Review of risk factors and control measures for occupational health hazards in a dental practice

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ABSTRACT

The purpose of this article was to investigate the potential dangers and risks associated with exposure to prosthodontic practise. These include exposure to physical and chemical hazards, dental materials, an infectious workplace, an unsuitable work schedule, and psychosocial stress. The possible harm and prevention of these dangers are underlined. Students, prosthodontists, dental technicians, and others. Individuals working in prosthodontic clinics and laboratories should be aware of the unique risk factors and take precautions to minimise and eliminate these dangers.

Keywords: Health hazards; Occupational exposure; Occupational hazards; Risk management

INTRODUCTION

Every occupation has its own inherent dangers and risks. Occupational hazard is described as a threat to a person's safety in the workplace. It may be a deadly accident, minor to serious injuries, an allergic reaction, or all of the above. Systemic consequences In addition to these immediate repercussions, there are others that manifest at a later time. The World Health Organization defines "hazard" as an intrinsic quality of an agent or circumstance that has the potential to generate undesirable effects when an organism, system, or population is exposed to it. In contrast,[1-2] Risk refers to the likelihood of causing unfavourable health impacts. The exposure of an individual to a hazard influences the degree of risk and associated adverse effects. The primary purpose of the Occupational Safety and Health Administration (OSHA) is to raise employee awareness of workplace hazards and protective measures.

Dental work setup provides numerous dangers to personnel. According to a Norwegian survey, fifty percent of public health dentists reported occupational

health concerns such as dermatoses (40 percent), ocular, respiratory, and systemic symptoms (13 percent), and musculoskeletal disorders (3 percent). 2 A New Zealand study indicated that over forty percent of dental practitioners were impacted with hand dermatoses and irritations to the eyes, nose, and airway at some point in their careers, and that the likelihood of allergy incidence was doubled for female dentists.[3]

In prosthodontic clinics, there is the possibility of exposure to irritant chemicals, inhalation of fumes, dust particles, high-speed rotary equipment, and combustible materials.Autoclaves, Bunsen burners, and furnaces can frequently cause thermal injuries. Methacrylates, rubber glove allergens, natural rubber latex proteins, and glutaraldehyde are allergens that may cause urticaria and occupational asthma in sensitive individuals.[4] The risks in a prosthodontic practise can be roughly categorised as infectious, non-infectious, ergonomic, and psychological risks. The purpose of this study is to highlight the occupational hazards and risks connected with prosthodontic practise and to briefly address their management strategies in everyday practise in order to raise awareness and encourage professionals to adopt preventative measures to lower the risk.

MATERIALS AND METHODS

Using PubMed and Google Scholar, a comprehensive search of the English dentistry literature for research and reviews pertaining to occupational hazards and risks was conducted.Health hazards, occupational exposure, occupational hazards, risk management, curing light dangers, noise pollution, and ergonomic hazards are the search terms. Using information compiled from pertinent research, reviews, and organisation websites, this report monitored and arranged the dangers, risks, and their management in context.

Physical dangers

Direct physical trauma, heat and fire injuries to the face and scalp, especially the eye, are prevalent in prosthodontic practise. The direct physical trauma consists of incidental skin wounds and abrasions caused by the use of blunt or broken equipment or high-velocity projectiles during denture trimming and polishing.

Such trauma can serve as an entry point for pathogens or toxins. According to a survey, 3.4% of dentists experience percutaneous injuries annually. 4.5% was the second highest prevalence rate among specialists, followed by 5.5%, 2.6%, 1.9%, and 1.3% for pedodontists, oral surgeons, orthodontists, and endodontists, respectively. [5]

In prosthodontic clinics and laboratories, Bunsen burners, spirit lamps, and blow torches are required. Burns from Bunsen burners were the most frequent injury in an institutional setting. This was followed by needle and blade injuries to the eye. Common sources of sharps injuries included cleaning probes in the sterilisation room, recapping injection needles with two hands, and handpieces containing burs.[6]

In prosthodontics, grinding and polishing with vibrating tools is widespread. The high frequency of the grinding tools might cause direct harm to the face and upper extremities.

Additionally, vibration can cause vibration syndrome [7] or vibration white finger on the hand. 8 The primary results are constriction of the arteries in the fingers and hands and nerve injury at the extremities. Early signs include diminished blood flow to the fingers, diminished sensitivity to pain, touch, vibration, and warmth, and blanching of one or more finger tips.

EYE INJURIES

In prosthodontic practise, traumatic eye injuries are more prevalent because to the use of high-speed rotating tools that can generate hot particles travelling up to 9 metres per second. Abrasive and diseased. Lacrimation, discomfort, conjunctivitis, corneal abrasion, and blurred vision are among the symptoms. [9] Laboratory materials present more substantial dangers. Accidental splashing of methyl methacrylate monomer or pumice containing lime and quartz causes painful reactions; pumice also causes abrasions. [10] Commonly, curing lamps are employed to polymerize restorative resin compounds. They emit bright blue light with a wavelength between 400 and 500 nm. A report indicates that the higher eye risk occurred at approximately 440 nanometers. [11]

NOISE

In any environment, noise levels of a specific intensity and duration pose a possible health risk. Hearing loss and tinnitus are common adverse effects of noise exposure acceptable levels inside a system. In 2001, the National Institute for Occupational Safety and Health (NIOSH) listed occupational hearing loss on a list of 21 research priorities. [16] Exposure pattern to acoustic trauma (few exposures, extreme sound intensity), transient threshold shift (temporary hearing alteration following exposure to noise), and permanent threshold shift (accumulation of exposure to noise; irreversible) can be used to classify hearing loss. [17] Exposure to 85 dB of noise, defined as an exposure action value, for more than eight hours a day can result in irreversible hearing loss, according to OSHA. [18] Prosthodontists and laboratory workers are subjected to possibly hearing-damaging noises from low-speed handpieces, high-speed turbine handpieces, ultrasonic instruments, high-velocity suction and cleaners, vibrators and other mixing devices, and model trimmers, among others. 19 These devices may emit sounds between 66 and 91 decibels.[18]

Chemical hazards

In clinical prosthodontic practise and in the laboratory, a variety of manufactured and naturally occurring substances, including as eugenol-containing materials, alloys, and polymeric materials, are utilised. Utilized materials include acrylic resins, ceramics, cements, sealants, etchants, hypochlorite, waxes, and elastomeric impression materials.[21] Polymethylmethacrylate resins comprise accelerators (amines), co-polymers such butyl-methacrylate, plasticizing agents like di-butyl-phthalate, inhibitors like hydroquinone, and cadmium salt-based colouring additives.

These substances pose no risk to the patients, but are detrimental to the technicians during packing, grinding, and finishing.[12] For metal ceramic restorations, particularly chromium, cobalt, nickel, beryllium, and gold alloys are utilised. During grinding and polishing of cast dental restorations, dental professionals are exposed to respirable metal fumes and grinding dust. A study

found that 53 of 70 dental workers were affected with pneumoconiosis, which may have been caused by dental material production dust. [13]

More frequently, latex gloves sprinkled with cornflour powder are utilised in dental offices. Allergenic corn starch causes acute allergic reactions. Combining starch particles with latex Airborne protein allergens are breathed or absorbed through the skin.[21] The in vitro examination of natural latex, synthetic rubber, and synthetic polymeric glove materials revealed varying degrees of cytotoxicity; thus, powder-free silicone gloves with a lower risk were introduced. [22]

Biological risks

Bacterial contamination via spatter and aerosol dispersal created by high-speed instruments continues to pose a substantial concern to dental staff.[13] Epidermis of hands, oral epithelium, nasal epithelium, epithelium of upper airways, epithelium of bronchial tubes, epithelium of alveoli, and conjunctival epithelium are the primary infection entry points for a dentist.[14] In addition to microbial contamination, the composition of aerosol created by rotary instruments is a cause for worry. According to research, these aerosols contain silica particles from the adhesive resin fillers and different byproducts of bur substance. The estimated diameters of these particles vary from 2 m to 30 m, placing them inside the hazardous-product particle limit of 2.5 m. The concern over the small size of these particles stems from the fact that they can reach the alveoli and are implicated in numerous illnesses.[15]

Additionally, contaminated impressions (dirty with blood and other infectious substances) are a source of infection in prosthodontics. When plaster is placed into a contaminated impression, the surface bacteria spread into the cast, which is then handled in the dental laboratory. Plaster dust from infected casts enters the respiratory system, accumulates on clothing and ambient surfaces, and remains infectious for an extended period of time. Mycobacterium tuberculosis, for instance, stays hazardous for several weeks. [16] According to McNeill et al., impression material can serve as a vehicle for the transfer of harmful bacteria and viruses, leading to cross contamination in the clinic and in the laboratory. [17] Another study reported the cross-infection potential of impression material and concluded that pathogenic hospital bacteria such as Staphylococcus aureus, Actinobacter baumanii, Capnocytophaga species, Actinobacillus species, Viridans Streptococci, and Morganella morganii were present in every step of impression making and cast pouring. [18]

Other potential infectious contamination sources include dental unit waterlines (DUWL), handpieces, saliva ejectors and suctions, other devices connected to air and waterlines, and radiography equipment.[19] Opportunistic and respiratory pathogens such as Legionella species (cause of pneumonia and legionnaires' illness), Mycobacterium species, and Pseudomonas species pose a threat from DUWL. Dentists with occupational exposure to Legionellae were shown to have higher Legionella antibody titres. [10]

Due to the confined work area and reduced vision associated with the oral cavity, prosthodontists face a considerable risk of neck and back disorders. These working constraints frequently result in

their to assume stressful body positions in order to get good access and visibility within the oral cavity, which results in difficult positions for extended periods of time and back discomfort.

Low back pain, stiffness, and sciatica with neurological characteristics such as tingling, paresthesia, and muscular weakness are the symptoms.[11] An electromyographic study conducted by Milerad et al. and colleagues revealed that shoulder, neck, and arm muscles are subjected to the most strain during conventional dental procedures.[13] In a separate study, Nebraskan dentists stated that crown and bridge procedure was most likely to induce abnormal feelings in their upper extremities. [14]

Table 1: Risk management strategies for the dental professional

Type of hazard	Risk factors	Management
Physical	Blunt or broken instruments or high speed, projectile, vibration, fire, noise, blue light, heat	Face shield or shatter-resistant eyeglasses with side shields, ear plugs, splash guards/safety guards for lathes and table-top rotary devices, fire extinguishers
Chemical	Methyl methacrylate , nickel, chromium, cadmium, beryllium, free silica particles,	Local exhaust ventilation systems, adequate fume extraction system, aerosol/dust evacuation hood in the dental laboratory, appropriate
	Alginate dust	PPE
	Latex gloves	Nitrile, vinyl gloves
Biological	Infectious bio aerosols, infectious body fluids, percutaneous exposures and incidents	OSHA guidelines -exposure control plan, exposure control, precautions, laundry procedures, mandatory hepatitis B vaccinations, housekeeping standards, and waste disposal regulations
Ergonomic	Inadequate working postures, forceful hand movements, inadequate equipment or workplace designs	At least 6 minutes of rest every hour, proper ergonomic dental unit design, personalized rehabilitation exercises, stretching and regular aerobic activity.
Psychosocial	Financial, uncooperative patients, over workload, constant drive for technical perfection, underuse of skills, low self-esteem	Stress management workshops, deep breathing exercises, relaxation, hypnosis and desensitization technique

Psychosocial hazards

Occupational stress, such as dealing with difficult or resistant patients, an excessive workload, the relentless pursuit of technical perfection, and treatment dissatisfaction, is prevalent among medical professionals dentists. According to Kay and Lowe, the most frequent causes of workplace stress are patient expectations (75%), practise management/staff concerns (56%), fear of complaints/litigation (54%) and non-clinical paperwork (55%). [16] These physical and emotional demands lead to mental and physical exhaustion. A comparison of the stress levels and coping stress of male and female dentists revealed that stress levels were comparable, but women experienced greater personal and home stress. Regarding coping reaction, both sexes demonstrated similar

characteristics, with the exception of women's greater propensity to disclose their difficulties. [17]

Administration of hazards and dangers

OSHA's primary objective is to educate companies and employees on workplace dangers, risk assessment, and risk management techniques.[18-20] Several variables, such as age, individual susceptibility, total daily exposure, exposure assessed over time, and medication, may influence the risk level. It is the obligation of professionals and technicians to comprehend the unique risk factors or hazard agents and to develop an efficient protocol for preventative management. The table below discusses risk management solutions for professionals.

Modern prosthodontic practises are outfitted with smart work area layouts, proper ventilation, and cutting-edge equipment that may prevent noise pollution and chemical and ergonomic concerns. The use of masks, aspirators, and the mechanical removal of as much resin as feasible prior to the use of rotating instruments may decrease biological exposures.[22-24] The orange shield used with the curing equipment filters blue light between 350 and 500 nanometers satisfactorily. In addition, blue light filtering glasses with side shields provide protection against reflection and scatter. The state-of-the-art approach for decontaminating DUWL with ozone is used.

The natural next step for this technology would be to incorporate ozone-generating equipment into dental treatment units.[26-28] The incorporation of ozone into a dental unit expands a disinfection and sterilising system for DUWL into the clinical management and patient arena.19 The use of relaxation, exercise, meditation, and hobbies to combat stress is advocated.

CONCLUSION

Several occupational hazards and concerns, including MSD, contact dermatitis, high speed projectiles, and bioaerosols, continue to be of grave concern in prosthodontic practises. Understanding the numerous dangers will educate the professional in regards to better work practises and health care. Knowledge of the hazard and acquaintance with its characteristics alone are insufficient for assessing the potential threat. A safe and healthy practise requires an understanding of the level of exposure to the danger and techniques for limiting the consequences of occupational hazards and risks.

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