

Acoustical signal check: microphone integrity evaluation through a common hearing aid analyzer

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The integrity test of cochlear implants involves both internal and external components.

The protocol adopted in the Audiology Unit in Varese consists of a series of electrophysiological and radiological procedures aiming at checking the position and functionality of the internal system. Assessing the integrity of external components is also important, since soft failures may reduce hearing performances, to some extent.

The external components to be checked include processors, coils, cables and microphones. The tools available in Nucleus systems are the coil check device, the cable and coil box, the special earphone for monitoring the acoustical input.

Occasionally a breakdown in some external components of the hardware may occur; sometimes the failure is easily identified, for example when a damage to cables, coils or processor casing is clearly visible, or if the recipient itself reports unusual noises, sudden drops in loudness or abrupt sound interruptions.

More often, understanding the problem can be rather challenging, particularly with children, because it may arise slowly as a progressive decrease in microphone sensitivity, which is neither detected by the patient nor by parents when doing routine acoustic checking through the earphones.

Considering this experience, an objective test of microphone sensitivity was implemented inside the integrity protocol. Frequency response and maximum output curves of the microphone are recorded in a hearing aid analyzer, through the comparison with a reference one. The connection between the speech processor and hearing analyzer is obtained through the acoustical monitor earphones of the processor, modified for Sprint and Esprit 3G, and unmodified with Freedom devices.

The clinical relevance of this procedure was confirmed during the year 2006, when 59 soft microphone failures were identified out of 305 external failures (about 20 %). In order to quantify the impact of soft microphone failures on speech performances, the degree of microphone sensitivity loss was compared with the decrease in recognition scores in 32 soft failures.

The results show that there is a direct and strict correlation between the two aspects. After fixing of the faults, the hearing and communicative skills were completely restored, so the importance of testing microphone sensitivity was confirmed.

Considering that in Italy Cochlear repair laboratories receive this kind of failure report mostly from Varese Audiology Unit, we may infer that many cochlear implant users are not performing at their best, due to a simple microphone sensitivity loss.

A multicentric approach is needed to confirm the reported data and to plan a correct checking strategy of cochlear implants including microphones.