Abstracts from the Literature

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Editor's note: Within the last 6 months, a relatively large number of articles have been published dealing with hearing loss and other conditions related to noise exposure. The most recent issue of The Hearing Review [13(3), 2006] *devotes most of its space to various aspects of musicians' hearing. The first four abstracts in this column continue the review of these articles that was begun in the last issue.—W.J.D.*

Santucci M: Please welcome on stage . . . Personal in-the-ear monitoring. *Hearing Rev* 2006;13(3). http://www.hearingreview.com/Articles.ASP?articleid=H0603F07.

Musicians need to hear themselves on stage over myriad competing sound sources. Traditional wedge-shaped loudspeaker monitors on stage present a variety of problems for performers, audience, and sound engineers alike. The advent of personal monitoring has revolutionized onstage sound reinforcement and provided a listening experience for the performer that surpasses the traditional monitors. This article describes the mechanics and shortcomings of onstage monitoring, compares personal monitors to traditional floor wedge monitors, and discusses the role of the audiologist in selecting the appropriate earpiece and guiding the musician to safe use of the system. A personal in-the-ear monitoring (IEM) system consists of a beltpack amplifier that can be either hard-wired or wireless and a set of earphones with tiny loudspeakers. The benefits are many and clearly listed. The goal of the system is to provide a full-bandwidth stereo mix to the stage performer while acoustically blocking out the competing sound sources. Good earphone designs allow the performer to hear more detail than is possible with floor monitors, resulting in decreased sound levels at the ear. The best fit, comfort, and sound quality come from custom-molded earpieces. The problem of musician isolation from both audience and other performers with traditional IEMs has been addressed with the development of a new system that uses hybrid microphones in the earpieces and active circuitry to provide a full mix of music and local ambient sound at the performer's ear. The article contains tips for safe use of these systems by musicians, as well as additional guidance the audiologist can offer the performer.

Russo FA: Perceptual considerations in designing and fitting hearing aids for musicians. *Hearing Rev* 2006;13(3). http://www.hearingreview.com/Articles.ASP?articleid=H0603F09.

To make music, musicians must be able to produce and keep track of subtle changes that occur along numerous dimensions of sound, often unfolding simultaneously over time. Individuals with acquired hearing loss are often aware, on some level, of reduced sensitivity to particular dimensions of music. In the case of professional musicians or dedicated music lovers, this reduced sensitivity may be particularly troubling. This paper presents an overview of several perceptual dimensions contributing to music experience that may have implications for the treatment and research of hearing loss and highlights the findings of experimental psychologists working in the field of music perception and cognition. Topics covered include fundamentals of relative pitch; melodic pitch relations, timbre, and amplifications; harmonic pitch relations and reduced frequency selectivity; hierarchical pitch structure, intensity variation, and compression; and tonality, inharmonicity, and presbyacusis. Many of these topics are pertinent to the design of hearing instruments for those with hearing loss. The author notes that the results of future experiments will contribute to knowledge of the specific auditory deficits that reduce the listening experiences of hearing-impaired listeners and should provide a road map for designing and fitting hearing assistive devices.

Chasin M: Hearing aids for musicians. *Hearing Rev* 2006;13(3). http://www.hearingreview.com/Articles.ASP?articleid=H0603F02.

Understanding and managing the four physical differences between speech and music will allow the hearing health care professional to select appropriate hearing aid circuitry, thus approximating the electroacoustic parameters to provide maximum enjoyment of music for musicians and music-lovers. First, the long-term speech spectrum is well defined, whereas that of music is highly variable, and the goal is poorly conceived, without a specific music target as for amplified speech. Second, the dynamic range of music as an input to a hearing aid is on the order of 100 dB, versus 30 to 35 dB for speech. Third, the root mean square for speech intensity is about 65 dB, with peaks extending an additional 12 dB higher. Music has less dampening than speech, and consequently, its peaks or crest factors are 18 to 20 dB. Finally, speech is derived from the mid-

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and high-frequency regions of the spectrum, while music requires that all ranges be represented. For instance, the clarinet and violin have similar energy spectra but dramatically differing uses of the sound. Hearing aid technology now exists to permit a hearing aid to automatically identify something as music or music-like and engage a "music program" without any action taken by the hearing aid user. Dr. Chasin presents five parameters that define such a music program, with explanations geared specifically for the audiologist who prescribes the specific hearing aid. However, knowledge of this information can be helpful to the hearing-impaired musician, by helping him or her assist the hearing health care professional in selection of the proper aid.

Niquette P: Hearing protection for musicians. *Hearing Rev* 2006;13(3). http://www.hearingreview.com/Articles.ASP?articleid=H0603F06.

Most musicians will develop some degree of music-induced hearing loss over the course of their careers. Other music industry professionals also are at risk for cochlear damage and hearing loss. There are no known cures for noise-induced hearing loss or its associated conditions of tinnitus, diplacusis, or hyperacusis; early identification of auditory dysfunction and prevention of cochlear damage is the only viable option at this time. Increasing numbers of music professionals are becoming aware of the dangers of high sound-level exposure, and more are seeking help to protect their hearing. Conventional ear protectors present problems for musicians because they produce too much high frequency attenuation, too much overall attenuation, and too much occlusion effect. Specific musician earplugs are designed to replicate the resonance of the normal ear, resulting in smooth, flat attenuation of sound across frequencies. One commonly used model has interchangeable attenuators within the plugs that provide the option of 9, 15, or 25 dBA noise reduction. Custom ear molds with a deeply seated plug provide the best option for avoiding the occlusion effect. The paper contains a table giving specific recommendations as to which music attenuators to use, depending on the type of sound exposure. Musician earplugs are a custom product that requires professional fitting and care, including appropriate audiological follow-up to verify the accuracy and appropriateness of the chosen hearing protection. Details are presented for earmold impression techniques and fitting and care of the earplugs.

Petersen J, Hölmich P: Evidence based prevention of hamstring injury in sport. *Br J Sports Med* 2005;39: 319–323.

The hamstring strain is a common injury in sprinting and jumping sports, as well as in dance. A major problem is the high incidence of reinjury. This literature review showed that hamstring strains have been little studied in elite dancers, although one study found them to be common among Swedish *dance* students. Muscle injuries can be classified as direct or indirect and are typically grouped into three degrees of injury severity. Several potential risk factors have been proposed, but only a few are evidence based and some are founded mainly on theoretical assumptions. The most common modifiable factors include imbalance of muscle strength with a low hamstrings-to-quadriceps ratio, muscle fatigue, hamstring tightness, insufficient warm-up, and previous injury. There is a lack of clinical research on the effectiveness of rehabilitation programs for hamstring strains. Although the initial treatment of rest, ice, compression, and elevation is accepted for muscle strains, no consensus exists for their rehabilitation. The authors found only two prospective studies that examined prevention of such strains. The correct timing for return to activity after a hamstring injury is traditionally based on regaining normal strength and flexibility and the ability to carry out specific sport activities without pain. However, the healing process after this type of strain may be much slower than the clinical findings might indicate, and the authors indicate a need for further studies on this topic.

Chitkara A, Meyer T, Keidar A, Blitzer A: Singer's dystonia: first report of a variant of spasmodic dysphonia. Ann *Otol Rhinol Laryngol* 2006;115(2): 89–92.

Spasmodic dysphonia is most commonly a task-specific focal dystonia related to speaking. Singer's laryngeal dystonia is a previously undescribed variant of spasmodic dysphonia that affects the singing voice. The authors report on five professional-caliber singers with this condition. Four demonstrated phonatory characteristics consistent with adductor spasmodic dysphonia in their singing voices, while one demonstrated abductor spasmodic dysphonia. Each patient initially exhibited normal connected speech in conversational voicing. One patient had developed an upper extremity dystonia; the others had no additional abnormal neurologic findings. Treatment included prolonged speech therapy, and in four patients, low-dose botulinum toxin into the thyroarytenoid muscles. All four patients reported decreased frequency and intensity of laryngeal spasms after injections. Although the injections were of benefit, even minimal chemical denervation resulted in decreased loudness and vibrato, as well as a truncated pitch range. The authors recommend that physicians who treat voice disorders be able to recognize this entity so that accurate diagnosis can be made and appropriate and timely treatment instituted.

Bernardi L, Porta C, Sleight C: Cardiovascular, cerebrovascular, and respiratory changes induced by different types of music in musicians and non-musicians: the importance of silence. *Heart* 2006:92:445–452.

The authors wished to assess the potential clinical use, especially in controlling stress, of cardiovascular and respiratory changes produced by music—specifically, tempo, rhythm, melodic structure, pause, individual preference, order of presentation, and previous musical training. Twelve practicing

musicians and 12 age-matched controls were monitored for breathing rate, ventilation, CO_2, blood pressure, midcerebral artery blood flow, and baroreflex. Presented to them in random order were six different music styles, first in a 2-minute and then a 4-minute track, with a randomly inserted 2-minute pause in either track. The styles were compared for harmonic, melodic, or rhythmic structure, and also tempo. Ventilation, blood pressure, and heart rate increased and midcerebral artery blood flow velocity and baroreflex decreased with faster tempi and simpler rhythmic structures compared with baseline. The pause reduced heart rate, blood pressure, and minute ventilation, even below baseline. Musicians had greater respiratory sensitivity to music tempo than did nonmusicians; otherwise, the two groups were essentially identical. Slow or meditative music can induce a relaxing effect which is particularly evident during a pause. The relaxation and reduced sympathetic activity may be potentially useful in the management of cardiovascular disease.

Hamilton D, Aronsen P, Løken JH, et al: Dance training intensity at 11-14 years is associated with femoral torsion in classical ballet dancers. *Br J Sports Med* 2006;40:299–303.

This study examined the influence of femoral torsion (FT) and passive hip external rotation (PHER) on dancer turnout. Sixty-four female dancers, mean age 18+ years, were questioned about starting age, years of classical ballet training, and both current and past dance training intensity. FT was measured clinically, PHER was measured with the subjects prone, and turnout while standing. Mean turnout was 136°, mean unilateral PHER was 49.4°, and mean FT was 18.4°. The authors observed a positive correlation between PHER combined (PHERC) and turnout ($p < 0.001$). A negative association was found between FT combined (FTC) and PHERC ($p < 0.001$). No association was found between starting age or years of classical ballet training and FTC, PHERC, or turnout. Dancers who trained for more than 6 hrs/wk during the 11- to 14-year age range had less FT than those who trained less. Students with current longer training had higher levels of turnout but comparable PHERC and FTC. The findings are not consistent with the conventional wisdom that starting dance training before 11 years of age is an advantage in developing the ideal turnout. Femoral torsion is significantly associated with PHERC. The data also suggest that childhood physical activity is associated with skeletal modeling; specifically, dancers aged 11 to 14 who trained for more than 6 hrs/wk had greater femoral retrotorsion. This skeletal geometry is associated with greater PHER, which may enable dancers to achieve ideal turnout using fewer compensatory strategies and consequently reducing the risk of injury.

Anticaglia JR, Sataloff RT, Hawkshaw M: What singing teachers should know about complementary, alternative, and integrative medicine. *J Singing* 2005: 62(1):45–52.

The field of complementary and alternative medicine (CAM) is vast. The challenge for the patient is to distinguish the therapies that are useful from the useless, and those that are safe from the dangerous. *Complementary* medicines are therapies used along with or in addition to conventional medicine, producing a different therapeutic effect from those achieved separately. *Alternative* medicine uses therapies in place of conventional medicine, while *integrative* medicine incorporates proven effective outcomes of conventional/alternative medicine with conventional medicine. Some singers use CAM indiscriminately, despite the known uncertainties and risks of some dietary supplements and preparations. The authors devote the rest of the article to a discussion of herbal remedies and products, concentrating first on their nature and the difficulties with obtaining quality control and product regulation. They follow with descriptions of a dozen commonly used herbal products, including both scientific and common names, uses, adverse reactions, and comments for each. Even greater depth of information is provided for kava, ginkgo biloba, echinacea, St. John's wort, and ephedra. It is recommended that singers and other voice professionals who choose CAM modalities should take herbal products for the right reasons, at the right time, and from reputable manufacturers who have standardized the formulations of their products. They also should let responsible people know what medications they are taking, and recognize that at certain times they will be at greater risk compared to others because of the use of these substances.