
PREVALENCE OF MUSCULOSKELETAL DISORDER AND ITS DETERMINANT FACTORS AMONG DENTISTS

(PREVALENSI MUSCULOSKELETAL DISORDER DAN FAKTOR-FAKTOR YANG MEMPENGARUHI PADA DOKTER GIGI)

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Abstract:

Musculoskeletal pain has been found to be a health problem for dental practitioners. If the disorders ignored, cumulative damage may result in lowered productivity and even early retirement, injury or disability. Reported prevalence musculoskeletal disorders (MSD) to the dental practitioners in Indonesia were not yet known for certain. The aims of this study were to determine the prevalence of MSD among dental practitioners in Malang, Indonesia and to identify the factors that affect the occurrence of MSD. The study design was a cross-sectional analysis. The participants were 95 general dentists in Malang-Indonesia who asked self-administrated filled out the questionnaire. The questionnaire contained inquiry about: age, gender, body mass index, the time-lapse as a dentist, working hours, number of patients, working with an assistant, exercises on the sidelines of working time, sports activity, working position and asking whether they were suffering from musculoskeletal disorders in the last 12 months. The data analyzed by descriptive and logistic regression. The results showed 58.9% dentists complaint musculoskeletal pain in the last 12 months. The common complaints felt by the participants were back pain 34.6%, shoulder 18.9% and neck 16.9%. The determinants factors statistically significant correlations on MSD were working hours per week, working position, and exercises on sidelines working time.

Keywords: Dentist, ergonomics, musculoskeletal disorders, prevalence, back pain

Abstrak:

Nyeri muskuloskeletal telah menjadi salah satu masalah kesehatan bagi praktisi gigi. Jika gangguan ini diabaikan, terjadi kerusakan kumulatif yang dapat menurunkan produktivitas dan bahkan pensiun dini, cedera atau cacat. Prevalensi gangguan muskuloskeletal pada dokter gigi di Indonesia belum diketahui secara pasti. Tujuan dari penelitian ini adalah untuk mengetahui prevalensi gangguan muskuloskeletal pada dokter gigi di Indonesia dan menentukan factor penentu yang mempengaruhi terjadinya gangguan muskuloskeletal. Desain penelitian adalah analisis *cross-sectional*. Partisipan terdiri dari 95 dokter gigi umum di Malang-Indonesia. Kuesioner berisi pertanyaan tentang: usia, jenis kelamin, indeks massa tubuh, selang waktu sebagai dokter gigi, jam kerja, jumlah pasien, bekerja dengan asisten, latihan di sela-sela waktu kerja, aktivitas olahraga, posisi kerja dan menanyakan apakah mereka menderita gangguan muskuloskeletal dalam 12 bulan terakhir. Data di analisis secara deskriptif dan regresi logistic. Hasil penelitian menunjukkan 58.9% dokter gigi merasakan nyeri muskuloskeletal pada 12 bulan terakhir. Keluhan umum yang dirasakan oleh responden adalah nyeri punggung 34,6%, bahu 18,9% dan leher 16,9%. Faktor-faktor penentu yang berkorelasi signifikan secara statistik pada terjadinya gangguan muskuloskeletal adalah jam kerja per minggu, posisi kerja, dan latihan di sela-sela waktu kerja.

Kata Kunci: Dokter gigi, ergonomi, gangguan muskuloskeletal, prevalensi, nyeri punggung

INTRODUCTION

World Health Organisation has issued a recommendation to emphasize the urgent need to improve occupational health and safety at work to control work-related health hazards, to prevent occupational

diseases and other work-related illnesses.¹ Many countries in their study reported musculoskeletal pain had been found to be a health problem for dental practitioners.²⁻⁶ In Saudi Arabia 85% dentist re-

ported had developed some pain due to work.⁴ Study of Iranian dentist, 67.5% had been suffering from some physical symptoms in the past 12 months.⁶

Musculoskeletal Disorders (MSD) among dental practitioners, could happen especially when occurring at high levels and in combination of repetitive movement, forceful or prolonged exertions of the hands; pushing or pulling, prolonged awkward postures and also duration, vibration, and psychosocial factors.⁷ If the disorders ignored, cumulative damage may result in lowered productivity and even early retirement, injury or disability.⁸

Knowledge about ergonomics is important as a useful guide for dental practitioners.⁷ Training and educating the dental practitioners based upon such guidelines is a critical issue for preventing work-related injuries to one of the important group of the health practitioners.⁶

Reported prevalence MSD to the dental practitioners in Indonesia and his assistant were not yet known for certain, but prevalence among people in community found in the age group above 45 years which 66.9% of 1,645 respondents in DKI Jakarta experiencing musculoskeletal disorders.⁹ Symptoms of MSD at dental student had reported at clinical dental student at the Faculty of Dentistry, Indonesia University. The study found 74% of respondents suffer neck ache, 44% experience shoulder ache, 55% have the upper back ache, and 54% feel lower back ache.¹⁰ Study in Tasikmalaya, Indonesia reported 60% dentist complains of muscle pain.¹¹ The aim of this study is to provide data on MSD prevalence among dental practitioners in Malang, Indonesia and to identify the determinants that contribute to the occurrence of MSD.

MATERIALS AND METHODS

The study design was cross-sectional with total sampling. The participants were the general dentists who work at the government or private clinic in Malang district, one of the regions in East Java Province, Indonesia. Ninety-five dentists agreed to participate signed an informed consent form and filled out the questionnaire. The questionnaire contained inquiry about following: age with cut of point 40 years old¹¹, gender, body mass index (BMI), the time lapse as a dentist after graduation, working hours per week, number of patients in a day on average, working with assistant, exercises on the sidelines of working time (moving the limbs for stretch), routine sport activity and working position was most often performed (sitting or standing) as a determinant factors. The participant was also asking whether they were suffering from any musculoske-

letal disorders in the last 12 months and its location. Participants in the study were obviously fully voluntary, and secrecy of identity was guaranteed. Data retrieval was done by giving the questioner directly and self-administrated.

Demographic characteristics of participants related to the variables of the study were calculated by frequency and percent. A significance level of the analysis was used < 0.05 . The prevalence of musculoskeletal disorders among dentists was calculated according to the location. Logistic regression analysis was used to measure the role of the ten variables that may contribute to MSD. The mean value of those with or without MSD was compared if a variable had a statistically significant effect on all determinant factors.

RESULT

Musculoskeletal pain was analyzed to 63 female dan 32 male dentists in Malang who participate in this study. Age is the most in the group >40 years as much as 46.3% and ≤ 40 years of as much as 53.7%. There were 56 participants (58.9%) who complaint musculoskeletal pain in the last 12 months. Among them, more than 60% admitted experiencing pain in more than one body part. The common complaints felt by the participants were back pain 34.6%, shoulder 18,9% and neck 16.9% (Table 1).

Table 1: Area wise predilection of MSD of the dental practitioners from 56 dentists who complaint musculoskeletal pain in the last 12 months

| Location of the pain | Number* | % |
|----------------------|---------|------|
| Back | 55 | 34.6 |
| Shoulder | 30 | 18.9 |
| Neck | 27 | 16.9 |
| Arm | 15 | 9.43 |
| Head | 8 | 5.03 |
| Fingers | 7 | 4.40 |
| Wrist | 7 | 4.40 |
| Eyes | 4 | 2.52 |
| Thigh | 4 | 2.52 |
| Elbow | 2 | 1.26 |

*Participants may experience more than one musculoskeletal pain

This study also found, age of the most participant was 53.7% under 40 years old, BMI 68.4% of participants were normal, time-lapse as a dentist after graduation 52.6% participants were under 10 years, working hours per week participant were 52.6% un-

der 35 hours, average patients per day participants were 56.8 % under 10 person, 82.1% of participants were working with assistant, participants were 66.3% working position was sitting, participants were 61.1% had no sport activity routinely and 62.1% participant was done exercises sidelines of working time for stretching (Table 2).

Table 2. Socio-demographics of the participant in relation to the prevalence of MSD (n=95)

| | n | % |
|---------------------------------|----|------|
| Gender | | |
| Male | 32 | 33.7 |
| Female | 63 | 66.3 |
| Age (years) | | |
| ≤40 | 51 | 53.7 |
| >40 | 44 | 46.3 |
| BMI | | |
| Normal | 65 | 68.4 |
| Overweight | 30 | 31.6 |
| Time-lapse as a dentist (years) | | |
| ≤10 | 50 | 52.6 |
| 11-15 | 7 | 7.4 |
| >15 | 38 | 40.0 |
| Working hours per week | | |
| <35 | 55 | 52.6 |
| >36 | 40 | 47.4 |
| Average patient per day | | |
| ≤10 | 54 | 56.8 |
| ≥11 | 41 | 43.2 |
| Working with assistant | | |

| | | |
|-------------------------------------|----|------|
| Yes | 78 | 82.1 |
| No | 17 | 17.9 |
| Working position | | |
| Sitting | 63 | 66.3 |
| Standing | 32 | 33.7 |
| Sport activity | | |
| Routine | 26 | 27.4 |
| Rarely | 17 | 11.6 |
| No | 58 | 61.1 |
| Exercises sidelines of working time | | |
| Yes | 59 | 62.1 |
| No | 36 | 37.9 |
| Musculoskeletal disorders | | |
| Yes | 56 | 58.9 |
| No | 39 | 41.1 |

All determinants were analyzed bivariate using Chi-square in the presence or absence of musculoskeletal disorders before logistic regression analysis. Based upon bivariate analysis Chi-square knew that age, gender, body mass index, time-lapse as a dentist, average patient per day, working with an assistant and routinely sports activity had no statistically significant correlation on the musculoskeletal disorders ($p > 0.25$) (Table 3).

Table 3. Bivariate analysis determinant factors with musculoskeletal disorders variable

| | | MSD* (-) | | MSD (+) | | p-value | OR | CI 95% | |
|---------------------------------|------------|----------|------|---------|------|---------|-------|--------|-------|
| | | n | % | n | % | | | min | max |
| Gender | Male | 12 | 37.5 | 20 | 62.5 | 0.779 | 0.800 | 0.33 | 1.91 |
| | Female | 27 | 42.9 | 36 | 57.1 | | | | |
| Age (years) | ≤40 | 22 | 43.1 | 29 | 56.9 | 0.814 | 1.205 | 0.53 | 2.74 |
| | >40 | 17 | 38.6 | 27 | 61.4 | | | | |
| Body mass index | Normal | 29 | 44.6 | 36 | 55.4 | 0.415 | 1.611 | 0.65 | 3.98 |
| | Overweight | 10 | 33.3 | 20 | 66.7 | | | | |
| Time-lapse as a dentist (years) | ≤10 | 22 | 44 | 28 | 56 | 0.835 | 1.205 | 0.51 | 2.84 |
| | 11-15 | 2 | 28.6 | 5 | 71.4 | 0.902 | 0.613 | 0.11 | 3.58 |
| | >15 | 15 | 39.5 | 23 | 60.5 | *** | | | |
| Working hours per week | <35 | 27 | 49.1 | 28 | 50.9 | 0.098** | 2.25 | 0.95 | 5.31 |
| | >36 | 12 | 30 | 28 | 70 | | | | |
| Average patient per day | ≤10 | 22 | 40.7 | 32 | 59.3 | 1.000 | 0.971 | 0.43 | 2.22 |
| | ≥11 | 17 | 41.5 | 24 | 58.5 | | | | |
| Working with assistant | Yes | 8 | 47.1 | 9 | 52.9 | 0.777 | 1.348 | 0.469 | 3.870 |
| | No | 31 | 39.7 | 47 | 60.3 | | | | |

| | | | | | | | | | |
|----------------------------------|----------|----|-------|----|-------|---------|-------|-------|-------|
| Working position | Sitting | 31 | 49.2 | 32 | 50.8 | 0.041** | 2.906 | 1.135 | 7.442 |
| | Standing | 8 | 25 | 24 | 75 | | | | |
| Sport activity | Routine | 14 | 53.8 | 12 | 46.2 | 0.261 | 1.909 | 0.75 | 4.87 |
| | Rarely | 3 | 27.3 | 8 | 72.7 | 0.740 | 0.614 | 0.15 | 2.56 |
| | No | 22 | 37.9 | 36 | 62.1 | | *** | | |
| Exercises sidelines working time | Yes | 20 | 55.63 | 16 | 44.46 | 0.042** | 2.632 | 1.120 | 6.186 |
| | No | 19 | 2.2 | 40 | 7.8 | | | | |
| Total | | 39 | 41.1 | 56 | 58.9 | | | | |

*MSD = musculoskeletal disorders, (-) without, (+) with

**p<0.25 entered in logistic regression analysis (working hours per week, working position, exercises sidelines of working time)

***Comparison

Therefore the determinants included in the logistic regression analysis were working hours per week working position and exercises sidelines working time ($p < 0.25$). This result was supported by the fact that dental practitioner who works more than 36 hours per week 70% had MSD, standing working

position 75% had MSD and didn't do exercises at sidelines working time 67.8% had MSD (Table 3).

Logistic regression analysis obtained logistic regression equation models $Y = 2.337 + (-1.015.X1) + (-1.395.X2) + (-1.042.X3)$ (Table 4).

Table 4. Logistic regression analysis

| | Coefficient | S.E | Wald | df | p-value | OR | 95% C.I | |
|-----------------------------|-------------|-------|--------|----|---------|-------|---------|------|
| | | | | | | | Min | Max |
| Working hours per week (X1) | -1.015 | 0.479 | 4.494 | 1 | 0.034 | 0.36 | 0.14 | 0.93 |
| Working position (X2) | -1.395 | 0.525 | 7.062 | 1 | 0.008 | 0.25 | 0.09 | 0.69 |
| Exercises (X3) | -1.042 | 0.470 | 4.914 | 1 | 0.027 | 0.35 | 0.14 | 0.89 |
| Constant | 2.337 | 0.622 | 14.137 | 1 | 0.000 | 10.35 | | |

It means if the dentist has working hours per week below 35 hours, the working position is usually sitting and do exercise on the sidelines working time for stretching, he/she will have 24.7% possibility have the musculoskeletal disorders. Otherwise, If the dentist has working hours per week more than 35 hours, the working position usually stands and not doing exercise on the sidelines working time for stretching he/she will have 91.2% possibility have musculoskeletal disorders

The quality of the regression equation evaluated from the calibration parameter by Hosmer and Lemeshow test was 0.154, which means the equation was good. The quality of regression equations regarding discriminated parameters by the area under the curve (AUC) the value was 0.745 which means discriminated parameters moderate.

DISCUSSION

The World Health Organization defines an MSD as a disorder of the tendons, muscles, vascular system or peripheral nerves not directly resulting from an acute or instantly event (e.g., slips or falls). These

disorders are considered to be the performance of work contribute significantly, but are only one of some factors contributing to the causation of multifactorial disease.¹² The dental practice may result in muscular imbalance, neuromuscular inhibition, and pain and dysfunction mainly due to cumulative microtrauma and repetitive use of awkward positions.¹²

The result of this study, more than 60% participant, and admitted experiencing pain more than one limbs. The three common complaints were back pain 34.6%, shoulder 18.9% and neck 16.9%. These results were different in order and percentage with study at Iranian^{2,6}, India^{3,13}, Saudi Arabia⁴, and Australia¹⁴. Iranian common complaint was 51.9% in the neck, wrist 92.9%, waist 11.1%, and shoulder 7.4%.⁶ In India, the most common complaint was lower backache (57.8%) followed by neck ache (37.5%) and shoulder ache (29.6%).¹³ In Saudi Arabia, common pain was reported in the lower back region reported 60%, pain in the neck and shoulder regions 48% each, hands (27%) and upper back region (23%).⁴ In Australia, common pain was at the neck 57.5%, lower back 53.7% and shoulder 53.3%.¹⁴

The common pain from these studies was back region, shoulder, and neck.

Back discomfort has been associated with dental work in numerous studies. Repetitive neck movements and continuous arm and hand movements affecting the neck and shoulder demonstrate significant associations with neck MSD.¹⁵

This study found the determinant factors that affect the occurrence of MSD were working hours per week, working position, and exercises on sidelines working time. Study at Tasikmalaya, Indonesia showed that work position while extracting teeth was the only factor which predicts the occurrence of MSD.¹¹ Meanwhile, at Iranian, age, BMI, number patient per day and physical exercises had a statistically significant effect on the prevalence of MSD.⁶

In most cases, a combination of multiple risk factors seems to operate rather than a single risk factor.¹⁶ Prolonged static postures, repetitive movements, workplace designs, poor positioning, genetic predisposition, mental stress, physical conditioning, age, and non-work activities can all be involved.¹⁶⁻¹⁸ The long working time in a day was used irrationally from ergonomics, which over the years of work done continuously increased the number of disorders of the musculoskeletal system.¹⁹

Meanwhile, there is no ideal posture for sitting or one position which should be sustained. Healthy sitting body position, therefore, is best thought of as an active, not a static phenomenon. In the resting position, between movements, healthy sitting posture can be thought of as occurring when unnecessary (static) muscle activity, ligamentous tension, intradiscal pressure, and zygapophyseal joint forces are minimized, and when the body weight is distributed evenly through the ischial tuberosities and thighs to the seat and through the torso via the backrest.²⁰ When operators in sitting posture, pain occurs not only in their backs but also their necks, shoulders, and arms. On the other hand, the operators who primarily stood will be experienced low back pain, as well as neurocirculatory disease including varicose veins, postural defects, and flat foot.²¹

Stretches performed in the reverse direction of awkward prolonged static postures may prevent muscle imbalances that can lead to pain and MSD. Body strengthening exercises by stretching and strengthening the muscles that support the back and neck and those used in the forearm, wrist, and hand will help them remain strong and healthy. Directional stretches can be performed before, during or after treating the patient into a daily routine that fa-

cilitates balanced musculoskeletal health. The way stretching movements involves a rotation, side bending or extension component that is in the different direction of that in which the operator often do. Resting hands frequently are believed to be one of the most important factors in preventing MSD. Move the head down slowly and allow the arms and head to fall between the knees; hold for a few seconds; rise slowly by contracting the stomach muscles and rolling up, bringing the head up last. Try head rotation for neck stiffness. Pulling the shoulders up can be used to stretch the shoulder muscles that may be stressed from holding oral evacuator, instruments and telephone handset. Pull the shoulders up toward the ears, roll them backward and then forward in a circular motion. This strategy addresses the muscle imbalances that tend to develop.^{22,23}

Dentists with clinical ergonomic education are less likely to have lower back pain. Dentists who recognize and know the risk factors and MSD symptoms dentists will increase prevention to change their habits, identify their postures, practicing positions, select proper ergonomic equipment and frequent breaks with stretching and strengthening exercise before painful episodes occur. In doing so, exercise plays an important role in their career to be healthy, safe and have a longer career.²²⁻²⁴ Dental ergonomics should be an integrated part of curricula and continuing professional development programs to all oral health professional.^{18,19,24} Basic educational programs and new educational models that incorporate a multifactorial approach can be beneficial.^{18,23,24} The limitations of this study were participants who willing to follow this research was still limited and taking place in one region in Indonesia. Based on determinant factors that affect MSD, it is necessary to improve the understanding of the dentist about determinant factors associated with the occurrence of MSD, how to prevent and cope with it. Further study will involve more dentists from different regions in Indonesia.

Conclusion, in Indonesia also reported a high prevalence of MSD among dentist. The determinant factors on MSD were working hours per week, working position, and exercises on sidelines working time. MSD can reduce the active year of the dentist in practice, if not handled appropriately. The Indonesia dental curriculum and continuing dental education course must accommodate courses that educate students and dentist with ergonomic principles in the oral health profession in order to maintain a healthy body to provide a higher quality of oral health services.

REFERENCES

1. WHO. Global strategy on occupational health for all: The way to health at work. Recommendation of the Second Meet WHO Collaborating Centres in Occupational Health. Beijing, 1994
2. Pargali N, Jowkar N. Prevalence of musculoskeletal pain among dentists in Shiraz, Southern Iran. *Int J Occup Environ Med.* 2010; 1(2): 69-74.
3. Muralidharan D, Fareed N, Shanthi M. Musculoskeletal disorders among dental practitioners: Does it affect practice? *Epidemiol Res Int.* 2013; 2013: 1-6.
4. Alghadir A, Zafar H, Iqbal ZA. Work-related musculoskeletal disorders among dental professionals in Saudi Arabia. *J Phys Ther Sci.* 2015; 27(4): 1107-12.
5. Abbas SB, Qazi SR, Iftikhar S, Iqbal MU. Musculoskeletal Disorders Among Dentists and Dental Students. *Pakistan Oral Dent J.* 2015; 35(3): 461-6.
6. Nokhostin MR, Zafarmand AH. Musculoskeletal problem : Its prevalence among Iranian dentists. *J Int Soc Prev Community Dent* 2016; 6(Suppl.1): S41-6.
7. Gupta A, Bhat M, Mohammed T, Bansal N, Gupta G. Ergonomics in dentistry. *Int J Clin Pediatr Dent* 2014; 7(1): 30-4.
8. Valachi B, Valachi K. Mechanisms leading to musculoskeletal disorders in dentistry. *J Am Dent Assoc* 2003; 134 (10): 1344-50.
9. Andayasari L, Anorital. Gangguan muskuloskeletal pada praktik dokter gigi dan upaya pencegahannya. *Media Litbang Kesehatan* 2012; 22(2): 70-7.
10. Muslim E, Nurtjahyo BM, Darwita RR, Widinugroho BP. Working Posture Evaluation of Clinical Student in Faculty of Dentistry University of Indonesia for The Scaling Task in Sitting Position in A Virtual Environment. *Makara Kesehatan.* 2012;16(1): 36-44.
11. Ambarwati T, Suroto, Wicaksana B, Sopianah Y, Miko H. Posture Work to Complaint Musculoskeletal Disorders at the Dentist. *J Int Dent Med Res.* 2018;11(1):57-61.
12. Identification and control of work-related diseases. World Heal Organ - Tech Rep Ser. 1985;714.
13. Rehman K, Ayaz H, Urooj W, Shah R. Work-Related Musculoskeletal Disorders Among Dental Practitioners in Khyber Pakhtunkhwa. *Pakistan Oral Dent J.* 2013;33(3):1-4.
14. Leggat PA, Smith DR. Musculoskeletal disorders self-reported by dentists in Queensland , Australia. *Aust Dent J.* 2006;51(4):324-327.
15. Russell. JG. Ergonomics in the Dental Surgery. *J Soc Occup Med.* 1973;23(4):128-131.
16. Smith SW, Verhagen CM. An Introduction to Ergonomics : Risk Factors , MSDs , Approaches and Interventions. American Dental Association; 2004.
17. Alexopoulos EC, Stathi I-C, Charizani F. Prevalence of musculoskeletal disorders in dentists. *BMC Musculoskelet Disord.* 2004;5:16.
18. Yamalik N, Ankara T. Musculoskeletal disorders (MSDs) and dental practice Part 2. Risk factors for dentistry, magnitude of the problem, prevention, and dental ergonomics. *Int Dent J.* 2007;57(1):45-54.
19. Szymanska J. Disorders of the musculoskeletal system among dentists from the aspect of ergonomics and prophylaxis. *Ann Agric Environ Med.* 2002;9 (2):169-173.
20. Gandavadi A. Working Postures in Dental Practitioners and Dental Students : Relationships Between Posture Seating , and Muscle Activity. *Etheses BhamAcUk.* 2008
21. Biller FE. The occupational hazards in dental practice. *Oral Hyg.* 1946;36:1194-1201.
22. Kovačevska Ivona, Georgiev Zlatko, Dimova Cena, Šabanov Erol, Petrovski Mihajlo FK. *Ergonomics At Dentistry. Medicine (Baltimore).* 2014;IV(1):83-86.
23. Valachi B, Valachi K. Preventing musculoskeletal disorders in clinical dentistry: strategies to address the mechanisms leading to musculoskeletal disorders. *J Am Dent Assoc.* 2003;134(12):1604-1612.
24. Rucker LM, Sunell S. Ergonomic risk factors associated with clinical dentistry. *J Calif Dent Assoc.* 2002;30(2):139-148.