EFFECT OF EQUIPMENT USED IN LABORATORY ENVIRONMENT ON DENTAL TECHNICIANS' HEARING THRESHOLD

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SUMMARY: Dentists and dental technicians are exposed to noise of various sound levels while working in dental offices or laboratories. The amount of noise that the dental practitioner is exposed to is over the limit of risk of hearing loss. The equipment used in laboratory environment emits characteristic noises that are potentially hazardous to the ear and may cause acoustic trauma. It also has some physiological and psychological undesirable effects on human beings. In this study, we evaluate the possibility of the hearing loss of 25 dental technicians working under these conditions. Their age ranged between 20-35. There are differences existing between the normal group and the technicians in the range of 125-8.000 Hz. hearing threshold. This difference is statistically significant ($p<0.001$).

Key Words: Dental technicians, hearing threshold.

INTRODUCTION

Since the late 1950s, dentists had the advent of the high-speed turbine dental drill, the progressive increase in rotational speed had increased cutting effectiveness and reduced operating time. The high-speed equipments have also reduced the discomfort caused by vibration (4,7). However, increased rotational speeds expose the dentists to certain health risks. The high pitched noise that is potentially hazardous to the ear carries the risk of acoustic trauma has attracted the attention of several investigators in the past (4,6,7,12).

The beginning of acoustic trauma, as a result of high intensity noise stimuli may be acute and painful. Acoustic trauma may also develop chronically as a consequence of prolonged exposure to lower intensity sound stimuli not strong enough to provoke a painful reaction. The absence of pain makes acoustic trauma more dangerous. Lesions derived from acute acoustic trauma (hemorrhage, rupture, luxation) may cause either reversible or irreversible damage to the ear drum, middle ear or the basilar membrane of organ of corti (10,11). Lesions resulting from chronic acoustic trauma are irreversible. Auditory lesions may remain undetected for years, the severity of the hearing loss can only be detected when the oral communication problems occur (10,11). The factors that must be considered in acoustic trauma are frequency of vibration, intensity, length of exposure, intervals between exposures and the susceptibility of the individual (4,6,8,10, 11,13,14).

If one ear is affected more than the other, it may be relative to subsequent injury or damage or proximity of

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that ear to the noise creating hand piece (12). The range of hearing in normal adults is from 20-20.000 Hz, with sounds below and above those extremes referred to as infrasound and ultrasound (4). The effects that are mentioned are supported by studies performed on human and animal in the sound ranges in the dental environment include annoyance, emotional problems, nervousness, indigestion, headache, decreased ability to concentrate, low overall efficiency and reduced ability to perform complex or multiple tasks (12).

According to reports from the Occupational Safety and Health Administration just 8 hours of continual exposure to a noise level of 85 dB (A) is permissible daily (1,12,14). The amount of noise that the dental practitioner is exposed to is over the limit of risk of hearing loss. Dentist and dental practitioner are exposed to noise of various sound levels while working in dental offices or laboratories (5,8,12,14). On the other hand, in clinics or laboratories where two or more high-speed hand pieces operate simultaneously in the same room, the dentist or technician exposed not only to the trauma of his own hand piece, but also to the reverberation of others (10,11).

In this study, we considered the working environment of the dental technicians and compared the hearing threshold of normal human ear findings with the hearing threshold of dental technicians data.

MATERIAL AND METHODS

This study is based on the findings of 35 dental technicians. Technicians were tested otologic and audiologicaly in Hacettepe University Medical Faculty Otolaryngology and Audiology Department. 10 technicians were eliminated from the study, because they already have severe sensorineural hearing loss. The remaining 25 technicians composed of 21 males and 4 females forms the base of our data. The age range of the technicians is among 20-35 with a mean of 28.

The other criteria for selection technicians forming our data base are mentioned below:

- Minimum 5 year work experience,
- Normal ear nose ad throat findings,
- Normal Impedance metric findings,
- No other previous acoustic trauma story,
- Age limit maximum 35 years (This age was selected due to the normal hearing loss caused by presbycusis)

Table 1: The mean of hearing thresholds from normal and dental technicians group.

	The mean of hearing thershold (dB)	
Frequency (kHz)	Normal Group	Dental Technician Group
0.125	7.08	20.45
0.25	5.00	19.89
0.5	4.44	16.93
1	6.11	15.34
2	4.72	17.39
4	6.94	23.75
6	14.44	23.75
8	14.58	24.17
10	19.44	26.93
12	24.86	29.48
14	33.05	36.05
16	46.28	47.67
18	53.75	54.54

The normal working hours of these technicians are 6 days in a week and 8 hours in a day. The audiologic tests were performed in the sound proof rooms build by IAC (Industrial Acoustics Company). 125-6.000 Hz. air-conduction hearing threshold test was performed by Interacoustics AC-5 clinic audiometer with MX41 AR standard earphone. 8.000-18.000 Hz. air-conduction hearing threshold test was performed by Interacoustics AS 10 HF high frequency audiometer with Koss HV-Al ear phones. Bone conduction hearing threshold is measured by Oticon 69273 bone vibrator. Impedance metric measurements are performed by Interacoustics AT-22 electro acoustic impedancemet. The statistical data was evaluated by student's t test.

RESULTS

Table 1 reveals the findings of the audiometric observations from these tests. The data is compared with the mean findings of normal group against the technicians' findings (2).

As can be seen from the Table 1, there are differences existing between the normal group and the technicians in the range of 125-8000 Hz hearing threshold. The difference is statistically significant ($p<0.001$). However, the data is insignificant for the range of 10.000 Hz.

Table 2: The noise frequency analysis of gas-air blow pipe.

Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000
Level (dB) SPL	66	70	76	85	93	97	100	102

The noise level of the laboratory equipments also measured by Brüel and Kjaer 2236 SLM (sound level meter). The noise level of the plaster model trimmer has 89 dB (A), gas-air blow pipe has 104 dB (A), trimming of acrylic prosthesis has 98-102 dB (A). Table 2, reveals the noise frequency analysis of gas-air blow pipe.

DISCUSSION

Increasing attention has been recently focused on the relationship between exposure to noise from the high-speed drill and noise induced loss of hearing within members of the dental profession.

Observations reported by various studies revealed that a significant loss of hearing happens in the dental practice, while some other studies disputed these findings (1,3,8,15-17).

In the laboratory environment where the dental technicians work, certain noise level exists due to the dental equipments working intensively. This environment creates certain hearing risks to the staff of these laboratories. However, we are not aware of any study reported on this subject. In this study, we evaluated the findings of the noise level measurements of various equipments used by the dental technicians. We tried to find whether the usage of these equipments creates a negative effect in the hearing thresholds of these technicians. According to the findings of our study, there is a significant hearing loss of the dental technicians in the 125-8000 Hz level compared with the normal human beings. The hearing loss is significantly increasing for the higher frequencies. As it is well known, the early effects of acoustic trauma happens at the level of 3000-4000 Hz (4). The frequency analysis level increase (Table 2). This is the reason of the higher rate of hearing loss in high frequencies.

If we add the negative effects of music, telephone bell and the external noise created by the cars and various sources, to the already existing noisy environment of the dental laboratories, the potential risks of hearing loss for the technicians inevitably increases (12).

Noise level is measured in decibel (dB). The +85 dB (A) scale of sound is announced as a hazardous and the maximum exposure time is set for the +85 dB (A) noise level (4,5). Maximum daily tolerable dosage of noise is set as 90 dB (A) for 8 hours, 93 dB (A) for 4 hours, 96 dB (A) for 2 hours, 99 dB (A) for 1 hour, 102 dB (A) for 30 minutes, 105 dB (A) for 15 minutes (4).

In our study, after measuring the noise levels of various laboratory equipments, we found out that these equipments have high sound frequencies. In line with this finding, dental technicians are subject to severe hearing loss, especially in the range of 125-8000 Hz. Considering that these technicians are working 6 days per week and 8 hours per day, it appears imperative that some precautions should be taken to improve their working conditions.

The daily work schedule should be planned in certain intervals in the use of dental tools, thus limiting the acoustic trauma to shortest possible time period. The simultaneous use of several turbines should be avoided. The hand piece should be well maintained, since low maintenance of the equipments increases noise intensity. Dental drills should be kept at least 35 cm away from the ear. Laboratory walls and ceiling should be covered with sound absorbing materials. Earplugs provide adequate protection. Those using high speed instruments continuously in dental practice should be studied by audiography periodically for early detection of hearing loss (1,10-12).

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