REVIEW

Hearing Damage and it's Prevention in Dental Practice

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ABSTRACT

Dentists and dental technicians are exposed to noise of varying intensities while working in dental clinics or laboratories. This paper discusses the different sources and characteristics of noise in the dental clinics. Studies of noise and its effect on hearing have been analyzed and necessary recommendations to reduce noises in the dental clinics have been offered.

Keywords: Noise, Hearing Damage, Dental Practice.

INTRODUCTION

As dental professionals, we encounter several occupational hazards every day. Hearing loss is definitely one of them. Our hearing might be at risk due to the noises encountered in our dental practice that may make us susceptible to the development of permanent hearing loss. Noise is an acoustic phenomenon which mainly arises in a gas, solid or, on occasion, liquid environment. We are all accustomed to everyday "normal noise", which are constantly present all around us[1]. Apart from normal noise we as dental professionals have to encounter noises which are always present in our dental offices.

`Noise or sound intensity is measured in decibel (dB). Ten decibels means a sound pressure 10 times greater than zero decibels and 20 decibels a hundred times greater than zero decibels[2]. As a guideline it should be noted that a 3 decibel noise increase is equivalent to a doubling of sound intensity. Decibel is logarithmic unit in which simple addition is not attainable 100dB + 100dB = 103dB[3].

SOURCES OF NOISE IN DENTAL OFFICE

Dental offices have several sources of noise including ones produced by dental equipment and ones produced by gadgets used for patient comfort. The sources of dental sounds that can be treated as potentially damaging to hearing are high-speed turbine hand pieces, low-speed hand pieces, high-velocity suction, ultrasonic instruments and cleaners, vibrators and other mixing devices, and model trimmers. Also worth mentioning are air conditioners and office music played at too loud a volume[4,5].

Kilpatrick[5] has listed the decibel ratings for various office instruments and equipment, which amount to 70–92 dB for high-speed turbine handpieces, 91 dB for ultrasonic cleaners, 86 dB for ultrasonic scalers, 84 dB for stone mixers and 74 dB for low-speed handpieces.

The noise levels generated during cutting were significantly higher than those of non cutting, which was proved in the course of the measurements. These demonstrate that the noise level for laboratory machines during cutting is 85.33 dB, without cutting – 77.51, and, respectively, for the laboratory electromotor handpiece - 82.04 and 67.86, the angled-design turbine handpiece - 78.98 and 66.84, the low-speed angled design handpiece 71.89–67.53. This may be attributed to the friction between the cutting material and cutting tools[6].

Effects of Noise

Auditory effects :

Auditory Fatigue (90dB or 4000 Hz)

Deafness- *Temporary* (4000-6000Hz)

Permanent (100dB)

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Non Auditory Effects:

Interference with speech

Annoyance

Reduction in efficiency

Physiologic damage (increased intracranial pressure, increased heart rate, headache etc)

NOISE INDUCED HEARING LOSS

The ear can be injured by noise in 2 different ways, depending on the type of exposure. High-level, short duration exposures exceeding 140 dB can stretch the delicate inner ear tissues beyond their elastic limits, then rip or tear them apart. This type of damage—acoustic trauma—occurs rapidly and results in an immediate, permanent hearing loss[7].

The second type of injury is due to exposure to noise between 90 and 140 dB damages the cochlea metabolically rather than mechanically and causes damage relative to the level and duration of exposure. Noise-induced hearing loss, in contrast to acoustic trauma, develops slowly over years, is caused by any exposure regularly exceeding a daily average of 90 dB, and proceeds in 3 stages[7].

In the first stage, sensory cells within the cochlea are damaged by excessive exposure. These cells do not regenerate; they are replaced by scar tissue. In the second stage, after weeks to years of excessive exposure, hearing loss can be detected audiometrically. Early loss occurs in the high-frequency range, around the highest C note played on a piano. Speech comprehension is not significantly affected; therefore, this loss is seldom noticed unless hearing is tested for some other reason[7].

With continued exposure, the loss spreads to the lower pitches necessary for understanding speech. At this point, the third stage, the patient usually becomes aware of the problem and may seek medical attention. Unfortunately, much of the damage has already occurred.

Hearing among dentist

The degree of risk to dentist depends upon several factors[8] - Frequency of vibration, intensity of loudness, length of exposure, interval between exposure and susceptibility to exposure.

A study to check the Hearing-damage Risk and Communication Interference in Dental Practice concluded that the sound energy contribution of a typical dental practice is about 8% to 12% of the dentist's average 24-hour noise exposure. However, noise levels during dental procedures result in an articulation index of 0.21 to 0.37, corresponding to understanding of about 18% to 48% of nonsense syllables and 52% to 90% of sentences. It appears that hearing-damage risk is slight among dentists using modern equipment. However, further noise control in handpieces is necessary so that error-free communication during dental procedures can be ensured[9].

Sound level in a dental practice with 4 dental units was evaluated using a complex system, which comprises: a Sound Blaster Live 5.1, a Dual microphone, a PC and special software for the acquisition and data analysis. The sound level detected was similar to the data from the international literature with some particular aspects and suggests that the dental practice is a noise polluted environment although most of the sound levels are beneath the damaging noise level for the human ear (85 dB)[10].

Noise levels of current dentistry equipment under very controlled conditions were evaluated. Working noise was simulated by drilling a polyacetal plate. During drilling and idling, the noise of the hand pieces was measured over a reflecting plane on the hemisphere surface, the radius of which was 0.3 m, and 10 noise samples were picked for each hand piece. During the simulated work, the average A-weighted sound pressure level of the new and old hand pieces was 76-82 dB(A), that of the power suction tube 77 dB(A), the saliva suction tube 75 dB(A), and the ultrasonic scaler 83 dB(A). The average ultrasound level of the ultrasonic scaler was 107 dB at the one-third octave band of 25000 Hz[11].

Noise levels in dental schools were determined using a precision sound level meter that was positioned at ear level and at 1 m distance from the operator. They concluded that the noise levels registered vary between 60 and 99 dB. The results also recorded differences in sound levels when the equipment was merely turned on and during cutting operations. Differences between brand new and used equipment were also noted. It appears that hearing damage risk may be lesser amongst dentists who use brand new equipment[12].

A study to determine the noise levels made by different clinical hand-pieces, laboratory engines, and other significant equipment such as ultrasonic scalers, amalgamators, high-speed evacuation, and other items in dental clinical and laboratory practice. Sound levels were measured at four dental practices and three dental laboratories. The noise levels were determined using a precision sound level meter, which was positioned at ear level and also at 2 meters distance from the operator.

Virtually all noise levels at the dental clinics were below 85 dB(A). The noise levels in the dental laboratories had much higher maxima, with some cutting activities, steam cleaning, and sandblasting up to 90 dB(A), and compressed air blasts with a maximum of 96 dB(A). The noise levels in the dental clinics are considered to be below the limit of risk of hearing loss. However, technicians and other personnel who spend many hours in noisy dental laboratories may be at risk if they choose not to wear ear protection[13].

A pure tone air conduction audiometric evaluation was done among 137 dentists and 80 physicians. The physicians were found to have better hearing threshold levels, notably in the 4000Hz center frequency range. The left ear of right handed dentists showed a greater loss of hearing ostensibly related to proximity to the noise source. Dental specialists showed a loss pattern similar to those of the general dentists. The findings suggest that there may be a cause and effect relationship between hearing loss and use of the high speed dental handpiece[14].

Study to measure the noise level made by different dental instruments in dental offices and laboratories was performed in 89 dental offices and nine dental laboratories. The noise levels were determined using a sound level meter, which was placed at the operator's ear level in dental offices and laboratories and also at two-meter distance from the technician's ear in laboratories. They noted that the maximum sound level was 85.8 dB in dental offices and 92.0 dB in laboratories. In dental clinics, the highest noise was produced by the ultrasonic-scaler (85.8 dB) and the lowest noise (49.7 dB) by the high-volume aspirator, whereas in the laboratory, the highest noise was caused during grinding by the stonecutter (92.0 dB) and the lowest by the denture-polishing unit (41.0 dB). After close evaluation, they concluded that the maximum noise level in dental offices, although often beneath the damaging noise level for the human ear, is very close to the limit of hearing loss (85.0 dB). However, laboratory technicians may be at risk if they choose not to wear ear protection (earplugs or earmuffs)[3].

Study to determine the prevalence of hearing problems among dentists in Saudi Arabia concluded that 16.6% had tinnitus, 14.7 %had difficulty in speech discrimination and 63% had problems with speech discrimination in a background noise. They also found that the dental technicians were the most affected group and the incidence of these symptoms were more in personnel exposed to dental noise for more than 4 hours per day. They recommended that the dental field team should wear ear protector to reduce hazards of dental field noise[15].

Noise control in dental operatory - Noise monitoring should be done with noise dosimeters routinely in the dental operatory and necessary measures to reduce noise should be taken. Noise control can be discussed under 3 categories mentioned below.

Control at noise source

Application of muffles,

Handpieces should be well maintained

Compressors should be fitted away from the work place

The design of the surgery should locate compressors, ultrasonic instrument cleaners and other equipment outside or in an isolated part, whereas the arrangement of the equipment inside the office should not result in an interference of sounds produced by them[16].

Control of transmission

Sound absorbing material wall

Resilient floors

Sound proof acoustical ceiling

Sound-dampening materials ought to be used for finishing the walls and ceilings of offices [16].

Protection of exposed person

Simultaneous use of several turbines should be avoided

Dental drills should be kept 35 cm away from ear

Ear plugs and muffs

Audiography test periodically for early detection

The dentist should maintain a proper distance from the operating field. Kilpatrick[5] recommends the distance from the dentist's eye to the patient's mouth to be 14 inches, i.e. about 35 cm. When the operator is closer, decibel rating increases. Miranda[4] mentions other controllable variables: how the ear is oriented to the working field, the orientation of handpiece exhaust ports to the ears, and the position of the hand piece in relation to the mouth. The rotary instruments must be activated only when they are ready to be used.

Annual hearing tests should be taken[17]. Hearing tests should also be taken at the beginning of the professional career (students, young doctors) which would function as a reference point for the subsequent tests taken during the career, for assessing possible later changes in the ear[1].

Conclusion

National Institute for Occupational Safety has suggested that Noise level of 85dB for 8 hours is permissible. The best way to prevent hearing damage to the dental personnel is to reduce the excessive noise in the dental clinic as well as in the laboratory and not to sit in the noisy environment for long time at a stretch.

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