Medical Journal of the
Islamic Republic of Iran

Volume 7
Number 2
Summer 1372
August 1993

THE EFFECT OF NOISE-INDUCED HEARING LOSS ON DENTISTS

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ABSTRACT

This paper presents noise problems associated with the use of air-turbine drills in dental practice. Two hundred and fifty dentists (male and female) were randomly selected from the faculty of dentistry as well as the dentists who worked private in Tehran. The results indicated that the mean value of sound pressure level produced by the high-speed drills was 69.1 db. Most of the energy from the drills lied in the high frequency range, 6000- 8000 Hertz. Audiological evaluations showed that the loss of hearing in all age groups and years in dental practice lie in 6000 Hertz which has a positive correlation with the value of sound pressure level in this frequency. The hearing loss in the right ear of women was slightly higher than the left one, while this was not true in men. The hearing loss in the female group was greater than in male group.

MJIRI, Vol. 7, No.2, 83-86, 1993.

Keywords: Dentists, air-turbine drills, noise, hearing loss, audiometry

INTRODUCTION

It is a long time that dentists have had an occupational interest in the subject of noise-induced hearing loss (NIHL). This came with the advent of the high-speed turbine dental drill, which was immediately notable for the high level and unpleasent high-frequency noise that it emitted.[1] This soon led to the speculation that it might be a hazard to the hearing of dentists using this drill and to the advice on preventive measures including periodic audiometric examination.[2-5]

The first conclusive evidence that damage to hearing can result from exposure to this noise was published by Taylor and co-workers in 1965 in a carefully controlled study of dentists.[6] These workers also comment on the relatively greater importance of other noise exposures, current or previous, notably the firing of rifles or shotguns.

Forman-France and associates, however, studied 70 dentists from eight specialties and found no significant decrease in hearing thresholds when compared with a normal age-adjusted population.[7] An important corroborative study was that of Ward and Holmberg.[8] Coles et al. concluded that the auditory hazard was very slight and preventive measures were also recommended.[1] Akbarkhanzadeh reported that although the hearing damage caused by high-speed drill was slight in 12 dental surgeons using these drills for a number of years, the possibility of hazardous effects at least for susceptible ears was not excluded.[9] Wilson et al. have recently studied the hearing damage risk among dentists, and the extent of communication interference. The noise levels during dental procedure result in an articulation index of 0.27 to 0.37 and it was concluded that hearing damage risk was slight among dentists using modern equipment.[10]

It has also been estimated that most turbine users are exposed to high - speed handpieces ranging from total on times of 12 minutes or 12-45 minutes to 10 minutes per hour.[7] It is estimated that the sound energy contribution of a typical dental practice is about 8% of the dentists' average 24-hour noise exposure.[10]

The purpose of the present study was to obtain an up-to-date assessment of the nature and extent of possible hearing in this country.

MATERIALS AND METHODS

250 dentists, 60 women and 190 men, from different specialties were randomly selected from the faculty of dentistry and private clinics in Tehran. All the subjects filled out a questionnaire which included questions about the work schedule, dental specialty, years in practice; previous history of exposure to industrial noise, gunfire, and any incidents that might have affected their hearing.

The noise measurements were made by Rion sound level meter and the narrow band, octave and one-third octave filter set model SA-56A. All noise measurements were taken at the position of dentists' ears. Routine audiometric testing was performed on each subject with the use of Madsen audiometer type 0-B40 confirming to IEC178 and ANSI-3.6-1969 standard and was calibrated to 150-R389-127/B.S. 2497 recommendation. It was calibrated before the survey according to the calibration procedure recommended in the Madsen operating manual. Each dentist was instructed to use the audiometer button. Hearing sensitivity at 250, 500, 1000, 2000, 4000, 6000, and 8000 Hertz was determined for left ear and then right ear. The audiometric findings for the dentists were adjusted for age, producing age-corrected auditory thresholds.[11]

RESULTS

Environmental Measurements

The main noise sources in the visited dental clinics and the faculty of dentistry were identified as the high-speed drills. In addition, some noise levels were measured from aspirators, air conditioning and background ambient noise. As these levels were not a main hazard, the main attention was given to the high-speed dental drills.

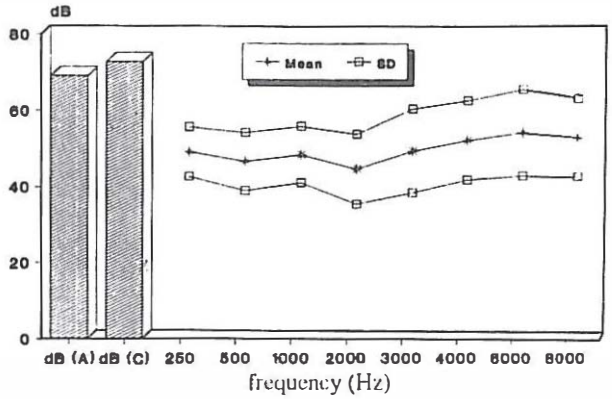

Fig. 1. Mean sound pressure level and octave band analysis of air turbine drills.

Fig. 1 shows the mean overall sound pressure level measurements associated with octave band analyses of high-speed drills which have been made in the dental clinics in Tehran. The maximum sound pressure level was 52db with standard deviation of 11.3 db concentrated in 6 KHz, and 50.6 db with the standard deviation of 10.2 db in 8 KHz and the minimum sound pressure level was 41.3 db in 2 KHz.

Audiological Measurements

A total of 250 dentists were examined, 24 percent of the studied group were female and 76 percent male. The largest percentage (73.2%) of the studied population consisted of general practitioners. The age ranged from 20 to 65 years. The years in dental practice ranged from five to 39 years.

Table I summarizes the individual characteristics of the studied population. The mean hearing threshold of the right and left ears of the dentists in six groups according to the years in dental practice are presented in Fig. 2.

DISCUSSION

It is believed that the high-speed drills are a hazard to

Table I. Mean value and standard deviation of individual characteristics of studied dentists

Dentists	Female						male					
	General	n	Specialist	n	Total	n	General	n	Specialist	n	Total	n
Age	30.71	41	39.39	19	33.36	60	40.15	142	42.54	48	40.76	190
	5.45		9.04		7.79		10		7.76		9.55	
Years in Practice	9.1	41	14.83	19	10.88	60	16.22	142	16.92	48	16.4	190

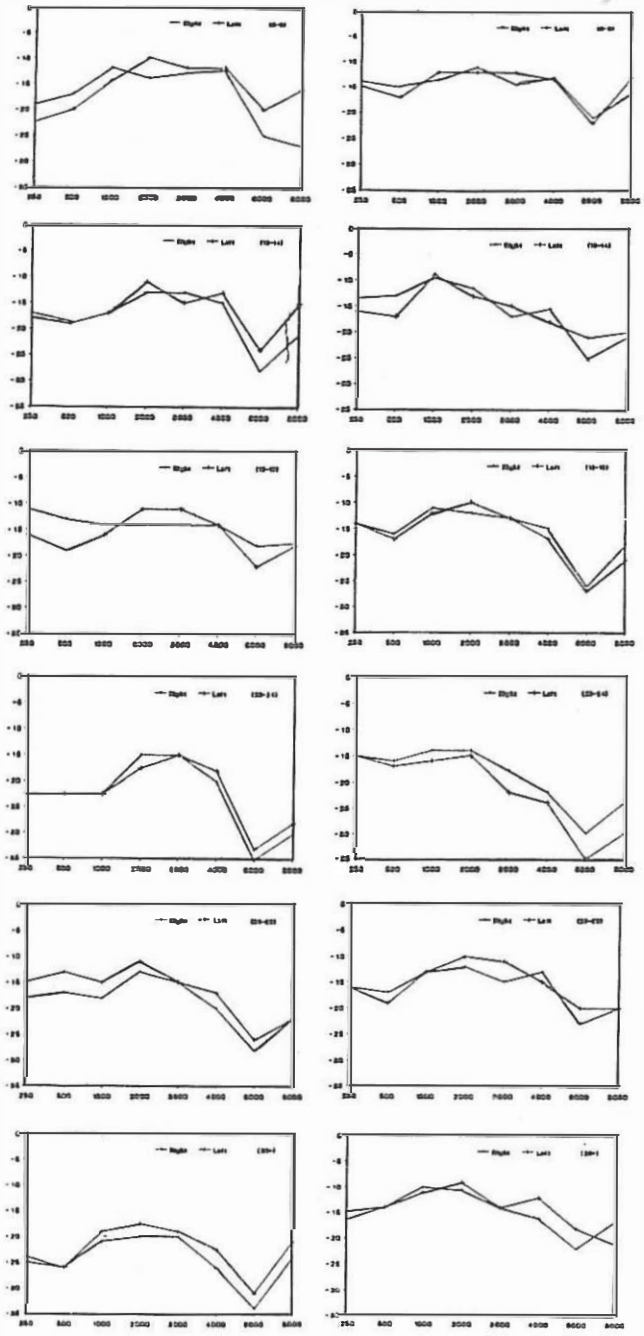

Fig. 2. Hearing threshold level of noise-exposed male and female dentists according to the years in dental practice.

dentists' hearing. The factors to be considered in acoustic trauma are intensity and frequency of sound, length of exposure, and interval between exposure.

Different opinions exist about the effects of the noise generated by high-speed drills on the dentists' hearing acuity. Some investigators found no evidence that the use of such a drill is detrimental to hearing,[12-14] yet others have found a significant loss of hearing.[15,16]

Most of the energy from high-speed dental drills is concentrated in the higher frequencies, above 3000 Hz. The sound pressure level measured was 52 db at 6000 and 50.6 db at 8000 Hz.

The damage risk criteria for continuous eight hour exposure is 90 dbA.[17] Depending on the individual and the type of dental practice, variations of total exposure time for eight hours ranged between 12 and 45 minutes.[7] Thus on the basis of the lenght of exposure and noise intensity, air-turbine drills in proper working order should be safe regarding damage to hearing.

The first step in our study was to exclude all dentists with a known exposure to noise or any history of ear disease, present or past, leaving 250 dentists (190 male and 60 female) for the survey. Comparison of the group audiograms shows that there is a definite threshold at the higher frequencies in the drill noise exposed. In women, greater loss of hearing exists at 6 KHz in the group of 20-24 and more than 30 years of dental practice. Then, we measured the average hearing loss in those practiced more than 10 years and compared it with those practiced less than 10 years. At 6 KHz, in female dentists, there was 0.93 db (right ear) and 5.2 db (left ear) difference in hearing threshold level. The difference is statistically significant for left ear, $P<0.025$. The differences indicating that the right ear shows greater loss than left ear are statistically significant in female dentists ($P<0.05$).

The audiograms of male dentists, although showing a change in the threshold of hearing, are not as severe as those in the female group. Among the six studied groups, the greatest hearing loss existed in the group with 20-24 years of practice which was similar to the female hearing loss. The differences between the right and left ear of noise-exposed male dentists with more than 10 years and less 10 years of dental practice were as follows:

The right ear exceeded 3.72 db while the left ear exceeded 1.34 db, the difference is significant for the right ear, $P<0.025$.

It is concluded from this study that the average sound pressure level measured in clinical settings were less than the permissible limits but the nois-induced hearing loss was observed both in male and female dentists. The loss, being at the 6 KHz frequency region, is beyond the speech frequency range and is undetected by the dentists. However, the continued noise exposure may indicate a gradual encroachment on the frequencies of the speech range.

ACKNOWLEDGEMENT

The authors wish to acknowledge the cooperation of the Iranian Dental Association who made significant contribution toward the success of this study.

Sincere thanks are extended to the dentists who participated in this research project.

The authors also would like to express their appreciation to Mr. Jamshid Pirnazar for his assistance in audiological examination and to Mr. Ahamd Dorosti-Motalagh for his contribution in processing of data.

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