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Benefits of objective measures in cochlear implants

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Cochlear implants represent today an important and widespread reality and for this reason the objectives tools used to evaluate CI recipients should be a routine service in the clinical field.
In this communication we will not consider morphological tests like CT scan or MRI.
To understand and to correctly analyse the results of audiological objective measures one should keep in mind that the CI is an artificial cochlea and the electrical potentials must therefore be classified by the different stations of the auditory pathways.
The objectives measures of the natural cochlea are acoustic otoemissions and cochlear microphonics and such tools are useful but not an essential prerequisite, because information about the receptor may be inferred from other tests.
In an implantee instead, checking the functionality of the device is fundamental because any failure, even a soft one, may alter the response of the higher stations of the auditory pathway.
The three tests to used to check CI functionality are impedance telemetry, A.E.V. (Averaged Electrical Voltages) and Objective Microphone Evaluation (OME). All three tests are crucial to obtain an overall evaluation because they complete one another.
The second station is the acoustic nerve, which can be evaluated acoustically by means of ElectroCOchleoGraphy (ECOhG), and the electric equivalent is the ECAP (Electrical Compound Auditory Potential).
Upwards along the pathway, the potential that can be recorded are the brainstem response (ABR acoustically and EABR electrically), the Middle and Cortical responses.
For many aspects the acoustically and the electrical responses are similar, but some differences are to be mentioned, like the possibility to elicit the electrical brainstem response stimulating all the electrodes and not only the basal turn ones.
The main drawback in evaluating the retrocochlear pathway through a cochlear implant is the presence of an important electrical artifact and that's why a for that particular strategy is needed to improve the SNR of the response, because common tools like the averaging are not sufficient.
Therefore a complete evaluation of the auditory apparatus even for an implantee is today possible.
By means of audiological objectives measures we can:
• identify the system failures and their influence on the hearing performances;
• identify a new pathology that can affect the patient after implantation;
• obtain an objective fitting of the device;
• study the maturation of the auditory apparatus as a consequence of electrical stimulation;
• analyze clinical results.