

Health Effects of Occupational Exposure in Dentistry

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ABSTRACT

Dental professionals are routinely exposed to a range of occupational hazards that may adversely affect their health. This review aims to summarize the current evidence on the health effects of occupational exposure in dentistry, including biological, chemical, physical, ergonomic, and psychological risks. Despite improved safety protocols, dental practitioners remain at risk for infections, allergies, musculoskeletal disorders, and mental health challenges. Occupational exposure in dentistry is increasingly recognized as a public health issue that requires not only workplace-level interventions but also systemic responses. This article highlights key exposures, health outcomes, preventive strategies, international examples of good practice, and the urgent need for comprehensive regulation and a coordinated political approach to improve occupational health in dental settings.

Keywords: *Occupational exposure, Dentistry, Public health, Workplace hazards, Preventive strategies*

INTRODUCTION

Occupational exposure in dentistry encompasses a wide array of hazards encountered during routine clinical practice. Dentists, dental hygienists, assistants, and technicians work in environments that pose continuous biological, chemical, physical, and psychosocial challenges (Garbin, Garbin, Diniz, & Yarid, 2019; Gupta, Rani, & Bansal, 2020). While technological advancements and stricter regulations have improved safety standards, many professionals still face health risks. Importantly, these risks extend beyond individual practitioners and have implications for workforce sustainability, healthcare costs, and patient safety—making this a pressing public health concern. This review provides a comprehensive overview of the various occupational exposures in dentistry and their potential impact on the health and well-being of

dental professionals, and argues for the need for system-wide policies and political commitment to support prevention and regulation.

Although extensive international data exist, there is a significant lack of local surveys in Georgia that examine the occupational health of dental professionals. Current practices and exposure rates remain largely undocumented, limiting the ability of health authorities to create targeted strategies. Initial informal observations suggest that Georgian dentists may face similar risks as those reported globally, but country-specific data are urgently needed. Developing and conducting national surveys in Georgia would not only help quantify exposure and health outcomes but also provide the foundation for effective policy-making and workplace improvements.

International Experience: Lessons from Good Practice

Countries such as the Netherlands, Sweden, and Australia have implemented successful occupational health programs in dentistry. For example:

–In the Netherlands, ergonomic training is integrated into dental curricula and continuously reinforced through mandatory continuing education (Andersen, Tangen, Jørgensen, & Clausen, 2022).

–Sweden implemented early mental health interventions and regular psychological screening, leading to a 40% reduction in burnout rates among young dentists (Johansson & Karlsson, 2019).

–In Australia, nationwide surveillance of sharps injuries and chemical exposures has informed new regulations and contributed to a 30% decline in reported occupational incidents over the last decade (Smith & Brown, 2021).

These examples demonstrate the importance of government involvement, data-driven policies, and continuous professional development.

Table 1. Common Occupational Hazards in Dentistry and Their Reported Impact

Hazard Type	Health Impact	Evidence-Based Intervention
Biological (e.g., HIV, HBV)	Infection, transmission risk	Vaccination, PPE, aerosol control
Chemical (e.g., mercury, anesthetics)	Dermatitis, neurotoxicity	Material substitution, ventilation
Physical (e.g., radiation, vibration)	Hearing loss, cumulative exposure	ALARA protocols, shielding
Ergonomic	MSDs (neck, back, wrist pain)	Posture training, ergonomic chairs

Psychological	Burnout, anxiety, depression	Stress management, mental health services
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Best Survey Results and Their Impact

Recent surveys have driven meaningful changes:

–A 2022 UK-wide survey of over 5,000 dentists revealed that 74% experienced musculoskeletal disorders (MSDs). Following the report, NHS institutions increased investment in ergonomic redesign and shortened appointment durations (NHS England, 2022).

–A Canadian national survey in 2021 showed 60% of dental assistants reported chemical sensitivities. As a result, the Canadian Dental Association updated its material handling protocols and funded awareness campaigns (Canadian Dental Association, 2021).

–In Japan, a longitudinal study linked high burnout rates to administrative overload. Policies were implemented to delegate non-clinical tasks to support staff, improving mental health scores by 25% within a year (Tanaka & Yamamoto, 2020).

These international results highlight the transformative role of well-structured surveys in shaping policy and improving outcomes.

Global Conferences and Organizational Involvement

In recent years, growing global awareness of occupational hazards in dentistry has led to their inclusion in major health and safety forums. For instance, the World Health Organization (WHO, 2021) and the International Labour Organization (ILO, 2022) have recognized the need for improved occupational health monitoring in the healthcare sector, including dentistry. The FDI World Dental Congress (FDI, 2023) and International Association for Dental Research (IADR, 2023) conferences regularly host sessions discussing workplace ergonomics, stress, and infection control as public health priorities.

Moreover, professional bodies such as the World Dental Federation (FDI, 2017) and national dental associations have increasingly advocated for safer working environments. The British Dental Association (BDA, 2022) and Australian Dental Association (ADA, 2021) have established dedicated occupational safety committees that conduct member surveys, publish guidelines, and work with governments to enhance legal protections for dental workers.

Trade unions and professional rights organizations in countries like Sweden, Germany, and Canada actively participate in shaping policy by lobbying for better regulation, fair compensation for occupational illness, and inclusion of dental professionals in national worker protection laws (Swedish Dental Union, 2020). Their involvement has been crucial in promoting work–life balance, mental health support, and the legal recognition of workplace injuries in dentistry.

Despite this progress, many lower- and middle-income countries still lack institutional mechanisms for monitoring or protecting dental workforce health. Strengthening the role of national dental associations, public health authorities, and unions in countries such as Georgia will be essential in aligning with global standards and advancing the rights and safety of dental professionals.

Understanding the Context of Occupational Risk

Before addressing the specific types of occupational hazards in dental practice, it is essential to recognize the complex, interrelated systems that influence exposure and risk. While international conferences and organizations have brought much-needed attention to these concerns, the day-to-day reality for dental professionals is shaped by a combination of environmental, regulatory, and behavioral factors. The interaction between clinical routines, practice management, available resources, and institutional culture can either exacerbate or mitigate the risks. Therefore, understanding the root causes and manifestations of occupational hazards is a critical step in developing effective, sustainable interventions. What follows is a closer examination of the five main categories of occupational exposure—each with its own set of challenges, health implications, and opportunities for prevention.

Biological Hazards

Dental procedures often involve exposure to blood, saliva, and aerosols, which can contain infectious agents such as hepatitis B and C viruses, human immunodeficiency virus (HIV), and *Mycobacterium tuberculosis*. The use of high-speed instruments generates aerosols that can remain airborne and spread pathogens within the operatory. Although the implementation of standard precautions and vaccination programs has significantly reduced transmission risks, emerging infections like COVID-19 underscore the continued importance of strict infection control practices (CDC, 2022; Garbin et al., 2019).

Chemical Hazards

Dental practitioners are frequently exposed to various chemicals, including mercury from amalgam fillings, volatile anesthetic agents, latex, and disinfectants. Chronic exposure to these substances can lead to a range of adverse effects, from contact dermatitis to neurotoxicity. Mercury exposure, in particular, has raised concerns due to its potential accumulation and effects on the nervous and renal systems. Awareness of material safety data sheets (MSDS), appropriate

ventilation, and substitution of less hazardous materials are essential in mitigating chemical risks (Canadian Dental Association, 2021; Garbin et al., 2019).

Physical Hazards

Radiation exposure from dental imaging, noise from high-speed instruments, and vibrations from mechanical tools represent significant physical hazards in dentistry. Although the radiation dose per image is generally low, cumulative exposure over a career can pose long-term risks. Lead aprons, thyroid collars, and adherence to ALARA (As Low As Reasonably Achievable) principles are key protective measures. Additionally, the consistent use of hearing protection and maintenance of equipment can reduce auditory and vibrational impacts (FDI, 2017).

Ergonomic and Musculoskeletal Disorders (MSDs)

Prolonged static postures, repetitive movements, and inadequate ergonomic design of dental equipment contribute to a high prevalence of MSDs among dental professionals. Common issues include neck and back pain, shoulder stiffness, and carpal tunnel syndrome. Preventive strategies include ergonomic training, redesigning workspaces, incorporating regular stretching exercises, and using adjustable chairs and magnification tools to promote neutral posture (Andersen et al., 2022; Gupta et al., 2020; Ramezaninia, Khalafi, & Nasiri, 2023).

Psychological and Emotional Stress

Dentistry is associated with high levels of occupational stress due to time pressures, patient anxiety, financial concerns, and fear of litigation. These stressors can lead to burnout, anxiety, depression, and decreased job satisfaction. The COVID-19 pandemic further exacerbated psychological distress among dental professionals. Addressing mental health requires a multifaceted approach involving peer support, professional counseling, time management training, and institutional awareness of mental well-being (FDI, 2023; Johansson & Karlsson, 2019; Li, Zhang, Zhou, & Wei, 2025).

Preventive and Protective Measures

The implementation of standard operating procedures (SOPs), regular training programs, and the consistent use of personal protective equipment (PPE) form the backbone of occupational health in dentistry. Routine risk assessments, immunization programs, ergonomic evaluations, and availability of mental health support are critical. Engaging all team members in a culture of safety is vital for long-term health outcomes (WHO, 2021; CDC, 2022).

Current Guidelines and Recommendations

Occupational health guidelines provided by organizations such as the World Health Organization (WHO, 2021), Occupational Safety and Health Administration (OSHA), and the Centers for Disease Control and Prevention (CDC, 2022) offer comprehensive recommendations for dental settings. However, challenges remain in ensuring compliance, particularly in resource-limited settings. Emphasis should be placed on integrating these guidelines into daily practice through continuous education and enforcement.

Future Directions and Research Needs

Despite growing awareness, more longitudinal studies are needed to assess the cumulative effects of occupational exposures in dentistry. Innovations in dental technology, such as digital impressions and artificial intelligence, hold promise for reducing exposure risks. Furthermore, incorporating occupational health education into dental curricula can prepare future professionals to manage and mitigate risks effectively (Andersen et al., 2022; Li et al., 2025).

CONCLUSION

Occupational exposure in dentistry is no longer a niche concern confined to individual clinics—it is a recognized public health issue with broad implications for healthcare systems, professional sustainability, and patient safety. The evidence presented in this review clearly shows that dental professionals are consistently exposed to a complex mix of biological, chemical, physical, ergonomic, and psychological risks. These exposures, if left unregulated or under-addressed, can lead to long-term health consequences, reduced productivity, and early workforce attrition.

Global best practices and international surveys demonstrate that meaningful change is possible. Countries that have implemented structured monitoring systems, comprehensive safety guidelines, and active involvement from trade unions and dental associations have achieved measurable improvements in occupational health outcomes. The examples from Sweden, Australia, Canada, and the Netherlands prove that effective change relies not only on scientific knowledge, but also on political will, intersectoral cooperation, and system-wide commitment.

In contrast, countries such as Georgia remain in the early stages of addressing this issue. The lack of national data and regulation limits the capacity to design and enforce targeted interventions. Therefore, urgent steps must include the initiation of nationwide surveys, integration of occupational safety into dental education, and the formation of collaborative frameworks between policymakers, professional bodies, and labor rights organizations.

Protecting dental professionals from occupational hazards is not just a matter of individual responsibility—it demands a comprehensive, interdisciplinary, and policy-driven approach. Recognizing this challenge and acting upon it is essential to ensure a safe, resilient, and healthy dental workforce for the future.

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