



THE IMPORTANCE OF IMPLEMENTATION OF ERGONOMIC WORK PRINCIPLES IN DENTIST AS EFFORT TO PREVENT MUSCULOSKELETAL DISORDERS

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ABSTRACT

Musculoskeletal disorders that include the upper and lower spine, shoulders, and wrists are risk factors in the dentist profession. In some previous studies, prevalence of musculoskeletal disorders in dentists ranged from 25-85%. A number of technical factors such as dental units, work lights and other equipment used are not ergonomic. Non-technical factors such as how and position when treating patients is a risk factor that plays an important role to cause musculoskeletal disorders in dentists. Improving technical and non-technical risk factors can be done to prevent musculoskeletal disorders in dentists. Technical factors include standing position when caring for patients fixed with sitting position, ergonomic equipment (dental unit, desk, work light). Musculoskeletal Disorder's can be caused by various risk factors such as individual factors, occupational factors or biomechanics and psychosocial factors. Occupational factors associated with musculoskeletal disorders may result from ergonomic exposure in the form of awkward posture, static and repetitive motion. Ergonomics designs a system in which the location of work, methods of work, equipment, machinery, and work environment in accordance with the physical limitations and characteristics of workers. The main principle in ergonomics is to harmonize work with workers or "fitting the job to the worker". Occupational Safety and Health Administration (OSHA) recommends an ergonomic action to address musculoskeletal complaints in two ways, ie engineering techniques on station design and work tools, and management engineering in work organization.

Keywords : Ergonomics, Dentists, Musculoskeletal Disorders

INTRODUCTION

The dentist is one of the professions that has many potential dangers in his workplace including at the time when he is doing his work. This of course if left unchecked will cause interference to the dentist (Leggat, 2007).

The dentist in running his profession will spend a long time with a static position because it relates to his work that perform examination and treatment of dental and mouth patients. In performing examination and dental and oral care in general dentist has a position of hands and shoulders that remain stable for a long time. So that can result in injury, among others, on the neck, shoulders or

on the backbone. In addition, dentists in their daily work are required to perform care that requires care in a relatively small area of care. Therefore, it is not uncommon to find a dentist who does his job in an awkward position in a relatively long time with precision hand movements. This of course can pose a risk to the health of the body in the context of ergonomics. The Ministry of Health of the Republic of Indonesia / Departemen Kesehatan RI states that 40.5% of workers have health-related occupational diseases such as musculoskeletal disorders as much as 16.0%, 8.0% cardiovascular disorders, 6.0% neurological disorders, 1.3 skin disorders %, and nose throat ear disorders by 1.0% (Departemen Kesehatan RI, 2007).

Commonly dentists only pay attention to the comfort of the treated patients, but pay less attention to the comfort for themselves while caring for their patients. The dentist assumes that those who have to move to the patient rather than position the patient sitting on a chair. This makes the risk of musculoskeletal disorders can occur in the dentist (Furlong, 2000).

Most musculoskeletal disorders occur because the dentist is unconsciously at an unfavorable posture when treating the patient. When performing tooth preparation or extracting a tooth for example, sometimes the dentist leans toward the patient, moves abruptly, spins from one side to the other. The whole movement is done many times over a long period of time. This is what can cause musculoskeletal syndrome (Hamann, 2001, Dougherty, 1999). Although working with neutral posture can prevent or reduce the musculoskeletal syndrome, most dentists are unaware of the importance of ergonomic system benefits with a good position when treating patients (Sholihah, 2014). Good posture and correct need good equipment as well, for example the ergonomic shape of the seat operator can support the backbone in a good position (Dougherty, 1999, Mito and Fernandez, 2002)

MATERIAL AND METHODS

Ergonomic Principle

Ergonomics is derived from the Greek ergo means work and nomos means law. Ergonomic definition according to Occupational Safety and Health Administration (OSHA) is a human relationship with the work environment that does not result in a disorder. In general, ergonomics means the creation of a healthy work system, safe, and comfortable for humans. Basically ergonomic conditions are very beneficial because it can prevent musculoskeletal disorders and can reduce errors that can result in injury to the workers. In this connection, ergonomics is not only about feeling better physically, but also how to place the equipment in an accessible position that will increase efficiency and effectiveness (Sholihah, 2012). According to OSHA, musculoskeletal disorders associated with a person's work may occur when there is a mismatch between the physical needs of the work and the physical ability of the human body.

Interest with the science of Ergonomics has been known since the 19th century at that time was done limitation of working time workers working in mines / factories. This is the beginning of the development of Ergonomics in the world in the field of industry, so that ergonomics is often referred to as Human Factor (Sholihah, 2013).

Clark & Corlett says that Ergonomics is a Science that studies human capabilities and characteristics that affect the design of equipment, work systems and jobs aimed at improving efficiency, OSH and worker welfare (Sarkar and Shigli, 2012 Kroemer and Grandjean, 2004). While Wickens defines ergonomics is the science of studying human factors to design machines that can accommodate human limitations. The International Labor Organization (ILO) says that Ergonomics is a science that studies or measures work (Sholihah, 2013).

Ergonomics is a multidisciplinary science, a combination of health science and engineering science. In health sciences studied include human body anatomy, biology, physiology, health anthropology and psychology. While in the science of engineering, among others, studied engineering science, industry, design and mechanics. The discipline of health / medicine provides limits and explanations of human capabilities and limitations. The disciplines of engineering design tasks, workplace and work system. Ergonomic systems in the field of dentistry are not merely operator positions and tool designs, but the integration of the equipment used in dental practice (Dougherty, 1999).

Implementation of Ergonomic Principles

Implementation of ergonomics can be applied to the work environment, namely by making the workplace (workstation) in accordance with work needs and activities undertaken workers. In addition, by making or using work tools that fit the size of the worker's body, as well as in accordance with the movement of the movement and make sense of comfort when using it. Other implementations may be performed on the product, the result of a process, whereby the product is ergonomic for those using it. Ergonomic implementation can also be used in home environments, where the interior of the house can be made ergonomic, and use ergonomic tools or home furnishings so as to create a sense of comfort from the inhabitants of the house (Mali and Vyavahare, 2015; Van Niekerk, S.M et al, 2012).

Ergonomic Risk Factors

Some things that can increase the risk of ergonomics, among others (Sarkar and Shigli, 2012; Kroemer, and Grandjean, 2004):

1. Repetitive Movement
2. Use of Strength
3. Mechanical Stress
4. Static body attitude
5. Awkward position
6. Vibration
7. Temperature extremes (Cold or hot)
8. Stress

In doing the work and activity, need to note the good posture, that is (Sarkar and Shigli, 2012; Kroemer, and Grandjean, 2004):

1. No bowing
2. Do not squat
3. Do not turn the body
4. Height of workplace between center height and elbow height
5. Not reaching object / work tool exceeds shoulder height
6. Location of the object in the field of view (30 degrees from each eye 60 degrees)

Antropometry in Ergonomy

Theoretically, all equipment should be designed to accommodate all individuals, from the smallest to the largest, yet impossible to accommodate for everyone. A common approach is to design equipment / workplaces for a given percentile of the population. (1%, 5%, 90% or 95%). This is necessary because the automation process in the workplace must still take into account the human body sizes in the design of the workplace (Pirvu et al, 2014). The type of measurement that is often used is a static size that consists of length, width and thickness.

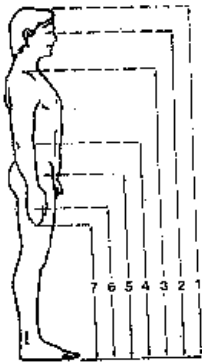


Figure 1. long size

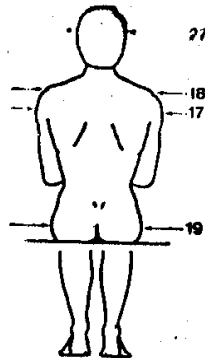


Figure 2. Wide size

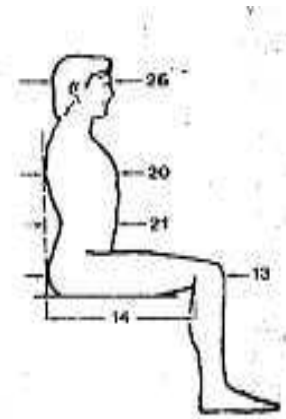


Figure 3. Thick Size

Risk of Work on Dentist

The dentist in performing his or her work has considerable potential hazards, including potential physical hazards such as vibration from a dental drill, electro magnetic waves from electrically used appliances, ultra violet rays from the appliance during the process of patching teeth, lighting, noise from the compressor or drill tool (Mansfield, 2005).

Potential biological hazards of viruses, and bacteria from the patient's oral cavity as well as the results of action performed on dental patients. The potential chemical hazard may result from the use of chemical substances while performing the process, such as Mercury, Methyl methacrylate, cyanoacrylate, Glutaraldehyde, ethylene oxide, N₂O, Halothane, cleaning fluids and latex glove materials (Leggat, 2007).

The potential dangers of ergonomics that the dentist encounters are repetitive movements, static working positions (sitting or standing) and strange movement positions such as power grip, pinch grip, pressing, hand extension, hand flexion, rotating, position head bowed, tilted, tengadah, back position bend, tilt, twisting, and so forth (Garcia et al, 2017). Potential psychosocial hazards experienced by dentists include relationships with colleagues, job stress targets.

Work health issues on Dentist

Based on research from Leggat, Kedjarune and Smith in 2007 (Leggat, 2007) found dentists in Belgium and Australia experienced Low Back Pain (54%) and 64% respectively. Meanwhile, the second largest case in Belgium was eye disorder (52%), in Australia a headache (58%). Cases of dermatoses in dentists are common in Norway (40%) and Australia (22%).

In addition Leggat et al found that cases of lower back pain is the most common cases found in

dentists in Australia and Saudi Arabia, while cases of shoulder pain is found mostly in the country of Denmark. Canada and the United States found the most musculoskeletal cases are carpal tunnel syndrome in the dentist (Leggat, 2007).

Design of dentist workplace

The inappropriateness between the size of the human body and the workplace will affect the attitude of the body while working. This can cause a variety of musculoskeletal disorders, ranging from pain to muscle injury & increase the risk for an accident.

Broadly speaking, the principle of designing a workplace should pay attention (Council on Dental Practice, 2004; Colin, 2002):

1. Principle of interest: the most important is generally placed close to the worker
2. The principle of the most common usage: the most frequently used should also be placed close to the worker
3. Functional principle: arranged in such a way that the function of the place settings in accordance with its designation and does not make it difficult at work
4. Principle of order: set work tools, facilities and infrastructure must be in accordance with the order that will be used so that will simplify the work and shorten the time diperlukan

The dentist's work has a certain job karakteristik, where precision work is required, by working in limited and narrow areas, and requiring long time and sometimes the object is slightly dark (the oral cavity) and requires special and specific equipment (Council on Dental Practice, 2004; Colin, 2002).

Dentist workplace components

Components of the dentist's workplace consist of a doctor's chair, patient chair, appliance table, lamp / light and appliance. Dentist in practice should always pay attention to his posture or body position to be always ergonomic and also should not do static body position for too long such as sitting, standing or checking the patient. Try to always be balanced in doing so. Adjusted high dentist seats with patient seats with comfortable seating, and works by bringing the patient's cursory closer together (Council on Dental Practice, 2004; Colin, 2002).

1. Dentist's chair

The characteristics of the dentist's chair are 5-foot, adjustable height, backrest as per the curve of the body, armrests can be adjusted. The dentist always uses an adjustable chair and there is a lumbar, thoracic and hand support.

2. Patient's seats

Patient seat is one of the things that must be considered. This is useful for patients to feel comfortable during the examination. The patient's seatrest should be adjustable, that the backrest can be upright or supine. This is tailored to the needs. The patient's leg should be straight, so that the patient feels more comfortable and relaxed. The height of the patient's seat can be set by the dentist by using the foot. It is endeavored to minimize the use of the feet by making the patient comfortable in a horizontal position.



Figure 4. Patient's seats

3. Place the tool

The place for dental tools should be easy to move, stable and adjustable to low. This is all concerned for the wearer's comfort. In addition the place of the tool should also be ergonomic arrangement (Lay-Out Ergonomic), meaning it must be within the range of the user, in this case the dentist. Note also that excessive use of fingers is avoided when practicing dentistry.



Figure 5. Dentist's tool

4. Placement of work lights

Light placement works when the dentist performs its activity is very important. So please note the position and location of the lamp, cultivated to light the light on the object that made the work area. Light does not affect the body or be blocked by body parts. The temperature of the room where the dentist should be comfortable and should not feel hot, because it will interfere with dentist activity while working. The temperature caused by the lamp should be considered, so it is necessary to choose a lamp that does not cause high heat when used. The lighting for work should be tailored to the needs and movable moveable. For more details can be seen in the picture below.



Figure 6. Optimal work light placement

CONCLUSION

Each dental service facility can be upgraded to be more ergonomic and Dentists need to pay

attention to early symptoms of health problems to prevent early detection and prevent long-term health problems. The workings of ergonomics in work need to be improved continuously and proactively by every dentist to stay healthy and productive.

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