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**OCENA ZASTOSOWANIA AKTYWNYCH IMPLANTÓW
NA PRZEWODNICTWO KOSTNE W KOMPENSACJI
NIEDOSŁUCHU PRZEWODZENIOWEGO I MIESZANEGO**

SUMMARY

The dynamically progressive development of new medical technologies currently provides the potential for increasingly more effective prostheses for patients suffering from different types of hearing loss. For those with conductive and mixed hearing loss, application of the different types of prosthesis using bone conduction of sound either do not require surgical intervention or are partially implantable. The stimulation of the auditory system by bone conduction using implantable bone conduction systems has been practised from the end of the 1970s. For this purpose, osteointegrating titanium elements are implanted in the mastoid bone, permitting the delivery of vibrations from the externally worn audio processor, which converts the vibration derived acoustic signal, across the abutment, direct to the hearing receptor (the BAHA system - Bone Anchored Hearing Aids). Devices of this type, still used today, provide satisfactory hearing benefits, but present the risk of dermatological complications. Beginning in 2012, practical clinical use of active bone conduction implants have been used: the Bonebridge system. The first operation to implant this system in Poland took place in the World Hearing Center of the Institute of Physiology and Pathology of Hearing. The appliance is characterized by its different construction and by its method of transferring the signal to the implanted element, which, due to the absence of direct contact between external and internal parts, permits a significant reduction of the risk of dermatological complications, whilst providing good auditory results. This solution is dedicated to patients suffering from conductive and mixed hearing loss and single-sided deafness.

The main objective of the research, as described in individual articles, was the evaluation of auditory benefits and confirmation of the safety of the application of the Bonebridge bone conduction implant on patients with conduction and mixed hearing loss.

Carried out evaluations particularly concerned:

1. Sound detection (hearing benefits)
2. Speech discrimination (hearing benefits)
3. The quality of life related to health (hearing benefits)
4. Sensitivities of hearing for bone conduction (safety of applying the implant)
5. Complications and undesirable side-effects (safety of applying the implant)

The series of publications together describe a group of 34 patients supplied with the Bonebridge implant. The group is constituted of patients with diagnosed hearing loss of the conduction and mixed types in the ear selected for the operation, who were implanted with the Bonebridge system in the World Hearing Center of the Institute of Physiology and Pathology of Hearing during the years 2012 – 2016.

Within the framework of evaluating the effectiveness and confirmation of the safety of the application of the Bonebridge system, assessment was made in a free-field evaluate the ability to detect signals and to discriminate speech through use of the implant, to evaluate by questionnaire the efficiency of the system (using the APHAB questionnaire), to evaluate the preservation of hearing through bone conduction by pure-tone audiometry before and after treatment, and also analysing the medical records of patients from the point of view of the occurrence of complications and undesirable side-effects.

Analysis of the results obtained indicates statistically valid improvement in the areas of ability to detect signals and in the discrimination of speech in silence and in noise, in both cases compared to the base reference established in similar tests carried out before the treatment and with the implant switched off. Analysis of the evaluation questionnaire confirm perceptible benefits in auditory performance in different acoustic conditions through the use of the Bonebridge implant, which correspond with the hearing benefits shown through the results from the audiological research that was carried out. Notable was the lack of substantial differences in the magnitudes of hearing thresholds by way of bone conduction pre- and post-operatively and the lack of serious undesirable side-effects, which confirms the safety of the procedure that was undertaken. Assessments undertaken over timed intervals obtained stable results.

On the basis of the work carried out and the results obtained one can formulate the following conclusions:

1. The analysis of findings carried out in a free-field confirms significant hearing benefits from the Bonebridge implant system for people with bone conduction and mixed hearing loss, both in improving detection of sounds, and speech discrimination both in silent and noisy conditions.

2. Findings from the questionnaire indicate improvement in the quality of health-related life with use of the Bonebridge implant, both for children and adults.

3. Throughout the period of the analysis, the Bonebridge system showed itself to be a safe tool in compensating for bone conduction and mixed hearing loss.

4. Under suitable anatomical conditions the Bonebridge implant can constitute a safe alternative for other generally applied systems using bone conduction of sound. Difficult anatomical conditions, requiring modification of the surgical procedure, need not limit the hearing benefits after implantation of the device.