

REVIEW ARTICLE

NOISE POLLUTION - AN UNDER DIAGNOSED POTENTIAL OCCUPATIONAL HAZARD IN DENTISTRY

ABSTRACT

In this world of advanced technology and industrialisation, one of the biggest health hazard faced by human beings is noise pollution. The chronic inevitable exposure to noise at work places leads gradually to Noise Induced Hearing Loss (NIHL). The prevalence of this disorder would be more among dental professionals as they work in an unhealthy acoustic environment created by the noises of the dental operatory. This is a totally preventable disease when the dentists receive adequate health education and undergo regular screening tests. Along with this proper environmental and administrative controls need to be administered in the dental setting. This paper gives a review of the unaddressed health hazard noise pollution, its impacts and preventive methods in a dental environment.

Keywords: noise, noise pollution, dental, environment.

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J Odontol Res 2022;10(2)10-4.

INTRODUCTION

A wrong sound, in the wrong place, at the wrong time defines the term noise.^{1,2} The word noise roots from the Latin word “Nausea” that indicates unwanted/unpleasant/unexpected loud sound.² Noise pollution refers to emphasize the massive disharmony caused by of health hazard causing sounds generated in the modern life.¹

As per the statistics projected by Centre for Disease Control (CDC), every year, at work place around 22 million workers are exposed themselves to potentially toxic levels of noise.³ The Recommended Exposure Limit (REL) for job-related noise exposure according to NIOSH is 85 decibels. Meanwhile the suggested noise levels in health care facilities should be 35-40 dB(A) in the daytime and 30-40 dB(A) in the evening as per the International Noise Council and the World Health Organization.^{3,4,5} According to the data released by the National Institute for Occupational Safety and Health (NIOSH), noise has been identified as one among the ten reasons of job related injuries or diseases.^{6,7}

Considering the characteristics of the working environment and the service rendered, dentists and auxiliaries are at high risk of developing occupational hearing loss.⁸

Consequences of noise pollution

The health-related consequences of noise pollution is primarily governed by characteristics of the sound generated (intensity and frequency), duration of exposure and individual susceptibilities.⁹ Generally it can cause auditory and non-auditory ill effects. The major auditory effects are auditory fatigue (buzzing and whistling in the ears) and deafness (permanent or temporary depending on duration of exposure to noise). The common non auditory effects comprise of speech intervention, general annoyance, compromised efficiency and diminished productivity, physical stress associated changes like high blood pressure, high intracranial pressure, tachycardia, high breath rate, sweating as well as sleep and visual disturbances.^{1,10}

Other physiological alterations include stimulated cardio vascular function, pituitary, and adrenal gland stimulation, increased secretion of gastric juices and compromised immune function. Also noise is considered to be an intrusive agent into one’s private space.^{10,11}

Noise pollution in dental environment

The inevitable chronic exposure to dental machines producing high intensity sound renders dental professionals and auxiliaries to be a vulnerable group for Noise Induced Hearing Loss (NIHL).¹⁰ Just like the noise polluted environment in a dental office, the scenario at teaching hospitals is also not different. The auditory environment of teaching, educational and academic dental faculty is highlighted by higher noise levels as compared to other zones of education, as it involves the application of various noise generating equipments by multiple students at the same time.¹²

Sources of noise pollution in dental environment

Various dental equipments like handpieces, air-conditioning and broadcasting systems play a role in making the environment noise polluted. Even high human voices in conversation, office music and children crying at the clinics can contribute to noise pollution.^{10,14}

According to Garner et al. the major exposure in a dental set up include angled-design turbine handpieces, low-speed angled-design handpieces, lab electromotor handpieces, high-speed turbine handpieces, low-speed handpieces, stone mixers, lab machines, ultrasonic scalers and cleaners. Many of these machines generate sounds of 66 dB to 91 dB whereas airturbines can emit upto 100 dB.^{13,14}

Factors affecting noise pollution in dentistry

Equipment related factors:^{15,16,17,18}

- type and speed of the instrument
- wearing of the instrument
- intensity of noise produced
- number of instruments operated at a time
- insufficient lubrication and turbine failure

Personal and professional factors:^{15,16,17,18}

- Individual sensitivity
- years of exposure
- specialisation
- type of practice (teaching/non-teaching)
- proximity to the instrument

Effects of noise pollution in dentistry

Other than the general auditory and non-auditory effects of noise pollution, noise directly or indirectly intervene in dentists' activities by dropping their capability to focus or pay attention, affecting their speed of work and movements. It can also result in reduced clarity of conversation and acts as an obstacle to proper communication capabilities. All these factors eventually end up in compromised work productivity of the professional.¹⁹ Also it is reported that some noise generating machines used to render dental care causes potential health hazard even to patients.⁶

Assessment of noise pollution

The elementary instruments used in noise assessment include

- 1) Sound Level Meter wherein the sound intensity is measured in dB or dB (A)
- 2) Octave Band Frequency Analyzer, where the noise is measured in octave bands.
- 3) Audiometer generally measures the hearing capacity. In the audiogram, the topmost zero line indicates normal hearing whereas a dip at 4000 Hz frequency shows NIHL.¹

In dental literature, studies have employed decibelometer or a sound level meter with a mounted microphone (singh, kuppe) and noise dosimeter for the assessment of noise levels.²¹

Also Middle Ear Analyser (MEA), Pure Tone Audiometry (PTA) and Oto-Acoustic Emission (OAE) were employed by various investigators to estimate variations in the hearing thresholds among dental professionals in a dental school.²³ Otoscopy is yet another measurement tool.²⁰

Prevention of NIHL

NIHL is a radically preventable ailment. As per the recommendation of the American Dental Association Council on Dental Research in 1959, those dental professionals regularly using high-speed drills need to undertake intermittent hearing tests to screen their hearing capacity. The dental professionals are recommended to undergo regular otologic examinations and audiometric tests for the

same.¹⁵ It is advised to establish Hearing Conservation Program (HCP) in noisy indoor working sites as a part of preventive protocols.^{24,25}

The components of an operative HCP comprise of a survey on noise, engineering controls, administrative controls and use of personal hearing protectors.¹⁵

1) Noise survey

The preliminary aim of this process is to identify those areas of the work place where the labourers are exposed to potentially toxic noise levels. The identification of such areas help in further development of administrative and engineering controls. 15,24,25

2) Engineering controls

This step includes identification of source of noise production and methods adopted to address the issue. Sound can be controlled either at its source of production or its track of passage. The various attempts that can be tried out in dentistry include repairing or replacing the loud equipment with less noisy one, positioning the operator away from the source, implementation of materials with potential of vibration absorption and the usage of silencers, acoustic shields and barrier walls.^{15,24}

3) Administrative controls

This includes various measures like reduction of chronic exposure time by transferring the workers employed in loud noise areas to low noise areas for certain intervals and preparation of work time schedules that favour reduced exposure time. Exclusion of employees with higher susceptibility to NIHL in noisy areas is another option, but its practical feasibility is limited as this factor depends on individual susceptibility to loudness.¹⁵

4) Use of hearing protectors

Hearing protector devices can be like an ear phone type/ear plug type or custom made/ disposable. An ideal one should protect the dentist from the unnecessary noise exposure by the machines he uses. At the same time the device should be designed in such a way that the dentist should be able to communicate with his patients.²⁴

Generally earplugs are introduced into the ear canal, whereas earmuffs shield the entire external ear with the help of a sealed cup. Both these devices decrease the noise intensity by around 30-35 dB providing

least interference to communication with the patient or other personnel in the dental office.¹⁵

The Council on Dental Materials and Devices also recommends that practitioners concerned about the potential impairment should have an otologic examination and audiometric evaluation in a silent room, to assess the present situation. An audiometric evaluation should be made after a typical workday and again at the beginning of the next day to observe temporary threshold shift and apparent recovery.^{15,24,25}

Conclusion

As dental professionals and auxiliaries work in an inevitable high acoustic environment, measures to assess the level of noise generated and sustained need to be undertaken. This chronic exposure leads to auditory and non-auditory ill effects. Over a period of time, the involved personnel's health, health related quality of life and professional performance enter into a dropping phase. Hence considering the work related environment they should be well educated about the ill effects of noise pollution and well trained to implement measures to combat this health hazard.

REFERENCES

1. K Park. Parks Textbook of Preventive and Social Medicine. Bhanot Publishers. 23rd edition. Page 741-3.
2. Jariwala, H.J.; Syed, H.S.; Pandya, M.J.; Gajera, Y.M. Noise Pollution & Human Health: A Review. Noise and air pollution. 2017; 3:1-4.
3. <https://www.osha.gov/noise>
4. <https://www.cdc.gov/niosh/topics/noise/default.html>
5. Vinodhkumaradithyaa A, Srinivasan M, Ananthalakshmi I, Kumar DP, Jeba Rajasekhar R V, Daniel T, Thirumalaikolundusubramanian P. Noise levels in a tertiary care hospital. Noise Health 2008;10:11-3
6. Singh S, Gambhir RS, Singh G, Sharma S, Kaur A. Noise levels in a dental teaching institute - A matter of concern!. J Clin Exp Dent. 2012;4(3):e141-5.
7. Mojarad F, Massum T, Samavat H: Noise levels in dental offices and laboratories in Hamedan, Iran. J Dent (Tehran) 2009, 6(4):181-186
8. Al Shanqiti, Afaf Mustafa, Hassan Ahmed Abugad, and Khaled Fikry Salama. "Assessment of Ambient Noise Exposure among Medical Staff in Dental Clinics Center of Dammam Medical Complex, Saudi Arabia." Journal of Ecophysiology and Occupational Health 20.3&4 (2020):120-127.
9. https://www.euro.who.int/_data/assets/pdf_file/0008/136466/e94888.pdf
10. Ma K.W, Wong H.M., Mak C.M. Dental Environmental Noise Evaluation and Health Risk Model Construction to Dental Professionals. Int. J. Environ. Res. Public Health 2017,14,1084
11. Passchier Passchier-Vermeer W, Passchier WF. Noise exposure and public health. Environmental Health Perspectives. 2000; 108(suppl.1):123-31.
12. Amine, Meriem, et al. "Assessment of Noise Levels of Equipment Used in the Practical Dental Teaching Activities." International Journal of Dentistry 2021(2021).6642560:1-5.
13. Kumar, Prince, et al. "Noise pollution in dental office: Are we sheltered?." International Journal of Health & Allied Sciences.2012; 1(3):207-8.
14. Al-Omoush SA, Abdul-Baqi KJ, Zuriekat M, Alsoleihat F, Elmanaseer WR, Jamani KD. Assessment of occupational noise-related hearing impairment among dental health personnel. Journal of occupational health. 2020;62(1):e12093:1-12
15. Kadanakuppe S, Bhat PK, Jyothi C, Ramegowda C. Assessment of noise levels of the equipments used in the dental teaching institution, Bangalore. Indian J Dent Res. 2011;22(3):424-431.
16. Zubick HH, Tolentino AT, Boffa J. Hearing loss and the high speed dental handpiece. Am

J Public Health. 1980 Jun;70(6):633-5.

17. Shanbhag VL. Importance of prevention of noise production in Dental College. Arch Med Health Sci 2015;3:357-8
18. Willershausen B, Callaway A, Wolf TG, Ehlers V, Scholz L, Wolf D, Letzel S. Hearing assessment in dental practitioners and other academic professionals from an urban setting. Head & face medicine. 2014 Dec;10(1):1-7.
19. Schettini SR, Gonçalves CG. Quality of life, perception and knowledge of dentists on noise. Revista CEFAC. 2017; 19(6):782-91.
20. Dierickx M., Verschraegen S., Wierinck, E., Willems G., van Wieringen A. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists. Int. J. Environ. Res. Public Health 2021; 18, 5617:1-13.
21. Choosong T, Kaimook W, Tantisarasant R, et al. Noise exposure assessment in a dental school. Saf Health Work. 2011;2(4):348-354.
23. 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.
24. <https://dentalacademyofce.com/courses/1466/pdf/noiseinducedhearingloss.pdf>
25. Dierickx M, Verschraegen S, Wierinck E, Willems G, van Wieringen A. Noise Disturbance and Potential Hearing Loss Due to Exposure of Dental Equipment in Flemish Dentists. Int J Environ Res Public Health. 2021 May 24;18(11):5617.