Chapter

Introductory Chapter: A Short Excursus into the Realm of Cochlear Implants Today

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1. Introduction

To date, the Cochlear Implant represents a very sophisticated and effective neural prosthesis, whose hardware and software have made significant technological leaps ahead, over the last 20 years. From the two aspects of this technology, the software aspect has been particularly evolved, considering the great advancements in the area of computer science and Artificial Intelligence.

These CI prostheses are very effective in the rehabilitation of severe and profound hearing impairment cases and can be applied to the hearing rehabilitation of subjects of almost any age, from neonates to adults. In addition, data in the literature suggest that CIs can significantly enhance the perception of the quality of life, particularly in the elderly, improving self-confidence, depressive status, and eventually cognitive functions [1–5].

Future and expected advances in CI technology could involve: novel surgical approaches, introducing minimal invasive techniques for electrode insertion in order to reduce or minimize an eventual cochlear trauma; electrode reservoirs releasing locally healing and protective pharmacological agents; new stimulation protocols collecting better the residual neural responses; and an additional minimization of the hardware with optimized energy requirements and enhanced performance. It is expected that these features will significantly improve the overall stimulation of the spiral ganglion neuron population and thus will significantly improve the CI performance [1, 3, 4].

There have been reports in the literature of a CI model not requiring external hardware [3]; this could probably be quite a revolution in the clinical practice. In this case, the electrode array placed in the cochlea would be stimulated by the intact external and middle ear sound transducer and could be wirelessly recharged using a mobile phone or a special pillow charging device. However, there are still several hardware limitations, and further research is necessary before these interesting features could reach clinical use.

The most impressive impact on the CI evolution is related to the CI software development; in particular, the latest research reports findings in the area of a wider and more intelligent connectivity between the implanted device and other devices such as smartphones and smart wearables. Controlling certain aspects of the Implant via a smartphone has already reached the clinical practice. However, it is likely that in a near future, features such as remote assistance and/or a fuller remote control of

the device could be further developed, offering new solutions in terms of medical follow-up in a telemedicine context [6–8].

Another important aspect of the CI development is related to the constantly increasing cost of these devices; while one could assume that hardware and software developments would be reflected in a decrease in the required implant cost, the financial reality is different. To offer the above-mentioned new technological solutions, the manufacturing companies have also increased the costs of the devices. This can generate a problem in terms of the availability of these prostheses in third-world countries.

2. Conclusion

Data in the literature suggest that the evolution of the Cochlear implant devices is constant, and many important hearing rehabilitation landmarks have already been achieved. Unfortunately, these developments are in a straight contrast with the possible diffusion of new technologies in developing third-world areas of the planet, where they are most needed.

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