Canadian Audiologist

The Official Publication of the Canadian Academy of Audiology

NIHL-Shape Of The Audiogram – Part 1

Published November 24th, 2015

Originally posted at HHTM On October, 2015. Reprinted with permission.

From time to time, I am asked either by a referring physician, a union, or a local Workers Compensation Board (sometimes referred to as the Worker's Safety and Insurance Board) whether a particular worker has a hearing loss that could have been caused by his or her occupational noise (or music) exposure.

As a field of hearing health care professionals, clinically we make several assumptions about the nature of what a noise (or music) induced hearing loss would look like. This includes the "shape" or the slope of the audiogram (part 2 of this blog series), the degree and type of hearing loss, and the "correction" if any, for age (part 3 of this blog series). Because of the importance that "shape of the audiogram" seems to have in the acceptance or rejection of a claim for NIHL, as well as the "correction factor" that is applied to account for presbycusis, these two "assumptions" will be handled separately over the next several weeks (in part 2 and part 3 respectively).

Unlike most other areas of the field of audiology, very little modern research has been performed that underlies the auditory basis of noise exposure that leads to hearing loss. Much of the "seminal" research is from the 1970s and one has to be concerned about research that is more than 35 years old. Nevertheless a review of what our audiology ancestors found may provide a glimpse into why things are the way they are now.

85 dBA fence:

We have all heard of the 85 dBA "fence". The way that it is used with noise induced hearing loss (and in many jurisdictions, music induced hearing loss) this fence or "threshold limit value" (TLV) is the action point- exposure below 85 dBA and no action is taken; at, and above 85 dBA and action is taken.

In 1966, the Committee on Hearing and Bioacoustics (CHABA) was the first North American group to try to get a handle on how some aspects of noise could affect hearing. Because it was among the first group of researchers to broach this complex topic, CHABA made some assumptions- some were not very important such as the relationship between temporary threshold shift (TTS) and permanent threshold shift (PTS), and other assumptions were of greater importance, such as whether intermittent noise exposure can be used to calculate an "equivalent" steady state type of noise exposure.

The CHABA recommendations were used by the United States Air Force to develop an enforceable hearing conservation program and that was first instituted in 1956. For an excellent overview of the history of this work, Dr. Alice Suter wrote a chapter in David Lipscomb's excellent textbook Hearing Conservation in Industry, Schools and the Military (1994, Singular Publishing Group, ISBN 1-56593-380-X). This is the blue colored book that many of us have sitting on our bookshelves. Despite the age of this book, it is a gem and worthwhile getting if you

can find it in a used book store.

In 1969, based on the earlier work of CHABA, in an attempt to develop a threshold limit value or fence to the general, non-military workforce, several groups, but mainly the American Conference of Governmental Industrial Hygienists (ACGIH) developed a voluntary standard that was later adopted by the Occupational Safety and Health Administration (OSHA) under the Walsh-Healy Public Contracts Act. This was initially only applicable to the contracts from the American government but later was also applied to Federal Coal Mine Health and Safety Act. And in 1971 this was extended through OSHA to the general American workforce (industry and construction). The Fence or threshold limit value was 90 dBA (over an 8 hour work shift and using a 5 dB exchange rate- see part 2 of this blog series).

In 1983 OSHA, recognizing that long term exposure to levels slightly below 90 dBA can also cause hearing loss, made an change called the Hearing Conservation Amendment which requires most, but not all workers, to have a baseline audiogram, annual audiometric test, and if the exposure is between 85 dBA and 90 dBA, be offered hearing protection.

Shortly after its creation in 1971, the National Institute for Occupational Safety and Health (NIOSH), in an attempt to establish best practice exposure limits, came out with a 85 dBA fence in 1972 (but still using the OSHA and CHABA 5 dB exchange rate). In 1998, NIOSH revised its recommendations by using a 3 dB exchange rate, while still maintaining the 85 dBA threshold limit value fence.

Most countries outside of the United States follow the NIOSH 85 dBA threshold limit value with a 3 dB exchange rate and this includes the European Union, and most provinces in Canada (with the exception of Quebec). Of notable exceptions around the world are Brazil and Israel that still use the more conservative OSHA recommendations.