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Dental Assistants And Ergonomics: Occupational Hazards, Global Best Practices, And Prevention Strategies In Saudi Clinics — A Narrative Review

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Abstract

Background: Dental assistants are essential members of the dental care team, yet their work often involves prolonged static postures, repetitive movements, and close patient contact, predisposing them to a range of occupational hazards. In Saudi Arabia, musculoskeletal disorders (MSDs) are particularly prevalent, alongside environmental, biological, and psychosocial risks. While global best practices offer effective solutions, their application locally faces several challenges.
Objective: This narrative review synthesizes evidence on the ergonomic challenges and occupational hazards faced by dental assistants in Saudi clinics, examines international best practices, and proposes targeted prevention strategies adapted to the Saudi healthcare context.
Methods: A narrative review approach was used, drawing on peer-reviewed studies from Saudi Arabia and relevant international literature. Data sources included PubMed, Scopus, Google Scholar, and Ministry of Health publications, focusing on studies addressing MSD prevalence, ergonomic risk factors, intervention outcomes, and policy frameworks.
Results: Saudi studies report MSD prevalence rates exceeding 80% among dental assistants, with the lower back, neck, shoulders, and upper back most affected. Contributing factors include inadequate workstation design, inconsistent ergonomic training, and high patient loads. International interventions—such as adjustable equipment, micro-break programs, task rotation, and participatory ergonomics—have demonstrated significant benefits but require cultural, financial, and organizational adaptation for Saudi settings.
Conclusion: The occupational health of Saudi dental assistants can be significantly improved through an integrated approach combining policy reform, clinic-level ergonomic interventions, and continuous professional training. Adapting global best practices to the local context is crucial to reducing injury rates, enhancing job satisfaction, and improving patient care outcomes.
Implications: Policymakers, clinic managers, and educators should collaborate to enforce ergonomic standards, modernize equipment, and integrate ergonomics into dental assistant education to ensure sustainable improvements in workplace health.

Keywords: Dental assistants; ergonomics; musculoskeletal disorders; occupational health; workplace safety; Saudi Arabia; prevention strategies; participatory ergonomics; global best practices; Ministry of Health guidelines

1. Introduction

Dental assistants are vital members of the dental care team in Saudi Arabia, supporting dentists in clinical procedures, instrument handling, infection control, and patient management (Gowdar et al., 2022). Their work is physically demanding, often requiring prolonged static postures, repetitive hand and wrist movements, and precise coordination in confined spaces—conditions that place them at a high risk of occupational hazards, particularly musculoskeletal disorders (MSDs) (Aljanakh, 2024; Bakhsh et al., 2021).

Ergonomics, defined as the science of designing tasks, equipment, and workplaces to fit the worker, is essential in preventing work-related injuries and enhancing productivity (International Ergonomics Association [IEA], 2023). In dental settings, poor ergonomic practices can lead to chronic pain, reduced mobility, and, in severe cases, early career termination (AlHazim et al., 2022). For Saudi dental assistants, these risks are compounded by factors such as limited ergonomic training, suboptimal clinic design, and high patient volumes in both public and private facilities (Khashaba et al., 2025).

Several studies in Saudi Arabia have reported a high prevalence of MSDs among dental assistants, with the lower back, neck, shoulders, and upper back being the most commonly affected areas (Bakhsh et al., 2021; Aljanakh, 2024). These findings highlight a pressing need for effective prevention strategies, including engineering controls, administrative adjustments, and participatory ergonomics, tailored to the local clinical environment (Gowdar et al., 2022).

This narrative review aims to synthesize available literature on the ergonomic challenges and occupational hazards faced by dental assistants in Saudi clinics and to identify evidence-based prevention strategies that can be implemented within the Saudi healthcare system. By focusing on the Kingdom's unique clinical, cultural, and organizational context, the review seeks to guide policymakers, educators, and clinic managers in promoting safer and more sustainable working conditions for dental assistants.

2. Occupational Hazards in Saudi Clinics

Dental assistants in Saudi Arabia operate in an environment where clinical, environmental, and organizational factors intersect, creating a complex set of occupational hazards. These hazards are not limited to physical strain; they encompass biological exposure, psychosocial stressors, and environmental challenges unique to the Kingdom's dental healthcare settings.

2.1 Musculoskeletal Disorders (MSDs)

Musculoskeletal disorders remain the most prevalent occupational health problem among Saudi dental assistants, with prevalence rates consistently reported above 80% in national studies (Aljanakh, 2024; Bakhsh et al., 2021). The most commonly affected regions include the lower back, neck, shoulders, and upper back. For example, Aljanakh (2024) reported that 56.5% of dental assistants in Hail province experienced shoulder pain in the past 12 months, while 53.6% reported lower back pain severe enough to affect daily activities.

Several risk factors have been identified in the Saudi context:

- **Prolonged static posture**: Dental assistants often lean over patients during four-handed dentistry, leading to sustained spinal flexion (Khashaba et al., 2025).
- **Repetitive movements**: Frequent handling of suction devices, passing instruments, and adjusting dental mirrors without adequate rest breaks (Gowdar et al., 2022).

- **Improper workstation height**: Many Saudi dental clinics use non-adjustable chairs or stools, forcing assistants to work at angles that strain the cervical and lumbar spine (AlHazim et al., 2022).
- **Patient positioning issues**: Inadequate training on adjusting patient chairs often results in awkward assistant postures, particularly during posterior tooth procedures.

2.2 Physical and Environmental Hazards: Environmental factors in Saudi dental clinics can significantly contribute to occupational strain.

- **Noise exposure**: Continuous operation of high-speed handpieces, suction systems, and ultrasonic scalers can exceed recommended occupational noise levels, potentially leading to auditory fatigue or hearing loss over time (Alamri, 2022).
- **Lighting**: Poorly positioned or insufficient operatory lighting has been observed in several private Saudi clinics, forcing dental assistants to strain their eyes and adopt awkward head positions (Gowdar et al., 2022).
- **Vibration**: Prolonged use of ultrasonic scalers and other handheld devices can expose assistants to low-frequency vibration, which can exacerbate hand and arm fatigue.
- **Temperature control**: Due to energy-saving measures or malfunctioning HVAC systems, some clinics in Saudi Arabia experience uneven temperature distribution, causing discomfort and contributing to fatigue.

2.3 Biological Hazards: Given their close contact with patients' oral cavities, dental assistants are at risk of exposure to bloodborne pathogens such as hepatitis B, hepatitis C, and HIV, as well as airborne infections including tuberculosis and, more recently, COVID-19 (Bakhsh et al., 2021).

- **Aerosol generation** during ultrasonic scaling and high-speed drilling increases the risk of inhalation of infectious particles, especially if high-volume evacuation systems are absent or improperly used.
- **Percutaneous injuries** from sharp instruments remain a hazard, with some Saudi clinics reporting needle-stick injury rates above 20% annually among dental staff (AlHazim et al., 2022).
  Although the Saudi Ministry of Health mandates strict infection control protocols, studies have found gaps in compliance—particularly in smaller, privately owned practices lacking dedicated infection control officers

2.4 Psychosocial Hazards: Psychosocial stressors significantly affect Saudi dental assistants' occupational health.

- **High patient volume** in urban centers such as Riyadh and Jeddah can lead to long working hours without adequate breaks, contributing to mental and physical fatigue (Gowdar et al., 2022).
- **Workplace hierarchy** in many clinics may limit dental assistants' autonomy, creating feelings of undervaluation and reducing job satisfaction.
- **Patient anxiety management**—especially with pediatric or special-needs patients—can increase emotional strain and lead to burnout.

3. Ergonomic Risk Factors in Saudi Dental Clinics

The ergonomic challenges faced by dental assistants in Saudi Arabia stem from a combination of workstation design limitations, task-related demands, and organizational constraints. These factors contribute significantly to the high prevalence of musculoskeletal disorders (MSDs) and other occupational health issues observed in the Kingdom's dental sector.

3.1 Workstation Design and Equipment Layout

In many Saudi dental clinics, especially in private practices, workstation designs often fail to accommodate the ergonomic needs of assistants (Khashaba et al., 2025).

- Fixed-height dental chairs and operator stools force assistants to adapt their posture rather than adjust the equipment, leading to awkward spinal alignment (AlHazim et al., 2022).
- Limited legroom and cramped operatory layouts restrict free movement, especially in older clinics where space planning did not follow modern ergonomic guidelines.
- Instrument positioning is often suboptimal, with frequently used tools placed outside the assistant's optimal reach zone (less than 50 cm), forcing repetitive trunk twisting and arm extension (Gowdar et al., 2022).

  In public hospitals, while newer facilities may provide adjustable chairs and better space allocation, budget constraints and high patient throughput can still result in overuse of poorly maintained equipment, further compromising ergonomic safety.

3.2 Work Practices and Clinical Techniques

The way dental assistants perform their daily tasks plays a critical role in ergonomic risk exposure.

- Four-handed dentistry, although widely taught, is inconsistently applied in Saudi clinics. Assistants sometimes revert to one-handed or awkward assisting positions due to space constraints or lack of synchronized teamwork with dentists (Aljanakh, 2024).
- Patient positioning is not always optimized. In some clinics, patients are seated in positions that are comfortable for the dentist but require the assistant to lean excessively, increasing cervical spine and shoulder strain (Bakhsh et al., 2021).
- Repetitive micro-movements, such as continuous suctioning or passing instruments in high-volume clinics, can result in overuse injuries to the wrist and forearm muscles.
- Extended working hours without micro-breaks—common in private sector clinics—magnify the effects of static postures and repetitive strain.

3.3 Organizational and Administrative Factors: Beyond physical layout and techniques, organizational structures in Saudi dental settings can exacerbate ergonomic risks.

- High patient loads in urban clinics like Riyadh and Jeddah leave little time for ergonomic adjustments between patients (Khashaba et al., 2025).
- Lack of ergonomic training programs for dental assistants is a recurring issue, with most receiving only brief orientation sessions during employment rather than structured continuing education (Gowdar et al., 2022).
- Absence of formal ergonomic policies in many private clinics means there are no scheduled breaks, no equipment maintenance schedules, and no regular workstation assessments.
- Staffing shortages in some Ministry of Health (MOH) clinics lead to role overload, with assistants performing both clinical and administrative tasks in the same shift, increasing physical and mental strain (AlHazim et al., 2022).

Global Best Practices and Relevance to Saudi Arabia

- International experiences in improving dental workplace ergonomics offer valuable lessons that can be adapted to Saudi clinics. In Scandinavian countries, where dentistry is highly regulated, the integration of ergonomically adjustable dental chairs, optimal instrument positioning, and mandatory annual ergonomic training has significantly reduced musculoskeletal disorder prevalence among dental staff (Lindegård et al., 2021). Australia has implemented structured micro-break programs and rotational task assignments as part of standard dental practice management, resulting in measurable reductions in neck and shoulder strain (Nielsen et al., 2020). In the United States, participatory ergonomics programs, where dental assistants actively contribute to clinic layout design and workflow optimization, have led to sustainable ergonomic improvements and higher job satisfaction (Rempel et al., 2019). These strategies share

common elements: engineering controls that prioritize adjustability and accessibility, administrative measures that protect staff from prolonged static postures, and a strong emphasis on continuous professional development in ergonomics. Adapting these best practices to the Saudi healthcare context requires considering local factors such as clinic infrastructure, patient volume, workforce demographics, and regulatory frameworks. For example, Scandinavian-style adjustable workstations can be incorporated into newly established Saudi clinics through Ministry of Health (MOH) procurement guidelines, while micro-break policies similar to those in Australia can be introduced into staff schedules without disrupting patient flow in high-demand urban centers like Riyadh and Jeddah. Participatory ergonomics, as successfully applied in the U.S., could be implemented in Saudi Arabia by forming multidisciplinary ergonomic committees within both public and private dental facilities, ensuring that dental assistants, dentists, and administrators collaborate on workspace redesign. Furthermore, adapting training modules to include culturally relevant examples and bilingual instruction (Arabic and English) would enhance understanding and compliance among Saudi dental assistants. By selectively integrating proven international strategies with local operational realities, Saudi Arabia can significantly advance ergonomic standards in dental practice, leading to healthier and more productive clinical teams.

Table 1 Comparison of Global Ergonomic Practices and Their Adaptation to Saudi Arabia

Country / Region	Implemented Intervention	Reported Outcomes	Adaptation Considerations for Saudi Arabia	Reference
Scandinavia	Adjustable dental chairs and operator stools; optimal instrument positioning; mandatory annual ergonomic training for dental staff	Significant reduction in MSD prevalence and sick leave among dental workers	Integrate adjustable workstations into MOH procurement for new clinics; require annual ergonomic certification for license renewal	Lindegård et al., 2021
Australia	Structured micro-break programs; task rotation between clinical and administrative duties	Reduced neck and shoulder strain; improved job satisfaction	Implement micro-break policies in high-volume Saudi clinics without affecting patient flow; adjust schedules for cultural norms	Nielsen et al., 2020
United States	Participatory ergonomics programs involving staff in clinic layout design and workflow optimization	Sustainable ergonomic improvements; increased staff engagement	Establish multidisciplinary ergonomic committees in Saudi clinics; provide bilingual (Arabic/English) training materials	Rempel et al., 2019

Note. MSD = Musculoskeletal disorders; MOH = Ministry of Health.

Barriers to Ergonomic Implementation in Saudi Clinics

Despite the availability of proven ergonomic interventions, several cultural, financial, and organizational barriers hinder their full implementation in Saudi dental settings. From a cultural perspective, ergonomics is often undervalued compared to clinical output, with many clinic managers and staff prioritizing patient volume over workplace safety (Khashaba et al., 2025). In some cases, there is a perception that musculoskeletal discomfort is an inevitable part of dental practice rather than a preventable condition, leading to low motivation for change (Bakhsh et al., 2021). Financial constraints also play a significant role, especially in small private clinics where profit margins are tight and investments in adjustable dental chairs, ergonomic stools, or optimized lighting systems are viewed as secondary to revenue-generating equipment (AlHazim et al., 2022). Public Ministry of Health (MOH) facilities generally have more standardized procurement processes and can integrate ergonomic equipment into new clinic designs, but retrofitting older facilities remains slow due to budget cycles and competing infrastructure priorities. Organizational barriers further complicate adoption. In private clinics, the absence of formal ergonomic policies means that work schedules often lack micro-breaks, task rotation, or equipment maintenance routines, while in public MOH facilities, high patient demand and staffing shortages limit opportunities for assistants to adjust their workstations or rest between procedures (Gowdar et al., 2022). Additionally, ergonomic training is not consistently embedded into continuing professional development, leaving many dental assistants with limited awareness of safe work practices (Aljanakh, 2024). These barriers collectively create a gap between the global best practices outlined in ergonomics literature and the reality of clinical work in Saudi Arabia, underscoring the need for targeted interventions that are financially feasible, culturally accepted, and organizationally supported.

Conclusion and Recommendations

The evidence from Saudi Arabia clearly demonstrates that dental assistants face a high prevalence of work-related musculoskeletal disorders, compounded by physical, environmental, biological, and psychosocial hazards. These risks are closely linked to suboptimal workstation design, inconsistent application of ergonomic principles, and the absence of structured policies to protect staff well-being. While global best practices from countries such as Scandinavia, Australia, and the United States offer effective solutions, their application in Saudi clinics is often limited by cultural perceptions, financial constraints, and organizational barriers. Without targeted action, these challenges will continue to impact the health, productivity, and job satisfaction of Saudi dental assistants, ultimately affecting the quality of patient care. To address these issues, a multi-level approach is essential. At the policy level, the Ministry of Health should establish and enforce national ergonomic guidelines for dental clinics, mandate ergonomic compliance as part of licensing and accreditation, and integrate periodic ergonomic audits into quality assurance programs. At the clinic level, managers should invest in adjustable dental chairs and stools, reorganize instrument layouts to minimize unnecessary movement, and implement micro-break schedules and task rotation to reduce prolonged static postures. At the education and training level, ergonomics should be embedded into the core curriculum of dental assistant programs, supported by hands-on workshops and continuing professional development courses that are culturally adapted and bilingual. In addition, participatory ergonomics committees within clinics can empower dental assistants to identify hazards, propose solutions, and monitor progress, ensuring that ergonomic improvements are both sustainable and relevant to daily practice. By integrating policy reform, workplace redesign, and continuous education, Saudi Arabia can significantly reduce the occupational health burden on dental assistants, improve staff retention, and enhance the overall efficiency of its dental healthcare services.

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