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THE EFFICIENCY OF NITINOL/PTFE PISTON OUR EXPERIENCE

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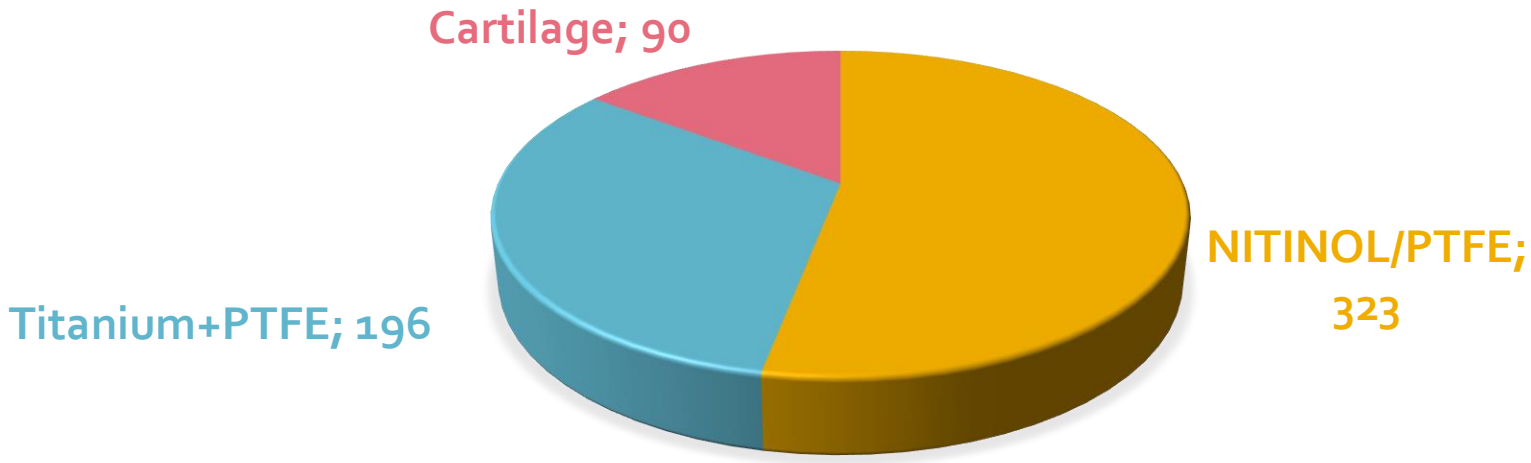
Aim

To analyze the effectiveness of stapedoplasty with self-crimping superelastic NITINOL/PTFE (polytetraflorethylene) piston-prosthesis.

Materials and methods

435 patients (609 ears) with otosclerosis, who underwent stapedoplasty from 2015 to date were included in this study.

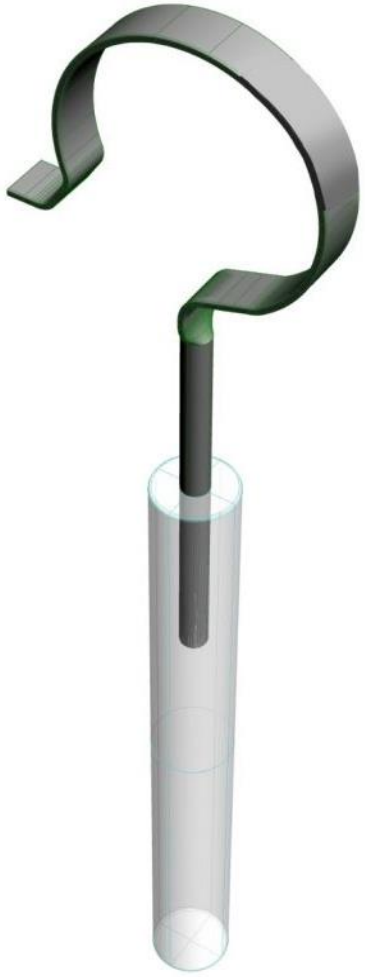
We used piston-prosthesis in 519 cases (self-crimping superelastic NITINOL/PTFE piston in 323 cases, Titanium+PTFE piston in 196 cases). Piston-type stapedoplasty was performed in cases of simple non-complicated forms of otosclerosis without incomplete dislocation of incus, facial nerve overhang, obliteration of oval window and cochlea.



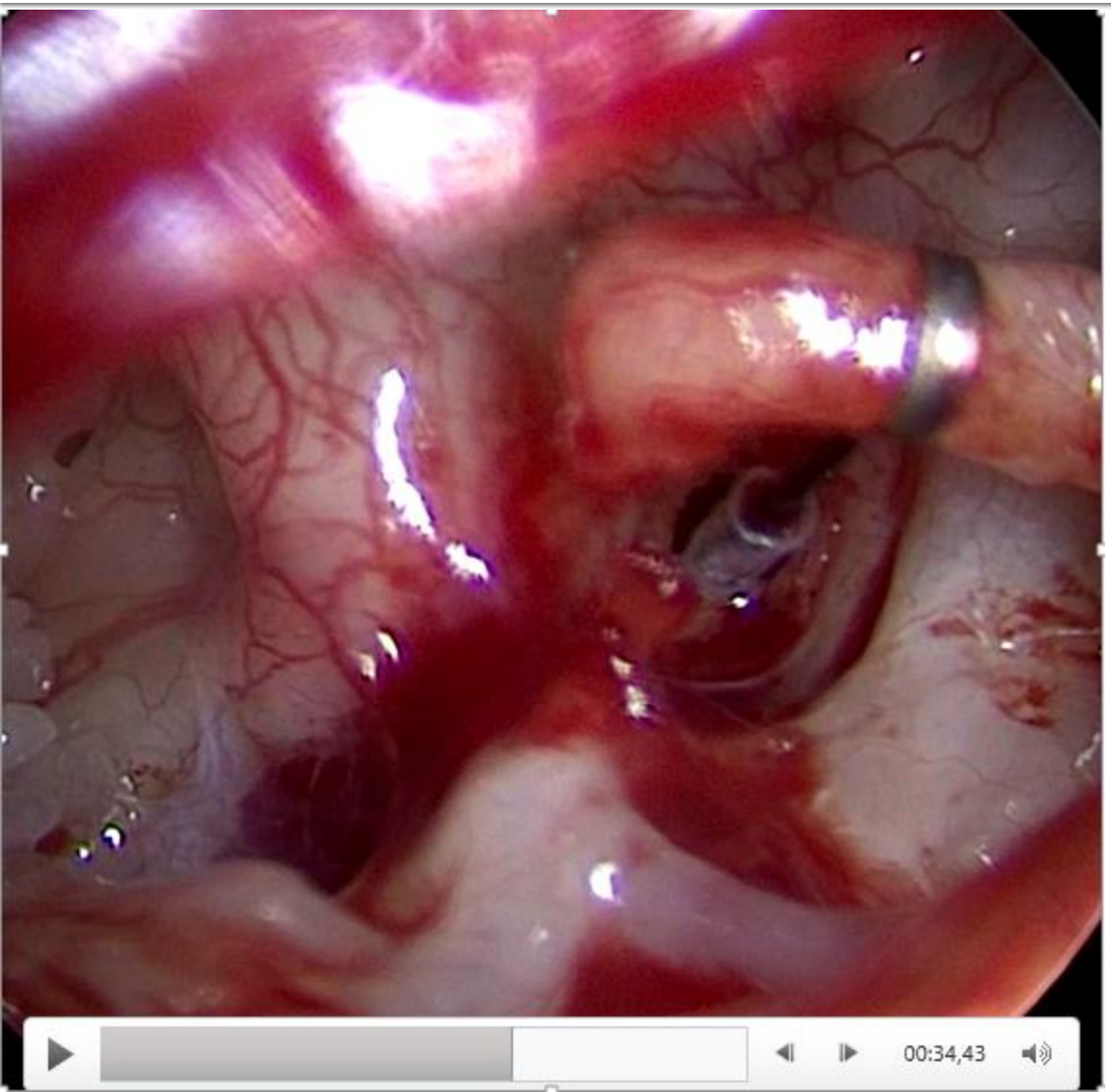
Background

NITINOL is a Nickel (Ni) and Titanium (Ti) alloy accidentally discovered by two American researchers at the Naval Ordinance Laboratory (NOL) who called it NiTiNOL, which is the acronym of Nickel (Ni) Titanium (Ti) and the laboratory where it was discovered. The microscopic structure of this alloy presents a distinctive molecular reticule which can work
in two ways:

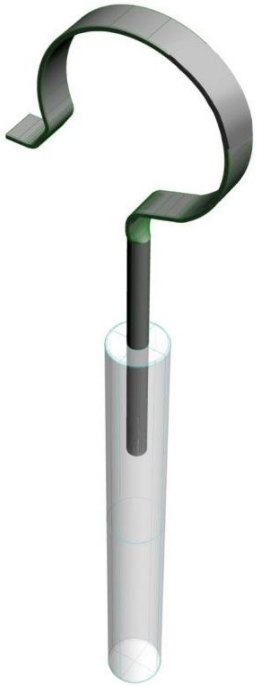
- the molecular reticule shapes in two different ways depending on the temperature THERMAL MEMORY NITINOL: cold worked Nitinol can be deformed but it returns to its original shape if is subjected to heat.
- The molecular reticule always maintains the same shape and it never deforms.



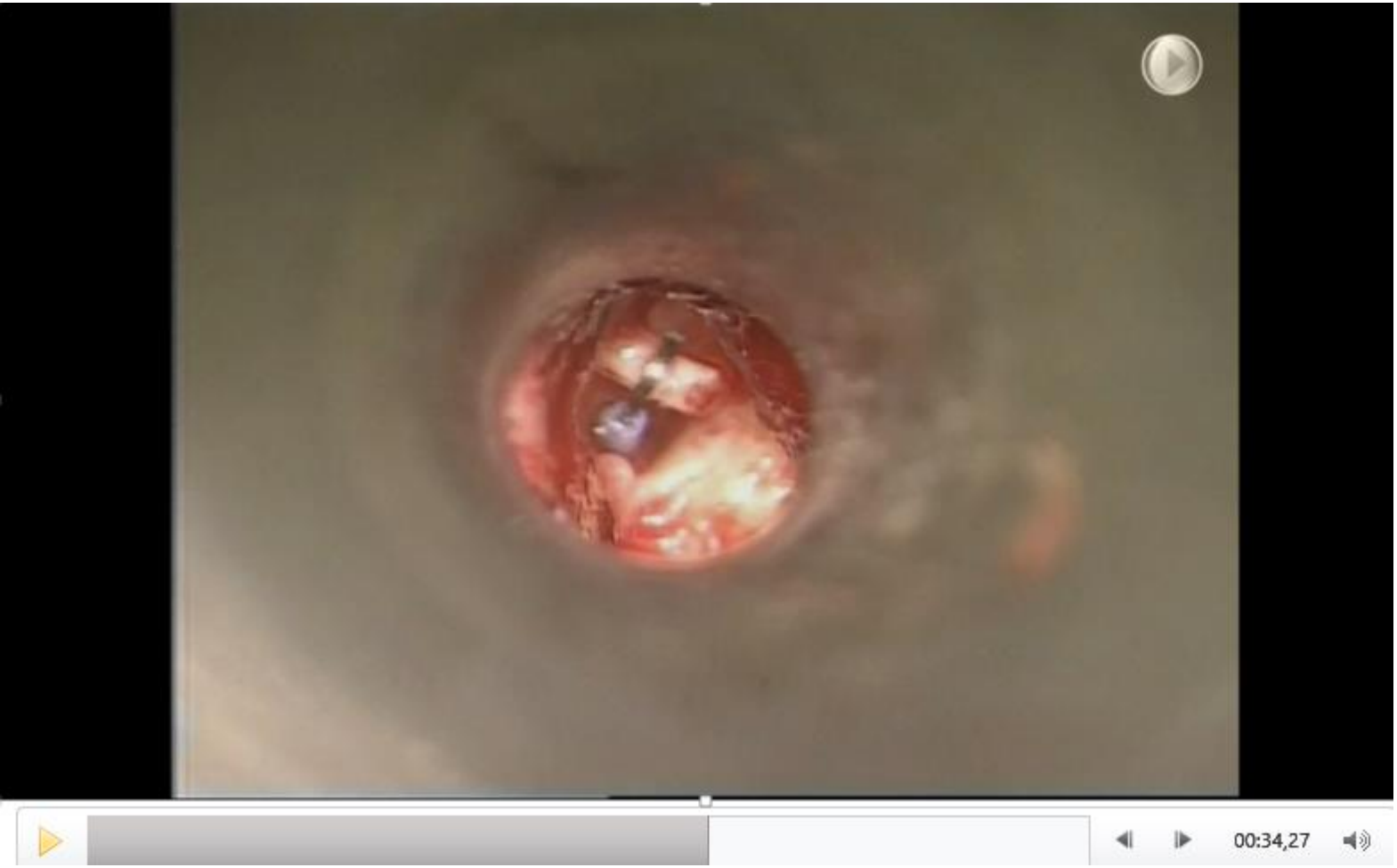
Transcanal endoscopic stapes surgery

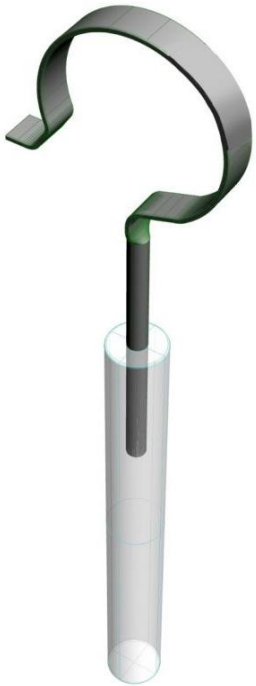


Stapes surgery with self-crimping superelastic NITINOL/Polytetraflorethylene piston-prosthesis

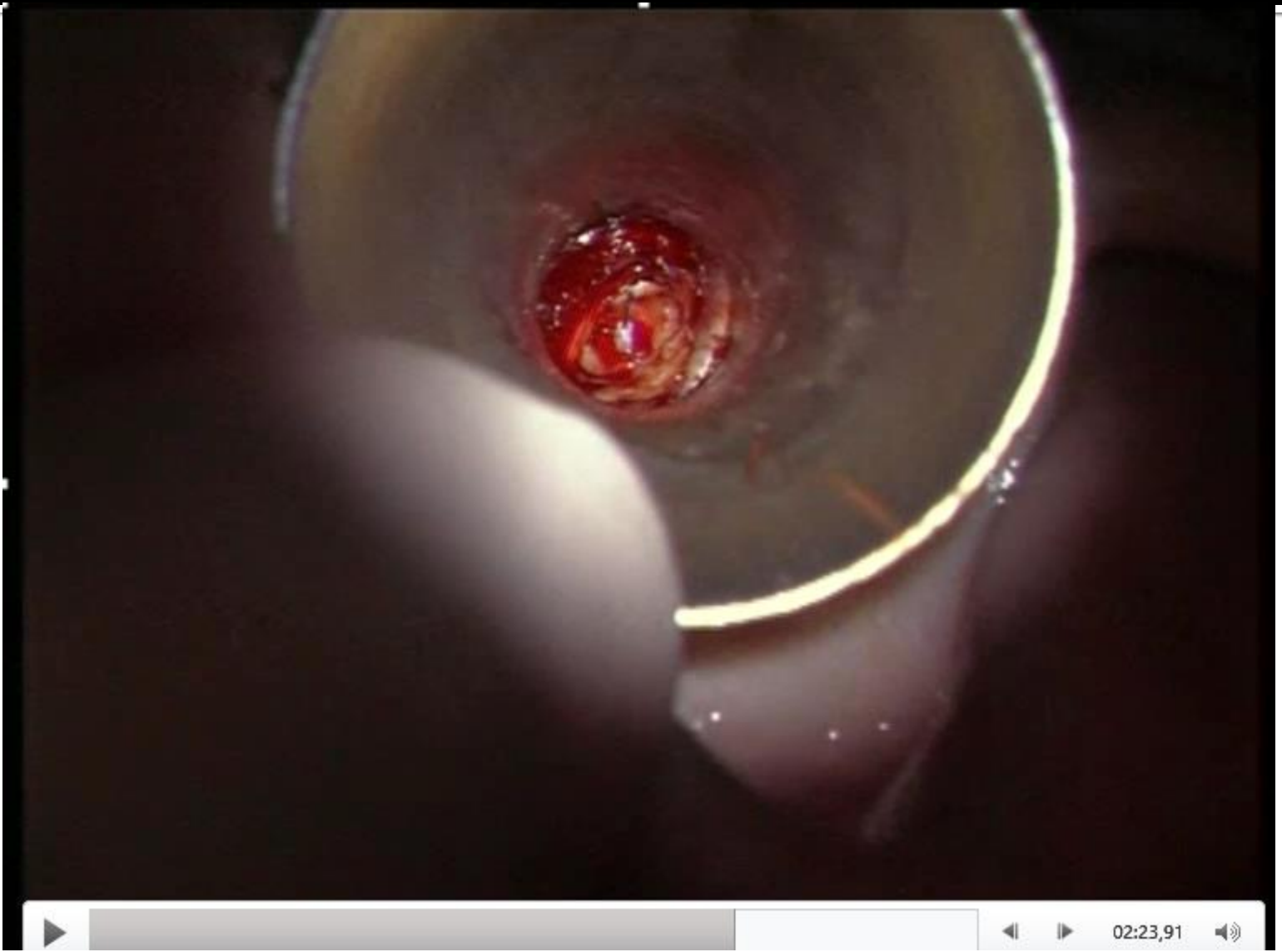


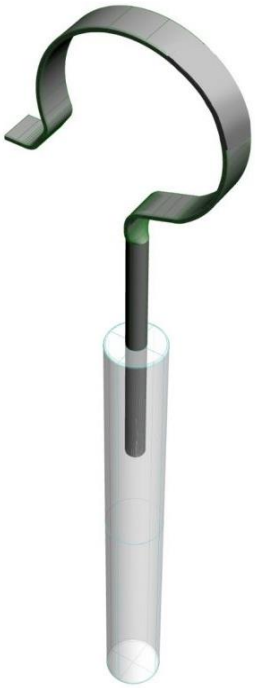
Stapes surgery with piston-prosthesis





Stapes surgery with piston-prosthesis





Stapes surgery with piston-prosthesis. Heermann's approach

Materials and methods

In cases when patient had certain anatomical features (dehiscence and overhand of facial nerve, obliteration of oval window, obvious perilymph leakage), in cases of revision surgeries (aseptic necrosis of long incus process) or in cases of unintentional mobilization of stapes foot we practiced to use methodology created in the Russian Federation – that is stapedectomy with stapedoplasty using “auto-cartilage on vein” placement. Oval window after stapedectomy is covered with auto-vein sized 3*5 mm and is pressed by auto-cartilage prosthesis, fixed under lenticular incus process, or under the malleus (malleuvestibulopexia).

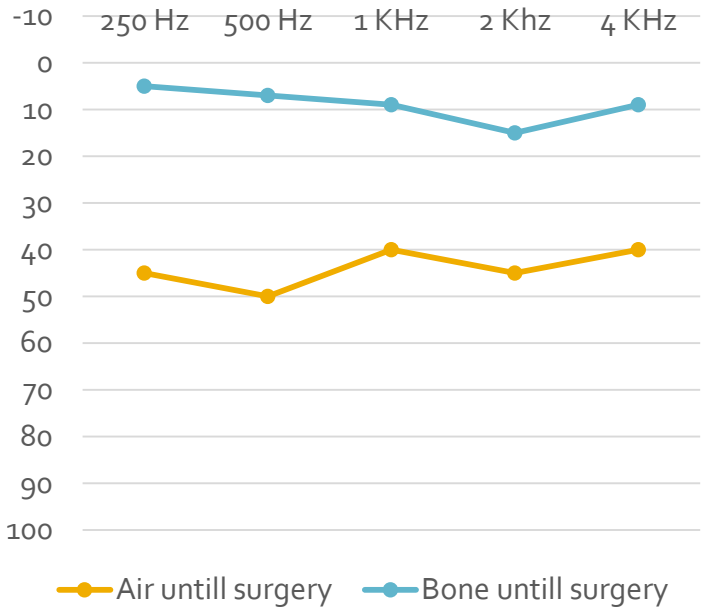
Stapes surgery with cartilage

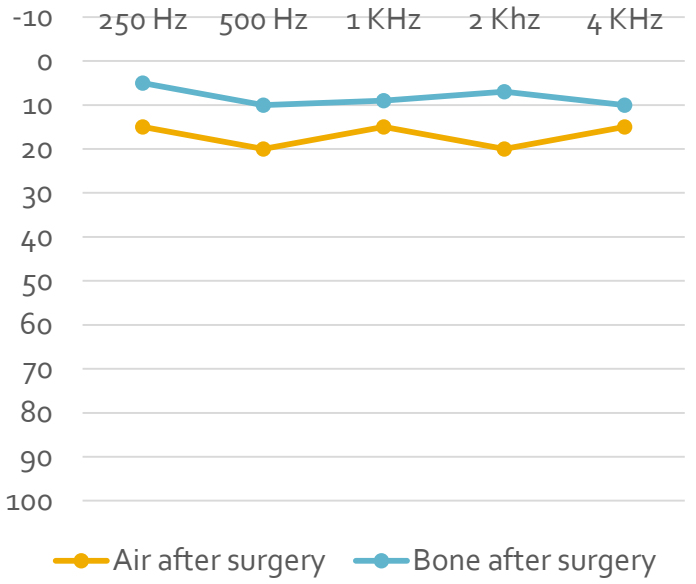
cartilage

Results

The average air conduction was 45,5±5,6 dB before surgery and significantly decreased to 15,0±3.2 dB at 6 months postoperatively in patients who underwent stapedoplasty using a self-crimping superelastic NITINOL/PTFE piston-prosthesis (n=323). In 10 cases, the piston in Titanium was use due to thick long incus process. Analysis of the functional results showed a statistically significant ($p < 0.05$) decrease air-bone gap to 10,2 ± 2.3 dB (before operation 35,2 dB) in patients who underwent stapedoplasty using methodology of “auto-cartilage-on-vein” placement. Displacement of piston prostheses were not observed during research study.

Results. Stapes surgery using NITINOL/PTFE piston-prosthesis





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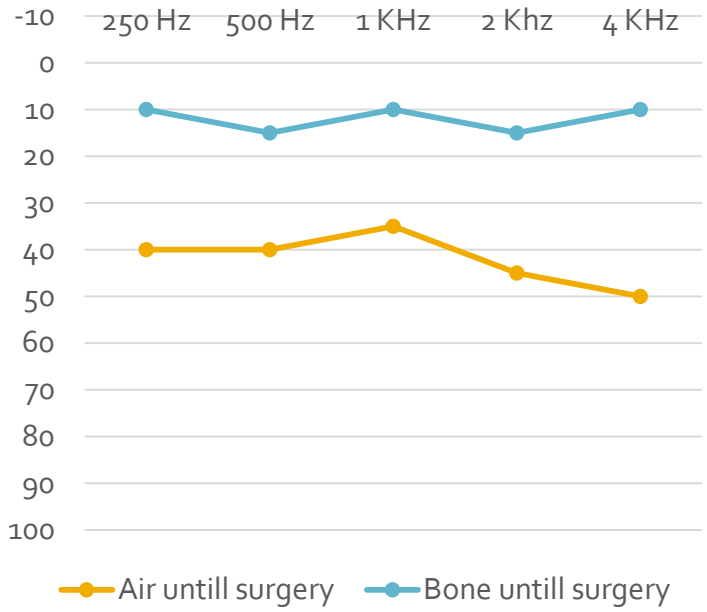
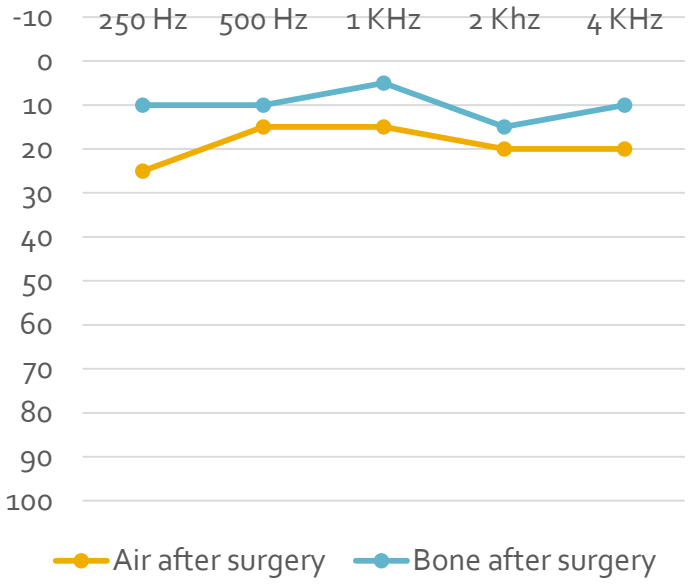
Results. Stapes surgery using cartilage

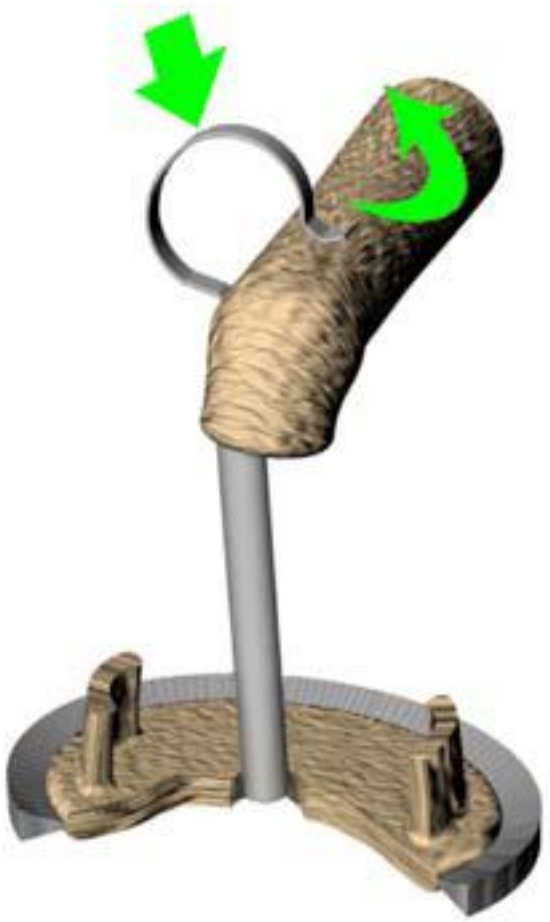




Analysis of the functional results showed a statistically significant ($p < 0.05$) decrease air-bone gap to 10,2 ± 2.3 dB (before operation 35,2 dB) in patients who underwent stapedoplasty using methodology of “auto-cartilage-on-vein” placement (n = 90).

Discussion and conclusion

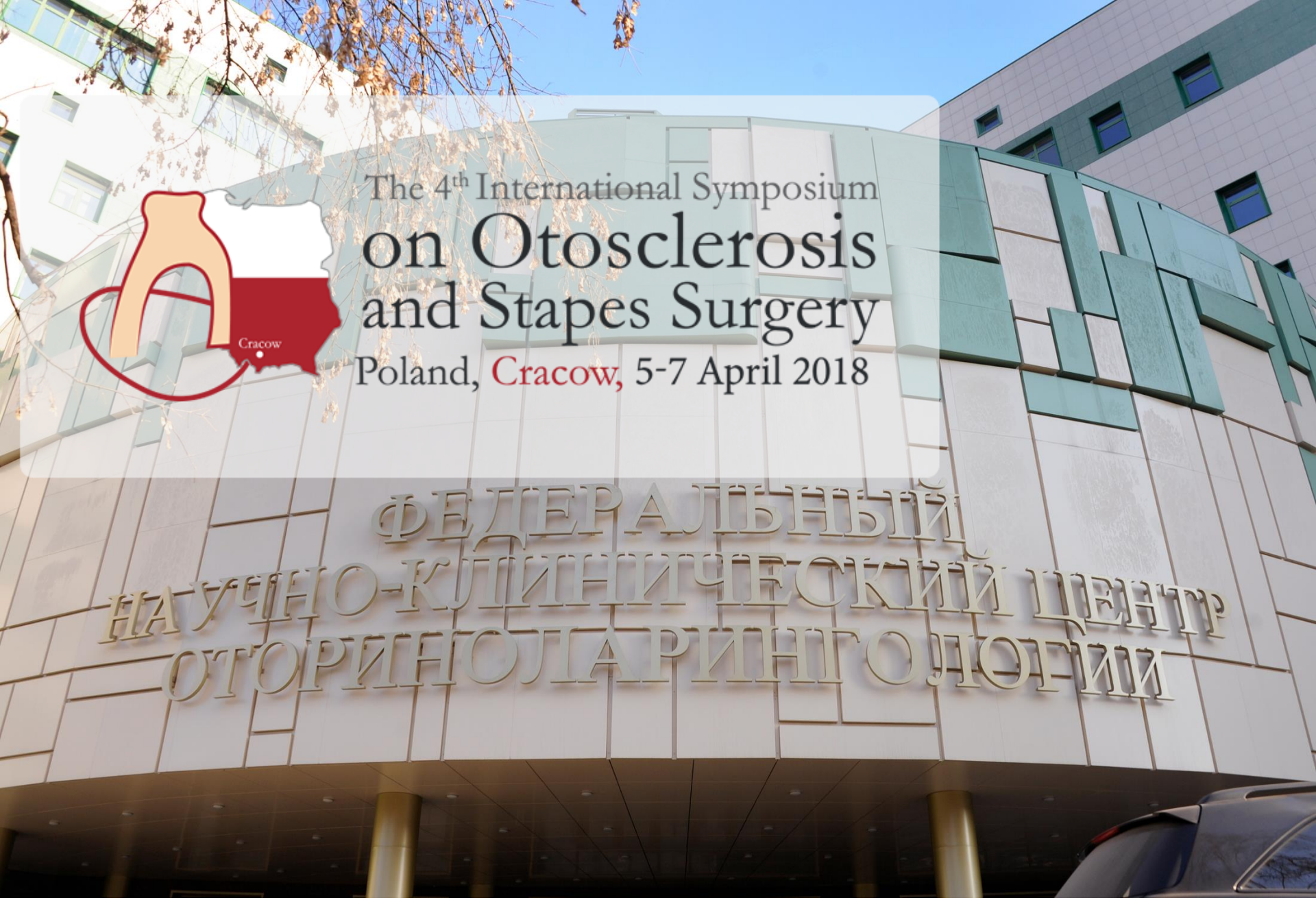
Usage of superelastic NITINOL/PTFE piston-prosthesis helps to decrease duration of surgical procedure and consequently impact on inner ear's structures. The hook elasticity reduces the surgery steps and the difficulties that may occur during the closing phase. The hook closes softly, uniformly wrapping the pressure along the total periphery of the long incus process, and minimize the risk of compressive necrosis.



Discussion and conclusion

Positive aspect of stapedoplasty using methodology “auto-cartilage on vein” placement is possibility to shape auto-cartilage prosthesis (creation of auto-cartilage with a certain angle position) that helps to go round overhang of facial nerve, saving the pressure on it.

Observation and analysis of surgeries showed high effectiveness of mentioned treatment methods, that allows ENT surgeon to have certain algorithm of his activities in situation of any difficulty.



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