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Partial ossicular reconstruction – experimental and clinical comparison of three different prostheses

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Closure of the tympanic membrane and reconstruction of the ossicular chain to restore patients hearing are the main issues of tympanoplasty. Depending on the intra-operative findings the extent of ossicular damage requires a partial or total ossicular reconstruction. Focusing on the case of a functionally intact stapes and interrupted long incus process we used three different methods for partial reconstruction aiming to determine a superior method for acoustic ossicular-prosthesis coupling: (a) Incus-interposition, (b) titanium clip-prosthesis and, in contrast to the stapes elevation techniques, (c) bridging a defect between the long incus process and the stapes by an angle-prosthesis. Measurements on 18 temporal bone specimen (n= 6 per group), prepared according to the mentioned defect and reconstructed respectively, were compared with the post-operative audiological outcome of 50 patients with matching middle ear pathology. LDV measurements were performed on the stapes footplate with an intact cochlear and normal air-conduction stimulation (96 dB). Pre- and post-operative audiograms were used to assess the development of the air-bone gap; middle ear aeration was determined by valsava´s maneuver and tympanometry. In the experimental setting no significant differences in sound transmission were observed between the groups. A tendency to an inferior transmission in lower frequencies was detected using an angle-prosthesis. Generally, when compared with equal clinical settings in patients who underwent middle ear surgery, the reconstructed middle ear in vivo lags behind the experimental setup in vitro. None of the used prostheses for ossicular chain reconstruction was superior to another in the experimental setting, if the prosthesis was inserted without any prestress or angulation, indicating nearly similar prosthetic-coupling properties of sound conduction. Experimental and clinical results do not generally favour the use of one specific prosthesis in the characterised setting, rather than suggesting the correct choice of a prosthesis upon the anatomically and patho-physiologically conditions found in the individual patient.