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Development of a new clip-piston prosthesis for the stapes

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Inserting 275 Clip-Pistons type "a`Wengen" within three years have revealed difficulties in about 15 % of the cases. In that case it was necessary to deform the clip plastically before insertion due to the different dimension of the long process of incus. During more than 100 middle ear surgeries in the region where the clip is attached the cross section of the long process of incus was measured. This led to data which have not been known before. By virtue of a Finite Element model these data could be used for optimization of the form of clip. Design criteria were a minimal variation of the contact force for different cross sections and a minimal force to sliding on the clip over the incus process. The new clip design has a lower stiffness and therefore it is applicable for different diameters of incus process. The lower contact force reduces the risk of arrosion. Due to its optimized shape, the maximal stress in the clip is lowered which prevent a plastic deformation during insertion. The force to slip on the clip could be decreased by one third. This leads to an easy and safe application reducing the risk of damaging the ossicular chain like luxations of incus-stapes joint.