



Ergonomic Interventions for Work-Related Musculoskeletal Disorders (WRMSDs) Among Dentists- A Review

Divyashree Mohapatra¹ and Dr. Manju Mehta²

¹Ph.D. Scholar, Dept. of Resource Management and Consumer Science, College of Community Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India-125004. email: divyashree.1395@gmail.com

²Director, Human Resource Management, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India-125004. Email: manjujmehta19@gmail.com

ABSTRACT

Work-related musculoskeletal disorders (WRMSDs) are prevalent among dentists due to the repetitive and physically demanding nature of their profession. Work-related musculoskeletal diseases (WRMSDs) are responsible for morbidity in numerous working populations which are of multifactorial origin and global concern due to industrialization. Dentists as health-care professionals are also prone to develop these WRMSDs. Literature has shown that various factors leading to WRMSDs are multifactorial and may be attributed to posture, repetitive movements, physical loads, cerebral stress, and other ergonomic factors. The study aims to determine the qualitative assessment of the frequency of WRMSDs among dentists. Hence, musculoskeletal pain, a common symptom among dental professionals can be affected by several factors like ergonomically awkward positions and extended work hours. This study also assessed that there is a high frequency of WRMSDs among dentists. So, this paper explores various ergonomic interventions aimed at preventing and managing WRMSDs among dentists. The effectiveness of ergonomic strategies, including workstation modifications, proper tool design, and training in ergonomic principles, is examined based on recent literature. Understanding these interventions is crucial for promoting dentist well-being and optimizing patient care. Thus, self-acknowledgment is essential for the prevention of occupational damages of musculoskeletal nature. Ergonomic recommendations and healthy measures need to be integrated with the professional practice of dentists.

KEYWORDS- Ergonomic, Intervention, Work-related musculoskeletal disorders (WRMSDs), Dentist

INTRODUCTION

WRMSDs are the prevalent world over and are one of the commonest causes of long-term pain and disability affecting hundreds of millions of people. This fact was being recognized by World Health Organization (WHO) and the United Nations with their endorsement of the Bone and Joint decade 2000–2010 (Woolf and Pfleger, 2003). WRMSD is characterized by the presence of discomfort, disability, or persistent pain in the body parts and other soft parts caused or aggravated by repeated movements and prolonged awkward or forced static body postures at work which require more than 50% of the body's muscle to contract while resisting gravity. When the body is repeatedly subjected to such prolonged static postures (PSP), it results in pain, injury, or career-ending work-related musculoskeletal disorders (Valachi and Valachi, 2003).

Among various populations, occupational hazards are very common; work-related musculoskeletal disorders (WRMSDs) are one of the important occupational hazards that affect different members of various healthcare professions (Aljanakh *et al.*, 2015). Dentistry is among the occupations which is more frequently affected by the musculoskeletal disorder, their work comprises the risk factors that may result in various WRMSDs such as tenosynovitis, bursitis, tendinitis, and synovitis (Mishra and Sharma, 2014). By definition, musculoskeletal disorders can be described as the disorder of the nerve, tendons, muscles, joints, ligaments, spinal disc, and cartilage (Shaik *et al.*, 2011). Maintaining static postures for long hours with hand precision are the WRMSDs or the professional/occupational health hazard for dentist (European Commission 2003; Szeto *et al.*, 2009).

Many factors contribute to WRMSDs in dental professionals, including repetitive motion, pinch-grasp, awkward positions, sitting for a long period, operator position, poor posture, lack of flexibility and strength, poor ergonomics, and insufficient work breaks (Sanders, 2002). WRMSDs are conditions that affect the muscles, nerves, tendons and supporting structures. It occurs with symptoms that range from any of the subsequent complaints such as stiffness, swelling, weakness, redness, paraesthesia to more severe, prolonged, intense, and chronic pain (Amell, 2001). Since all the dental practitioners' work revolves around the usage of their hands, with long hours in the seated-bent position most of the time, WRMSD will hurt the productivity and efficiency of work (Murtomaa, 1982).

Valachi and Valachi (2003) from their article cited a flowchart diagram of muscle activity and pain leading to work-related musculoskeletal disorders (WRMSDs) (Figure 1).

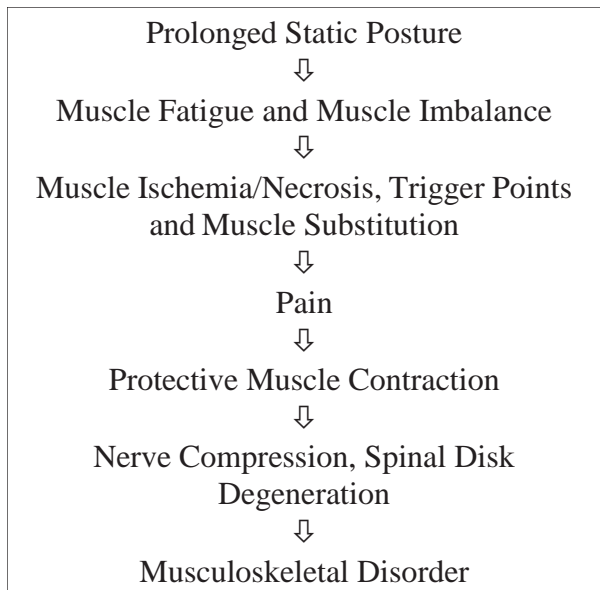


Figure 1- Flowchart of muscle activity and pain leading to WRMSDs.

WORK-RELATED MUSCULOSKELETAL DISORDERS (WRMSDs) CLASSIFICATION

Source- (Mirella and Veronica, 2007)

1. Nerve disorders: carpal tunnel syndrome.
2. Occupational disorders of neck: cervical spondylosis
3. Shoulder disorders: shoulder pain
4. Tendonitis of the elbow, forearm and wrist: tendonitis
5. Hand-arm vibration: strain in palm
6. Back discomfort: chronic low back pain.

These WRMSDs not only affect the comfort and health of dental practitioners but can also impair their ability to perform procedures effectively and efficiently. Furthermore, untreated WRMSDs may lead to chronic conditions that necessitate time off work and could ultimately impact the quality of patient care provided by dentists. Therefore, implementing ergonomic interventions and promoting awareness of proper ergonomic practices are crucial for preventing and managing WRMSDs among dentists, ultimately fostering a healthier and more sustainable work environment in the dental profession.

Work-related musculoskeletal disorders (WRMSDs) are a significant occupational health concern among dentists due to the physically demanding nature of their work. Dentistry involves prolonged periods of static postures, repetitive movements, and fine motor tasks, which can contribute to WRMSDs affecting the neck, shoulders, back, and upper extremities. Ergonomic interventions are essential for addressing these issues by optimizing the dental workspace and promoting healthier work habits among dental professionals. This paper reviews recent studies investigating ergonomic interventions specific to dentistry and their impact on reducing WRMSDs. Ergonomic interventions aimed at improving workstations, tools, and practices have been explored to prevent and manage WRMSDs in dental professionals. This paper examines various studies and interventions focused on ergonomics to address WRMSDs among dentists.

LITERATURE REVIEW

A study by Rendzova *et al.* (2018) investigated the impact of ergonomic interventions on WRMSDs in a group of practicing dentists. The interventions included adjustable dental chairs, ergonomic instruments, and training on proper posture and movements. Results showed a significant reduction in reported musculoskeletal discomfort and improved work performance following the implementation of these interventions.

Longridge *et al.* (2020) conducted a detailed ergonomic assessment of dental workstations to identify risk factors contributing to WRMSDs. They highlighted the importance of adjustable equipment, proper lighting, and ergonomic seating arrangements in preventing strain and injuries among dental students. The study emphasized the need for personalized workstation designs based on individual ergonomic needs.

A pilot study by Bakar *et al.* (2019) explored the benefits of using loupes and magnification devices in reducing WRMSDs among dentists and dental students. By enhancing visual acuity and reducing the need for awkward postures, loupes were found to alleviate strain on the neck and back muscles. Dentists using loupes reported fewer symptoms of musculoskeletal discomfort compared to those without magnification aids.

In a longitudinal study by Ajwa *et al.* (2018), the long-term effects of ergonomic training on WRMSDs were investigated. Dentists who underwent regular ergonomic training sessions demonstrated sustained improvement in posture, reduced fatigue, and lower incidence of WRMSDs over a two-year follow-up period. The study emphasized the importance of ongoing education and reinforcement of ergonomic practices.

DISCUSSION

Published literature reviews have shown a high prevalence of WRMSDs among dentists. This has been attributed to prolonged static postures, repetitive movements, use of force and vibrations which are considered to be risk factors for WRMSDs.

Ratzon *et al.* (2000) reported that 83% of the dentists had experienced lower back pain and neck pain respectively in their survey of WRMSDs among dentists in Israel. It was also noticed that the dentists who work in the sitting position have more severe low back pain than those who do work alternately between sitting and standing postures even though those who sat at least for 80% of the time worked fewer hours and had less of workload during their working hours. This suggested that altering position was recommended to dentists. Hence, an intervention study, however, was needed to demonstrate that changing posture will decrease the prevalence of low back pain in dentists.

Wazzan *et al.* (2001) concluded that 73.53% of the respondents had back pain some time in their workplace, while neck pain was 54.41% less common. This might be due to postural practices. The results of this survey showed that 90.69% of them had postural faults about back status and 83.83% about neck posture while observing the candidates during work. It was found that 79.12% of the dentists had suffered back problems also.

Muralidharan *et al.* (2012) in their study noticed that 78% of the total seventy-three dental practitioners had a prevalence of at least one WRMSD symptom over the past twelve months. The most common areas affected by WRMSDs in order of magnitude were neck, low back, shoulders and wrist. A high prevalence of WRMSDs existed among three-quarter of the dental practitioners who required sick leave from their practice during the preceding year.

Batham and Yasobant (2016) identified that more than 92% of dental practitioners reported pain and discomfort in at least one part of their body. The major affected body part was the neck followed by the lower back and wrist. More than half of the orthodontists and oral surgeons reported that their work-related musculoskeletal disorders (WRMSDs) had a work-related origin.

Khan *et al.* (2017) assessed the main clinical symptom of work-related musculoskeletal disorders (WRMSDs) among dentists remains as the pain that was frequently felt in the region of the neck (96%), shoulder (90%), and upper extremities (82%). Low pain has been felt in the region of lower extremities area. Pain in knees (34%) and ankle/feet (20%) was also recorded. In their study, they reported a high prevalence of WRMSDs associated with multiple factors. Thus, self-acknowledgment is essential for the prevention of occupational damages of musculoskeletal nature. This study recommended that there was a need to incorporate ergonomic work practice to create alertness of the risk of WRMSDs and to endorse health and safety measures.

Ajwa *et al.* (2018) showed that 61% and 34% of dental respondents reported lower back and neck pain respectively. The leading cause of the pain was inappropriate work posture. Moreover, survey results further showed a relationship between some personal characteristics like the dentistry profession and musculoskeletal disorder-related variables, with only 8.1% of participants not reporting pain. Back pain was the most common type of pain/disorder among dental practitioners found in this survey. Exercise, a simple and useful method of alleviating pain was ignored by practitioners.

Bakar *et al.* (2019) explained that some anatomical body parts were indicated to have a high prevalence in experiencing musculoskeletal disorders. They were waist (55%), right shoulder (49%), upper neck (48%), right wrist (45%), and lower neck (42%). The quality of the pain was varied. The high prevalence of work-related musculoskeletal disorders (WRMSDs) may be caused by static postures and the big force needed by certain body parts during dental treatment.

Joshi *et al.* (2019) found out the most common specific disorder among dental professionals was tendonitis of the shoulder and repetitive strain injury. There was an increasing trend in the presence of neurological pain with an increase in several years in dental practice. The musculoskeletal region most frequently affected in all three groups was the lower and upper back contributing about 40% of regions affected. However, there was no pain recorded among 32% of dental professionals. Pain involving the body parts depends on the posture, time, and procedures. Dental professionals always need to maintain multiple postures for prolonged periods. Therefore, dental procedures should have rotational appointments to minimize the time-consuming clinical procedures and ultimately reduce WRMSDs.

Berdouses *et al.* (2020) from their study indicated that 54.1% of the sample experienced work-related musculoskeletal disorders (WRMSDs); the prevalence of the problem was increased after 10 years of practice (33.2%) and was doubled after 30 years of practice in the 69.6% of the cases. The most prevalent WRMSDs were back problems (18.6%), hands problems (18.6%), cervical syndrome (14.0%), shoulder (10.5%), lower leg problems (11.9%), and carpal tunnel syndrome (8.3%). Only 12.7% of the dentists practiced four-handed dentistry in a seated position with an assistant next to a prone patient. The statistics demonstrated that there was little difference in the prevalence of WRMSDs between those who practiced four-handed dentistry (or with the help of nurse/ nursing support) and those who didn't. However, there was a change in the distribution of WRMSDs between different parts of the body.

Longridge *et al.* (2020) in their study reported that 76.5% of the respondents experienced pain in the neck or back after following a clinical session. Moreover, from the total respondents who experienced pain, 67.9% experienced pain at least once a month or more. It was also found out that

21.6% of the respondents were unsure of the correct height to place their patients to optimize their posture during treatment and a further 57.8% of the respondents were slightly aware of the correct height to place their patients during treatment.

Ohlendorf *et al.* (2020) drew data from their study that the overall prevalence among dentists was significantly higher than in the general population. The results highlighted that the dentists suffered frequently from work-related musculoskeletal disorders (WRMSDs) (seven days: 65.6%, twelve months: 92%, lifetime: 95.8%). The most affected body regions included the neck (42.7%–70.9%–78.4%), shoulders (29.8%–55.6%–66.2%) and lower back (22.9%–45.8%–58.7%) was significantly higher than in the general population.

ERGONOMIC INTERVENTIONS

Research by Joshi *et al.* (2019) showed that the implementation of ergonomic interventions, such as adjustable equipment and ergonomic tool design, led to decreased musculoskeletal symptoms among practicing dentists.

Improving ergonomics for dentists is crucial for their comfort, health, and long-term career sustainability. Some of the ergonomic solutions tailored for dentists:

- Adjustable Operator Chairs: Dentists spend hours sitting while treating patients. Investing in ergonomic operator chairs with adjustable features like height, backrest, and armrests can provide proper support and reduce strain on the spine.
- Ergonomic Loupes: Magnification loupes with adjustable settings can help dentists maintain proper posture by reducing the need to hunch over during procedures. They also improve precision and reduce eye strain.
- Ergonomic Instruments and Tools: Using lightweight and ergonomically designed dental instruments can reduce hand and wrist fatigue. Handles with ergonomic grips can also improve control and precision during procedures.
- Height-Adjustable Dental Chairs and Equipment: Dental chairs and equipment should be adjustable to accommodate the dentist's preferred working height, allowing them to maintain a neutral posture and reduce strain on the back and shoulders.
- Proper Lighting: Adequate lighting is essential for accurate diagnosis and treatment. Adjustable task lighting that minimizes shadows and glare can help dentists work more comfortably and effectively.
- Foot Rests: Foot rests can promote proper posture by reducing pressure on the lower back and legs. They also encourage shifting of weight between feet, which improves blood circulation and reduces fatigue.
- Anti-Fatigue Mats: Placing anti-fatigue mats in areas where dentists stand for extended periods, such as around the dental chair, can cushion their feet and lower limbs, reducing discomfort and fatigue.
- Organized Workstations: Organizing dental instruments and supplies within easy reach minimizes the need for repetitive bending and reaching motions, reducing the risk of strain injuries.
- Regular Breaks and Stretching Exercises: Encouraging dentists to take regular breaks and perform stretching exercises can help alleviate muscle tension and reduce the risk of repetitive strain injuries.
- Ergonomic Training: Providing ergonomic training and education to dentists and dental staff can raise awareness of proper posture and techniques to prevent work-related injuries.

A study by Ohlendorf *et al.* (2020) found that ergonomic education and training significantly reduced the prevalence of WRMSDs among dental students. Longitudinal studies have highlighted the sustained benefits of ergonomic interventions over time, emphasizing the importance of ongoing training support and education.

CONCLUSION

To conclude, a high frequency of WRMSDs exists among dentists which affect the diurnal practice of dentists. Further studies are required to identify the specific problem factors for WRMSDs to introduce effective remedial measures. Literature has shown that various factors leading to WRMSDs are multifactorial and may be attributed to posture, repetitive movements, physical loads, cerebral stress, and other ergonomic factors. This might be due to the lack of an ergonomically acquainted work practice among the Indian dentists; still, further studies are in need to be conducted to make logical conclusions. Against this background of a large population, rising oral health care requirements, and a huge dental force, the health, and effectiveness of dental care professionals play a crucial part in furnishing optimal oral health care. A better planned long term study barring limitations of the current study and using a mixed system approach will give a more accurate estimate of WRMSDs and exposure to problem situations among dentists and thereby a better means to directly recommend and apply programs and strategies to combat this serious issue of WRMSDs among dentists. Ergonomic interventions play a crucial role in preventing and managing WRMSDs among dentists by optimizing work environments and practices. This review highlights the importance of ergonomic considerations in promoting dentist well-being. Studies reviewed underscored the effectiveness of adjustable equipment, ergonomic training, and magnification devices in reducing musculoskeletal discomfort and improving the overall well-being of dental professionals. Continued research and implementation of tailored ergonomic solutions are essential for promoting a healthy and sustainable dental

practice. Ultimately, integrating ergonomic principles into dental practice can enhance practitioner comfort, improve patient care outcomes, and contribute to the overall sustainability of the profession.

REFERENCES

- Ajwa, N., Khunaizi, F. Al., Orayyidh, Al. Al., Qattan, W. Al., Bujbarah, F., Bukhames, G., Saad, Z. Al. and Khars, S. Al. 2018. Neck and back pain as reported by dental practitioners in Riyadh city. *Journal of Dental Health Oral Disorders & Therapy*. 9(4): 340-345.
- Aljanakh, M., Shaikh, S., Siddiqui, A. A., Al-Mansour, M. and Hassane, S. S. 2015. Prevalence of musculoskeletal disorders among dentists in the Hail Region of Saudi Arabia. *Annals of Saudi Medicine*. 35: 456-461.
- Amell, T. and Kumar, S. 2001. Work-related musculoskeletal disorders: Design as a prevention strategy. A review. *Journal of Occupational Rehabilitation*. 11: 255-265.
- Bakar, A., Rifani, Ningrum, V. and Lee, S. C. 2019. Musculoskeletal disorders among dentists and dental students in West Sumatera, Indonesia. *Journal of Dentomaxillofacial Science*. 4(2): 92-95.
- Batham, C. and Yasobant, S. 2016. A risk assessment study on work-related musculoskeletal disorders among dentists in Bhopal, India. *Indian Journal of Dental Research*. 27(3): 236- 241.
- Berdouses, E. B., Katsantoni, A., Andrikoula, T. and Oulis, C. J. 2020. Work-Related Musculoskeletal Disorders among Greek Dentists - A Nationwide Survey. *Dental Research and Oral Health*. 3: 169-182.
- European Commission. 2003. Work and health in the EU, a statistical portrait. Luxembourg. Luxembourg Publishers. ISBN No. 92-894-7006-2.
- Joshi, A. D., Soni, H. K., Hedao, A. S., Bande, C. R., Goel, M. R., and Mishra, A. A. 2019. Prevalence of musculoskeletal disorders affecting general dental practitioners in Nagpur and proposal of a new composite classification system. *Journal of Indian Association Public Health Dentistry*. 17: 241-246.
- Khan, R. S., Ahmad, F. and Merchant, Md. S. 2017. Prevalence of work-related musculoskeletal disorders (MSD) among dentists. *International Journal of Contemporary Medical Research*. 4(5): 1208-1211.
- Longridge, N. N., Panju, R. and Fox, K. 2020. Work-Related Musculoskeletal Disorders in Dental Students: A Cross-Sectional, Pilot Study from a UK University Teaching Hospital. *Journal of Musculoskeletal Disorders and Treatment*. 6(3): 1-6.
- Mishra, P. and Sharma R. K. 2014. A hybrid framework based on SIPOC and Six Sigma DMAIC for improving process dimensions in the supply chain network. *International Journal of Quality and Reliability Management*. 31: 522-546.
- Muralidharan, D., Fareed, N. and Shanthi, M. 2012. Musculoskeletal Disorders among Dental Practitioners: Does It Affect Practice? *Epidemiology research international*. 2013: 1-6.
- Mirella, A. and Veronica, A. 2007. Musculoskeletal disorders (MSDs)- Consequences of prolonged static postures. *Journal of Experimental Medical & Surgical Research*. 4:167-172.
- Murtomaa, H. 1982. Work-related complaints of dentists and dental assistants. *International Archives of Occupational and Environment Health*. 50: 231-236.
- Ohlendorf, D., Naser, A., Haas, Y., Haenel, J., Fraeulin, L., Holzgreve, F., Erbe, C., Betz, W., Wanke, E. M., Brueggmann, D., Nienhaus, A. and Groneberg, D. A. 2020. Prevalence of Musculoskeletal Disorders among Dentists and Dental Students in Germany. *International Journal of Environmental Research and Public Health*. 17(23): 1-19.
- Rendzova, V., S Apostolska, M Eftimoska, B Džipunova, V Filipovska, S. Cyril, 2018. Work related musculoskeletal disorders among dentists at the university dental clinic in Skopje. *Serbian Dental Journal*. 65(2): 122-148.
- Ratzon, N. Z., Yaros, T., Mizlik, A. and Kanner, T. 2000. Musculoskeletal symptoms among dentists about work posture. *Work*. 15(3): 153-158.
- Sanders, M. A. and Turcotte, C. M. 2002. Strategies to reduce work-related musculoskeletal disorders in dental hygienists: Two case studies. *Journal of Hand Thermodynamics*. 15: 363-374.
- Shaik, A. R., Rao, S. B., Husain, A. and Dsa, J. 2011. Work-related musculoskeletal disorders among dental surgeons: A pilot study. *Contemporary of Clinical Dentistry*. 2: 308-312.
- Szeto, G. P., Ho, P., Ting, A. C., Poon, J.T., Cheng, S. W. and Tsang, R. C. 2009. Work-related musculoskeletal symptoms in surgeons. *Journal of Occupational Rehabilitation*. 19: 175-184.
- Valachi, B. and Valachi, K. 2003. Preventing musculoskeletal disorders in clinical dentistry: strategies to address the mechanisms leading to musculoskeletal disorders. *Journal of the American Dental Association*. 134(12): 1604-1612.

Wazzan, Al. K. A., Almas, K., Shethri, A. S. E. and Qahtani, Al. M. Q. 2001. Back & neck problems among dentists and dental auxiliaries. *Journal of Contemporary Dental Practice*. 2: 17- 30.

Woolf, A. D. and Pfleger, B. 2003. The burden of major musculoskeletal conditions. *Bulletin of the World Health Organization*. 81(9): 646–656.