International Journal of Epidemiologic Research
doi:10.15171/ijer.2019.17 2019 Summer;6(3):92-95 http://ijer.skums.ac.ir

Original Article

Determination of Risk Factors for Musculoskeletal Disorders and Corrective Priorities to Perform the Work in Dental Careers by Posture Analysis Using REBA in Shahrekord

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Received: 2 Nov. 2015
Accepted: 5 Jan. 2019
ePublished: 25 Sep. 2019

Abstract

Background and aims: Nowadays, work-related musculoskeletal disorders are the most common occupational diseases. The prevention of these disorders requires a posture analysis during work and the improvement of working conditions. The purpose of this study was to determine risk factors for musculoskeletal disorders and corrective priorities to perform the work by conducting postures analysis using Rapid Entire Body Assessment (REBA).

Methods: In this descriptive-analytical study, the posture of dentists during working was analyzed using the REBA software. The incidence rate of musculoskeletal disorders was investigated by the Nordic Musculoskeletal Questionnaire (NMQ). A *P* value less than 0.05 was considered statistically significant.

Results: In this applied study, the incidence rates of the pain in neck, waist, shoulders, and wrists were reported to be 68%, 55%, 41% and 28%, respectively. The above-mentioned values were higher in women than in men. The pain in thigh and leg was related to work and the pain in ankle and sole was related to body mass index (BMI). The relationship between musculoskeletal disorders and occupational postures of dentists was statistically significant ($P<0.05$).

Conclusion: Training the principles of ergonomics and anthropometrics, the correct methods and principles of performing work, and the ways of using the instruments are necessary for the studied population. Occupational postures require ergonomic intervention and correction.

Keywords: Musculoskeletal disorders, Dental ergonomics, Posture

Introduction

Musculoskeletal disorders are the most common occupational disorders. The incidence of these disorders leads to decreased efficiency in work, increased healthcare costs, increased absenteeism in the workplace, increased length of useful work, and ultimately disability of workforce in the working environment. The physical workload leads to musculoskeletal disorders. Physical factors associated with increased risk of work-related disorders include monotonous movements of hands and arms, painful or strenuous work positions, heavy lifts, and sedentary work.[1] Dental careers impose a heavy workload, particularly on the trapezius muscle, as it has been observed in electromyographic activity.[2] In dentistry, the incidence of musculoskeletal disorders in different parts of the body especially neck, shoulders, wrists, waist, legs, ankles and soles is likely. In conducted researches, the incidence of these disorders globally has been reported to be 63%-93% for the waist, neck, shoulders, and hands.

In Iran, the incidence rate of pain has been reported to be 30% for the waist, 32% for the neck, 42% for the neck, and 8% for the shoulders in dentists.[3] Due to poor prevention of dental diseases and poor monitoring of oral health, the rate of referral to the dentists, especially in public healthcare centers, is very high in Iran. Given the high workload of dentists and their complaints about pains in different parts of their bodies during work, we were encouraged to analyze their postures by the REBA (Rapid Entire Body Assessment) and to determine the risk factors for these disorders and corrective priorities to perform the work.

Materials and Methods

In this descriptive-analytical study, the REBA was used to

analyze postures. Fifty-eight participants consisting of 49 men and nine women were included in the study. This method was designed in 1998 by Hignett and McAtamney.[4] According to this method, 3 positions are predicted for head, body and feet that are rated based on the degrees of the angles between them and the body's vertical axis during working. The final degree is obtained by summing these degrees proportionally to this degree. The risk factors for musculoskeletal injuries were determined. Finally, the necessity of improvement of occupational postures is investigated according to this degree.[5] The monitoring of occupational postures was done in dental offices and oral healthcare centers in Shahrekord for 20-40 minutes with a 30-second pause for every occupational posture. The observations were recorded on the rating sheet according to the REBA. Then, the observed postures were analyzed by the REBA software. For determining the incidence rate of musculoskeletal disorders in each part of the body, the Nordic Musculoskeletal Questionnaire (NMQ) was completed by the participants. The NMQ was designed by Cornice et al. in the Professional Health Institute of Scandinavia in 1987. The NMQ includes some personal questions. The assessment of musculoskeletal disorders due to occupational postures was carried out using the REBA for dental careers in Shahrekord in September 2014.

Results

In this study, participants consisted of 49 men and 9 women (45 general dentists, 4 experimental dentists and 9 oral healthcare workers). The average age of the participants was 37.7 years, the average work experience was 10.7 years, the average weight was 72.7 kg, and the average height was 173 cm. Based on the body mass index (BMI), 7% of our participants were thin, 58% were normal, 3% were overweight and 4% were obese. The incidence rates of pain in different parts of the body are presented in Tables 1 and 2. According to the results, 33% of the participants experienced obligatory absence from work because of pain in any parts of the body. It was revealed that 15% of the participants had experienced pain in the neck, 8% of them had experienced pain, and 35% of them had experienced low back pain (LBP). The incidence rates of pain in the neck and shoulders in male dentists were 51% and 36%, and in female dentists, they were 77% and 45%, respectively. There was a relationship between pain in the thigh and the number of patients visited per day and work experience (0.047 and 0.018, respectively), and there was a statistically significant relationship between pain in leg and work experience (0.005). The relationship between the pain in other parts and variables such as age, work experience, the number of patients, stress, smoking, and BMI was not statistically significant ($P > 0.05$). The REBA was suggested by Hignett and McAtamney to evaluate the occupational postures in healthcare occupations. Then, after conducting researches on English dentists, a reliability of 62%-85% was reported for studied positions.[5] The results for sample populations in these countries were reported to be 59%, 62%, 60% and 40%, which are relatively similar.[6] However, the incidence rates of pain in the shoulder and wrist were lower, which is related to postures in performing the tasks. The incidence rates of pain in the neck, shoulder, and wrists were higher

Table 1. The Frequency of Muscular-skeletal Disorders Based on Occupation

Pain		Job			
		General Dentist, No. (%)	Experimental Dentist, No. (%)	Oral Healthcare Workers, No. (%)	All 3 Groups, No. (%)
Neck	Yes	19 (54)	3 (75)	5 (56)	27 (56)
	No	16 (46)	1 (25)	4 (44)	21 (44)
	Total	35 (100)	4 (100)	9 (100)	48 (100)
Backache	Yes	14 (40)	-	4 (44)	18 (35)
	No	21 (60)	4 (100)	5 (56)	30 (62)
	Total	35 (100)	4 (100)	9 (100)	48 (100)
Shoulder	Yes	13 (37)	1 (25)	4 (44)	18 (38)
	No	22 (63)	3 (75)	5 (56)	30 (62)
	Total	35 (100)	4 (100)	9 (100)	48 (100)
Wrist	Yes	10 (29)	2 (50)	3 (33)	15 (31)
	No	21 (71)	2 (50)	6 (67)	23 (69)
	Total	35 (100)	4 (100)	9 (100)	48 (100)
Waist	Yes	21 (60)	4 (100)	4 (44)	29 (60)
	No	14 (40)	-	5 (56)	19 (40)
	Total	35 (100)	4 (100)	9 (100)	38 (100)
Ankle and sole	Yes	3 (11)	2 (50)	-	6 (12)
	No	31 (89)	2 (50)	9 (100)	42 (88)
	Total	35 (100)	4 (100)	99 (100)	48 (100)

Table 2. The Frequency of Muscular-Skeletal Pain in Different Organs Based on Occupation

Pain		Job							
		General Dentist		Experimental Dentist		Oral Healthcare Workers		All 3 Groups	
		No.	%	No.	%	No.	%	No.	%
Group A (Neck, waist, backache, ankle and sole)	Yes	30	85.7	4	100	6	66.7	40	83.2
	No	5	14.3	-	-	3	33.3	8	16.7
	Total	35	100	4	100	9	100	48	100
Group B (wrist, shoulder,	Yes	17	48.6	2	50	5	55.6	24	50
	No	18	51.4	2	50	4	44.4	24	50
	Total	35	100	4	100	9	100	48	100

in women than in men. In the study done by Savants et al, the incidence rate of carpal tunnel syndrome was reported to be three times higher in women compared to men.[5] The pain in the wrist of these people can be considered a strong predictor of the incidence of carpal tunnel syndrome.

The incidence of pain in different parts in all three career groups was higher in group A than in group B. The parts of group A in terms of ergonomic and biomechanical patterns have higher risk compared to those of group B, which can be attributed to the involvement of these parts during the work. This condition represents the correlation between the incidence of musculoskeletal disorders and the occupational posture in these people. The relationship between pain in thigh and leg and BMI represents disproportionality of the bodies of our participants and their sensible overweight. Moreover, all the occupational postures of these people need improvement.

Based on the REBA method, the parts of the body are divided into two groups: group A (body, neck, and feet) and group B (arms, forearms and wrists), and the incidence of pain in the parts is investigated by observation and recording. Based on the REBA, the occupational postures in group B had higher frequencies (Tables 3 and 4). Since in static positions, there is higher pressure on feet, the risk is higher and the need for corrective movements is further intensified. For right parts (Tables 3 and 4), the body, neck, and wrists are extremely bent to both sides and the arms are kept at a distance from the body.

The risk is higher for right parts (Table 3), which shows that occupational postures should be improved in the near future. Because of the less bending of the neck and body, the calculated risk is low. Occupational posture in dental careers is considered the condition after 12 o'clock hand . Accordingly, the posture of the dentist is defined in relation to the patient.

Discussion and Conclusion

The incidence rate of musculoskeletal disorders was higher in experimental dentists than in other dentists and the employed staff in dental careers, which shows a relationship between the incidence rate of these disorders and work experience. The incidence rates of LBP, neck

Table 3. The Evaluation of Standing Posture

Posture	Right Organs		Left Organs	
Remove teeth from the upper jaw (hours 7-8)	Risk	Very soon	Risk	Very soon
Remove teeth from the lower jaw (hours 7-8)	Risk	Very soon	Risk	Very soon
Remove teeth from the left side of the upper jaw (hours 7-8)	Risk	Very soon	Risk	Very soon
Remove teeth from the right side of upper jaw (hours 7-8)	Risk	Very soon	Risk	Very soon
Remove teeth from the right side of the lower jaw (hours 7-8)	Risk	Very soon	Risk	Very soon

Table 4. The Evaluation of Sitting Posture

Posture	Right Organs		Left Organs	
	Risk	Required Practical Procedures	Risk	Required Practical Procedures
The regeneration of teeth on the right side of the lower jaw (7 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth in the upper jaw by indirect vision (8-9 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth on the right side of the upper jaw (11 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth on the right side of the lower jaw (11 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth in the lower and upper jaw (7 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth in the upper jaw by indirect vision (12 o'clock)	Average	Is required	Average	Is required
The regeneration of teeth in the upper jaw by direct vision (12 o'clock)	High	Is required very soon	Average	Is required very soon

pain, shoulder pain, and wrist pain in our participants were 60%, 56%, 38%, and 31%, respectively. The intensity of pain and temporary or permanent abandonment of job due to pain were investigated by the NMQ and the statistical software SPSS using an independent *t*-test, Chi-squared test and Fisher's exact test. A *P* value less than 0.05 was considered statistically significant. For working on the superior maxillary bone (jaw), it is recommended that the patient lie down on the back so that his/her body is positioned parallel to the horizontal surface, and for working on the inferior maxillary bone (jaw), the patient slightly lean back. The normal position of the left wrist is avoided if it is more than 15 degrees while working because it decreases the power force to 60% of normal position. Therefore, the curvature is utilized to decrease the need for bending the neck.

The use of magnifying instruments during working is recommended. The instruments should be designed and located in such a way that minimum bending is needed during working with body rotation. The instruments are installed by applying minor changes, which lead to an increase in the diameter because this task causes a decrease in the pressure exerted on the median nerves on the left side of the wrist. Considering that weight can decrease the pressure on upper parts of the body and the waist, a course on ergonomic principles and biomechanics can be incorporated in dentistry. It is also recommended that short-term training programs (the diagnosis of the causes of biomechanical factors, musculoskeletal disorders related to work and the appropriate methods of working) be held especially for employed dentists in the public sector. Moreover, guidelines on ergonomics and appropriate performance of work should be provided especially for dentists employed in the private sector.

Conflict of Interest Disclosures

None.

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How to cite the article: Kahyani ZA, Karimi M, Amiri M, Mosharraf S, Rouhi Broujeni H. Determination of risk factors for musculoskeletal disorders and corrective priorities to perform the work in dental careers by posture analysis using REBA in Shahrekord. Int J Epidemiol Res. 2019;6(3):92-95. doi: 10.15171/ijer.2019.17.