Transducer Attachment For Direct Drive Bone Conduction Devices

Cristina Rigato
Chalmers University of Technology, Gothenburg, Sweden
Sahlgrenska University Hospital, Gothenburg, Sweden

Objectives: In the context of direct drive bone conduction devices (BCDs), the main objective of this study is to determine whether the way a transducer is attached to the skull bone affects the transmission of vibrations to the cochlea, and hence impacting the quality of the rehabilitation given by the device.

Background: BCDs are successfully used to rehabilitate specific groups of patients. Recent development trends are moving towards so-called active transcutaneous BCDs, where the transducer is implanted directly on the skull bone and the external audio-processor unit is magnetically retained over intact skin. At the moment, only one such device is commercialized in Europe and Canada, while none is available on the USA market yet. However, solutions are expected to be introduced to the market within a few years. Concerning direct stimulation of the skull bone, one aspect that has not been much investigated yet is how the attachment to the bone is influencing the vibration transmission efficiency.

Methods: Three transducer-to-bone attachments are tested on eight human head sides: (A) a flat small-sized surface, (B) a flat wide surface, and (C) two separated screws. The utilized stimulation is a swept sine 0.1-10 kHz. The response is evaluated in terms of cochlear promontory acceleration and ear canal sound pressure level.

Results: Slightly higher transmission is achieved with attachment A compared to B especially at frequencies above 1 kHz. Attachment C shows increased performance in the high frequencies range (5-7 kHz), while variation is seen at low- and mid-frequencies. High inter-subject variability is seen in all the measurements.

Conclusions: When considering the whole frequency range, average results from the different attachment techniques are comparable, although local differences are seen mainly in the high frequency region, indicating advantages for smaller surfaces and screw attachments.