Original Article

Changing hearing pattern in young male adults- A retrospective preliminary study

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It is well known that repetitive and continuous exposure to high intensity noise causes temporary and thereafter permanent noise induced hearing loss. The medical records of 287 candidates in the age of 16–28 yr. spread out over the past 40 years were examined. There is progressive increase in threshold of hearing in young adults over the decades and the apparent cause is exposure to continuous environmental noise of medium intensity

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Increase in environmental noise is expected to have an impact on hearing of the entire population. Industrialisation and urbanisation have brought in an attendant increase in environmental noise. It is well known that repetitive and continuous exposure to high intensity noise causes temporary and thereafter permanent noise induced hearing loss [1]. This hearing loss usually starts in the higher frequencies and then spreads into the speech frequencies [2]. It is known that it takes years of exposure to high intensity noise for an individual to develop hearing loss of a significant degree. High intensity noise emanates from the aviation industry, heavy machinery and vehicular traffic etc. However, overall noise level in the environment has been increasing.

This increase in noise level in the environment is an increase in medium intensity noise. It is to this noise level that the general population is exposed for much larger periods of time and in a continuous manner as compared to other individuals who are only exposed to high intensity impulsive or intermittent noise. Further, the general population is exposed to this increased medium intensity noise level in a subconscious fashion and without any protection. The impact of the exposure to this medium intensity noise level has been less well studied.

Defence forces are unique, in that all the entrants are audiometrically examined. These individuals are drawn from the general urban population of all classes of society and are therefore a good representative of the entire population. It was thought that study of such audiometry records within the same age group over a period of time would be indicative of hearing loss, if any, due to exposure to medium intensity ambient noise. It was with this aim that this study was planned to ascertain the impact of continuous medium intensity noise on hearing threshold of young individuals over a period of four decades.

Material and Methods

The medical records of 287 candidates in the age group of 16-28 yr. (average age 19 yr.) spread out over the past 40 years were examined. These records were obtained from the initial medical examination centres of the Indian Air Force viz. Air Force Central Medical Establishment, New Delhi and Institute of

Table 1. Mean Threshold Value at different decades for different Frequencies

Freq	Ear	1950–59 (n = 17)	1960–69 (n = 80)	1970–79 (n = 60)	1980–89 (n = 130)
250Hz	Rt	−1.5 ± 7.43	2.42 ± 6.25	6..33 ± 4.3	11.15 ± 2.87
	Lt	−3.0 ± 8.12	2.14 ± 7.10	6.70 ± 4.2	10.76 ± 1.80
500Hz	Rt	1.8 ± 6.32	1.71 ± 6.31	9.62 ± 2.69	12.30 ± 2.49
	Lt	−3.0 ± 8.12	1.28 ± 6.58	10..60 ± 3.60	12.69 ± 2.49
1000Hz	Rt	0.0 ± 3.67	1.57 ± 4.59	7.96 ± 3.40	11.53 ± 3.60
	Lt	1.0 ± 5.83	0.28 ± 5.20	6.70 ± 3.80	11.15 ± 2.10
2000Hz	Rt	−1.5 ± 5.50	0.71 ± 5.62	7.40 ± 4.76	12.30 ± 3.72
	Lt	−2.5 ± 5.50	−3.14 ± 6.01	6.60 ± 5.00	11.53 ± 2.31
3000Hz	Rt	−3.0 ± 6.00	−2.05 ± 6.57	7.59 ± 3.93	11.53 ± 3.02
	Lt	−2.5 ± 5.12	−1.00 ± 7.05	8.00 ± 4.50	11.15 ± 2.87
4000Hz	Rt	−3.5 ± 7.08	−1.42 ± 7.02	8.51 ± 5.41	10.38 ± 3.07
	Lt	−4.0 ± 5.38	−0.28 ± 7.83	9.40 ± 4.70	12.30 ± 3.17
6000Hz	Rt	−3.0 ± 6.00	1.57 ± 7.72	8.51 ± 6.20	9.60 ± 3.64
	Lt	1.0 ± 5.38	1.57 ± 7.34	8.70 ± 6.0	10.76 ± 2.66
8000Hz	Rt	−1.5 ± 6.34	0.70 ± 5.09	6.48 ± 7.43	9.61 ± 3.07
	Lt	0.0 ± 4.47	0.85 ± 6.49	6.48 ± 5.00	10.00 ± 3.39

Table 2. Mean Audiometric Threshold Value of Low Frequencies at various decades

Period	Mean ± SD		Mean ± SD	P Value
1950–59	−1.33 ± 6.04	1960–69	0.33 ± 5.90	NS
		1970–79	8.14 ± 4.25	<0.01
		1980–89	7.49 ± 2.95	<0.01
1960–69	0.33 ± 5.90	1970–79	8.14 ± 4.25	<0.01
		1980–89	7.49 ± 2.95	<0.01
1970–79	8.14 ± 4.25	1980–89	7.49 ± 2.95	NS

Aerospace Medicine, Bangalore. Uniformity and standardisation of audiometric assessment was ascertained in each case. These 287 cases were considered representative of each year and the records of candidates with urban background were selected. No case had any otological disease. Hearing threshold in frequencies 150, 500, 1000, 1500, 2000, 3000, 4000, 6000 and 8000 Hz were observed. Special note was taken of speech frequencies (500 to 2000 Hz) and higher frequencies (3000-8000 Hz) and these were compared separately. Statistical analysis using the unpaired 't' test was used.

Table 3. Mean Audiometric Threshold Value of High Frequencies at various decades

Period	Mean ± SD		Mean ± SD	P Value
1950–59	−1.31 ± 6.20	1960–69	−0.11 ± 7.07	NS
		1970–79	7.97 ± 5.75	<0.01
		1980–89	10.57 ± 4.07	<0.01
1960–69	−0.11 ± 7.07	1970–79	7.97 ± 5.75	<0.01
		1980–89	10.57 ± 4.07	<0.01
1970–79	7.97 ± 5.75	1980–89	10.57 ± 4.07	<0.01

Results

Table 1 shows distribution of 287 cases over the 4 decade period with mean threshold at various frequencies in right as well as left ears. As can be seen, there is a homogenous representation and spread of cases over the 4 decades. Tables 2 & 3 show a comparison of low and high frequencies respectively over the year period. The same is represented in graphic form in Fig 1.

The mean threshold for both the ears for lower frequencies (speech frequencies) were found to be - 1.33 dB for 1950-59, 0.33 dB for 1960-69, 8.14 dB for 1970-79 and 7.49 dB for 1980-89. The threshold values for higher frequencies were found to be -1.31 dB, -0.11 dB, 7.97 dB and 10.57 dB for 1950-59, 1960-69, 1970-79, and 1980-89 years respectively. This

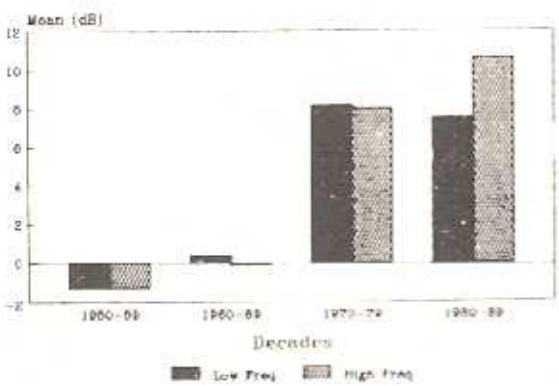

Figure 1. Audiometric threshold values of high & low frequency.

sudden sharp increase in threshold value in 1970-79 and 1980-89 group for low as well as higher frequencies were found to be statistically significant (P<0.01) as compared to 1950-59 and 1960-69 group (Tables 2 & 3). There has been a steady rise of threshold values for both higher as well as lower frequencies as the decade progressed.

Discussion

Occupational hearing loss has been documented as long back as the bronze age when metals were first discovered. Noise pollution and its effects on production of deafness has been recognised since the first century. However, site and nature of the disease was first described by Hebarman. After audiometry was introduced Fowler observed dips at 4 KHz in those exposed to high intensity noise. Bunch published the first audiometry data demonstrating the typical high frequency loss acquired by those exposed to noise [1].

In this retrospective cross sectional study, audiograms of young individuals in the age group 16-28 yr. (mean age 19 yr.) were studied.

The study group represents a cross section of urban population in the age group of 16 to 26 years. The mean hearing threshold was - 1.33 dB in 1950-59 which became 0.33 dB in 1960-69. This level significantly rose to 8.14 dB in 1970-79 and 7.749 dB in 1980-89. A steady progressive increase in the hearing threshold is observed. Since the measurements were made under similar conditions, it can safely concluded that there has been a progressive increase in threshold of hearing over the entire frequency range.

Environmental noise is a mixture of low as well as high frequencies and is likely to affect hearing in all the frequencies. This is evident in this study also. The sudden increase in hearing threshold in the seventies may be attributed to the rapid industrialisation that has occurred in India in the post 70 era.

Noise is known to affect reproductive system in addition to its other known physiological effects [3]. It may be that prolonged exposure to environmental noise has a bearing on this increased threshold shift. The foetus is capable of perceiving sound and responding to them by motor activity and cardiac changes [4]. Exposure to environmental noise over the infancy and childhood phase may be additive and manifest as a hearing threshold shift in young adults.

Conclusion

From this retrospective study, the following points are noteworthy:

(a) There is progressive increase in threshold of hearing in young adults over the decades and the apparent cause is exposure to continuous environmental noise of medium intensity. The threshold is likely to increase further if environmental noise pollution is not checked.

(b) Audiometric standard of 20 dB threshold for defence aircrew is adequate at present. It should be reviewed every 10 years.

(c) Defence personnel are more prone to exposure to high intensity noise and hence higher threshold shift is expected. So, reduction of noise at source and use of protective device should be strictly implemented.

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