

TREATMENTS FOR NOISE-INDUCED HEARING LOSS

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Introduction

This literature review was undertaken to review the status of research on available treatments for noise-induced hearing loss (NIHL) on behalf of Safety & Health in Arts Production and Entertainment (SHAPE). This review focuses on the studies that have exhibited a positive effect on NIHL in humans and that have been published since 1985 (see Appendix 1 for literature search strategies).

Results

There are a number of different treatments for NIHL that have been and are being researched. While most of these treatments are pharmaceutical in nature, some are not. Table 1 lists the treatments and the rationale for their effectiveness.

Table 1 - Treatments for NIHL

Treatment	Theory/Effects	Reference(s)
Corticosteroids (synthetic hormones)	Improve the microcirculation in the cochlea after acute noise trauma.	(Duan, Ulfendahl et al. 2002)
Blood flow promoting drugs (e.g. epinephrine, dextran pentoxifylline and hydroxyethyl starch)	Increase the blood flow through the cochlea when administered after acute noise trauma.	(Duan, Ulfendahl et al. 2002) (Miller, Laurikainen et al. 1994)
Oxygen	Reduces hearing threshold shifts and hair cell loss following impulse noise trauma.	(Duan, Ulfendahl et al. 2002)
Neurotrophins (e.g. nerve growth factor, brain-derived nerve growth factor, neurotrophin-3 and glial cell line-derived neurotrophic factor)	Stimulate auditory nerve re-growth and protect from sensorineural hearing loss.	(Miller 2004) (Duan, Ulfendahl et al. 2002)
Anti-oxidants and scavengers	Remove reactive oxygen species which might be involved in noise trauma.	(Duan, Ulfendahl et al. 2002)
Glutamate receptor antagonists	It is thought that the glutamate receptors are over-stimulated during noise trauma. Antagonists will reduce this over-stimulation and also any negative effects on hearing.	(Duan, Ulfendahl et al. 2002)
Gene therapy	Uses viral vectors or liposomes to deliver nucleic acids (e.g. transgenic neurotrophin) to the cochlea.	(Duan, Ulfendahl et al. 2002)

Discussion and Conclusion

Of these treatments, the blood flow-promoting drugs were thought to be the most promising, with the dextran pentoxifylline being tested in a randomized, double-blind,

placebo-controlled human trial. (Probst, Tschopp et al. 1992) However, the effects were not found to be significantly different from effects of non-treatment. Since this study, the research on cochlear blood flow promoting drugs seems to have been abandoned.

Neurotrophins seem to be the “next big thing” in treatment and prevention of sensorineural hearing loss, with a new patent (Miller 2004) registered last year which proposed the use of a glial cell line to promote the regrowth of nerves in the cochlea. While still in the animal testing phases (guinea pigs and chinchillas), the fact that they registered for a patent indicates that they are confident in their results, and we might expect some human studies to be conducted within the next couple of years.

In conclusion, it appears that there is a number of promising treatment strategies for noise induced hearing loss. While none of the treatments have made it successfully through clinical trials yet, some treatments (most notably neurotrophins) may progress to this stage in the next couple of years. In the meantime, the best line of defence against noise-induced hearing loss is still prevention through reducing noise exposure.

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References

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Appendix 1: Literature Search Strategy

Four bibliographic databases were used to identify the literature for this review: PubMed, CCINFOWeb, Compendex/Inspec, and Web of Science. PubMed, produced by the U.S. National Library of Medicine, specializes in health literature. CCINFOWeb, produced by the Canadian Centre for Occupational Health and Safety, specializes in occupational health and safety literature. Compendex contains information on engineering, and some noise measurement papers were located using this database. The search was conducted in February 2005 and employed combinations of the following keywords: noise and exposure, drug, pharmaceutical, hearing, noise-induced hearing loss, therapy and treatment. In addition, a significant portion of the literature cited within this review was identified through pearling, or hand searching of references found within other papers. We excluded articles that were written in languages other than English and French. Finally, with respect to potential control measures, a patent search was conducted using similar search terms.