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### ENVIRONMENTAL HAZARDS IN DENTISTRY - A REVIEW

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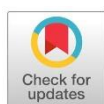
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**Abstract:** The overarching and interdisciplinary approach of occupational health aims to safeguard and enhance the well-being of workers. Productivity flourishes when workers are assured of their physical, social, and mental welfare. Dentistry, as a profession, presents numerous occupational hazards encompassing biological, chemical, physical, biomechanical, and psychological factors. Dentistry is associated with exposure to various biological and chemical agents like viruses, bacteria, prions, and fungi, which can instigate infections of varying severity. Chemical hazards arise from dental materials medications and disinfectants, potentially causing allergy, hypersensitivity reaction, skin allergies, burns and injuries. Dentistry is fraught with physical hazards such as ionizing non-ionizing radiation, loud sound, artificial lighting, and dental filling curing lights, posing threats to workers' vision, hearing, and overall health. Biomechanical factors such as improper posture, repetitive movements, prolonged mechanical strain, and exposure to vibrations can contribute to musculoskeletal disorders, neurological issues, and other health problems among dental workers. To mitigate these occupational hazards, raising awareness among dental professionals is essential through various educational initiatives like seminars and workshops. This proactive approach can help prevent workplace injuries and illnesses, ensuring the health and well-being of dental practitioners.

**Keywords:** *Dentistry, hypersensitivity reaction, skin allergies, burns and injuries*

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## I. INTRODUCTION

Occupational hazards are risks that are associated with a specific job, including factors such as work conditions, materials, substances, and processes that can lead to accidents or illnesses in the workplace. Dental healthcare providers are exposed to a variety of hazards, including biological, physical, chemical, biochemical, biomechanical, and psychological hazards.<sup>1</sup> Biological hazards in dentistry include exposure to bacteria, viruses, prions, and fungi, which can result in infections<sup>2</sup>. Physical hazards involve factors such as ionizing , non-ionizing radiation, noise, artificial lights, and polymerization light, which can cause hearing and vision problems and other radiation-related issues. Chemical hazards arise from substances like dental materials, medications, sharp instruments and disinfectants, which can lead to allergies, skin conditions, sharp injuries, hypersensitivity reactions, burns, and other injuries<sup>3</sup>. Biomechanical hazards are related to issues such as improper posture, prolonged mechanical strain, repetitive movements, and vibrations, which can result in musculoskeletal and neurological issues<sup>4</sup>. Furthermore, dental practice can also engender psychological challenges like stress and chronic fatigue, contributing to mental health issues such as depression and burnout syndrome, and potentially manifesting in physical ailments like cardiovascular and digestive disorders<sup>3</sup>.

### 1.A. BIOLOGICAL HAZARDS

Biological hazards within dental practice present substantial risks to healthcare providers, stemming from exposure to airborne microorganisms and transmission via bodily fluids. Among the pathogens encountered, bacteria, viruses (such as HIV, HBV, and HCV), and fungi are prevalent, with an annual exposure estimate of nearly 385,000 healthcare workers<sup>5</sup>.

Dental professionals face a heightened risk of needle stick injuries (NSIs) due to the confined nature of their workspaces<sup>6</sup>. Of particular concern are HBV and HCV, with transmission rates following percutaneous exposure ranging from 6-30% and approximately 1.8%, respectively<sup>7</sup>.

The heightened risk among dental practitioners is influenced by few factors, including the regular use of sharp tools, working in close proximity to patients' oral cavities, and producing contaminated aerosols through high-speed rotary instruments. Research conducted in Washington revealed that 20% of occupational injuries occurred within the dental profession<sup>8</sup>.

Moreover, dental professionals are also vulnerable to viral infections such as Zika virus (ZIKV), as the virus's RNA has been detected in various bodily fluids, including saliva and blood, heightening the risk of transmission during dental procedures<sup>9</sup>.

Dental laboratory technicians (DLTs) encounter their own set of health hazards, notably from exposure to metal dust, which can lead to pneumoconiosis, a lung disease. Cross-contamination within dental environments is prevalent, particularly through water systems and aerosols generated during procedures. Consequently, adherence to disinfection protocols is crucial in mitigating these risks<sup>10</sup>.

### 1.B. RADIATION HAZARD

Radiation hazards have become more prevalent in medical and dental settings in recent decades due to the increased use of ionizing radiation<sup>11</sup>. Prolonged exposure to ionizing radiation can have detrimental effects on various body systems, including the immune, respiratory, hematopoietic, circulatory, reproductive, musculoskeletal, nervous, digestive, endocrine, and

urinary systems. Skin burns, cataracts, leukemia, and several different type of cancers that are among the adverse effects of ionizing radiation<sup>12</sup>. Dental practices are particularly at risk for radiation hazards due to the frequent use of X-rays. Protective measures such as lead aprons, radiation-resistant gloves, and thyroid collars can help safeguard healthcare workers and patients from the harmful effects of ionizing radiation<sup>13</sup>. It is important to handle radiation hazards with caution, as neglecting the proper safety measures can lead to serious major health issues, including cancer<sup>14</sup>.

### I.C.HARMFUL PHYSICAL AND MECHANICAL FACTORS

Physical and mechanical hazards include cuts from sharp instruments, injuries to eyes from projectiles, or puncture wounds from needles or any other sharps. Radiation hazards and intense noise in dental practice are also some of the physical and mechanical hazards, Ionizing radiation such as X-rays and Non-ionizing radiation such as visible and UV light have destructive effects on body tissues. Hearing problems are increasing in dental professionals due to vibrations and noise produced by hand pieces or other noise producing devices<sup>3</sup>.

#### 1.D. HEARING LOSS

The National Institute for Occupational Safety and Health (NIOSH) has identified noise as a major factor in work-related diseases and injuries<sup>15</sup>. Prolonged exposure to unsafe noise levels is common in many of the occupations, resulting in a high prevalence of noise-induced hearing loss (NIHL) in the US<sup>16</sup>.

Continuous noise subjection has both auditory and non-auditory effects<sup>17</sup>. Non-auditory effects include sleep disturbance, hypertension, lessen learning performance, impaired communication and concentration, stress reactions, mental weariness, annoyance, and reduced efficiency. Auditory effects may include tinnitus (ringing ears) or temporary or permanent hearing loss<sup>10</sup>. The risk of noise-related injury depends on the frequency, intensity, and duration of exposure.

In dental practices, several noise-producing devices pose a significant ominous sign to the hearing of dentists and patients. These include high-speed turbine hand-pieces, ultrasonic instruments and cleaners, high-velocity suction, low-speed hand-pieces, vibrators, and mixing devices like amalgamators.

The Occupational Safety and Health Administration (OSHA) permits a maximum of 85 decibels of continuous noise exposure in the workplace for up to 8 hrs<sup>26</sup>. However, patients in dental settings are gravely affected by noise, which can induce fear, anxiety, reducing their cooperation and compliance.

Using earplugs and earmuffs in corresponding environments can help mitigate the damage lead by noise exposure<sup>18</sup>.

## II. MUSCULOSKELETAL FACTORS

Ergonomics is the scientific discipline dedicated to designing products and systems that optimize human performance, comfort, and safety. Applying ergonomic principles is vital for maximizing workplace efficiency, reducing the risk of occupational injuries, and fostering employee satisfaction. However, failing to prioritize ergonomics can lead to serious consequences, especially the evolution of work-related musculoskeletal disorders (MSDs)<sup>19</sup>.

A study of dental students revealed that over half (58.6%) recognized the momentousness of maintaining ergonomic postures to prevent future health issues and occupational diseases. Despite this awareness, 62.1% admitted struggling to adopt ergonomic postures due to the nature of the treatments they were performing and the areas of the mouth they were working on. The primary reasons cited for their peers' failure to maintain ergonomic postures included lack of attention, insufficient practice, and forgetfulness (44.8%), as well as challenges with visualizing the operating field or procedure (27.6%)<sup>20</sup>.

## 2.A. PSYCHOLOGICAL FACTORS

The dental profession is frequently perceived as highly stressful by both healthcare providers and the general public. Managing anxious patients, meeting tight schedules, dealing with unexpected emergencies, and performing potentially painful procedures involving anesthesia or uncertain outcomes are commonly identified as major sources of stress<sup>21</sup>. These challenges can contribute to mental health issues among dentists, such as depression and burnout, as well as physical symptoms like digestive and cardiovascular problems<sup>3</sup>. Pre-work anxiety and nighttime awakenings were frequent complaints. An overwhelming 94.2% of respondents reported that long working hours impacted their overall health, with 41.7% experiencing this distress frequently or very frequently. Although fewer than 10% of dentists reported feeling overworked, they acknowledged that long hours affected their mental wellbeing<sup>22</sup>.

A significant psychological challenge for dentists is burnout syndrome, a specific kind of job-related stress response. It is made distinctive by emotional exhaustion, depersonalization, and reduced feelings of personal accomplishment.

## III. BIOMEDICAL WASTE MANAGEMENT

Biomedical waste is a broad category encompassing various materials used in healthcare, including human and animal tissues, medical equipment like syringes and needles, and substances used in diagnosis, treatment, and research<sup>23</sup>. In dentistry, potentially hazardous waste includes used needles, human tissue remnants, blood- and saliva-contaminated cotton and extracted teeth. Dental practices also generate highly hazardous waste like chemical solvents, dental amalgam, and mercury<sup>24</sup>. Improperly getting rid of mercury and other substances like strontium, barium, and polystyrene poses significant environmental and occupational health risks. Therefore, it's crucial to handle and dispose of these materials carefully to minimize their negative impacts<sup>25</sup>.

Most biomedical waste does not degrade naturally and shall not be fully removed through treatment processes. Consequently, the long-term persistence of biomedical waste can harm both wildlife and humans. Photocatalysis is increasingly being explored for pollution remediation and environmental safety due to its future as a green and eco-friendly process. Nanostructured photocatalysts, compared to their conventional counterparts, offer advantages like non-toxicity, inexpensive, and higher absorption efficiency across a broad solar spectrum span, making them ideal for photodegradation.

#### IV. CONCLUSION

Dentistry involves several occupational hazards that can impact worker well-being. To mitigate these risks, it's essential to be aware of the hazards and the strategies for addressing them. Regular acquaintance programs, inclusive of continuing dental education and workshops, should be implemented. This not only enhances worker productivity but also supports the delivery of high-quality patient care.

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