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Body Posture Evaluation of Dental Specialty Groups and Risk of Developing Musculoskeletal Disorders

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Cover Page Footnote

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ORIGINAL ARTICLE

Body Posture Evaluation of Dental Specialty Groups and Risk of Developing Musculoskeletal Disorders

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ABSTRACT

Objective: Adopting correct body postures is extremely essential in preventing future musculoskeletal disorders in Dentists. The aim of this study was to evaluate the body posture of general and specialist dentists to find awkward body postures, badly postured body parts and the risk of developing future MSDs. **Methods:** Stratified sampling method was used to recruit 224 dentists in Kerman and Mashhad. The most frequently adopted body posture was selected and based on Rapid Entire Body Assessment (REBA) method, scores were given to the angulation of different body parts. T-test and ANOVA test were performed to analyze the data. **Results:** About 10% of dentists had a REBA score which showed a high or very high risk of developing MSDs. Specialists and general dentists were not different in terms of REBA score. Among different specialties, periodontists had the highest REBA score. Overall, forearms and neck had the highest REBA score. **Conclusion:** General dentists and all dental specialties (except operative dentists) were at moderate risk of developing MSDs. Periodontists were at higher risk of developing MSDs. Based on REBA, the forearm and the neck were the most badly postured body parts.

Key words: dentistry, dental specialty, musculoskeletal diseases, posture

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INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are “injury to the human support system, including the bones, cartilage, muscles, ligaments, tendons, blood vessels, nerves due to exposure to hazards at the workplace”.¹ They are multifactorial in cause. Even though dentistry is sedentary in nature, dentists are subjected to extremely high levels of strain; higher than any other medical profession.² High prevalence of MSDs (up to 85%) have been reported in dentist.^{3,4} In a recent study, more than 90 percent of Iranian dentists have reported MSDs in the previous year.⁵ Also, a study on 60 dental students in Iran showed that students who have started clinical activities, experience more musculoskeletal pain compared to those who have not yet started clinical activities. This means that a time as short as three years is enough to cause such pains.⁶ Among the many inevitable causes of MSDs, body posture is the key to preventing these

disorders. Long-lasting asymmetric and static postures required for dental practice,^{7,8} leads to MSDs causing low productivity and early retirement from work.⁹ Also incorrect body posture during dental practice affects the quality of dental service provided.²

Incorrect working postures are very common among dentists. Some dentists are habituated to wrong working positions and some are obliged to work in incorrect body postures due to badly-designed work stations.¹⁰ For example, head rotation and hands held away from the body put dentists at higher risk of MSDs.¹¹

A study in Iran revealed a high prevalence of postural disorders in dental staff, in which forward head posture (FHP) was detected in 85% of dental staff.⁹ Higher working hours and greater age are also reported to be effective in encountering MSDs in this profession.⁴

Table 1. Final REBA Score

Final REBA score	Risk level	Action level	Action (including further assessment)
1	Negligible	1	Not necessary
2-3	Low risk	2	may be needed
4-7	Medium	3	Necessary
8-10	High	4	Very necessary (soon)
11-15	Very high	5	Very necessary (now)

Having in mind that incorrect working postures are one of the most important causes of MSDs in dentists and that appropriate preventive activities can effectively decrease MSDs[12],the present study was designed to evaluate the work postures of general and specialist dentists in Kerman and Mashhad, Iran. Unlike other related studies this study included the evaluation of dental specialists' body postures, also the most badly postured body parts were identified to give a better view of the involved body parts and make posture correction easier.

Rapid Entire Body assessment (REBA) was developed in 2000. It is an assessment tool offering a systematic process in order to assess occupational MSD risks associated with body postures.¹³ This ergonomic assessment method has a reliability of 62%-85 % and is designed for easy use without need for an advanced degree in ergonomics or expensive equipment.¹⁴ This method is useful for jobs which require static-dynamic, unstable and rapidly changing postures. Many studies have shown a relationship between the severity of the pain experienced by the dentists and their REBA score indicating that dentists with a higher REBA score need to adapt their working postures.¹⁵

METHODS

This cross-sectional study was carried out in Kerman and Mashhad, centers of two biggest provinces of Iran. The ethical code IR.KMU.REC.1398.540 was allocated to this study by the ethical committee of Kerman University of Medical Sciences.

A list of dentists working in Kerman and Mashhad was obtained from the medical council and stratified sampling method was used to randomly recruit samples based on the proportion of general dentists and different specialists to the total number of dentists in each city. Groups of study included general dentists, pedodontists, periodontists, oral and maxillofacial (OMF) surgeons, orthodontists, prosthodontists, endodontists and operative dentists. A dentist familiar with dental work and positions along with a specialist in ergonomics, referred to dentists' private office or

dentistry clinics in Kerman and Mashhad and carried out the study.

Participants consisted of 224 dentists (100 dentists in Kerman and 124 in Mashhad). Dentists with congenital muscular and skeletal disorders and those who reported a severe accident that had major impact on their skeletal and muscular status were excluded from the study. After receiving an informed consent dentists were asked about their years of clinical experience, weekly working hours and approximate number of daily patients treated. For each dentist self-reported height and weight was also recorded to calculate their Body Mass Index (BMI). They were also asked about their dominant hand while working. Additionally, they were asked about their regular weekly exercise program through a yes/no question. Participants who exercised less than 3 times a week were recorded as "No". Subsequently, each dentist was carefully observed for at least 30 minutes during a dental procedure. The most frequently used body posture was determined for further analysis using Rapid Entire Body Assessment (REBA) method. According to the angulation of each body part, a score was given to the head, neck, body, upper limbs and lower limbs. These scores were recorded in a note paper and the interpretation of the final scoring of REBA method was carried out using Table 1. T-test and Anova was used for data analysis using version 20 of SPSS software. Significance level was set as 0.05.

RESULTS

Overall 224 dentists participated in this study and mean age of participants was 37 ± 7.5 years. Regarding gender, 70% of dentists were male and 30% were female. In total, 181 were general dentists and 43 were specialists in different fields. Also 98.2% were right-handed and 1.8% were left-handed. Other basic data are listed in Table 2.

The risk level of developing MSDs and the priority of corrective actions needed in dentists are shown in Table 3. Overall, 75.9% of participants had a mean REBA score of 4-7 which means they are at a

Table 2. Basic data of participants

	Minimum	Maximum	Mean±(SD)
Years of clinical experience	1	41	10.8±(7.4)
Weekly working hours	9	95	33.9±(12.3)
Number of patients treated in a day	2	40	7.2±(4.9)
Body mass index	19	36	24.9±(2.6)

Table 3. The risk level of developing MSDs and the priority of corrective actions needed in dentists

Final REBA score	Frequency	Percentage	Mean REBA score	Risk level	Action level	Action (including further assessment)
1	0	0	0	Negligible	0	Not necessary
2-3	32	14.3	2.5	Low	1	May be necessary
4-7	170	75.9	4.97	Moderate	2	Necessary
8-10	21	9.4	8.61	High	3	Very necessary (soon)
11-15	1	0.4	11	Very high	4	Very necessary (now)

Table 4. Mean REBA score of general dentists and different specialties

Dental profession	Frequency	Mean REBA Score	Risk level	Action level	Action (including further Assessment)
General dentist	179	5.08	Moderate	2	Necessary
Endodontists	11	3.9	Moderate	2	Necessary
Orthodontists	6	5.5	Moderate	2	Necessary
Pedodontists	7	5.8	Moderate	2	Necessary
Operative dentists	5	3.6	Low	1	May be necessary
Prosthodontists	5	4	Moderate	2	Necessary
Periodontists	4	6.5	Moderate	2	Necessary
OMF Surgeons	5	4.2	Moderate	2	Necessary

Table 5. REBA score of each body part in general dentists and different specialties

Dental profession	Trunk	Neck	Feet	Arm		Forearm		Wrist	
				Right	Left	Right	Left	Right	Left
General Dentists	2.34	2.24	1.09	2.30	2.41	1.71	1.71	1.70	1.74
Endodontists	2.09	1.90	1	1.90	1.90	1.54	1.54	1.63	1.54
Orthodontists	2.16	2.16	1	2.5	1.83	1.5	1.5	1.83	1.83
Pediatric dentists	2.71	2.42	1	2.42	2.57	2	2	1.57	1.57
Operative dentists	1.80	2	1	2.4	2.4	1.2	1.4	1.6	1.4
Prosthodontists	1.80	2	1.2	2	2.4	1.2	1.4	1.6	1.4
Periodontists	3.5	2.5	1	2.5	3	1.75	1.75	2	1.75
OMF Surgeons	1.60	1.8	1.2	2	1.8	1.4	1.4	1.8	1.6

Table 6. Mean REBA score of dentists based on body parts and dental specialty after converting to 100-degree scale

Body part	General dentists	Endodontist	Orthodontists	Conservative dentists	Pediatric dentists	Prosthodontists	OMF surgeons	Periodontists	p-value
Trunk	46.85(16.8)	41.81(14.0)	43.33(26.5)	36.0(16.7)	54.28(19.0)	36.00(16.7)	32.00(16.8)	70.00(11.0)	0.02*
Neck	74.90(17.5)	63.63(17.9)	72.22(25.1)	66.66(23.5)	80.95(17.8)	66.66(23.5)	60.00(14.9)	83.33(19.2)	0.15
Leg	27.38(7.4)	25.00(0.0)	25.00(0.0)	25.00(0.0)	25.00(0.0)	46.88(16.8)	46.88(16.8)	46.88(16.8)	0.67
Right arm	38.38(13.3)	31.81(8.9)	41.66(17.5)	40.00(9.1)	40.47(13.1)	33.33(11.8)	33.33(20.4)	41.66(9.6)	0.68
Left arm	40.26(13.4)	31.81(8.9)	30.55(12.5)	40.00(9.1)	42.85(16.2)	40.00(14.9)	30.00(21.7)	50.00(13.6)	0.10
Right forearm	85.67(22.6)	77.27(26.1)	75.00(27.4)	60.00(22.4)	100.0(0.0)	60.00(22.4)	70.00(27.4)	87.50(25.0)	0.01*
Left forearm	85.95(22.5)	77.27(26.1)	75.00(27.4)	70.00(27.4)	100.0(0.0)	70.00(27.4)	70.00(27.38)	87.50(25.0)	0.1
Right wrist	56.92(22.5)	54.54(26.9)	61.11(25.1)	53.33(18.3)	42.38(17.8)	53.33(18.3)	60.00(27.8)	66.66(0.0)	0.97
Left wrist	58.05(22.9)	51.51(22.9)	61.11(13.6)	46.66(18.2)	52.38(17.8)	46.66(18.2)	53.33(29.8)	58.33(16.6)	0.8

moderate risk of developing MSDs in the future and further assessment is needed. Also 9.8% of dentists showed high and very high risk of developing MSDs and immediate action was needed regarding posture improvement.

Mean REBA score of general dentists was 5.08 ± 1.69 and mean REBA score of professionals was 4.62 ± 1.94 . This difference was not statistically significant (p -value=0.11). Also, the difference between male and female REBA scores was not statistically significant (p -value=0.16). Likewise, dentists' REBA scores were not different according to their exercise status (p -value=0.38). In contrast, left-handed dentists had a higher mean REBA score (7 ± 1.41) compared to right-handed dentists (4.96 ± 1.73) (p -value=0.02).

In Table 4, REBA scores of different specialties are presented. As shown in Table 4, general dentists and all specialties (except endodontists and operative dentists) had a REBA score that showed moderate risk of developing MSDs. Periodontists, pedodontists and orthodontists had the highest REBA score, respectively. In contrast, endodontists and operative dentists' REBA score showed a low risk level.

Because REBA has different coding systems for different body parts and the minimum and maximum score for each body part is different, we could not determine the worst body part in each specialty group (Table 5). Therefore, all scores were converted to a 100-degree scale range so that they could be compared (table 5). For example, in pedodontists the forearms, neck and trunk had the worst postures. In general dentists, right and left forearms had the worst postures and therefore needed special attention.

Figure 1. Comparison of mean REBA score of each body part

The difference between mean REBA score of trunk was different between periodontists and OMF surgeons ($p=0.02$). Also, the score of right forearm was significantly higher in pedodontists compared to prosthetic and restorative dentists ($p=0.01$). REBA score of other body parts were not significantly different between different specialty groups. Overall, the left forearm with a score of 79.46/100 had the most awkward posture during dental work. After that, the right forearm and the neck were parts with the worst posture (Figure1).

DISCUSSION

In this study, further assessment and posture correction was necessary for 85.7 percent of dentists. Other studies carried out on dental students and graduated dentists in Iran show similar results. Shirzaie noted

that 84% of dental students are at a moderate risk level of developing MSDs and posture correction is necessary for them. Likewise, another study revealed 81.9% to be at high risk of MSDs.^{6,16,17} Also Movahhed reported dental students to be in a moderate to high risk of developing future MSDs using RULA technique.¹⁸ Similar to our findings, Shirzaie and Yaghubi reported students to have the best posture during operative practice.^{6,19} Meanwhile, in Shirzaie's study students had the worst body posture in endodontic department. Also, Yaghubi mentioned endodontic work as medium risk. Unexpectedly, in this study, endodontists were at borderline low risk of MSDs. Given that our findings are based on a limited number of specialists in each group, we are not able to confirm endodontic work as low risk.

Among all dental specialists, the risk of MSDs was highest in periodontists with the neck and forearms as the most badly postured body parts in this specialty. No similar finding was observed in literature. Meanwhile, the direct sight needed for placement of grafts and dental implants could be the reason for awkward body postures of periodontists. In Movvahed's study, gender, academic year and working in different wards of dental clinic did not affect Rapid upper limb assessment (RULA) score.

In the present study, gender and exercise status did not influence a dentist's body posture. This is in line with other studies.^{17,20,21} Meanwhile, a study in India showed that younger and male dentists and those with physical activity experienced less MSDs.²² Also Hosseini and colleagues acknowledged that MSDs were more frequent in dentists who were female and those with less than 3 hours of weekly exercise.⁵ Having in mind that MSDs are multifactorial and incorrect work posture is one of many possible causes, it seems that body posture is not different between male and female dentists and other causes of MSDs such as psychological factors may explain higher MSDs in females.

Unexpectedly, in this study the right and left forearms gained highest REBA scores meaning that they were the most poorly postured body parts during dental work. Therefore, giving special attention to these body parts and avoiding any action that would compromise their posture is of great importance. According to REBA, high score of right and left forearms show the bending of less than 60 degree or more than 100 degrees of this body part. This is mostly caused by working at a wrong height. To avoid this problem, the working level should be set 5-10 cm lower than the dentists elbow.¹⁷ Our findings revealed neck as the third poorly postured

body part by adopting a flexion of more than 20 degree or twisting or side bending. There are many studies reporting neck pain as an extremely common MSD in dentists.¹ Proper use of a dental mirror, use of power lenses, consideration of 35-40 cm sight distance and adhering 30 degree eyesight from left and right to mid-sagittal plane and exactly in front of the patient is essential.^{23,24}

The present study has only investigated dentists' body posture (as one of the main causes of MSDs). Given the time limitation, each dentist was monitored for at least 30 minutes to try and find the most frequent body posture, still we are not certain that body posture would have been the most frequent throughout the dental practice time. Although we were the first to examine different groups of dental specialists' body posture, still the sample size of specialists was relatively low and caution must be taken when interpreting results. Future studies should aim at concurrently investigating body posture and other ergonomic factors such as equipment lay out, lightening and magnification, patient positioning and also a higher sample size in specialist groups would be more desirable.

MSDs are difficult to treat. Even when treated they tend to recur if same working patterns are repeated.¹ Many awkward body postures can be prevented simply by ergonomically adjusting the work environment. For example, adjusting the chair height so that feet are remained flat on the floor and thighs keep a slight downward slope, while keeping the chair position near to the patient help keep the trunk in an upright position. Therefore, Dentists can highly avoid such awkward body postures by increasing their ergonomic knowledge. Also ergonomic education should be integrated into dental education curriculum both before and during clinical practice. Also dental students should constantly be monitored to avoid incorrect body postures during all dental practices.

This paper highlighted the need to adopt correct body posture to avoid MSDs in dentists. Special attention should be given to the posture of forearms and neck.

CONCLUSION

General dentists and all dental specialties (except operative dentists) were at moderate risk of developing MSDs. Among all dental specialists, periodontists were at higher risk of developing MSDs. The forearm and the neck were the most badly postured body parts, requiring special attention for the prevention of pain and musculoskeletal disorders.

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CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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