

Abstracts – MEMRO 2006, Zurich July 27–30, 2006

4th International Symposium on Middle Ear Mechanics in Research and Otology

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Ossicular motion during static pressure changes in the avian middle ear

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Purpose: To investigate the hypothesis that birds are likely to have a 'decoupling' mechanism' within the middle ear to cope with changes in static pressure.

Method: We have investigated the motion of the single ossicle found in the middle ears of four different species of birds (pheasant, *Phasianus colchicus*; gannet, *Morus basanus*; rock dove, *Columba livia* and glaucous gull, *Larus hyperboreus*) using captured video clips during changes in the pressure in the external auditory meatus between +100 and -100 dPa. The middle ear structures were examined via a posterior approach to the middle ear and the pressure was changed using a manual tympanometer (Amplaid, Italy) connected to a sealed external auditory meatus. The magnitude of the pressure changes generated was confirmed using a Testo digital pressure gauge.

Results: In the avian middle ear the off centre attachment of the extracolumella to the tympanic membrane and flexion of the joint between the extracolumella and columella results in rocking of the foot plate rather than direct excursion in and out of the vestibule.

Conclusion: We postulate that this is a protective mechanism to avoid excessive displacement of the footplate into the vestibule during changes in middle ear pressure and that it is analogous to the ossicular 'decoupling' observed in the human middle ear in the same circumstances.