

Pragmatic competence in children with Cochlear Implant: a new tool to assess the understanding and production of ironic sentences.

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Abstract

Introduction: A growing number of deaf children receive Cochlear Implant (CI) in their first years of life. Early CI implantation could improve the performance of these children in both perceptual and language development. However, although children show that they fall within the normal range in perceptual and linguistic tests, they may show difficulties in complex language structures as pragmatic skills. The Italian Standardized Batteries evaluate pragmatic competence useful for academic skills, but they do not consider some complex use of figurative language, such as irony, that it is useful for social interactions. In the present study a new tool was developed to evaluate the comprehension and production of ironic situations and sentences. This tool was tested to compare the performances of CI users with those of normal hearing peers.

Methods: A case-control study was conducted on 10 deaf children (CI group), unilateral or bilateral CI users, with normal perceptive and linguistic competences, and 10 normal hearing peers (NH group). Irony comprehension was evaluated with the support of nine cartoons, ex novo designed, that represent different ironic situations. Whereas two stories with ironic elements, were used to assess irony production.

Results: The CI group scored significantly lower than the NH control group in both irony comprehension and production. A positive trend with the increased age was recorded in both groups. However, no deaf subject was able to identify ironic situations as ironic and to produce ironic utterances.

Conclusions: Early CI implantation allows children to reach excellent perceptual and linguistic outcomes, however some difficulties in complex pragmatic skills, as irony, may persist. These difficulties could have an impact on the social life of these individuals and should be included in the rehabilitation programs of these subjects.

Keywords: Hearing loss, Cochlear implant, pragmatic skills, irony

Introduction

Cochlear Implant (CI) is the gold standard for subjects with severe hearing loss and has a great impact on perceptual and language development in children.

Hearing difficulties are an important risk factor for language delays and can also impact early social experiences and communicative interactions.

Early diagnosis and intervention are essential to minimise and, in some cases, to reverse the serious effects that hearing impairment may have on language development and on the overall development of the children (Berrettini, 2015).

However, children with CI and a very high level of linguistic performance may show

difficulties in some linguistic aspects, as the pragmatic features of language.

Pragmatic communication ability is the ability to use language in context, beyond understanding and expressing basic word meanings (semantics) in the correct grammatical forms (syntax). Pragmatic competences allow us to communicate, and to give and receive accurate information to use language in different contexts. For this reason, pragmatic deficits can have major effects on social, educational, and rehabilitative outcomes. Pragmatic skills, as well as other aspects of communication may be negatively affected due to the presence of a hearing impairment. In this case a disruption in pragmatic aspects of communication can be defined as *secondary pragmatic disability*. (Turkstra, 2017)

New-borns develop pragmatic non-verbal skills, as eye contact, alternating shifts, the use of gestures, that help to achieve shared attention. A child can show communication initiative through shared attention, or by following and directing attention to distant objects through gestures. These behaviours function to create learning opportunities through experiences of social interaction.

Children with hearing difficulties usually struggle to communicate with their parents, who may be inhibited in the way they communicate with their children, adopting a more manageable and less responsive style of interaction (Rinaldi, 2013; Most, 2010; Mancini, 2015).

In addition, pragmatic development is closely related to Theory of Mind (ToM) and may be impaired in deaf children. Several research reports that deaf children, who use oral language, show a delay in their ability to complete false belief tasks, understand complex mental states, and consider the view of others (Ketelaar, 2012).

The reason for ToM's delay in deaf children is probably due to a limited access to speech about mental states. These children may be exposed both quantitatively less and temporally later to situations that consider the use of figurative language, referring to the mental states of others (Nicastri, 2014).

Children wearing CIs could have difficulties in understanding the intentions of other people like normal hearing children. Therefore, they may show problems to grasp the desires

of others and false beliefs, even when they exhibit good verbal skills (Ketelaar, 2012).

In addition, Incidental Learning has an important role. The fragility of pragmatic competence shown by deaf children could be caused by lesser exposure than normal hearing children to communication strategies learned incidentally (Most, 2010).

These fragilities are often underestimated, but they may have an impact on social inclusion of deaf people. Italian Standardized Batteries as "APL MEDEA" (Lorusso, 2009) and "Prove di Valutazione della Comprensione Metalinguistica" (Rustioni Metz Lancaster, 2010) evaluate pragmatic competence useful for academic skills, but they do not consider some complex use of figurative language, such as irony, that it is still important for social interactions.

Verbal irony is a complex mode of communication that has been analysed over the years according to different perspectives (Bertucelli, 2018). Being a pragmatic phenomenon requiring a non-literal interpretation of language, the ability to understand and produce irony is necessarily linked to good pragmatic skills.

The understanding of irony means to understand that the speaker does not mean what he/she has said literally. It is a complex cognitive process requiring the decoding of what the speaker has said literally, plus the recognition of a certain mimic and a tone of voice (Ervás, 2011).

The aim of this pilot study is to present a new tool to assess irony comprehension and production and give preliminary results regarding irony development in both normal hearing and deaf children.

Methods

The present study is a case-control study that compares the performances of children with severe-to-profound hearing loss and wearing CIs (CI group) to those of normal hearing peers (NH group).

CI subjects were recruited in the ENT Clinic of the University Hospital of Padua.

Inclusion criteria for the CI group are: congenital severe-to-profound hearing loss (Pure Tone Average in the better ear > 70 dB HL for 500-4000 Hz), aged 7.0-12.6 years at the time

of test administration, CI activated within 60 months (activation age average 32 months), good speech perception abilities (recognition >80% in a silent room for bisyllabic words), language development within normal range at standardized linguistic test, absence of other associated disorder. Italian should be the mother tongue (L1).

Eligibility criteria for the control group are a normal threshold (20 dB HL at 250-6000 Hz) and the absence of language or associated disorders in the clinical history. Italian should be the mother tongue (L1). All subjects of the control group were matched for chronological age with participants of the study group and they attended the same classes.

To assess pragmatic competence of the CI group, APL MEDEA Test (Lorusso, 2009) was administered.

A new assessment tool was developed to evaluate irony comprehension and production.

The first part, that allows to assess irony comprehension, consists of nine *ex novo* designed cartoons, each showing different kinds of ironic situations. An example is shown below.



Example of cartoon representing an ironic situation

("What a beautiful day for a picnic")

Before showing each cartoon, a brief contextualization of the characters and facts, called *scenario*, was presented. The children had to answer orally to structured questions designed to obtain information about irony comprehension. In case of confused, incorrect or no response, the examiner used a multiple-choice answer. To reduce bias induced by decoding abilities, they were pre-

sented on A4 paper format and were read by the examiner.

The second part is the evaluation of irony production. Two ironic stories without the respective endings were used. The children had to complete both stories with an ironic sentence. The test was preceded by a pre-test during which the examiner asked the child for a definition and example of irony. If the response was missing or incorrect, the examiner explained and gave an example. The subject was guided to the production of an ironic expression. To minimize bias relating to decoding abilities, the stories were presented orally and it was given the child the opportunity to follow the reading and if necessary to reread it.

The scoring is from 0 to 3 for each comprehension item and from 0 to 2 for each production item. The comprehension score was computed according to the following criteria:

- 0 points: completely incorrect; even after using the facilitation, the subject related exclusively to literal meaning.
- 1 point: correct using facilitation; the subject answered correctly using facilitation.
- 2 points: partially correct; the subject recognized the non-literal meaning without facilitation. Nevertheless, when the subject did not define it as ironic.
- 3 points: completely correct; the subject recognized and defined the situation as ironic.

The production score was computed according to the following criteria:

- 0 points: completely incorrect; no ironic sentence was expressed.
- 1 point: partially correct; the ironic sentence was partially expressed.
- 2 points: correct; the sentence was ironic.

Since irony is a phenomenon which develops and improves with age, a qualitative analysis of behaviour in understanding and producing irony by age was examined. Both study groups were divided in three age subgroups (7.0-9.0 years, 9.0-11.00 years, 11.00-12.6 years).

Statistical analysis

The *Kolmogorov-Smimov test* was used to test the normality of the population distri-

bution. Normal distribution of the comprehension task was tested by the *Two-sample t-test*. The trend of no normal distribution of the production task was verified by the *Mann-Whitney U test*.

Results

10 CI children (5 males, 5 females) met the inclusion criteria for the present study. The average of activation was 32 months. All subjects received CI at < 38 months; only two children between 55 and 60 months.

10 normal hearing peers (5 males, 5 females) who did not exhibit language disorders in their clinical history, were included in the study. The average age of both groups was 10.3 years (range from 7.0 to 12.6 years).

The results in the APL-MEDEA Test, 8 of 10 subjects show performances into the normal range. Qualitative analysis shows all deaf subjects made more mistakes in figurative language tasks, while they made fewer or no mistakes in those investigating inferential abilities.

The results of the new tool to assess irony comprehension show that CI children (mean score: 9.1) performed significantly worse than NH group (mean score: 17.2). The p-value is 0,000465.

In the irony production task, the scores of CI children were constantly lower than NH participants. Statistical significance was found (p-value=0, 0104).

When results are analyzed dividing the groups by age, a positive trend increasing with increasing age was recorded in both groups. In the comprehension and production task, all age subgroups of the study group performed worse than the control group. No statistical analysis was adopted due to the small number of subjects for each subgroup.

Discussion

The present study aimed to obtain preliminary results on the irony comprehension and production in CI children with good perceptual skills and adequate formal oral language abilities. To assess this ability and to compare their competences with NH children, a new tool of assessment was developed.

Results are still preliminary in nature and they show the performance of a small sample. Consequently, statistical analysis could be compromised by the bias of a small population. However, the study sheds light on a field that has not been investigated.

Regarding the APL-MEDEA, a qualitative analysis of mistakes made by CI children at the test showed that, for all subjects, errors were not for items that investigate inferential abilities, but rather in those of figurative language. This observation was consistent with the results obtained from the Nicastrì et al. (2014): CI children performed significantly below their normal hearing peers in figurative language.

Our findings agree with this study because irony is a particular use of figurative language that takes on different meanings depending on the context and the interlocutor. It may appear in recurring forms, but the content is susceptible to numerous variables. Significant difference between study groups was found in both the comprehension and production task.

Regarding the comprehension task, there was a positive trend with the increasing age in both groups. Nevertheless, all CI children performed significantly below NH children in all subgroups age. This finding is related to the *Processing Model of Figurative Language* by Cacciari and Levorato (2008), that highlights the acquisition of mature competence in the use of figurative language developed in adolescence.

Instead, CI children in the subgroup 11-12.6 years, were able to suspend the literal meaning and implement the inferential processes, but they failed to understand this particular use of figurative language. Despite age, CI subjects were not able to recognize the situation as ironic.

Regarding the production task, the study showed that no subject of the subgroup age 1 of the CI children was able to produce an ironic sentence, while NH peers began to formulate sentences approaching to take an ironic form.

According to the *Processing Model of Figurative Language*, the ability to produce figurative sentences begins at around 8 years; despite some attempts occurring

earlier, the ability to use figurative language correctly develops about 11 years (Iozzi, 2008). Only NH subjects of subgroup age 3 were able to produce ironic sentences.

The fragility of CI children in the figurative language and, consequently, in the use of irony could be explained due to a reduction of Incidental Learning.

Deaf children may be exposed to a lower range of communicative behaviours and strategies, limiting their ability to learn from the communicative environment.

Another important point to take in consideration is that hearing parents tend to relate with their deaf children using different lexicon from those who adopt with hearing children. Parents use fewer references to a mental lexicon, relating in a more concrete way (Ketelaar, 2012). They elude the most figurative aspects of language and expose them, quantitatively less and later, to certain uses of language, including irony.

The fact that deaf children with excellent perceptual and linguistic skills show difficulties in the use of figurative language poses new challenges to rehabilitators.

The tool used in this study aims to be a first proposal to evaluate and investigate complex skills such as irony, which lack of understand-

ing may have important social implications for deaf people.

To implement rehabilitation treatments that may be relevant to the social life of deaf people,

an important future perspective could be developing an instrument tool to investigate the pragmatic skills that have an important social impact, such as irony, sarcasm, and humour.

Conclusions

Hearing loss could be a risk factor for the development of good pragmatic skills, even when the perceptual and linguistic skills are good.

Continuing to investigate complex pragmatic skills in deaf children is important to ensure that the social communication of these subjects is appropriate, and they do not perceive deafness as a social disability.

A broader understanding of pragmatic communication functions can help speech and language therapists to identify a patient's strengths and limitations, to improve treatment planning to ensure a more appropriate stimulation of communicative behaviours.

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