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Research Report

Correlation between working position of dentists and malondialdehyde concentration with musculoskeletal complaints

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ABSTRACT

Background*: Musculoskeletal complainstof dentists have become common issues in dentistry since the awkward positions during treating the patients; such as position of a dentist who bends towards the patient, moving abruptly, twisting the body from a side to another side. All those movements are done several times in long term. Such high level of activity without sufficient recovery time may lead to an oxidative stress, so it will affect on the musculoskeletal and concentration of malondialdehyde (MDA) in blood.* ***Purpose:*** *The purpose of this study was to identify the correlation between MDA concentration on the risk of musculoskeletal complaint on dentist with working position of maxilla dental patching at community health center(Puskesmas) in Surabaya.* ***Method:*** *This study was observational analytics using cross sectional approach with cluster random sampling technique. The total samples were 19. Musculoskeletal complains assesment is conducted using a Nordic body map questionaire that devided into 4 scores. Working position of samples were asseses using Ovako working posture analysis (OWAS). Bloos sampling was conducted to examine the concentration of MDA.* ***Result:*** *From data analysis result using Spearman correlation test, it was found that there was a significant correlation between working position and musculoskeletal complaint using Spearman correlation test and the p value obtained was<0.05. This research also found that there was a significant correlation between malondialdehyde concentration and musculoskeletal complaint using Pearson correlation test and the p value obtained was <0.05.* ***Conclusion:*** *There was a correlation between working positions of dentists and musculoskeletal complaints. There was a correlation between working position and MDA concentration with the musculoskeletal complaints.*

Keywords: *malondialdehyde; musculoskeletal complaint; working position*

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INTRODUCTION

Musculosceletaldisorders (MSDs) is a chronic disorder on muscles, tendons and nerves caused by repetitive use of energy, rapid movement, enormous use of energy, contact with pressure, awkward or extreme posture, vibration, and low temperature.[1] Dentist is a profession with frequent MDSs due to the works. From the literatures, it can be identified that prevalence of MSDs on dentists in Saudi Arabia is 82.9%. In Australia, musculoskeletal disorder reaches 87.2%, in India it is 78%, Lithuania 86.5%, and Turki reaches 94%. From those data, it can be seen that the high prevalence of musculoskeletal prevalence on dentist in other countries.[2]

In Indonesia, the number of incidents is unidentified since there has been no data provided about the prevalence of musculoskeletal complained by dentists in Indonesia According to the result of screening conducted at Faculty of Dentistry, Universitas Indonesia using body discomfort map and brief survey as instruments, which found that 80% of dentists who work in the clinic experience musculoskeletal disorder, particularly on neck, shoulders, forearms, upper arms, hands and back.[2]

One of the causes of musculoskeletal syndrome experienced by dentists is because the dentists assume that

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they are the one who should make moves to get close to the patients rather than they should arrange patient's sitting position on the dental chair. Most musculoskeletal disorders among dentists occur since the dentists are positioning their body unconsciously that do not support their movement during treating the patients. When preparing for dental or pulling of the teeth, for example, sometimes the dentist frequently bends towards the patient, move abruptly, twist the body from a side to another side. All those movements are done several times for prolonged period.[3] Musculoskeletal disorder is also proven to contribute in the decrease of productivity and even finish their professional career earlier. Obviously, this risk is a serious matter so that it requires a preventive treatment and education starting from the time when the dentists are still in their learning period at faculty of dentistry.[4]

The activities of dentists and a lack of attention for their comfort when treating the patient could be a workload for the dentists. Activities and the workload may cause oxidative stress. Oxidative stress is a condition where there is an imbalance between free radicals production or reactive oxygen species (ROS) with the antioxidant, where the level of free radical is higher compared to the antioxidant.[5]

Several results of the research exhibits that the level of free radical increases after performing activities or exercises signified with the occurring of increasein lipid hydroperoxide.[5] In other words, oxidative stress is a condition where there is an imbalance between free radical and antioxidant. Oxidative stress is a component on the mechanism of tissue damage in human. Oxidative stress can be identified by having a higher level of malondialdehyde (MDA) serum or tissue.[6] The main indicator utilized to identify the presence of lipid peroxide and the parameter of incurring oxidative stress is MDA. MDA is one of the substances whose molecule weight is quite light which is generated as the final product of lipid peroxide within the body due to free radical reaction.[7]

MDA is formed from lipid peroxyde (lipid peroxidation) on cell's membrane namely free radical reaction (hydroxyl radical) with polyunsaturated fatty acid (PUFA). While MDA level increase, it shows that there is a lipid peroxidation process, which is highly potential causing complication whether it is microvascular or macrovascular.[6]

The activities conducted by the dentists without sufficient recovery time will lead to oxidative stress so it may affect on musculoskeletal complaints and concentration of MDA. From the previous backgroundsof the study, this study aimed to identify whether there was a correlation between concentration of MDAin blood and musculoskeletal complaint on the subject of dentists.

MATERIALS AND METHODS

This research is categorized into observational analytic research using cross sectional approach. Sampling technique used in this research was cluster random sampling using 19 partisipants. All partisipants were dentists. Partisipants criteria in this research are: maximum age of 50 years old, not yet menopause and are not in the middle of period (during blood sampling) for female, maximum tenure of 5 years, physically and mentally healthy, and were willingly to act as research subjects.

Musculoskeletal complaint assessment is conducted using a Nordic body map questionnaire. This questionnaire provides picture of human body which has been categorized into 9 main parts, namely: neck, shoulders, upper back, elbows, lower back, wrists/hands, hip/bottom, knees, heels/feet. A Nordic body map questionnaire is divided into 4 scores, namely low between score of 0-20, medium between score of 21-41, high between score of 42-62, and very high between score of 63-84.

This research also assessed the working position of dentist using an Ovako working posture analysis (OWAS) method. OWAS method is a simple method and is utilized to assess body posture during working. Working position assessment using this method is by providing risk score on the back parts of the body (4 positions), arms (3 positions), feet (7 position), and loading (3 intervals).[8] According to the observation on the posture which has been conducted, it may identify the urgency of remedial action on such posture through the classification of the 4 action categories from scale 1 to 4. Combination of the four digit numbers then will provide us an overview of which action categories of the posture that we observe is located at. Manually, we may identify the score of action category by looking at the combination of those four numbers. [8]

Blood sampling was conducted to examine the concentration of MDA, which was conducted using syringe to take the vein blood samples for 2cc. After that, the blood samples were insertedinto red tubes and delivered to the laboratory for centrifuge and to take 0.5 ml the serum. The serum was processed by adding cold phosphate-buffered saline (PBS) solution, 15% trichloroacetic acid (TCA) and 0.37% 2-thiobarbituric acid (TBA) in 0.25 N hydrochloric acid (HCl). After it was cooled down, serum was centrifuged and a measurement on MDA concentration according to MDA supernatan absorbent score was conducted using microprocessor controlled UV/Visible Range spectrophotometer (Boeco, Hamburg, Germany).

RESULTS

In this research, working position of respondent was identified using an OWAS method. Table 1 shows that the total number of respondents with the highest frequency were 10 respondents (52.6) of which the score was 2. Meanwhile, the total number of those with the lowest frequency was 3 respondents (15.8%) of which the score was 1. Most respondents in this research had medium muscoskeletal complaint risk level, which means that their working position (posture) had several effects, which may harm the musculoskeletal system.

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In this research, musculoskeletal complaint was assessed using a Nordic Body Map questionnaire. From the classification, the risk level was divided into four levels such as low, medium, high, and very high levels. Table 1 shows that among 19 respondents, there were only low, medium, and high risk levels. 11 respondents (57.9%) experienced low level of complaints, 5 respondents (26.3%) experienced medium level of complaints and 3 respondents (15.8%) experiencedhigh levelcomplaints.

The statistical test result using Spearman correlation test shows a significant correlation between working position and musculokseletal complaints. The statistical test result using Pearson correlation test shows a significant association between MDA concentration in blood and musculokseletal complaints (Table 2).

DISCUSSION

Assessment of dentist's working position in this research utilized an ovako working posture analysis (OWAS) method, which is an ergonomical evaluation method to observe working posture at back, arms, and limbs parts objectively. An OWAS identifies several postures, which commonly occur on an occupation (particularly manufacture). Body posture that includes back, arms, and limbs has particular codes so that a result of OWAS evaluation may provide a series of 7 digit numbers. The first digit of the code represents back posture, the second digit represents arms posture, the third digit for feet limbs posture, and the fourth digit is the code for the load handled by the worker. The next two digits describe the sectional code of work set whose posture is being observed.[9]

Table 1. Frequency of working position of respondents and respondents' musculoskeletal complaints among dentists at Community Health Center (Puskesmas) in Surabaya in 2016

Risk categories (OWAS Scores)	Frequency (People)	Percentage (%)
Low (1)	3	15.8
Average (2)	10	52.6
High (3)	6	31.6
Very high (4)	0	0
Total	19	100
Musculoskeletal complaints		
Low	11	57.9
Average	5	26.3
High	3	15.8
Total	19	100

Table 2. Analysis of association between working position and MDA concentration in blood and respondents' musculoskeletal complaints among dentists at Community Health Center (Puskesmas) in Surabaya in 2016

Independent variable	Dependent variable	P	Explanation
Working position (OWAS)	Musculoskeletal complaints	0.011	Related
MDA	Musculoskeletal complaints	0.048	Related

Results of this research showed that there was a significant correlation between working position and musculoskeletal complaints, which means that there was an association between the incidents of musculoskeletal complaints and working position of dentists. These results showed the working position of dentists with long duration and frequency, which may lead to a risk incurring musculoskeletal complaints. When administering a treatment, a dentist perform the treatment in the position of bowing the body and bowing the neck in long duration, so that it may lead to the possibility of vertebral injury. Data on results of this research is shown in table 1, which says that if the dentists do not have sufficient break, it may harm the dentists.

Working positions of the subjects in treatment action are mostly conducted in standing, bowing position in long duration repetitively and the neck, which tends to go upfront. This is in line with the research conducted by Ikrimah[10] who stated that the complaints experienced by the workers due to bowing working position and twisting movement on hip area, bowing neck and repetitive movements without any interval of sufficient rest or break. Career in dentistry is shown by the presence of statical and stiff body position in executing treatments for the patients. The patients who are treated on dental chair will force the dentists to sit or standing while bowing in long duration. This kind of body position may cause the dentists experience sort of pain during their clinical practice or discomfort on neck, shoulders and backbone areas so that it may cause, among other things, musculoskeletal disorder in the form of low back pain.[3]

Standing position in long period is actually the body is only able to tolerate the standing-still pose in one position only for 20 minutes. If it is more than that period, tissue elasticity will gradually decrease and muscle pressure will increase so that there will be discomfort on back area. If such back muscles receiving static loads when the person is standing for such a long time, it may cause complaints in the form of damage on joints, ligaments and tendons. These complaints and damages which is commonly called as musculoskeletal or injury on musculoskeletal system.[8,11]

The works conducted in sitting position shows that the body parts being complained for are hip, back and neck area. Sitting position at musculoskeletal and vertebral should be retained by backrest so that it may prevent the body from back pain and fatigue. In addition, when sitting, the feet should be on footwear and on the sitting pose which allows for a bit movement and relaxation. Working position in sitting needs a smaller amount of energy compared to

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standing, therefore, it may decrease the amount of static muscle load at feet. The wrong sitting position may cause back problems such as hip and neck pain. Pressure on vertebral will increase during sitting, compared to when standing or lying down. Straining sitting position needs more muscle or back nerves activities. Therefore, sitting position may affect the performance of a worker. [11]

Dentists, in their clinical practice, often perform multiple extreme statical postures such as bowing their heads, bowing their bodies down, leaning their bodies, putting their hands up and rising their shoulders up. Such extreme positions may cause muscle fatigue and mechanical pain on neck, shoulders and lower hip. During working, the needs of blood circulation may increase from ten to twenty times. The increase of blood circulation on the working muscles enforces the heart to pump more blood. When the body is used to stand for a long duration, the muscles tend to work statically, of which this static muscle work is signified by muscle contraction for a long time, which is commonly according to body position. It is not recommended to continue the work of static muscle for long time since it may cause pain.[12]Arda stated that one of the triggers of back pain is sitting or standing in such position a long period, or the same repetitive movement, which makes the muscles become stiff (spasme).[13]

A musculoskeletal complaint occurred among dentists is not only caused by position factor during treatment, but the workload also provides several roles on musculoskeletal complaints. Too many patients, long period of treatment and business hours per day is the workload that should be done by the dentists. Excessive workloads may cause oxidative stress which lead to an increase on lipid peroxidation. Lipid peroxidation is a mechanism of cell's trauma, whether it is on plants or animals, therefore, lipid peroxidation is used as an indicator of oxidative stress on cells and tissues. MDAis a dialdehyde compound, which is the final product of lipid peroxidation within the body. MDA shows unsaturated lipid acid oxidation product by free radical. An increase of free radical will cause oxidative stress. An increase of oxidative stress is according to the increase of MDA forming.[14,15]

In this research, we found an association between MDA and musculoskeletal complaints on the subjects of dentists. These data explained the correlation between workloads and musculoskeletal complaints. These musculoskeletal complaints will increase free radical production and if it exceeds antioxidant resistance capacity, it may cause oxidative stress which is reflected by an increase in MDA concentration within the serum.[16]

In this research, MDA concentration in group of normal body mass index (>25 BMI) was higher than normal (18.5 BMI). This was probably signified by several things such as an increase of lipoprotein oxy-disability or antioxidant decreases. In a study, body weight loss can be specifically taking role in reducing MDA concentration as an indicator of change on oxidative stress and lipid profiles. MDA concentration significantly can be reduced when reducing body weight. MDA acts as peroxidase lipid indicator because this molecule is the main product of oxidative stress. [17]

The activities done by the dentists without sufficient recovery time will be a burden for the dentists. Excessive workloads may cause oxidative stress. The BMI is one of dentists' workloads, which significantly affects MDA concentration. It can be concluded that there was a correlation between working position of dentist and musculoskeletal compaint. There was a correlation between working position and MDA concentration with the risk of musculoskeletal complaint.

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