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OCCUPATIONAL HAZARDS IN DENTAL OFFICE

[1] Swaroop Kumar Reddy [1] Professor

[1,]Department of Conservative Dentistry and Endodontics, Narayana Dental College, Nellore, Andhra Pradesh, India.

ABSTRACT:. The purpose of this article was to review the occupational hazards related to day to day procedures carried out in dental office. The classification of hazards was based on major sources of risks by system or tissues. Potentially hazardous factors relate to the general practice setting are to specific materials and tools that expose the operator to vision and hearing risks; to chemical substances with known allergenic, toxic, or irritating actions; to increased microbial counts and silica particles of the aerosols produced during debonding; and to psychological stress with proven undesirable sequelae. The identification and elimination of these risk factors should be incorporated into a standard practice management program as an integral part of education.

KEYWORDS: Occupational hazards, injuries, Mucoskeletal problems, Dermatoses and allergies

INTRODUCTION

A good understanding of the nature and prevalence of disabling conditions in the orthodontic specialty is necessary before one can begin to start dental practice. Professionals in dentistry are exposed to many occupational hazards; their effects appear as ailments that affect the dental practitioner and tend to intensify with age. These problems include musculoskeletal conditions due to improper body posture; physical hazards from light, noise, and trauma; biological risks from irradiation and microorganisms; and chemical detrimental sources. Studies found that methacrylates, natural rubber latex proteins, rubber glove allergens, and glutaraldehyde caused reactions ranging from cell-mediated contact allergy to urticaria and occupational asthma. [1,2]

SOURCES OF HAZARDS

A general classification of potential operator hazards includes the following.

1. Health hazards impose threats to a person's biological balance from exposure to physical factors (lights, vibration, noise, heat and trauma), chemical irritating or toxic factors (latex, monomers, aerosols, sterilization and radiology fluid), and biological factors (infections from micro-organisms).

Other hazards include risks to the professional's well-being, associated with physical or psychological factors such as ergonomic considerations (insufficient or inappropriate equipment, inappropriate work area design) and psychological stress (dealing with patients in general, difficult patients, employees, legal action, and work organization). [3]

Nikolaos Pandis et al categorizes the hazards of dental practice by work area in Table 1; the Figure gives a general classification of the hazards based on the source of risk. [3]

HEALTH HAZARDS

Health hazards for clinicians include physical factors such as lights, noise, vibration, heat, and trauma. Lights affect the eyes and vision. Office lighting and dental chair light are critical for optimal working conditions in an orthodontic setting. Additionally, other forms of light are used during daily procedures; the most important is the curing light for polymerization of bonding materials.

The hazards associated with laser light range from corneal to retinal damage depending on the wavelength of the beam produced. Eye strain can also be a problem, due to insufficient lighting, and inappropriate position of working light in relation to the orthodontist. [4]

The eyes of people operating curing lamps are at risk from acute and cumulative effects, mainly due to back reflection of the blue light. Satrom et al [5] evaluated 11 curing lights systems that produced visible blue light in the 400 to 500 nm range and found that no unit posed a health risk. A more recent and relevant study, comparing the effects of halogen, plasma, and light-emitting diode units on vision, reported that the exposure time required for plasma and light-emitting diode lamps to achieve curing depth similar to the tungsten-halogen light was longer than the irradiation times recommended by the manufacturers.

This is important to know because blue light or ultraviolet (UV) hazard is related to exposure time, and thus requirements for prolonged irradiation can adversely affect vision. Additionally, some plasma units were been found to emit light in the ultraviolet-region. [6]

Infections can be caused by aerosols and trauma from wires, burs, and other projectiles. Trauma associated with microorganisms could cause various eye infections. Chemical burns come from acids or alkaline substances. Acids are usually less dangerous than alkalis because

Table 1. Hazards in dental office by work area

	Respiratory	**Muscoloskeletal**	**Hearing**	**Vision**	**Skin**
Dental chair area	Inhaling of chemicals Allergens Infection	Neck, shoulder, upper and lower back pain Tendinopathies Repetitive strain injuries	Handpiece noise High volume Suction Ultrasonic scaler	Dry-eye syndrome Maculopathies Cataract Eye trauma Eye strain Infection	Allergy (chemicals) Trauma Infection
Sterilization area	Inhaling of chemicals Allergens Infection	Neck, shoulder, upper and lower back pain	Ultrasonic cleaner	Dry-eye syndrome Eye trauma Chemical burn Infection	Allergy (chemicals) Trauma Infection Burning
Laboratory area	Inhaling of chemicals Allergens Infection	Neck, shoulder, upper and lower back pain Tendinopathies Repetitive strain injuries	Model trimmer Vibrators Low-speed hand-pieces	Dry-eye syndrome Eye trauma Chemical burn Infection	Allergy (chemicals) Trauma Infection Burning
X-ray developer area	Inhaling of chemicals Allergens	Neck, shoulder, upper and lower back pain		Dry eye syndrome Eye trauma Chemical burn Infection	Allergy (chemicals) Trauma

Table 3. Precautions and measures to reduce the exposure to hazardous material

	Respiratory	Muscoloskeletal	Hearing	Vision	Skin
Dental chair area	Fresh air access Ventilation Use mask Follow guidelines for infection control	Adopt proper body posture Use ample lighting Divide work load instrument to be handle properly Use stretching before and after work	Check noise level of operatory	Avoid prolonged concentration Always use protective shield for photopolymer-ization Use protective eyewear (patient and staff also) Avoid splashes during rinsing and spraying	Use powder-free, silicone gloves if irritated by conventional powdered latex Exercise standard measures suggested by Centers for Disease Control for infection control Cover cuts in exposed body areas
Sterilization area	Use ventilation and masks	Ergonomically designed area and appropriate bench height Easy access to instruments/ equipment	Use insulation for ultrasonic baths	Use protective eyewear	Cover all skin areas by using long sleeves, gloves, mask
Laboratory area	Masks Ventilation Follow guidelines for infection control	Ergonomically designed area and appropriate bench height Adopt proper body posture Easy access to frequently used instruments Take frequent breaks	Use insulation Use ear plugs	Disinfect impressions Exercise measures as in other areas for eye protection	Avoid contact with methacrylates Use ventilation

they tend to precipitate tissue proteins, which form barriers and inhibit deeper penetration; therefore, lesions are limited to lids, conjunctiva, and cornea. Alkalis saponify lipids in the corneal epithelium and bind to mucoproteins and collagen in the corneal stroma. In this way, they disrupt the normal barriers of the cornea, gain rapid access to the more posterior parts of the eye, and can cause severe eye complications including cataract and secondary glaucoma. [7]

NOISE

The effects of occupational noise in the dental office can lead to noise induced hearing loss (NIHL); symptoms can include difficulty with speech communication and other auditory signals, fatigue, and tinnitus. The symptoms of NIHL increase gradually with continual exposure. [3]

NIHL, currently not treatable, occurs when exposure to harmful sounds causes damage to the tiny hair cells in the cochlea and to the acoustic nerve. The greatest damage is usually caused at 3000 to 6000 Hz. NIHL can be caused by repeated exposure to sounds at various loudness levels, measured in decibels (dB), over an extended time or by a 1-time exposure to an intense sound. [3]

Exposure to noise over a long time can cause a temporary threshold shift, which is a temporary elevation in the hearing threshold that gradually recovers. It might range from a change of a few decibels to a change that temporarily renders the ear severely impaired. After a long period of continual exposure to hazardous noise combined with the effects of aging a noise induced permanent threshold shift occurs. [8]

According to the National Institutes of Health, sounds above 85 dB are potentially hazardous. To determine which sounds are hazardous, the frequency and the duration of the sound must be specified. Generally, a noise level of 85 dB (A) in the normal range of hearing, for an 8-hour per day exposure, over a period of years, might be damaging. Sound levels less than 75 dB (A) are considered unlikely to cause permanent hearing loss.

Several studies on used and new dental equipment recorded the sound levels of common sources of noise in dentistry; Table 2 shows their findings. [9-12]

The degree of risk might depend on several factors including age, personal susceptibility, total daily exposure, exposure measured over many years, smoking, medication, and noise exposure outside the dental office. [13]

INJURIES

Occupational injuries of health professionals are another area of interest, due to the increased awareness of patient-doctor cross contamination. In 1995, a survey sponsored by the American Dental Association [14] found injuries at a yearly rate of 3.4% among dentists; this agreed with the 3.6% reported by a similar study. [15, 16] Among specialists,[17] orthodontists had the second lowest prevalence (1.9%) after endodontists (1.3%); pedodontists ad 5.5%, prosthodontists 4.5%, and oral surgeons2.6%. [14] Other procedures included ligating materials, pumicing, and acid etching. Most of the injuries (83.5%) were treated on site without long-term effects. Extra caution should be used during laboratory procedures, when injuries from projectiles are possible.

DERMATOSES AND ALLERGIES

The dentists thought that 21.5% of the dermatoses were related to the materials used in the profession, with methacrylates and natural rubber latex gloves as the 2 most common materials giving rise to complaints. Another survey in Norwegian showed that 40% had hand or finger dermatoses. [18] The mean age was 46 years, and 18% were female. It was found that these complaints were often mild and were related to seasonal variations and temperatures. Occupational Safety and Health Administration (OSHA) believes that 8% to12% of health care workers are sensitive to latex and states that, between 1988 and 1992, there were more than 1000 reported adverse health effects from exposure, including 15 deaths. [19] There appear to be good evidence for the increasing prevalence of latex allergy caused by more occupational exposure to latex products.[20]

Biologic factors include microorganisms and particles. In the dental office practices the main source of infection is through interaction of the patient with the health caregiver. This can occur from direct contact with blood, body fluids, secretions, and excretions (except sweat), regardless of blood presence, non-intact skin and mucous membranes regardless of blood presence.

Table 2. Noise levels from dental Equipment

Device	dB (A)
Air turbine handpiece	65.5-93
Micromotor handpiece	61.9-77
Scaler	73-88
Irrigator	76
Power suction tube	75
Saliva suction tube	73
Ultrasonic scaler	72-81
Gypsum cutting equipment	93.5
Vibrator	98.5
Aspirator and engine	81.7-86.5

BIOLOGIC FACTORS

Infection can occur indirectly by contact with contaminated instruments, surfaces, equipment, and materials. Contact of sensitive body areas with infected droplets expelled from infected persons at short range or inhalation of suspended microorganisms that can survive for long periods can occur in the office environment. Other possible sources of infectious contamination are dental unit waterlines, hand-pieces, saliva ejectors and suctions, other devices attached to air and waterlines, and radiology equipment (especially digital sensors). Impression materials transported between the clinical area and the laboratory could be a source of infection.

Toroglou et al [21,22] in specialty-specific studies, evaluated the contents of aerosols produced during debonding procedures in an orthodontic office. They concluded that orthodontists are exposed to high levels of aerosols and contaminants, and that debonding procedures are potentially hazardous to their health.

Apart from microorganism contamination, a concern was recently expressed on the composition of aerosol produced during the use of rotary instruments. Research indicated that these aerosols contain silica particles from the adhesive resin fillers and various bur material byproducts. The sizes of these
particles have been estimated between 2 and 30, thus falling within the hazardous-product particle range of 2.5. [23] Thus, ventilation, use of masks and aspirators, and mechanical removal of as much resin as possible before using rotary instruments are suggested.

InTable 3, Nikolaos Pandis et al suggested precautions and measures to reduce the exposure to hazardous materials and procedures are listed. [3]

OTHER HAZARDS
MUSCULOSKELETAL PROBLEMS

Dental professionals often develop musculoskeletal problems, which are related to suboptimal work environment

ergonomics that might be responsible for improper sitting postures and movements causing unnecessary musculoskeletal loading, discomfort, and fatigue. Insufficient or inappropriate equipment, inappropriate work area design, direct injuries,
repetitive movements from working with dental instruments, or sitting for extended times with a flexed and twisted back are contributing factors to neck and low-back ailments.

The dental chair position and the dentist's stool position and orientation relative to that of the patient, combined with the doctor's effort to maintain visibility of the oral environment, result in awkward positions over long periods of time; these in turn result in back problems. The symptoms include low back pain, stiffness, and sciatica with neurological features such as tingling, paresthesia, and muscle weakness.

In the work environment, Carpal tunnel syndrome (CTS) results from rapid, repetitive, and daily use of the hand and fingers for many hours at a time. The problem is compounded when working with a bent wrist, exerting force, working with vibratory tools, and in cold environments. Rapid movement of tendons in the synovial tube causes inflammation and fluid buildup. This can result in atrophy of the ulnar muscles; tingling in the thumb, index, middle, and half of the ring finger; night pain; and pain when handling tools.

PSYCHOSOCIAL PROBLEMS

Several studies identified issues related to finances and job growth, time and scheduling, dentist-patient relations, and staff and technical problems as stress sources in dentistry. [24-27] High levels of occupational stress among dentists are correlated with hypertension, coronary artery disease, and suicide.

A study of burnout and its causes among dentists in Finland identified psychological fatigue, loss of enjoyment for work, and becoming insensitive toward patients. [28] Comparisons of stress and coping in male and female dentists found that stress levels were similar, although the women experienced more personal and domestic problems. Regarding coping style, both sexes responded similarly in most respects, except that the women were more inclined to discuss their problems. [29] Brand and Chalmers [27] compared stress patterns of dentists of various ages and concluded that older practitioners had less stress than their younger colleagues. However, for some issues related to finance and patient management, both groups were equally affected.

CONCLUSION

There are many potentially hazardous factors related to the general setting of practice; to specific materials and tools that expose the operator to vision and hearing risks; to chemical sub-stances with known allergenic, toxic, or irritating actions; to increased microbial counts and silica particles of the aerosols produced during debonding; to ergonomic considerations that might have an impact on the provider's muscoleskeletal system; and to psychological stress with proven undesirable sequelae. The identification and elimination of the foregoing risk factors should be incorporated in a standard practice management program as an integral part of dental education. Professional organizations can also assist in informing practitioners of potential hazards and methods to deal with them.

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Corresponding Author

Dr. Swaroop Kumar Reddy
Professor ,Department of conservative Dentistry and Endodontics
Narayana Dental College
Nellore, Andhra Pradesh
Email:- ndc1@gmail.com
Ph: 919849986253