

Dangerous Liaisons: Shootin' Guns and Ridin' Motorcycles

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The noise associated with shooting firearms and riding motorcycles is responsible for many standard threshold shifts (STSs) and permanent hearing loss in the general population and those working in the firearm and motorcycle industries. Hearing healthcare professionals evaluating patients for the cause of their hearing loss may see these as special circumstances that are weighed against the patient's job, hearing changes over time, audiometric configuration, medical complications, environmental and genetic findings, age, and other noise exposures and traumas.

An in-depth evaluation of the time-weighted average, peak data, and noise exposure types with or without the synergy of chemicals is mandatory for industrial cases; determining that industrial noise exposure is sufficient to cause an STS. The addition of noisy hobbies and activities into the mix can make hearing loss greater, mask industrial noise issues, or in some cases, be the sole cause of hearing loss.

Patients may tell me they only shoot once in a while, wearing ear plugs or muffs, or they wear a full-face helmet and ear plugs while riding. I expect, in these cases, to see a noise-induced, high-frequency hearing loss with a notch in the audiometric history. Despite the use of hearing protection and old wives' tales, hearing loss may still occur in many cases, especially for those with occupations requiring these exposures and those genetically susceptible.

Estimates suggest that half of the 50 million recreational shooters are at risk for hearing loss. One shot of gunpowder is powerful; accident cases I have evaluated show an airbag deploying at 165 dB SPL peak resulting in sudden changes in hearing and the onset of tinnitus. The rear of a .22 caliber bullet exits the muzzle at the supersonic speed of 800 meters per second, creating more than 165 dB SPL peak. (*Sound Vib* 2009;43[8]:14.) Wearing earmuffs and ear plugs under ideal conditions provides maximum protection of 30 to 35 dB, reducing the potential exposure to only 130 dB to 135 dB at best.

Information from the National Institute of Occupational Safety and Health confirms the potential for hearing loss to occur with one shot above 140 dB SPL peak, but who shoots only one round? (NIOSH. *Noise and lead exposures at an outdoor firing range—California*, September 2011. [See FastLinks.]) Only three shots a day are permissible at a peak level of 135 dB SPL, and up to 100 rounds are allowed at 120 dB SPL before hearing loss may be acquired with repeat exposures. This would suggest that skeet and trap shooters and bird hunters are at greatest risk. The synergy and potentiation between lead dust, solvents, and noise cannot be ignored because outdoor air quality measured within shooters' personal breathing zone exceeds all permissible exposure levels. Even picnic Table surfaces, hands, and especially



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firearms at target ranges are at dangerous levels. In this case, there is a synergy between lead dust (and cleaning solvents for the firearms) that is breathed in and the development of hearing loss. The combination may increase the degree of hearing loss from noise. This is a common issue in industry and literature shows that toxic chemicals when combined with noise increase the potential for greater hearing loss. The army, for example, tests hearing when low concentrations of lead dust are evident.

A similar problem exists for the six million professional motorcyclists and recreational riders, even if they wear a full helmet. Street motorcycle riders are typically at less risk than professional racers and skeet shooters, but the noise inside a full helmet with a face shield traveling at 62 miles an hour is more than 100 dBA. (CIEH 2004. *Noise induced hearing loss in occupational motorcyclists*. [See FastLinks.])

Most of us may think the noise comes from the engine and tires, but the primary noise source is aeronoise, which is created by air between the base of the helmet, the chin bar, and the rider's neck. Bikes like the Harley-Davidson Softail with its straight pipes can reach 100 dBA with peaks in the low frequencies (≤ 500 Hz). It is likely that some degree of hearing loss occurs over time from a combination of noise sources because ear protection was not allowed or was ineffective.

A complete history of all noise exposure is needed when evaluating hearing loss causation, and it should include shooting guns and riding motorcycles, regardless of the significance to the patient or claims of hearing protection. An evaluation of the risk for noise-induced hearing loss and tinnitus because of these exposures must be considered an important factor in occupational noise determinations. [H](#)



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