ORIGINAL ARTICLE

Gender-Specific Risk of MSDs in Dentists: The Impact of Work Posture

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ABSTRACT

Introduction: Ergonomic positioning, which is important for efficient and safe work engagement, has a significant impact on the prevalence of Musculoskeletal Disorders (MSDs) among dentists. Due to their work posture, both male and female dentists are susceptible to diseases in the field of oral health. This study aimed to explore the correlation between gender-specific working posture among dentists and the incidence of MSDs. **Material and Method:** This research is an analytical observational study with a cross-sectional approach. There was 111 respondents consisting of 56 male dentists and 55 female dentists. This study was conducted in Surabaya, Indonesia, at area of community health center. Working Posture was evaluated using the Rapid Entire Body Assessment (REBA) and MSDs via the Nordic Body Map (NBM). SPSS Statistics Standards 22 was used to analyze the data. Reliability and validity analysis was carried out. The correlation test was performed using the Spearman test and the Mann-Whitney test was utilized to compare location of musculoskeletal disorders complaints in male and female dentists. **Results:** There was a significant correlation ($r=0.835$, $p<0.05$) between body posture and MSD, with female dentists showing a higher susceptibility to MSD. Inappropriate work posture resulted in high MSDs complaints. The age of the respondents had a significant impact on the complaints. **Conclusions:** Female have moderate to high complaints, while most male report low complaints. Given the smaller muscle volume in female, gender-adapted ergonomic interventions are recommended to reduce the risk of MSDs.
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INTRODUCTION

Dentists are particularly prone to Musculoskeletal Disorders (MSDs) because their work often demands extended concentration and maintaining static postures for long periods (1). An ergonomic posture not only boosts efficiency and comfort during procedures but also reduces the likelihood of fatigue, discomfort, and stress, all of which can increase the risk of developing MSDs (2). The practice and regulation of work, tailored by the community to ensure efficient and safe bodily interaction, is termed as ideal or ergonomic posture (3). Ergonomic posture extends beyond a dentist's stance while treating patients, it encompasses the positioning while utilizing dental equipment like chairs, lamps, burs, among others, which could trigger muscle strain and musculoskeletal disorders.4 Many dentists persist in incorrect postures due to habitual work practices, adversely affecting their health, as there are adaptive limits to the human body (2). To mitigate MSD risks, maintaining a neutral posture while treating patients is vital, this position optimizes body performance and minimizes deviation-induced MSD risks (5).

MSDs are described as muscle pain on supportive tissue that interferes with the dentist's daily tasks (6). There are three types of risk factors for MSDs: biomechanical, psychosocial, and individual (7). Repetitive movement, force, mechanical pressure, uncomfortable posture (prolonged static posture), vibration, and extrinsic pressure are all biomechanical risk factors in MSDs (8). Temperature or environment, social connections, and influence from the workplace are all psychosocial risk factors, while age, sex, the period of works, number of patients, stretching, four-handed application, working hours, BMI, activity zone, and expertise are the individual characteristics (8).

A recent study in Iran showed the prevalence of dentist's neck pain caused by musculoskeletal disorders in males was around 54.2% and females 57.6% followed by back pain in males by 42.7% and 44% in females (9). In Indonesia, however, there was no discernible difference in the prevalence of musculoskeletal problems among male and female dentists (10).

The aim of this study was to identify the correlation between the differences of work position between male and female dentists and the occurrence of musculoskeletal disorders.

MATERIALS AND METHODS

This research was an analytical observational study with a cross-sectional approach. Following receiving ethical authorization from the Health Research Ethics Committee of the Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia (Number: 128/HRECC.FODM/IV/2019), a cross-sectional study was undertaken. Samples were community health center dentists aged 25-60 years in Surabaya. Simple random sampling was taken as a technique to select 111 respondents consisting of 56 male dentists and 55 female dentists. They must have at least 24 months of work experience and be willing to participate in this research.

Reliability and validity analysis was carried out. REBA (Rapid Entire Body Assessment) worksheet was utilized evaluator to observe the dentists' working postures. Working postures were evaluated by assigning scores to different body parts. The body, neck, and legs were evaluated in group A, while the upper arms, forearms, and wrists were evaluated in group B. There were 5 scores of REBA; 0-1 score was ignorable, 2-3 score was low, 4-7 score was medium, 8-10 score was high, and 11+ score was very high. A higher score indicated a higher risk level of working posture. REBA assessment for a relatively simple task might take anywhere from 10 to 15 minutes.

The dentists' musculoskeletal disorders were observed using NBM (Nordic Body Map). NBM refers to a questionnaire containing body parts that are divided into 9 main parts; neck, shoulders, upper back, elbows, lower back, wrists/hands, waist/buttocks, knees, and heels/feet (11). The respondents were asked to provide markings on these body areas. The scores on NBM are classified into four categories; 28-49 score is low, 50-70 medium, 71-91 high, and 92-112 score very high.

A questionnaire was used to determine the combination of factors (domain knowledge) that worsened the occurrence of MSDs. SPSS Statistics Standards 22 was used to analyze the data. The correlation test was performed using the Spearman test with a significance level of (p) < 0.05 and the Mann-Whitney test was utilized to compare location of musculoskeletal disorders complaints in male and female dentists.

RESULTS

The total number of 55 female dentists (49,5%) and 56 male dentists (50,5%) were recruited in this study. Differences in working posture between male and female dentists are illustrated in the following figure.

Fig. 1 showed that the highest prevalence among male respondents is in the age category of 26-35 years, and the lowest is in age category of 55-60 years. Meanwhile in female respondents the highest prevalence is in age category of 26-35 years and the lowest prevalence is in age category of 46-55 years. From the research results, it was found that there were no significant differences significant between female and male. This is because at four age categories namely 26-35 years, 36- 45 years, 46-55 years, and 56-60 year, there is not too much difference in the number of respondents between female and male respondents. In the 26-35 year age category, the number of female respondents was 22 while male respondents were 25. In the 36-45 year age category, the number of female as many as 16 respondents and 12 male respondents, for ages 46-55 year, the number of female respondents was 8 while male as many as 11 the respondents. Age category 56-60 years, 9 for female respondents and 8 respondents for male.

Upon examination of the figure 1, it is evident that 29 female respondents (47.3%) possessed a high level of knowledge, scoring between 52-70, whereas 45 male respondents (80.4%) exhibited a moderate level of knowledge, with scores ranging from 35-51. Complaints of MSDs in low score category of 28-49 are higher in males, while in 50-70 score category females have higher complaints. In the category score 70 and above very few males have complaints even though there are still many females who do have complaints.

The results of Spearman test (table 1) showed that the correlation between work posture (using REBA) and MSDs (using NBM) was the strongest with a value of $r = 0.835$ (p value <0.05). Inappropriate work posture resulted in high MSDs complaints. The age of the respondents had a significant impact on the complaints. The lowest correlation, with a value of $r = 0.364$, was identified between length of labor and musculoskeletal disorders (using NBM).Correlation between activity zone with musculoskeletal disorders had p value of 0.000 and correlation values of 0.653.

The Mann-Whitney test showed significant differences in risk factors (all 0.05) between male and female dentists in the variables of number of patients per day, stretching, temperature, working posture (REBA), MSD complaints, knowledge, and the activity zone with respective values.

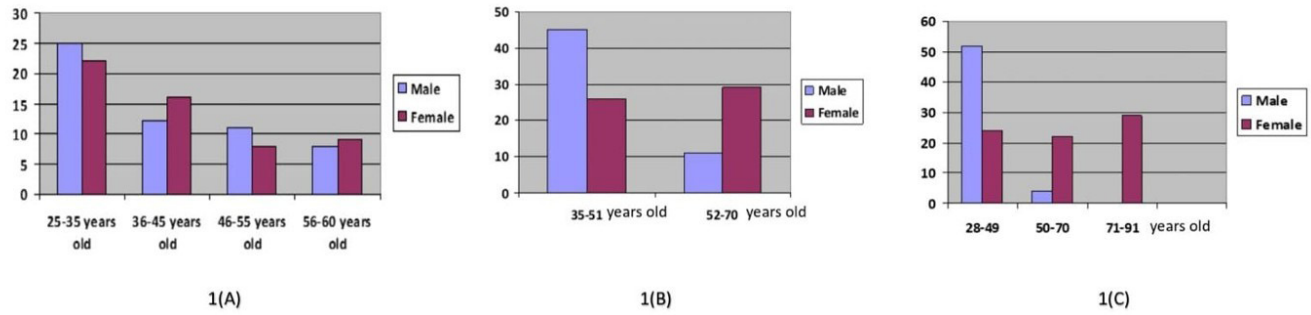

Fig. 1: Prevalence distributions. (A) The prevalence in female and male respondents based on age. (B) The prevalence of male and female respondent based on knowledge score. (C) The prevalence of MDSs complaints in female and male dentists

Table I: Correlation test of MSDs complaints as the risk factors of working posture by number of patients, knowledge, length of practicing hours (days), working period (years), stretching, and room temperature

Variable	Nordic Body Map (MSDs complaint)		Working posture (REBA)		Length of Practice (hours)		Working period (years)		Number of patients		Knowledge		Stretching		Room temperature	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Nordic Body Map (MSDs)			0.835	0.000	0.364	0.000	0.537	0.000	0.535	0.000	-0.283	0.003	-0.034	0.000	-0.029	0.000
Working posture (REBA)	0.835	0.000			0.345	0.000	0.353	0.000	0.515	0.000	0.345	0.000				

Notes:
*p value <0.05

DISCUSSION

Female dentists had a larger number of patients per day than male dentists in the variable of the number of patients. There is a positive correlation between the daily patient load and the frequency of musculoskeletal disorder complaints among healthcare professionals. Taking regular breaks during work has been shown to reduce the occurrence of musculoskeletal disorders (12). Female dentists had a higher level of knowledge than male dentists. This study's findings indicate that female tend to have a higher level of knowledge compared to male. Female often exhibit a stronger episodic memory, making it easier for them to remember things due to their heightened proficiency in verbal tasks. Previous research has indicated a correlation between hormonal influences and working memory, with female experiencing peak working memory performance during their menstrual phase, while male tend to perform at their best during times of increased testosterone levels(11). The menstrual phase in female is a regular monthly occurrence, making it a contributing factor to their overall knowledge being potentially higher than that of male, given their superior ability to remember and perform better in working memory tasks.

Medical practitioners, particularly doctors, should possess comprehensive knowledge of potential risk factors that can lead to pain-related issues in their field. The occurrence of MSDs must have increased as a result of extensive practice hours per day that continued for years, especially when the practice was carried out in an unsuitable work position like fleed lumbar or forward head position due to a lack of awareness about ergonomic posture. Furthermore, the high number of patients they had to treat each day may have aggravated the situation, leaving the dentists with insufficient time to stretch in between jobs. All of these factors contributed to the high number of MSD complaints. Therefore, the application of ergonomic principles is essential. Incorporating ergonomic principles into daily practice is beneficial for both practicing dentists and dental students, as it helps to prevent and mitigate musculoskeletal disorders, as demonstrated by Karibasappa et al (13).

Female dentists tend to engage in more frequent stretching routines compared to their male counterparts, and they also demonstrate better working postures. Stretching offers a multitude of benefits, such as anxiety reduction, improved blood circulation, and decreased muscle fatigue when incorporated into regular breaks between tasks. Therefore, integrating stretching into one's daily routine can significantly reduce the risk of developing musculoskeletal disorders. Female dentists had more MSD complaints than male dentists, with a statistically significant difference. The highest mean score for the variable of zone activity also indicated a significant difference. In determining the right zone, female dentists had a higher value than male dentists. From a biological aspect, it says that fibers in the trapezius

muscle between male and female have difference, there are more female have type 1 fiber compared to male. Type 1 fibers are associated with pain myofascial. More trapezius muscle area narrow in female shows that its functional capacity is more low and plays an important role in symptoms musculoskeletal disorders of the neck and shoulders(14).

The Mann Whitney test showcased higher NBM scores in females than males across all tested body sites, signifying a notable difference. Nonetheless, not every site displayed a significant gender difference in NBM scores. No significant variance was observed in complaints from male and female dentists regarding several body parts, except females primarily reported right shoulder issues, while males reported nape complaints.

Working posture and MSDs were found to have a strong correlation, according to the data. When a dentist's working posture departs from ergonomics, the muscles responsible for bending or turning get stronger, while the muscles responsible for following ergonomics become stretched, weakened, resulting in muscle imbalances (15,16). Damaged tissue could be healed during rest in normal circumstances. Muscle necrosis can occur when the extent of the damage surpasses the ability of the body to repair itself during rest.6 Incorrect work posture, often adopted for perceived comfort during patient treatment, contributes to MSDs (17). Significant posture variation was observed between genders, with female dentists facing moderate risk versus the lower risk in males. This mirrored a study on tobacco sorters linking work posture to MSDs (18). Non-ergonomic postures, like prolonged head tilting and body bending, cause muscle tension and soft tissue stretching around joints (19). Hindered access or visibility to the oral cavity often results in overbent postures. Misdefining activity zones based on tasks could further lead to incorrect work postures (2).

Another finding in this study showed that female dentists had a higher risk of MSDs than male dentists, this is due to female muscle volume is smaller than male muscle volume (9). Another study found that male and female trapezius muscle fibers are distinct. Females had a higher concentration of type 1 fiber than males. Myofascial discomfort is linked to this type 1 fiber. Females had a narrower trapezius muscle, which meant they had a lesser functional capacity and had a key role in MSD symptoms, particularly in the neck and shoulder (20).

Females exhibited a higher prevalence of shoulder pain due to a difference in anthropometric and strength associated to motoric control, with males having stronger muscle strength than females (21). Females' shoulder was also weaker than males' because they had lower strength and 45% less muscle in the brachial biceps and had different anatomic of the glenoid fossa (21).

Male dentists predominantly experienced upper neck pain, aligning with Charles' study attributing this to awkward positions and high physical workload (22). Factors like higher patient load and lesser stretching among female dentists exacerbated MSD incidence. Stretching, known for reducing discomfort and enhancing Range of Motion (ROM), proved beneficial in a study on construction workers (23). The heightened patient count subjected female dentists to mental and psycho- emotional stress, increased muscle tension, and inattention to work posture, leading to inefficiency (2). Despite superior episodic memory aiding recall, higher education didn't shield females from ergonomic risks, aligning with previous findings (13). Various factors, intrinsic and extrinsic, impact ergonomic adherence in practice.

The study indicated that females, with their clearer episodic memory, had a knowledge advantage, aiding recall. However, despite superior education, they faced higher musculoskeletal risks than males, aligning with past findings that knowledge alone doesn't ensure ergonomic work practices (13). Various factors, both intrinsic and extrinsic like speedy service demands and inadequate infrastructure or human resources, significantly impact ergonomic adherence in the field.

CONCLUSION

There was a significant correlation between work posture and MSD in both genders of dentists, with female dentists showing a higher risk of MSD. Data shows that female have moderate to high complaints, while most male report low complaints. The location of complaints most often felt by female is on the right shoulder, while male are on the nape of the neck. The high volume of patients among female dentists has the potential to cause increased muscle tension and reduced attention to body posture, giving rise to MSDs complaints. Male have higher muscle strength than female, while female shoulders are too weak compared to male because male have 45% less muscle in the biceps brachii area and have a different anatomical shape of the glenoid fossa (21).

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