

# REPAIR ISSUES ASSOCIATED WITH COCHLEAR IMPLANTS EXTERNAL COMPONENTS: THE INFLUENCE OF AGE AND TIME OF USE

## *Falhas dos componentes externos do implante coclear: influência da idade e do tempo de uso*

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### ABSTRACT

**Purpose:** to identify what are the most frequent technical flaws of the external components of the cochlear implant and verify the influence of age and the time of use of the device in these failures. **Methods:** retrospective study. It was analyzed 128 medical records of the Association of Deaf Parents, Friends and Cochlear Implant Users, which presented a complaint in the functioning of the external component for the period from June to August 2011. For analysis of data was carried out the descriptive analysis of failed components, as well as the variables studied. It was applied to an inferential statistics through the Kruskal-Wallis test to analyze the influence of patient's age and time of use of the cochlear implant with failure, with significance level  $p < 0.05$ . **Results:** the components that were more failure was the external antenna (29,7%), followed by the battery compartment (23,4%), speech processor (14,10%), microphone (10,90%), transmission cables (9,40%), controller (6,30%), batteries (5,50) and battery charge (0,80%). Has not been verified influence of time of use of the cochlear implant and the chronological age of the patient in relation to failures presented in this study. **Conclusion:** the findings obtained from this study can assist professionals in guidance on the maintenance of these components, but the trends presented here cannot be generalized to the entire national territory, as these were analyzed in a limited number of cases.

**KEYWORDS:** Hearing; Hearing Loss; Cochlear Implantation; Correction of Hearing Impairment; Unified Health System

### ■ INTRODUCTION

Audiological intervention can be defined as a process of problem solving, with the goal of minimize the activity limitation and participation restriction of an individual with a hearing impairment <sup>1</sup>. In this way, the rehabilitation of sensorineural hearing loss through hearing aid (HA) and/or cochlear implant (CI), with auditory training is highly successful, helping to reduce the negative consequences of

hearing loss <sup>2-4</sup>. These devices, which are high cost, are provided free to the public via the Public Healthcare System (SUS) <sup>5-7</sup>.

About to the CI, although the whole process is guaranteed to Brazilian population by the Ministry of Health, since the preoperative evaluation to the postoperative follow-ups, the SUS does not cover the expenses regarding the maintenance of the external components, ie expenses related to repair issues with headpiece, cables, batteries and speech processors. The CI companies provide three years of warranty for certain components, such as headpiece, for example, but after this period, the expenses with the CI must be assumed by the patient and/or their families.

Until the present moment scientific literature concerning which the most common technical failures on CI external components and the

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frequency that occur are scarce. However, is very common in follow-ups returns patients or their families report failures in these devices.

In the scientific research recently published<sup>8</sup> was analyze the number and type of repair issues associated with the use of CI in children who have worn either the body-level or ear-level style for four to five years of CI use. Charts for 62 children who received unilateral CI were examined, to explore information about CI external component breakdowns over time. The results show that CI external component breakdowns are common and the repair rate per year of 4.1 and 2.7 for the body style and ear-level style, respectively. For the group of children who used body worn speech processor, the repair problems most frequent were cables, microphone and headpiece and for ear-level style, speech processor and headpiece are the items which needed more repair.

Even the CI is guaranteed by SUS since 1993, there are no Brazilian studies about the maintenance of CI external components. Such information is extremely important to support scientific evidence to improve CI dispensation by the Ministry of Health as well as reinforce the importance the public realm in the maintenance of this electronic device.

With this in mind, the purpose of this study was to examine the frequency and type of external component repair issues in CI users, as well as the influence of chronological age and time of use of the device (the period between the activation CI and timing of repair issue) in the problems presented.

## ■ METHODS

The present study was approved by the Ethics in Research Committee of the University of Guarulhos (Research Protocol # 208/2010).

The study was characterized as a retrospective cross sectional, based on primary data collected by checking 128 patients' records from Association of the Deaf, Parents, Friends and Users of Cochlear Implant (named as ADAP), with any complaint about CI external component functioning (as problems with speech processor, cables, headpiece or battery), regardless of the chronological age and local that surgery was performed.

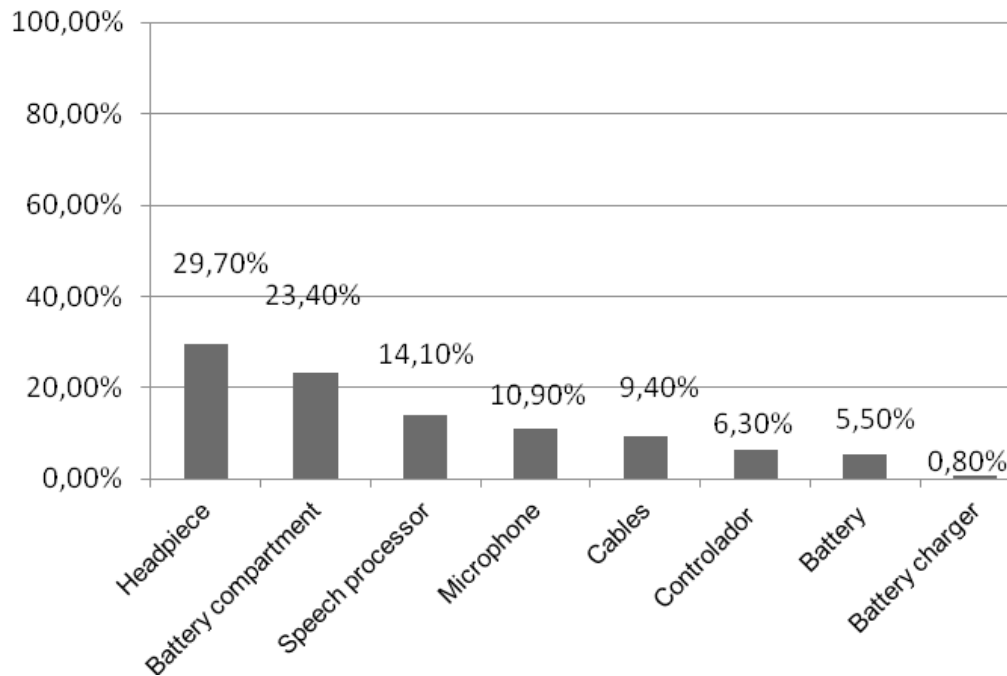
External repair issues were classified as: speech processor, microphone, headpiece, earhook, battery, battery compartment, cables and battery charger. The casuistic included all attendances related to CI external components complaints during the period of data collection at ADAP, representing 5.7% of registered members in the Institution during the period of study. The investigation was done in ADAP because the Institution aggregates external technical failure information from a larger number of Brazilian CI users.

The data collection was done during June to August 2011. This period was selected by the researchers based on the availability of the Institution.

Statistical analysis was performed using Kruskal-Wallis test, to check the influence of CI users' chronological age and CI time of use on repair issue observed. For all the cases we adopted a 5% level of significance.

## ■ RESULTS

The figure 1 shown the repair issue most frequently involved in the study. The components that showed more problems were headpiece (29.7%) then battery compartment (23.4%).



**Figure 1 - Repair issue most frequently involved in the study**

The table 1 shows mean CI users' chronological age and CI time of use for patients who complain about external CI technical failure, until the moment that occurred it.

To check the influence of CI users' chronological age and CI time of use on repair issue observed was selected only the most frequently repair issue involved in the study, as headpiece (29,7%), battery compartment (23,4%), speech processor (14,10%), microphone (10,90%).

**Table 1 - Descriptive analysis of the CI users' chronological age and CI time of use**

	AGE (years)	CI use (months)
Mean	12,1	54,98
Median	6,0	35,00
Minimum	1,0	1,00
Maximum	77,0	212,00
Standard deviation	15,4	45,05

CI: Cochlear Implant

In table 2 is possible to see the relation between CI users' chronological age and component which presented failure. According to the Kruskal-Wallis test, there is no influence of this variable on the repair issues ( $p=0,190$ ).

The table 3 shows the results from CI time of use and repair issues observed. After statistical analyses it was not observed relation between CI time of use and external technical failure ( $p=0,267$ ).

**Table 2 – Relation between CI users' chronological age and repair issues**

	EXTERNAL COMPONENT WITH TECHNICAL FAILURE				
	Speech Processor	Speech Processor	Speech Processor	Speech Processor	Speech Processor
Mean	13,9	14,3	9,5	14,3	
Standard deviation	20,0	12,5	12,7	15,9	0,190
N	18	14	38	30	

Statistical test – Kruskal-Wallis (significance level  $p < 0,05$ )

**Table 3 - Relation between CI time of use and repair issues**

	EXTERNAL COMPONENT WITH TECHNICAL FAILURE				p-value
	Speech Processor	Microphone	Headpiece	Battery compartment	
Mean	62,0	66,4	52,2	61,3	
Standard deviation	50,2	40,7	49,9	49,5	0,267
N	18	14	38	30	

Statistical test – Kruskal-Wallis (significance level  $p < 0,05$ )

## ■ DISCUSSION

Numerous studies<sup>9-15</sup> have examined major complications of CI, such as reimplantations/revision surgery hard or soft device failure. Despite the paucity of research available about repair issues associated with the external components of CI, this is an issue that deserves highlight, especially in Brazil, since such devices are dispensed by SUS, with public budget.

First of all is important to stress that the findings of this study should be carefully analyzed to be generalized for CI users from all over the country, because the study examined a limited number of cases, compared to the number of implanted patients in the country.

However, the results may help professionals in guidance on the maintenance of these components, from a scientific view, since the guidance on the handling and use, which must be carried out properly, consistently and constantly by professionals of CI programs which accompany these patients in order to prevent breakings or technical failures of devices are caused by bad use<sup>16</sup>.

As shown in figure 1, the repair issue most frequently involved in the study are headpiece (29,7%), battery compartment (23,4%), speech processor (14,10%), microphone (10,90%), cables (9,40%), controllers (6,30%), battery (5,50%) and battery charger (0,80%). The results differ to some extent from those of international research, which

reported headpiece and speech processor as most frequent problems for ear-level processor. The factors could have influenced the somewhat discrepant results are speech processor model, since the present study evaluated models of latest generation, or also by the participants age range, since the present study evaluated individuals from one to 77 years, while the other study only examined the pediatric population.

The high failure rate in the battery compartment is not a surprise, once this item has pins which are connected to the speech processor and, when in contact with moisture or water, begins the oxidation process. This may interfere in communication of the speech processor and battery compartment. This situation could be minimized or even prevented with the systematic use of dehumidifier and silica<sup>17,18</sup>.

Another result that draws attention is the rate breaks in transmission cables (Figure 1), as it would be expected that failure rate of this component was larger than that obtained. In turn, it is might be thought that the parents and/ or users do not forward this item to the repair, since usually the transmission cables have only three months warranty from first stimulation. After this period, the CI user and/or their family has to bear the purchase of this item. Aware this information, the user ends up not forwarding this item to evaluation and gets a new transmission cable.

The mean age at the time of this study was 12.1 years, ranging between one and 77 years of age

(Table 1). When considering the median of this variable, it can be inferred that 50% of the cases studied were younger than six years. However, no influence of CI users' chronological age on repair issue was observed (Table 2).

Meanwhile, as shown in table 1, it is found that the mean time of use, until the moment when the external component needed some repair was 54.8 months (median 35 months). However, is not possible to tell which specific component broke after a mean of 54.8 months, since the information analyzed do not necessarily represent the first repair issue. It was not observed the influence of time of use on repair issues present by the external components of CI (Table 3).

Although not analyzed in this study, it is possible to infer that in many cases the repair issue present could be avoided if the CI users follow some recommendations as prevent falls and contact with water or sweat and dehumidifier use. This form of guidance is provided by the audiologist at the time of first stimulation to patients and/or their guardians, but both patient and family (in the case of children ) may be anxious about the situation , which makes difficult the retention of this kind of information about CI external components care.

The amount of information about CI use, handling, care and maintenance can also contribute

to the difficulty in retaining the information about CI care <sup>16</sup>. This emphasizes the importance to give some written material to patient or family as well as the audiologist in charge for the follow-up or rehabilitation program always provides this kind of information. With the daily routine and the CI handling, the CI users will be more able to receive this information <sup>2</sup>.

## ■ CONCLUSION

The repair issues most frequently are headpiece, battery compartment, speech processor, microphone, cables, controllers, battery and battery charger.

It was not observed the influence of chronological age and time of use on repair issues present by the external components of CI.

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## RESUMO

**Objetivo:** identificar quais são as falhas técnicas mais frequentes dos componentes externos do implante coclear e verificar a influência da idade do usuário e o tempo de uso do dispositivo nessas falhas. **Métodos:** estudo retrospectivo, por meio da análise de 128 prontuários da Associação dos Deficientes Auditivos, Pais, Amigos e Usuários de Implante Coclear, que apresentaram alguma queixa no funcionamento do componente externo, no período de junho a agosto de 2011. Para análise dos dados foi realizada a análise descritiva dos componentes que apresentaram falha técnica, bem como das variáveis estudadas. Posteriormente, foi aplicada a estatística inferencial por meio do teste Kruskal-Wallis para verificar a influência da idade do paciente e tempo de uso do implante coclear com a falha apresentada, com nível de significância  $p < 0,05$ . **Resultados:** os componentes que apresentaram mais falhas foram: antena externa (29,7%), seguida do compartimento de bateria (23,4%), processador de fala (14,10%), microfone (10,90%), cabos de transmissão (9,40%), controlador (6,30%), baterias (5,50%) e carregador de baterias (0,80%). Não foi verificada influência do tempo de uso do implante coclear e a idade cronológica do paciente em relação às falhas apresentadas no presente estudo. **Conclusão:** os achados obtidos a partir do presente estudo podem auxiliar os profissionais da área na orientação sobre a manutenção destes componentes, mas as tendências aqui apresentadas não podem ser generalizadas para todo território nacional, pois estas foram analisadas em um número limitado de casos.

**DESCRITORES:** Audição; Perda Auditiva; Implante Coclear; Correção de Deficiência Auditiva; Sistema Único de Saúde

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