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A middle ear implant with a titanium canal wall prosthesis for a case of an open mastoid cavity

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Abstract

Objective: Open mastoid cavity rehabilitation should focus on both anatomical and functional aspects. We hereby report the technique and results of a combined strategy to reconstruct the external ear canal using a titanium wall implant and the middle ear using a fully implantable active middle ear device.
Methods: A fully implantable active middle ear implant was used to rehabilitate the mixed hearing loss of a 63-year-old woman, and a titanium posterior canal wall prosthesis was used to reconstruct the external ear canal during the same procedure. The middle ear implant was placed directly on the footplate. The auditory results were compared to the preoperative unaided thresholds and to the amplification of a conventional hearing aid.
Results: Following the procedure, there was an anatomically normal external ear canal with a healed tympanic membrane separating the external from the middle ear spaces. The postoperative auditory gains were on average 31.8 dB on pure-tone audiometry, and 20 dB on speech reception threshold. No complications occurred.
Conclusion: The rehabilitation of the external ear canal in an open mastoid cavity allows for clinical follow-up of the patient, and the implantation of an active middle ear implant provides appropriate auditory gains both in pure tones and in speech reception thresholds.

Keywords: Middle ear implant; Open cavity; Rehabilitation; Mixed hearing loss; Fully implantable hearing aid

1. Introduction

Canal wall down (CWD) mastoidectomy was common at the beginning of the 20th century and is still being performed nowadays in many centers. The bony posterior ear canal wall is removed in order to exteriorize the middle ear and mastoid cavities. Despite several modifications to this technique, many patients continue to have troublesome problems (chronic otorrhea, vertigo). For many years, we have developed a strategy of rehabilitation of open mastoid cavities which aimed to treat these problems and prevent long-lasting damage induced by the persisting inflammatory skin lying on the semicircular canals, Fallopian canal and tegmen tympani [1,2]. Results are usually good regarding the otorrhea and the quality of life, but the auditory results are less rewarding. Active middle ear implants (AMEI) have been recently used for the rehabilitation of conductive and mixed hearing loss. We hereby present our experience of using a middle ear implant in the setting of an open mastoid cavity to treat the mixed hearing loss concurrently with the reconstruction of the ear canal. This is, to our knowledge, the first case of combined rehabilitation of the external ear canal and of the middle ear.

2. Clinical case

2.1. Patient's consent

A 63-year-old woman was referred to our department for management of chronic right-sided otorrhea. She also

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complained of intermittent vertigo. The right ear had been operated on three times and the left ear five times since childhood for bilateral cholesteatoma (Fig. 1). The patient had bilateral hearing aids, with insufficient gain on the right (see Fig. 2). Her primary concern was to be relieved from the otorrhea and vertigo and, second, to improve her hearing on the right. Physical examination revealed an anatomically normal left ear canal with lateralization of the drum and, on the right, a CWD mastoid cavity with keratin debris and lateralization of the tympanic membrane. Audiometry revealed a bilateral mixed hearing loss. Computed tomography (CT) scan and non-echo planar imaging diffusion weighted magnetic resonance imaging (MRI) ruled out the possibility of a cholesteatoma or a retrocochlear mass. The patient declined any new attempt at ossiculoplasty on the left or on the right side, considering her multiple previous unsuccessful surgeries. We then proposed rehabilitation of the open cavity in conjunction with implanting a hearing aid (either a BAHA™ (Cochlear, Australia) or an AMEI). She declined a BAHA fitting because she feared having a transcutaneous abutment with its associated risk of skin infections. We informed her about the different semi- or fully implantable types of available middle ear implants: Vibrant Soundbridge (Medel, Austria), and MET and Carina™ (Otologics, USA). After obtaining her consent, we finally decided to proceed with the auditory rehabilitation using the fully implantable Carina implant concurrently with the canal rehabilitation. This would avoid the need for

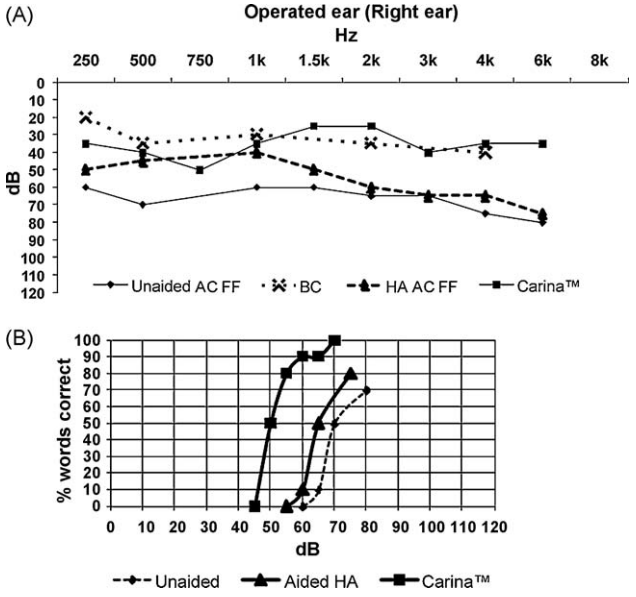

Fig. 2. Functional results on the operated ear (right). Auditory findings pre and postoperatively, in pure tones and using disyllabic words recognition scores. All thresholds were obtained in free field except for the bone conduction. *Unaided AC FF*: hearing thresholds in air conduction in free field (with masking of the contralateral ear); *BC*: bone conduction thresholds; *HA AC FF*: hearing thresholds in air conduction in free-field condition with the conventional hearing aid; Carina™: hearing thresholds in air conduction in free field with the implant activated.

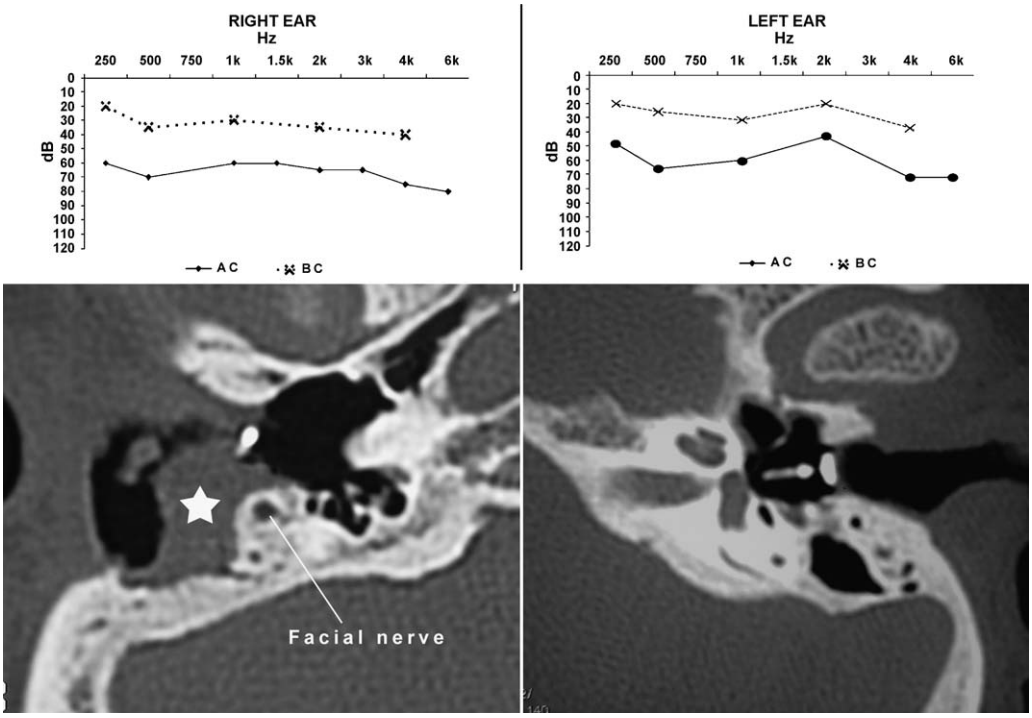

Fig. 1. Preoperative auditory and axial CT scan findings of both ears. Both ears present with mixed hearing loss. On the right side, open mastoid cavity with squamous debris (*) and well aerated middle ear space. On the left, lateralization of the tympanic membrane with lateralization of the type III ossicular prosthesis. *AC*: hearing thresholds in air conduction; *BC*: bone conduction thresholds.