Assessment of Biomechanics Disorders in Iranian Dentists

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ABSTRACT

The major work–related disorders in workplaces are biomechanics disorders, which are the main reasons for workers' disability. This study was performed to evaluate the prevalence of contributing factors to biomechanics pain in dentistry. A descriptive analytical study was conducted on 200 dentists in Tehran, Iran. Nordic standard questionnaire was used to collect data about biomechanics disorders via interview; Postural evaluation was performed by direct observation during work; photos were taken; videos were recorded; and REBA (Rapid Entire Body Assessment) was used for data collection. Ethics statement: the study was authorized to use human subjects by the university human research ethics committee (Irct ID: IRCT2014051117649N1). The prevalence (95% confidence interval (CI)) of neck, shoulder, elbow, wrist, low back, and knee pains in the study sample were 22.0% (28.39 – 16.46), 25.5% (19.61 – 32.13), 8.5 (5.02 -13.26), 18.5 (13.37 – 24.59), 32.16 (25.72 – 38.60), and 32.5 (26.06 – 39.46), respectively. Based on multiple logistic regression results, the relationship between occurrence of biomechanics disorders in different parts of body and ergonomic factors such as working hours, height, work precedent, and demographic factors such as age, sex, marital status, and education was significant (P value≤0.05). Postural evaluation during work using REBA, indicated high risk of biomechanics disorders for the dentists. Most of the determinants of biomechanics pain including being forced to work, job dissatisfaction, and body posture during work can be controlled. Therefore, the managers and decision makers' attention in improving the quality of working conditions is important along with specific occupational health education.

Key Words: Biomechanics pain, Nordic Questioner, Ergonomic, REBA Method.

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INTRODUCTION

High prevalence rates of work-related biomechanics disorders (WRMSDs) among dentists have been reported [1-8]. Dentists are at high risk of biomechanics disorders [MSD]. WMSDs are of the leading causes of disability and discomfort in dentists [9-14].

In general, Pain in dentists were associated with the following characteristics: awkward posture, and excessive tightening of the back during work; and the application of vibrating tools and equipment not designed ergonomically [4]. The biomechanics disorders, that are on the rise worldwide, has numerous repercussions from serious ill-health effects at quality of life [9]. A poor ergonomic

the wrong working style which might lead to MSDs [10]. Professional Hazards are becoming an impending health problem in various specialties and dentists are no exception according to the nature of the stressful work they perform. Dentists are constantly exposed to a number of specific occupational hazards, which develop and intensify with years [8]. Biomechanics pain and injury (most often in the back, neck, shoulders, hands, wrists, and thumbs) are associated with minute and repetitive strains during work [11].

The common painful areas of the body were reported as follows: neck (43.4%), back (35.8%), and shoulder and wrist (each 25%). A relatively high prevalence of biomechanics pain has been revealed among dentists. [3].

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posture could make the dental students get habituated to

Dantas reported that the highest prevalence of complaints was related to the lower back (58.4%) and the lowest prevalence was found in the elbow (10.3%) [4].

In another study, 62% of dentists had at least one biomechanics complaint, 30% reported chronic complaints, 16% had spells of absence and, 32% sought medical care [6].

In Kurşun study the prevalence of biomechanics pain was 49% in postgraduate dental students. The lower back was found to be the most commonly affected area [34%]. [15]. The mentioned results reemphasize the need for ergonomic preventive cares in dentistry and the importance of training on ergonomic principles from the beginning of the clinical course. Furthermore, special attention should be paid to the design of working environment based on ergonomic principles [15].

Despite many studies on biomechanics disorders, there is still no clear and scientific method to evaluate risk factors of biomechanics disorders with REBA Method, and the ones available have some defects. The ultimate aim of the present study is to provide a new method to assess risk factors of biomechanics disorders in various phases of dental practice of 1) oral implantology and endodontics, 2) oral and maxillofacial surgery, 3) orthodontics and dentofacial orthopedics, 4) pedodontics, and 5) periodontics.

MATERIALS AND METHODS

The present study is a descriptive analytical study on 200 dentists during dental practice in Tehran, Iran in 2015.

Data collection
Demographic/occupational and Nordic standard questionnaires were employed for data collection. Demographic questions consisted of age, marital status, number of children, working hours per week, work history, lifting 25 kilograms or more per day, working with hands above shoulder level, repetitive movements of wrist and fingers, rewards, staff and managers' support, job satisfaction, and perceived occupational safety information; the Nordic standard questionnaire related to back, neck, shoulder, elbow, and wrist pains [1, 2].

Working position
200 dentists were randomly selected and their posture during work was evaluated via observation, taking photo, recording video, and REBA (Rapid Entire Body Assessment).

Dentistry profession was divided into five tasks: oral implantology and endodontics, oral and maxillofacial surgery, orthodontics and dentofacial orthopedics, pedodontics, and Periodontics. Afterward, the risk level of each task was calculated using REBA software. This is one of the most recent techniques of analysis the body position during work to evaluate possible risks of MSDs. REBA is one of the observational methods in postural evaluation. This method, a quick way to evaluate body posture within a short time, was first introduced in 1995 by Lynn Mac Atamny and Hygnt [16].

REBA procedure
In this procedure, different parts of the body are divided into two groups, A and B for analysis:
A) Trunk, neck, and feet postures consist of 60 combined postures.
B) Arms, forearms, and wrists postures consist of 36 combined postures.

Considering factors such as range and direction of joint motion, rate of force exertion, the tool griping mode and activity, and the score of each limb was calculated. In the next stage, the total score was estimated using specific REBA tables. The final score represented the potential exposure to MSDs. The validity and reliability of the instrument are confirmed in numerous studies [16].

Ethics statement.
This trial was registered in Iranian Registry of Clinical Trials (Irct ID: IRCT2014051117649N1). The study was authorized to use human subjects by the university human research ethics committee.

Statistical analysis
Chi-square and multiple logistic regression analysis were used for data analysis.

RESULTS AND DISCUSSION

Subjects' average age was 31.38 ± 9.54 years with a range of 15-67 years. 78% of the subjects were male and 22% female. In terms of marital status, 62% were married, 37% single, and 1% were widows. Average height of the subjects was 170.23 ± 8.68 cm, and 45.5% of the subjects had a family history of MSDs.

Table 1. Distribution of samples according to risk factor experience in an average working day

Risk factors	Numbers	Percent
Repetitive movements of wrist or fingers more than 4 hours	182	91%
Repetitive Flexion and Extension of elbow for more than 1 hour	182	91%
Working with hand above shoulder level for more than 1 hour	55	27.5%
Carrying 25 kg or more load by hand	36	18%
Go up or down stairs for more than 30 steps per day	43	21.5%
Kneeling or squatting or bending for more than 1 hour	120	60%
Payments to employees based on the number of tasks/ products	150	75.8%
Determined amount of the daily work of employees	91	45.7%

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Reward payment for working more than the agreed amoun	64	32.3%
Being under pressure for doing work in specified time	68	34%
Being self – employed	59	29.6%

Table 1 shows the distribution of the samples according to risk factor experience in an average day. Based on these data, the most common risk factors in samples were repetitive movements of the wrist or fingers for over 4 hours and repeated flexion and extension of elbow for more than 1 hour.

The prevalence (95% CIs) of neck, shoulder, elbow, wrist, low back, and knee pain in the study sample was 22.0% (28.39 – 16.46), 25.5 (19.61 – 32.13), 8.5 (5.02 -13.26), 18.5 (13.37 – 24.59), 32.16 (25.72 – 38.60), and 32.5 (26.06 – 39.46) respectively. Knee pain was the most common MSD in samples. The results of multivariate logistic regression of factors associated with biomechanics pain are given in Table 2.

Table 2. Results of multivariate logistic regression of factors associated with biomechanics pain

Limb	Factors		Odds ratio	95% CIs	P-value
Neck	Family history of biomechanics pain		2.59	1.23-5.47	0.013
	Being under pressure for doing work at specified time		3.92	1.80-8.53	0.001
	Reward payment for working more than the amount that was agreed		0.47	0.21-1.07	0.070
Shoulder	Back pain		5.18	6.35-42.35	<0.001
	Neck pain		16.40	2.22-12.12	<0.001
	Being left-handed		0.083	0.008-0.83	0.034
	Proportion of money received with the type of activity		0.34	0.13-0.87	0.027
Elbow	Being self – employed		10.98	1.76-68.74	0.010
	Shoulder pain		20.99	2.53-173.30	<0.001
	Wrist pain		26.80	4.44-161.22	<0.001
	Being left handed		29.08	1.75-483.44	0.019
	Repetitive movements of wrist or fingers for more than 4 hours		0.03	0.002-0.43	0.010
	Age		1.13	1.03-1.23	0.008
Wrist pain	Shoulder pain		3.124	1.351-7.226	0.008
	Elbow pain		9.097	2.761-29.969	0.000
Back pain	Sex		2.861	1.297-6.309	0.009
	Family history of biomechanics pain		4.02	1.29-6.30	0.000
	Being under pressure for doing work at specified time		2.54	1.22-5.30	0.013
	Working time per week		0.978	0.962-0.994	0.010
	Lack of job security		0.499	0.374-14.732	0.013
	Reward payment for working more than the amount that was agreed		0.44	0.19-1.004	0.051
Knee pain	Marital status		4.086	1.672-9.986	0.002
	Education		0.477	0.221-0.903	0.025
	Working time per week		0.962	0.927-0.999	0.044
	Working time per day		1.678	1.216-2.314	0.002
	Working with hand higher than shoulder level for more than 1 hour		0.207	0.0452-0.950	0.043
	Kneeling or squatting for more than 1 hour in a day		2.784	1.245-6.222	0.013
	Decision making about how to do the work	Often	-	-	-
		Some times	0.059	0.004-0.815	0.035
		seldom	0.121	0.009-0.815	0.098
		Never	0.831	0.016-42.17	0.926
	Decision making about type of the work	Often	-	-	-
		Some times	25.15	0.016-42.17	0.016
		Seldom	36.87	2.874-473.03	0.006
		Never	2.207	0.045-0.950	0.561

This table shows the factors significantly correlated with pain in the neck, and includes family history of biomechanics pain, pressure to do the job at a specified time, and getting reward for doing extra work. The first two variables were directly related to the risk of neck pain, but the third variable was reversely related.

The correlation between back pain, neck pain, being left-handed, and the balance between income and type of activity with shoulder pain was statistically significant.

Back and neck pain increased the occurrence of shoulder pain, but the other two variables reduced it.

The correlation between self-employment, shoulder pain, wrist pain, being left-handed, repetitive movements of the wrist or fingers for more than 4 hours, and age with elbow pain was statistically significant. Among different variables, the correlation between shoulder and elbow pain with wrist pain was significant.

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The correlation between gender, family history of biomechanics pain, being pressured to do the job at the specified time, working hours per week, lack of occupational safety, and getting reward for doing extra work was significant with back pain. Among these variables, the last factor reduced the occurrence of back pain significantly.

The correlation between marital status, education, working hours per week and per day, being left-handed, kneeling or squatting more than an hour during the day, the decision on how to perform work, and making decisions about the type of work was statistically significant with knee pain.

Table 3: The results of evaluating working posture in dentists using REBA method

Task	Right limb		Left limb	
	Danger level	Requirement of practical action	Danger level	Requirement of practical action
Oral Implantology and Endodontics	Very high	Is required quickly	Very high	Is required quickly
Oral and maxillofacial surgery	Very high	Is required quickly	Very high	Is required quickly
Orthodontics and dentofacial orthopedics	Very high	Is required quickly	Very high	Is required quickly
Pedodontics	Very high	Is required quickly	Very high	Is required quickly
Periodontics	High	Is required as soon as possible	High	Is required as soon as possible

Evaluation of working posture in dentistry using REBA (Table 3) showed that oral implantology and endodontics, oral and maxillofacial surgery, orthodontics and dentofacial orthopedics, pedodontics and periodontics had very high scores of working position, and risk of MSDs in the right and left limbs of workers in these tasks was too high. Furthermore, the risk of MSDs in all dentistry fields was high, and the score of working position in this task, was high based on REBA. These results show that working posture has to improve.

The study Rabiei [3], Dantas [4], Cherniack [5], and Alexopoulos [6] showed that high prevalence of MSDs in dentists was related to time-worn, low rest, static working pressure, and repetitive movements. This findings are in agreement with the present study.

The present study showed that knee pain and back pain (trunk) were the most common biomechanics pains among dentists. Åkesson [7], Sakzewski [9], Dable [10] studies showed that the most common MSDs in Dentistry were in the trunk, neck, and shoulders that is in agreement with a part of the present study's results. But, it does not approve Kumar [12] that found a high prevalence of neck and shoulder pain in dentists. Harvin [11] suggested that MSDs were resulted from improper work station design which is consistent with the present study's results.

Thanathornwong BS. [13], Kozak AS. [14], Kurşun ŞE. [15] suggested a strong relationship between biomechanics pain (e.g. neck and shoulder pain) and stress in workplace that is resulted from being under pressure to do the work and lack of security in work. These studies confirmed the present study's results. Evaluation of working position using REBA showed that dentistry had a very high score in 1. Oral Implantology and endodontics, 2. Oral and maxillofacial surgery, 3. Orthodontics and dentofacial orthopedics, 4. Pedodontics for MSDs. This result confirms Bennadi DK. [8] study who declared MSDs have a high prevalence in some works like Dentistry.

CONCLUSIONS

Several studies have been done on different industries employees to assess MSDs prevalence and management such as the study by Sadeghian [1] on Clinical Laboratory Workers and Oakmana [17], on non-nursing health care sector employees.

The present study suggests further epidemiological studies with the aim of modifying work stations and work time of dentists to reduce pressure on body limbs. Furthermore, it proposes ergonomic training with the aim of improving the existing situation and eliminating the static working status to reduce MSDs. The same suggestion is also emphasized by other researchers such as Gupta [18] and Valachi [19]. The present study suggests further Evaluation economic of ergonomics studies with the aim of modifying work stations and reduce MSDs prevalence and control accident at work [20, 21].

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