

Dentist's Hub Bub - A Cross-Sectional Study on Impact of Long-Term Occupational Noise Exposure on Hearing Potential among Dental Practitioners

Jayaprada Reddy Surakanti¹, Vikram Reddy Guntakandla², Preethi Raga³, Vishwaja Uppalapati⁴, Sai Praveena Kunaparaju⁵, Harikumar Vemisetty⁶, Suryakanth Malgikar⁷

^{1,4,5,6} Department of Conservative Dentistry and Endodontics, Kamineni Institute of Dental Sciences, Narketpally, Nalgonda, Telangana, India. ^{2,7} Department of Periodontology, Kamineni Institute of Dental Sciences, Narketpally, Nalgonda, Telangana, India. ³ Department of ENT, Kamineni Institute of Medical Sciences, Narketpally, Nalgonda, Telangana, India.

ABSTRACT

BACKGROUND

Dentists are liable to loss of hearing during dental treatment due to noise exposure. A study was carried out to determine whether or not dental professionals from the Department of Periodontics, Conservative Dentistry and Endodontics and Prosthodontics ought to cause hearing decrement with the aid of using continual excessive frequency sounds created by dental equipments.

METHODS

This study involved 38 dentists from the specialities of Periodontics, Conservative Dentistry and Endodontics, and Prosthodontics who were subjected to noise during operating for 6 hours per day and 38 medical professionals who were matched served as a control group. Three audiometric examinations included an otoscopic exam; tympanometry and pure tone audiometry were performed by the participants.

RESULTS

According to the data, 15.8 % of dentists and 2.6 % of the control group suffered from loss of hearing. In the pure tone audiometry test, there was no substantial difference between the two groups; however, the qualitative analysis showed that the dentists' group had a greater percentage of hearing loss than their control counterparts. In the pure tone audiometry test, there was a statistically significant difference between the specialists from periodontics, conservative dentistry and endodontics, and prosthodontics ($P = 0.005$).

CONCLUSIONS

Noise from dental clinics has been shown to cause hearing problems, with the left ear being affected when compared to that of the right; again, these problems aren't serious. Dentists were common among noise-induced hearing impairment and periodontic specialists than conservative dentistry and endodontics, and prosthodontic specialists than the control group,

KEY WORDS

Dental Professionals, Long Term Exposure, Noise-Induced Hearing Loss, Pure Tone Audiometry.

Corresponding Author:

*Dr. Suryakanth Malgikar,
Reader, Department of Periodontology,
Kamineni Institute of Dental Sciences,
Narketpally, Nalgonda Dist.-508254,
Telangana, India.*

E-mail: drmalgikarsuryakanth@gmail.com

DOI: 10.14260/jemds/2021/745

How to Cite This Article:

Surakanti JR, Guntakandla VR, Raga P, et al. Dentist's hub bub - a cross sectional study on impact of long-term occupational noise exposure on hearing potential among dental practitioners. J Evolution Med Dent Sci 2021;10(43):3676-3682, DOI: 10.14260/jemds/2021/745

*Submission 08-05-2021,
Peer Review 08-10-2021,
Acceptance 16-10-2021,
Published 25-10-2021.*

Copyright © 2021 Jayaprada Reddy Surakanti et al. This is an open access article distributed under Creative Commons Attribution License [Attribution 4.0 International (CC BY 4.0)]

BACKGROUND

Dental professionals in dental settings are exposed to occupational hazards such as radiation and noise.¹ Noise intensity is measured in decibels (dB).² Several sources in day today dental setups such as (e.g., sonic and ultrasonic scalers, high volume suction, handpieces, trimmers used for models and compressors) and non - dental sources such as (e.g., air conditioner, phone ring and workplace music played at loud volume) noise is created. Noise exposure of dental equipment's for many years regularly may lead to noise-induced hearing loss (NIHL). There are several factors that are contributing to NIHL such as the amount of noise exposure over time, the amount of exposure every day, period of exposure, average sound level, the peak intensity levels of loud sounds, the frequency spectrum of sound, individual's age, physical condition, and also the operating environment.^{3,4} The recommended noise exposure by National Institute for Occupational Safety and Health (NIOSH) is eighty-five decibels (dB) at forty hours per week.⁵ Among directives for specialized dental devices, ISO standard 7785 for high-speed handpieces specifies that noise levels created ought to be not up to sixty - five decibels (dB) and never exceed eighty decibels (dB).^{6,7} The purpose of the present study was to identify noise-induced hearing loss in dental practitioners in Tertiary Health Care Institute, operating within the Department of Conservative Dentistry and Endodontics, Periodontics and Prosthodontics wherever the noise generating instruments were used frequently.

METHODS

The present study was carried out at a single centre from May 2019 to January 2020. A total of 90 participants were enrolled in the study. The institutional ethical committee approved the study (Reg. No: IEC / 2019/21).

Patient Selection Criteria

The potential participants were enrolled in the study directly personally to clarify the consequences of instrument noise on hearing. The entire procedure was explained to the willing participants and were then asked to sign the written consent form before receiving the audiometric examination.

Inclusion Criteria

- Age group 35 - 50 years.
- Dental practitioners practising dentistry for a minimum of 10 years and an average exposure to occupational noise for 6 hours per day.
- Medical professionals who were not exposed to noise during their work hours.

Exclusion Criteria

- Non-occupational noise exposure for more than 3 hours⁸
- Use of hearing protection device
- Hypertension and diabetes mellitus

- Chronic ear disease history
- History of trauma to ear, sensorineural hearing loss, ototoxicity drugs, ear surgery, hereditary factors if any, cold, cough/ear blockage in the previous week
- Radiation or Chemotherapy.

Sample Size

A total of 76 individuals satisfying the inclusion and exclusion criteria were enrolled in the study. The individuals were divided into two groups. Group I included thirty-eight dentists working in specialities conservative dentistry and endodontics, periodontics and prosthodontics and Group II included thirty-eight medical professionals who were matched. Matching was done based on whether or not the participants were smokers or non-smokers, their age and gender.

Sample Design

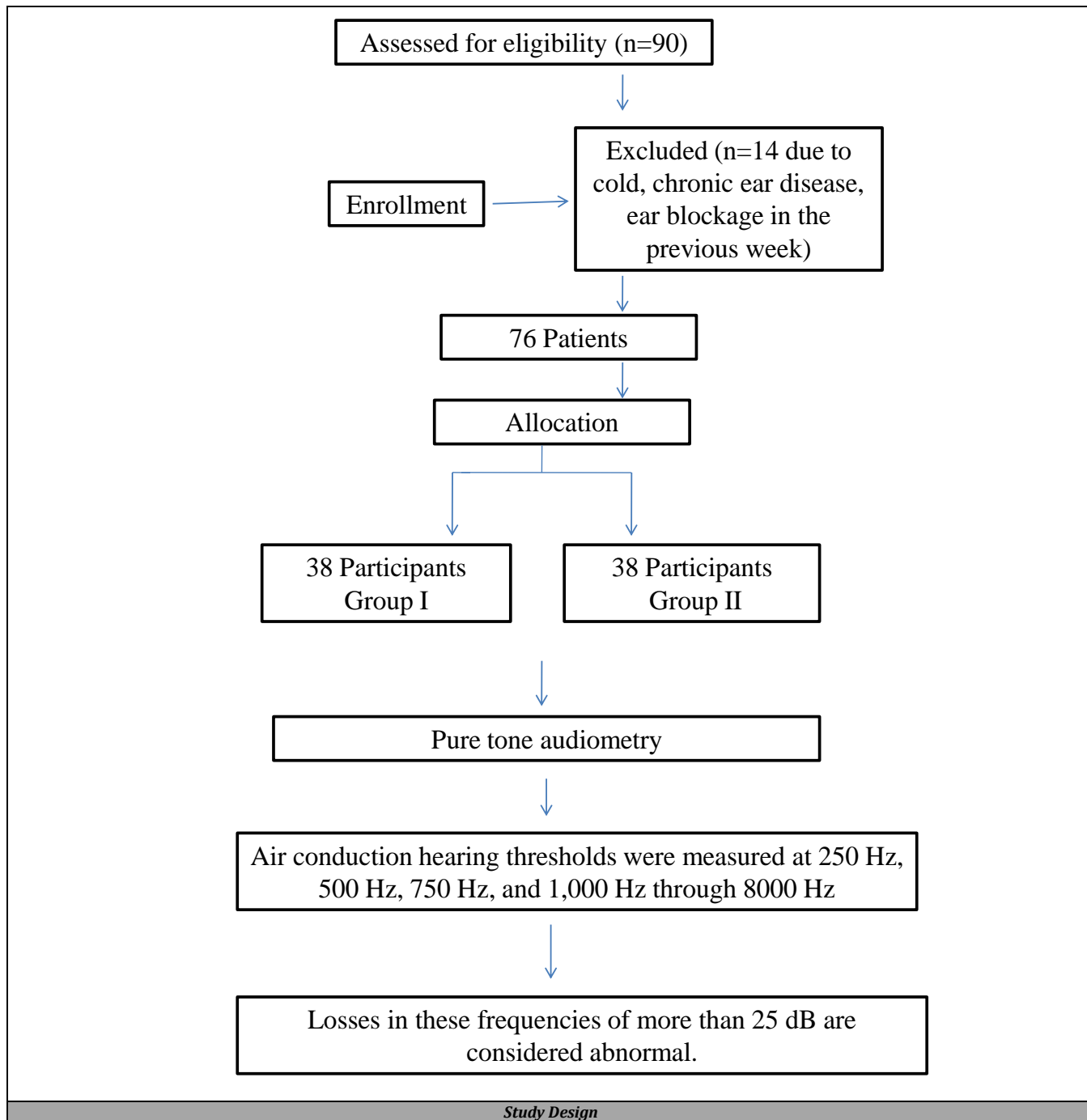
The data collected included age group (35–38, 39–42, 43–46 and 47–50 years of age), both genders, years of practice (10–12 or \geq 13 years), number of days of exposure in a week (3, 4, 5, or 6 days), length of exposure to loud noise per week (\leq 18–27 hours, 28–36 hrs, or \geq 37 hrs), specialisation (Conservative Dentistry & Endodontics, Periodontics, and Prosthodontics), and right-handed or left-handed dentists (Table 1).

Study Design

Audiological Evaluation

Pure tone audiometry

Hearing threshold for all the participants was done by audiological testing. Before audiological testing, the enrolled participants were sent to otoscopic examination and the procedure was explained to the participants (Figure 1A) that was done by employing a Heine mini - 3000 otoscopes. Pure tone audiometry (Digital audiometer CLASSIC - I 01708563) was done to all or any participants. The audiometer (Figure 1B) was calibrated on an everyday basis and in accordance with the International Standards Organization (ISO Protocol, 19 389, 1991). A soundproof room was used for the pure-tone test. (Figure 1C). The participants were asked to pay attention to pure tone beeps starting from simple sounding to just imperceptible sound levels, and inform the examiner once these pulses were perceived (Figure 1D). The loudness of sound was measured in decibels (dB) and the air conduction hearing thresholds were measured at the subsequent frequencies: 250 Hz, 500 Hz, 750 Hz, and 1,000 Hz through 8,000 Hz, to determine if the patient had a normal range of hearing levels (25 decibels or lower at 250 - 8,000 Hz). Hearing thresholds over 25 dB in these frequencies are usually thought of as abnormal (Figure 1E). This audiological analysis test was performed by a licensed audiologist from the ENT Department.



Study Design



Figure 1A. Examining the Ear with an Otoscope



Figure 1B. Audiometer



Figure 1C. Soundproof Room



Figure 1D. Pure Tone Audiometry (PTA) Test

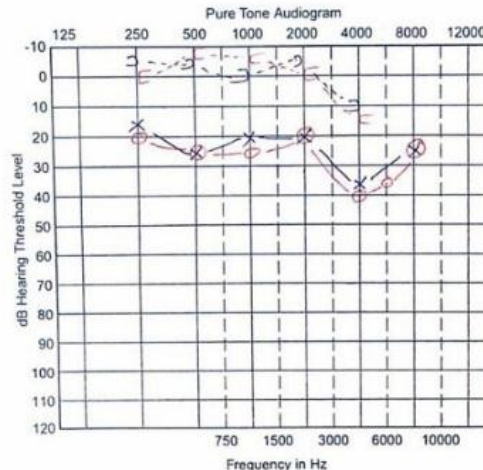
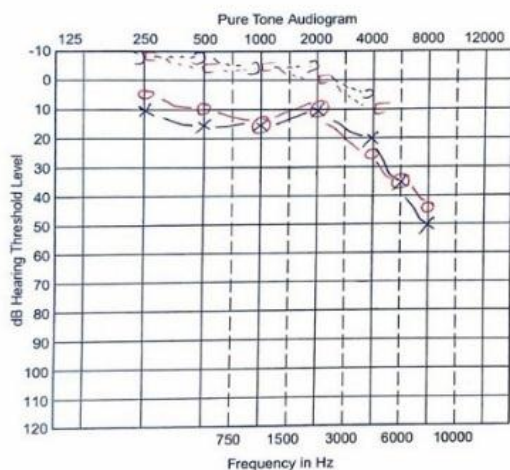


Figure 1E. Audiograms in the Right and Left Ear with Findings Greater than 25 dB in High Frequencies

- *Normal hearing (N)*: hearing threshold levels better than or equal to 15dB HL at all measured frequencies (i.e. 0.5, 1, 2, 3, 4, 6, 8 kHz).
- *Notch moderate (NM)*: maximum threshold level of 3, 4, and 6 kHz between 15 and 20 dB poorer than the pure-tone average of thresholds at 0.5, 1 and 2 kHz and at least 10 dB poorer than the threshold level at 8 kHz. This is similar to Niskar et al. (2001) criterion of a noise notch in adolescents.
- *Notch profound (NP)*: similar to NM, but maximum threshold level of 3, 4, 6 kHz at least 25 dB poorer than the pure-tone average of thresholds at 0.5, 1 and 2 kHz.
- *Sloping loss (SL)*: maximum threshold level of 3, 4, 6 kHz at least 5 dB poorer than the pure-tone average of thresholds at 0.5, 1 and 2 kHz and threshold level at 8 kHz at least 5 dB poorer than the maximum threshold level at 3, 4, and 6 kHz.
- *Flat loss (FL)*: audiograms which do not fall into the above mentioned categories, with no hearing thresholds exceeding 30dB at all measured frequencies.
- *Rest (R)*: all audiograms that do not match the characteristics of the above described categories.

Figure 2. Jansen et al.⁹ Provided Criteria for Characterization of Pure-Tone Audiograms and also the Degree of the Noise Notch

Statistical Analysis

For Windows, the analysis was carried out using IBM SPSS (Statistical Social Sciences Package, Version 20.0, SPSS Inc., Chicago, IL, United States). To conduct power analysis and assess the appropriate sample size, the 3 Power G3.1 program (G*Power: Statistical Power Analyses Heinrich - Heine - University Dusseldorf, Dusseldorf, Germany) was used. Wilcoxon test was used to assess if the pure tone audiometry of the test group and the control group was significantly different. The level of significance was ≤ 0.05 . The quality analysis of pure tone audiometry findings was carried out based on Jansen et al.⁹ characterization parameters, used by musicians of symphony orchestras as part of the investigation of noise-induced hearing loss. They adopted a very strict standard listening requirement and precise guidelines for the noise level when present (Figure 2).

RESULTS

The present observational study was done at a single centre. All the participants were between 35 - 50 years. Twenty-three (61 %) were males and fifteen (39 %) were females (Table 1). Six participants in group I (15.8 %) and one participant in group II (2.6 %) had a sensorineural hearing impairment. There was no variation between the 2 groups in terms of NIHL combined in each ear or the left and right ears individually (Table 2A). Once the additional rigorous criteria of fifteen-decibel hearing loss (HL) ⁹ were applied, the prevalence of hearing loss was twenty-nine participants in group I (76 %) and twenty - three participants in group II (60 %). No important distinction was noticed in each of the groups within the pure tone audiometry results at the subsequent frequencies: five hundred Hz, one kHz, two kHz, four kHz, six kHz, and eight kHz.

Population figures N* = 38 (%)		
Gender	Female	15 (39.47)
	Male	23 (60.52)
Age (years)	35 - 38	17 (44.73)
	39 - 42	11 (28.94)
	43 - 46	6 (15.78)
	47 - 50	4 (10.52)
	3	2 (5.26)
Weekly working days	4	11 (28.94)
	5	19 (50)
	6	6 (15.78)
Weekly working hours (h)	$\leq 18-27$	13 (34.21)
	28-36	11 (28.94)
	>37 h	14 (36.84)
Years of expertise	10 - 12	19 (50)
	>13	19 (50)
Speciality	Conservative dentistry and endodontics	13 (34.21)
	Periodontics	14 (36.84)
	Prosthodontics	11 (28.94)
Handiness	Right - handed	37 (97)
	Left - handed	1 (3)

Table 1. Dentists' Population Figures
Abbreviation: n*, number of dentists.

Dentist's Ear	Dentist (N* = 38)	Pure Tone Audiometry			
		Low Frequency Std	Low Frequency Mean	High Frequency Std	High Frequency Mean
Right	38	5.96077	11.2916	6.92840	11.6429
Left	38	6.24268	9.9379	8.00434	11.5600
Both ears (Right and Left)	38	6.10070	10.6147	7.43577	11.6014

Table 2b. For Dentist's, it Depicts Descriptive Statistics of Hearing Thresholds at Various Frequencies
Abbreviation: N*, number of dentists.

Participants Ear	Dentist, N = 38 (%)						Control, N = 38 (%)					
	Normal	Notch Moderate	Notch Profound	Sloping Loss	Flat loss	Rest	Normal	Notch Moderate	Notch Profound	Sloping Loss	Flat Loss	Rest
Right Ear	13 (34.2 %)	0 (0 %)	0 (0 %)	2 (5.2 %)	23 (60.5 %)	0 (0 %)	16 (42.1 %)	0 (0 %)	0 (0 %)	1 (2.6 %)	21 (55.2 %)	0 (0 %)
Left Ear	16 (42.1 %)	3 (7.8 %)	0 (0 %)	0 (0 %)	19 (50 %)	0 (0 %)	20 (52.6 %)	0 (0 %)	0 (0 %)	0 (0 %)	18 (47.3 %)	0 (0 %)

Table 2A. The Disparity in Pure Tone Audiometry between the Dentist's and the Control Group

Control's Ear	Control (N* = 38)	Pure Tone Audiometry			
		Low Frequency Std	Low Frequency Mean	High Frequency Std	High Frequency Mean
Right	38	5.00613	10.4055	4.85405	10.0229
Left	38	5.45226	8.4011	7.11611	9.2416
Both ears (right and left)	38	5.29593	9.4033	6.06303	9.6322

Table 2C. For Control Group, it Depicts Descriptive Statistics of Hearing Thresholds at Various Frequencies.
Abbreviation: n*, number of controls.

Participants Ear	Dentist (N* = 38)	Control (N* = 38)	Pure Tone Audiometry The P* Value of the Affected Frequencies	
			Low Frequency	High Frequency
			Right	38
Left	38	38	0.293	0.217
Both ears (Right and Left)	38	38	0.173	0.132

Table 3. Audiogram Findings for Each Group were Characterized Using Parameters advised by Jansen et al. 9 for Pure Tone Audiograms
Abbreviations: n*, number of participants; P*, level of significance <0.05.

The mean values for each dentist and their control counterparts are seen in Tables 2B and 2C for the pure-tone audiometry test. Dentists operating within the speciality of periodontics were most established in terms of noise-induced hearing loss than in conservative dentistry and endodontics, and prosthodontics ($P \leq 0.05$). Dentists had 60.5 % flat loss whereas 5.2 % of the exhibited sloping loss in the right ear when compared to the left ear, 50 % had a flat loss and 7.8 % had a moderate notch respectively. On the opposite hand, 42.1 % of the control group showed normal hearing within the right ear, and 52.6 % had normal hearing in the left ear (Table 3). Jansen et al.⁹ in their qualitative analysis showed different patterns among the dentists as compared to their control.

DISCUSSION

Exposure to noise levels higher than eighty-five dB without any form of hearing aids result in hearing impairment.¹⁰⁻¹² Hence, in the dental setups the noise generated mustn't be overlooked.¹³ High-speed rotary handpieces, high-velocity suction, sonic and ultrasonic scalers in the dental clinic may cause hearing damage to ears by their sounds.¹⁴ 15.8 % of hearing impairment was seen among dentists using the pure tone audiometry test. The intensity of the sound and length of exposure is a risk to the dentist.^{14,15} Dental practitioners

exhibited around similar incidences of symptoms; i.e., 16.6 % tinnitus, 14.7 % speech discrimination difficulties and 63 % had issues with speech discrimination within the presence of background noise in Saudi Arabia.¹⁶ According to Altinoz et al.¹⁷ dentists who practice in noisy environments should avoid engaging in disruptive tasks directly after work. The authors claimed that "the hearing capacity of the ear starts to recover when it relaxes."

According to the literature, the incidence of noise-induced hearing impairment in dental practitioner's ranges from seven to sixteen percent.¹⁸⁻²⁰ The Khaimook et al.²¹ analysis has shown that the incidence of hearing loss among dental personnel is 17.7 %. But, compared to the control group there were no major variations. The danger of developing noise-induced hearing loss among the dental practitioners will be attenuated by encouraging them to follow the advice of the ADA Council on dental materials and devices,²² which embrace the following: Noise attenuation steps ought to be targeted in 3 areas: best rotary instrumentation management, dodging of ambient noise levels in the operator, and personal safety by the use of earplugs. Annual audiometry tests should be done by dentists. Manufacturers are being suggested to increase potency by reducing the quantity of noise created by high-speed dental handpieces. Furthermore, as old and tired equipment wears out, vibration increases, leading to higher sound levels and emphasizing the importance of standard servicing and replacement.²³ The curriculum in several dental schools should embrace education regarding the various occupational hazards.²⁴

CONCLUSIONS

There is a potential risk for developing hearing problems through the noise from dental clinics, which had a larger impact on the left ear compared to the right. Dentists had noise-induced hearing loss compared to medical professionals. Among the dentist's, the practitioners from the periodontics speciality exhibited significant hearing loss compared to conservative dentistry and endodontics and prosthodontics.

Limitations of the Study

Limitations of the present study are many variables in hearing loss, smoking, ethnicity, dental professionals, noises from several dental equipments, and left-handed dentists versus right, was restricted because of a less sample size. As a result, further trials with a larger sample size are needed to investigate the impact of years of experience, working hours per week, smoking, and gender on hearing loss, as well as to determine which members of the dental staff are the most affected by noise exposure.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

Financial or other competing interests: None.

Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

REFERENCES

- [1] Leggat PA, Kedjarune U, Smith DR. Occupational health problems in modern dentistry: a review. *Ind Health* 2007;45(5):611-21.
- [2] Saini R, Saini G, Saini S, et al. Dental practice and perilous auditory effect as occupational hazard. *Noise Health* 2010;12(46):56.
- [3] Setcos JC, Mahyuddin A. Noise levels encountered in dental clinical and laboratory practice. *Int J Prosthodont* 1998;11(2):150-7.
- [4] Bahannan S, el-Hamid AA, Bahnassy A. Noise level of dental handpieces and laboratory engines. *J Prosthet Dent* 1993;70(4):356-60.
- [5] Maximum noise permissible limits in dental operator, 1998. <http://www.cdc.gov/niosh/topics/noise/stats.html>.
- [6] Standard 7785 - 1. Part 1: High - speed Air Turbine Hand pieces in Dental Hand pieces International Standardization Organization Geneva 1997. http://www.ada.org/sections/scienceAndResearch/pdfs/0707_hsairstestmethods.pdf.
- [7] Dyson JE, Darvell BW. Dental air turbine handpiece performance testing. *Aust Dent J* 1995;40(5):330-8.
- [8] Torre P. Young adults' use and output level settings of personal music systems. *Ear Hear* 2008;29(5):791-9.
- [9] Jansen EJ, Helleman HW, Dreschler WA, et al. Noise induced hearing loss and other hearing complaints among musicians of symphony orchestras. *Int Arch Occup Environ Health* 2009;82(2):153-64.
- [10] Berger EH. Hearing protector performance: how they work-and-what goes wrong in the real world. E - A - R Log Series of Technical Monographs on Hearing and Hearing Protection 1980:1-4.
- [11] Dobie RA. Industrial audiometry and the otologist. *Laryngoscope* 1985;95(4):382-5.
- [12] World Health Organization. Prevention of deafness and hearing impairment: report by the Director-General. Thirty Ninth World Health Assembly. World Health Organization 1986:31-8.
- [13] Bali N, Acharya S, Anup N. An assessment of the effect of sound produced in a dental clinic on the hearing of dentists. *Oral Health Prev Dent* 2007;5(3):187-91.
- [14] Kumar PR, Sharma P, Kalavathy N, et al. Hearing damage and it's prevention in dental practice. *Journal of Dental Sciences and Research* 2011;2(2):32-5.
- [15] Daud MK, Noh NFM, Sidek DS, et al. Screening of dental staff nurses for noise induced hearing loss. *B-ENT* 2011;7(4):245-9.
- [16] Alwazzan K, Alqahtani M, Alshethri S, et al. Hearing problems among dental personnel. *JPDA* 2005;14:210-4.
- [17] Altinoz HC, Gokbudak R, Bayraktar A, et al. A pilot study of measurement of the frequency of sounds emitted by high-speed dental air turbines. *J Oral Sci* 2001;43(3):189-92.
- [18] Dube KJ, Ingale LT, Ingale ST. Hearing impairment among workers exposed to excessive levels of noise in ginning industries. *Noise Health* 2011;13(54):348-55.
- [19] Engdahl B, Tambs K. Occupation and the risk of hearing impairment -- results from the nord - trondelag study on hearing loss. *Scand J Work Environ Health* 2010;36(23):250-7.

- [20] Krishnamurti S. Sensorineural hearing loss associated with occupational noise exposure: effects of age-corrections. *Int J Environ Res Public Health* 2009;6:889-99.
- [21] Khaimook W, Suksamae P, Choosong T, et al. The prevalence of noise-induced occupational hearing loss in dentistry personnel. *Workplace Health Saf* 2014;62(9):357-60.
- [22] Noise control in the dental operatory. Council on dental materials and devices. *J Am Dent Assoc* 1974;89(6):1384-5.
- [23] Coles RR, Hoare NW. Noise-induced hearing loss and the dentist. *Br Dent J* 1985;159(7):209-18.
- [24] Al Shayea Eman I. Prevalence of noise induced hearing loss and other associated risk factors among saudi dental professionals. *J Res Med Dent Sci* 2020;8(4):17-23.