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ORIGINAL RESEARCH

Usage of Protective Eye Wear among the Dental Practitioners of Bengaluru City: A Survey with Review of Literature

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ABSTRACT

Background: Eye is one of the organs that is disposed to many hazards among dental practitioners due to the long strenuous working hours and various kinds dental equipment. These work-related eye hazards range from eye injuries, fatigue, hazards due to lasers and light-curing units. Awareness among dental practitioners regarding the same is important so that they employ protective measures to avoid any eye hazards.

Aim: The aim of this study was to find the awareness regarding the occupational eye hazards among dental practitioners of Bengaluru city by assessing the usage of protective eye wear among them.

Study and design: A questionnaire-based survey was conducted among 150 dental practitioners of Bengaluru city.

Materials and methods: The questionnaire comprised of questions regarding their age and gender and whether they used protective eye wear while working.

Statistical analysis: Using percentage, the number of dental practitioners using protective eye wear and those not using the same were compared.

Results and conclusion: It was found that slightly more than half of the surveyed dental practitioners used protective eye wear while the rest did not use any eye protection while working. There is need to make more and more dental practitioners aware about the eye hazards that can happen due to work and emphasis needs to be laid on the use of protective eye wear while working so that these hazards can be minimized.

Keywords: Eye hazards, Occupational health hazards, Dental practitioners, Injury, Fatigue, Lazers, Light-curing units, Protective eye wear.

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INTRODUCTION

Dental practitioners are predisposed to a number of occupational health hazards (OHHs).[1] It is essential for the dental practitioners to recognize these risk factors and use protective measures against them. Among the various organs that are vulnerable in the dental situation are: the eyes, the ears, the respiratory system, the palms of the hands, the back and the vertebrae.[2] The primary means of protecting against these potential hazards are meticulously keeping proper working conditions, using adequate eye protection, wearing gloves and mouth masks, proper seating at the dental chair etc. A questionnaire-based study was conducted to assess the awareness among dental practitioners in Bengaluru city regarding the use of protective eye wear while working.

MATERIALS AND METHODS

A questionnaire was circulated among 150 Bengaluru-based dental practitioners which comprised of questions regarding their personal details, like name, age, sex and whether they used protective eye wear while working or not.

RESULTS

There were 83 male and 67 female dental practitioners in our study. It was found that 55.3% of the dental practitioners in our study used protective eye wear while working, while 44.6% did not use the same.

DISCUSSION

An important OHH is the effect of dental procedures on the vision of the dental professionals. Eyes can be physically affected by fragments while drilling or carrying out procedures, such as scaling and polishing. Aerosols containing saliva, gingival liquid, organic dust particles and rich bacterial flora generated during dental procedures can similarly affect the eyes. Lasers and curing lights are also recognized sources of danger to the eyes. Work-related eye/vision hazards can be broadly categorized under the following headings:

1. Injuries
2. Fatigue

3. Hazards due to laser
4. Hazards due to light-curing units.

Injuries

In a dental workplace, routinely normal-speed and high-speed drills are used for the purpose of removing of old fillings or excess filling materials, preparing carious defects, polishing fillings, orthodontic and prosthetic work and also surgical procedures on bone. The possibility of injury to the eyes of the operator with materials or fragments of tissue increases greatly due to drilling procedures. In many instances, the foreign body locates itself in the conjunctival sac or cornea. This causes acute pain, lacrimation and, often, reddening of the eyeball. However, deeper penetration of the foreign body may result in perforation of the cornea and a consequent injury to the lens.[3,4] Another source of eye injury encountered in dentistry is the manual or mechanical instruments used for the removal of bacterial plaque or calculus deposits from tooth surfaces. Mechanical instruments which include ultrasonic or air scalers sprinkle copious quantities of water on the teeth producing the characteristic aerosols which consist of saliva, gingival liquid, organic dust particles (plaque, calculus, tissue remnants) and rich bacterial flora.[5] The aerosols can cause mechanical injury to the respiratory and conjunctival tracts of the dental professional and the assistant by penetrating.[6-9] In order to prevent eye injuries due to these reasons an effective and simple remedy is to wear protective eye glasses.[4,10-12]

Fatigue

A busy dental practice often demands long and debilitating working hours. The overall exhaustion of the dental professional is often accompanied by eye fatigue manifested as heavy eyelids, burning and stinging under the eyelids and sometimes vision-related issues. Blood-shot eyes, frequent blinking, lacrimation and increased sensitivity of the eyeball to touch are consequences of eye fatigue which are then followed by frequent headaches and eye pain. Temporally, the boundaries of visibility areas become blurred and visual acuity decreases. There is also decrease in critical frequency, a delayed accommodative reflex, a reduced accommodation width and a shift of refraction toward myopia or hypermetropia.[13,14] Eye fatigue can originate from lighting or may be of muscular origin. In dental practice, natural as well as artificial light is used. These, in fact, are the basic factors determining the safety, efficiency and quality of dental work.[15] Working for long hours under the artificial light can over a period of time result in eye fatigue. However, frequently switching off the artificial light source taking small breaks and working under a light source which is not very intense may help. Eye fatigue of muscular origin arises from accommodation and convergence. It may have a sensory character since the retina has a low sensitivity or may arise from the central nervous system when the vision center (visual cortex) in occipital lobe demonstrates a lower efficiency.[16] Prolonged visual strain leads to overall exhaustion of the body. It is also difficult to distinguish between symptoms of general fatigue and fatigue of the eye. In this vicious cycle, the quality of work of the dentist may suffer. Hence, adequate care to avoid eye fatigue either due to artificial light or muscular strain must be taken.

Hazards due to Lasers

Lasers which employ low or medium-intensity light have a biostimulating effect on the biological tissues. This bio-stimulating effect is responsible for elimination of pain and inflammation.[17-20] In clinical practice, the various uses of lasers include treating:

- Diseases of the tooth pulp
- Hypersensitivity of teeth
- Diseases of periapical tissues
- Recurrent aphthous ulcers
- Post-extraction wounds
- Alveolitis
- Trigeminal neuralgia
- Gingivitis and periodontitis.

The mean strength of biostimulating laser in dental equipment is usually less than 50 MW.[5] Laser radiation though useful in dentistry has also been found to cause many hazards; particularly to the eyes and the skin of both the dentist as well as the patient and assistant. In the application of lasers, not only is the light beam emerging from the source of light and hitting the patient's eye dangerous; but also any reflected and diffused light which are equally hazardous. Since the lens of the eye concentrates the beam entering it, the optical density increases many times. This, in turn, increases the possibility of eye injury.[21]

Ultraviolet radiation has harmful effects on all the optical elements of the eye. The cornea and lens are the first to be affected by this harmful radiation. Radiation of 300 nm wavelength gets completely absorbed by the cornea and that between 300 and 400 nm gets absorbed by the lens. Corneal cataract is one of the serious consequences of this absorption of UV radiation by the eye. Cancer of the eye ball and retinitis have also been reported.[22-25] The UV radiation actually leads to various biochemical and morphological changes in the eye lens which result in destruction of its cytoskeletal apparatus and deterioration of its functions.[26,27]

Hazards due to Light-curing Units

Dental curing lights which emit intense blue light in 400 to 500 nm wavelength range are used for the following purposes in dentistry for:[28-31]

- Photo polymerization of resins for pit and fissure sealing
- Cavity preparation
- Bonding of indirect restorations
- Orthodontic bonding
- Tooth bleaching.

Special lamps emit this blue light and these can be stationary with a long light pipe, pistol lamps or light-emitting terminals mounted directly on dental units.[32] Prolonged exposure to blue and UVA light has adverse effects on the eyes. Although polymerization units for light curing restorative materials have filters that reduce UV, infrared and any other undesirable kind of light, care should be taken to protect the operator's eyes from direct or indirect light emitted from the unit. Maximum ocular damage related to blue light occurs at 440 nm and that related to UV light at 270 nm.[33] The blue light is transmitted through the ocular media and absorbed by the retina. At chronic low levels of exposure, the blue light amplifies retinal aging and degeneration by causing photochemical injury to the pigmented epithelium and choroid of the retina.[34,35] Due to this, acute photo retinitis and premature age-related macular degeneration can occur.[35] However, as compared to the blue light, UV light is absorbed by the conjunctiva, cornea and lens before it reaches the retina.[36] Hence, UVA radiation causes corneal injury or photokeratitis as well as cataractogenesis.[37]

The Quartz Tungsten Halogen (QTH) light-curing units which were commonly used in 1980s delivered irradiances of about 300 MW/cm,^{2} but the high power plasma arc (PAC) and light emitting diode (LED) curing lights which are frequently used these days deliver much higher irradiances, up to 3000 Mw/cm.^{2} The QTH light-curing units were found to have very little potential to cause ocular damage.[38,39] A study was conducted to evaluate the potential for blue and UV light from models of plasma arc light, LED and QTH dental curing lights to damage the eye. It was concluded that the eyes of the dental professionals may easily be exposed to unsafe cumulative levels of radiation from dental light care unit (LCU). High powered LCUs showed the potential to cause ocular damage mediated by blue light at shorter distances, with the potential damage occurring after cumulative viewing of about 6 seconds at a distance of 30 cm (over an 8-hour workday).[36] The International Organization for Standardization (ISO) 10650-1 standard for halogen curing lights limits the irradiance in the region from 190 to 385 nm to no more than 200 MW/cm.[2,40] Since the eye has a natural aversion response to bright light, it usually limits single exposures to less than 0.25 seconds. But, LED units emit a narrow band of radiation and, therefore, do not always evoke this aversion response.

In their study, Labrie et al estimated the maximum permissible ocular exposure times for four types of curing lights. They concluded that the shortest permissible cumulative daily exposure times and the greatest potential for retinal damage occur when the light source was positioned on the palatal aspect of the tooth, with partial exposure past the incisal edge of the tooth. They estimated that for an operator whose eyes are 30 cm from a palatally positioned light guide, the maximum daily exposure limit would be exceeded after two 5-second curing cycles with plasma arc light unit, after two 20-second cycles with the LED unit and after four 20-second cycles with the LP LED light or QTH units.[36]

It must be remembered that clinicians, patients or assistants who have had cataract surgery and also those who are taking photosensitizing medications (antimalarial drugs, chlorpromazine, diethylchlor tetracycline, etc.) have a greater susceptibility to retinal damage. In such individuals ocular injury would occur even with shorter exposure times.[41] The American Conference of Governmental Industrial Hygienists (ACGIH) provides guidelines for exposure to blue and UV light, but not on the maximum irradiance of dental curing units that emit light in the 400 to 515 nm range. Also there are no regulations regarding the time for which they can be used on patients. Ordinary prescription glasses do not prevent penetration of blue or UV light. Both the patient and the dentist should wear protective eyeglasses that have been designed to filter out the harmful wavelengths from the particular LCU.[41-43]

The findings of our study showed that more than half of our study sample were aware about the ill effects of long strenuous working hours and various dental equipment on the eyes and hence used adequate eye protection while working. However, the percentage of those dental practitioners who did not use eye protection while working was also high emphasizing the need for imparting greater awareness among the dental practitioners regarding the possible eye injuries that can be encountered and the benefits of wearing protective eye wear while working.

CONCLUSION

The delicate organ 'eye' is often the most neglected one while working for long strenuous hours. The deleterious effects of the practice of dentistry on eyes cannot be overlooked. There is need to increase the awareness regarding the benefits of protective eye wear usage among dental practitioners so that these deleterious effects can be avoided.

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