An Evaluation of Hearing among the Dental Professionals of NMCTH

Joshi RR, Shah S, Rijal AS, Dhungana A, Maharjan S

Department of Otolaryngology and Head Neck Surgery, Nepal Medical College and Teaching Hospital, Jorpati, Kathmandu, Nepal.

Corresponding Author: Dr. Rupesh Raj Joshi, Department of ENT & HNS, Nepal Medical College and Teaching Hospital, Jorpati, Kathmandu, Nepal; E-Mail: dr.rupesh123@yahoo.com

ABSTRACT

Loud noise is present in dentists' workplaces, which may cause damages to the auditory systems. Pure tone audiometry is an important tool in the investigation in the early diagnosis of hearing loss. This study was done to analyze the auditory thresholds at frequencies from 500 to 8,000 Hz of dentists working at Nepal Medical College and Teaching Hospital**.** This comparative cross-sectional study was done by testing the hearing thresholds from 500 to 8,000 Hz. Fifty dental professionals who were exposed to loud noise as case and equal number of non-dental, medical professionals who were not exposed to loud noise as control were considered**.** Subjects were tested with conventional audiometry. Results showed that 88% of dentists did not receive any information regarding noise at university; however, 95% said they knew the effects of noise on hearing. All (100%) acknowledged the existence of noise in their workplace, and 72% believed that noise to be of medium intensity and 28% believed it to be of loud intensity. Seven (14%) dentists had sensorineural hearing impairment**.** There were significant differences in auditory thresholds of the dental professionals at the frequencies of 500, 4000 and 8000 Hz in both ears. Subjects who had been working as dental professionals for longer than 10 years had worse hearing thresholds at high frequencies. Therefore, we concluded that dental professionals are at risk for the development of sensorineural hearing loss especially after 10 years of service.

Keywords: dental instruments, dental professionals, hearing loss, loud noise, noise induced,

INTRODUCTION

We experience sound in our environment every day. Sound in the environment, may be regarded as pleasant or unpleasant depending on the subjective experience and stimulate hearing in humans. It may be either in home such as the sounds from household appliances, music system and television or in the workplace. Normally, these sounds are at safe levels that don't damage our hearing. But sounds can be harmful when they are too loud, even for a brief time, or when they are both loud and long-lasting. These sounds may cause irreversible damage to sensitive structures in the inner ear and cause noise-induced hearing loss (NIHL).[1] Generally, acute damage to hearing can be caused by constant exposure to sound pressure levels exceeding 85 decibel (dB). A sound pressure level exceeding 120 dB can cause irreversible hearing damage; even the exposure was only for few seconds. Also, extremely high sound pressure levels like from blasts or explosions in close proximity to the ear normally lead to permanent damage.[1] Loud noise is present in dentists' workplaces. It may be either from the clinical equipment used, such as dental drills, suction tubes, amalgamators, air compressors (when located in the room), suction pumps, autoclaves, and air conditioners, or from external sources, such as ambient noise including traffic from nearby vehicles and other urban noise.[2–4] When the noise levels in dental teaching institutions were assessed by Kadanakuppe *et al* using precision meters, values of 64 to 97 dB were recorded. Due to the increased availability of many dental high frequency devices as well as their constant usage, noise levels can increase so that they can come close to the limits of the risk for hearing loss.[5] High-level noise exposure may damage the auditory system in dentists. Since the 1950s, it was seen that there was high sound pressure levels in dentists' workplaces due to high-speed equipment. Studies have shown that, the dentists are at risk of developing noise-induced hearing loss (NIHL) [6-10] Therefore, the American Dental Association in 1959, recommended periodic audiological evaluations for dentists due to noise exposure.[11] The auditory thresholds show a classic sign of NIHL in the audiometric notch at the frequencies in the range between 3 and 6 KHz.[12–14] As a result of these considerations, this study aimed to analyze the auditory thresholds at frequencies from 500 to 8,000 Hz amongst dental professionals of Nepal Medical College and Teaching Hospital.

MATERIALS AND METHODS

This comparative cross-sectional study was carried out at Nepal Medical College and Teaching Hospital (NMCTH), Attarkhel, Kathmandu, Nepal between August to February 2016. Prior informed written consent was taken. Fifty active dental professionals, who were working at Dental Department of Nepal medical college and teaching hospital, of 21-48 years of age were considered as case and equal number of medical professionals of same age group who were not exposed to occupational noise as control group. Detailed history and ENT, head-Neck examination with relevant general examination was done. Subjects with any kind of middle ear pathologies were excluded from the study. All participants were tested by Pure Tone Audiometry testing with AD 229 b, Interacoustic audiometer. Tests were carried out in sound treated room and subjects were not exposed to noise16 hours before test. Both air and bone conduction thresholds were tested on each subject, using calibrated TDH 39 earphones and B-71 bone vibrator respectively. The frequencies testing sequences was 1 kHz, 2kHz, 4kHz, 8kHz, 500Hz and 250 Hz for air conduction, and 1kHz, 2kHz, 4kHz, 500 Hz and 250 Hz for bone conduction. The descending method was used for measuring thresholds with both transducers, using audible and inaudible sound, as proposed by Carhart and Jerger. The severity of hearing loss was graded according to the World Health Organization (WHO) (**Table I)**

Table 4. World Health Organization grading for hearing loss

Degree of hearing loss	Hearing loss range (dB HL)
Normal	< 25
Mild	25-40
moderate	41-55
Moderately severe	56-70
Severe	71-90
Profound	>90

For the analysis of the data, each subject from control group was matched one-to-one with someone from the group of dental professionals. Statistical methods that enabled the determination of significant audiological assessment between groups' results were used for data analysis, considering a 0.05 significance level (5%). Descriptive statistics were applied and t-test was used to compare the thresholds of the groups.

RESULTS

The group of dental professionals was composed of 50 subjects, 18 males and 32 females. The subjects' ages ranged from 21 to 48 years (mean 29.74 years, standard deviation 5.31 years) and time of practice was 1 to 17 years (mean 5.63 years and standard deviation 3.81 years).

The working hours of the dental professionals varies from 6 to 12 hours daily. We observed that 88% of dental professionals did not receive any information regarding noise during their academic training; however, 95% said they knew the effects of noise on hearing. All (100%) acknowledged the existence of noise in their workplace, and 72% believed that noise to be of medium intensity and 28% believed it to be of loud intensity. None of dental professionals used hearing protection devices. Among the dental professionals, seven had sensorineural hearing loss, which was bilateral in five and unilateral in two cases. The hearing loss was only of mild intensity ranging from 30 to 40 db. The hearing loss was seen at 4 kHz in six cases and in one case the hearing loss was at 6 kHz.

All individuals among the group not exposed to occupational noise had hearing within normal limit. Auditory thresholds for 50 dental professionals were analyzed and compared with the control group. Comparison of hearing thresholds in all frequencies between groups is shown in (**Table 2)**

There were significant differences in auditory thresholds of the dental professionals at the frequencies of 500, 4000 and 8000 Hz in both ears and in addition to these frequencies, left ear showed significant differences at 6,000 Hz. Results were worse in dental professionals compared to controls. The auditory thresholds of dental professionals were also analyzed on the basis of their work experience. The dental professionals were separated into two groups: those with over 10 years of experience and those with less than 10 years. Forty-three had over 10 years of work experience and seven had less than 10 years of work experiences. Differences were noted between the frequencies of 3000, 4000 and 6,000 Hz for the right ear, and the average conventional auditory tone thresholds were worse among those with more than 10 years of experience, but there was no significant difference at any frequencies in both ears. **(Table 3)**

Table 2. Comparison of hearing thresholds in all frequencies between groups

frequency	Right Ear					95%Confidence interval of the difference		Left ear					95%Confidence interval of the difference	
	Dentists		Control					Dentists		Control				
	Mean	Std dv	Mean	Std. dv	p	Lower	Upper	Mean	Std dv	Mean	Std. dv	p	Lower	Upper
250HZ	11.20	2.78	12.30	2.89	.055	-.026	2.226	11.20	3.12	12.30	2.52	.055	-.026	2.226
500HZ	11.20	2.96	12.50	2.53	**.020**	.209	2.391	11.10	3.08	12.40	2.52	**.023**	.183	2.417
1KHZ	11.50	2.90	11.30	2.44	.710	-1.263	.863	11.40	3.20	12.40	2.52	.086	-.144	2.144
2KHZ	12.10	3.36	11.10	2.09	.077	-2.112	.112	11.30	2.43	11.30	2.43	.604	-1.443	.843
3KHZ	12.45	5.12	12.50	2.53	.950	-1.553	1.655	12.10	3.51	12.60	2.53	.416	-.714	1.714
4KHZ	17.70	8.40	11.80	2.42	**.000**	-8.355	-3.445	17.80	6.24	12.30	2.52	**.000**	-7.388	-3.612
6KHZ	13.16	4.29	12.90	2.50	.709	-1.660	1.134	13.40	3.97	12.10	2.50	**.053**	-2.615	.015
8KHZ	14.20	5.19	12.20	3.06	**.021**	-3.690	-.310	14.50	4.77	12.96	2.48	**.047**	-3.061	-.021

Table 3. Comparison between frequency

Frequency	Right Ear					95%Confidence interval of the difference		Left ear					95%Confidence interval of the difference	
	0-10y		Over 10					0-10y		Over 10				
	Mean	Std dv	Mean	Std. dv	p	Lower	Upper	Mean	Std dv	Mean	Std. dv	p	Lower	Upper
250HZ	11.05	2.79	12.14	2.67	.338	-3.374	1.181	11.28	3.10	10.71	3.45	.662	-2.016	3.146
500HZ	11.05	3.00	12.14	2.67	.368	-3.523	1.330	11.16	3.05	10.71	3.45	.725	-2.097	2.994
1KHZ	11.51	2.79	11.43	3.78	.945	-2.319	2.485	11.16	3.24	12.86	2.67	.197	-4.298	.910
2KHZ	11.98	3.30	12.86	3.93	.526	-3.654	1.893	11.51	3.37	12.14	2.67	.640	-3.327	2.065
3KHZ	11.90	4.68	**15.71**	6.72	.068	-7.906	0.287	11.86	3.28	13.57	4.76	.236	-4.576	1.154
4KHZ	16.86	7.72	**22.86**	11.13	.080	-12.734	0.740	17.21	5.90	**21.43**	7.48	.097	-9.239	.800
6KHZ	12.74	4.16	**15.71**	4.50	.090	-6.431	0.478	13.37	3.89	13.57	4.75	.903	-3.485	3.087
8KHZ	14.19	5.11	14.29	6.07	.963	-4.394	4.194	14.42	5.03	15.00	2.89	.768	-4.523	3.360

DISCUSSION

The effects of noise on hearing have been reported to fit into three general categories: acoustic trauma, temporary threshold shift, and permanent threshold shift.[12] Acoustic trauma describes the effect of one or few exposures to very intense sound levels such as an explosion. The amount of the hearing threshold shift and the recovery time are related to the intensity and duration of exposure to the noise. Permanent threshold shifts refer to a change in hearing that, once it occurs, is permanent and irreversible. This may be a common occurrence as small amounts of permanent damage result from many noise-induced temporary threshold shifts.[13] Permanent threshold shifts are the consequence of an accumulation of noise exposures that are repeated over a period of many years.[12] Several studies and surveys have been completed to determine the effects of noise in the workplace for dentists. Many of these studies have examined whether the noise found in a dental practice exceeds the Occupational Safety and Health Act (OSHA) standards. OSHA regulations for industry limit a worker's exposure to steady state noise levels of 90 dB in an eight-hour time period.[14] The National Institute for Safety and Health (NIOSH) recommends that the time spent exposed to noise should be reduced by half as the sound level doubles.[13]

In our study, we observed that 88% of dental professionals did not receive any information regarding noise during their academic training; however, 95% said they knew the effects of noise on hearing. All acknowledged the existence of noise in their workplace, 72% believed that noise to be of medium intensity and 28% believed, it to be of loud intensity, but none of the dental professionals used the hearing protection devices. Such findings corroborate another study in which 48 dentists, ages 22 to 55, participated, with only one reporting the use of hearing protection.[15] In a study on the perception of noise from dentists, 49% of the 163 professionals surveyed felt that the noise in their workplace was of medium intensity and only 3% knew the effects of noise on health and used hearing protection.[16] In the present study, among all the dental professionals, seven (14%) had sensorineural hearing impairment; bilateral in five and unilateral in two cases. The hearing loss was seen at 4kHz and 6kHz in

six and one case respectively but the hearing loss was only of mild intensity ranging from 30 to 40 db.

Lopes *et al* in another study of 198 dentists, 27% had sensorineural hearing loss suggestive of NIHL. [17] Gambarra *et al* did a study in 50 dental professionals of both genders aged between 25 and 54, and with work experience between 3 and 29 years, found 28 (56%) dentists had hearing loss.[15] Cavalcanti *et al* in a study with 48 dentists, conventional audiometry was performed and taking into account the frequencies of 3, 4, and 6 kHz, 52.17% subjects had bilateral hearing loss, [18] In the present study, dental professionals had lower mean hearing thresholds than the control group; this difference was significant at frequencies of 500, 4,000, and 8,000 Hz in the bilateral ear. In addition, the hearing threshold of left ear was also significantly decreased at frequency of 6000Hz. In subjects, who had experience of more than 10 years of working as dental professionals, there were reduced hearing thresholds for the right ear at frequencies of 3,000, 4,000, and 6,000 Hz and reduced hearing threshold for left ear at frequency of 4000Hz, configured as an acoustic notch characteristic of hearing loss due to exposure to high sound pressure levels. A study with dentists in Bauru, Sao Paulo, also found the right ear to have worse hearing thresholds than the left ear.[17] other studies identified dentists presenting worse thresholds in their left ears.[19, 20] These findings corroborate with researches, which found that older workers with a longer time of service are most vulnerable to hearing impairment.[11, 21]It is noteworthy that the age factor may also affect the results, especially in high-frequency hearing thresholds [15, 22]

It can be concluded from this study that dentists are at risk for the development of sensorineural hearing loss, especially after 10 years of service. However, There were significant differences in auditory thresholds of the dental professionals at the frequencies of 500, 4000 and 8000 Hz in both ears and in addition to these frequencies, left ear showed significant differences at 6,000 Hz; results were worse in dental professionals compared to controls. We suggest further studies to compare groups exposed to and not exposed to occupational noise to better understand the pattern of hearing damage.

Disclaimer: none

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