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Short Communication

Use of Hearing Protectors in the Workplace

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Abstract

Hearing protectors have gone a long way in the last half a century. The number and variety of existing devices is astonishing. Attenuations obtained by their use is sufficient to reduce the noise levels found in most workplaces to values dimed "safe" by jurisdictions and legislations. However, workers are still experiencing hearing losses. Many are resisting their use or are not wearing them correctly. Effort by myriads of health and safety professionals appears to return results that are not sufficient or satisfactory. One question remains not solved: that of comfort. There is no definition, and there is no objective way for comfort measurement. Until those are found, the only real tool for making protectors to be used is increasing worker's education and raising the awareness regarding the hazardous effect of noise. This paper deals with hearing protectors in general but focuses mainly in problems with ear plugs.

Keywords: Protectors; Ear Plugs; Noise

Introduction

- **Fact #1:** Most jurisdictions and the World Health Organization (WHO) accept noise exposure of 85 dBA as a "safe" limit [1].
- **Fact #2:** Most hearing protectors used in workplaces are labelled as NRR=/>25 dB
- **Fact #3:** Most workplace noise exposure levels are lower than 100 dBA [2].
- **Fact #4:** Occupational noise induced hearing loss is still the most important hazard in the workplace [3].

A simple calculation shows that the noise exposure of a worker exposed to 95 dBA, wearing a hearing protector labelled NRR 25 (derated by 50% as per CSA Z94.2-14 [4]) will decrease to 85.5 dBA. Still It will be slightly higher than the recommended value of 85 dBA, but it cannot explain the Fact #4, that hearing loss is still the hazard that brings the most claims for compensations.

Obviously, there is a serious reason for having hearing losses even with adequate hearing protectors. It appears that the protectors do not provide sufficient attenuation to the wearers. Following is an examination of some of those reasons (see Figure 1).

Figure 1: Why there are so many hearing losses.

Protectors are not worn all the time

A first reason for protectors not to protect properly is that they are not worn all the time the person is exposed. People use to remove them, especially when trying to talk. By doing so, they im-

prove intelligibility severely affected by the environmental noise [5]. The combination of noise and hearing protectors is not the best when the issue is speech. This is especially serious problem for people whose mother tongue is different from the one they are using to communicate as well as for people with hearing loss.

Removing the protector while exposed to noise, even for a short time, results in a severe drop of the effective protection [6]. The decrease is proportional to the duration the protector is removed. Also, it depends of the attenuation of the protector: the larger the attenuation, larger is the loss of the protection. As an example, if a protector labelled NRR 25 is taken off for 10 minutes during an 8 hours workshift, the resulting NRR drops to almost 20. (For the same duration, a protector labelled NRR 20 drops only by 2 dB).

Protectors are not properly fit

Wearing a device that is not properly fit is the second reason protectors are not protecting as much as they could. When the seal between plug and the walls of the earcanal is compromised the result is a better transmission of the sound energy and a sharply reduced attenuation.

There are two main causes for a deficient fit. The first is that the wearers do not follow properly the procedure recommended by manufacturers. Inserting an ear plug is an operation that requires paying attention and not mechanically inserting the device while thinking on something else. It requires time and attenntion, but it is time well invested.

Unfortunately, there is no easy way for testing the fit after plugs are inserted. There are two field testing procedures that are commonly recommended:

- Using one finger and feeling that the plug is fully inserted in the earcanal. Its end should be aligned with the earcanal opening, and
- Covering both ears with both hands after plugs are inserted and observing if the ambient noise level feels reduced. If they are properly inserted the noise should not appear to change.

Unfortunately, no one of those "tests" appears to appeal to wearers and, consequently they are seldom used.

Fit is compromised also when plugs move and change position during the workday due to motion of the jaws while talking or eating. They tend to slide toward the opening of the ear canal and the net effect is reduction of the attenuation. Unfortunately it is in rare occasions that the wearer re-fits his protectors during the workshift to correct such a change of position of the plug.

The issue of comfort

No personal protector element is comfortable even though some are better than other. For example, safety shoes and safety glasses are generally better tolerated. Among the worst offenders are respirators and hearing protectors. Workers know that respirators save lives and not wearing them may be the difference between life and death. Also, there is an easy way of testing fit of respirators ("bread in, bread out"), and so, if the fit is deficient it is easily detected and corrected.

This is not the case with hearing protectors. For the majority, noise is perceived as part of the work environment that has to be endured. Also, because hearing loss takes long time to develop, the noise hazard is ignored or neglected. The net result is that the use of protectors is frequently uncared for, even in workplaces where using them is a condition for employment. This is more frequent in the construction industry where workers do take precautions against immediate physical hazards but are reluctant to protect themselves from noise [7]. Also the very nature of their works tends to involve several noisy periods of short duration, spread out during the workshift.

It has been observed that in general, when the noise levels are really high, workers tolerance towards protectors and the proportion of people wearing those increases. As a rule the problem of not wearing protectors appears to be worst with short duration noise exposures (even with high noise levels) or when the levels are relatively moderate. In other words, if the environment levels are higher, more people wear protectors.

From the above considerations, it would appear that there is a negative reaction from potential protectors' users towards wearing those devices, resulting in poor wear or no wear at all. This can be directly related to lack of comfort [7-9]. As mentioned above, protectors are not comfortable to wear!

When dealing with hearing protectors, two characteristics are of utmost importance. They are sound attenuation and comfort. The first, hearing attenuation, is defined as the difference between

sound levels of the open and the protected ear. This characteristic is properly defined and different measuring methods are described in an ISO international standard [10] as well as in ANSI [11].

There is, however, no definition on comfort in general and of hearing protectors' comfort in particular. There are no published standards for its measurement either. Why has comfort not been studied more extensively? The literature shows that it is not because of a perceived lack of importance on the subject. As stated by Casali "even if a hearing protector device is sonically superb, if it is uncomfortable it may not be worn at all, or perhaps worn improperly, or even modified by the user" [12].

Therefore, there should be other reasons for the comfort not to be better known and regulated as is. One could be the lack of definition mentioned above. If an issue is not defined it is difficult to decide which one of its characteristics is important and then proceeding to its study and quantification.

Other important reason is the subjective nature of comfort. Many factors define comfort and almost all are evaluated using questionnaires. Some are environmental, such as the ambient temperature and humidity. Others are the anatomical differences among wearers. Then, there are the characteristics of the protector itself (e.g., shape, softness, weight, texture). Finally, there is the interaction among PPEs, when the worker has to wear more than one and how it affects the type of activity the person is developing. (Typical example is the welder that has to wear a mask and a hearing protector). All characteristics are evaluated using questionnaires. This is a serious limitation since results are influenced by the state of mind of the individual filling the questionnaire, on that particular day and time.

There are two other elements of comfort important enough as to be taken in consideration. One, noise localization, is vital when dealing with mobile noise sources such as trucks or forklifts. The person wearing hearing protectors should be able to perceive the source of noise, where is it coming from and, eventually its speed. Those are all factors directly related to his safety. Their perception can be severely affected by the protectors, especially in presence of background noise.

The ability to hear hazardous signals while wearing protectors is another issue directly related to safety at work, important enough to be taken into account. Here, again, protectors may impede their perception and, by doing so, generate a hazard in the workplace.

Is there a way out?

It would appear that we are dealing with a problem almost impossible to be solved: protectors are not comfortable. We don't know how to improve comfort, since we cannot measure something that is not even defined. So, there is little chance for designing and manufacturing comfortable hearing protectors that would be acceptable and desirable.

There is, however, a way out, mimicking what is happening with the respirators. They are also uncomfortable. However, there is a clean path between life at the cost of comfort, and death. Could the health professionals follow the same logic, tracing the path between hearing at the cost of comfort and hearing loss? This is nothing new as a concept; it is just a question of finding the way of "selling" it.

This is only done by education. Hearing conservationists have been doing it day in and day out hammering the basic notions of noise and hearing loss. However, the results show that there is something missing. What has to be achieved is that each and every person exposed to noise be prepared to endure the lack of comfort to conserve his hearing. If that is not the case, then the problem of people not wearing protectors will continue as well as the number of hearing loss claims.

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