"Hearing and Cognition"
Update in otology – From Research to ENT Practice

Seville, Spain - 12-13th of May 2017

Friday, May 12th: Hearing and Cognition Scientific Chair: Andrea Peracino & Sergio Pecorelli - Lorenzini Foundation (Italy – US)	
09.00	**Opening Remarks** Sergio Pecorelli & Andrea Peracino - Lorenzini Foundation (Italy – US)
09.10	**Prevalence and Socio Economic Aspects of Dementia** Andrea Peracino & Sergio Pecorelli - Lorenzini Foundation (Italy – US)
09.40	**Hearing Loss and Cognition: The Role of Hearing Aids, Social Isolation and Depression** Piers Dawes (Manchester, UK)
10.10	**What can we conclude from the studies on Hearing & Cognition (Epidemiology)?** Elizabeth P. Helzner (Brooklyn, New York, US)
10.40	**Break**
11.20	**Improvement of Cognitive Function After Cochlear Implantation in Elderly Patients** Isabelle Mosnier (Paris, France)
11.50	**Study on the impact of hearing care on cognition** Stefano Berrettini (Pisa, Italy) & Valeria Gugliemi (Rome, Italy)
12.20	**Taking Cognition into account in a Professional Hearing Care Protocol** Mark Laureyns (Milano - Antwerp, Italy - Belgium)
12.50	**Conclusion** Maurizio Memo (Brescia, Italy) & Andrea Peracino - Lorenzini Foundation (Italy – US)
13.00	**Lunch**

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ABSTRACT

Friday morning, May 12th : Hearing & Cognition

Introduction

Andrea Peracino & Sergio Pecorelli - Lorenzini Foundation (Italy – US)

The devastating impact of dementia on affected individuals and the burden imposed on their families and society has made the prevention and treatment of dementia a public health priority. Interventions that could merely delay the onset of dementia by 1 year from now, would lead to a more than 10 % decrease in the global prevalence of dementia in 2050.

Researchers say hearing loss seems to speed up age-related cognitive decline, and think that treating hearing loss more aggressively could help delay cognitive decline and dementia. Over the next 100 years, hearing impairment is projected to affect about 30 % of Europeans due to Europe's ageing population.

Therefore it is critical now to update our knowledge on: the evaluation of social and economic burdens of dementia to society; the brain's acceptance of hearing signals; the correlation between hearing loss and cognitive ageing; the relationship between hearing loss and dementia; the evidence of hearing rehabilitative interventions in affecting cognitive decline; the expected goals of hearing care in the new cognitive hearing science; and lifelong preventative therapy in the hearing impaired field relative to the course of cognitive decline.

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Friday morning, May 12th: Hearing & Cognition

Prevalence and Socio Economic Aspects of Dementia

Andrea Peracino & Sergio Pecorelli - Lorenzini Foundation (Italy – US)

Dementia represents a substantial health and financial burden on society, one that is similar to the health and financial burden of heart disease and cancer. On top of that, dementia is the most feared health condition in seniors over the age of 55 and costs the society more than cancer, stroke, or heart disease combined.

The global number of people with hearing loss is estimated at 360 million by the world health organisation and this number is expected to at least double to 720 million by 2050. In Europe the number of people with self-reported hearing loss is 52 million today and this number will increase to 80 million in 2050.

Neuroimaging reveals detailed semantic maps across human cerebral cortex. The studies on brain support the evaluation of a system for auditory working memory based in regions of the cerebral cortex collectively known as the semantic system.

In cerebral terms, ageing starts early—long before symptoms manifest. The typical human brain begins to shrink at about age 20; by the time it is 100 years old, the brain has lost 20% of its mass. And this is for a healthy brain. Those affected by neurodegenerative disorders such as Alzheimer's disease decrease in mass even more.

The concept of ageing is not only a basis of discussion but it is the framework for all studies from pre-pregnancy until the appearance of the dementia.

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Hearing Loss and Cognition: The Role of Hearing Aids, Social Isolation and Depression

Piers Dawes (Manchester, UK)

Hearing impairment is a marker of risk of cognitive decline and dementia. I will outline the hypotheses concerning the relationship between hearing impairment and cognition, as well as summarising studies that have modelled the impact of hearing aid use on cognitive decline and dementia.

My summary of research will include two recently published studies where we

i) modelled relationships between hearing impairment, cognitive functions, social isolation, depression and hearing aid use in the very large UK Biobank data set (n=164,000) and
ii) modelled cognitive outcomes and incident dementia among hearing aid users and non-users in the US Epidemiology of Hearing Loss data set.

I will also report on very recent modelling of the impact of hearing aid use on cognitive decline using UK and European population-based samples (the English Longitudinal Study and the Survey of Health and Retirement in Europe).

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What can we conclude from the studies on Hearing & Cognition (Epidemiology)?

Elizabeth P. Helzner (Brooklyn, New York, US)

Hearing loss is one of the most common disabling conditions among older adults, affecting as many as two-thirds of those in their 70s.

It is well-known that hearing loss compromises quality of life by interfering with communication and causing social withdrawal. But new evidence suggests that age-associated hearing loss is also linked to poorer cognitive function, faster cognitive decline, and even dementia.

Hearing loss and cognitive decline may be related via a shared physiological pathway. Alternatively, the 'effortful listening' associated with hearing loss may draw resources away from other cognitively demanding tasks, eventually decreasing the brain's resilience.

Intriguing neuroimaging studies have shown that older adults with hearing loss have less gray matter in the auditory cortex, suggesting that hearing loss may cause cortical reorganization.

In this presentation, we will review the epidemiological evidence linking age-related hearing loss and cognitive function and discuss its implications.

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Improvement of Cognitive Function After Cochlear Implantation in Elderly Patients

Isabelle Mosnier (Paris, France)

Objective: Association between peripheral hearing loss and cognitive decline has been clearly established. Despite these associations, the impact on cognition of hearing rehabilitation using conventional hearing aids generated controversial results. In a cohort of 94 patients aged 65 to 85 years, hearing rehabilitation by cochlear implant has proven to be successful at 1-year post-implantation with an improvement of speech perception in quiet and noise, of quality of life and of cognitive abilities1,2. The aim of our study was to evaluate the cognitive and audiological benefit 7 years after cochlear implantation in this group of patients.

Methods: Tests were performed before, at 12 months and 7 years after implantation. Speech perception was scored in quiet and in noise using disyllabic words. Quality of life was evaluated using the Nijmegen Cochlear Implant Questionnaire. Cognitive function was assessed using a battery of six tests evaluating attention, memory, orientation, executive function, mental flexibility, and fluency (Mini Mental State Examination, 5-word test, clock drawing test, d2 test of attention, fluency tests and Trail making test A and B).

Results: From the 94 patients initially enrolled, 69 patients aged 72 ± 5.1 years [65-85] at time of implantation did complete the tests at 7-years. Speech perception scores in quiet and noise, and quality of life remained stable between 1 and 7 years post-implantation. Before implantation, 35 patients (51%) presented a mild cognitive impairment (MCI) versus 5 to 19% in the general population aged 65 and older; 49% of patients had normal cognitive function. Literature showed that in the general population, 50% of patients aged over 65 years with a MCI progress to dementia within 5 years3. In our population, at 7 years post-implantation, only 2/35 patients with MCI (6%) became dement. Other MCI patients remained stable (60%) or return to normal (34%) at 7 years post-implantation. Among the 34 patients with a normal cognitive function before implantation, 71% remained stable and 29% presented a MCI at 7 years post-implantation.

Conclusion: Fifty-one percent of elderly patients with a profound hearing loss who are candidates for a cochlear implantation presented a mild cognitive impairment compared to 15% in the general population. However, after hearing rehabilitation with cochlear implant, progression to dementia in this population was very rare, compared to what was observed in the general population with a MCI. Further studies are needed to better characterize the cognitive dysfunction of deaf patients and understand the preventive effect of hearing restoration on cognitive decline.

1. Mosnier I et al. Predictive factors of cochlear implant outcomes in the elderly. Audiol neurotol 2014, 19 (suppl 1): 15-20.
2. Mosnier et al. Improvement of cognitive function after cochlear implantation in elderly. JAMA ORL 2015, 141(5): 442-450.
3. Gauthier et al. Mild cognitive impairment. Lancet 2006, 367 : 1262-1270.

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Study on the impact of hearing care on cognition
Stefano Berrettini (Pisa, Italy) & Valeria Gugliemi (Rome, Italy)

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Taking Cognition into account in a Professional Hearing Care Protocol

Mark Laureyns (Milano - Antwerp, Italy - Belgium)

When providing hearing care – the audiogram is a very limited source of information. It only evaluates when people start to hear pure tones at different frequencies … we need to look at all dimensions of hearing "performance" and how the "person" perceived these dimensions if we want to understand the variability of outcomes and make evidence based decisions. Therefore next to audibility (the audiogram), we also need to evaluate speech intelligibility in quiet, in noise, noise acceptance, aspects of central auditory processing and cognitive aspects like working memory.

Anderson published a very interesting study, looking in how a dynamic auditory-cognitive system supports speech-in-noise perception in older adults. They had 120 older test subjects (50 to 79 years) and ran a full battery of test on peripheral hearing, central auditory processing and cognitive abilities. They also collected data on demographic measures of life experiences like education, physical activity, intellectual engagement, musical training and more. Based on all this information, they could develop a predictive model on how somebody would understand in noise that explains 57% of the variance. Interesting enough, audibility (the audiogram) was the weakest predictor. The most important predictor was "central processing", followed by "cognition" and then followed by "life experience".

Therefore it is not surprising that the field of "cognitive hearing science", where hearing and cognition and their interaction is studied, is rapidly gaining importance and should be considered systematically in evidence based professional hearing care. It will also allow us to avoid trial and error in selecting the best settings of features in hearing aids and partly explain the variability in aided outcomes.

We will present results on using the reading span test as a measure of working memory capacity in a professional hearing care protocol, the relation with educational level and the consequences for clinical practice.

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