

OTOIMPLANT - A NEW MIDDLE EAR PROSTHESIS AS AN ALTERNATIVE MEDICAL DEVICE IN OPERATIVE TREATMENT OF HEARING

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Introduction

The most common origins leading to the destruction of the continuity of ossicles chain connection are chronic inflammations and mechanical injuries [1]. Damage of ossicles continuity cause consequences that are manifested by conductive hearing loss. Partially or completely destroyed conductive apparatus of the middle ear requires surgical treatment using tympanoplastic techniques of chain reconstruction using grafts or adjustment and implantation of alloplastic implants [2]. New construction and material possibilities allow design and production of prostheses not only in various sizes and shapes, but also differentiated in terms of alloplastic materials, such as metals, ceramics, plastics or composites. Auditory ossicle prostheses are used to transmit sound or a sound signal from the tympanic membrane to the inner ear when the ossicles of the human middle ear are entirely or partially absent or damaged [3].

The use of new middle ear implants with bactericidal and bioactive properties may not only restore continuous bone structures and restore lost functions, but also may reduce recovery periods and risk associated with complications in the course of infection and bacterial infections.

Materials and Methods

Otoimplant - is an alternative to existing solutions offered on the market. It is made of a composite on a matrix of biostable medical polymer and silver nanoparticles. antibacterial and lightweight may be treated as innovative aspects of developed prosthesis. Implants made of polymer and silver nanoparticle-modified composite after the *in vitro* phase have been implanted in the buttock muscle of Wistar rats. After 30, 90 and 180 days, histochemical and histoenzymatic tissue specimens were evaluated. The last step was a clinical trial involving implantation of a prosthesis into the middle ear space of a patient suffering from hearing loss due to partial destruction of the auditory ossicles.

Results and Discussion

The *in vitro* studies indicate high antimicrobial efficacy of Gram-positive and Gram-negative bacteria. The *in vivo* studies have confirmed the biocompatibility of implants in the tissue environment. After 90 days of implantation, there is a decreasing granulation area showing the inflammatory process, and emerging regenerative muscle fibers. On the 6th of April 2017 the first pioneering operation of otoimplant implantation was performed during clinical trials at the University Hospital in Cracow. This operation has confirmed the effectiveness of the implant.

Conclusions

The surgical procedure of inserting the otoimplant into the middle ear spaces and the postoperative period run without complications. Patient reported subjective improvement in hearing.

Prosthesis designed for the reconstruction fitted perfectly and allowed precise implantation.

Proposed implant might be successfully used in present surgery. The first operation confirmed the effectiveness of the implant. Positive results of committed research will allow wide group of patients to get access to modern medical product. Cheaper, more accessible implants with bactericidal properties will support antibiotic treatment. Developed prosthesis will act like a barrier protecting from reoccurring illness and inflammation what will shorten necessary hospitalization and accelerate convalescence.

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