Bone density-based selection of optimal implantation sites for bone conduction implants.

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Objectives

When implanted in regions of denser bone, the transmission of mechanical vibration generated by bone conduction (BC) hearing implants is expected to be optimized. This study aims to validate a thickness and density-based column density index.

Materials and Methods

Quantitative CT imaging was performed in five Thiel-fixed whole head cadaver specimens. Topographic bone density maps were computed using the column density index (CODI) [1]. On every temporal bone, multiple locations characterized by different values of CODI were identified (Fig.1) and prepared to host the bone anchored hearing aid (BAHA 110 Power™, Cochlear, Australia). The 3D distance between every implantation site and the cochlear promontory (CP) was measured.

Laser Doppler vibrometry was used to measure the velocity of the cochlear promontory under bone conduction stimulation with a transducer from a bone anchored hearing aid between 100 Hz and 10kHz (Fig.2). An artificial mastoid was used to measure the output force level (OFL) of the implant’s transducer in order to normalize measured CP acceleration levels.

Results

Our obtained LDV measures were consistent with the literature [2]. The increase in normalized CP acceleration was of 0.82 dB re 1 m/s² N for every single increment of CODI. A significant relation between the CODI and the normalized CP acceleration was found all over the frequency spectrum.

Conclusions

Bone regions with higher CODI are ideal for the placement of BC implants, in order to guarantee a better transmission of mechanical vibrations to the inner ear.

References