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Risk Assessment for Work-Related Musculoskeletal Disorders in Dentistry - United Arab Emirates

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ABSTRACT

Every job involves risks that are unique to the workplace, depending on the role and situation of the practitioner. Some occupational risk factors only affect workers directly, while others, such as dentistry, affect others. For instance, the dentist, the nurse, the janitors, and those nearby the patients are all at risk of infection in dentistry. There are numerous other risk factors specific to dentistry, including physical, chemical, ergonomic, biological, and safety risk factors. Some of these elements are prevalent in all workplaces, but others, like biological and chemical elements, are particularly prevalent in jobs in the health sector. Musculoskeletal disorders (MSD) are the most prevalent among dentists. Therefore, it is crucial to have a plan to minimize and manage these risks in the workplace and lower accident rates and expenses. The Control Hierarchy was used in this study to investigate various occupational risk factors in dentistry. A management strategy that includes ergonomics education programs, recommendations for using new tool innovations, and human resource interventions is recommended to reduce risk among dental professionals.

Keywords: Dentistry; Risk Assessment; Risk Management; Musculoskeletal Disorder.

1. INTRODUCTION

Dentistry is a significant sector, and almost everyone should see a dentist every six months. However, the work environment for dentists is constantly changing as new technologies, theories, knowledge, and instruments are introduced to the industry. Despite all of these technologies and hygiene measures, research indicates that it ranks second in the incidence of musculoskeletal disorders (Șoaita, 2014). In addition to dentists, there are dental nurses, dental technicians, dental therapists, dental hygienists, and even dentistry students who spend a significant amount of time in clinics and labs during their undergraduate years. Several studies are being conducted to look into the risk factors in dental clinics. Infections (including the Human Immunodeficiency Virus and viral hepatitis); percutaneous exposure incidents, dental materials, radiation, and noise; musculoskeletal disorders; psychological problems and

dermatitis; respiratory disorders; and eye insults are among these factors (Ardekani et al., 2012). Depending on the specialty and position of the dental professional, each of these risk factors comes from a different source. For instance, nurses move around more than dentists do during an operation, making them less vulnerable to ergonomic risk factors like percutaneous exposure incidents and musculoskeletal disorders, which affected 41.8% of dentists in the UAE in 2016. (Moodley et al., 2018). Additionally, dental professionals are exposed to noise for very long periods of time every day due to the use of handpieces, which is said to be the most common cause of hearing loss in adults. Dental professionals are additionally exposed to infections like HIV, Hepatitis B, and C viruses due to the relatively small working space and the small, sharp equipment. However, 74.6% of dentists in the UAE have received both the influenza vaccine and the vaccine against these viruses. Allergies caused by professional activities are also reported by 76.1% of UAE dental practitioners. Latex allergy symptoms include pruritus, urticaria, eczema, and asthma (Moodley et al., 2018). Furthermore, radiation is only experienced by lab technicians because the area is restricted and only allows specialized personnel.

A recent study in the UAE aims to evaluate the frequency of MSDs and the sociodemographic and dentistry work environment risk factors associated with it. It shows that the prevalence of occupational MSDs for dentists is as high as 90.4% and it is associated with elevated stress level at work. It also shows that private sector dentists are more susceptible to MSDs due to their extra working hours compared to the government dentists. The study also suggests more attention in the research on the importance of ergonomics to the dentists in addition to increasing efforts towards awareness to clinics and hospitals managers (Hussein et al., 2022). Another study aimed to investigate the prevalence of Musculoskeletal pain in oe or several body parts including shoulders, neck, and lower back for 202 dental students in the University of Ras Al-Khaimah in the UAE. Almost half of the students (48.5%) experienced severe pain in one of the body parts during the previous week and 68.3% experienced Musculoskeletal pain in the past year. The authors suggest that this is due the lack of awareness about the ergonomics at the work or study place in addition to the lack of exercise and active lifestyle (Hashim et al., 2021).

Another study targeted 844 dentists in three emirates in the UAE (AbuDhabi, Dubai and Sharjah) using a questionnaire distributed to investigate the prevalence of some health and lifestyle problems among dentists. This study revealed that 61% of dentists aged between 22 and 70 do not have enough time to exercise regularly. And 16% have systemic problems, mainly cardiovascular problems. The study suggests that this is a result of the high smokers' percentage among dentists in addition to the low exercise time. Which requires more attention to the lifestyle and more awareness towards work-life balance (Hashim & Al-Ali, 2013)

However, studies that discuss the work environment for dentists specifically in the UAE are very limited. While other studies and publications focused on similar topics such as oral health knowledge and pediatrician behaviors towards oral health issues (Aburahima et al., 2020). Additionally, other publications by the Ministry of Education for example, discuss in detail the certification process as well as requirements and guidelines of day-today dentists duties. However, it does not include details about ergonomics or body postures during work ("Professional Competence Standards of Graduates," 2021).

There are several laws and regulations in the UAE regarding the safety of workers as instructed by the Ministry of Human Resources and Emiratization including Decree-Federal Law No.2 of 2011, Articles 21 and 22

(u.ae, 2022). In this work a risk assessment that investigates different occupational risk factors in dentistry will be conducted.

2. METHODOLOGY AND DATA COLLECTION:

A risk assessment will be performed to evaluate the dentistry, specifically the musculoskeletal disorder. Occupational risk assessment is a detailed examination of potential issues that affect workers' health and pose threats to job continuity. The following are the main steps in the procedure:

2.1 Risk Identification

It is important to proactively identify and assess risk factors in the workplace, this helps in controlling at an early stage. Therefore, many studies investigate different occupational risk factors in dentistry. A cross-sectional study was done, used the one-stage complex sampling technique to evaluate the results of a self-reporting questionnaire, involved 844 dentists working in three cities (Abu Dhabi, Dubai, and Sharjah) in the UAE to identify some of the risks (Al-Ali & Hashim, 2012). In addition to the risks mentioned in the introduction, the study identified the main risks that as follows: musculoskeletal pain, percutaneous injury, dermatitis,
eye problems and hearing problems.

Musculoskeletal disorders are impairments of bodily structures aggravated mainly by work and they are identified as the most common risk for dental practitioners according to the previously mentioned study and other similar studies in the UAE. Musculoskeletal disorders are characterized by the presence of discomfort, disability, or persistent pain in some tendons, joints muscles, and other soft parts, aggravated by movement repetitions, sitting unsupported, and prolonged or forced body postures (Al-Ali & Hashim, 2012). There are several factors that lead to MSDs such as prolonged static postures (PSPs), repetitive movements, suboptimal lighting, poor positioning, genetic predisposition, mental stress, physical conditioning, and age. MSDs are considered an ergonomic risk since they involved repetitive motions during work. Usually, muscular pain is harmless and easy to treat with simple remedies (Shaikhji, 2015). Therefore, symptoms are ignored until they become chronic. The most affected area are the back, neck, shoulders, and hand.*2.2 Exposure Assessment*

Unlike most occupational diseases, MSDs are multifactorial. Therefore, there were several methods developed for MSDs exposure assessment and they are listed below in order of increasing precision of the data gathered and invasiveness to the worker being assessed (David, 2005)

- Self -reports
- Observational methods
- Direct measurements

Self-reports can use questionnaires or interviews with the worker which is apparently easier than direct measurements. Direct measurements could use more advanced techniques which record body postures that rely on the attachment of optical, sonic, or electromagnetic markers to specific anatomic points on the practitioner and are coupled with scanning units to track the position and angular movement of several body segments. this can be recorded in real-

time using computer systems to generate three-dimensional models of all body markers. For example, The Lumbar Motion Monitor is an electronic exoskeleton applied to the torso that records continuous data for three-dimensional components of trunk position, velocity, and acceleration for subsequent analysis by computer (David, 2005). Moreover, observational methods could range from simple to more advanced methods. The simple method involves observing workers and analyzing their postures and ergonomics while the advanced step involves videotaping the workers and developing various computer systems to analyze them (David, 2005). The choice of the methods depends on several things such as the requirements of the data collected, budget, time, and availability of the workers' studies and techniques available.

Most epidemiologic information about MSDs is based on cross-sectional studies which are relatively easy, quick, and not expensive. However, in cross-sectional studies, it might be difficult to discern the temporal sequence between the exposure and health outcome and they might experience selection bias (e.g., selection among cases or 'healthy worker effect'). Cross-sectional surveys serve administrative purposes well, but they are less suitable for etiologic studies (Violante et al., 2000).

The first study in the UAE that investigates dentistry-related risks used cross-sectional studies in the UAE. The questionnaire used in this study included twenty-one close-ended questions about worker's characteristics, such as marital status, gender, age, number of years since graduation, and working hours per week. Furthermore, the questionnaires investigate information on the worker's musculoskeletal complaints in five anatomical regions of the body (back, neck, shoulder, face/scalp, and wrist/hand) during the previous seven days and previous twelve months. Eight hundred and forty-four dentists General Dental Practitioner (GDP) and specialists working in three cities (Abu Dhabi, Dubai, and Sharjah) in both sectors (private and public) in the UAE were given this questionnaire under the condition they completed a year in the industry (Al-Ali & Hashim, 2012). In this study, there was no association between age, working hours, and the number of patients visiting, and the MSDs. However, repetitive motions with a flexed neck and elevated and abducted arms were associated with a high percentage of neck and shoulders pain (Al-Ali & Hashim, 2012).

2.2 Dose-Response Assessment

In the dose-response step, the risk is quantified based on lab animal data to reflect the human health effects. However, because of the differences in the physical and mental properties of animals from humans, this step is not possible to apply for ergonomics. Also, there are no chemicals associated with the MSDs in the workplace which also implies that dose-response does not apply to such studies and as per literature, other direct and indirect methods were used.

2.3 Risk characterization

In the Nordic countries, it is estimated that the total cost of treating musculoskeletal disorders of the neck and upper limbs ranges from 0.5-2.0% of the GNP. Musculoskeletal disorders (MSD) are the most prevalent among dentists, according to risk assessment and management for dentistry.

In UAE, 68% of the dentists reported the occurrence of MSDs in the past 12 months, mainly in the back, neck, and shoulders by 49%,33%, and 25% respectively as shown in table 1 (Al-Ali & Hashim, 2012). There was no association between working hours per week, experience years, age, and the number of patients seen with the occurrence of musculoskeletal disorder pain. There was also no association of specific movements with the body part in pain. However, although the number of females was less than males in the study, the percentage of females reporting MSDs was significantly higher probably because of the assumption that females have more willingness to report symptoms. It's worth mentioning that the questionnaire also included questions about occurrence but not pain intensity or frequency.

Table 1. The prevalence of MSDs (Al-Ali & Hashim, 2012)

Anatomical region	**Male n (%)**	**Female n (%)**	**Total n (%)**
Musculoskeletal pain in the past 12 months			
Back pain	211 (47)	148 (51)	359 (49)
Neck pain	131 (29)	109 (38)	240(33)
Shoulder pain	94 (21)	91 (32)	185(25)
Facial and scalp muscle pain	6 (1)	6 (2)	12(2)
Wrist/hand pain	35 (8)	44 (15)	79(11)
Other	16 (4)	14 (5)	30(4)
Musculoskeletal pain in the past 7 days			
Back pain	136 (31)	102 (35)	238 (33)
Neck pain	96 (22)	90 (31)	186 (2)
Shoulder pain	68 (15)	86 (30)	154 (21)
Facial and scalp muscle pain	6 (1)	3(1)	9 (1)
Wrist/hand pain	31 (7)	34 (12)	65 (9)
Other	11 (3)	13 (5)	24 (3)

3. CONCLUSION AND DISCUSSION

After assessing the risks, it is critical to control them through the implementation of an effective management plan. This is accomplished through following the steps that's illustrated in the control hierarchy, as shown in Figure 1. The earlier intervention, the better, because MSDs can impair worker performance, resulting in more sick days and business interruption. As a result, control measures should be implemented on a regular basis, which requires workers to support the process by providing continuous feedback or complaints, as well as employers to allocate budgets, time, and resources for consistent assessment, management, and communication.

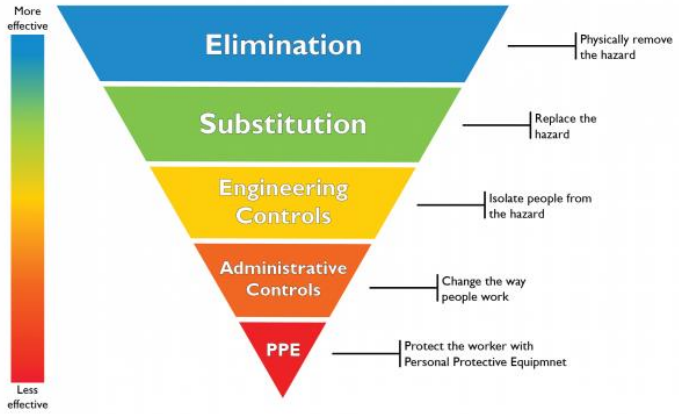

Figure 1: Control Hierarchy (NIOSH, 2021)

The most effective way to deal with any hazard is to remove or try substituting it. However, because MSDs are multifactorial and the majority of risk factors are environmental or dependent on the worker's involuntary reactions and habits, using those tools is difficult. Nonetheless, with better technologies and more research, some dental tools, such as those that vibrate a lot, could be replaced, or removed. The small handles which require the use of higher hand forces could be replaced or modified to balance the hand forces and the size of the mouth. Moreover, engineering tools are more common in ergonomics solutions. For example, redesigning the workplace so it has more space for body movements, and it allows more machinery assistance for repetitive movements. It is also suggested that the distance between the working field and the dentist's eyes be 35-40 cm. this is to avoid departing from the correct posture while looking for tools. Also, stool height and stool adjustments are important to avoid MSDs. 105-110 degrees between the thighs and the shanks should be adjusted to allow correct orientation between the thighs and the floor in addition to shifting the seat angle forward 5 to 15 degrees to increase the low back curve. In addition, using a saddle-style stool increases the hip angle by 130 degrees and allows a low back curve. Also, the knees should be slightly lower than the hips with the feet placed firmly on the floor

Administrative controls are the next most effective control measures in the hierarchy. The employer should provide training and awareness sessions to the dental staff on all the ergonomics and MSDs most recent studies. Even if they know the information, they need reminders and motivation especially to the means of communication. For example, they must be aware of the communication channels and how to report MSDs related issues. They need to be involved in the policy-making process, thorough risk assessment and risk management plans. Also, their feedback should be sought and reported on the effectiveness of the management plan and modifications should be applied continuously. Moreover, there should be awareness sessions on the strengthening and aerobic exercises necessary. For example, areas to strengthen include the trunk stabilization muscles, basically the transverse and oblique abdominal muscles and multifidus muscles; the stabilizing muscles of the shoulder girdle, mainly the middle and lower trapezius muscles; and the downward gliding muscles of the rotator cuff, the infraspinatus, subscapular and teres minor muscles. However, dentists should avoid over strengthening the chest and anterior neck musculature, deltoid muscles, and upper trapezius muscles, as this may aggravate muscle imbalances to which they are prone. In addition to that, administrative controls should include break time to allow for these exercises as well as including patient scheduling. Dental practitioners should schedule patients according to the needs of the patient and the tolerances of the practitioner (alternate patients with varying degrees of calculus).

PPEs are the least effective method since it requires the worker to deal with the risk using more protective equipment. In the case of ergonomics risks in dentistry, there are very few PPE that can be used, for example, special gloves anti-vibratory gloves could be used for small handpieces. However, adjusting the gloves for different vibration and handle sizes is not always applicable or easy. Also, there are special pads that are placed on the stool that help to adjust the spinal curves). The most crucial step is distributing the management plan to the affected employees and allowing them to provide feedback through a designated channel. Given that employees spend almost half of their lives at work, occupational health is crucial, and as such, it is not just the employers' responsibility. They ought to be prepared to voice and receive complaints in an unreserved manner.

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