Ergonomic position and musculoskeletal disorders in Hasanuddin University Dental Hospital, Indonesia

Posisi ergonomik dan gangguan muskuloskeletal di Rumah Sakit Gigi dan Mulut Universitas Hasanuddin, Indonesia

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ABSTRACT

Musculoskeletal disorders (MSDs) are the single most common cause of long-term pain and disability affecting hundreds of millions of people, which have been reported to be work-related. Dentist is one of the professions with the highest risk of developing this disease. This study aims to see the level of complaints, assess the musculoskeletal risk and attacks in students at the Hasanuddin University Dental Hospital. A cross-sectional study was conducted on 83 residents and dental interns. A structured questionnaire was employed to gather data, the Nordic Musculoskeletal Questionnaire (NMQ), Rapid Entire Body Assessment (REBA) and Rapid Upper Limb Assessment (RULA), Quick Exposure Check (QEC). The data were analyzed using SPSS software (version 22) with Chi-Square significance and Pearson correlation test. Strong positive correlation was found between the existing incidence and risk (r=0.832) and there was a very significant relationship between incidence and MSDs ($p<0.01$). It was concluded that there is a relationship between ergonomic position and musculoskeletal disorders in students at HUDH. The high prevalence of MSDs and the high level of risk, as well as the attack rate based on REBA and QEC indicate im-proper and incorrect ergonomic posture habits.

Keywords: musculoskeletal, ergonomic, rapid entire body assessment, rapid upper limb assessment

ABSTRAK

Gangguan muskuloskeletal (GMS) adalah satu-satunya penyebab paling umum dari rasa sakit dan kecacatan jangka panjang yang mempengaruhi ratusan juta orang, yang telah dilaporkan terkait dengan pekerjaan. Dokter gigi merupakan salah satu profesi dengan risiko tertinggi berkembangnya penyakit ini. Penelitian ini bertujuan untuk melihat tingkat keluhan, menilai risiko muskuloskeletal dan serangan pada mahasiswa di Rumah Sakit Gigi Mulut Universitas Hasanuddin. Sebuah studi *cross-sectional* dilakukan pada 83 residen dan dokter gigi magang. Kuesioner terstruktur digunakan untuk mengumpulkan data, digunakan kuesioner *Nordic Musculoskeletal Questionnaire* (NMQ), *Rapid Entire Body Assessment* (REBA) dan *Rapid Upper Limb Assessment* (RULA), *Quick Exposure Check* (QEC). Data dianalisis menggunakan software SPSS (versi 22) dengan signifikansi Chi-Square dan uji korelasi Pearson. Korelasi positif yang kuat ditemukan antara kejadian dan risiko yang ada (r=0,832) dan ada hubungan yang sangat signifikan antara kejadian dan GMS ($p<0,01$). Disimpulkan bahwa ada hubungan antara posisi ergonomis dengan GMS pada mahasiswa di RSGM Unhas. Prevalensi MSD yang tinggi dan tingkat risiko yang tinggi, serta tingkat serangan berdasarkan REBA dan QEC menunjukkan kebiasaan postur ergonomis yang tidak tepat dan tidak benar.

Kata kunci: muskuloskeletal, ergonomi, *rapid entire body assessment*, *rapid upper limb assessment*
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INTRODUCTION

Musculoskeletal disorders (MSDs) are commonly found worldwide and are one of the most common causes of long-term pain and disability affecting hundreds of millions of people, which have been reported to be work-related. The World Health Organization (WHO) and the United Nations (UN) has recognized this fact with the approval of bone and joint 2000-2001.[1] In the United Kingdom, around 43.4% of complaints and injuries are due to MSDs. Forty-five percent of these injuries are found on the back, 22% on the hands, and 13% on the arms.[2] Other data stated that in America there are about 6 million cases of MSDs per year or an average of 300-400 cases per 100,000 workers. Musculoskeletal complaints contributed 29% of the total number of causes of occupational accidents and diseases. The incidence of this condition increased by 6% from the previous year to 155 cases per 100,000 workers.[3] In Indonesia, based on the results of a 2005 study conducted by the Ministry of Health, there were approximately 40.5% workers who suffer from work related diseases. Out of all disorders experienced by 482 workers in 12 districts/cities in Indonesia, 16% of them were MSDs; in 2010 there were 168,768 hospital visits due to this matter, the second highest after respiratory infections. Research Center for Health Studies in 2006-2007 showed that 40-80% of workers reported musculoskeletal complaints.[4] The MSDs are characterized by discomfort, disability or constant pain in joints, muscles, tendons, bones, nerves, and blood vessels, which are caused or exacerbated by repetitive movements and prolonged or forced posture.[5]

Dentists are one of the most susceptible professions to get attack due to this disorder, including risk

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factors that could cause multiple pathologies, such as tendinitis, synovitis, tenosynovitis and bursitis.[6] About two out of three dental professionals complain of occupational pain in MSDs, and it is became the leading cause of early retirement (29.3%) in dentists worldwide. The risk factors for MSDs in dentists are poor static position for a prolonged period of time, repetitive movements, inadequate lighting, stress and psychological conditions, age, also obesity.[7] In general, dentists understand that the ergonomic position during dental treatment procedures is important, but most of the dentists kept working in the wrong position for a long time or seem forced due to their effort to shorten working time. This requires more attention from government and also the hospital itself.

Law Number 23 of 2003 concerning health, Article 23 states that all workplaces that are prone to disease, workplaces that have a risk of health hazards, and workplaces that have at least 10 employees, are obliged to implement occupational safety and health (K3) measures. Hospitals, health centers, clinics, community health centers, laboratories are workplaces that are included in the categories mentioned in the Law, because these places could pose some hazards and could interfere with the worker's health, furthermore this hazards are not limited only to those who work there but also to the patient. Hazards lurking in the hospital is not only limited to infectious diseases but also potentially from inappropriate ergonomic application, fire, accidents from electrical installation, radiation, anesthesia gasses, and hazardous chemicals.[8] The hospital head is responsible for occupational safety and health, and is obliged to carry out LBP case management as a form of protection of workers' rights in accordance with statutory regulations, in order to prevent financial and non-financial losses for both workers and hospitals. One of the efforts to prevent MSDs, in this case reducing risk, is by improving the ergonomics of work facilities and infrastructure, as well as considering human limitations and the health problems that can result from it.[9]

In Indonesia, the prevalence of MSDs complaints in dentistry is not well documented, and the risks as well as attacks from MSDs in dentists have not been identified using a standard tool. By assessing risk and attack using standardized tools, dentists can identify the level of risk and attack of MSDs, which are then used to take appropriate action. The purpose of this study was to see the level of complaints, assess the risk as well as the MSDs attack in students at a dental hospital.

METHODS

A cross-sectional study was conducted on 83 students, residents and dental interns, at the Hasanuddin University Dental Hospital. Data were collected proportionally according to the both respondents and the researcher's convenience, accompanied by informed consent. The inclusion criteria are: respondents who had at least 1 year of clinical experience or had passed all clinical departments; whereas respondents with a history of uncontrolled systemic disease and a history of trauma affecting the musculoskeletal system were excluded. Ethical clearance was obtained from the Hasanuddin University Dental Hospital Research Ethic Committee (0279/PL.09/KEPK FKG-RSGM Unhas/2019 and protocol number UH 17120282). Nordic Musculoskeletal Questionnaire (NMQ) method was implemented in this study to determine MSDs complaints in the form of discomfort, soreness, or pain in any of the 9 regions of the body and can identify MSDs in respondents during dental and oral care procedures for the last 12 months or 7 days and limitations of daily activities due to the symptoms that arise. The NMQ has been recognized internationally for the standard evaluation of MSDs, this questionnaire was developed by Kourinka in 1987 and modified by Dickinson in 1992.[10] Quick Exposure Check (QEC),[11-12] Rapid Upper Limb Assessment (RULA) scores,[13] and Rapid Entire Body Assessment (REBA)[14-15] was used consecutively every 10-15 minutes to observe each respondent during dental and oral care procedures and to evaluate the risks and MSDs attacks. The RULA method was used to detect risk factors for MSDs in the upper limbs on respondents' body posture during dental and oral care treatment designed by Lynn McAttamney and Nigel Corlett.[13] Whereas, the REBA method was used to detect risk factors for MSDs as a whole to body posture during the action designed by Lynn McAtamney and Sue Hignett.[14] The QEC method is a physical (musculoskeletal) and psychological assessment of the respondent's ergonomic position during treatment developed by Guangyan Li and Peter Buckle in 1999.[11] Assessment were carried out from two sides, namely the observer's assessment (Observer's Assessment Checklist) and the assessment of the respondent (Worker's Assessment Checklist).[12] Data analysis was carried out using SPSS software version 22. Descriptive statistics (mean, standard deviation, frequency, percentage) and inferential statistics were used. Chi-square significance test for comparison and to see the p-value ($p<0.05$). The Pearson correlation test was applied to understand the correlation between attack and risk.

RESULTS

Table 1 shows that of the total respondents, 28,9% were residents and 71.1% were dental interns, 73.5% were female, 63.9% were unmarried, 88.0% of the respondents were muslim, the mean age of respondents was 26.41 (±5.1) years, and a mean BMI value of 23.52

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Table 1 Respondents' sociodemographic and education characteristics

Variable	Category	n (%)
Sociodemography		
Education	Dental interns	59 (71.1)
	Residents	24 (28.9)
Marital status	Married	30 (36.1)
	Unmarried	53 (63.9)
Religion	Moslem	73 (88.0)
	Catholic	1 (1.2)
	Christian	8 (9.6)
	Buddhist	1 (1.2)
Gender	Male	22 (26.5)
	Female	61 (73.5)
Age	Mean ± SD: 26.41 ± 5.1 years, Interval: 21 – 48 years	
Body Mass Index (BMI)	Mean ± SD: 23.52 ± 3.49, Interval: 16.23 – 33.30	
Education		
Education period	Mean ± SD: 4.57 ± 3.30 years, Interval: 1,75 – 16 years	
Number of patients per day	Mean ± SD: 3.59 ± 3.37, Interval: 1 – 15 people	
Daily working hour	<8 hours	45 (54.2)
	≥8 hours	38 (45.8)

Source: Primary data, 2019

Table 2 Risk levels and MSDs attacks analyzed with REBA/ RULA and QEC during dental treatment

Variable	Category	n(%)
Risk assessment (RULA)	Low risk	9 (20.0)
	Moderate risk	11 (24.4)
	High risk	19 (42.2)
	Very high risk	6 (13.3)
	Mean ± SD: 4.49 ± 1.65, Interval: 2 – 7	
Risk assessment (REBA)	Low risk	4 (10.5)
	Moderate risk	15 (39.5)
	High risk	16 (42.1)
	Very high risk	3 (7.9)
	Mean ± SD: 7.0 ± 2.65, Interval: 2 – 11	
Risk assessment (QEC)	Low attack	13 (15.7)
	Moderate attack	26 (31.3)
	High attack	42 (50.6)
	Very attack	2 (2.4)
	Mean ± SD:91.46 ± 18.17,Interval:58-126	

Source: Primary Data, 2019

(± 3.49). In terms of educational characteristics, the mean educational period was 4.57 (±3.30) years, the mean number of patients per day was 3.59 (±3.37) patients, and most respondents worked less than 8 hours per day (54.2%).

For the residents, lower back and neck region (70.8%) had the most complaints in the last 12 months, followed by upper back and shoulders (54.2%), hips (45.8%), hands or wrists (29.9 %). The knee region (12.5%) was the region least complained by the residents in the last 12 months. Meanwhile, for the dental interns the neck region (57.6%) had the most complaints in the last 12 months, followed by shoulders (54.2%), upper back (47.5%), and lower back (44.1%). The elbow region (10.2%) was the region least complained by the dental interns in the last 12 months.

Among residents, the neck region (33.9%) had the most complaints in the last 7 days, followed by shoulders (28.8%), lower back (25.4%), and legs (23.7%). Elbow region (1.7%) was the region least complained by the residents in the last 7 days. Meanwhile, among dental interns the hip and lower back region (25.0%) had the most complaints in the last 7 days, followed by neck (16.7%), shoulders (12.5%), and legs and upper back (8.3%). Elbow, knee, and hand region (4.2%) were the regions least complained in the last 7 days.

Table 2 shows that of the 83 residents and dental interns, according to the RULA score, 42.2% were categorized as high risk for MSDs, followed by 24.4%, 20.0% for moderate risk category and low risk category for MSDs, respectively. The mean RULA score was 4.49 ± 1.65. The REBA score of 42.1% is categorized as high risk of MSDs, followed by 39.5%, 10.5% of moderate risk category and low risk of MSDs, respectively. The mean score of RULA was 7.0±2.65. Meanwhile, on the QEC score, 50.6% of residents and dental interns were categorized as having high MSDs attacks, followed by 31.3%, 15.7% were categorized as moderate attacks and low musculoskeletal attacks, respectively. The mean QEC score was 91.46 ± 18.17.

Table 3 shows a very strong positive correlation between the level of attack based on the QEC score and the level of risk based on the RULA score with a final score of 0.494, which mean the correlation is very significant ($p<0.01$; $r = 0.494$). Likewise, the level of attack based on the QEC score and the risk level based on the REBA score showed a very strong positive correlation with a final score of 0.553, which shows a very significant correlation ($p<0.01$; $r = 0.553$).

In Table 4 chi-square test results show statistically significant associations between age, education period, and daily working hours with MSDs ($p<0.05$). Other sociodemographic characteristics, such as gender and BMI did not show a statistically significant association with MSDs.

At Table 5, it shows a very significant relationship between the level of risk based on RULA and REBA scores with MSDs in residents and dental interns (p-value less than 0.01); and attack rate according to QEC score also showed a very significant association with MSDs ($p <0.01$).

DISCUSSION

Dentists are at high risk of developing MSDs due to repetitive activities for a long period of time or for-

Table 3 Relationship between MSDs risks and attacks in respondents

Correlation		RULA Score	REBA Score	QEC Score
Score RULA	Pearson correlation	1	.a	.494**
	Sig. (2-tailed)		.	.001
	n	45	0	45
REBA Score	Pearson correlation	.a	1	.553**
	Sig. (2-tailed)	.		.000
	n	0	38	38
QEC Score	Pearson correlation	.494**	.553**	1
	Sig. (2-tailed)	.001	.000	
	n	45	38	83

**. Correlation is significant at the 0.01 level (2-tailed).
.a. Cannot be computed because at least one of the variables is constant

Table 4 Relationship between respondent characteristics and MSDs

Variable	Category	MSDs n (%)	p-value
Age (Year)	≤ 25	38 (54.3)	0.004*
	26 – 30	18 (25.7)	
	31 – 35	10 (14.3)	
	>35	4 (5.7)	
Gender	Male	20 (28.6)	0.328
	Female	50 (71.4)	
***Body Mass Index* (BMI)**	Underweight	3 (4.3)	0.130
	Normal	51 (72.9)	
	Overweight	11 (15.7)	
	Obese	5 (7.1)	
Education Period (Year)	≤ 2	27 (38.6)	0.002*
	3 – 7	28 (40.0)	
	8 – 12	13 (18.6)	
	> 12	2 (2.9)	
Daily working hour	<8 hours	33 (47.1)	0.000**
	>8 hours	37 (52.9)	

*Significant correlation p < 0.05
**Significant correlation p < 0.01
Source: Primary data, 2019

Table 5 Relationship between attacks and risks during dental procedures and MSDs in respondents

Variable	Category	MSDs n (%)	P-value
RULA	Moderate risk	10 (28.6)	0.000**
	High risk	19 (54.3)	
	Very high risk	6 (17.1)	
REBA	Moderate risk	16 (45.8)	0.017*
	High risk	16 (45.7)	
	Very high risk	3 (8.6)	
QEC	Moderate attack	26 (37.1)	0.000**
	High attack	42 (60.0)	
	Very high attack	2 (2.9)	

*Significant correlation p < 0.05
**Significant correlation p < 0.01
Sumber: Primary data, 2019

ced posture due to the feeling of being rushed. The prevalence of MSDs varies across professional groups and in specific areas. This study examined the prevalence and distribution of MSDs with complaints, such as pain, stiffness, numbness, fatigue, discomfort associated with the risk and attack of these disorders in a cross-section of the dental population. According to the results of the research with 83 respondents, the majority of the subjects were dental interns, were female, unmarried, and almost all were moslem. According to the WHO category, the mean age of respondents is in the category of adolescents or youths with the oldest age of 48 years and the Body Mass Index (BMI) category is normal or ideal. In educational characteristics, mean education period is 4.57 years, the average number of patients per day is 3 patients with a maximum number of 15 patients per day, and most respondents work for <8 hours per day. The results of this study indicate that among residents and dental interns, the lower back and neck regions had the most complaints in the last 12 months. Meanwhile, in the last 7 days, most residents complained about the neck region, as well as the hip and lower back region among dental interns, this is supported by the research conducted by Sultana, et.al[16] and Emmanuel, et.al.[17] In comparison, there are other research, which stated that the prevalence of MSDs was much higher in dentists in the last 12 months based on observations from various countries, such as USA (76%),[18] India (78%),[19] Australia (87.2%),[20] Poland (92%),[21] Brazil (65.6%),[22] Saudi Arabia (77.9%),[23] and Bangladesh[40] stated that 90% of dentists experienced musculoskeletal pain during work in the last 3 months. In this study, the RULA and REBA scores of most respondents were categorized as high risk of MSDs, indicating the need for further examination and changes in the implementation of ergonomic positions. Meanwhile, on the QEC score, most respondents were categorized as having a high level of MSDs attack, indicating the need for further investigation and treatment in the near future. The correlation coefficient on the final score of the QEC attack level and the risk level score of REBA and RULA shows that the relationship between attack and risk is a very strong positive correlation, this is supported by the research by Yasobant and Rajkumar.[24] Chi-square test results show that a significant statistical relationship was found in the pe-

riod education and weekly working hours with MSDs. This is almost similar to the research by Rafie, et.al[25], which explains that the longer the working period and the higher the hours daily working hour is, the higher the MSDs complaints. Meanwhile, other sociodemographic characteristics, such as age, gender, and BMI did not show a statistically significant relationship between groups with MSDs and without disorders, this is similar to the study by Tinubu, et.al.[26] This study showed a very significant relationship between the risk level based on RULA and REBA scores with MSDs in respondents, as well as the relationship between attack rates based on QEC scores and MSDs.

Based on the results of the research that has been conducted, it can be concluded that there is a relationship between ergonomic position and MSDs in students at Hasanuddin University Dental Hospital. The high prevalence of MSDs and the high level of risk, as well as the attack rate based on REBA and QEC indicate improper and incorrect ergonomic posture habits.

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