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ERGONOMIC ASSESSMENT FOR WORK-RELATED MUSCULOSKELETAL DISORDERS (WRMSDs) AMONG DENTISTS- AN QUALITATIVE APPROACH

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ABSTRACT

Work-related musculoskeletal disorders (WRMSDs) are a significant concern among dentists due to the nature of their profession, which involves prolonged static postures, repetitive motions, and precision tasks. Due to the physically demanding nature of their work, dentists are prone to various musculoskeletal issues that can affect their quality of life and professional performance. This paper explored the prevalence for WRMSDs among dentists. It aims to provide a comprehensive understanding of the ergonomic risk factors faced by dental professionals and propose evidence-based interventions to mitigate these risks. This paper also aims to identify the primary factors contributing to these issues and propose ergonomic solutions and best practices to alleviate discomfort and prevent long-term health problems. The findings underscore the critical need for ergonomic awareness and interventions in the dental profession. Regular ergonomic assessments, appropriate equipment, and posture training can significantly mitigate the risk of MSDs. Moreover, fostering a culture of ergonomics within dental practices is essential for long-term occupational health. By prioritizing ergonomics through education, equipment design, and workplace practices, the dental industry can enhance the well-being and efficiency of its practitioners.

Keywords: Ergonomic, assessment, work-related musculoskeletal disorders (WRMSDs), dentists, qualitative

1. INTRODUCTION

WRMSDs are defined as the conditions that affect the muscles, nerves, tendons, ligaments, joints, and spinal discs. These disorders are caused or exacerbated by workplace activities and are characterized by discomfort, pain, and functional impairment.

Work-related musculoskeletal disorders (WRMSDs) pose a significant occupational health challenge for dentists worldwide. The demanding nature of dental practice, characterized by prolonged periods of static postures, repetitive tasks, and awkward positions, predisposes dental professionals to a high risk of musculoskeletal injuries. WRMSDs not only affect the physical health and well-being of dentists but also impact their professional performance and quality of patient care. Work-related musculoskeletal disorders (WRMSDs) are a common occupational health issue affecting dental professionals. The nature of dental work, characterized by repetitive tasks, static postures and precise manual operations, predisposes dentists to various musculoskeletal problems.

Ergonomics is the study to fit the work according to humans' needs. For dentists, ergonomics focuses on designing dental practices and work environments to fit the physical needs and limitations of the practitioners, aiming to reduce the risk of work-related musculoskeletal disorders (WRMSDs) and improve overall efficiency and comfort.

The dental profession requires practitioners to maintain static and awkward postures for extended periods, often leading to work-related musculoskeletal disorders (WRMSDs). Dentistry demands meticulous precision and concentration, placing significant physical and mental demands on dental practitioners. However, the profession also entails inherent ergonomic challenges, as dentists frequently assume static postures and perform repetitive tasks for extended durations. Such working conditions predispose dental professionals to musculoskeletal disorders (MSDs) and occupational discomfort, affecting both their health and clinical efficiency. Dentistry is a demanding job that requires precision, concentration, and extended periods of focused work. Dentists often spend prolonged hours in static positions, performing intricate procedures that necessitate fine motor skills and intense visual focus. The occupational hazards associated with dentistry extend beyond the cognitive and technical aspects, encompassing ergonomic challenges that pose significant risks to the musculoskeletal health of dental professionals. Poor posture, repetitive movements, inadequate workspace design, and improper equipment usage are among the key contributors to

the development of musculoskeletal disorders (MSDs) within the dental community. Dentistry is a profession characterized by intricate manual tasks, prolonged static postures, and repetitive motions, placing significant physical strain on practitioners. As such, dentists are prone to developing musculoskeletal disorders (MSDs) and ergonomic-related injuries, which not only impact their quality of life but also compromise patient care and productivity. Despite the growing recognition of ergonomic concerns in dentistry, there remains a gap in understanding the specific risk factors and effective interventions tailored to the dental profession. Dentistry is inherently demanding, requiring prolonged periods of static postures, repetitive motions, and precise manual tasks, which predispose dentists to various musculoskeletal disorders (MSDs) and ergonomic-related injuries. Through a comprehensive review of existing literature, this study identifies the ergonomic hazards specific to dental practice, analyzes their impact on dentists' health and productivity, and evaluates current ergonomic assessment methods and interventions. Work-related musculoskeletal disorders (WRMSDs) are a significant occupational health concern among dentists, characterized by pain, discomfort, and functional impairment in the musculoskeletal system. The unique nature of dental practice, which involves prolonged periods of static postures, repetitive movements, and awkward positions, predisposes dentists to WRMSDs.

2. LITERATURE REVIEW

Multiple studies have documented the high prevalence of WRMSDs among dental practitioners. These studies vary in their geographic focus, sample sizes, and methodologies, but consistently show that musculoskeletal pain and disorders are widespread in this profession.

A study conducted by Valachi and Valachi (2003) found that nearly 85% of dentists experience musculoskeletal pain, with a significant proportion reporting chronic issues.

Research in European countries, such as a study by Kierklo *et al*. (2011) in Poland, reported that 91% of dentists experienced some form of musculoskeletal discomfort.

They assume prolonged static positions which are uncomfortable and asymmetric. They sit or stand for prolonged periods and they maintainhead, neck and shoulders in fixed positions for long intervals (Kierklo *et al*., 2011). In dentistry, inconvenient posture, repetitive tasks as well as improper working habits, such as: cavities preparation and filling, root canal instrumentation, scaling contribute greatly to WRMSDs, psychological stress and finally cause fatigue These conditions can result in decrease of quality of work. Moreover, the monotony of work, artificial light, and work in noise are risk factors for dental personnel (Alexopoulos *et al*., 2004).

Numerous studies indicate a high prevalence of WRMSDs among dental professionals. For instance, a study by Alexopoulos *et al*. (2004) found that up to 64% of dentists experience musculoskeletal pain, with the neck, shoulders, and lower back being the most commonly affected areas.

A comprehensive review by Bedi *et al*. (2015) reported that the prevalence of musculoskeletal pain among dentists ranges from 64% to 93%, depending on the study population and specific body regions assessed.

A more recent meta-analysis by Decharat *et al*. (2016) indicated that the prevalence of WRMSDs in dentists is approximately 62%, with neck, back, and shoulders being the most commonly affected areas.

A study by Puriene *et al*. (2008) revealed that 78% of dental professionals suffered from musculoskeletal pain, predominantly in the lower back and neck regions.

Lower back pain is reported by around 60% to 65% of dentists, as evidenced by research such as that by Syzmanska (2002).

Ratzon *et al*. (2000) reported that 83% of the dentists had experienced the lower back pain and neck pain respectively in their survey of MSDs 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 alternate between sitting and standing postures despite the fact that those who sat at least for 80% of the time worked less hours and had a less of workload during their working hours.

A study by Akesson *et al*. (2000) demonstrated that using adjustable chairs with proper lumbar support significantly reduced lower back pain among dentists.

Research by Aghadir *et al*. (2015) found that dentists who used magnification loupes reported significantly less neck and shoulder pain compared to those who did not.

Valachi and Valachi (2003) evaluated the impact of ergonomic training programs and found a notable reduction in musculoskeletal symptoms among participants.

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3. DISCUSSION

PREVALENCE OF WRMSDS IN DIFFERENT BODY REGIONS:

1. Neck and Shoulders

Prevalence: Studies show that neck and shoulder pain are extremely common among dentists. Bedi *et al*. (2015) reported that up to 93% of dentists experience neck pain at some point in their careers, and approximately 65% suffer from shoulder pain.

Exposure: Dentists frequently work in a forward head posture with elevated shoulders to gain better access to the patient's oral cavity. This posture, combined with prolonged periods of static positions, puts significant strain on the cervical spine and shoulder muscles.

Impact: Chronic neck and shoulder pain can lead to reduced range of motion, difficulty in performing precise tasks, and increased risk of developing conditions such as cervical spondylosis and rotator cuff injuries. This can impact dentists' ability to work efficiently and comfortably, potentially leading to increased absenteeism and reduced job satisfaction.

2. Lower Back

Prevalence: Lower back pain is highly prevalent, affecting between 50% and 70% of dentists. Longridge *et al*. (2007) found that approximately 60% of dental practitioners suffer from lower back pain.

Exposure: The primary risk factors for lower back pain include prolonged sitting, inadequate lumbar support, and frequent forward bending. Dentists often spend long hours leaning forward over patients, which places excessive pressure on the lumbar spine.

Impact: Persistent lower back pain can lead to decreased work efficiency, absenteeism, and in severe cases, conditions such as disc herniation that may require medical intervention or surgery. Lower back pain can also significantly affect a dentist's quality of life, leading to chronic discomfort and disability.

3. Hands and Wrists

Prevalence: Hand and wrist disorders are prevalent among 40% to 60% of dentists. Conditions such as carpal tunnel syndrome and tendonitis are common due to the repetitive fine motor tasks performed during dental procedures.

Exposure: Dentists perform repetitive tasks like gripping instruments and applying force during procedures, which leads to overuse injuries. Poorly designed instruments that require excessive force exacerbate these issues.

Impact: Hand and wrist pain can significantly impair manual dexterity and precision, essential for dental work. Chronic conditions may necessitate surgical intervention or force dentists to limit their practice or change their working habits, which can impact their career longevity and effectiveness.

4. Upper Back

Prevalence: Upper back pain affects around 50% to 60% of dentists, as reported by Ratzon *et al*. (2000).

Exposure: Poor posture, lack of back support, and repetitive arm movements contribute to upper back strain. Dentists often maintain static positions for extended periods, leading to muscle fatigue and pain in the upper back.

Impact: Upper back pain can cause discomfort and stiffness, reducing the ability to maintain prolonged static postures required for dental procedures. This can lead to decreased productivity and increased discomfort during and after work hours.

5. Elbows

Prevalence: Although less common, elbow pain, including conditions like lateral epicondylitis (tennis elbow), affects about 20% to 30% of dentists.

Exposure: Repetitive arm movements, forceful exertions, and awkward wrist positions can lead to elbow strain. Using heavy or poorly balanced instruments increases the risk.

Impact: Elbow pain can limit the ability to perform procedures that require precision and strength, impacting the overall quality of care provided by the dentist. Chronic elbow pain can also lead to longer recovery times and potential changes in work practices to avoid further injury.

ERGONOMIC ASSESSMENT PROCESS

A flowchart diagram outlining the process of assessing work-related musculoskeletal disorders (WRMSDs) among dentists:

1. Identification of Symptoms- The process starts when a dentist report experiencing discomfort or pain in specific body regions.

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2. Initial Screening- Administering a standardized questionnaire to gather information on symptoms, affected body parts, duration, and severity. Reviewing the dentist's medical history to identify any pre-existing conditions or previous injuries.

3. Ergonomic Assessment- Analyzing the dentist's workstation setup, including chair, tools, and equipment positioning. Recording the dentist's posture and movements during typical procedures. Assessing the dentist's work patterns, including the frequency of breaks, task variety, and work hours.

4. Risk Factor Identification- Identifying specific ergonomic risk factors contributing to the WRMSDs, such as repetitive motions, awkward postures, and insufficient breaks.

5. Physical Examination- Performing a physical examination to assess the musculoskeletal condition of the affected areas, including range of motion, strength, and tenderness.

6. Evaluation of Psychosocial Factors- Evaluating psychosocial factors, including stress levels, job satisfaction, and workplace environment, which may contribute to WRMSDs.

7. Development of Intervention Plan- Creating a tailored ergonomic intervention plan based on the findings from the assessments. This may include workstation adjustments, ergonomic tool recommendations, posture training, and changes in work patterns. Recommending physical therapy or specific exercises to address musculoskeletal issues.

8. Implementation and Monitoring- Putting the ergonomic and therapeutic interventions into practice. Regularly monitoring the dentist's symptoms and work conditions to assess the effectiveness of the interventions.

9. Follow-Up Assessment- Periodically re-assessing the dentist's musculoskeletal health and workstation ergonomics to ensure continued improvement and address any new issues.

This flowchart outlines a systematic approach to assessing WRMSDs among dentists, ensuring a comprehensive evaluation and effective intervention plan.

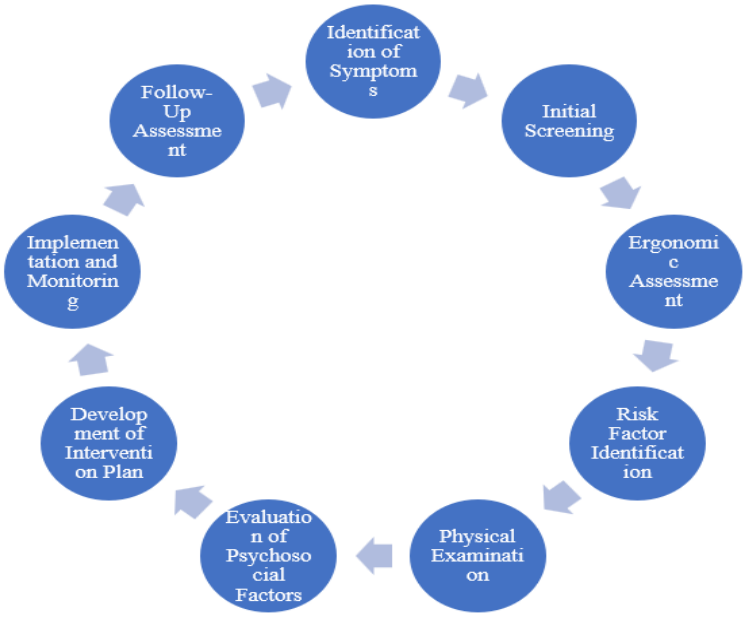

Figure 1- Flowchart diagram outlining ergonomic assessment process

RISK FACTORS CONTRIBUTING TO WRMSDS

Several risk factors contribute to the high incidence of WRMSDs among dentists:

Repetitive Movements: Dental procedures often require repetitive hand and arm movements, leading to overuse injuries.

Awkward Postures: Dentists frequently adopt awkward postures, such as leaning forward or twisting, to gain better access to the oral cavity.

Prolonged Static Postures: Extended periods of sitting or standing in fixed positions without adequate breaks can strain the musculoskeletal system.

Forceful Exertions: Tasks that require significant force, such as extractions or manipulating instruments, can contribute to musculoskeletal strain.

Psychosocial Factors: Stress, time pressure, and high job demands can contribute to muscle tension and WRMSDs.

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AMOUNT OF EXPOSURE TO RISK FACTORS

1. Duration of Work:

Dentists often work long hours with minimal breaks, increasing their exposure to musculoskeletal risk factors. Continuous work without adequate rest periods exacerbates muscle fatigue and strain. For example, a typical dental appointment can last from 30 minutes to several hours, with dentists frequently holding static postures and performing repetitive tasks throughout the day.

2. Work Environment:

Poorly designed dental workstations contribute significantly to musculoskeletal strain. Non-adjustable chairs, inadequate lighting, and improperly positioned equipment force dentists to adopt awkward postures. A well-designed ergonomic workstation should include adjustable chairs, proper lighting, and strategically placed equipment to reduce the need for reaching and twisting.

3. Instrument Design:

The use of non-ergonomic instruments that require excessive force or repetitive movements can exacerbate hand and wrist disorders. Ergonomically designed instruments with larger, padded handles and lightweight materials can distribute pressure more evenly and reduce the risk of overuse injuries.

4. Posture and Movement:

Dentists frequently adopt awkward postures and perform repetitive movements that lead to muscle fatigue and strain. Maintaining a neutral posture with proper alignment of the spine, head, and shoulders is crucial in reducing musculoskeletal risk. Regular movement and stretching exercises can help alleviate muscle tension and prevent the onset of WRMSDs.

5. Workload and Stress:

High patient volumes and time pressures increase physical and psychological stress, contributing to muscle tension and WRMSDs. Effective workload management and stress reduction techniques, such as mindfulness and relaxation exercises, can help mitigate these risk factors.

IMPACT OF WRMSDS ON DENTISTS

Reduced Productivity: Pain and discomfort can decrease dentists' efficiency and increase procedure times.

Career Longevity: Chronic musculoskeletal pain can lead to early retirement or career changes.

Quality of Life: Reduces comfort, health and overall well-being of the dentist.

ERGONOMIC WORKSTATION INTERVENTION

Proper Workstation Setup:

Adjustable Dental Chairs: Ergonomically designed dental chairs that allow for height adjustments and proper back support are crucial. These chairs should enable the dentist to maintain a neutral spine position and adjust according to different patient positions. Research by Gandolfi *et al*. (2021) demonstrated that adjustable chairs significantly reduce lower back strain. Ensuring that the dental chair, patient chair, and other equipment are adjusted to the appropriate height to maintain a neutral posture while working. This includes proper positioning of the dental instruments and tools within easy reach to reduce reaching and twisting movements.

Operator Stools: Using operator stools with lumbar support and adjustable height can help maintain proper posture. Stools with a saddle design encourage an open hip angle, reducing pressure on the lower back.

Proper Layout: Arranging dental equipment and tools within easy reach minimizes excessive reaching and twisting. A study by Valachi and Valachi (2003) found that optimizing the layout of dental instruments reduces shoulder and neck strain.

Ergonomic Instruments and Tools:

Lightweight and Well-Balanced Instruments: Using dental tools that are lightweight and ergonomically designed reduces hand and wrist fatigue. Instruments with larger, padded handles distribute pressure more evenly across the hand. Investing in ergonomic dental equipment, such as ergonomic stools, adjustable dental chairs, and instruments with ergonomic handles, to reduce strain on the muscles and joints during procedures.

Magnification Loupes and Lighting: Implementing magnification loupes with proper lighting reduces the need for dentists to lean forward, thereby minimizing neck and upper back strain. Studies, such as those by Berdouses *et al*. (2020) have shown that magnification loupes improve posture and decrease musculoskeletal discomfort. Utilizing magnification loupes and adequate lighting to improve visualization of the oral cavity, reducing the need for awkward postures and minimizing eye strain.

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Larger Handle Instruments: Instruments with larger, padded handles to distribute pressure more evenly across the hands and reduce grip fatigue.

Training and Education:

Posture and Body Mechanics Training: Educating dental professionals about proper posture and body mechanics is crucial. Training programs should include techniques for maintaining a neutral posture, adjusting equipment, and taking breaks to stretch and move. Providing training and education on proper body mechanics and ergonomic principles to raise awareness among dental professionals about the importance of maintaining good posture and avoiding repetitive motions that can lead to musculoskeletal injuries.

Regular Ergonomic Assessments: Conducting periodic ergonomic assessments helps identify risk factors and areas for improvement and ensure ongoing compliance with ergonomic guidelines. Continuous education reinforces good ergonomic practices.

Customized Solutions: Tailoring interventions to specific job roles and individual needs.

Work Organization:

Task Rotation and Breaks: Implementing job rotation and ensuring regular breaks can reduce the risk of repetitive strain injuries. Short, frequent breaks are more effective than longer, infrequent ones in preventing fatigue. Encouraging dentists to take regular breaks to rest and stretch their muscles. Implementing a system of patient rotation can also help distribute physical workload among dental staff.

Scheduling: Allowing sufficient time between patient appointments for recovery and ergonomic adjustments can help prevent musculoskeletal overload. Streamlining workflow processes and incorporate ergonomic principles into the design of dental clinics to minimize unnecessary movements and reduce physical strain.

Physical Fitness and Conditioning: Offering exercise programs and access to physical therapy services to strengthen muscles, improve flexibility, and address any existing musculoskeletal issues.

By implementing these ergonomic interventions, the risk of work-related musculoskeletal disorders among dentists can be reduced and create a safer and more comfortable working environment.

4. CONCLUSION

The findings underscore the critical need for ergonomic awareness and interventions in the dental profession. Regular ergonomic assessments, appropriate equipment, and posture training can significantly mitigate the risk of MSDs. Moreover, fostering a culture of ergonomics within dental practices is essential for long-term occupational health.

WRMSDs are highly prevalent among dentists, affecting various body regions due to the physical demands and ergonomic challenges of their profession.

The conclusion emphasizes the importance of preventive strategies in reducing the incidence and severity of WRMSDs among dentists. Moreover, it calls for collaborative efforts among stakeholders to prioritize WRMSD prevention and create supportive work environments that enable dental professionals to thrive in their careers while safeguarding their physical health. Neck, shoulder, lower back, hand, wrist, and upper back pain are common complaints that significantly impact dental professionals' health and career longevity. Understanding the prevalence and exposure to risk factors is crucial for implementing effective ergonomic interventions and preventive strategies to improve the well-being of dental practitioners. By adopting ergonomic workstation designs, using well-designed instruments, providing training and education, organizing work effectively, and promoting physical fitness, dental practices can create a healthier and more sustainable working environment.

WRMSDs are a significant occupational hazard for dentists, impacting their professional performance and quality of life. By understanding the risk factors and implementing comprehensive ergonomic, educational, and organizational strategies, dental professionals can mitigate the incidence and severity of these disorders. Continued research and awareness are essential to developing innovative solutions that promote long-term musculoskeletal health in the dental profession. WRMSDs are highly prevalent among dentists worldwide, affecting various body regions and significantly impacting both their professional and personal lives. The repetitive and static nature of dental work, combined with ergonomic challenges, makes WRMSDs a critical concern in the field of dentistry. Addressing these issues through ergonomic interventions, proper training, and supportive workplace practices is essential to reduce the prevalence and severity of WRMSDs among dental professionals. Effective prevention and management require a holistic approach that includes ergonomic improvements, professional training, and individual health management. By adopting comprehensive strategies, dental practitioners can significantly reduce the incidence and severity of musculoskeletal disorders, thereby enhancing their professional longevity and overall well-being.

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