

Hearing Loss as a Potential Occupational Health Hazard Amongst Dentists: A Questionnaire Based Study

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ABSTRACT

Background: Our aim was to investigate prevalence and factors associated with perceived hearing loss amongst dental practitioners. The dental staff is continuously exposed to noise produced by suction tubes, turbines, ultrasonic scalers, compressors and micro motor/ air rotor hand pieces which may affect their hearing capacity.

Keywords: Dental equipment, Hearing loss, Occupational noise, Dental practitioners.

INTRODUCTION

Occupational hazard can be defined as a risk to a person usually arising out of employment.¹ Dentists are predisposed to a number of occupational hazards such as cross infection, musculoskeletal disorders, allergic reactions to various dental materials, radiation hazards to eyes and stressful conditions causing psychological hazards.² Most of the dentists seem to be unaware that the noise produced by their dental tools is predisposing them to another very significant health hazard i.e. hearing impairment.³ Though there are a few studies linking noise created by various dental equipments such as turbines, suctions and ultrasonic scalers and progressive hearing loss amongst dental professionals^{3,4,5,6}, literature is deficient about such studies in India. This questionnaire-based study was conducted amongst 100 dental surgeons in Indore with an aim to evaluate the prevalence of various signs and symptoms of hearing impairment amongst dentists and to highlight various associative risk factors.

MATERIALS AND METHOD

This questionnaire based study was conducted amongst 100 dental practitioners of Indore city. Informed consent was obtained from all participants. The questionnaire consisted of various closed and open ended questions. (Table 1, 2 and 3)⁷The open ended questions were included so as to increase the sensitivity of the study and to compensate the lack of appropriate subjective assessment indices. Demographic data including name (optional), age & sex, specialty, years of practice, daily working time (hours) and hours of driving were noted. History of ear infection or ear treatment, head & neck trauma, family history of ear/hearing problems, any other relevant medical history was recorded. Current or past use of drugs (Aminoglycosides/Quinine/ Cisplatin) and frequency of use of mobile phones and ear phones were also ascertained. Dental surgeons were enquired about their frequency of visiting an ENT specialist. Habit history included tobacco consumption (smoking and chewing). Exposure to

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traffic noise in residence area and frequency of visiting discotheque/high noise areas were also evaluated. The life (in years) of ultrasonic scaler, micro-motor hand-pieces, air rotor hand-pieces and suction were also noted. The subjects were asked to

report the presence and severity of tinnitus, fullness, pain, headache and compromised hearing.

RESULTS

The results have been depicted in Tables 1, 2 and 3.

Table 1: Demographic data of the subjects

S.N.	Characteristics	Mean $\pm$ Standard Deviation
1.	Age (years)	30.99 $\pm$ 5.73
2.	Practice years	6.62 $\pm$ 4.40
3.	Daily working hours	7.67 $\pm$ 2.75
4.	Driving hours	1.38 $\pm$ 0.55
5.	Hours of use of mobile phones	1.94 $\pm$ 1.51
6.	Hours of use of ear phones	0.60 $\pm$ 0.92
7.	Life (years) of ultrasonic scalers	3.9 $\pm$ 2.73
8.	Life (years) of suction	4.3 $\pm$ 2.77
9.	Life (years) of micromotor handpiece	4.42 $\pm$ 2.82
10.	Life (years) of air-rotor handpiece	4.37 $\pm$ 3.02

Table 2- Other relevant features of the subjects

S.N	Characteristics	Frequency
1.	History of ear infection/hearing problems	09%
2.	Family history of ear/hearing problems	08%
3.	Any other systemic history	
	Diabetes-	02%
	Hypertension-	03%
4.	History of head & neck trauma-	05%
5.	Current/past use of drugs-	09%
	Aminoglycosides-	
	Quinine-	
	Cisplatin-	
6.	Exposure to traffic noise in residence area-	
	High-	06%
	Medium-	54%
	Low	40%
7.	Frequency of visiting discotheque/high noise areas-	High-
	Medium-	09%
	Low-	24%
		38%
8.	Perception of noise-High-	22%
	Normal-	64%
	Low-	14%

Table 3: Prevalence of hearing problems and ENT consultations amongst dental professionals

Characteristics	Once	Occasional	Frequent	Total
Perceived compromised hearing	14	16	07	37%
Hypoacusis	03	02	04	09%
Pain	06	05	01	12%
Fullness	13	08	05	26%
Tinnitus	11	14	04	29%
Migraine/severe headache	10	26	06	42%
ENT visits	33		07	40%

Mean age of practitioners was 30.99 years, mean practice duration was 6.62 years, mean daily working hours were 7.67. (Table 1) History of ear infection was reported in 9%, family history of hearing problems in 8%, history of hypertension in 03%, diabetes in 2%, history of head and neck trauma in 5% of subjects. (Table 2) Mean lives of ultrasonic scaler, suction, micromotor and air-rotor handpieces were found to be 3.95, 4.3, 4.42 and 4.37 years respectively. (Table 1) Out of the subjects surveyed, 37% perceived (14% once, 16% occasional, and 7% frequent) compromised hearing, 29% reported tinnitus, 26% complained of fullness in one or both ears, 12% gave a history of pain in the ear while 42% admitted to having had headache/migraine. Regular visits to an ENT specialist were reported by 7% professionals only. (Table 3)

RESULTS

A high prevalence of various hearing complaints such as, perceived compromised hearing (37%), hypoacusis (9%), tinnitus (29%), pain (12%), fullness in ears (26%) and migraine or headache (42%) was reported amongst dental practitioners.

CONCLUSION

The higher than expected prevalence of hearing impairment amongst relatively younger dental practitioners with newer equipment's has certainly set the alarm bell ringing.

DISCUSSION

This questionnaire based study was conducted with an aim of identifying a hidden and slowly progressing health hazard i.e. hearing loss amongst the dental practitioners of Indore. Though

audiometry is a more sensitive and specific test for diagnosing hearing impairment; in the current study self-perceived hearing loss was taken into consideration because our emphasis was to elucidate the importance of awareness regarding auditory complaints amongst dental professionals. In a way, this was a screening study, the data of which can be subjected to a more scientifically sound objective test.

The aim of the study was to specifically report the prevalence of hearing loss amongst dental practitioners and not to attribute this only to dental clinic settings alone. All other noise pollution parameters common to general public are true for dental practitioners also. So this study only takes into account the additional burden of noise pollution in dental clinic setups, hence no control group was assigned.

There can be a lot of risk factors for the occurrence of hearing loss such as repeated otitis media (ear infection), structural & functional defects of ear, hypertension and diabetes mellitus.^{8,9} The noise induced hearing loss has been recognized as one of the leading occupational health hazards.⁴

The effects of noise on hearing can be divided into three types¹⁰:

1. Acoustic trauma: Sudden intense exposures exceeding 140dB (such as explosions) can stretch the delicate inner ear tissues beyond their elastic limits and tear them apart resulting in immediate and permanent hearing loss.¹¹ Such incidences are rare in dental clinics.
2. Temporary threshold shift: This refers to a temporary change in hearing thresholds following an exposure to noise. Patient may feel

a reduction in hearing sensitivity, tinnitus or feeling of fullness in ears ¹². The importance of these early symptoms of progressive hearing loss has made us include them in our questionnaire.

3. Permanent threshold shift: There is a permanent and irreversible change in hearing which results from many noise induced temporary threshold shifts.¹²This develops slowly over years and is caused by any regular exposure exceeding a daily average of 90dB. This occurs in three stages:
 - a) In the first stage, sensory cells within the cochlea are damaged by excessive exposure. These cells do not regenerate and are replaced by scar tissue.
 - b) In the second stage, after weeks to years of excessive exposure, hearing loss can be detected audiometrically. Early loss occurs in high frequency range, but speech comprehension is not significantly affected. Therefore, this loss is seldom noticed by patient.¹¹
 - c) In the third stage, loss spreads to the lower pitches necessary for understanding speech. At this stage, patient becomes aware of the problem.

Tinnitus is a condition in which one hears ringing, whistling or buzzing sound that is perceived only by the affected person.¹³ As many as 90% of people who experience tinnitus may have had some noise-induced hearing loss and it may be an early symptom.^{13,14}

In our study, 29% of dentists reported tinnitus and 26% complained of fullness in one or both ears. Pain was also reported by 12% of dentists. All these symptoms may represent an early sign of hearing loss. Hypoacusis (slightly diminished auditory sensitivity) was reported by 9% and appreciable loss of hearing in one or both ears was reported by 37% of dentists. The frequent perceived hearing loss was reported by only 7% dentists and occasional was reported by 16% of them. One time or occasional perceived hearing impairment cannot be clubbed together with frequent complaints, but these have to be reported never-the-less as they

may be a prelude to more severe and frequent complaints in future.

These represent the cases of permanent hearing shift. Only 7% dentists routinely consult an ENT surgeon. This reflects a lack of awareness or an indifferent attitude of dentists towards their own health.

These findings are in agreement with Khalid who determined the prevalence of hearing problems amongst dentists in Saudi Arabia and concluded that 16.6% had tinnitus, 14.7% had difficulty in speech discrimination and 63% had problems with speech discrimination in a background noise.¹⁵Gullikson also found significant number of dentists suffering from tinnitus in his survey.¹⁶Dogan et al concluded that the audiometric values of dental technicians were found to be statistically higher in comparison to control group³ but Rahko et al , in their research on high frequency audiometric tests of the dental staff did not find any significant difference in comparison to control group. They attributed this finding to widespread use of modern working equipments.¹⁷

In our study, mean daily working time was found to be 7.67 hours, mean age of practitioners was found to be 30.99 years and mean number of practice years was found to be 6.62. In the light of these findings, the prevalence rates observed in our studies were too alarming.

Forman-Frenco et al conducted audiometry tests to evaluate hearing loss amongst dental practitioners and concluded that a correlation appeared to exist between years in dental practice and progressive loss of hearing. Though no difference in hearing loss was found between practitioners and general population, they considered this correlation as a function of advancing age.¹⁸Messano& Petti concluded that general dental practitioners with at least 10 years of practice are likely to be at a greater hearing impairment risk.⁷

Dentists are routinely exposed to noise generated by various types of equipments such as handpieces, micromotors, air rotors, ultrasonic scalers, ultrasonic cleaners and suctions.¹⁹ Various authors have studied the level of noise created in dental office during working hours and concluded the following facts:

- 1) The air turbine handpiece produces noise levels above 84dB when idling (i.e. not working on tooth).⁵
- 2) Kilpatrick reported that the noise produced by ultrasonic cleaner, ultrasonic scalers, high speed turbines and low speed tools were of around 91dB, 84 dB, 70-92 dB and 74dB, respectively.²⁰
- 3) Sampaio Fernandes recorded noise levels of 66-99dB in dental schools using a precision sound level meter that was positioned at ear level and at a distance of 1metre from the operator. Differences in noise levels were observed during working of instrument or when just idling. Differences between new & used instruments were also noted. They concluded that hearing damage risk is minimum in dentists who use newer equipment.²¹ In our study, the average life of equipment was approximately four years.
- 4) Zubick et al concluded that dental specialists show a hearing loss pattern similar to general dentists and suggested that there may be a cause-and-effect relationship between use of high-speed dental handpiece& hearing loss.²²
- 5) Setcos observed that highest noise was produced by ultrasonic scaler (85.8dB) and the lowest noise (49.7dB) by high volume aspirator in dental clinics, while in dental laboratories, highest noise was observed with stone cutter (92.0dB) and the lowest created by denture polishing units (41.0dB).²³

OSHA guidelines allow eight hours exposure to a 90dB sound pressure level stimulus; in addition to this, each 5dB increase in noise levels halves the exposure time.²⁴

In our study, mean daily working time was found to be 7.67 hours. Though most of dental equipments individually produce noise within acceptable range, the continuous long term cumulative exposure to the noise created by these equipments may be far beyond the accepted threshold.

Risk of hearing loss depends on various factors:

- 1) Intensity of sound: Though in dental clinics, noise created by individual equipments is

below threshold level but concomitant exposure to multiple equipments like ultrasonic scaler and suction may increase actual noise produced.

- 2) Distance: Kilpatrick²⁰ recommends a distance of 14 inches (35cm) from dentist's eye to the patient's mouth. When operator is closer, decibel rating increases.
- 3) Working hours: Duration of exposure affects the risk of hearing impairment.⁷
- 4) Practice years: Hearing impairment seems to be more prevalent after more than 10 years of practice⁷ but in our study, in spite of younger subject population (approximately 31 years) with comparatively newer practice (5 to 7 years), high prevalence was reported. This indicates early involvement and rapid progression of hearing disability.
- 5) Condition and age of equipments: Old worn out equipments create more noise. Use of turbines older than a year increases risk of presumptive hearing impairment by 3-20 times.⁷
- 6) Dental speciality: Messano& Petti concluded that people working in the departments of Prosthodontics and Operative Dentistry are more at risk as the noise created there was 10-20% more than other specialities.⁷
- 7) Other risk factors: Life style is a cumulative experience of all habits and practices. No single factor can dictate our quality of life. In our study, the presence of factors like mean daily driving hours, use of mobile and earphones, visits to discotheques/ high noise areas, smoking and tobacco chewing, use of drugs with known auditory adverse effects, history of head and neck trauma, ear infection, Diabetes Mellitus and hypertension was found to be very minimal. This miniscule influence may not pose a strong individual impact on hearing loss, but cumulative long term effect of all these factors may pose a serious threat to our hearing sensitivity. Individually each factor may appear insignificant and meager but concomitant occurrence over a long period of time may cause significant impact.

Prevention of hearing impairment:

The noise control can be achieved by reduction at noise source, control of noise transmission and protection of exposed persons.²⁵ The various methods that can be employed are as follows:

- 1) The use of ear plugs (foamed plugs or flanged plastic plugs and headsets)²⁶ and muffs is recommended.²⁵
- 2) The design of dental clinic should permit the location of compressor, ultrasonic cleaners and suction machines in insulated and isolated chambers or cabinets.²⁷ Sound dampening materials should be used for walls and ceiling.²⁷
- 3) Dental professionals should maintain good working posture.¹⁰
- 4) Proper lubrication and maintenance of equipment is recommended. The use of worn out instruments should be avoided.¹⁰
- 5) Simultaneous use of several turbines should be avoided.²⁵
- 6) Use of mobiles and earphones should be minimized.
- 7) Fabry recommended that dentists should undergo periodic audiometry for an early detection & prompt management.²⁴

CONCLUSION

In today's fast and furious world, being "**LOUD**" is considered the surest way to be noticed. But unwanted sound or **NOISE** can be detrimental to our long term well- being. Constant exposure to noise in our dental offices from dental tools adds on to the noise pollution we face. These can cause compromised acoustic health in dentists. This survey was an **eye-opener** for the dental fraternity. Hearing impairment should be recognized as a potential occupational health hazard. The study is a first baby step towards collecting scientific evidence behind the "quasiheard" anecdotes. We hope this study will help create awareness within the dental community so that the dental professionals can successfully overcome this professional hazard.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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