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Original Article

# Hearing threshold evaluation of dentists in Babol (North of Iran)

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## Abstract

**Introduction:** Noise in dental offices is one of the risk factors in the workplace. One of the major effects of noise is hearing loss. This study aimed to determine the effects of noise on hearing thresholds of dentists of Babol city.

**Methods:** This descriptive analytical cross-sectional study was performed on 40 dentists in Babol City (as case group) and 40 office workers (as control group). Hearing thresholds were measured from all the subjects. The mean hearing threshold was calculated at different frequencies in each group and compared with the number 15 db. The data were analyzed by statistical software SPSS 17 and $p \leq 0.05$was considered significant.

**Results:** The mean and standard deviation of hearing thresholds for the right ear of dentists and the control group without considering the different frequencies were 13.6156±9.14210 db and 10.0156±5.4488 db ($p=0.036$), respectively and for the left ear were 12.5115±8.7609 db and 10.059±5.9254 db respectively. Hearing threshold of right and left ear of young and middle age dentists was not significant. The hearing thresholds of the dentists with work experience of 15 years or less were not significant for the right and left ear. Auditory thresholds were significant between male and female only for the left ear ($p=0.02$).

**Conclusion:** There was a change in hearing thresholds at all frequencies. A clear difference was in the left ear of men and women and hearing loss was higher in men. Also, age and working experience were not among the contributing factors to the incidence of noise-induced hearing loss.

**Keywords:** Noise, Hearing loss, Dentistry

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Hearing threshold evaluation of dentists

# ارزیابی آستانه شنوایی دندانپزشکان در بابل (شمال ایران)

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## چکیده

**مقدمه:** نویز (نوفه) مطب دندانپزشکی یکی ازعوامل مخاطره آمیز در محیط کار می باشد. یکی ازمهم ترین اثرات نویز افت شنوایی می باشد. این مطالعه با هدف تعیین تاثیر نویز بر آستانه شنوایی دندانپزشکان شهر بابل انجام شده است.

**مواد و روش ها:** این مطالعه مقطعی توصیفی–تحلیلی بر روی ۴۰ نفر از دندانپزشکان شهر بابل (گروه مورد) و ۴۰ نفر از کارکنان اداری (گروه شاهد) انجام شد. آستانه شنوایی کلیه افراد اندازه گیری شد. میانگین آستانه های شنوایی هر یک از گروهها در فرکانس های مختلف محاسبه و با عدد ۱۵دسی بل (db) مقایسه گردید. اطلاعات با استفاده از نرم افزار آماری (SPSS 17 ) مورد تجزیه و تحلیل قرار گرفت و$p\leq0.05$ معنی دار تلقی شد.

**یافته ها:** میانگین و انحراف معیار آستانه شنوایی برای گوش راست دندانپزشکان و گروه کنترل بدون در نظر گرفتن فرکانس های مختلف به ترتیب 14210 db .9 ±13.6156 و ($p\leq0.036$) 5.4488 db ± 10.0156بود و برای گوش راست به ترتیب 8.7609 db ±12.5115 و 10.059±5.9254 db بود. آستانه شنوایی دندانپزشکان جوا ن و میانسال در گوش راست و چپ تفاوت معناداری نداشت. همچنین آستانه شنوایی دندانپزشکان با سابقه کاری بالای ۱۵ سال و کمتر یا مساوی ۱۵ سال درگوش راست و چپ معنادار نبود. آستانه شنوایی دندانپزشکان مرد و زن فقط در گوش چپ معنادار بود. ($p=0.02$)

**نتیجه گیری:** در همه فرکانس ها در آستانه شنوایی تغییری وجود داشت. تفاوت مشخصی در گوش چپ خانم ها و آقایان وجود داشت و کاهش شنوایی در آقایان بیشتر بود. همچنین سن و سابقه کار از عوامل تاثیرگذار بر بروز افت شنوایی ناشی از نویز نمی باشد.

**واژگان کلیدی:** نویز، افت شنوایی، دندانپزشکی

## Introduction

Noise in dental clinics is one of the risk factors in the workplace. Impairment of auditory system and hearing loss are among the major effects of noise (1, 2). America's National Occupational Health and Safety (NIOSH) states hearing loss as one of the ten most common occupational diseases (3). Hearing loss affects the quality of life. It limits a person's ability to communicate and causes misunderstanding and isolation. This trend reflects the impact of hearing loss in addition to physical problems on the mental health (1, 2). Various studies are performed within and outside the country on the levels of exposure of dentists to noise. Singh and et al. in a study measured the noise generated by dental instruments in a dental




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institution. As a result, dentists are at lower risk of developing hearing loss than dental lab technicians. But auditory damage occurs over time (4).

Daud and et al. in their study aimed to determine the intensity and frequency of noise generated by dental instruments and prevalence of noise-related hearing loss. The prevalence of hearing loss was 5% (5). Najarkola and et al. performed a study to investigate the noise induced hearing loss in rabbits. They concluded that severe noise can cause temporary or permanent hearing loss (6).

Tahmaseby and et al. in a study on 25 dentists with a working experience of 3 to 15 years (cases) and 28 dental students in 10$^{th}$ semester and above (controls) concluded that 16 percent of dentists and 60.7% of the students in the right ear and 4 percent of dentists and 53.6% of the students in the left ear had hearing loss. The hearinglosses of dental students were more (7).

Fazli and et al. performed a study to determine the effects of noise on dentists hearing ability. They concluded that noise can be considered asa serious threat for health of dentists over a long time (8). As mentioned, one of the major effects of noise is hearing loss, this study aimed to determine the effects of noise on hearing thresholds of dentists of Babol city.

## Methods

This study was a descriptive analytical cross-sectional study. It was performed to examine the effects of noise on hearing threshold of dentists at dental clinics. Thistest was performed on 40 dentists. The reason for choosing this number of dentists was mostly because the dentists of Babol city had no interest in taking part in our study.

In contrast, the control group consisted of 40 office workerswith their age (up to 3 years) and sex matched with dentists who had not worked in a noisy environment and had no congenital or acquired deafness. Dentists should have working experience of over 10 years. Experience is considered since the time they entered the university department.

Dentists and office workers suffering from the external and middle ear infections are excluded. They should not have the history of audio or traumatic shock and also congenital or acquired hearing loss. First of all, the dentists and the controls having the inclusion criteria are referred to the audiology clinic with an invitation and a form containing personal information (name, gender, age and work experience) and disease (specific disease, underlying disease) and overall (Case history) is filledout in the clinic.

Then, the external ear canal and tympanic membrane are examined by stethoscope. They are tested under standard conditions in the special acoustic test chamber.

Although, the goal of hearing screening is measurement of air conduction, to eliminate the possibility of other conductive diseases such as otitis media andin addition to measuring air conduction, bone conduction of the patient also wasevaluated. It is called PTA test.

In this study, double channel audiometry machine (Interacoustic AD 229) was used. Both ears should be examined. Air-conduction thresholds of individualsat 8000H, 6000Hz, 4000Hz, 3000Hz, 2000Hz, 1000Hz, 500Hz and 250Hz frequencies to be evaluated and by plotting the intensity values versus the frequency values, a chart called pure tone audiogram was obtained.

All of the dentists and the control group's personal information were preserved and archived. Then, the mean of hearing thresholds was calculated for the group of dentists and controls at each frequency. It was compared with 15 db that is the border between occurrence and non-occurrence of hearing loss. 15db or more was considered as loss.

The patient's bone conduction at frequencies of 4000Hz, 3000Hz, 2000Hz, 1000Hz and 500Hz and 250Hz was measured.The data were analyzed using SPSS 17 statistical software and by statistical tests including T-test, x2, Pearson correlation coefficient and Anova Repeated measures. $p<0.05$ was considered significant.

## Results

Ten dentists were excluded from the study because of having exclusion criteria such as atherosclerosis, otitis andothers eventually, 40 dentists and 40 individuals participated in this study. In each group, 31 (77.7%) individuals were males and 9 individuals (22.5%) were females. The mean age of dentists and the control group was 43.5±4.61 years and 42.83±5.38 years and ($p=0.55$), respectively, therefore, statistically there was no significant difference in terms of age. The dentists work experience was between 10 to 28 years with a mean of 14.73±4.478 years.

The mean and standard deviation (SD) of audiometry results in the left and the right ears of the dentists and office workers at various frequencies is given in table 1. Box plot graph (fig. 1 and 2), indicates mean hearing thresholds of dentist and control group in the both ears in different frequencies.

The comparison of mean hearing thresholds of dentists and controls indicate that significant differences exist at the 8000Hz, 6000Hz, and 4000Hz and 250Hz frequencies in the right ear. The difference in the mean hearing thresholds of dentist and office workers in the left ear was not statistically significant.

The mean and standard deviation of hearing thresholdsin the right ear of dentists and control group without considering different frequencies were 13.6156±9.14210 db and 10.0156±5.4488 db (p=0.036), respectively.

The mean and standard deviation of hearing thresholdsin the left ear of the dentists and the control group without considering the different frequencies were 12.5115±8.7609 db and 10.059±5.9254 db (p=0.146), respectively.

The comparison of hearing thresholds of both groups at all frequencies indicates that there was a significant difference in the right ear. Hearing thresholds data for the right and left ears of the dentists and the office workers in terms of sex is shown in table 2.

**Table 1. The Mean and standard deviation of hearing thresholds of air- conduction for right and left ears of dentists and office workers at different frequencies**

| Group | | N | Mean | Std. Deviation | Std. Error Mean | P. Value |
|---|---|---|---|---|---|---|
| AC. R250 | Dentist | 40 | 10.75 | 5.943 | .940 | 0.040 |
| | Control | 40 | 8.13 | 5. 273 | 0834 | |
| AC. R500 | Dentist | 40 | 8.50 | 5.454 | .862 | 0.347 |
| | Control | 40 | 7.38 | 5.187 | .820 | |
| AC. R1000 | Dentist | 40 | 8.75 | 6.279 | .993 | 0.927 |
| | Control | 40 | 8.88 | 5.369 | .849 | |
| AC. R2000 | Dentist | 40 | 9.00 | 7.268 | 1.149 | 0.687 |
| | Control | 40 | 9.63 | 6.543 | 1.034 | |
| AC. R3000 | Dentist | 40 | 14.53 | 14.385 | 2.247 | 0.117 |
| | Control | 40 | 10.55 | 6.649 | 1.051 | |
| AC.R 4000 | Dentist | 40 | 18.78 | 18.585 | 2.939 | 0.024 |
| | Control | 40 | 11.43 | 7.438 | 1.176 | |
| AC. R 6000 | Dentist | 40 | 19.00 | 16.791 | 2.655 | 0.017 |
| | Control | 40 | 11.90 | 7.448 | 1.178 | |
| AC. R 8000 | Dentist | 40 | 19.63 | 17.592 | 2.782 | 0.020 |
| | Control | 40 | 12.25 | 8.619 | 1.363 | |
| AC. L250 | Dentist | 40 | 9.75 | 5.183 | .819 | 0.116 |
| | Control | 40 | 8.00 | 4.641 | .734 | |
| AC. L 500 | Dentist | 40 | 8.13 | 5.024 | .794 | 0.919 |
| | Control | 40 | 8.25 | 5.943 | .940 | |
| AC. L 1000 | Dentist | 40 | 9.00 | 6.622 | 1.047 | 0.928 |
| | Control | 40 | 8.88 | 5.716 | .904 | |
| AC. L 2000 | Dentist | 40 | 8.63 | 8.396 | 1.328 | 0.942 |
| | Control | 40 | 8.50 | 6.813 | 1.077 | |
| AC. L 3000 | Dentist | 40 | 12.80 | 11.346 | 1.794 | 0.172 |
| | Control | 40 | 9.93 | 6.731 | 1.064 | |
| AC. L 4000 | Dentist | 40 | 16.63 | 15.500 | 2.451 | 0.087 |
| | Control | 40 | 11.88 | 7.569 | 1.197 | |
| AC. L 6000 | Dentist | 40 | 17.08 | 16.379 | 2.590 | 0.093 |
| | Control | 40 | 12.18 | 7.759 | 1.227 | |
| AC. L 8000 | Dentist | 40 | 18.13 | 18.868 | 2.983 | 0.116 |
| | Control | 40 | 12.88 | 8.689 | 1.374 | |




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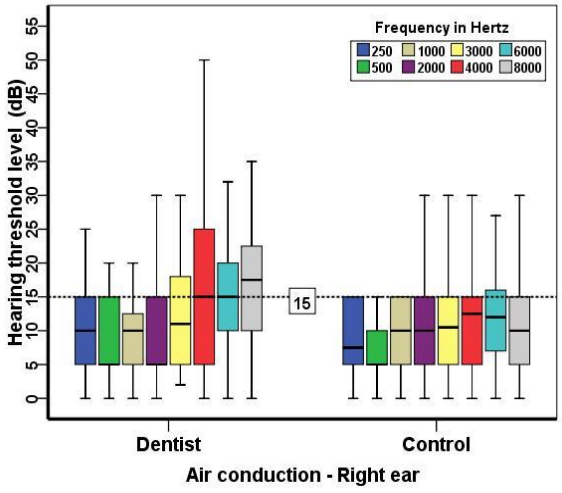


**Figure 1. Mean hearing thresholds of dentist and control group in right ear**

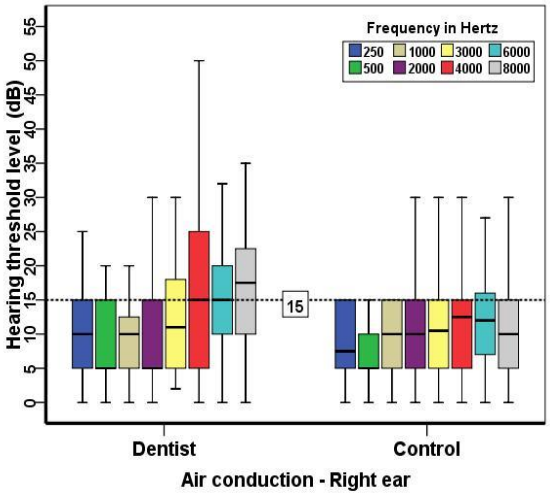


**Figure 2. Mean hearing thresholds of dentist and control group in left ear**

**Table 2. The Mean and standard deviation of hearing thresholds for right and left ears of dentists and office workers based on gender**

| Group | | Sex | N | Mean | Std. Deviation | Std. Error Mean | P Value |
|---|---|---|---|---|---|---|---|
| Dentist | AC. R | Male | 31 | 15.0081 | 9.89049 | 1.77638 | 0.073 |
| | | Female | 9 | 8.8194 | 2.68685 | .89562 | |
| | AC. L | Male | 31 | 14.2258 | 9.10971 | 1.63615 | 0.020 |
| | | Female | 9 | 6.6250 | 3.55097 | 1.18366 | |
| Control | AC. R | Male | 31 | 10.7298 | 5.45016 | .97888 | 0.125 |
| | | Female | 9 | 7.5556 | 4.95610 | 1.65203 | |
| | AC. L | Male | 31 | 11.0282 | 5.80146 | 1.04197 | 0.054 |
| | | Female | 9 | 6.7222 | 5.36546 | 1.78849 | |

Comparison of hearing thresholds of male and female dentists indicates that comparing to the female dentists; the male dentists have a higher hearing threshold (more hearing loss) in the left ear.

In the right ear, the mean and standard deviation of hearing thresholds in the male dentists was more than the female dentists but this difference was not statistically significant. To examine the effect of age on the hearing threshold, the hearing levels of 21 (52.5%) dentists with 45 years of age and below was compared with 19 (47.5%) dentists over 45 years old.

According to the results of T-test, although the hearing levels of theright and theleft ears in adults is more than theyoung, but this difference was not statistically significant.

To investigate the effects of working experience on the hearing thresholds, the hearing level of 24 dentists (60%) with 15 years of experience and below was compared with the hearing level of 16 (40%) dentists with more than 15 years of work experience. T-test showed no significant differences between the hearing levels of two groups.

## Discussion

In our study, hearing loss occurred at 8000Hz, 6000Hz, 4000Hz and 250Hz frequencies. The results of this study are consistent with most studies that have been conducted so far. Daud and et al. (5) assessed the hearing ability of 65 dental personnel.

As a result, dental staff is at high risk for hearing loss. In this study, hearing is only assessed at 4000Hz, while in our study hearing thresholds were measured at more number of frequencies. Fazli and et al. (8)




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reviewed the hearing ability of 60 dentists and concluded that dentists have hearing loss. Unlike our study, they did not use a control group.

Bali and et al. (9) examined the effects of produced noise on hearing ability of dentists in the dental clinic. They found there was a change in hearing thresholds at all frequencies and comparison of men and women hearing thresholds showed a clear difference in the left ear and hearing loss was higher in men. Male dentists have higher hearing thresholds in the left ear compared to the female dentists.

Unlike our study, the control group was not used. Gigbels and et al. (10) in a 10-year review of the hearing thresholds in a number of dentists concluded that there was hearing loss at 4000Hz frequency like our study. Unlike our study, in that study the control group was not used.

Lehto and et al. (11) by evaluating the hearing changes in 68 dentists with 10 years of work experience concluded that the hearing thresholds at 8000Hz, 6000Hz, 4000Hz frequencies are higher than normal. After a 15-year follow-up,they found that the loss rate is not constant over time.

The results of their study confirmed our study. Statistically no significant hearing loss occurs with increasing in age and working experience. Al Wazzan and et al. (12) in their study assessed the hearing of 204 dental personnel and concluded that 60% of them had hearing problems. In this study, no audiometry test has been conducted.

The results were assessed based on a questionnaire about tinnitus and difficulty in speech recognition in the presence of background noise but in our study all individuals, in addition to filling out the questionnaire underwent audiometry test.

Jafari and et al.(13) in a case control study on hearing thresholds of 30 dental students and 30 dental hygiene students concluded that there was no significant difference in hearing thresholds between the two groups. This is in contrast with our study as the participantsin their study were in $10^{th}$ and $11^{th}$ semesters and compared to our dentists who were exposed to a much lesser extent of noise.

The results showed that the noise in dental office is considered as an important risk factor for hearing loss and it increases hearing thresholds. According to the results of this study, comparing to women, men are more exposed to hearing loss. Age and working experience are not risk factors in the incidence of noise induced hearing loss in the dental clinics. Since noise-induced hearing loss is incurable, prevention is considered as a fundamental principle for the health of dentists.

While using noisy dental instruments, dentists should maintain the maximum distance with patients. To minimize the noise, dentists should lubricate the hand pieces and avoid using old hand pieces. It is better to use special protectors for ears. Periodic checkups are necessary.

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