Musicians and Hearing Loss:

Interview with Marshall Chasin, AuD

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Douglas L. Beck, AuD, speaks with Dr. Chasin about hearing protection for musicians, spectral warping, and more.

Academy: Hi, Marshall. Thanks for your time today.

Chasin: Hi, Doug. My pleasure.

Academy: Marshall, you're one of the most published audiologists on the topics of musicians and hearing loss and I was hoping we could get an update on music, musicians, and other news along those lines?

Chasin: Okay, sounds like a plan.

Academy: I remember your first book, *Musicians and the Prevention of Hearing Loss*, published in 1996 and I know you are the editor of the brand new 14-chapter book, *Hearing Loss in Musicians*. So I was curious, from your perspective, what has changed over the ensuing 13 years?

Chasin: Well, many things have changed. One thing that strikes me is the knowledge of hearing loss among musicians and their need to protect their ears, but also the awareness of musicians and their special needs among our colleagues. When the 1996 book came out, I know the audience for my presentations on these topics was modest, and now the same or similar topics have become much more popular. So, the audience is more receptive and much larger. It took people a while to realize the differences between the more typical industrial noises and the unusual sounds professional musicians find themselves in. However, they are different sounds and the people involved have different needs and different realities.

Academy: Marshall, I've heard you compare musicians to athletes. Can you review that?

Chasin: Sure. The musician is similar to an athlete, but the musician may be thought of as a "small muscle athlete." Nonetheless, the performing artist is subject to injuries just like a football player or a construction worker. As far as their hearing, when you think about the practice time, the performance time, and the listening time, their ears often reflect the same sort of damage as might be seen with industrial noise exposure.

Academy: In some respects, the musicians are in a more difficult situation. For example, people exposed to industrial noise can often wear hearing protection devices (HPDs) successfully, which instantly reduces the sound pressure level, thus, the noise exposure is reduced and the worker can go about their day. But, the musician has to work in and produce music that is often louder than safe levels. However, when the musician wears HPDs they cannot hear the softer sounds, or the harmonics and quite often the musical overtones and the whole sound quality is thrown out of balance. Of course, there are musician's ear plugs available, and they work well, but relatively few musicians wear them and so the noise exposure often goes unchecked.

Chasin: And the issue goes beyond sound and/or noise exposure. Of course, a musician's noise exposure issues are enormous, but in addition to that, they also have problems with pitch perception and tinnitus, which can be quite disabling for a working musician.

Academy: Good point, so beyond preventing the actual hearing loss, we might also think of hearing protection in terms of preventing distorted pitch perception and tinnitus. Of course, the literature in the United States shows there are even more people with tinnitus than with hearing loss, but as many audiologists and Web sites

address tinnitus. Let's leave that for another time. Rather, if you don't mind, would you please tell me more about pitch distortion and musicians?

Chasin: Yes, this is a relatively new discussion for many of us. The issue is when we look out some 20 or 30 or even 40 years, how can we help assure the musicians, music fans, or anyone else for that matter, will still be able to enjoy the music they're playing or listening to?

In 1948, Davis studied U.S. servicemen with unilaterally damaged cochleas. He found that as he increased the frequency of the stimuli, in the bad ear, people perceived the increased pitch as an increase in loudness, not as an increase in pitch. In other words, once you have significant cochlear damage, changes in pitch perception become so bad that they be perceived as changes in loudness in the injured ear. Another example of that same sort of phenomena is observed in Pete Townsend, the guitarist from the WHO (and would be WHOM if he was Canadian). When he plays a "C" on his guitar, his perception of that same note is actually a B flat. He has said that when he plays acoustic instruments the problem is a little less, but still difficult, and as we discussed earlier, he too, has tinnitus, which is what bothers him the most.

Academy: That's striking. I certainly was aware of Pete Townsend's hearing loss, but I had no idea his pitch perception was so horribly distorted. Frankly, I cannot imagine how he can play and sing at the same time with that magnitude of "spectral warping" occurring in his ears. And that gets me to the topic of frequency compression or frequency transposition as applied in hearing aids. Has that technology offered relief to musicians or non-musicians with regard to spectral distortion or warping, or with regard to helping them perceive sounds more accurately or easily?

Chasin: I want to be really blunt here, as this comes up all the time. I know there's a lot of media coverage and articles on this topic, but I have not had one successful client/patient/musician who's been successful with regard to musicians performing or music appreciation by non-musicians. Now, having said that with regard to musicians and fans and music, I would also say frequency transposition may work just fine for people who actually have true "dead regions," but in the musicians I've worked with, it hasn't been very successful. Musicians are so highly trained and aware of sound that they're not likely to accept intentional spectral compression. It just doesn't sound right to them, and it interferes with their knowledge of what sound is supposed to be. Again, there may be other candidates for this technology, but I don't think musicians and music fans will embrace it.

Academy: Okay, and that gets me to the old issue of what to do for musicians and music lovers with hearing loss, who regularly wear hearing aids. What should they do when they perform live music or attend noisy events? When I was in clinical practice, I used to tell musicians with mild or moderate hearing loss there was no need to wear hearing aids on stage, and in fact, they really should do the opposite and wear musicians ear plugs. Is that correct?

Chasin: Yes, that's still the best advice. In fact, I like the 15 dB attenuating musician's ear plugs for all-around protection. But sure, this goes back to the old loudness growth functions of Fletcher-Munson. Most people just don't need hearing aid amplification for these louder inputs. The thing to keep in mind is that most people need to wear hearing aids i to amplify the very softest parts of speech, such as sounds that occur at 40 or 50, or maybe even 60 dB SPL. However, with live music, the sounds are essentially all louder than that, and so for most people, and for most musicians when dealing with live music, hearing aids are not necessary. So the best thing is as you said, to consider wearing hearing protection, and that's true for people with up to perhaps a 55 or 60 dB sensorineural hearing loss. Additionally, we know that hearing aids are designed to handle soft, medium, and loud speech, perhaps up to **extremely loud** such as 80 or 85 dB input. Even at these extremely loud speech levels, modern hearing aids are fine, they're made to handle that. However, music and industrial noise can easily exceed these levels, which usually saturates and overdrives the analog-to-digital convertor resulting in tremendous distortion. Once distortion is present in the input, processing cannot remove it.

Academy: The analogy I've often used is that if a photograph is taken out of focus, there's nothing that can be

done, digitally or otherwise, to "refocus" it once the shot is captured. And so we might add in that for stadium events, orchestral concerts, certainly in crowded bars with live or canned music, for the majority of people wearing hearing aids for mild and moderate hearing losses, it may be best to simply remove the hearing aids during the musical presentation.

Chasin: Yes, I agree. Of course, it is different for the musician or fan with severe or profound hearing loss, but they are the minority of hearing aid wearers, and for them, they may need amplification in music venues. For those with severe and profound hearing loss, the best thing to do is speak directly with their audiologist about their specific hearing loss and their specific hearing aids, to learn the best way to manage challenging situations!

Academy: One thing I'd like to mention about speech versus music is the recent *Hearing Review* (February 2009) that you and your colleagues assembled. Larry Revit had a fabulous illustration that showed the vast spectral differences between speech and music. Specifically, he noted that of the 88 keys on the piano, 63 of the 88 keys have fundamental frequencies below 1,000 Hz. However, we all know that to hear clearly, the most important parts of speech are all above 1,000 Hz, and more specifically around 2,700 Hz or so. Revit also noted that if one were to review the Mueller and Killion "Count the Dots" Audiogram (1990), 74 of the 100 dots are located at or above 1000 Hz, indicating that some 74 percent of intelligibility (more or less) comes from the sounds above 1,000 Hz. So there's a real dilemma here. Hearing aids are primarily designed to successfully manage the most important speech sounds which are above 1,000 Hz, and music is essentially a low frequency event… so one can see how hearing aids set primarily for soft speech sounds might not do as well with live or loud music. Fortunately, there are some newer and very clever "music" algorithms out there, and they have been successful because they treat music and speech as separate entities, and thus apply different amplification and processing strategies.

Chasin: I really enjoyed working on that Hearing Review, and thanks for mentioning it. It was titled "What Do Musicians Need to Hear" and it's got lots of information and applications.

Academy: Thanks, Marshall. It's always great chatting with you. And thanks for your time and sharing your expertise.

Chasin: My pleasure, Doug.

Marshall Chasin, AuD, is the director of research at the Musician's Clinics of Canada, the director of research for the Canadian Hearing Society, an adjunct professor of linguistics at the University of Toronto, and an associate professor in the Audiology Department of the University of Western Ontario.

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For More Information, References and Recommendations:

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