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Closed, occlusion-free earmoulds? History, findings, and new research

The acoustic properties of individually manufactured earmoulds can be tailored as desired. A special focus is often placed on reducing the occlusion effect to provide users with a natural perception of their own voice. Besides using vents, which have the well-known disadvantages, this may also be achieved by a seal deep in the auditory canal, and appropriate removal of material at the outer parts, as suggested in the "Nugget" or "Black Beauty" earmoulds. However, extensive evaluation studies on such earmould designs are still missing.

In this contribution, I shall review the physical foundations of, and give a historical perspective on, closed, earmould designs that reduce occlusion. I shall also illustrate challenges and promising solutions for their practical application, and present current research findings on earmoulds where occlusion and all coupling parameters were considered. On this basis, one can discuss whether "occlusion-free" earmoulds actually minimise the occlusion effect without introducing other disadvantages that are usually associated with opening the auditory canal.