSD) [1]. Because of the musculoskeletal disorders, dentists often have to limit or even abandon their professional activities, and as a result, MSD has negative impact on either their finance and / or their healthy life.

Musculoskeletal disorders among dentists were investigated by different researchers with different methodologies [1-8]. The awareness of MSDs in the

dental profession has led to the development of a great deal of ergonomics and new technology in dentistry.

Musculoskeletal disorders were attributed to numerous risk factors including prolonged static posture, repetitive movements, suboptimal lighting, poor positioning, genetic predisposition, mental stress, physical conditioning, and age [9,10].

More recently, sedentary dentistry has increased MSDs dramatically and each professional dentist tends to develop imbalance in specific muscles. Operators strive to maintain a balance posture while 50% of their body's muscles are made to contract to hold the body motionless. The awkward posture is susceptible to pain by causing injuries in muscles, which are under pressure in each repetitive work that finally threatens the

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dentist's career. By changing the ergonomic of dentistry from standing to seated fourhanded dentistry, there is only a change in parts of the body, which experience pain.

The overall prevalence of musculoskeletal disorders in dentistry differs from 63 to 93 percent worldwide [2]. It is postulated that upper limb muscles and skeleton are more implicated during dental operation rather than other sites of the body [3-8].

The Rapid Upper Limb Assessment (RULA) is a survey method developed to investigate the exposure of individual workers to risk factors associated with work-related upper limb disorders [11]. This enables us to determine to draw boundaries between repetitive actions and force loads, which make change the awkward postures inevitable.

This study focused on investigating musculoskeletal work-related disorders by standard questionnaires; Nordic and RULA among dentists in north of Iran, their prevalence, site and severity of pain contributing to risk factors.

## MATERIALS AND METHODS

### *Subjects*

The study protocol was approved by the Research Vice-Chancellorship of Guilan University of Medical Science. During 2006 a cross sectional study was carried out on all dentists who worked in private and/ or public dental offices in the city of Rasht, north of Iran.

A total of 158 dentists received a questionnaire on the topic of musculoskeletal work-related pain in their offices. However, from the total participants, ninety-two subjects (58%) accepted to sign the consent form and admitted to this study. The main reason to refuse contribution was due to being observed by another person during his or her task and/or lack of time.

### *Questionnaire and data collection*

Questionnaire consisted of three sections in each part of which crucial points on musculoskeletal disorders were drawn. The first part was a self-administered questionnaire about the respondents' demographic information including age, sex, time of post, their major task, and job satisfaction. Job satisfaction was evaluated based on satisfaction of work environment, lighting, staff, unit equipment, and dentists' working chair using a 5-point scale.

In the second part, musculoskeletal complaints were recognized by the Nordic Musculoskeletal Questionnaire (NMQ) suitable for application in work places and for a large number of workers very quickly and cheaply. This questionnaire included nine body areas including neck, shoulders, upper back, lower back, elbows, wrist/hands, thighs, knees, and ankles. Musculoskeletal complaints were defined as pain perceived in the last 12 months experienced as ache,

discomfort, and numbness, trouble during last seven days and preventing activity during last 12 months with yes or no answers [12].

A visual analogue scale was adopted to estimate the severity of each painful site perceived by dentists through a continuous line between two end-points from 0 to 10. The third part was a quick investigation by a professional ergonomic health worker in dentists' offices during their operation by RULA questionnaire. This ergonomic technique evaluates people's exposures to postures, forces and muscle activities that have been shown to contribute to Repetitive Strain Injuries; the postures of the neck, trunk, and upper limbs [11].

RULA is consisted of three sections: the first was recording the working posture, the second was scoring system, and the third was action level of risk and need for action to be conducted to gather assessment that is more detailed. A coding system, categorized into four levels, indicates the level of intervention required to reduce the risk of injury activities. Using this ergonomic evaluation approach results in a risk score between one and seven where higher scores signify greater levels of apparent risk. RULA is a tool without the need of any special equipment or investigator, which only requires a clipboard and pen, and can be done in confined workplaces without disruption to the workforce [11].

### *Statistical methods*

Data were analyzed by SPSS (version 16). Basic statistics calculated as prevalence rates. The differences between groups assessed using Chi-square. Moreover, Logistic Regression Analysis performed to evaluate the individual characteristic, risk factors in work and health status on the occurrence of musculoskeletal complaints. Prevalence odds ratio with 95% confidence intervals calculated as a measure of association. *P*-values less than 0.05 were considered statistically significant.

## RESULTS

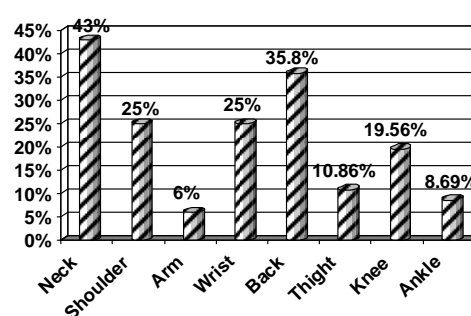
### *Prevalence of musculoskeletal pain*

A total of 92 subjects answered the questionnaire, (response rate was 58 percent), fifty nine of which were male and 33 were female. The mean of ages $\pm$ SD was 30.14  $\pm$  8.7 within a range from 26 to 82 years.

Sixty-nine of the participants were general dentists and 23 were specialists. Their major tasks were operative dentistry followed by endodontic, prosthodontics, oral surgery, and periodontics. Sixty-eight participants (73%) had complained of musculoskeletal pain, while 24 (26%) had no complaint, 18 (19.6%) had only one painful site and 50 (59.4%) suffered from pain in more than one site. Their mean working time was 5.21 $\pm$ 0.827 days per week and 5.91 $\pm$ 1.27 hours per day. Nineteen respondents had a family history of musculoskeletal disorders. Table 1 demonstrates whole characteristics of the study population.

**Table 1.** Background characteristic of study population

Risk factors	Total participants N=92
<b>Sex (%)</b>	
Male	59(64.1)
Female	33(35.9)
<b>Age (years, mean(SD))</b>	39.1 (8.73)
<b>Position in the work (%)</b>	
Sitting	49(53.3)
Sitting and standing	43(46.7)
<b>Vision in the work (%)</b>	
Direct	9(9.8)
Indirect	5(5.4)
both	78(84.8)
<b>Type of task (%)</b>	
Operative	39(42.4)
Endodontics	36(39.1)
Peridontics	3(3.3)
Prostodontics	8(8.7)
Surgery	6(6.5)
<b>Duration of work (years, mean(SD))</b>	12.2(7.99)
<b>Work days in a week (years, mean(SD))</b>	5.2(0.79)
<b>Work hours in a day (years, mean(SD))</b>	5.92(1.67)
<b>Visual analogue scale</b>	3.24(2.6)

**Fig 1.** Frequency of musculoskeletal pain by Nordic

(2.42), 5.75 (2.87), respectively ( $p < 0.001$ ).

The results of the multivariate analyses on risk factors for the occurrence of neck, shoulder, and low back pains are shown in Table 2. The only risk factor for developing neck pain was direct observation (OR=35.34,  $P$ : 0.03). There is an increase in the number of painful sites with action level.

### Prevalence of painful sites

The NMQ revealed that the common painful sites were neck (43%) followed by back (38%) and shoulder and wrist respectively (25%). The mean estimated pain by visual analogue scale was 3.24 (2.6) (Fig 1).

According to the third part of the RULA questionnaire, contributors were divided into three main parts due to their action levels. There were 56 subjects (62%) in the mild group which adopted position in action levels 3 and 4, thirty-two subjects (34%) in the moderate group (action level 5 and 6), and only four participants need immediate intervention to reduce the risk (severe group or action level 7). Females were more likely to have severe awkward postures ( $P$ : 0.02). Moderate and severe RULA were reported in 48.5% of females compared to 33.9% of males.

### Pain evaluation

The mean score of VAS significantly increased based on the RULA group. The VAS score for mild, moderate, and severe RULA were 2.16 (2.16), 4.78

### DISCUSSION

Fourhanded seats were suggested and equipment was developed within the ergonomic promotion mainly because of complaints of musculoskeletal disorders in dentists. Although it could not cease the pain, related literature drops a hint that the painful sites were changed. Likewise, different ergonomic assessment tools developed and brought about the condition to evaluate inappropriate positions in dentistry. RULA, rapid limb assessment, is a survey method for individual workers in dentistry. We can imagine a dentist during his/her job that holds a mirror in one hand and a low or high speed instrument in the other hand (or other professional instruments) with an extended neck for better visual inspection. In other words, RULA ensues to assess this condition and makes us realize the seriousness of the state of affairs.

This investigation revealed that more than half of the participants (73%) reported musculoskeletal disorders. This result is similar to other investigators (65-78%)

**Table 2.** Multivariate analysis of self-reported risk factors and musculoskeletal pain

Risk factors	Neck pain OR (95% CI)	Shoulder pain OR(95% CI)	Low back pain OR(95% CI)
Age (years)	1.02 (0.87-1.19)	0.96 (0.81-1.14)	1.08 (0.91-1.28)
Sex (male)	1.03 (0.29-3.59)	1.32 (0.31-5.51)	0.97 (0.26-3.56)
Duration of work (years)	1.02 (0.85-1.21)	1.01 (0.83-1.22)	0.98 (0.82-1.18)
Work days in a week	1.56 (0.71-3.43)	1.47 (0.64-3.42)	1.23 (0.59-2.54)
Work hours in a day	0.90 (0.62-1.32)	0.93 (0.61-1.42)	1.09 (0.75-1.59)
Position in the work			
Standing	1	1	1
Sitting or standing	1.21 (0.41-3.62)	1.68 (0.46-6.12)	0.72 (0.23-2.21)
Vision in the work			
Indirect	1	1	1
Direct	35.34 (1.42-878.4)*	5.56 (0.13-233.0)	3.22 (0.19-55.7)
Direct and indirect	1.72 (0.21-13.9)	1.01 (0.079-12.9)	0.89 (0.09-8.3)
Environmental satisfaction	1.31 (0.61-2.83)	0.89 (0.37-2.11)	0.88 (0.42-1.85)
Tabor satisfaction	1.24 (0.55-2.76)	3.37 (1.23-9.2)*	0.62 (0.29-1.32)
Unit light satisfaction	1.11 (0.51-2.42)	0.41 (0.16-1.06)	0.70 (0.31-1.56)
Associate Satisfaction	1.23 (0.71-2.12)	1.75 (0.88-3.47)	1.61 (0.91-2.85)

\* $p < 0.05$  OR=odds ratio CI=95% Confidence Interval

[3,4,9]. Furthermore by means of Nordic we can deduce that the most painful sites were confined to upper side of limb, therefore consequently utilizing RULA for appraise the situation would be more helpful. There are no consensuses in different researches on prevalence and consequence of painful sites such as neck and upper back, which have strong impacts on dentists. Almost all reviewed literature agreed on neck and back involvement, which we can infer that there is a deficit on equipment improved to prevent enhancing forces on muscles. This study revealed that direct inspection was the underlying cause of neck pain. Notwithstanding, there is no serious effort to improve dental units or mirror or other instruments structure to altering and decrease musculoskeletal problem for bringing correct ergonomic.

Forty three percent of participants had neck pain similar to reports of Yazd, IRAN (47%), Birjand, Iran (48%). This was lower than that reported in Queensland Australia (57.5%), in Denmark (65%), in Saudi Arabia (65%) and in Tehran, Iran (5.6%), but higher than that reported for dentists in Israel (38.3%) [2, 6-8].

On the other hand, prevalence of back pain was similar to, Yazd, Iran (33.3%), Tehran, Iran (32.3%), but lower than Birjand Iran (48%), Queens land Australia (53%), Denmark (50%), Israel (55%), New South Wales (NSW), and Australia (64%) [4-6]. Another study showed that back pain is more prevalent than neck pain in Greece [5]. As mentioned above, our painful sites are similar with other Iranian studies and we can infer that the body structure and or underlying similarities may cause the same finding in these areas. Otherwise, accompanying RULA with measuring painful sites proposed the necessity of observation by an ergonomic expert to change and alter the awkward position, bring about the better functionally position and prevent the injury.

RULA assessment proceeds to find four-action-levels, the recovery needs and indicates the level of intervention required to reduce the risk of injury due to physical loading on the operator.

Action level one refers to acceptable posture: a person is working with no risk of injury from their work posture. Action level two draws an individual who is working in a posture that could present some risk of injury; most likely, it is the result of one part of the body being in a deviated and awkward position, so this should be investigated and corrected. Action level three is working in a poor posture: it indicates quick change is required to prevent an injury. The fourth level reveals a person who is working in the worst posture; investigation and change are required immediately.

In this investigation, we found that 24 people did not feel pain while our action level began at the second level. Therefore, curiously, all participants are at risk of injury though there are not any complain of pain. We can deduce that all dentists have at least one involved site, and in the same way, pain will increase as time goes by. That is why they need to correct their postures. Most of our dentists were in level two and four of those were at the worst position and need to change their

situation as soon as possible. This study also draws attention to the perception of pain in each action level and we may conclude that at a higher action level the mean amount of pain increases dramatically. However, there are some exceptions like those who continue to do their job with pain.

Furthermore, concerning the age group, the investigation revealed pain was more prevalent in individuals between 35 to 50 years; in fact, they spent more time working [6]. Strictly speaking, women are more susceptible to musculoskeletal job induced pain, which resembles another female occupational community [2]: RULA precise increasing impact on women during their career.

Taking pleasure in the office environment due to job satisfaction has unforeseen adverse effects, i.e. it has a significantly upward trend to musculoskeletal disorders (OR: 3.37, 95% CI: 1.23-9.2). Although it is unjustifiable to say that most of dentists who had severe pain forget their pain during their work and feel comfortable [13]. Personal time, staff, and specialty training are important work environment factors for job satisfaction [13]. They felt pain but prefer to continue their job instead of taking rest, and by RULA they are in the upper action level.

As we expected, by increasing the RULA group and the number of involving sites, the mean VAS score elevated significantly. Thus, they had to adjust their posture to a correct position. Considering everything, dentists are susceptible to musculoskeletal disorders, which need to be investigated. However, for further investigation we proposed to have a critic consideration and measurement on the dimension of units and the height of dentists' upper limb and their chair during their tasks to appraise the harmony of instruments with the structure of body.

## CONCLUSION

Prevention of chronic pain requires that dentists have more knowledge, change their habits, select proper ergonomic equipment, and have a break after each operation with stretching exercise. In doing so, exercise plays an important role in their career to be healthy, safe and have a longer career. Further studies are necessary to find out new dental instruments compatible with ergonomic and to reduce musculoskeletal disorders.

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