Journal of Dentistry Indonesia

Volume 28 | Number 2 Article 7

8-31-2021

Assessment of the Working Posture among Dental Students to Prevent Musculoskeletal Disorders

Eleena Mohd Yusof
Centre for Restorative Dentistry Studies, Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, Sungai Buloh, Malaysia., eleena9727@uitm.edu.my

Muhamad Amir Hazim Razli
Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, Sungai Buloh, Malaysia., amirhazim789@gmail.com

Siti Aisyah Iman Mohd Nasir
Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, Sungai Buloh, Malaysia., hai.aisyahiman@gmail.com

Assessment of the Working Posture among Dental Students to Prevent Musculoskeletal Disorders

Cover Page Footnote

ACKNOWLEDGMENT We would like to thank Madam Izyan Hazwani Baharuddin for her guidance and assistance with the statistical analysis. CONFLICT OF INTEREST None FUNDING/GRANTS None

Journal of Dentistry Indonesia 2021, Vol. 28, No. 2, 105-111
doi: 10.14693/jdi.v28i2.1256

ORIGINAL ARTICLE

Assessment of the Working Posture among Dental Students to Prevent Musculoskeletal Disorders

Eleena Mohd Yusof*[1], Muhamad Amir Hazim Razli[2], Siti Aisyah Iman Mohd Nasir[2]

[1]Centre for Restorative Dentistry Studies, Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, Sungai Buloh, Malaysia.
[2]Faculty of Dentistry, Universiti Teknologi MARA (UiTM) Sungai Buloh Campus, Sungai Buloh, Malaysia.
**Correspondence e-mail to: eleena9727@uitm.edu.my*

ABSTRACT

Poor working posture among dental practitioners has been known to cause musculoskeletal disorders (MSDs), which are made worse by lengthy procedures and a lack of awareness about the proper working posture. **Objectives:** To assess the working posture of clinical dental students to determine if interventions were needed to reduce MSDs. **Methods:** The working postures of 225 clinical dental students were recorded and assessed within 10 minutes into procedures from March-December 2019, using the Rapid Upper Limb Assessment (RULA) method. The results were then statistically analysed using chi-square and Fisher's exact tests. **Results:** Of the 225 students observed, 64 (28.4%; 95% CI: 23.1-35.7%) were classified as having RULA scores of 1-2 and 3-4, 141 (62.7%; 95% CI: 58.4-65.7%) had RULA scores of 5-6 and 19 (8.4%; 95% CI:5.3-12.4%) had RULA scores of 7. Only one student had a RULA score of 1-2, where posture was considered acceptable. The working postures of the students in year 4 ($P<0.001$) were worse than those of the students in the other clinical years. No significant difference was observed concerning gender variance. **Conclusion:** Students' working postures should be evaluated frequently, and other tools, for example, dental loupes, should be provided to help them maintain good working postures.

Key words: working posture, musculoskeletal diseases, occupational health

How to cite this article: Yusof EM, Razli MAH, Nasir SAIM. Assessment of the working posture among dental students to prevent musculoskeletal disorders. J Dent Indones. 2021;28(2):105-111.

INTRODUCTION

Working in a small, restricted area such as the oral cavity is one of the risk factors leading to poor working posture among dental practitioners. The number of skills needed to adapt to visual demands during any given dental treatment procedure contributes to an inflexible work posture.[1] Furthermore, long static muscle activity resulting from prolonged sitting coupled with a forward inclination of the torso or sitting in a drooping posture in a dental clinical setting may result in the increase of strain on the spinal ligaments and stretching of the back muscles, causing musculoskeletal disorders (MSDs).[1, 2] Studies have shown that improper work postures in dentistry have led to straining of the postural muscles, for example, the upper and lower back, the neck and the shoulders and pain in the upper limbs such as the wrist and arm.[2] Over time, these unfavourable postures lead to severe back pain and fatigue, which then result in poor productivity, early retirement and even disc herniation and suicidal tendencies among dental professionals.[2-4]

Maintaining a good posture throughout a dental procedure is imperative because this reduces the body's energy usage, improves organ performance, and protects the muscles from unnecessary prolonged stretching.[1, 5] The terms lordosis and kyphosis refer to the curvatures of the spine. Lordosis describes the normal inward curvatures of the spine in the cervical and lumbar regions and typically affects the latter region more frequently than the former. Lumbar lordosis results when a person is seated at less than 90 degrees from the longitudinal axis, causing the pelvis to be pulled forward and tight hamstring muscles to be relieved.[1, 6] Unlike lordosis, kyphosis refers to the normal outward curvature of the spine, specifically at the thoracic region. Pynt, as cited by Gandavadi, Ramsay and Burke (2007), suggested that regular interchangeable position from lordosis to kyphosis is necessary to reduce an awkward, static lumbar position when working for a long period.

MSDs are not an uncommon sight among dental students. A questionnaire conducted by students in a dental school in Saudi Arabia found that a limited number of students had adequate knowledge of or had been taught enough about dental ergonomics and its preventive measures to reduce the risk of developing MSDs.[7] Another study found that 68% of female dental students and 43% of males reported having pain in their upper and lower backs, shoulders and necks that they attributed to doing clinical dental work.[8] These students also reported that they had frequent headaches.[8] In general, dental students are exposed to multiple factors that could present risks for developing musculoskeletal symptoms that involve ergonomic, work and biomechanical factors.[9] These conditions could be assessed using a Rapid Upper Limb Assessment (RULA) method which allocates scores based on the three-dimensional body areas, including the upper arm, the lower arm, the shoulders and the wrist, neck, trunk and lower limbs. RULA can also be used to assess muscle use and force.[10]

Poor working posture is not the only risk factor for MSDs; the addition of physiological changes such as being seated for long periods can further exacerbate musculoskeletal symptoms among dental students.[11] Poor posture leads to higher disc pressures and spinal hypomobility, which contributes to degenerative changes in the lumbar spine and low back pain or injury.[11] Negligence in maintaining good working posture can be added to external factors such as handling vibrating instruments repeatedly, sitting on uncomfortable operator chairs that lack adequate lumbar-dorsal support, using inappropriate instruments during dental treatment and accommodating the positioning of patients on the dental chairs.[9] Moreover, previous studies have shown that there is a convincing association between MSDs and the clinical burdens of dental practitioners.[12] Evidence also suggests that MSDs can develop in students during the process of their education and preclinical and clinical training. This may be caused by the pressures of tertiary education along with the physical and emotional burden of clinical training.[12] This study aimed to assess the working posture among clinical dental students, to determine if interventions are needed to reduce the risk of developing MSDs.

METHODS

This covert cross-sectional study, which was conducted from March to December 2019, involving the undergraduate clinical dental students of the Faculty of Dentistry, Universiti Teknologi MARA, Malaysia. The study followed the guidelines of the STROBE statement for reporting observational studies.[13] Ethical approval was obtained from the Research ethics committee of the faculty. Written consent was subsequently distributed to the dental students to attain their agreement on covert observations at undisclosed times and locations. This study included the clinical dental students of years 3, 4 and 5. A pilot study was conducted on eight students who were randomly selected for calibration before the commencement of the main study to minimise discrepancies and ambiguities during RULA scoring and to ensure accuracy in scorings between the investigators. The main study included 225 out of 251 clinical dental students. Two independent investigators observed the students while they were performing dental treatments on their patients in the presence of an assistant. These discreet observations were started within 10 minutes of the beginning of treatments in which a minimum of 2 minutes of treatment involving the oral cavity was required for data collection. The treatment procedures observed were restorations, root canal treatments, full-mouth scaling, dental and periodontal charting and simple dental prophylactic procedures. Procedures that were performed standing were excluded including making impressions and dental extractions. RULA method was utilised for scoring and analysis. Photographs were also acquired throughout the observations. Analysis of the reliability of the measurement of agreement between the investigators was performed using Cohen's Kappa calculation formula, which resulted in an intraclass correlation coefficient of 1 (95% confidence interval 1=1).

Table 1. Action required according to the final RULA score

RULA final score	Action levels	Action required
1 or 2	1	Acceptable posture
3 or 4	2	Further investigation is needed and interventions may be required
5 or 6	3	Investigation and interventions are required soon
7	4	Investigation and interventions are required immediately

RULA is a survey method established for use in ergonomics investigations to assess postures where work-related upper limb disorders are reported.10 RULA was used in this study to evaluate postures using diagrams and a scoring table. The working posture assessments of the students were divided into two; arm and wrist analysis and neck, trunk and leg analysis. If the posture of a student was static for more than one minute or there were repeated movements of more than three times per minute, the student would receive a high score. Subsequently, the final score was translated into an action level to establish the action required for each posture (Table 1). Students working

Table 2. Statistical analysis of RULA score between clinical years.

			RULA score				Total	Statistical analysis	p-value
			1 & 2	3 & 4	5 & 6	7			
Year groups 3, 4 & 5	Year 3	Count	1	29	37	3	70		
		Percentage	1.40	41.50	52.80	4.30	100		
	Year 4	Count	0	10	58	12	80		
		Percentage	0.00	12.50	72.50	15.00	100		
	Year 5	Count	0	25	46	4	75		
		Percentage	0.00	33.40	61.40	5.30	100		
	Total	Count	1	64	141	19	225	30.966	0.001
		Percentage	0.40	28.40	62.70	8.40	100		
Gender	Male	Count	0	8	22	3	33		
		Percentage	0.00	24.30	66.70	9.10	100		
	Female	Count	1	56	119	16	192		
		Percentage	0.50	29.20	62.00	8.30	100		
	Total	Count	1	64	141	19	225	0.921	0.969
		Percentage	0.40	28.40	62.70%	8.40	100		

without an assistant, students who spotted they were being observed and students who did not consent to the observation were excluded. The results were statistically analysed using chi-square and Fisher's exact tests. The SPSS software was utilised for this purpose.

RESULTS

A total of 225 clinical dental students were included in the study. This number amounted to approximately 90% of all the clinical students for the year 2019. Of these 225 students, 33 (15%) were male and 192 (85%) were female. Among the students, 64 (28.4%; 95% CI: 23.1–35.7%) were classified as having RULA scores of 3-4, 141 students (62.7%; 95% CI: 58.4-65.7%) had RULA scores of 56 and 19 (8.4%; 95% CI: 5.3–12.4%) had RULA scores of 7. Only one student had a RULA score of 1-2, where the posture was considered acceptable (Table 2).

Using the RULA method provides a way of analysing the general posture and body areas (Figure 1). High-risk areas included the upper arm and the lower arm. Most students had 0–20° upper arm flexions (with extensions) without abductions or shoulder elevations and lower arm flexions of more than 100°. The feet and legs were mostly supported, as is demonstrated by 59% of the students (Figure 2).

Other high-risk areas included the wrist, neck and trunk: 43% of the students had more than 15° wrist flexion or extension, with 39% exhibiting a midline bend, while 16% of them had 20–60° forward trunk flexion and 1% had more than 60° flexion. A 0–20° flexion of the neck and trunk was observed in 33% and 62% of the participants, respectively (Figure 3).

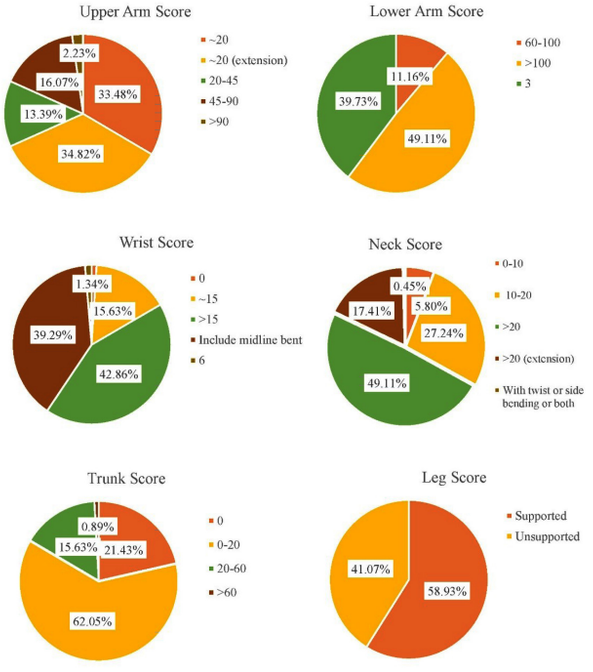

Figure 1. The distribution of RULA score for each body subcategory

There was a significant difference in the postures of the clinical students in years 3, 4 and 5 ($p = 0.001$) (Table 2). Year 4 students had significantly poorer postures than the other years, especially in terms of their legs ($p = 0.017$), and year 5 students exhibited poor postures involving their lower arms ($p < 0.001$). There were no significant differences between the students in any of

Figure 2. The feet and legs were mostly supported

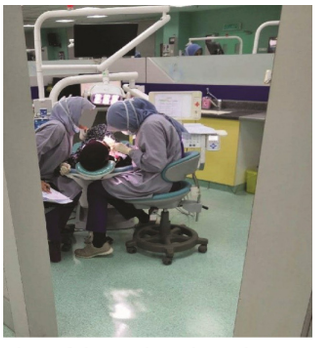

Figure 3. Flexion of the neck and trunk

the years with regard to other body areas such as the upper arm, wrist, neck and trunk ($p > 0.05$) (Table 3). This study did not find any significant associations between posture and gender ($p = 0.969$) (Table 2). In addition, no significant differences were found between different body areas and the genders of the students ($p > 0.05$) (Table 4).

DISCUSSION

The study revealed that, among the 225 undergraduate clinical dental students included in this study, there were no significant correlations between the RULA scores and gender, and this agrees with the findings of previous studies.[3, 14] However, a study by McLaren et al. found that females had poorer leg positioning and males had worse neck and trunk postures, all of which might lead to MSDs. The authors reasoned that this difference in body movement between females and males may be due to the distinctive and differing body sizes and strengths of the two genders.[3] Nevertheless, this study found no differences between the postures for specific body areas and gender.

The results of this study showed a significant difference between the clinical years, with the year 4 students exhibiting poorer working postures than those in the other years, specifically in terms of the positioning of their legs, and this may be due to the lack of awareness regarding dental ergonomics. This statement is further supported by the fact that the year 4 students focused heavily on finishing certain tasks and tended to place their bodies in awkward and harmful positions throughout the dental procedures. Some of the students brought in more than one patient in a single clinical session and attempted to overlap multiple procedures in a limited amount of time. As inexperienced dental personnel, the awkward working posture coupled with higher stress levels often leads to body pain and the development of musculoskeletal symptoms.[15, 16]

Year 5 students demonstrated poor posture that involved the positions of their lower arms. Indeed, the study found that most of these students tended to neglect their postures, to prioritize the needs of the patients, and the primary focus was on completing treatments on time, regardless of their physical capabilities. The results of the study by McLaren et al. showed that dental students who are in their final years have unacceptable working postures, and this may be linked to an increase in their clinical hours in comparison to those of students in other years.[3] Furthermore, in this study, the year 5 students were struggling to complete their endodontic requirements, which involve working mostly with lower arms in static and awkward positions. Working within a small operational field with limited vision and repeatedly handling small instruments such as the endodontic files could result in this posture being even worse. A study conducted on those who were studying oral health and dentistry showed that a significantly higher number of students studying oral health were experiencing pain related to their hands, possibly from doing repetitive scaling work.[17] Bernard and Putz-Anderson found that wrist and hand pain was associated with a high level of personal- and clinical-related stress, which may cause muscle and biomechanical tension.[18] Muscle tension and flexion of the lower arm are associated with an increasing prevalence of carpal tunnel syndrome.[19]

This study focused on determining the working postures of dental students by using clinical year and gender as the variables. The use of dental loupes could be a confounding factor influencing the work postures among dental students. In this study, none of the students was found to have put on the dental loupes, even though the clinics did have a few pairs. There is strong evidence to show that the use of loupes helps to improve postures and reduces the risk of developing work-related MSDs.[3, 17] Nevertheless, the dental students in this study had not been provided with information that emphasized the importance of using loupes during treatment procedures, and an improvement in ergonomic education is called for. According to McLaren et al., using loupes is associated with improved neck and trunk positioning.[3] Clearly, then, dental students should be encouraged to use loupes, to reduce the number of students who have poor working postures. Promoting the use of

Table 3. Statistical analysis of each body subcategory assessed using RULA for each.

		Year Group							
		Year 3		Year 4		Year 5		Statistical	p-value
		Count	Percentage	Count	Percentage	Count	Percentage	Analysis	
Upper arm score	1	29	41.40	27	34	19	33.50	19.865	0.11
	2	25	35.70	32	41	21	34.80		
	3	8	11.40	10	12.70	12	13		
	4	5	7.10	9	11	22	16.10		
	5	3	4	1	1	1	2		
Lower arm score	1	3	4	10	13	12	16	35.321	< 0.001
	2	34	48.60	24	30.40	52	69.30		
Wrist score	1	1	1	0	0	1	1	2.741	0.95
	2	10	14.30	14	18	11	15.60		
	3	33	34.40	34	43.00	29	38.70		
	4	25	35.70	30	38.00	33	44.00		
Neck score	1	4	5.70	5	6.30	4	5.30	13.742	0.089
	2	18	25.70	26	32.90	17	22.70		
	3	38	54.30	27	24.50	45	60		
	4	10	14.30	20	25.30	9	12		
	5	0	0	1	1.30	0	0		
Trunk score	1	11	15.70	22	27.80	15	20	4.675	0.586
	2	46	65.70	45	57	48	64		
	3	13	18.60	11	13.90	11	14.70		
	4	0	0	1	1.30	1	1.30		
Leg score	1	38	54.30	40	50.60	54	72	8.164	0.017
	2	32	45.70	39	49.40	21	28		

Table 4. Statistical analysis of each gender assessed using RULA for each variable of interest

		Gender					
		Male		Female		Statistical	p-value
		Count	Percentage	Count	Percentage	Analysis	
Upper arm score	1	9	27.30	66	33.50	2.235	0.693
	2	11	33.30	67	34.80		
	3	4	12.10	26	13.60		
	4	8	24.20	28	14.70		
	5	1	3	4	2.10		
Lower arm score	1	4	12.10	21	11	2.586	0.274
	2	20	60.60	90	81.80		
Wrist score	1	0	0	2	0.90	1.179	0.882
	2	5	15.20	30	15.70		
	3	14	42.40	82	42.90		
	4	13	39.40	75	39.30		
Neck score	1	1	3	12	5.80	5.916	0.206
	2	4	12.10	57	27.20		
	3	21	63.60	89	46.40		
	4	7	21.20	32	16.80		
	5	0	0	1	0.50		
Trunk score	1	4	12.10	44	23	5.774	0.123
	2	25	75.80	114	59.70		
	3	3	9.10	32	16.80		
	4	1	3	1	0.50		
Leg score	1	24	72.70	108	57	3.045	0.081
	2	9	27.30	83	44		

Baumbach saddle chairs among dental students is also recommended, to prevent the dentists from adopting static sitting positions. The Baumbach saddle chair is designed to facilitate the interchanging position of an operator from lordosis to kyphosis, which is necessary for preserving the health of the lower back and consequently preventing lower back pain.[1]

The photographs obtained from this study were captured from only one side of each of the students. One of the limitations of the study is that some of the dental assistants noticed they were being observed. A blinded method for taking the photographs is preferable for preventing the dentists from becoming conscious of their postures and, therefore, reduces the risk of bias. Cubicles that are placed too close to one another in the polyclinics and the unstandardised positions of the dental chairs in each cubicle could also impose a risk of bias. The challenges that were experienced during this study included patients failing to attend their dental appointments when the data collection was supposed to take place, and the fact that most of the year 3 students were delayed in treating patients, as they were still completing their preclinical projects.

This study discovered that dental students in this institution were susceptible to acquiring work-related MSDs before the beginning of their professional careers. Because of this, the study suggests that the theories of work-related ergonomics should be incorporated into dental education and a good understanding of the importance and continuous awareness of this ergonomics is imperative. Garbin et al. demonstrated an unsatisfactory correlation between awareness of ergonomics and clinical applications among their dental students. They suggested improvements in the teaching and learning of ergonomics in dentistry through digital aids to curb this problem.[5] Further revisions to the content for teaching and learning are recommended, to reduce the risk of developing MSDs at early ages and promote the long-term survival of dental students as early as possible. Further research would be beneficial to determine the correlation between teaching dental students how to make improvements with regard to ergonomics and the students' compliance with this. Since this research was a cross-sectional study, a longitudinal study design will be valuable considering participation of the research subjects can be maintained in the following year.

CONCLUSION

Within the limitations of this study, it could be suggested that dental students need more exposure to proper training and practice regarding their postures. Because of their lack of awareness, the students neglected the importance of maintaining proper working postures. Postural training should be audited annually and changes implemented. Acquiring greater understanding of proper postures and implementing strict guidelines along with the provision of auxiliary tools, for example, dental loupes, among dental students are, therefore, crucial in preventing the development of work-related MSDs among undergraduate dental students.

ACKNOWLEDGMENT

We would like to thank Madam Izyan Hazwani Baharuddin for her guidance and assistance with the statistical analysis.

CONFLICT OF INTERESTS

All authors declared no conflict of interests.

REFERENCES

1. Gandavadi A, Ramsay JR, Burke FJ. Assessment of dental student posture in two seating conditions using RULA methodology - a pilot study. Br Dent J. 2007;203(10):601-5.
2. Ng A, Hayes M, Polster A. Musculoskeletal disorders and working posture among dental and oral health students. Healthcare. 2016;4(1):13.
3. McLaren W, Parrott L. Do dental students have acceptable working posture? Br Dent J. 2018;225(1):59-67.
4. Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. Ind Health. 2007;45(5):611-21.
5. Garbin AJ, Garbin CA, Diniz DG, Yarid SD. Dental students' knowledge of ergonomic postural requirements and their application during clinical care. Eur J Dent Educ. 2011;15(1):31-5.
6. Sadler SG, Spink MJ, Ho A, De Jonge XJ, Chuter VH. Restriction in lateral bending range of motion, lumbar lordosis, and hamstring flexibility predicts the development of low back pain: a systematic review of prospective cohort studies. BMC Musculoskelet Disord. 2017;18(1):179.
7. Almosa NA, Zafar H. Assessment of knowledge about dental ergonomics among dental students of King Saud University, Riyadh, Kingdom of Saudi Arabia. J Contemp Dent Pract. 2019;20(3):324-9.
8. Zafar H, Almosa N. Prevalence of work-related musculoskeletal disorders among dental students of King Saud University, Riyadh, Kingdom of Saudi Arabia. J Contemp Dent Pract. 2019;20(4):449-53.
9. Diaz A, Gómez-Palencia I, Díaz-Cárdenas S.

Ergonomic factors that cause the presence of pain muscle in students of dentistry. Med Oral Patol Oral Cir Bucal. 2010;15:906-11.
10. McAtamney L, Nigel Corlett E. RULA: a survey method for the investigation of work-related upper limb disorders. Appl Ergon. 1993;24(2):91-9.
11. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. J Am Dent Assoc. 2003;134(10):1344-50.
12. Thornton LJ, Barr AE, Stuart-Buttle C, Gaughan JP, Wilson ER, Jackson AD, et al. Perceived musculoskeletal symptoms among dental students in the clinic work environment. Ergonomics. 2008;51(4):573-86.
13. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Int J Surg. 2014;12(12):1495-9.
14. Movahhed T, Dehghani M, Arghami S, Arghami A. Do dental students have a neutral working posture? J Back Musculoskelet Rehabil. 2016;29(4):859-64.
15. Hayes M, Cockrell D, Smith D. A systematic review of musculoskeletal disorders among dental professionals. Int J Dent Hyg. 2009;7(3):159-65.
16. Movahhed T, Ajami B, Soltani M, Shakeri MT, Dehghani M. Musculoskeletal pain reports among Mashhad dental students, Iran. Pak J Biol Sci. 2013;16(2):80-5.
17. Hayes M, Rogers A, Chuanon J, Tan T, Lai I, Yong E. Dental and oral health students' perceptions of loupes. Int J Occup Saf Ergon. 2019:1-26.
18. Bernard BP, Putz-Anderson V. Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. Publication No. 97-141. National Institute for Occupational Safety and Health. Cincinnati OH: U.S. Department of Health and Human Services. 1997.
19. ZakerJafari HR, YektaKooshali MH. Work-related musculoskeletal disorders in Iranian dentists: a systematic review and meta-analysis. Saf Health Work. 2018;9(1):1-9.

(Received April 18, 2021; Accepted July 28, 2021)