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An optical coherence tomography study for imaging the round window niche and the promontorium tympani

Tino Just*, Eva Lankeu, Gereon Hüttmann, Hans Pau

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Tympanosclerosis may involve the tympanic membrane, the ossicles, as well as the oval and round window niche, respectively. The surgical treatment of the obliterated oval window niche is most challenging. Beside stapesplasty, vibroplasty with coupling the floating mass transducer (FMT) onto the round window niche and into a new, so-called third window is indicated. In the latter situation, drilling a hole into the promontorium is necessary to couple the FMT close to the membranous endosteum. Any damage of the membranous inner ear needs to be avoided. The question was whether OCT is useful to identify the endosteum and to provide microanatomical information about the round window niche. OCT was carried out on human temporal bone preparations in which a third window was drilled, while leaving the membranous labyrinth and the fluid-filled inner ear intact and removing the overhang of the round window niche. A specially equipped operating microscope with integrated OCT prototype (spectral-domain-OCT) was used. The OCT images and 3D reconstructions demonstrate the usefulness of OCT to measure the drilling cavity, to visualize the inner ear structures, and to obtain microanatomical information about the round and oval window niche. These findings may have an impact on stapes surgery, on cochlea implantation, and on vibroplasty with coupling the FMT onto the round and third window. OCT-guided drilling allows identification of the intact inner ear more precisely.

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