

VIDEO QUIZ ON EAR PROTECTIVE DEVICES

REG. NO. M-9520

**AN INDEPENDENT PROJECT SUBMITTED IN PART
FULFILLMENT FOR THE FIRST YEAR MASTER'S DEGREE
IN SPEECH AND HEARING TO THE UNIVERSITY OF MYSORE**

**ALL INDIA INSTITUTE OF SPEECH AND HEARING
MYSORE-570 006**

1996

DEDICATED TO MY

FAMILY AND FRIENDS

WHO'VE TOUCHED MY LIFE IN

SO MANY WAYS

CERTIFICATE

This is to certify that this, Independent Project entitled "VIDEO QUIZ ON EAR PROTECTIVE DEVICES" is the bonafide. work, done in part fulfillment for the First Year of the Master's Degree in Speech and Hearing of the student with Registration No. M-9520.

Mysore.

May'96



Dr. (Miss) S. NIKAM
Director
All India Institute of
Speech and Hearing
Mysore-570 006

CERTIFICATE

This is to certify that this, Independent Project entitled "VIDEO QUIZ ON EAR PROTECTIVE DEVICES" has been prepared under my supervision and guidance..

Mysore.

May'96


Dr. (Miss) S. NIKAM
GUIDE
All India Institute. of
Speech and Hearing
Mysore-570 006

DECLARATION

I hereby declare that this Independent Project entitled "**VIDEO QUIZ ON EAR PROTECTIVE DEVICES**" is the result of my own study undertaken under the guidance of Dr. (Miss) S. Nikam, Director, All India Institute of Speech Hearing, Mysore, and has not been submitted earlier at any University for any other Diploma or Degree.

Mysore.

May '96

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INTRODUCTION

Sound is a disturbance that propagates through an elastic medium at a speed characteristic of that medium. Sounds are the basis on which verbal communication occurs. This sound can be either pleasing or annoying. When any sound is aperiodic and annoying, it is referred to as noise.

Although noise doesn't seem very harmful, in fact, it can cause great harm. Noise is reported to have both auditory and non-auditory effects. The direct auditory effects include the obvious interference with communication, temporary and permanent threshold shifts and acoustic trauma. The other, not so obvious, non-auditory effects include annoyance, decrease in working efficiency, physiologic changes in heart rate, blood pressure and psychologic distress. These effects depend upon individual susceptibility in addition to the characteristics of the noise - intensity, spectrum, duration of exposure (during a day or entire work life), etc.

As is now obvious, noise has many and varied hazards. It is, therefore, imperative that steps are taken in industries to reduce the amount of noise exposure the workers are subjected to. Noise can be controlled by three methods - reduction of noise at source, reduction of noise

during transmission and control at the level of the worker. Most often it is not possible/feasible to carry out the former due to machinery and building limitations and we have to fall back upon protective devices to reduce the amount of noise exposure that the ear is subjected to.

The ear protective device (EPD) serves as a barrier between the noise and the inner ear which is the most vulnerable to damage due to noise. It attenuates the amount of sound reaching the cochlea considerably, thereby preventing noise-induced hearing loss and other detrimental effects of noise from occurring. The protection provided by an EPD depends upon its design, damping characteristics and physical characteristics of the user.

The various types of EPDs include

1. **Ear plugs:** They are made of plastic material moulded to fit the outer ear canal and remain there without any support. They are smaller, cheaper and can be cleaned with soap and water and can be carried around easily. They are made of cotton, paper, wax, glass wool, fibre glass, plastic or expanding vinyl foam. The ear plugs generally provide an attenuation of around 15 to 35 dB and have a better attenuation in the low frequencies. The types of ear plugs are prefabricated ear plugs, disposable and malleable ear plugs, individually moulded ear plugs, flanged plug, etc.

2. Semi insert: They are similar to ear plugs but are supported by a head band. They close off the entrance to the ear canal without actually being inserted into the canal. They are generally used more for communication purposes than for protection against noise. It requires support in the form of a head band and is more * cumbersome than a ear plug.

3. Ear muff: They cover the entire pinna and are held in place by a spring loaded adjustable band and are sealed to the head with soft circum-aural cushion seals. It may be incorporated in a helmet that covers the entire head. The muffs are made of rigid cups that are formed of a rigid, dense, imperforate material. The force with which the cups press the ear plays an important role in determining the attenuation provided by it. Protection decreases when worn with goggles, over long hair, spectacle frames, etc. Attenuation is around 20 to 40 dB especially at higher frequencies.

4. Helmets: They are the largest EPDs and are available in several sizes. They cover most of the head surface and supply ear protection either through a close fit or integral ear muffs or other built-in-ear pieces. They are Me Often USed tO safeguard the wearer against bump, crash and cold-type injuries.

Special types including frequency and amplitude selective EPDs are available.

In spite of such harmful, wide spread effects of noise, it is seen in India that there are only a few industries where EPDs are used to protect the hearing of the worker. Also, it is noticed that many individuals do not wear their EPDs because of lack of information regarding their need and usage. There are also, a number of misconceptions prevalent regarding EPDs.

This was the reason that an informative as well as interesting quiz regarding EPDs was made. This is meant to serve to increase the awareness of EPDs, their need, usage and to attempt to remove the common misconceptions regarding EPDs.

METHODOLOGY

The methodology of the project will be discussed under two major topics:

- Questions
- Subjects

Questions

The questions chosen for this quiz covered the entire gamut of ear protective devices. They were also easy and interesting in addition to being informative.

Four rounds were considered with four questions in each round. The rounds chosen are

1. Multiple choice - General
2. Visual round
3. Multiple choice - Technical
4. Rapid fire

The first round consisted of general questions regarding noise. Each question had three choices from which the concerned team had to choose the most appropriate answer. The second round consisted of visual clues which the team had to identify (or answer a question related to the visual). The third round also had three multiple choices for each question, the questions being technical. The fourth

round had a set of five questions meant for each team; the team was given one minute to answer as many questions as the members could during this time.

Two sets of questions per round were compiled. While one set has been used for the present quiz, the other set can be used for future purposes.

To gain more knowledge and insight, the student visited Bharat Earth Movers Limited a public sector undertaking. The noise control measures, incorporated, usage of EPDs, worker education were all noted and used to formulate the questions.

Subject selection

The subjects selected for the quiz were expected to have a basic knowledge regarding noise and hearing loss, but not possessing broad technical knowledge on the subject. The subjects, therefore, chosen for the quiz were students of First Year B.Sc. (Speech and Hearing). These people had a basic grounding in the field of speech and hearing, but they did not possess the technical knowledge.

Four subjects (two male and two female) in the age group 17-19 years were chosen for the rehearsal. They were students of first year B.Sc. (Speech and Hearing). They were quizzed and the video recording was carried out.

Four teams of three subjects each were chosen for the quiz, making in all twelve subjects (six male and six female) Their age ranged between 18 and 21 years with a mean age of 19.5 years. Also, these subjects were studying in first year B.Sc. (Speech and Hearing) during the recording of the quiz.

RULES FOR THE QUIZ

1. Each team is given a time of thirty seconds to answer the question.

2. Each correct answer fetches **ten marks**.

3. If the question is not answered, the question passes on to the next team which gets fifteen seconds to answer the question. The passed question fetches five **marks** for the right answer.

4. There are **four rounds** including a visual round, a buzzer round and a rapid fire round.

5. In the rapid fire round, a time of **one minute** is provided to each team in which they can answer as many questions as possible.

6. Quiz master's decision is final.

VIDEO QUIZ ON EPDs

Rounds in the quiz are

1. Multiple choice general
2. Visual round
3. Multiple choice-technical (buzzer)
4. General rapid fire/acronymns

Round-1

- A1. If you heard a loud sound what would you do,
- a. Close your ears
 - b. Run away
 - c. Turn your head
- A2. When do you consider a sound noise ?
- a. When its musical
 - b. When it is loud
 - c. When it is enjoyable
- A3. What is noise ?
- a. Any aural disturbance
 - b. Any aperiodic sound
 - c. Any aperiodic sound causing disturbance
- A4. Name any effect that noise can have on hearing
- a. Ear discharge
 - b. Hearing loss
 - c. Improvement in hearing

Visual round - Place EPDs and pictures/slides in front of the individuals and answer corresponding questions

- A1. Place a 'ear plug'
- Q. What is this ?
- A2. Place a 'ear muff'
- Q. What is this ?
- A3. Place a 'helmet'
- Q. What is this ?
- A4. Place a 'semi insert'
- Q. What is this ?

Third round - Multiple choice buzzer technical

A1. Who often uses the helmet type of EPD ?

- a. Pilots
- b. Industrial workers
- c. Rock stars

A2. What materials are ear plugs made out of ?

- a. Finger
- b. Tissue paper
- c. Foam and silicone

A3. Which of the following gives maximum reduction in energy across the frequency range ?

- a. Ear plug
- b. Ear muff
- c. Ear muff + Ear plug

A4. What is the overall attenuation produced by ear plugs ?

- a. 15-35 dB
- b. 0-5 dB
- c. 40-60 dB

4. Rapid fire

Aa. 1. Use of EPDs affects communication

T/F

2. One can buy EPDs from any shop

T/F

3. EPDs affect the ability to locate the direction of sound

T/F

4. Making holes on EPDs make them more comfortable

T/F

5. Fibre glass or glasswool are the best material for ear plugs

T/F

- Ab. 1. Loud industrial noises won't affect my hearing if I get used to it for a whole T/F
2. One has to consider many factors before choosing an EPD T/F
3. Noise can cause irritation and annoyance and reduce your ability to work T/F
4. EPDs can cause headaches T/F
5. EPDs can be frequency selective or amplitude selective too T/F
- Ac. 1. For normally hearing ears, EPDs improve reception of warning signals T/F
2. EPDs should be bought according to ISI standards T/F
3. Once an EPD is bought, it should never be changed T/F
4. Ear plugs cause ear infection T/F
5. There are various types of ear plugs T/F
- Ad. 1. Ear muff can be dangerous to speech communication T/F
2. EPDs can be prescribed by a general physician T/F
3. Ear plugs are more advantageous in industries than helmets T/F
4. Ear plugs needs to be washed regularly T/F
5. Noise exposure in industries are governed by Indian laws T/F

ANSWERS

Round-1

A1. a, A2. b, A3. c, A4. b

Round-3

A1. a, A2. c, A3. c, A4. a

Round-4

Aa. 1. False 2. False 3. True 4. False 5. True

Ab. 1. False 2. True 3. True 4. False 5. True

Ac. 1. True 2. True 3. False 4. False 5. True

Ad. 1. True 2. False 3. True 4. True 5. True

II SET

Round-1

B1. When sound do you consider noise ?

- a. Sound of an aircraft c. Library room
- b. Children playing

B2. What is the least level of noise/is harmful to hearing (for prolonged exposure)

- a. 190 dB b. 90 dB c. 105 dB

B3. When in a noisy party, what would you do

- a. Use some protection b. Sit in a coner
- c. Enjoy the noise and scream above it

B4. What does an EPD do ?

- a. Protects the ear c. Increases sound reaching the ear
- b. Protects hearing

Visual round - Place EPDs and pictures/slides in front of the individuals and answer corresponding questions

B1. Picture of three monkeys (Gandhiji's)

Q. Why is the monkey closing his ear ?

B2. Picture of child closing the ear

Q. Is this the more effective way to protect hearing or is it better to use an EPD ?

B3. Picture of an individual listening to music on a walkman (over ear phones)

Q. Is this the most comfortable and efficient way to listen to music and control noise exposure ?

B4. Picture of loud music blaring from a recorder.

Q. Can one use ear plugs while listening to loud music ?

Third round - Multiple choice buzzer technical

- B1. Which part of the ear is most affected by the noise ?
- a. Tympanic membrane
 - b. Cochlea
 - c. Pinna
- B2. At which frequencies does ear plug provide maximum attenuation ?
- a. Low frequencies
 - b. Mid frequencies
 - c. High frequencies
- B3. Why do air leaks in EPDs occur ?
- a. Due to poor sealing
 - b. From the material of the EPD
 - c. Through the skull vibration
- B4. What is plugging/occlusion effect
- a. Sound not reaching the ear when it is closed
 - b. The bone conduction (vibration) path being enhanced for frequencies below 2 kHz when EPDs are used
 - c. Sound reaching the ear becoming louder after the EPD is removed

Round-4

Unscramble the letters and expand the acronym

- B1. HPC (clue:It involves conserving the hearing of workers)
- B2. RNR (clue: It is used to evaluate the amount of reduction provided by an EPD to noise)
- B3. HDPP (clue: Another name for the EPD)
- B4. TST (clue: What results when there is excessive noise exposure)

ANSWERS

Round-1

B1. a, B2. b, B3. a, B4. b

Round-2

B1. Protect itself from noise and other evils

B2. Use an EPD

B3. One should

B4. No, the earphones make the sound reaching the ear louder

Round-3

B1. b, B2. a, B3. a, B4. b

Round-4

B1. Hearing Conservation Program

B2. Noise Reduction Rating

B3. Personal Hearing Protective Devices

B4. Temporary Threshold Shift

APPENDIX

Write up on the basis of which quiz questions were made/pamphlet to be distributed for quiz.

Sound is a disturbance created in a medium by vibrations. When the disturbance reaches the ear, it is perceived as a sound. This is the basis for speech and most of communication. When the sound that is perceived is aperiodic, loud and causing annoyance, it is considered as 'noise'.

Although, it seems harmless, it is a very subtle and wily enemy of man.

The amount and type of noise that each person reacts to varies. As it is said, "Music to one man is noise to another". In response to annoying noise, the most common response is plugging the ear with the hands. Of the three monkeys of Mahatma Gandhi, the one closing its ear could be thought of as representing a reaction to noisy surroundings. In the present day context, the knowledge of noise is very important. In addition, to the hazards of industrial noise, the noise pollution around us is on the rise.

In order to reduce the detrimental effects of industrial noise, Industrial Hearing Conservation Programs

(HCP) are to be conducted in every industry. These programs serve to reduce the amount of noise exposure to the workers, help conserve hearing of the workers, etc. Although

community noise is high too, discussion will mainly concern been implemented. Here, the discussion will mainly concern hearing conservation and protective devices as used in industries.

In addition to reducing the source of noise and reducing noise during its transmission (using double doors, carpets, etc.) a very efficient way of reducing the noise reaching the worker is the use of ear protective devices (also called Hearing Protection Devices or Personal Hearing Protective Devices, etc.).

Ear protective devices are worn by the worker on the ear/head and they serve to attenuate the noise reaching the inner ear, thus reducing the possibility of damage to the ear.

The various laws and DRCs specify an exposure of approximately 90 dB of continuous noise for more than 8 hours as damaging. Also, an impulse noise of greater than 105 dB is considered harmful.

Although noise seems to be very harmless, it can have both auditory and non-auditory effects on ,the human

ear. The obvious auditory effects of noise are hearing loss, tinnitus, etc. The hearing loss can be in the form of a temporary threshold shift, a permanent threshold shift or acoustic trauma. In addition to these, the effects of noise can extend to areas that are out of the purview of the ear. Irritation, reduced work performance, increased blood pressure, increased cardiac output, sleep disturbance, increased autonomic nervous system activity, etc. are a few of these effects.

Types of EPDs

There are four types of ear plugs each containing several brands. The four basic ones are

1. Ear plugs

They are moulded to fit over the outer ear canal and remain there without any additional means of support. Ear plugs are unobstrusive and must personally be fitted for every individual ear, under medical supervision by the audiologist. They are cheaper, smaller and can be carried around easily.

They are made of materials like cotton, wax, glass wool, fibre glass down, plastic or expanding vinyl foam. The ear plugs can be custom made for each ear or can be

malleable type. Standard ear plugs are also available, although they are not as efficient as the other ones. The types of ear plugs include

Prefabricated ear plug which is made of soft, flexible material that fits readily into the many ear canal shapes. They are non-toxic and can be cleaned with soap and water.

Disposable and malleable ear plugs: They are generally made from low cost material and are non-porous and easily formable. Glass wool forms one of the best disposable ear plugs.

Individual moulded ear plugs: They are generally some form of silicone rubber and are custom made for that particular ear and are permanent.

The ear plugs when inserted properly give an attenuation between 15 and 35 dB. The attenuation is better in the low frequencies.

The problems with ear plugs are that they require tight fitting for maximum attenuation. Also, they require more time and effort to fit and can become dirty and unsanitary. They have to be changed periodically and it requires good co-ordination.

2. Semi-inserts

They are similar to ear plugs but are supported by a head band. These devices close off the entrance to the ear canal without being inserted into the canal. These are also called concha seated ear protectors or canal caps. This is not very comfortable since it has to be pressed firmly against the ear canal.

3. Ear muff

They cover the entire pinna and are held against the sides of the head by a spring loaded adjustable band and are sealed to the head with soft circumaural cushion seals. The acoustic insulation between the outer shell is provided either by liquid filled or plastic foam filled seal.

Most ear muffs are similar in design and can be fitted to all persons with little adjustment. It is important to maintain the correct head band pressure for good attenuation.

Combination of ear plug and ear muff provides attenuation of 34 to 38 dB with maximum attenuation at 3 kHz while the muff alone can produce attenuation of around 20 to 34 dB, especially above 1 kHz.

4. Helmets

They are the largest and come in different sizes. They cover most of the head surface and can be used by

pilots to safeguard the wearer against head injury. The helmet may contain muffs inside it that serve for ear protection.

Special types of ear protectors

Frequency selective devices

An acoustic low pass filter with an EPD can reduce attenuation below 2 kHz which allows the speech frequencies to be passed permitting easier speech communication, unsuitable on factory floor.

Amplitude sensitive devices

They are designed to attenuate loud sounds more than quiet ones.

Interference with communication

If the ear protector has a flat frequency characteristic, speech will be most intelligible in continuous noise.

It has been observed that EPDs facilitate speech communication since over loading and consequent distortions are avoided resulting in better perception of speech when EPDs are worn. Ear muffs and helmets may affect the ability of an individual to localise the direction of sound.

Noise Reduction Rating

Noise Reduction Ratings are methods by which the amount of attenuation provided by an EPD is calculated to estimate its effectiveness.

Effects on skin

An EPD may cause inflammation of the skin which is controlled by discontinuing its use. It is not toxic and therefore, not dangerous to the ear.

If a ear plug is kept clean and free from dirt, it will not cause any infection or other problems.

Regular testing and cleaning of the ear should be undertaken to ascertain that there is no problem to the user.

Choosing of an EPD

An EPD cannot be bought off the counter from a store. The individual has to procure an EPD according to the recommendation of an audiologist (preferably industrial). Following a ear test and considering other factors (noise exposure intensity, duration, work area, work type, etc.), the audiologist will recommend the suitable type of EPD.

As there exist standards regarding the allowable amount of noise exposure; Standards are also present

regarding the quality of the EPDs. The EPDs should be certified as 'passing a standards test'. The Indian standards for EPDs are ISI.

The ear protector used for noise varies from the one's used for swimming and for listening to loud music. Commercially, the latter are available and they do not require the recommendation of an audiologist for use. However certain ear plugs for noise can be used for swimming with certain specifications.

Many workers feel that since their ears are "used to" noise, they do not require ear protectors. Although research is being conducted in this area, nothing conclusive is found. It is still mandatory than worker's exposed to noise use EPDs to prevent cochlear damage.

The reason many EPDs fail is the wrong usage. They need to be kept clean and changed regularly (especially for ear plugs). With use, the fitting may get loose and hence they have to be changed. While putting on/removing the ear plug care must be taken not to push it too deep as to hurt the ear.

In case of any problems with the EPD the worker should contact the audiologist concerned; but should not stop using the EPD.

Remember, noise is a subtle and wily enemy and the only ammunition against it is the Ear Protective Device.

BIBLIOGRAPHY

- Aarni, J.D. and Redfield, N.P. (1974). Attenuation characteristics of recreational helmets. Annals of Otorhinolaryngology. 83(1):119-124.
- Abel, S.M., Kunor, H., Dichora, F.M.K. and Alberti, P.W. (1985). Signal detection in industrial noise, effects of hearing protection. Scandinavian Audiology. 14(3): 161-173.
- Action, W.I. (1977). Problems associated with the use of hearing protection. Annals of Occupational Hygiene. 20(3):229-246.
- Alberti, P.W. (1987). Occupational hearing loss in Canada. Cited in Sataloff, R.T. and Sataloff, J. Ed.(1). Occupational Hearing Loss. Mared Dekkar. 597-604.
- Animesh, B. (1990). Question bank on ear protective devices. Unpublished independent project submitted in part fulfillment for first year Master of Science (Speech and Hearing) to the University of Mysore.
- Bebout, J.M. (1990). Industrial hearing conservation: Mixed outlook for the 90's. Hearing Journal. 43(3):11-17.
- Berger, E.H. (1992). Current issues in hearing protection. Cited in Dancer, A.L., Henderson, D. Ed.(2). Noise Induced Hearing Loss. Mosby Yearbook. 377-388.
- Betsford, J. (1972). Ear protectors - Their characteristics and uses. Sound and Vibration. 6(1):24-28.

- Croushore, G.C. Jr. (1977). An industrial hearing conservation program. Hearing Instruments. 28:8-10.
- Edwards, R.G., Broderson, A.B., Gren, W.W. and Lempert, B.C. (1987). A second study of the effectiveness of ear plugs as worn in the work place. Ear and Hearing. 8(2):126-130.
- Erlanelson, B., Hakanson, H., Ivarsson, A. and Nilsson, P. (1980). The difference in the protection efficiency between ear plugs and ear muffs. Scandanavian Audiology 9(4):215-221.
- Flugrath, J. and Tuberville, J. (1972). The effectiveness of ear plugs. Sound and Vibration. 6:32-36.
- Haas, R.B. (1964). Hearing protection in industry: one way to solve the noise problem immediately. Journal of American Safety Engineering. 9:21-26.
- Hall, J.W. and Santucci, M. (1995). Protecting the professional ear: Conservation strategies and devices. Hearing Journal. 48(3):37-45.
- Howell, K. and Martin, A.M. (1973). An investigation of the effects of hearing protectors on vocal communication in noise. Journal of Sound and Vibration. 41(2):181-196.
- Lipscomb, D.M. (1988). Components of an effective hearing conservation program. Cited in Lipscomb, D.M. Ed.(1). Hearing Conservation in Industry, Schools and the, Military. Taylor and Francis. 81-230.

- Marshall, C. and John Cheng (1991). An in situ ear protection program for musicians. Hearing Instruments. 42(12): 26-28.
- Melnick, W. (1984). Industrial hearing conservation. Cited in Katz, J. Ed. (4). Handbook of Clinical Audiology. Williams and Wilkins. 534-552.
- Nilsson, P. (1980). The difference in protection efficiency between ear plugs and ear muffs. Scandinavian Audiology 9(41):215-221.
- Rohini, H. (1988). Ear protective device: A review. An independent project submitted in part fulfillment for the first year Master of Science (Speech and Hearing) to the University of Mysore.
- Royster, L.M. and Royster, J.D. (1980). Industrial hearing conservation new considerations. Hearing Instruments. 31(1):4-5.
- Saloman, R.E. (1975). The role of ear protection in reducing occupational hearing loss. In proceedings of the Institute of Environmental Sciences. 2:178-179.
- Sataloff, R.T. and Sataloff, J. (1987). Hearing protection. Cited in Sataloff, R.T. and Sataloff, J. Ed.(1). Occupational Hearing Loss. Marcel Dekkar. 623-624.
- Shaw, E.A.G. (1979). Hearing protector attenuation: A perspective view. Applied Acoustics. 12(2):139-157.
- Smith, C.R., Barton, T.E., Petterson, C.B., Mozo, B.T. and Camp Jr. R.T. (1980). Insert hearing protector effects. Ear and Hearing. 1:26-29.

- Smith, C.R., Willimoth, J.M. and Borton, T.E. (1980).
Custom-moulded ear plug performance: A retrospective
study. Scandanavian Audiology. 9(2):113-117.
- Vasallo and Sataloff (1986). Procedures in hearing
measurement and protection. Cited in Lipscomb, Taylor,
Ed. Noise Control. Van Nostrand and Co. 173-177.
- Zwislocki, J. (1957). Ear protection. Cited in Harris, CM.
Ed. Handbook of Noise Control. McGraw-Hill Book Company.