2nd International Congress of Audiology (APtA-Portugal)

STRUCTURED SESSIONS

Panel I – Profession

Moderators: Jorge Humberto Martins and Odete Batista
Speakers:
1. João José Joaquim
2. Andreia Costa Andrade
3. Ana Alvarenga
4. Mark Lauryens

Historical Background of Audiology and Audiologists in Portugal

Ana Alvarenga

Audiology in Portugal has existed for 7 decades. From the introduction of audiology to our country and the development of the professional path of audiology technician, there has always been the challenge of new technologies and methods.

From Past to Present: Skills in the Profession – Belgium vs Portugal

Mark Laureyns

AEA (European Association of Hearing Aid Professionals)

In Belgium, hearing aids have been reimbursed since the early sixties. At that time the profession was called "Audio-prothésiste" and professionals needed to pass an exam organised by the national health insurance, a process through which they were regulated and received a recognition number. When an ENT prescribed hearing aids, this process allowed the user to be partly refunded.

The university college Marie Haps in Brussels started education for "audio-acoustics" in 1969, where students were trained in Hearing Aid Fitting and Clinical Audiology. Belgium was very active in the AEA when the Leonard Project on Education and Qualification of Hearing Professionals in Europe was created, a project which later led to the European Standard EN 15927 on 'Services offered by hearing aid professionals'. In the late nineties, six educational programs in audiology were created in Belgium (both a practical bachelor in Audiology and a Master in Audiology, mostly combined with Speech Pathology).

In 2004, the professions of hearing aid audiologist and clinical audiologist were formally recognised and regulated by the Belgian Ministry of Health, and this recognition was fully based on the EN 15927. We give an overview of the evolution of hearing aid delivery and the requirements for the refund of hearing aid costs in Belgium.

Economic Impact of Hearing Loss

Mark Laureyns

AEA (European Association of Hearing Aid Professionals)

Hearing loss is one of the most prevalent disabling health conditions in adults. More than 52 million EU citizens self-report to have hearing difficulties. The number of people with self-reported hearing loss is estimated at 1.1 million in both Portugal and Belgium. The yearly cost of untreated hearing loss is estimated at €178 billion in Europe, €3.6 billion in Portugal, and €3.9 billion in Belgium.

Untreated hearing loss leads to "difficulties in finding and retaining employment", "earlier retirement" and "reduced personal income", "social isolation", "depression", "cognitive decline", "reduced activities of daily life", "reduced quality of life", "frailty", and "loss of independence".

Based on EuroTrak, we see that only 73% of people who self-report hearing problems consult a medical professional. We also see that only 50% of people with self-reported hearing loss are diagnosed with a hearing loss which needs professional hearing care.

Of all the people in Europe with diagnosed hearing loss, 58% use hearing aids. We define this as 'uptake'. The rate varies in Europe from more than 90% uptake in the top 3 countries to 30% or less in the bottom 3 countries. For Portugal, the average uptake is 40%, significantly lower than the European average.

We present figures, based on evidence, for the financial consequences of untreated hearing loss and why professional hearing care is a cost-effective health intervention.

Panel II – Vestibular Rehabilitation

Moderator: Ana Alvarenga
Speakers:
1. Paulo Cardoso do Carmo
2. Mafalda Bento
3. Jean-Philippe Guyot

New Techniques on Vestibular Diagnosis and Intervention

Paulo Cardoso do Carmo[1,2]

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Background: Evaluation of balance complaints in vestibular patients is done with nystagmus measuring tools like videonystagmography (VNG) and functional Computerized Dynamic Posturography (CDP). More recently, evoked potentials, like Vestibular Evoked Myogenic Potentials (VEMPs), are a promising technique, and allow some topo-diagnostics in differentiating lesions from the saccule and utricle and respective afferences, as shown by cervical Vestibular Evoked Myogenic Potentials (cVEMPs) and ocular Vestibular Evoked Myogenic Potentials (oVEMPs). Now patients with vertigo complaints can undergo a video Head Impulse Test (vHIT), a new clinical test of dynamic semicircular canal (SCC) function that uses a high-speed digital video camera to record head and eye movement during and immediately after passive head rotations (while performing the Halmagyi test). Similarly, the angular vestibulo-ocular reflex (aVOR) is a teaching, training, and test tool for the vestibulo-ocular reflex.

Material and methods: Citation report results from Web of Science Core Collection between 1900 and 2018 for the terms: Videonystagmography (VNG); Computerized Dynamic Posturography (CDP); cervical Vestibular Evoked Myogenic Potentials (cVEMP); ocular Vestibular Evoked Myogenic Potentials (oVEMP); video Head Impulse Test (vHIT); angular vestibulo-ocular reflex (aVOR), combined with research in Health Superior School – Polytechnic of Porto, MOODLE@ESS database.

Results: Cervical Vestibular Evoked Myogenic Potential (cVEMP) testing is a vestibular function test used for evaluating saccular and inferior vestibular nerve function, measured by sternocleidomastoid (SCM) muscle activity. It is inhibitory and works ipsilaterally – British Society of Audiology (2012), Isaradisaikul (2012), Craig (2106). Ocular Vestibular Evoked Myogenic Potentials (oVEMP) testing is a vestibular function test for evaluating primarily utricle and superior vestibular nerve function, measured by extra-ocular muscles activity. It is excitatory and contralateral – Craig (2016). Angular vestibulo-ocular reflex (aVOR) is an app designed for both IPhone and IPad. It is a teaching, training, and test tool of the vestibulo-ocular reflex (VOR) system and its disorders, including BPPV. It demonstrates eye saccades, included those caused by canalithiasis (free-floating particles in the canals), and both functioning and dysfunctional VOR. It shows how BPPV is caused and forms a basis for treatment.

Conclusions: The future of vestibular diagnosis and intervention seems promising, with emerging new technologies each year, providing there is investment available for appropriate equipment. Even with budget constraints, a choice needs to be made based on customer preferences, indications, the occupancy rate of the equipment, and its profitability, as well as the criteria for its use.

Keywords: VNG • CDP • VEMP • vHIT • aVOR

Vestibular Rehabilitation Protocols

Mafalda Bento

CUF Porto Hospital

Background: The main purpose of the vestibular system is to allow humans to interact and keep in touch with the surrounding environment safely. The balance system is composed of sensory inputs: vestibular, visual, and proprioceptive systems. Therefore, balance might also be considered a sense. Recently, there has been great research developments in the field of vestibular science due to the evolution of new tools, new proceedings and techniques, and new ideas and paradigms. Several theories have been presented that seek to physiologically explain the different central compensation processes responsible for the recovery of the sense of balance following injury – either of vestibular, central, and/or mixed etiology. Classic vestibular compensation mechanisms of habituation, adaptation, and substitution are still well accepted as the basis of vestibular rehabilitation, as well as models of complex processes of interaction between systems – such as sensory reweighting, which combines mechanisms such as learning and memory. However, due to the numerous conclusions reached, doubts have arisen, especially regarding the choice of best protocol to be used for different pathologies and different lesion etiology.

Material and methods: Since the central question lacks a clear analysis and the interpretation of previously presented findings is uncertain, the approach chosen was first to review the available literature. The review is intended to expose the current research and clinical practices, to promote new questions, as well as promote a better understanding of the subject. Following this, a thematic discussion is presented to highlight new clinical relations and a model protocol for vestibular rehabilitation is proposed.

Conclusions: Vestibular rehabilitation can be considered as a form of sensorimotor therapy that stimulates balance-organ inputs, a process that induces central compensation mechanisms and output adjustments which promote recovery of the balance sense. It is essential to choose the correct protocol for the pathology and the patients' physical and psychological characteristics, and thus the ideal is to create a new vestibular rehabilitation protocol capable of being used for each type of vestibular dysfunction. This might involve intra-protocol modifications that allow the best stimuli and central compensation mechanisms to be selected. The complexity of the vestibular system and its associated pathologies leads us to the belief that balance rehabilitation must be done using a holistic perspective. The key to customizing a protocol lies in making small

changes to adjust it to the pathological condition and the patient characteristics.

Keywords: vestibular rehabilitation • central compensation mechanisms • habituation • adaptation • substitution

Vestibular Implants: Application and Clinical Outcomes

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Background: Just like blindness or deafness, a bilateral vestibular deficit (BVD), even without any other deficit, can affect the youngest patients as well as the elderly. No treatment currently exist to improve the patient's condition. Even physical therapy is only mildly effective. A vestibular implant is being developed in a concept similar to that of the cochlear implant: head motion information is captured by sensors and transmitted to the brain in the form of electrical currents through electrodes implanted close to vestibular nerve branches. The lecture will focus on the history of this development and the results achieved in humans.

Material and methods: The published and unpublished work from our team, between 2002 and 2017, is reviewed.

Results: We started experiments in 2002, by reproducing the pioneering animal studies of Suzuki and Cohen to confirm that it is possible to elicit vertical and horizontal nystagmic responses in humans using electrical stimulation of the nerve branches emerging from the posterior and lateral semicircular canals. The first human chronic implantation was performed in 2007. Today, 13 patients suffering from BVD (and with at least one deaf ear) have been equipped with a prototype cochleo-vestibular implant provided by Med-El (Innsbruck, Austria). One to 3 electrodes are removed from the cochlear array and used for vestibular afferent stimulation. First, we studied how humans would adapt to the restoration of a baseline (steady-state) activity consisting of a constant-amplitude electrical current pulse train. The adaptation period to the abrupt onset and offset of electrical activity was much shorter (less than 30 min) than previously observed in animals. Furthermore, vestibular symptoms were not observed when the baseline electrical activity was increased/decreased gradually instead of abruptly. As the device can be safely turned on and off without causing significant discomfort, there is no need to develop a device working continuously (24 h/day). The reestablished baseline activity of the vestibular system can then be modulated in amplitude or frequency to artificially restore vestibular function. Today, we can elicit an artificial vestibulo-ocular reflex (pendular and video head-impulse tests) which permits dynamic visual acuity to be normalized. We have also demonstrated signs of restoration of the vestibulo-collic reflex by recording vestibular myogenic evoked potentials.

Conclusions: These results demonstrate the feasibility of artificially restoring vestibular function with a vestibular implant in humans, suggesting a useful clinical application in the near future. Of course, the purpose of the vestibular implant is to help patients suffering from DVB. However, it also allows the study of vestibular perception, not in response to a functional loss but in terms of how the system is activated. Finally, it opens up new possibilities for studying the processes of integration of the multiple sensory inputs necessary for maintaining balance.

Panel III – Hearing Rehabilitation – specific to childhood

Moderator: Carla Matos
Speakers:
1. Carla Pinto Moura
2. Luísa Varão
3. João Januário
4. Cristina Murphy

Paediatric Hearing Rehabilitation – decision-making

Luísa Varão

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Background: The decision to apply paediatric hearing systems is to minimize the impact of hearing loss on language acquisition and development. Adjusting tonal thresholds to perceive speech allows the child to understand speech and develop appropriate skills in communication. Audiologists play a key role in providing counselling tailored to each family, allowing fully informed and individualized decisions to be made for each patient in terms of the type of rehabilitation best suited to them, and to make possible changes over time.

Material and methods: In this presentation, we review the audiological tests used in children for the purpose of obtaining audiometric profiles useful for adapting a hearing aid to the anatomical and physiological characteristics of the child, and to take account the selection of a hearing aid style, earmold, and fitting.

Results: The incidence of asymmetrical, progressive, and varied configurations of audiometric thresholds across frequencies creates the need to have flexibility in shaping and fitting a device. It calls for continuous monitoring, verification, and validation of paediatric fittings, outcome assessments, and management of follow-ups and referrals. Adapting hearing aids to use with other assistant technologies like FM systems and remote microphones is another important aspect.

Conclusions: The clinical cases to be presented allow us to conclude that it is not enough for paediatric audiologists to look at just diagnostic tests but to evaluate the child using a holistic perspective.

Panel IV – Hearing Rehabilitation – specific to geriatrics

Moderators: Margarida Serrano
Speakers:
1. Susana Sousa
2. Mark Lauryens
3. Malgorzata Zgoda

Demographic and Functional Aging in Portugal

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Background: Population aging is a long-term trend visible in the evolution of the age structure of the population; it is associated with a decrease in fertility and life expectancy and an increase in mortality rate. Biological aging is a degenerative, global, and irreversible process. The most affected perceptive modalities resulting from aging are balance, hearing, and vision, and they have negative psychological and social consequences. Hearing loss has a deeper and more devastating impact on the elderly person's communication process (Miranda, 2012). Known as presbycusis, this sensory deprivation has a tendency to decrease social contact and cause marked emotional changes in many elderly people (Marques, Kozlowski, & Marques, 2004). The decrease in auditory perception also affects cognitive performance (Lopes, 2011).

Objectives: Data collection on the demographic and functional aspects of the hearing of older Portuguese.

Material and methods: Review of official data on people aged 65 and over from National Institute of Statistics (INE) and PORDATA.

Results: In Portugal (2011 census), there were about 2,000,000 people (±19%) aged 65+. According to projections of the INE for 2012–60, a population decline of 22% is expected (10.5 to 8.6 million), resulting in a continuous and strong demographic aging. The aging index will increase from 131 to 307 elderly per 100 young people, passing the potential sustainability index from 340 to 149 active people by 100 elderly people. About 50% of the elderly have difficulty or are unable to perform at least one of 6 daily activities. The proportion of the population with at least one daily difficulty increases with age. The proportion of women who cannot perform, or have much difficulty performing, at least one activity is higher than the proportion of men in all age groups. Only 4.4% of the elderly had difficulty or could not perform any of the 6 activities. Of those 65+ who had at least one difficulty, 70% could not, or did not, find it very difficult to walk or climb stairs, followed by difficulty in seeing, even when wearing glasses (50%). The third difficulty with relevant incidence is related to memory (40%). In fourth position, with about 380,000 elderly, are those who cannot hear, or have much difficulty hearing, even when using a hearing aid. Some 365,000 elderly people with at least one difficulty cannot (or have much difficulty) in dressing or bathing alone, and 256,000 have limitations in understanding (either understanding others or making themselves understood).

Conclusions: Although demographic aging is inevitable, its consequences depend on the measures taken to overcome its challenges. These data demonstrate the importance of studying demographic trends, anticipating scenarios, and finding ways to respond to new challenges such as monitoring the aging process, the provision of health and social care, and the measurement and monitoring of groups with specific needs.

Keywords: aging • demographics • hearing function

Hearing and Cognition

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When providing hearing care, the audiogram is a very limited source of information. It only evaluates the level at which people start to hear pure tones at different frequencies. Instead, we need to look at all dimensions of hearing "performance" and how the person perceives those 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 and in noise, noise acceptance, aspects of central auditory processing, and cognitive aspects like working memory.

Anderson published a very interesting study looking at how a dynamic auditory-cognitive system supports speech-in-noise perception in older adults. They used 120 older test subjects (50 to 79 years) and ran a full battery of tests 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, and musical training. Based on this information, they developed a predictive model on how somebody understands speech in noise which explained 57% of the variance. Audibility (the audiogram) was the weakest predictor. The most important predictor was "central processing", followed by "cognition", and then "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 also allows 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.

Cochlear Implants in Elderly Patients: World Hearing Centre Experience

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Background: A large proportion of people (50 to 60%) above 70 years of age suffer from a hearing impairment (Alice at al. 2013). From that group, 0.6 to 1.1% have severe to profound loss, which cannot benefit from a hearing aid but can benefit from a cochlear implant. A growing number of seniors using cochlear implants should prompt large-scale studies, using internationally used assessment tools, to compare outcomes, a process which could improve care and make it more suitable to the needs of this specific group. In the lecture, results of two projects run by the World Hearing Centre will be presented: "The benefit of cochlear implantation for elderly patients with partial deafness (PD)", and "The impact of cochlear implants on symptoms of depression in people over 65 years of age". The purpose of the first study was to determine whether hearing outcomes were significantly different in the elderly compared to younger adult cochlear implant recipients. The goal of the second study was to investigate the impact of cochlear implant use on symptoms of depression in seniors.

Material and methods: Patients were recruited from a cohort of patients from the Institute of Physiology and Pathology of Hearing. All patients received a unilateral multichannel cochlear implant. Outcome measures were the abbreviated profile of hearing aid benefit (APHAB) (used to evaluate self-reported sound and speech perception), and the Geriatric Depression Scale (GDS-15) (used to measure depression).

Results: For APHAB global score, a significant effect of a CI was evident. The CI subjective benefit was calculated by subtracting preoperative results from the results obtained at 7 years after implantation. In both groups, elderly and young adults, the CI benefit was almost the same and provided around 30% problem reduction. Mean preoperative GDS-15 score was 3 and postoperative mean score reached 2 points after 7 to 30 months of CI use. The difference between pre and post scores was significant.

Conclusions: Cochlear implants improve the hearing abilities of elderly individuals with PD. In the adult population the effectiveness of cochlear implants is not age-dependent. Improvement of hearing in the 65 plus group with state-of-the art technology reduces the symptoms of depression.

Keywords: cochlear implant • elderly • hearing abilities • depression

WORKSHOP

Importância da Avaliação Neuropsicológica – Instrumentos de Rastreio

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A Neuropsicologia é a especialidade que estuda as relações entre o cérebro e o comportamento, sendo que a avaliação neuropsicológica é um procedimento que pretende definir o estado cognitivo de um paciente destacando e diferenciando as capacidades preservadas e afectadas. Pode realizar-se em indivíduos de todas as idades, existindo uma diversidade grande de instrumentos para o efeito, com diferentes especificidades que têm em conta a faixa etária, género, escolaridade, entre outras da população-alvo.

Existem diferentes tipos de testes para avaliar os diversos domínios cognitivos, que variam na sua forma, conteúdo e tempo de realização. Nos dias de hoje, torna-se premente a utilização de testes de rastreio que permitam a rápida mas acurada detecção de trasntornos cognitivos e que possam ser utilizados pela maioria dos técnicos de saúde, de forma a facilitar o encaminhamento atempado para as especialidades que tratam este tipo de patologias.

O objectivo desta comunicação é dar a conhecer alguns instrumentos de rastreio disponíveis no nosso país que podem e devem ser aplicados por qualquer técnico de saúde e permita realizar diagnósticos e intervenções terapêuticas o mais precoce possível.

POSTERS

Acupuntura no Tratamento de Acufenos

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Background: O acufeno é uma sensação auditiva de som sem estimulação externa. Sendo este sintoma muito comum na nossa população, e não tendo uma cura objetiva e concreta, mas sim diversas alternativas e terapias que fazem diminuir os acufenos percebidos pelo indivíduo, procurando melhorar a sua qualidade de vida. A Acupuntura é uma arte medicinal chinesa, onde através da inserção de agulhas em pontos específicos do nosso corpo se consegue obter um tratamento completamente natural e desprovido de contraindicações. O objetivo é avaliar o efeito da Acupuntura no tratamento de indivíduos com acufenos, através da administração da versão portuguesa do questionário Tinnitus Handicap Inventory (THI).

Material and methods: Foi realizado um estudo descritivo, no qual 3 pacientes foram avaliados, com idade compreendida entre os 45 e os 73 anos, que realizavam Acupuntura para o tratamento de acufenos nas Clínicas de Acupuntura Tradicional Chinesa Dr. Domingos Silva. A informação mais importante de cada paciente foi obtida através de entrevistas pessoais, na qual foram elaboradas as perguntas mais pertinentes para conseguir uma boa anamnese, e por meio da aplicação do questionário Tinnitus Handicap Inventory (THI) tendo sido recolhidos os dados mais concretos dos acufenos de cada individuo. A aplicação do questionário foi dividida em duas fases: uma primeira, antes do início do tratamento de Acupuntura ou nas primeiras consultas realizadas e uma segunda fase, após a conclusão do tratamento.

Results: Houve redução nas respostas ao questionário THI nos 3 pacientes após o tratamento de Acupuntura. Dos 3 pacientes, 2 melhoraram a perceção da gravidade do acufeno de severo para moderado depois do tratamento; e um terceiro reduziu o seu acufeno de moderado para ligeiro.

Conclusions: Os resultados sugerem que houve um efeito da Acupuntura na redução parcial dos acufenos dos pacientes, melhorando por conseguinte a qualidade de vida destes indivíduos.

Keywords: acufenos • THI • acupuntura

Apneia do Sono e Perda Auditiva em Indivíduos do Sexo Masculino

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Background: O Síndrome da Apneia Obstrutiva do Sono (SAOS) é uma perturbação respiratória relacionada com o sono, que consiste na obstrução do fluxo respiratório durante o sono por um período igual ou superior a dez segundos e mais do que cinco vezes por hora. Um dos efeitos mais claros desencadeados por este síndrome é a sensação de cansaço pela incapacidade de completar um ciclo de sono. O ciclo do sono é composto por cinco fases que podem durar de setenta a cento e vinte minutos. Durante este período ocorrem vários ciclos, podendo em cada noite realizar-se de quatro a seis ciclos.

Vários estudos demonstram que a diminuição dos níveis de oxigénio provocada pelo SAOS tende a levar a uma inflamação generalizada e distúrbios vasculares que podem afetar áreas cerebrais que controlam a audição.

Material and methods: Com a pesquisa do tema e dos diversos estudos anteriormente realizados, surgiu o propósito de tentar responder à questão 'existe uma relação entre o síndrome da apneia obstrutiva do sono e a hipoacusia?'. Sendo assim, este projeto tem como finalidade o estudo exploratório através da consulta de casos clínicos e respetivas polissonografias e audiogramas tonais, permitindo verificar se ocorrem ou não alterações auditivas causadas por este síndrome.

Results/conclusions: Considerando a análise de todos os dados obtidos para este estudo exploratório não se conseguiu obter conclusões decisivas da presença de diferenças significativas na audição com a presença da SAOS.

Keywords*:* Síndrome de Apneia Obstrutiva do Sono • audição • polissonografia • audiograma tonal • estudo exploratório

Sound Localization and Auditory Memory in Children with and without Middle Ear Alteration

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Background: According to studies, there is a relation between the alteration of the middle ear's ability to hear sound and auditory memory. Changes in the middle ear can lead to a lack of auditory stimulation with structural and functional consequences on the brain. There is a

limitation in the literature regarding the consequences that these alterations may have on cognition and memory. It is known that alterations can cause impairment in sound localization and auditory memory. This study aims to investigate the influence of middle ear alteration on auditory processing abilities, such as sound localization and auditory memory.

Material and methods: In the study there were 47 children, 19 of which had middle ear alteration, while the remaining 28 had no changes. The children were later submitted to audiological screening, impedance measurement, and tests of sound localization and auditory memory. A sound/space location test was also performed.

Results: In the sound localization tests, children with middle ear alterations showed a greater number of failures. In the case of the non-verbal sequential memory test, the children with middle ear alteration failed the most, although the difference was not so obvious.

Conclusions: There were statistically significant differences, confirming the idea that middle ear alterations may influence auditory processing skills.

Keywords: middle ear alteration • sound localization • auditory memory

Case Study: First Codacs Results

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Background: This work presents the first audiometric outcomes after implantation with the Cochlear Codacs™ Direct Acoustic Cochlear Implant System. This implant comprises a power-driven stapes prosthesis working as a vibrating system, and is intended for the treatment of severe mixed hearing loss.

Material and methods: In this case study, we evaluated the audiometric outcomes – conventional pure tone and speech audiometry as well as implant functional gain – of two patients who underwent Codacs™ implantation. Pre and postoperative results and functional gain outcomes were analysed at 1 month and 3 months.

Results: Patient A – a 59 year-old female, with previous stapes surgeries in both ears and progressive hearing loss, was implanted with the Codacs™ system in the left ear; Patient B – a 67 year-old male, with progressive hearing loss and no gain with hearing aids, was implanted with the Codacs™ system in the right ear. Patient's A preoperative audiometry showed a threshold average of 65 dB for bone conduction and 78.3 dB for air conduction; speech recognition threshold was 80 dB. Postoperative audiometric outcomes revealed an increase of 29.3 dB in patient's A air conduction thresholds to an average of 78.3 dB in bone conduction and 116.4 dB in air conduction; there was no discrimination at all. Unexpectedly, the functional gain within 1 month after implantation revealed an average pure tone threshold of 35 dB and speech recognition threshold of 40 dB; these results became even better within 3 months of implantation: 33.6 dB for pure tone thresholds and 30 dB of speech recognition threshold. In patient's B case, preoperative audiometric threshold were 60 dB for bone conduction and 90.2 dB for air conduction; speech recognition threshold was 90 dB. Postoperative thresholds decreased to 44.2 dB for bone conduction and 72.1 dB for air conduction; 65 dB was the speech recognition threshold. Functional gain within 1 month of implantation revealed thresholds of 29.3 dB for pure tones and speech recognition threshold of 30 dB.

Conclusions: The Cochlear Codacs™ implant is a powerful acoustic hearing solution. Although the outcomes from pre and postoperative evaluations were nonuniform, the functional gain of the Codacs meant that audiometric thresholds decreased significantly. When the functional gain of conventional hearing aids is insufficient to fulfill the patient's everyday hearing needs, Codacs might be considered as a solution.

Keywords: Direct Acoustic Cochlear Implant • CODACs • Cochlear • Middle ear transducer

The Fully Implantable Cochlear™ Carina® System: First Clinical Results

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CUF Porto Hospital, Portugal

Background: The Carina system is a totally implantable prosthesis designed to meet the needs of acoustic amplification in adults with moderate-to-severe sensorineural or mixed hearing loss. The microphone under the skin captures sound and sends it to the implant, without requiring the use of an external audio processor. The aim of this work is to describe the outcomes for the active middle ear implant fully implantable Cochlear™ Carina® System.

Material and methods: A retrospective observational non-randomized group study was conducted. From December 2014 to June 2017, 15 patients underwent Carina surgery at the ENT Department of CUF Porto Hospital. The implants were all from the last generation models developed by Cochlear™. Pre and postoperative air and bone conduction thresholds and speech recognition thresholds were evaluated, as well as implant functional gain by 1 month, 3 months, 6 months, and 1 year after implantation.

Results: 16 implantation surgeries were performed in 15 patients. The average age was 58 years; 60% of the implants were performed on the right ear; 53% female and 47% male patients. Nine patients presented with sensorineural hearing loss and the transducer was connected to the body of the incus. Six other patients presented mixed hearing loss and the transducer was connected to the stapes by a clip coupler. Preoperative average of air conduction threshold was 64.7 dB and speech recognition threshold was 66 dB. Postoperatively speech recognition thresholds and bone conduction thresholds were stable, but a slight increase in air conduction threshold was found. The functional gain within 1, 3, 6 months and 1 year were, respectively, 47.9,

49.8, 46.6, and 47.9 dB with speech recognition thresholds of 51.7, 48.2, 47.1, and 47.5 dB.

Conclusions: In spite of the small number of patients, our results confirm that a fully implantable middle ear implant is a viable treatment for patients with moderate sensorineural hearing loss. Implant functional gain and speech recognition thresholds showed an average improvement of 20 dB gain. In selected cases it may be an alternative to conventional hearing aids.

Keywords: active middle ear prosthesis • Carina • Cochlear • middle ear transducer

Universal Newborn Hearing Screening at the Hospital District of Santarém

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Background: The main objective of implementing Universal Newborn Hearing Screening (UNHS) is the early identification of hearing impairment, so that the difficulties that may arise can be minimized with proper and timely rehabilitation. Of 16,001 newborns, a coverage of 99.1% (15,852) was reached, and up to date 21 children with hearing impairment have been detected.

Material and methods: Three physiological methods were used: Transient Otoacoustic Emissions (TOAE), Automated Auditory Brainstem Response (AABR), and Auditory Brainstem Response (ABR).

Results: After 10 years and 3 months of UNHS at the Hospital District of Santarém (HDS), 99.1% (15,852) newborns were screened, thus making UNHS in HDS effective and universal, with a minimum of 95% desirable. For diagnosis, 176 children (0.9%) were referred for diagnosis. From the 176 children referred, 146 were discharged from the UNHS, representing 0.9% false positives. Since its implementation in HDS, 21 children with hearing loss have been identified, of whom 13 had no risk factors for hearing loss.

Conclusions: The fact that 13 newborns diagnosed with hearing loss did not present risk factors for deafness is more than sufficient reason to implement Universal and Neonatal Auditory Screening programs. The Hospital District of Santarém is a good example and model of UNHS implementation according to international audiology guidelines.

Keywords: UNHS • otoacoustic emissions • hearing loss

FREE PAPERS/COMMUNICATIONS

A Importância da Plataforma Para a Monitorização do Rastreio Auditivo Neonatal Universal (RANU)

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Background: A surdez pode ter implicações negativas quer no desenvolvimento da linguagem, quer no desenvolvimento global da criança. A detecção e intervenção precoce da surdez têm sido preconizadas por várias organizações nacionais e internacionais, como meio de minimizar o impacto pessoal, social e económico que esta pode ter na criança. A Plataforma online de RANU desenvolvida no nosso hospital tem assumido extrema importância para garantir a efectividade e eficiência do RANU, quer em aspectos quantitativos como qualitativos. Tem como objetivo apresentar as vantagens que obtivemos no programa de RANU com a utilização da Plataforma online do nosso hospital.

Material and methods: Estudo retrospectivo dos recém-nascidos avaliados no nosso hospital, entre Janeiro de 2010 e Dezembro de 2016, através dos dados obtidos pela Plataforma online de RANU e pelo SClínico.

Results: Após a implementação da Plataforma de RANU, verificou-se uma melhoria nos timings de diagnóstico e encaminhamento para intervenção na surdez. A monitorização obtida pela utilização da plataforma permitiu-nos diminuir as taxas de evasão, diminuir a perda de dados do RANU, assim como facilitar o acompanhamento das crianças em todas as fases do RANU e a obtenção dos dados estatísticos a todos os profissionais de saúde envolvidos no programa de RANU.

Conclusions: Através da plataforma online de RANU obtivemos uma monitorização efectiva das crianças. Concluímos, através da experiência que temos tido, que esta poderá contribuir futuramente para uma padronização e monitorização do RANU a nível nacional.

Reaction Times to the Onset and Offset of Auditory and Visual Stimuli

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Background: Reaction time (RT) studies contribute to the understanding of motion onset and offset detection mechanisms. Neural response latencies to visual motion onset have been found longer, and shown more pronounced stimulus dependence, compared to offset latencies. In RT tasks subjects are slower in responding to the offset of a visual stimulus than to its onset. As for the auditory modality, much less evidence is available. Some results suggest a significant asymmetry in the neurophysiological and perceptual processing of onset and offset of sound.

Material and methods: RT was measured to the presentation of spatialized auditory or visual stimuli. In a training task with feedback on the outcomes (task 1), 19 listeners were presented with free-field sound stimuli that, after an initial stationary phase, started to move rightward (motion onset) or that after moving rightward for some time became static (motion offset). Subjects judged as quickly as possible what kind of movement had been presented.

Results/conclusions: Only 9 subjects met the required criteria of correction during training, and were selected to subsequently perform in the experiment proper (task 2). In this experiment, both static and moving stimuli (auditory/visual) were presented in separate blocks. RT were measured in all conditions to the presentation of static stimuli or, for dynamic stimuli, to the occurrence of motion onset/offset. RT were then compared between the conditions, considering sensory modality (auditory *vs.* visual) as one factor and static presentation, motion onset, and motion offset events as the levels of a second factor (response signal).

Postural Balance in Factory Workers

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Workers in industrial environments are exposed to sounds with intensities high enough to affect the audio-vestibular system. Sounds can influence the postural stability of the human due to the relation between the vestibular system and the Corti organ.

Objective: To analyze whether sensory stimulation, specifically auditory stimulation, is related to an improvement in the postural balance of the factory workers.

Material and methods: The following tests were compared: mCTSIB, stability limits and evaluation of the anterior/posterior and medial/lateral plans. This study compares factory workers performance in the aforementioned tests before and after 8 hours of work in a high sensory stimulative environment. The goal was to verify if this factor influences workers' balance and to identify in which situations could they face more difficulties. Approximately 42 subjects were evaluated before and after 8 hours of work.

Results: Comparing the results of the mCTSIB test, after a work period of 8h, the subjects presented a more stable postural balance on Tests 2 and 4. As for the test of stability limits, there were only statistically significant differences in the maximum forward excursion. In the evaluation of the anatomical plans, it was verified that the oscillation in both cases decreased after work activity. However, throughout the tests, the medial/lateral plan always prove to be the one oscillating the most.

Conclusions: We can conclude from this study that factory workers have a better postural balance after work activity than pre-labor. Additionally noise and other sensory stimuli when correctly applied may help in the treatment of vestibular dysfunction.

Keywords: postural balance • sensorial stimulation • posturography • factory workers

Early Auditory Function

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Background: Hearing loss can be diagnosed through a battery of quantitative tests, electrophysiologic, acumetric and audiometric exams, which allow a quantitative evaluation and topodiagnosis. Quantitative assessment uses tools such as the *Early Listening Function* questionnaire, developed by Anderson (2002). Unlike quantitative tests, it is not intended to be a diagnostic tool but an affordable, simple way to be used by caregivers of children from 4 months to 3 years of age, making it possible to obtain information about how the child hears in their daily lives. ELF is based on 12 auditory activities with different intensities, in both silence and noise. The present work intends to validate the adaptation and the translation of the ELF questionnaire into Portuguese by Lopes and Cardoso do Carmo, called FAP (Early Auditory Function). Objectives: To describe the process of translation and linguistic and cultural validation into European Portuguese of the ELF questionnaire, known as FAP, initiated by the authors and supervisors of this work, Profª. Paula Lopes and Prof. Paulo Cardoso do Carmo. For this purpose, the α-*Cronbach* reliability test was used.

Material and methods: The translation and conversion of the questionnaire was carried out according to the usual standards and tested for reliability using the *α-Cronbach* reliability test. Data collection took place between May and September 2017.

Results: 13 caregivers of standard hearing children participated, 6 females and 7 males, with a mean age of 35.4 and standard deviation of 13.4. The FAP questionnaire gave an α=0.91, which corresponds to very good reliability. That is, the reliability of the version of the ELF questionnaire in European Portuguese has been verified.

Conclusions: The questionnaire is valid, but it is necessary to carry out analysis on a larger population to obtain even more reliable results.

Keywords: hearing loss • ELF • Early Listening Function • pediatric audiology • FAP • questionnaires • European Portuguese