

# DENTIST'S WORKING POSTURE AND GLUCOSA LEVEL ON RISK OF MUSCULOSKELTAL DISORDER

*by* Titiek Berniyanti

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## DENTIST'S WORKING POSTURE AND GLUCOSA LEVEL ON RISK OF MUSCULOSKELTAL DISORDER

Titiek Berniyanti <sup>1</sup>, Desti Hersrining Pratiwi <sup>2</sup>

<sup>1</sup>Departement of Public Health Faculty of Dentistry University of Airlangga

<sup>2</sup>Magister of Dental Health Science Students Faculty of Dentistry University of Airlangga

Email: [berniyanti@gmail.com](mailto:berniyanti@gmail.com)

### ABSTRACT

Introduction: Ergonomics good work is important so that workability, efficiency and a high level of clinical treatment can be maintained throughout the working life of a dentist. The success of the application ensures high productivity, avoid illness and injury, and improve satisfaction among dentist. On the other hand, the application of which is not suitable can cause musculoskeletal disorders related to work. MSD prevalence of dentists in the world is quite high, in India 78%, and Turkey reached 94%. The aim of the study was to determine the relationship between the dentist's working posture and levels of glucose on the risk of MSD among dentist in the Surabaya Health Center. Method: The study design was an analytical observational with cross sectional approach conducted at the working dentist, filled maxillary posterior teeth. The sampling technique was using cluster random sampling with sample number of 19 subjects. RULA method was used to analyzed working posture of the subject while MSD complaint were recorded using Nordic Body Map. Data are coded and entered into the tabulation prior to analysis using a statistical test to see the correlation. Basic statistics are calculated, including the prevalence rate. Results and discussion: There was a relationship between the glucose levels with Nordic Body Map with significant value  $p= 0.025$ . While the significant relationship between the Dentist't working posture and Nordic Body Map was  $p=0.012$ .

**Keywords:** Musculoskeletal disorders, Glucose, Position

### INTRODUCTION

Musculoskeletal disorders (MSDs), which are problems of musculoskeletal system, are significant and costly workplace problems affecting occupational health, productivity and the careers of the working population. Musculoskeletal diseases, including pain, weakness and parasesthesia, are reported to be associated with wide range of occupations. Nearly 2 million workers suffer from musculoskeletal disorders each year. These problems are caused by repetitive, awkward, or stressful motions. Dental personnel had an increased risk of developing such disorders (Abduljabbar, 2000). Dentistry is a demanding profession involving high degree of concentration and precision. Dentists require good visual acuity, hearing, depth perception, psychomotor skills, manual dexterity, and ability to maintain occupational postures over long periods. Diminution of any of these abilities affects the practitioner's performance and productivity. Despite numerous advances in dentistry many occupational health problems still persist in modern dentistry [Muralidharan et al. 2013]. Musculoskeletal disorders is a disease that causes pain when the muscles receiving prolonged static load repeatedly and over a long time. One will experience symptoms ranging from mild to severe. How to work and working conditions strongly support the emergence of these musculoskeletal disorders, which can cause a damage to the muscles, nerves, tendons, joints, cartilage, and vertebral disc(Andayasari et al 2012).

The World Health Organization defines MSD as "a disorder of the muscles, tendons, joints, intervertebral discs, peripheral nerves and vascular system, not directly

resulting from an acute or instantaneous event but installing gradually and chronically". There are many types of factors responsible for MSD: occupational factors, medical factors (physical disorders, genetic predisposition, and age) and life style factors. Usually two or more factors trigger MSD. Work in dentistry is characterized by some body postures with different degrees of distortion. In this case the professional factors are represented by: prolonged static postures, repetitive movements, inadequate lighting, the excessive exertion of the small muscles, and the instrument tight grip, raised arms, static exertion of the muscles on long term, vibration (Anghel et al, 2007).

In the Decree of the Minister of Health no. 432, 2007 potential ergonomic hazards risk to health includes manual work (like lifting weights), awkward posture while doing the work, as well as repetitive tasks (repetitive). One of the causes of musculoskeletal syndrome with a dentist is a dentist only consider a comfortable position at the time of taking care of patients, but less attention to the consequences that would arise from an ergonomic position (Andayasari et al 2011).

The prevalence of musculoskeletal disorders in dentists in Saudi Arabia 82.9%. The reported prevalence studies in Australia reached 87.2%, India 78%, Lithuania 86.5%, and Turkey reached 94%. Based on the results of screening performed in FKG UI with instrument Discomfort Body Map and Brief Survey, found 80% suffered neck MSD mainly on the shoulders, forearms, hands, and back to the dentist who practices employment (Wijaya et al 2011). From the data shown high prevalence of musculoskeletal disorders in dentists. In the field of applied ergonomics in dentistry is a dentist working position to prevent musculoskeletal disorders. Musculoskeletal disorders can be avoided by raising awareness of posture during the work, redesigning the workspace to create a neutral position, examined the impact of instruments used in upper extremity pain, and follow sound practice to reduce work stress on the body dentists (Ivona et al 2014).

Proper ergonomic design is necessary to prevent repetitive strain injuries that can develop over time and can cause long-term disability (Gupta 20110). Tools and working environment, if not designed properly will cause inconvenience, inefficient, and ineffective. To obtain a way, attitudes, tools and working environment healthy and safe, is based on the ability, skill, and human limitations. With an ideal destination is set up such work is within the boundaries of where humans can tolerate, without causing abnormalities. Complaints of the musculoskeletal system is a complaint on the parts of skeletal muscle is perceived by someone from mild to very severe complaints. When the muscle receives static load repeatedly and for a long time, will be able to lead to complaints of damage to the joints, ligaments, and tendons (Tarwaka, 2015).

Glucose is the main product formed from the hydrolysis of complex carbohydrates in the digestive process and is a form of sugar that is normally found in the bloodstream. Excess blood glucose levels, especially after the absorption of food (carbohydrates). Excess glucose levels, through the mechanism of glikogenesis, stored in the liver and muscles as glycogen. The amount of glycogen that can be stored in the liver and muscle each about 5-8% and 1-3% by weight<sup>(10)</sup>. In the ergonomic working conditions can cause the body include the muscle fibers showed fatigue in prolonged submaximal work so as to cause a decrease in the glycogen reserves in the muscles. A decrease in the glycogen can lead to a weakening of contraction due to lack of sarcoplasmic reticulum  $Ca^{2+}$  (Silverthorn, 2014). These conditions can lower labor productivity, so please be aware of the risks posed to be given some alternative ways of solving problems.

With this, the researchers consider it necessary to do research related to glucose levels and working position with the working musculoskeletal complaints dental fillings

dentist in the clinic Surabaya.

## METHOD

This research uses observational analytic study with cross sectional approach. The population in this study are dentists who treat patients with posterior maxillary dental fillings that are in Health Center (Puskesmas) of Surabaya. Sub-populations in this study include: a. Premenopausal; b. Not menstruating (time of blood sampling); c. Minimum term of 5 years; d. Physically and mentally healthy; e. Willing to be sampled in the study. The sample in this study is a dentist who meet the criteria selected using a sample size with cluster random sampling.

The variables in this study are: the independent variable is the glucose level and the working position, the dependent variable is musculoskeletal disorders. Instrument of research is Ergo Intelligence software, glucometers, digital camera, stationery. Processing and analysis of data using statistical tests.

## RESULT

Tabel.1 Dentist's Working Posture and their Risk of Musculoskeletal Disorders Respondents On Health Center Of Surabaya 2016

Final Score (RULA)	Risk Category	Frequency	Percentage (%)
1-2	Low	0	0
3-4	moderate	3	15.8
5-6	High	7	36.8
7+	Very high	9	47.4
<b>TOTAL</b>		<b>19</b>	<b>100</b>

From the above table indicates that respondents with the highest frequency as much as 9 respondents (47.8%) with a final score of 7+ the very high risk category. It is necessary for an investigation and repairs as soon as possible at the working position the dentist when performing posterior maxillary dental fillings.

Table. 2 Analysis of Relationship Dentist Working Posture With Musculoskeletal Disorders Respondents On Health Center Of Surabaya 2016

Variables	Dependent variable	p	Information
Work position	Complaint	0,012	There is a relationship

The above table shows that the value of significance between the working position with musculoskeletal complaints at 0.018. This shows that there is a significant relationship between the working position with musculoskeletal complaints.

Table 3 Overview of Respondents Glucose Levels In Dentist On Surabaya Health Center 2016

Category	Frequency	Percentage (%)
Low	1	5.3
Normal	18	94.7
High	0	0
<b>TOTAL</b>	<b>19</b>	<b>100</b>

Based on the above table shows that as many as 18 respondents (94.7%) have blood sugar levels in the normal category. Category normal with examination results

between 70 mg / dl to 200 mg / dl in the low category examination results obtained below 70 mg / dl, while in the high category examination results above 200 mg / dl.

Table 4 Mean and Standart Deviasi Glucose Levels and Musculoskeletal Disorders Respondents On Health Center Of Surabaya 2016

variable	n	Results Statistics Description
		Average Standard deviation
Glucose	19	107.79 ± 24.478
Complaint	19	19.63 ± 15.148

From the above table shows the results mean standard deviation of each variable studied.

Table 5 Relationship Analysis of Glucose Levels With Musculoskeletal Disorders Respondents On Health Center Of Surabaya 2016

variables	Dependent	p	Information
Glucose	Complaint	0,025	There is a relationship

The above table shows that the value of the significance of blood sugar (glucose) with musculoskeletal complaints by 0.025. This shows that there is a significant correlation of blood sugar levels (glucose) with musculoskeletal complaints.

## DISCUSSION

In this study, method of Rula (*Rapid Upper Limb Assessment* technique) was used to asses Dentist's working posture to estimate the risk of disorders of the musculoskeletal system, especially on upper limb (Tarwaka,2015). The analysis using Rula's methods showed that most respondents received a score of seven (Silverthorn, 2014). This result can be interpreted that the Dentist's working posture on this study was on the area of a risk level three (3), which is a very high category. In this case, it means that something has to be done to reduce the risk musculoskeletal disorder among dentist.

From statistical tests, it is indicated that based on Rula's method, level of Dentist's working posture taken from sampled respondent has mean of  $6.00 \pm 1.333$ . Results of the analysis showed that there is a relationship between a working position with musculoskeletal disorders ( $p = 0.012$ ). This is because the majority of dentists in doing the patient using a standing position and bend in a long time repeatedly at the neck position is likely to come forward. Posture is one of the things that is most often associated with risk factors. Frequent or prolong bent over, bend, sit, stand too long or make a move on the part of the body is not ergonomic and can cause pain in the loin muscle. Bad posture while working with long period of time may cause the load on the musculoskeletal system.

In a standing position with feet not aligned, the body tilted forward, the neck is too advanced and the seating position is strained, as tilted sideways, bend forward, neck tilted an initial response from risk factors to the employment relationship which can become a habit over time, Working with the arm away from the body, *overextended* and shoulders do not move normally and requires a higher muscle strength can increase the risk of injury. For the upper arms and shoulders, they are in relaxed neutral position with the shoulders parallel to the floor and in the same plane, arms at his side. Posture and positioning factors in the body, such as rotating your upper body, raise your shoulders, rotate / turn his head, lift the elbows can increase the

risk of symptoms of musculoskeletal complaints (Cahyanto, 2009).

Recommendation of the *Occupational Safety and Health Administration (OSHA)* explained that the action ergonomics to prevent sources of the disease can be two ways, namely engineering (such as station design and work tools) and engineering management (such as the criteria and the organization of work). These preventive measures are intended to minimize and prevent *overexertion* their work attitude is not ergonomic. Ergonomic working attitude will accelerate muscle fatigue so that it will tend to be musculoskeletal disorders (Tarwaka, 2015).

Muscle only has the ability to contract and *relax* (relaxing). The analogy of the mechanism is as *pneumatic cylinder*, single activity with a spring system. Although virtually no spring in the human body. Muscles as the prime mover in the opposite direction to the other muscles known as antagonists movement that serves to control and restore the position of the hands and feet to the place of origin. In a slow and controlled movement, muscle both the prime mover and the antagonist are in a tense position (*tension*) during the movement. In a fast movement, automatically antagonist muscle *relaxes* (Wiradharma, 2012).

Adenosin triphosphate (ATP) is the biochemical way to store and use energy; bind myosin, allowing it to release actin and be in weak binding state (a lack of ATP make the this step impossible, resulting in the rigor state characteristic of rigor mortis); myosin then hydrolyzes the ATP and uses the energy to move into the cocked back conformation. the molecular events of skeletal muscle contraction cycle, will start the first cycle of rigid conditions / rigor that is when the head of myosin binds tightly to actin-G molecule, no nucleotide (ATP or ADP), which binds to the myosin. Furthermore, an ATP molecule binds to the myosin head. ATP bond lowers the binding affinity of actin against myosin, actin and myosin in spite of. ATP binding place at the head of the myosin hydrolyzing ATP to ADP and remove one mole of organic phosphate. Power stroke will begin after  $Ca^{2+}$  binding to troponin and myosin binding open. At the end of Power stroke myosin release ADP which is a product of both ATP. With the loss of ADP, head back myosin binds tightly to actin in rigid conditions. To end the contraction of the calcium to be released from the cytosol, the sarcoplasmic reticulum calcium will be pumped back into the lumen using the  $Ca^{2+}$  - ATPase. By decreasing the concentration of free  $Ca^{2+}$  in the cytosol, the balance interference occurs between  $Ca^{2+}$  bound and free.

Calcium will be so regardless of troponin tropomyosin shifts back cover binding site for myosin on the actin. When bridges cross off, the muscle fibers relax with the help of elastic fibers in the sarcomere and supporting tissue in the muscle (Silverthorn, et al 2014). This situation can be evaluated by changing the working attitude that is not ergonomically ergonomics. Subjective complaints such as skeletal muscle disorders and fatigue can be reduced by improving work station and more ergonomic working attitude (Wiradharma, 2012).

Two forms of carbohydrate that the body uses as energy is blood glucose and muscle glycogen (Fox et al 1993). Glucose is a form of carbohydrate that is most important. Glucose is the carbohydrate in food is absorbed into the blood in large quantities and is converted in the liver (Mayes PA, 2000). Glucose is broken down in the body to provide energy to cells or tissue and can be stored as energy in the cell, as glycogen (Mayes PA, 2004). Based on the analysis, the result  $p < 0.05$ , which means that there is a relationship between blood sugar levels with musculoskeletal disorders in dentists with  $p$  equal to 0.025. This is because the concentration of glucose in the blood plays an important role in energy metabolism<sup>29</sup>. Energy is needed for the physiological

processes that take place in the cells of the body. These processes include muscle contraction, formation and conduction of nerve impulses, secretion glands, the production of heat to maintain the temperature, active transport mechanism and a wide range of synthesis and degradation reactions (Widiyanto. 2008).

Glycolysis is one form of energy metabolism processes that can run anaerobically without the presence of oxygen. Glycolysis uses glucose deposits which will be largely derived from muscle glycogen or also of glucose present in the blood stream to generate ATP. Definition of glycolysis is the process of solving one molecule of glucose into two molecules of pyruvic acid and occurs in the cytosol (cytoplasm) in anaerobic state. The amount of ATP that can be generated in the process of glycolysis will be different and depend on the origin of glucose molecules. If the glucose molecules derived from the blood of the two pieces of ATP will be generated, but if the glucose molecule derived from muscle glycogen then 3 pieces ATP will be produced (Purnomo, 2013).

The mechanism used in the regulation of blood glucose levels is very dependent on the presence of glycogen storage in the liver. If glucose levels are low, glycogen in the liver akan broken down into glucose through a process of glycogenolysis and then travels in the blood to be sent to the skeletal muscle and other organs that need it, and if high blood glucose levels, the glucose to be absorbed by the network with the help of the hormone insulin. The role of insulin and glycogen is a control system feedback to maintain normal blood glucose concentrations. When the concentration of blood glucose is high, then the resulting secretion of insulin, insulin will further reduce the concentration of blood glucose in order to return to its normal value. So that when the condition of respondents increased blood sugar levels can increase the risk of musculoskeletal disorders as well as conditions at the time the blood sugar levels decreased (Guyton,2006).

Rise and fall of blood sugar levels one of which is influenced by the hormone cortisol. The hormone cortisol can stimulate gluconeogenesis (the formation of protein and carbohydrate by some other substance) by the liver, increase the speed of gluconeogenesis by 6 to 10 fold. This situation is mainly due to two effects of cortisol (Guyton,2006). First, cortisol increases all the enzymes needed to convert amino acids to glucose in the liver cells. It is produced from the effects of glucocorticoids to activate transcription of DNA in the nuclei heart in a way similar to the function of aldosterone in the kidney tubule cells, accompanied by the formation of messenger RNA which can then be used to construct the enzymes needed in the process of gluconeogenesis. Second, cortisol causes the transport of the amino acids of extra hepatic tissues, especially of muscles as a result, a growing number of available amino acids in the plasma to enter the process of gluconeogenesis in the liver and therefore would increase the formation of glucose. One effect of increased gluconeogenesis is an increase in the amount of glycogen storage in the cells of the liver (Guyton,2006).

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