

Hearing Loss from a Bicycle Horn

Pamella M. McMillan*
Paul R. Kileny*

Abstract

A 39-month-old child with previously documented normal hearing suffered acoustic trauma from a bicycle horn activated at his ear. Six days after the insult, a 4000-Hz 50-dB sensorineural hearing loss was found. This threshold improved to 30 dB HL over 6 months. The horn produces 143 dB peak SPL, a level clearly associated with a high risk for hair cell damage. This case shows the need for regulations limiting sound levels or requiring warning labels on potentially damaging toys and other recreational devices. Had a warning been provided, the parents of this child would not have bought the horn as a toy.

Key Words: Child, hearing disorders, noise trauma

Toys and recreational devices that produce excessive noise can cause hearing loss in children. Investigators have measured dangerously loud noise levels from toy weapons and firecrackers (Gjaevenes, 1966; Marshall and Brandt, 1974; Gupta and Vishwakarma, 1989). Hearing loss has also been documented in prospective studies. Gupta and Vishwakarma (1989) reported permanent noise-induced hearing loss in 3 percent of children aged 3 to 15 years following exposure to toy gun and firecracker noise during a 1-day festival. Gjaevenes et al (1974) found permanent noise-induced hearing loss in 0.68 percent of 12- to 15-year-old boys following exposure to firecrackers.

The following report describes impulse noise trauma from a bicycle horn, with partial hearing recovery over a 6-month period, in a very young child.

CASE REPORT

A 23-month-old boy was referred to our department for evaluation regarding candidacy for PE tubes following recurrent otitis media. He was managed successfully with anti-

biotics over the next year and discharged from our care at 36 months of age. At that time, thresholds under earphones showed hearing within normal limits at 500 to 4000 Hz bilaterally (see Fig. 1).

At 39 months of age, this child's parents gave him a large bicycle horn (see Fig. 2) when he asked for it in the sporting goods department of a distributor's store. There were no warnings regarding sound levels or risk of hearing loss on the packaging or on the horn. At home, the child held the horn to his left ear and activated it several times. He immediately complained of ear pain and ringing, both of which subsided within several days. Testing 6 days after the trauma showed a 4000-Hz sensorineural hearing loss (see Fig. 3). Audiologic monitoring documented a partial recovery of hearing over the next 6 months (see Fig. 4).

The sound pressure level and spectrum produced by the horn at 2 inches were measured using a B&K type 4134 ½-inch condenser microphone, a B&K type 2619 preamplifier with a type 2804 power supply, a Tecktronix 466 storage oscilloscope, and a Stanford Research model SR760 spectrum analyzer. Measurements revealed a peak-to-peak value of 152 dB SPL, with the RMS equivalent computed to be 143 dB peak SPL.

COMMENT

The time course and degree of recovery to be expected after impulse noise trauma is not well understood. The 20-dB improvement

*Department of Otolaryngology, Division of Audiology, University of Michigan Hospitals, Ann Arbor, Michigan

Reprint requests: Pamella McMillan, Department of Otolaryngology, Division of Audiology, University of Michigan Hospitals, 1500 E. Medical Center Drive, 1404 TC/0312, Ann Arbor, MI 48109-0312

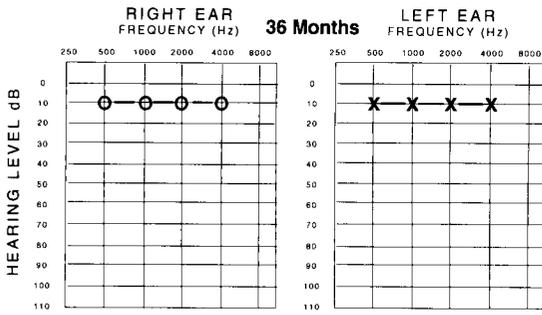


Figure 1 Pretrauma thresholds.

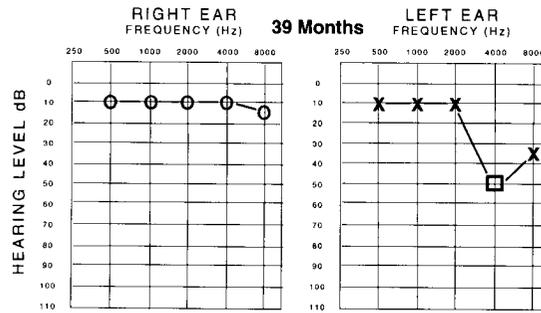


Figure 3 Thresholds 6 days post trauma. Open square indicates appropriate contralateral masking.

in our patient's 4000-Hz threshold occurred over a longer time than reported by most investigators. Ward (1979) reported that when temporary threshold shift at 2 minutes following impulse noise exposure is less than 40 dB, it is expected that maximum recovery in hearing sensitivity will occur within 16 hours. In cases of more marked immediate threshold shifts, recovery is expected to take several days or even several weeks. Pfander (1990) summarized studies used to develop damage risk values for impulse noise. Complete recovery of temporary threshold shift was seen in all subjects (military personnel) within 6 days following exposure to five gunshots with maximum sound pressure levels of 161 dB nHL. Flottorp (1990) presented two case studies of unilateral impulse noise trauma where hearing recovered completely to pretrauma levels at 4 to 6 weeks after exposure. Ward and Glorig (1961) reported a case of permanent threshold shift following impulse noise trauma and were able to monitor their subject for 2 years. Very little improve-

ment occurred after 1 month. Gupta and Vishwakarma (1989) followed children for 3 months after impulse noise trauma and found most hearing recovery in the first month. Gjaevenes et al (1974) found that many children with hearing loss in the first week after impulse noise exposure had normal hearing 2 weeks after exposure. Half of those impaired at 2 weeks were normal at 4 months.

Several investigators advise avoiding further loud noise exposure during recovery from impulse noise trauma (Ward, 1979; Flottorp, 1990; Pfander, 1990). We did not think to recommend this for our patient, but would do so in future cases of impulse noise trauma.

Although federal regulations do not permit worker exposure to impulse noises with peak SPLs above 140 dB, there are no regulations limiting noise output of toys or recreational devices and no requirements that consumers be warned of potential excessive noise. In 1991, a hearing was held before the House Select Committee on Children, Youth, and Families re-

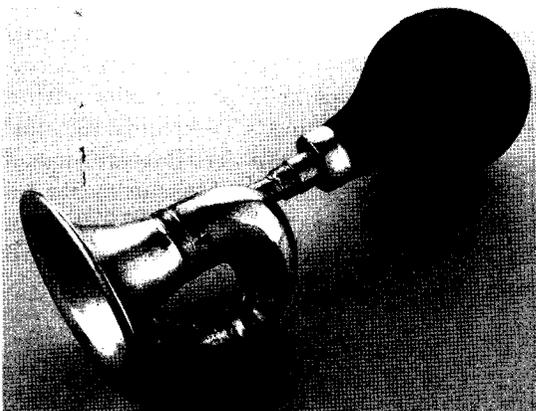


Figure 2 Dual-tone bugle horn.

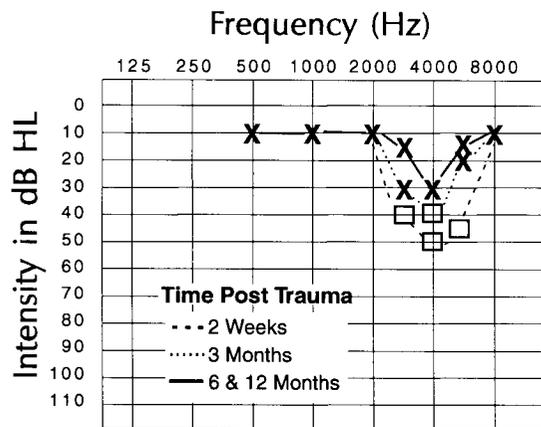


Figure 4 Left ear threshold improvement over 6 months. Right ear remained normal. Open squares indicate appropriate contralateral masking.

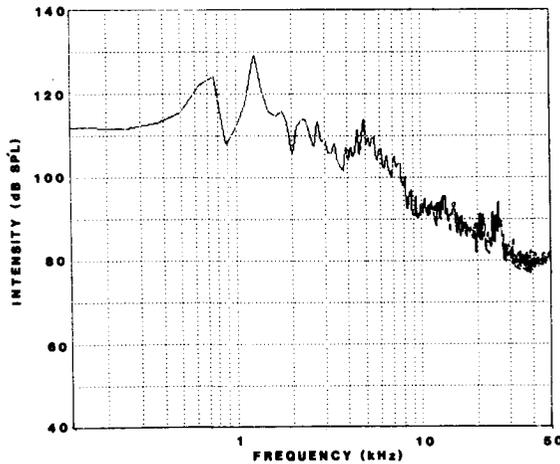


Figure 5 Spectrum of dual-tone bugle horn sound averaged over 10 honks.

garding noise and hearing loss. Following this, legislation (H.R. 3710) to fund an Office of Noise Abatement and Control was introduced but was not acted on before the end of the 102nd Congress.

The public needs to be informed about hearing conservation if they are to have a chance to protect themselves and their children from noise trauma. The distributor of this particular horn was informed of the case. While emphasizing that the horn was meant to be a warning device for adult bicyclists and not a toy, the vice president of marketing stated that a warning about dangerous loudness would be added to the horn's packaging. He also explained that the horn is not made in the United States and that many distributors handle it. This case prompted us to take several actions. We designed a flyer for our waiting room about preventing toy and appliance noise trauma in children. A local radio

health news show agreed to feature this case and the issue of noise trauma in children. Details of this case were also shared with federal legislators and American Academy of Audiology and American Speech and Hearing Association representatives who are interested in developing regulations to protect children from excessive noise exposure.

Acknowledgment. We thank Joseph Miller and Christopher Ellinger at Kresge Hearing Research Institute for noise measurements taken on the horn.

REFERENCES

- Flottorp G. (1990). Treatment of noise induced hearing loss. *Scand Audiol Suppl* 34:123-129.
- Gjaevenes K. (1966). Measurements on the impulsive noise from crackers and toy firearms. *J Acoust Soc Am* 39:403-404.
- Gjaevenes K, Moseng J, Nordahl T. (1974). Hearing loss in children caused by the impulsive noise of chinese crackers. *Scand Audiol* 3:153-156.
- Gupta D, Vishwakarma SK. (1989). Toy weapons and firecrackers: source of hearing loss. *Laryngoscope* 99: 330-334.
- Marshall L, Brandt JF. (1974). Temporary threshold shift from a toy cap gun. *J Speech Hear Disord* 39:163-169.
- Pfander F. (1990). Preliminary experience with the impulse noise simulator to identify individuals particularly sensitive to sound. *Scand Audiol Suppl* 34:87-96.
- Testimony before the House Select Committee on Children, Youth, and Families: "Turn It Down: Effects of Noise on Hearing Loss in Children and Youth." Washington, DC, July 22, 1991.
- Ward WD. (1979). General auditory effects of noise. *Otolaryngol Clin North Am* 12:473-492.
- Ward WD, Glorig A. (1961). A case of firecracker induced hearing loss. *Laryngoscope* 71:1590-1596.