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The effect of a multifaceted ergonomic intervention program on reducing musculoskeletal disorders in dentists

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Abstract

Background: Work-related musculoskeletal disorders (WMSDs) are the most common occupational injuries in dentists. These disorders occur due to the specific characteristics of dentistry occupation such as the use of tools and instruments and awkward posture. The present study aimed at evaluating the effect of multifaceted ergonomic program on reducing musculoskeletal disorders in dentists.

Methods: One hundred-two male dentists who worked in dentistry clinics of Tehran's hospitals participated in this interventional study. Participants were randomly divided into control (n=50) and intervention (n=52) groups. Dentists in the intervention group (n=52) underwent multifaceted ergonomic intervention program for 8 weeks and dentists in the control group (n=50) only received the measurements. The prevalence of musculoskeletal disorders was evaluated in each of the 2 groups at 3 time points before the intervention, 3, and 6 months after the intervention using the Nordic Musculoskeletal Questionnaire (NMQ). Paired t-test was used to compare the prevalence of musculoskeletal disorders before and after the ergonomic intervention program at the end of 3 and 6 months.

Results: The results revealed that the prevalence of musculoskeletal disorders was reduced after the intervention in the neck, shoulder, arm, wrist, back, thigh, knees, and feet ($p<0.05$). On the other hand, the prevalence of musculoskeletal disorders increased in the control group in the neck, shoulder, arm, wrist, thigh, and knee, respectively. The survey results revealed that 98% of the participants agreed with this intervention program.

Conclusion: The results of this study revealed that the multifaceted ergonomic intervention program, which included improving working conditions, identifying ergonomic risk factors, regular exercise, and discussion group meetings, could decrease the prevalence of musculoskeletal disorders in dentists.

Keywords: Dentists, Multifaceted Ergonomic Intervention Program, Musculoskeletal Disorders.

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Introduction

Work-related musculoskeletal disorders are the largest category of occupational diseases (1). These disorders have a high prevalence in countries around the world, and cause high costs and reduced quality of life in workers (2). Musculoskeletal disorders are identified by pain, discomfort, and inability of the joints, tendons and muscles, or tissues (3). These disorders often occur in the hands, elbows, wrists, neck, and shoulders (4). Studies have shown that musculoskeletal disorders occur due to repetitive movements that need force. On the other hand, the wrist, hand, and arm are at a higher risk due to repetitive movements with awkward postures (3). Musculoskeletal disorders are the most common occupational injury in dentists (5). In dentistry, ergonomic risk factors include awkward

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posture in a static position for a long time (6-8). On the other hand, studies have shown that prolonged awkward postures increase the risk of musculoskeletal disorders of the neck, shoulders, and waist in dentists (9,10). The occurrence of musculoskeletal disorders is multifactorial in dentistry occupation. Working habits such as bending of the neck, trunk rotation during operation, and static posture are known as the most important risk factors for musculoskeletal disorders in dentists (11,12).

Considering the high prevalence of musculoskeletal disorders in the dentists, applying ergonomic interventions to improve the working conditions of the dentists seems to be highly important. Ergonomic intervention programs in dental occupation have focused on the design of dental equipment and tools. However, not enough attention has been paid to utilizing strategies to prevent and reduce musculoskeletal disorders (13,14). On the other hand, many participatory ergonomic intervention programs have been done in different industries to reduce and prevent musculoskeletal disorders (15,16).

The multifaceted intervention program was developed for nurses, and the results demonstrated a significant reduction in the musculoskeletal complaints in nurses (17). On the other hand, previous studies revealed that the ergonomic intervention programs could reduce musculoskeletal disorders in the workplace (17). Therefore, the present study aimed at evaluating the multifaceted ergonomic intervention program, which included improved working conditions, identifying ergonomic risk factors, regular exercise, and discussion group meetings, to reduce musculoskeletal disorders in dentists.

Methods

This interventional study was conducted on all dentists employed in dental clinic of Milad hospital in Tehran based census method. First, the purpose of the study was explained to the participants by the executive team. Inclusion criteria were as follow: Lack of pregnancy in female dentists, lack of spine surgery, avoiding the use of pain relievers during the study, residing in Tehran and full participation in the study. Informed consent was obtained from all the participants. Finally, 102 dentists were eligible to participate in the study. The participants were randomly divided into 2 groups. Dentists of the intervention group (n=50) underwent a multifaceted ergonomic intervention program for 8 weeks, and dentists of the control group (n=50) only received the measurements. The General Nordic Questionnaire of musculoskeletal symptoms was used to examine the reported cases of MSDs among the study population. Reported MSD symptoms were limited to 12 months prior to the study (18). An 8-week ergonomic intervention program was designed to reduce the musculoskeletal disorders among the dentists. These multifaceted interventions were in 4 sections as follow:

1. Knowledge and Training about Ergonomics: Training sessions were held for the participating dentists at the start of the multifaceted ergonomic program, which covered the basic ergonomic principles, ergonomic risk factors in dental occupation, and intervention components of the ergonomic program.

2. Workstation Modification: At this stage, according to the ergonomic risk factors in the dental occupation, participants were instructed on how to modify their working postures in different situations at the workplace. For example, the correct working posture and correct alignment of the equipment was explained to the dentists.

3. Training and Surveying Ergonomics at the Workstation: At this stage, working conditions were evaluated during the working shift for each dentist. In this evaluation, ergonomic risk factors of the workstations were identified. To reduce ergonomic risk factors, active discussion was used in this section. Ergonomic evaluation of workstation and its modification were performed for each dentist.

4. A Regular Exercise Program: At this stage, a physiotherapist introduced several stretches to the dentists. These stretching movements affected neck, shoulder, waist, and bottom. Dentists were asked to note the daily sports activities in the logbook. This movement continued regularly during the study.

The Nordic Musculoskeletal Questionnaire (NMQ) was used to evaluate the effectiveness of the ergonomic interventions in the 2 groups after 3 and 6 months. At the end of this stage, the evaluation results were compared before and after the ergonomic intervention, and the effectiveness of the intervention program was determined. After the intervention, the benefits of multifaceted ergonomic intervention program were examined.

The Research Ethics Board at Iran University of Medical Sciences (No. 25814) approved the present study. Approval was obtained from the Research Ethics Committee of Iran University of Medical Sciences at each participating site. Research Ethics Board approvals were kept current for the duration of the study. Paired t-test was used to compare the prevalence of musculoskeletal disorders before and after the ergonomic intervention program at the end of the 3 and 6 months. The significance level was set at 0.05.

Results

Demographic data revealed that the Mean±SD age of the dentists was 39.82 ± 4.61 years in the intervention group, and it was 40.01 ± 4.12 years in the control group. No significant difference was found between the 2 groups in demographic characteristics. Table 1 displays some of the demographic characteristics of the research community.

Table 2 demonstrates the results of the prevalence of musculoskeletal disorders in different parts of the body, before, and after the ergonomic intervention program in the 3 and 6 months follow-up. These results revealed that the ergonomic intervention program had a positive effect on reducing

Table 1. Some Demographic Characteristics of the Study Population

Demographic Characteristics	Control Group (n=52)		Intervention Group (n=50)		
	Mean	Standard deviation	Mean	Standard deviation	p
Age	40.01	4.12	39.82	4.61	0.09
Length (cm)	178.12	10.4	179.01	4.09	0.06
Weight (kg)	65.44	11.23	66.24	10.23	0.07
Work experience(year)	7.08	2.12	7.1	2.3	0.08
Average working hours per day (hours)	7.9	1.01	7.9	1.02	0.08

Table 2. Results of the Prevalence of Musculoskeletal Disorders in Different Parts of the Body

	Knee		Thigh		Back		Wrist		Arm		Shoulder		Neck		Feet	
	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50	Control N=52	Intervention N=50
Before intervention	16 (32)	15 (30)	9 (18)	8 (16)	49 (95)	47 (94)	14 (27)	13 (26)	22 (43)	23 (46)	39 (75)	30 (60)	39 (75)	40 (78)	13 (25)	12 (24)
Three months after intervention	17 (32)	14 (28)	10 (19)	7 (14)	48 (92)	42 (84)	15 (28)	12 (24)	22 (43)	20 (40)	41 (78)	25 (50)	40 (76)	37 (74)	14 (26)	10 (20)
Six months after intervention	19 (36)	12 (24)	11 (21)	6 (12)	49 (94)	38 (76)	15 (28)	10 (20)	23 (44)	18 (36)	42 (80)	22 (44)	44 (84)	31 (62)	13 (25)	8 (16)
P*																
Between-group differences	0.001		0.02		0.01		0.04		0.09		0.01		0.001		0.03	
Time difference in each group	0.001		0.001		0.001		0.001		0.01		0.001		0.001		0.01	
Interaction between time and group	0.001		0.001		0.001		0.001		0.001		0.001		0.001		0.001	

* Repeated Measure ANOVA

musculoskeletal disorders ($p<0.05$). The result of judgment about the usefulness of the multifaceted ergonomic intervention program showed that 98% of the dentists agreed with this multifaceted ergonomic intervention program.

Discussion

Considering the mean age and work experience, the participants were relatively young and experienced. Therefore, their opinions about this multifaceted ergonomic intervention program are reliable. Average working hours per day was over 7.5, and this could increase the exposure to risk factors for musculoskeletal disorders. The present study showed positive results for the multifaceted ergonomic intervention program in reducing the prevalence of musculoskeletal disorders in dentists. The prevalence of musculoskeletal disorders in the intervention group at 3 and 6 months after the program reduced the musculoskeletal disorders in the neck, shoulder, arm, wrist, back, thigh, knees, and feet. On the other hand, the prevalence of musculoskeletal disorders in the control group increased in the neck, shoulder, arm, wrist, thigh, and knee. No significant difference was obtained between the prevalence of musculoskeletal disorders in the back and feet after 6 months in the control group, and this may be due to chronic low back pain in dentists. The results of this study are consistent with those of Wassanet al. study (19) in which a multifaceted ergonomic intervention program was conducted to resolve ergonomic risk factors. Moreover, their program focused on the opinions of dentists to reduce ergonomic risk factors. Kluifstra et al. used an intervention program (based on teaching the principles of ergonomics) to improve working conditions and reduce musculoskeletal disorders in nurses (20,21).

In the present study, we designed an exercise program intervention including stretching exercise for dentists in the intervention group. Previous studies have shown that exercise and stretching could decrease the prevalence of low back pain and musculoskeletal disorders in nurses (22,23). Thus, exercise might be effective in reducing low back pain and musculoskeletal disorders in dentists as well.

An interesting finding of this study was the interaction of time and group on each other, and their effect on the prevalence of musculoskeletal disorders in different parts of the body. This effect was more obvious when the interactive effect of time, the prevalence of musculoskeletal disorders and the multifaceted ergonomic intervention program were assessed. However, in the present study, only the interactive effect of time and prevalence of musculoskeletal disorders were assessed in the control group. Therefore, multifaceted ergonomic intervention program can effectively reduce the prevalence of musculoskeletal disorders in dentists.

Conclusion

The results of the present study revealed that the multifaceted ergonomic intervention program could be used to solve the ergonomic problem in dentists by reducing the prevalence of musculoskeletal disorders and improving workplace ergonomics through identifying ergonomic risk factors, offering regular exercise, and conducting discussion group meetings.

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