

Better Early Prevention: Dental Student's Awareness of Musculoskeletal Disorders

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ABSTRACT

Musculoskeletal disorders occur in 54-93% of dentists. Dental students are also at a high risk of developing MSDs as they also do the dentist works during professional training, and mainly owing to the deleterious postural habits they acquired. If the working position applied is not ergonomic, it will develop into health problem in the future.

Purpose: this study aim was to determine correlation between ergonomic working position toward musculoskeletal disorders on preclinical dental students.

Material and Methods: The study design was cross-sectional study. It was conducted in Dentistry Faculty of IIK Bhakti Wiyata Kediri, on November-December 2019. The study involved 102 respondents, taken by simple random sampling (d = 5%). Working position was measured using Test of Visual Perception. The musculoskeletal disorders were measure by Nordic Body Map questionnaire. The data was analysed using correlation contingency coefficient and Spearman test.

Results: There are significantly correlation between gender (p= 0,029), physical exercise (p= 0,036), smoking habit (p= 0,048), and working position (p= 0,001) toward risk of musculoskeletal disorders. The most commonly affected body sites are right wrist (56,86%), right arm (55,88%), upper neck (46,10%), back (45,10%), right lower arm (44,12%), and right shoulder (41,18%).

Conclusion: There are significant correlation between working position (p= 0,001) toward risk of musculoskeletal disorders.

Keywords: ergonomic, musculoskeletal disorders, dental students, prevention.

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INTRODUCTION

Musculoskeletal disorders (MSDs) are explained as a group of disorders that predispose various regions of the musculoskeletal system[1,2]. MSDs may be caused by an interplay of specific risk factors acting during work-related activities[3], such as repetitive motions, awkward or static postures[4,5], forceful movements, and exposure to vibration and/or mechanical stress[6]. When these factors exist simultaneously, the risk of developing MSDs increases significantly[7-9].

Medical workers are a high risk predisposed group developing MSDs. Higher incidence of MSDs occur in older individuals and women (54-93% of dentists)[10,11]. The use of vibratory tools, excessive repetitive movements, maintaining a static position while performing extremely precise procedures in a small workspace[12], and/or maintaining an inadequate posture for long periods of time[13] are some of the postulated reasons for the possible risk of the high incidence MSDs among dentists[14].

Dental students are also at a high risk of developing MSDs as they also do the dentist works during professional training, and mainly owing to the deleterious postural habits they acquired[15]. A study in Brazil revealed that most of dental students understand the knowledge of ergonomic working position theoretically, but they do not practice as well as the theory[16]. The most affected body areas are shoulders, back, and neck, whereas the most ignored by dental students are head and neck position[17].

The magnitude of risk and complaints arised by ergonomic hazards become the basic thought to formulate early prevention. The working position of preclinical dental students tend to be bad habit until professional training and being continued when they already become a dentist. If the working position applied is not ergonomic, it will develop into health problem in the future[15].

MATERIAL AND METHODS

The study design was cross-sectional study. It was conducted in Dentistry Faculty of IIK Bhakti Wiyata Kediri, on November-December 2019. The population were 107 undergraduate students, underwent Endodontic skill laboratory subject in 2019/2020. The study involved 102 respondents, taken by simple random sampling (d = 5%). Working position was measured using the *Test of Visual Perception*, by observing respondents 2-3 meters far without being recognized. The musculoskeletal disorders were measure by *Nordic Body Map* questionnaire. The results were presented in proportion table of characteristics of respondent, and correlation tests using contingency coefficient and Spearman test. The significance level was 5% ($\alpha = 0,05$).

RESULT

The majority were female students (80,39%), and rest were male students (19,61%). Either female respondents (84,15%) or male ones (75%) do not have physical exercise regularly. None of female student's smoke (0%),

but most of male students have smoking habit (85%). The majority practice ergonomic working position in moderate grade, either female students (51,22%) or male ones (40%). The respondent's risk of developing musculoskeletal disorders was moderate, none of them has very high risk (0%). There is only 1 female student who has high risk of musculoskeletal disorders (1,22%), and no male student has high one (0%).

There is significantly correlation between gender ($p=0,029$), physical exercise ($p=0,036$), smoking habit ($p=0,048$), and working position ($p=0,001$) toward risk of musculoskeletal disorders. Spearman test results correlation coefficient value of $-0,317$, referred to reverse correlation or the more ergonomic working positions are applied, the less musculoskeletal disorders will arise, but

the strength of correlation between working position and musculoskeletal disorders is weak. The most ergonomic working positions being ignored by students are about back position and avoidance to rotate body (male= 70%, female= 74,39%), head position (male= 70%, female= 74,39%), lamp positioning (male= 75%, female= 68,29%), and arm position (male= 75%, female= 63,41%), respectively.

The most commonly affected body sites are right wrist (56,86%), right arm (55,88%), upper neck (46,10%), back (45,10%), right lower arm (44,12%), and right shoulder (41,18%). There are no complaints about pain on bottom, left elbow, right elbow, left thigh, right knee and right foot (0%).

Table 1. The Proportion of characteristics of respondent based on gender, physical exercise habit, smoking habit, working position, and risk of developing musculoskeletal disorders

Variables	Male n = 20 (19,61%)		Female n = 82 (80,39%)		p value	r
	n	%	n	%		
Physical exercise					0,036*	
Yes	5	25	13	15,85		
No	15	75	69	84,15		
Smoking					0,048*	
Yes	17	85	0	0		
No	3	15	82	100		
Working position (TVP)					0,001*	-0,317
Poor	5	25	16	19,51		
Moderate	8	40	42	51,22		
Good	4	20	23	28,05		
Excellent	3	15	1	1,22		
MSDs risk (NBM)					0,029*	
Low	4	20	4	4,88		
Moderate	16	80	77	93,90		
High	0	0	1	1,22		
Very high	0	0	0	0		

TVP : Test of Visual Perception
 MSDs : Musculoskeletal disorders
 NBM : Nordic Body Map

Table 2. The practice of ergonomic working position by respondents based on Test of Visual Perception

Criteria	Male n = 20		Female n = 82	
	n	%	n	%
Sitting with thighs and legs forming angle 110° or more				
Yes	10	50	51	62,20
No	10	50	31	37,80
Operator should be symmetrically sitting straight forward, back on support to chair, trunk could be lean forward 10-20°, avoid trunk twisting to one side				
Yes	6	30	21	25,61
No	14	70	61	74,39
Operator's head could be tilted until 25°				
Yes	6	30	21	25,61
No	14	70	61	74,39
Positioning pedal drive near one of legs				
Yes	15	75	67	81,71

No	5	25	15	18,29
Uprighting arm approximately 10-25° from horizontal plane				
Yes	5	25	30	36,58
No	15	75	52	63,41
A distance of 35-40 cm should be maintained between operator's eyes and working area				
Yes	4	20	23	28,05
No	16	80	59	71,95
Positioning instruments 20-25 cm far from operator's eyes				
Yes	16	80	68	82,93
No	4	20	14	17,07
Light should be positioned above the operator's head height, before and during working, to produce straight light parallel to operator's sight				
Yes	5	25	26	31,71
No	15	75	56	68,29

Table 3. The distribution of body area most affected based on Nordic Body Map

Body sites	Pain			
	Yes		No	
	n	%	n	%
Upper neck	47	46,10	55	53,90
Lower neck	34	33,33	68	66,67
Left shoulder	13	12,75	89	87,25
Right shoulder	42	41,18	60	58,82
Left upper arm	7	6,87	95	93,13
Back	46	45,10	56	54,90
Right upper arm	40	39,22	62	60,78
Waist	41	40,20	61	59,80
Hip	2	1,96	100	98,04
Bottom	0	0	102	100
Left elbow	0	0	102	100
Right elbow	0	0	102	100
Left lower arm	17	16,67	85	83,33
Right lower arm	45	44,12	57	55,88
Left wrist	20	19,61	82	80,39
Right wrist	58	56,86	44	43,14
Left arm	18	17,65	84	82,35
Right arm	57	55,88	45	44,12
Left thigh	0	0	102	100
Right thigh	2	1,96	100	98,04
Left knee	4	3,90	98	96,10
Right knee	0	0	102	100
Left leg	19	18,63	83	81,37
Right leg	33	32,35	69	67,65
Left ankle	6	5,89	96	94,12
Right ankle	26	25,49	76	74,51
Left foot	2	1,96	100	98,04
Right foot	0	0	102	100

DISCUSSION

This study showed that certain risk factors present, deserve proper consideration particularly for the prevention of musculoskeletal disorders. There is some risk factor such as gender, physical activity, and smoking habit, beside working position itself. Female students in this study are reported to have musculoskeletal disorders problems more than male student. Study published in 2005 resulted the same, that these disorders have a higher incidence in women[11]. This was related to the

fact that women were more concerned about their health, tended to report health problems more often, and may pay more attention to their health and well-being compared to men, or that they may have a lower pain threshold or are less resistant to constant musculoskeletal tension[18].

There was a significant correlation between physical exercise and musculoskeletal disorders in this study. Published literature documents the important role that is carried out through physical activity, aerobics, and

stretching as a preventive ergonomic action. Aerobic exercise increases the flow of oxygen to the tissues, thereby increasing efficiency. Stretching exercises are effective in relaxation and also reduce muscle tension caused by incorrect posture[19]. Several studies mention that obesity and lack of activity are risk factors in the development of chronic MSD in medical practitioners, but are also often caused by fatigue caused by heavy workloads and long work[20].

Smoking habit was also correlated with the complaints of MSDs. Cigarette smoking harms the musculoskeletal system. The pathogenesis is complex, due to direct toxic effects on osteoblasts or osteoclasts activity of nicotine, and indirect actions on sex and adrenocortical hormones, vessels and oxygen supply, vitamin D, and intestinal calcium absorption. Smoking can cause or worsen the development of rheumatoid arthritis and back pain[21].

The most commonly affected body sites are right wrist, right arm, upper neck, back, right lower arm, and right shoulder, respectively. There are no complaints about pain on bottom, left elbow, right elbow, left thigh, right knee and right foot. The result similar with the study conducted previously that stated the spine, shoulder and wrist-hand channel disorders are often reported by dental practitioners, this disorder can cause low back pain, cervical pain, shoulder tendinitis, neck pain, carpal tunnel syndrome, De Quervain's syndrome, and Guyon syndrome[11].

A main cause of arm and wrist disorders is constant flexion and extension motions of the wrist and fingers. Repetitive movements of the hand and wrist, especially with the hand in 'pinch' position, seem to be the most detrimental. Another contributed factors to hand and wrist injuries include movements in which the wrist is deviated from neutral posture into an abnormal posture, mechanical stresses to digital nerves from steady grasps to sharp edges on instrument handles, working for long period without resting or alternation of hand and forearm muscles, intense work and extended use of vibratory instruments[20]. The shoulders and wrists as the mainly areas of the body that affected by repetitive strain, which often display symptoms of carpal tunnel syndrome[22]. If dental equipment is not at convenient working height, distance and position, operator is obliged to sustain an unbalanced position[20]. The forward-head tilt and rounded-shoulder postures increase loads on the upper neck muscles, include upper trapezius and levator scapulae, and spinal vertebral discs[23]. It could explain why the most notable painful body site is neck in this study. Similar with a study which reported the highest reported problem in MSDs was neck pain, that is similar to studies in Queensland, Saudi Arabia and Netherlands[24].

MSDs can cause by the strained posture and prolonged repetitive movements. The proper working posture in dental practice is neutral and symmetrical, the forearms are horizontal, the arms are close to the body, and the head is flexed by 20-25°, the operator is seated with the pelvis and shoulders parallel, the legs are slightly apart, the trunk perpendicular to the floor[25].

CONCLUSION

There is a significant correlation between working position toward risk of musculoskeletal disorders. The most commonly affected body sites are right wrist, right arm, upper neck, back, right lower arm, and right shoulder. The most ergonomic working positions being ignored by students are about back position and

avoidance to trunk twist at one side, head position, lamp positioning, and arm position. At the undergraduate training stages, all the MSDs risk factor such as risks that related to work and the preventive strategies should be explained, so that students can prevent the occurrence of MSDs by adopting an ergonomic approach in their dental practice.

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REFERENCES

1. Sakti M, Usman MA, Lee J, Benjamin M, Maulidiah Q. Atypical musculoskeletal manifestations of gout in hyperuricemia patients. *Open Access Rheumatol Res Rev* [Internet]. 2019; 11:47-52.
2. Osborne A, Blake C, Fullen BM, Meredith D, Phelan J, McNamara J, Cunningham C. Prevalence of musculoskeletal disorders among farmers: A systematic review [Internet]. Vol. 55, *American Journal of Industrial Medicine*. 2012 [cited 2020 Feb 25]. p. 143-58. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22069159>
3. Huda LN, Matondang R. The lean ergonomics in green design of crude palm oil plant. In: *TALENTA - Conference on Engineering, Science and Technology 2017, TALENTA-CEST 2017* [Internet]. Department of Industrial Engineering, Universitas Sumatera Utara, Jl. Almamater, Kampus USU, Medan, 20155, Indonesia: Institute of Physics Publishing; 2018.
4. Rimba JT, Naiem F, Rahim MR. Relationship between work posture and musculoskeletal disorders (Msds) at processing workers in Ptoarco Jaya, Rantepao city year 2017. *Indian J Public Heal Res Dev*. 2019 Jul 1;10(7):1025-9.
5. Rizkya I, Syahputri K, Sari RM, Anizar, Siregar I. Evaluation of work posture and quantification of fatigue by Rapid Entire Body Assessment (REBA). In: *TALENTA - Conference on Engineering, Science and Technology 2017, TALENTA-CEST 2017* [Internet]. Universitas Sumatera Utara Almater Street Kampus USU, Padang Bulan Medan, 20155, Indonesia: Institute of Physics Publishing; 2018.
6. Siregar I, Tarigan IR, Syahputri K, Sari RM. Application of biomechanics in industry. In: *2nd Nommensen International Conference on Technology and Engineering, NICTE 2018* [Internet]. Department of Industrial Engineering, Universitas Sumatera Utara, Medan, Indonesia: Institute of Physics Publishing; 2018.
7. Aljanakh M, Shaikh S, Siddiqui AA, Al-Mansour M, Hassan SS. Prevalence of musculoskeletal disorders among dentists in the Ha'il Region of Saudi Arabia. *Ann Saudi Med* [Internet]. 2015 Nov 1 [cited 2020 Feb 25];35(6):456-61.
8. Santoso JW, Nasirul HD, Alayyannur PA, Mulyono, Wijaya YR. Risk Assessment in the Laboratory of Epidemiology. *Indian J Public Heal Res Dev* [Internet]. 2019;10(8):982.
9. Zamzami LE, Alayyannur PA, Haqi DN, Martiana T. Relationship between knowledge and availability of personal protective equipment with the attitudes toward occupational safety and health of the students in laboratory X. *Indian J Forensic Med Toxicol* [Internet]. 2019;13(3):446-50.

10. Health and Safety Executive. Work related musculoskeletal disorder statistics (WRMSDs) in Great Britain, 2019 [Internet]. 2019 [cited 2020 Feb 25]. Available from: <http://www.hse.gov.uk/statistics/lfs/index.htm> 4:167-72.
11. De Sio S, Traversini V, Rinaldo F, Colasanti V, Buomprisco G, Perri R, Mormone F, Torre G La, Guerra F. Ergonomic risk and preventive measures of musculoskeletal disorders in the dentistry environment: An umbrella review. Vol. 2018, PeerJ. PeerJ Inc.; 2018. p. e4154.
12. Prayudha A, Simandjuntak RM, Sumarta NPM. Musculoskeletal disorder risk level evaluation of posterior maxillary tooth extraction procedures. *Dent J (Majalah Kedokt Gigi)*. 2019;52(1):18.
13. Wibowo H, Berniyanti T, Sunariani J. Correlation between working position of dentists and malondialdehyde concentration with musculoskeletal complaints. *Dent J (Majalah Kedokt Gigi)*. 2017 Mar 31;50(1):32-5.
14. Bhandari S.B., Bhandari R., Uppal R.S. GD. Musculoskeletal Disorders in Clinical Dentistry and Their Prevention | *Journal of Orofacial Research*. *J Orofac Res*. 2013;3(2):106-114.
15. De Carvalho MVD, Soriano EP, de França Caldas A, Campello RIC, de Miranda HF, Cavalcanti FID. Work-related musculoskeletal disorders among Brazilian dental students. *J Dent Educ*. 2009 May;73(5):624-30.
16. Sasso Garcia PN, de Araujo Gottardello A, Presoto C, Bonini Campos JD. Ergonomic work posture in undergraduate dentistry students: Correlation between theory and practice. *J Educ Ethics Dent*. 2015;5(2):47.
17. Nutalapati R., Gaddipati R., Chitta H., Pinninti M. BR. Ergonomics in Dentistry and the Prevention of Musculoskeletal Disorders in Dentists. *Int J Occupational Heal*. 2011;2(3):45-7.
18. Munshi, F.R. ASC and MM. Prevalence of Musculoskeletal Disorders and Psychosocial Aspects among Dentist-A Survey. *Int Arch Integr Med*. 2016 ;3(8):185-92.
19. Kumar DK, Rathan N, Mohan S, Begum M, Prasad B, Prasad ERV. Exercise Prescriptions to Prevent Musculoskeletal Disorders in Dentists. *J Clin DIAGNOSTIC Res*. 2014;8(7).
20. Gupta G, Bhat M, Gupta A, Mohammed T, Bansal N. Ergonomics in Dentistry. *Int J Clin Pediatr Dent*. 2014 Apr;7(1):30-4.
21. Abate M, Vanni D, Pantalone A, Salini V. Cigarette smoking and musculoskeletal disorders. *Muscles Ligaments Tendons J* [Internet]. 2013 Apr;3(2):63-9.
22. Abichandani S, Shaikh S, Nadiger R. Carpal tunnel syndrome - An occupational hazard facing dentistry. Vol. 63, *International Dental Journal*. 2013. p. 230-6.
23. Haddad O, Sanjari MA, Amirfazli A, Narimani R, Parnianpour M. Trapezius muscle activity in using ordinary and ergonomically designed dentistry chairs. *Int J Occup Environ Med*. 2012 Apr;3(2):76-83.
24. ShamsHosseini N, Vahdati T, Mohammadzadeh Z, Yeganeh A, Davoodi S. Prevalence of Musculoskeletal Disorders among Dentists in Iran: A Systematic Review. *Mater Socio Medica*. 2017;29(4):257.
25. Anghel M., Argesanu V., Talpos-Niculescu C. LD. Musculoskeletal disorders (MSDs)-Consequences of prolonged static postures. *J Exp Med Surg Res*. 2007;