The Impact of Work Environment and the Risks of Occupational Exposures of a Dental Professional

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Abstract

The multifaceted physical work environment of the dentist plays a quintessential role in the work life of the dentist. In spite of the numerous technological advancements in dentistry, occupational health threats are still prevailing in the physical work environment of the dentist. Immunization against the various infectious diseases, maintaining appropriate work postures, using adequate barrier techniques and high level sterilization, awareness of major signs and symptoms of allergic reactions including anaphylaxis during consultation, awareness and preventive strategies regarding the risks of blood borne infections must be promoted among the dental professionals. Exposure to serious infectious agents is a virtual risk and the dentist's hands can become contaminated by contact with the patient's mouth, saliva and gingival fluids. Most human pathogens can be obtained from the oral cavity and it has an environment which promotes bacterial growth. Health organizations have developed certain useful guidelines for hazard management by the use of personal protection and dentists should be aware of appropriate sterilization, other high-level disinfection utilities and individual protective measures like masks that must be changed in between patients to reduce the risk of the mask itself becoming a nidus of infection, head cap, gloves, operating gowns, over garments to protect the skin and the mucous membranes of the dental personnel from exposure to infections, care of hands by hand washing with surgical soap that contains antiseptics, and pre-procedural mouth rinsing with chlorhexidene by patient. This study is examining the different aspects that are going to affect the environment of the dentist in his work place like hygiene, x-ray machine and radiation safety, dental materials, bio-medical waste and the risks to occupational health due to exposures. This can lead to the development of safer and more effective work practices, which in turn makes the physical work environment a pleasant and safe dental office.

Key words: Occupational exposures, Hazard management, Personal protection, Risk of infection, Radiation safety, Hazardous materials, Waste management.

Introduction

Environment is defined as "something that surrounds us". The word ecology has been derived from a Greek word "OKIOS" meaning habitation and "logos" meaning study. Our environment is literally what surrounds us. The ultimate purpose of improving the work environment is to change and improve the work climate so that the interface of dentist, technology and the factors influencing the work environment inside the clinic makes for a more favorable work experience and designed outcome.

According to The U.S. Bureau of Labor Statistics employment opportunities for dentist will rise faster than the average by 2020, due to the awareness among the elderly to retain their existing teeth compared to their predecessors. The pediatric

generation will require complicated dental treatments and the younger generation will continue to require preventive treatment procedures. This is due to the increase in the study and awareness among the general public about overall health to good overall health.

Having one's solo practice requires well-developed business skills along with dentistry skills and also requires a large capital expenditure to build it, although the practice will become significant asset overtime. In spite of the technological advancement in dentistry, occupational health threats are still prevailing in the work environment of the dentist.

Conditions influencing the Work environment and the occupational exposures faced by a dental professional:

Hygiene

A hygienic dental clinic facilitates for a healthy working environment for the dentist and his staff members. It is of no use if the clinic is located ideally, furnished neatly and equipped with all the modern gadgets, if it is not kept tidy and clean. It has to be maintained on a daily basis to enable the work area to be pleasant and more satisfying reducing fatigue and discomfort. The work area must be cleaned with disinfectant on a regular basis for an unkempt clinic will only affect the health of the dentist. Separate footwear must be worn at all times inside the clinic to protect the cracks in the soles which forms a portal of entry for the microbes from the contaminated floors into the blood stream. A hygienic dental clinic increases the dentist's efficiency at his work.

The equipment and furniture in the clinic should be maintained on a regular basis in order to prevent surfaces from becoming reservoirs of antibiotic-resistant bacteria which in turn contribute to cross-infect the dental clinic. Walls, floors, chairs, benches, supporting equipment of the dental unit must be maintained by disinfecting on a regular basis with freshly prepared sodium hypochlorite or Glutaraldehyde. Containers for waste disposal should be placed at strategic locations and must be disposed at regular intervals. Linen with blood should be soaked in bleach solution and autoclaved. Dental materials should be stored neatly in closed cupboards. Materials should not be allowed to protrude out of racks and bins. The dental office can also have a totally paperless office system that computerizes all the medical records and negates the need for bulky file cabinets. Doors, windows, lamps, fluorescent tubes and their reflectors should be cleaned periodically. All switches and handles must be covered with plastic or aluminum foil and changed for every patient. Floors should be kept clean free from wax, blood, soiled cotton lumps, plaster, alginate, etc. which the dentist is constantly handling while treating the patient.

Studies suggest that blood exposure incidents occur frequently in dental setting and the dentists are exposed to harmful microorganisms through infected equipment, water droplets through aerosols, saliva droplets or through direct contact with patients. The use of high performance sucking devices during the aerosol production can protect them from the hazards arising from dental aerosols and also limit contaminating the work environment. Dentists are exposed daily to the risk of mercury intoxication. Conventional high volume suction evacuation system can be used, to reduce inhalation of mercury vapor during dental procedures like manipulation of amalgam and cutting old amalgam fillings. Cleaning the workplace once a day will not be sufficient in a dental clinic. Cleaning must be done after every patient leaves the clinic and before every patient enters the clinic. The walls should be painted regularly with colors that are soothing to the

eyes. Properly selected shades enhance the feeling of wellbeing and soft lighting imparts a sense of calm.

An important source of bacterial air infection generated during dental drilling procedures is microbial aerosol and have the potential to penetrate and lodge in the smaller passages of the lungs. The spittoons specially fitted in the dental chair must be cleaned regularly to prevent foul smell emanating due to saliva, blood and dead cells from the oral tissues of the patients mouth constantly being spat into the spittoon during treatment procedures. If it is left unclean it will affect the health of the dentist working long hours in the different patient's mouth. The dental chair waterlines are susceptible to microbiological contamination due to the formation of bacterial biofilm on the inside of the waterlines. The American Dental Association has recommended that dental unit output water should be no more than 200 CFU/ml of aerobic bacteria.

Eye injuries can occur while using air turbine hand piece, ultrasonic scalar while performing dental treatment procedures, projectiles such as bits of calculus and debris from the oral cavity can strike the eyes. Wearing protective eye wear like goggles during treatment procedures can safeguard the eyes. Care must be taken to sterilize and disinfect the environmental surfaces contaminated by spatter generated by air/water syringe, high speed instruments like dental turbine, air motor, micro-engine hand piece, air-turbine hand pieces, ultrasonic scalars, bicarbonate polishers, polishing cups and even from low-speed hand pieces. The staff must be encouraged to wash their hands often and especially when they begin to assist the dentist to provide a hygienic work environment for the dentist.

X-Ray Machine

Dental clinics are unique environments in relation to the safety of the dentists who work within them. The x-ray machine fitted next to the dental chair becomes surely a cause of concern for the health of the dentist who takes x-rays of the patient's tooth before every diagnosis he makes. The dentist is exposed to both ionizing and non-ionizing type of radiations while taking x-rays in the dental clinics.

Ionizing radiation is a well-established risk factor for cancer. Even the secondary radiation scattered from the bones in the patients head also poses a threat to the dentists. Studies indicate that multiple low-dose radiation exposures to dental radiography can lead to an increased risk of thyroid cancer and so The American Dental Association has recently stressed the need for shielding of the thyroid. Dental personnel are at potential risk for acquiring tuberculosis one of the deadliest scourges of mankind, herpes viruses, upper respiratory infections and hepatitis A through E. After the recognition of Acquired Immunodeficiency Syndrome (AIDS) in the 1980's, rigorous hygienic procedures have become prime importance in dental offices, cross – contamination in dental radiography is great because there are chances for the dentists hands to become contaminated by contact with the patients mouth and saliva – contaminated films and film holders and also while opening film packets to process the films in the darkroom. The chemicals used in radiology such as developing and fixing solutions also cause health effects like skin sensitization and allergic contact dermatitis. Chronic exposure when mixing the processor chemical compounds may also result in bronchospasm.

Dental Materials

It is ironic that the chronic exposures of the many potentially toxic and hazardous materials that are used by dentists in the absence of appropriate

precautionary measures pose yet another hazardous physical work environment for the dental practitioner. Mercury and mercury containing products are used in dental amalgam in clinical procedures and is the cause of certain undiagnosed illnesses. Metallic mercury can be absorbed through the skin or by ingestion, but the primary risk to the dentist is from inhalation of mercury vapor during mixing, placement and removal of restorations and condensation. The amalgam mixture should never be touched with bare hands because the freshly mixed alloy contains free mercury. The risk from mercury exposure to the dentist cannot be ignored.

Wax is used during construction of dentures. The hazards of wax to the dentist are allergic bronchitis, asthma, skin diseases. Chronic exposure can lead to even lung cancer. Gypsum products are used for making impressions in completely edentulous conditions and for making diagnostic casts and models. The resultant impressions will contain pathogenic organisms present in the saliva of the patient. The impressions and models must be disinfected from microorganisms.

All gypsum products are susceptible to be airborne which can result in settling in the nostrils whereby becoming a respiratory hazard. Care must be taken not to handle with bare hand because it can cause burning sensation and allergy. Gypsum bonded investment can cause isocyanides during casting procedure which is a potent poison.

Acrylic resin is used for making dentures. Inhalation of acrylic powder can cause respiratory diseases like asthma and sometimes cancer. The residual monomer is a potential irritant. The asbestos liner used in the casting procedure can produce asbestosis which is a respiratory carcinogen.

Alginate is used for making impressions in the patient's mouth. It is used to reproduce the form of the teeth and surrounding tissues. The dust from alginate impression materials may be inhaled and some products contain lead compounds.

The impression tray with impression taken out of the patient's mouth is a cause of concern because of viral diseases such as hepatitis B, AIDS and herpes simplex. Dental porcelain powders containing uranium are used for laminates, crowns and bridges, inlays and on lays, for artificial teeth, for orthodontic brackets.

Uranium containing powders are toxic due to its radioactivity. Gloves which contain latex causes skin irritation. Allergic skin reaction can be caused by detergents, lubricating oils, solvents and x-ray processing chemicals. By using hypoallergenic non-latex gloves, dentists can avoid latex allergy.

Bio-Medical Waste

The waste generated in the dental clinics like pharmaceutical wastes comprising of outdated, contaminated, discarded medicines and cytotoxic drugs must be incinerated or carefully disposed in secured landfills. Waste management is vital for the appropriate prevention of occupational exposures for the dental personnel. Dental clinics should also consider using companies licensed to pick up waste materials. Chemical waste comprises of discarded chemical substances such as laboratory reagents, film developers, film fixers and disinfectants which are expired and no longer is needed. The fixer processing solution which contains silver, the lead foil found in film packets another material of concern. There are several means available for properly disposing of the silver and lead. Silver may be recovered from the fixer by using either metallic replacement or electro – plating methods and the scrap silver can be sold to silver refiners and buyers. The lead foil is separated from the packet and collected and can be sold to scrap metal dealers.

Waste sharps comprises of needles, syringes, scalpels, blades, broken glassware, etc. Which were in contact with the patient and are capable of causing puncture and cuts in the skin, can get in direct contact with body fluids and transmit diseases. These sharps transmit viral infections which can be life-threatening such as bacterial infections, acquired immunodeficiency syndrome and hepatitis B when used in patient care and there is every chance that infections can spread through this type of injury before or after using a sharp on a patient. Deforming or destroying the sharps should never be done with bare hands. Heavy duty gloves, cutting pliers, mechanical or electrical needle cutters must be used. The electrical needle cutter burns away the needle and cuts the nozzle of the syringe making it unusable. Similarly used needles should never be recapped before disposal. All used disposable needles and other sharp items should be discarded in "puncture – resistant" containers and must be labeled "CAUTION: BLOOD AND BODY FLUID. DO NOT OPEN". It must be finally incinerated as such without opening.

Liquid wastes are generated from laboratory work, washing, cleaning, housekeeping and disinfecting activities. Care must be taken to see that blood and saliva is discharged into the drains without blockage as multiple blood borne pathogens are not stable in the environment. It is recommended that 5% hypochlorite be added to suctioned fluids before disposing into the drain. The chemicals used in the production of biological must be chemically treated before discharging into the sanitary sewers, for liquids and solids must be disposed in secured landfills.

A number of mercury containing products become part of solid waste in the dental clinics. Breakage, spills and waste water disposal from products in the clinics release mercury to the atmosphere or into the drains where it can persist for many years. The potential hazard can be greatly reduced by attention to few precautionary measures. The excess mercury including waste, disposable capsules and amalgam removed during condensation should be collected, placed in well – sealed containers and disposed through reputable dental vendors to prevent environmental pollution. Mercury dangers can be substantially reduced by using sealed amalgam capsules, water irrigation with high suction, proper ventilation, collection and appropriately discarding the amalgam.

Infectious material like patient specimens, human tissues, organs, body parts to be disposed should be placed into containers that are labeled as to their bio hazard risk or incinerated and the incinerated ash must be disposed in the municipal landfills. Other wastes which can hamper the physical work environment of the dental professional include solid waste soaked or saturated with blood or saliva such as blood soiled cotton, extracted teeth, surgically removed hard and soft tissues, used impression materials, soiled gauze, etc. must be put in leak-resistant biohazard bag used for non-sharp regulated medical waste.

Conclusion

The dentists are highly susceptible for contamination and the risk of infections and so they must be vigilant in following the recommendations for infection control practices in dentistry. The Centers for Disease control and prevention has published recommendations and updated infection control guidelines regarding protection from transmission of diseases. Efforts like operatory cleanup, instrument reprocessing, appropriate management of exposure to needle stick injuries, by using one-handed scoop technique and mechanical recapping device, use of personal protection, proper sterilization or disinfection practices must be adhered to by the dentists. In order to safeguard the dentists suffering

from ionizing radiation due to exposure, while taking x-rays in the dental clinics radiation level sensors, lead aprons and periodic maintenance of x-ray machines can reduces the risk of radiation dangers. Particulate respirators and high volume externally vented aspirators can be used as protection against respiratory diseases like tuberculosis. The various dental materials that the dentist uses in the dental clinic for treatment procedures and laboratory work can also turn out to be unwittingly threatening to his wellbeing and disastrous for his health and hence the dental professional must be vigilant in using protective gear for personal protection to ensure safety. Medical waste requires careful containment for treatment or disposal and all materials contaminated with potentially infectious agents must be decontaminated before waste disposal. This will reduce the risk of disease transmission in the work environment of the dentist and thereby ensuring a safer work environment to lead a healthy and active professional life. This study has dealt with the occupational exposures faced by a dental professional in his day to day life and the factors that have an impact on his occupational environment and there may be many more such hazardous factors in his work environment that needs to be further studied.

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