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• Scientific Articles •

Comparing the Postural Stability of Athletes and Non-Athletes Using Computerised Posturography

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Introduction: Postural balance is strongly related to sport skill, since an athlete with below-average stability cannot perform sporting manoeuvres as well.

Objective: This work assessed correlations between type of sport and stability of posture by comparing test results from postural experiments.

Methods: Findings from the following experiments were compared: Modified Clinical Test for the Sensory Interaction on Balance (mCTSIB), unipedal stance test, limits of stability between athletes of different sports (swimming, volleyball, football, rowing, and roller hockey) and individuals who did not engage in any type of sport. Results were also assessed in terms of each sport's individual players in order to gauge which sport is most demanding of postural stability. Some 10 to 15 athletes from each sport were tested, along with 68 physically inactive adults.

Results: Sportsmen showed higher posture stability under conditions 3 and 4 of the mCTSIB test and conditions 3 and 4 of the unipedal stance test. Concerning limits of stability, sportsmen had quicker reaction times than sedentary individuals, and had swifter movement. Lastly, when comparing tests from each type of sport, similar results were found, except for rowing, which showed statistically significant differences under conditions 1, 2, and 3 of the mCTSIB test and conditions 3 and 4 of the unipedal stance test.

Conclusions: The tests showed that sportsmen generally have better postural stability than non-sportsmen.

Comparison of the Performance of Left-Handed and Right-Handed Subjects in Auditory Processing Tests

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Introduction: Auditory processing (AP) is responsible for analyzing, connecting and interpreting auditory information that we receive through hearing, verbally or non-verbally. There are many questions about whether hemispheric specialization is equal in right-handed and left-handed individuals. Perhaps that is the reason why studies about auditory processing are made only with right-handed subjects. Studies that compare right-handed with left-handed persons have shown a disadvantage for the left-handed group.

Objective: To compare the performance of left-handed and right-handed individuals in tests that assess auditory processing (Duration Pattern Test, Dichotic Digits Test, and SSW Test), and through this comparison see if they have equal performance.

Methodology: 22 individuals (11 right-handers and 11 left-handers) aged 17 to 23 years submitted to auditory processing tests.

Results: No significant differences were found between the right-handed and left-handed groups. However, in SSW tests, left-handed individuals generally had worse results.

Conclusions: Left-handed individuals performed slightly worse than right-handed in just one of the hearing processing tests; more research is needed to confirm the performance difference.

• Structured Sessions •

Assessment and Intervention in Auditory Processing

Moderator: Margarida Serrano

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N400 Experimental Paradigm in Central Auditory Processing Assessment

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Introduction: The N400, described in 1980 by Kutas and Hillyard, is an ERP response observed during presentation of words and other significant stimuli. It is a negative-going deflection of the EEG signal around 400 ms post-stimulus onset. Kutas & Federmeier (2000) found that this component is linked to the semantic processing of significant or potentially significant stimuli. Studies on N400 responses are of great interest because they touch on central aspects of language comprehension. Auditory Processing Disorders (APDs) are seen as a functional hearing loss in which an individual cannot perform (central) auditory

processing (CAP) (Musiek, 2007; Katz, et al., 2009); furthermore, they complain of difficulty in understanding speech in noisy environments (signal degradation and/or competitive noise) (Schochat, 1997; ASHA, 2005). Musiek & Baran (2001) consider that the use of a set of tests – including behavioural and electrophysiological tests – in a CAP assessment is wise and necessary. So far the N400 has been excluded from most CAP assessment protocols.

Objective: To assess the semantic auditory processing in individuals with and without APD using behavioral and electrophysiological tests.

Methods (behavioral): The sample was 37 adults who were Portuguese native speakers (3 with confirmed diagnosis of APD). In a semantic categorization task subjects listened to a series of words denoting entities belonging to a lexical field (objects, fruits, animals); three words in the series belonged to the same field and a fourth unrelated item belonged to another semantic field (total 236). Subjects had to decide via a button box whether the word heard belonged to the current semantic field or not. Reaction times (RT) and accuracy were recorded.

Methods (electrophysiological): Another sample of 21 adults (3 with APD); experimental conditions as above were adapted for ERP methodologies.

Results: In the behavioral tests, individuals without APD produced 85.7% correct answers, being faster at congruous items than at incongruous ones (574.55 ms *vs.* 624.97 ms), a statistically significant difference. Individuals with APD presented 92.8% correct answers, but their results did not point in the same direction as the previous group, as they had faster RT for the incongruous words compared to the congruous ones (615.66 ms *vs.* 671.81 ms). The electrophysiological data (ERPs) showed that in individuals without APD the N400 appeared in the recording channels F3, T3, T5, Cz, and T4. Such an effect was not observed in individuals with APD.

Conclusions: In the behavioral tests individuals without APD were faster in congruence situations. In the ERP studies, the N400 appeared for incongruous words in F3, T3, T5, Cz, and T4. For individuals with APD, the incongruence seemed to contribute to a faster decision, registered in the behavioral tests, in the same way as the ERPs, with the observation of more positive waves for the incongruous items. These observations raise the hypothesis that the processing of meaning in speech perception is qualitatively different in APD subjects, and underlines the importance of including the N400 ERP semantic testing in CAP assessment.

Cognitive Auditory Evoked Potentials: Advances and Insights in Neuroaudiology

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Clinicians can now assess the peripheral auditory pathway with fair precision and reliability. There are psychoacoustic methods, such as pure-tone and speech audiometry, physiological methods, such as otoacoustic emissions and immittance measures, and electrophysiological techniques such as auditory brainstem response. However, it is in the auditory cortex that auditory and language neuroprocessing takes place. Auditory event-related potentials (AERPs), interpreted via cognitive psychophysiology, provide a theoretical rationale for assessing and investigating auditory linguistic neuroprocessing. This is important when we wish to consider clinical conditions which display language and auditory processing impairments, such as certain neurodevelopmental disorders.

AERPs are changes in the ongoing EEG which are time- and phase-locked. They reflect sensory central processing and cognitive activity, which might involve memory, expectation, attention, or changes in mental state. AERPs are one of the most informative, dynamic, and non-invasive methods for studying cognition and the dynamics of neural systems. They provide a continuous measure of processing between stimulus and response, revealing neural reactions not evident in behavior. Processing can also be measured under conditions that do not normally involve a behavioral response, and under some conditions neural systems can be identified. Moreover, its high temporal resolution (milliseconds) facilitates capture and study of neural processes such as auditory and language processing.

Here we draw attention to achievements in understanding the neurofunctional meaning of each AERP component. N1 reflects pre-attentive discrimination and early synchronization between primary and secondary auditory cortices in the lateral and supratemporal planum (Liasis et al., 2006). The significance of P2 is largely unknown, but it is reduced in schizophrenia (Salisbury et al., 2010). The N2 (N2b) is interpreted as a correlate of the controlled detection of stimulus changes and phonological categorization (Amenedo & Díaz, 1998). MMN currently provides an objective measure of auditory perception and discrimination based on the presence of short-term memory (sensory memory; Näätänen, 2001). P3a is related to the engagement of attention, especially orienting, involuntary shifts to changes in the environment, and the processing of novelty (Donchin, 1981). P3b is widely studied in terms of information processing, decision making, and can even measure how demanding a task is cognitively (Polich, 2007).

Other AERPs peaking after 300 ms are widely studied as endogenous language-related components, and are not studied with auditory oddball. The N400 response is seen in response to all meaningful or potentially meaningful stimuli, thus indexing semantic processing (Kutas & Hillyard, 1980). Lastly, the P600 or syntactic positive shift (SPS) is a late centroparietal positivity associated with the processing of syntactic anomalies (Friederici, 1995). A fundamental goal is understanding the basic neural processes which underpin more complex cognitive systems and operations. In terms of assessing central auditory processing, audiology can contribute significantly to cognitive neuroscience.

Central Auditory Processing Evaluation: Normative Data for a Portuguese Pediatric Population

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Introduction: The need for central auditory processing assessment tools motivated us to develop a suitable battery of tests. The battery has 6 tests: SSW, Filtered Speech, Speech in Noise, silence detection in noise, Duration Pattern, and Frequency Pattern. To be able to use the battery to diagnose central auditory processing disorders in the pediatric population, it is important to evaluate children with normal development.

Objectives: The present work is aimed at improving and adapting some existing tests in Portugal and gain performance data in children aged 5 years to 11 years and 11 months without disease. Based on this data, the battery can later be applied to children with learning difficulties.

Methods: An audiometer and a computer with specially developed software was used. Data was collected in a soundproof booth. All children were divided into age groups. In total, 216 children between 5 and 11 years were evaluated at 13 different locations in Portugal. The participants had been previously evaluated with tone and speech audiometry, impedance, and otoacoustic emissions. Tests were presented at 50 dB SL. Half the participants started the evaluation with the right ear and the other half with the left ear, in order to eliminate learning effects. Statistical analysis was conducted using SPSS 17 at a significance level of p=0.05.

Results: The results obtained in the evaluation of children with normal development allow the expected performance for each age to be defined.

Conclusions: The tests are adequate for pediatric evaluation. The results of the children with normal development are important for evaluating central auditory processing disorders in Portugal.

Auditory processing disorder: Management

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The characteristics and etiology of Auditory Processing Disorder (APD) are similar to those of other developmental disorders, and APD frequently co-occurs with language, literacy, and attention disorders. This underlines the importance of a multidisciplinary approach to management of APD. Such an approach is also important for complementing audiological diagnosis, ensuring that an accurate diagnosis is made. It allows a good understanding of all of an individual's weaknesses and strengths, which will form the basis of an adequate management plan. It is important to include professionals such as the audiologist, speech-language pathologist, teacher, psychologist, physician, and any other professional for the evaluation and treatment of each individual with APD. Neuroplasticity gives us the possibility of, with intensive training, changing auditory behavior (and so having a positive impact on possible co-morbidities). Multidisciplinary management should start as soon as possible after diagnosis, making use of the plasticity of the central auditory nervous system, allowing maximum benefit. Management should be individualized (taking into consideration aspects such as the individual's age, interests, and strengths and weaknesses) and use both top-down and bottom-up approaches. The management plan should also include: environmental modifications to ensure a better acoustic signal; use of communication strategies by the communication partners to enhance understanding of the message; encouraging the individual to take responsibility for their listening performance and use strategies to ensure adequate comprehension of the message; development of linguistic competencies; and formal and informal auditory training tasks.

Evaluation and Intervention in Tinnitus

Moderator: Fernanda Gentil

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Tinnitus Handicap in Cochlear Implant Users

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Introduction: A proportion of individuals with a cochlear implant (CI) have tinnitus; however less is known about the degree to which this is troublesome. We determined the proportion of individuals with handicapping tinnitus within the Cambridge University Hospitals CI population as a preliminary step towards a trial of sound therapy.

Methods: A bespoke questionnaire, incorporating visual analogue scales, was completed by 258 monaurally implanted individuals from the adult CI population (response rate of 55%). A novel feature of the questionnaire was that tinnitus was assessed alongside five other areas of potential difficulty (speech in quiet, speech in noise, music perception, naturalness of speech and of environmental sounds) – allowing a neutral comparison of problems caused by tinnitus and other difficulties.

Results: One in 5 individuals had a handicap VAS greater than 50%, and one in 10 greater than 75%. When placed in rank order, the tinnitus handicap score was the first or second most handicapping area for 37% of individuals. Handicap scores did not depend on implant type and correlated neither with age (p=0.59) nor duration since implantation (p=0.44).

Conclusion/Discussion: Tinnitus has significant impact in the adult CI population.

Management of Tinnitus Patients

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Introduction: Tinnitus is experienced by about 10–15% of the population, and about 5% of adults experience severe, persistent tinnitus affecting their well-being. Although many adjust, others are disabled by the condition.

Objective: A literature review of tinnitus etiology, approaches, evaluation, and current management strategies.

Results: Tinnitus is a symptom of many pathologies. It can originate from the outer, middle, or inner ear (e.g. wax in outer ear, otitis media, otosclerosis, presbycusis, acoustic neuroma). It can also be a symptom of hematologic disease (e.g. anemia), endocrinologic disease (e.g. hyperthyroidism), cardiovascular disease (e.g. glomus jugulare or glomus tympanicum, mitral or aortic stenosis), muscular mioclonus (e.g. palatal, tensor tympani, stapedius), pharmacological (e.g. benzodiazepine withdrawal, ototoxic drugs), artrogenous (e.g. dysfunction of the temporo-mandibular joint), or psycho-affective emotional distress (e.g. decompensated anxiety or depression). Severity is graded via questionnaires (e.g. Tinnitus Handicap Inventory) that are also useful for follow-up management. Because of multifactorial etiology it is important to have a detailed clinical history of the tinnitus patient. Is the tinnitus objective or subjective, pulsatile or not, clicking, pure tone or complex, low or high pitched? Is it variable or constant, and is it located in one or both ears or the head, and can the patient modulate their tinnitus with oro-facial or cervical movements. It is also important to record previous ototoxic drug consumption, noise exposure (e.g. at work, leisure, military), previous infectious diseases of the ear or other organs, cranio-cervical trauma, and neurological, muscular, artrogenous, psychiatric, endocrinological, or oncological disease. It is recommended to measure blood pressure, pulse rate, and temperature, and have a complete ear, nose, throat, head, and neck examination (as well as head and neck auscultation in case of pulsatile tinnitus). All tinnitus patients should have the following audiological exams: high frequency tonal audiometry, tinnitus pitch and loudness, loudness discomfort levels, Feldmann masking curves, and residual inhibition. Other specific exams may be relevant according to clinical history.

Conclusions: According to the specific etiology, other health professionals besides ENT, audiologist, and psychologist should be involved in tinnitus management (neurologist, psychiatrist, maxillo-facial specialist, physiotherapist, neurosurgeons). The ENT should focus on identifying tractable causes of tinnitus (specific underlying causes other than SNHL) because pharmacological intervention is not effective in the large majority of patients. Affected patients need support and counselling on healthcare options. According to the severity of the case, a combination of treatments can be applied: counseling, relaxation techniques, cognitive behavioral techniques, instrumentation (hearing aids and/or sound generator), and tinnitus retraining therapy.

Emotional and Psychological Aspects of Tinnitus Patients

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Introduction: Clinical experience with tinnitus patients, previous research, and the literature show that many tinnitus patients have psychological/psychosocial problems and reduced quality of life (QOL), and many therapies often have a low degree of success.

Quality of life: The QOL corresponds to the perception of position in life, cultural context, system of values, and the relation between goals, expectations, standards, and concerns. Tinnitus triggers changes in one's life, a sense of loss of silence, and calling for readjustment. Patients with tinnitus may suffer multiple disturbing states, such as despair, anger, anxiety, and depression. The THI can be used to evaluate the QOL of patients with tinnitus, although the THI was originally used as a way to quantify the severity of tinnitus.

Emotional aspects: There are many studies that link tinnitus with emotional problems, highlighting significant psychological disorders. The identification of anxiety and depression in tinnitus patients is important for therapeutic intervention.

Coping: Heinecke et al. (2008) found that physiological and psychological aspects were associated with stress responses. Tinnitus patients had a lesser capacity to resolve stressful situations. Intervention programs for tinnitus should consider ways of providing coping mechanisms under stress. A connection exists between maladaptive coping and subjective perception of tinnitus severity, something that does not exist when strategies are effective, which confirms the usefulness of psychological therapy.

Self-efficacy: Self-efficacy refers to how individuals perceive their own ability to organize and carry out activities in unfamiliar situations which are usually uncontrolled and unpredictable. Self-efficacy is an indicator of how effective an intervention is likely to be.

Intervention: There are examples of collaboration between ENT and psychotherapy, like the University Hospital of Geneva. Patients who do not accept their auditory dysfunction, or are very focused on tinnitus, are sent to a joint appointment with an ENT doctor and a psychologist. This consultation addresses the social and psychological aspects, trying to make the patient understand the relation between tinnitus and some aspects in their daily life which have been disturbed. CBT is a therapeutic strategy used with these patients, and has had positive results. It is therefore important to develop intervention strategies that enhance self-efficacy, optimism, and coping strategies as well as reducing anxiety/depression and promoting their QOL.

Conclusions: Motivated by clinical practice and the literature, this work has systematized an approach for implementing a QOL promotion program. It takes a psychological approach and complements standard therapy. Apart from psychotherapy such as CBT, specific strategies can lessen anxiety and depression. The aim is to increase optimism, self-efficacy, and coping strategies, allowing patients to cope more effectively with tinnitus. As the subjective discomfort gradually decreases, a stage may be reached where tinnitus no longer has an aversive connotation.

Early Identification and Intervention in Audiology

Moderator: Odete Batista

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Newborn Hearing Screening

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Normal hearing is critical to the development of speech and language. Deafness can be of congenital origin (genetic or extrinsic cause, acquired during pregnancy) or acquired (perinatally or postnatally). Childhood deafness is the most common congenital disability for which there is screening and early intervention. It is estimated that its incidence is 1 to 2 per 1000 newborns, rising to 2 to 4 per 100 newborns from Neonatal Intensive Care Units (NICUs) or with risk indicators. Deafness is a disability with repercussions on the acquisition of speech, language, and intellectual development of the child, making social integration more difficult. The first 3 years of life are crucial for language acquisition and speech.

In 1972 the Joint Committee on Infant Hearing drew up a list of risk indicators for deafness, recommending auditory screening to children that had these indicators. The key risk indicators are: prematurity, low birth weight, hiperbilirubinemia, family history of deafness, congenital infections, ototoxic medication, mechanical ventilation for more than 5 days, low apgar score, craniofacial anomalies, bacterial meningitis, associated syndromes, and NICU for over 48 hours. In 1994 the Joint Committee on Infant Hearing recommended universal neonatal hearing screening (UNHS) using easy and fast screening tests. The aim is to diagnose deafness before 3 months of age and to rehabilitate before 6 months. However, 50% of cases of infantile deafness are not associated with any known risk indicator.

There are several screening protocols adapted to each country, but otoacoustic emissions and automatic auditory evoked potentials are the most common screening methods. Currently, the average age of detection of hearing loss is about 2 years old, well beyond the age considered ideal for placing a technical aid, either hearing aid or cochlear implant. In 2005, the Screening and Intervention on Children Deafness Group (GRISI) was created. It is an interdisciplinary group consisting of various health professionals (ENT, audiologists, nurses, SPL therapists, and paediatricians). This group's main objective is the implementation of a national program of detection and early intervention, through joint actions with professional associations and several official entities.

Childhood Hearing Screening

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Matosinhos Hearing Screening Requirements for School-Aged Children Between October 2012 and May 2014

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Introduction: This research is focused on deafness and impaired hearing in children who attend special education, and its main objective is to understand whether the presence of an audiologist is an advantage and if it works as a complement to the linguistic, social, and cognitive development of children attending the 1st year of primary school.

Objectives: The research question was: *Is there any need to integrate an educational audiologist in primary schools?*

Methods: Exactly 22 schools in a northern region of Portugal were selected and a hearing screening was given to students attending regular classes, which included a brief anamnesis, otoscopy, and an audiogram. The aim was to determine whether there were otologic or hypoacoustic changes that could be detected by the educational audiologists in a school, justifying their presence and above all enabling early intervention and ongoing monitoring of the child.

Results: The results revealed the existence of these changes, confirming our work issues (37% with otologic disorders, 6.6% with right ear hearing loss, and 6.7% with left ear hearing loss). We conclude that if there are any students that have already been diagnosed by the family doctor, there are advantages in the inclusion of an audiologist in the multidisciplinary team that operates in schools.

Conclusions: Despite the benefits shown in the inclusion of these health professionals in these teams, audiology is still a little known profession in contexts apart from the hospital and clinic.

School-Age Hearing Screening

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School-age hearing screening in Portugal, as in many countries in Europe, is not mandatory. Despite the European Consensus Statement on Hearing Screening of Pre-school and School-age Children, signed in 2011, it has still not been possible to include hearing screening in the national health program. The aim of this summary is not to detail the empirical results of the screenings but to underline the benefits of having an audiologist working closely in a school setting and performing hearing screening, especially when it is not mandatory.

The case presented here is from an institution with 5 schools in the Lisbon area where, in each school year, approximately 250 children are screened. Children are from ages 5 to 7 and from lower/lower-middle class. The hearing screening program started 5 years ago and is performed by an educational audiologist. The screening protocol used was that proposed by the American Speech-Language and Hearing Association: otoscopy, tympanogram, pass/fail audiogram at 20 dB HL for 1, 2, and 4 kHz; if abnormal otoscopy and/ or tympanogram type C2 or B and/or the audiogram shows a fail, refer for assessment. As stated in the ASHA Guidelines for Audiological Screening: "Appropriate management and follow-up of children who do not pass the hearing screening is of utmost importance to the efficacy of the screening program. If a child is referred based on the results of his or her rescreening, a process for notifying the parent/guardian should be implemented that provides information, in lay language, regarding the meaning of the referral and recommended follow-up procedures." Particularly in a population from the lower/ lower-middle classes, notifying families has proven to be insufficient to guarantee rescreening or assessment.

Even though, prior to screening, parents/legal guardians give consent and therefore have been given an explanation of the purpose and importance of screening, our experience has shown that the proximity of the educational audiologist to families allows for a greater number of children who have failed hearing screening to undergo full assessment. Families tend to need a more extensive and more comprehensive understanding of the consequences of (transitory) hearing impairment and its possible relation to the difficulties that their child is experiencing. This also enables families to be more motivated to follow through with treatment when needed. Another advantage of hearing screening in schools is the possibility of educating school personnel. As with families, close contact to teachers allows for an increase in the number of referrals of students with auditory disorders, permanent and/or transitory, leading to appropriate management and a reduction in student underachievement. In sum, school-age hearing screening by an educational audiologist promotes earlier detection of audiological disorders; assessment and treatment of disorders; increase in hearing healthcare literacy for all school personnel; a closer engagement with parents allows them to be more aware and sensitive to hearing healthcare issues; and greater educational success for students.

Vestibulogy and Vestibular Rehabilitation

Moderator: Isabel Borges

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Importance of Computerized Dynamic Posturography in Vestibular Rehabilitation

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Balance is a human being's capacity to remain erect and make sharp movements and rotations without wobbling or falling. The central nervous system has three sensorial systems (vestibular, visual, and somatosensory) responsible for capturing positional information, and it is necessary for the systems to work in harmony in order to achieve equilibrium. Computerized Dynamic Posturography (CDP) is a computer system connected to a platform with different sensors. The sensors capture movement and monitor changes of weight at various spots in the feet in response to oscillations of the body under different sensory conditions. This summary demonstrates the utility and efficiency of CDP in diagnosing equilibrium disorders, and in rehabilitation through registering, analyzing, and quantifying different sensorial conditions. This allows one to observe the physical response to a received stimulus, in order to provide appropriate individual treatment to each patient.

Vestibular rehabilitation (VR) has the following goals: facilitate the process of central compensation; improve the limits of postural stability and enhance motor control; and develop and improve strategies of equilibrium. It can help prevent falls in the elderly, diminishes anxiety and boosts self-confidence, and improves quality of life.

A CDP exam requires an optokinetic stimulator, a projector, and a screen to project the images. The patient should be standing up, barefoot, on top of the platform, and should remain still during six different sensorial conditions: open eyes, fixed platform; closed eyes, fixed platform; optokinetic exposure, open eyes, fixed platform; open eyes, unstable platform; closed eyes, unstable platform; optokinetic exposure, open eyes, unstable platform. Oscillations in response to the stimuli are captured by the platform and analyzed. By determining the affected component, a suitable set of training exercises can be selected, usually for situations most difficult for the patient. To evaluate the patient's perception about their own sense of balance, we use the Dizziness Handicap Inventory (DHI), a self-assessment that consists of 25 items which quantify the impact of symptoms and evaluates physical, functional,

and emotional impacts. Testing before and after treatment allows progress to be monitored.

Case report: Neurofibromatosis type II. Female patient, 60 years, with diagnosis of acoustic neuroma of left ear. The audiogram showed left sensorineural hearing loss with a tinnitus frequency of 4 kHz, low discrimination, with bow on campanula, left severe hipovalencia in videonystagmography, having undergone radiosurgery. After 2 years, returns with instability, having been diagnosed with right ear neuroma. Performs CDP and the analyzed parameters show the degree of use of different sensory inputs: **Vestibular** – 0%; **Visual** – 100%; **Somatosensorial** – 70%. She did optokinetic treatment on the platform for 5 consecutive days, 10/15 daily minutes, 35–45º/sec, with progressively higher degrees of difficulty, particularly with head movements associated on pad and marking time at the same time (at 2nd and 4th session respectively). **1st day pre-VR-DHI** with 61% of total answers. At the end of the program, she repeated CDP which showed the following results: **Vestibular** – 100%; **Visual** – 100%; **Somatosensorial** – 100%; **5th day pos-VR-DHI** with 30% of total answers. At the end, the patient experienced significant improvements and more confidence.

Conclusions: CDP is an excellent way of evaluating and analyzing balance registration, allowing one to evaluate the outcome of RV by comparing posturography results pre and post RV. The possibility of identifying the affected sensorial area lets one adjust the treatment according to the capabilities and limitations of the patient, usually by motor control training exercises and habituation to the movement. This reduces/eliminates symptoms, increases mobility, and improves self-confidence and quality of life.

Effect of Cochlear Implantation on the Vestibular System and Postural Stability

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Introduction: The cochlear implant (CI) is a therapeutic option for patients with severe sensorineural hearing loss. The CI is a prosthesis whose main purpose is to substitute for a compromised organ of Cortí. There are conflicting results regarding the prevalence of vestibular dysfunction after cochlear implantation. Some authors argue that CI surgery interferes with vestibular function and so affects body balance; others point to no interference and even an improvement in body balance.

Objective: The purpose of this study was to verify the effects of cochlear implant surgery on the vestibular system and on postural stability.

Methods: This prospective study included 28 adult patients, mean age 42.7 years, who underwent unilateral cochlear implant surgery. Vestibular function was assessed through a questionnaire (dizziness handicap inventory, DHI), videonystagmography (caloric test and rotational chair test) for function of the lateral semicircular canals, and by vestibular evoked myogenic potentials (cVEMP and oVEMP) recordings for saccule and utricle function. Postural stability was evaluated using the Fukuda test, Romberg test, and computerized posturography (which measured the limit of stability (LOS), centre of gravity (COG), and modified clinical test of sensory interaction on balance, mCTSIB). Each patient performed a vestibular system test and postural balance test before and 5 and 8 weeks after implantation.

Results: Sensorineural hearing loss etiologies were associated with vestibulopathy and also with an abnormal vestibular function more frequently than other causes (meningitis, Mondiní dysplasia, labyrinthitis, and other inner ear malformations). Spontaneous nystagmus was present in 3 patients (10.7%) before and 8 (28.6%) after surgery. Caloric testing was normal only in the 21.4% of CI candidates, while 25% had bilateral complete areflexia, 39.3% partial asymmetrical hypoexcitability, and 14.3% partial symmetrical hypoexcitability. After CI, a worsening in vestibular system function was observed for both implanted and non-implanted ears. In a rotational chair test, an increase in vestibular system function was observed in 64.3% of patients. Before CI, the response rates of cVEMPs from both ears were 53.6% and absent in 25% of the patients. For oVEMPs, the response rates were 39.3% and absent in 50% of cases. After CI the cVEMP and oVEMP responses were preserved bilaterally in 3/28 and 1/28, respectively. cVEMPs on the operated side were absent after CI in 92.9% and the oVEMPs were absent in 96.4%. In the immediate postoperative period the number of patients with dizziness increased and unsteadiness was significantly higher as evidenced by DHI. The static and dynamic standing balance performance seemed to improve with time after CI surgery.

Conclusions: This study showed that CI surgeries can impair the vestibular system and postural control. Vestibular symptoms can get worse after CI surgery, especially in patients with previous symptoms of vestibular abnormalities. Vestibular evaluation such as cVEMP, oVEMP, and videonystagmography (caloric test and rotational chair test) can be used in screening vestibular function for CI candidates in order to decide which ear to implant and help decrease vestibular symptoms after surgery.

Pediatric auditory rehabilitation

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• Posters •

Adaptation to European Portuguese of the Questionnaire Early Listening Function (ELF) – Função Auditiva Precoce (FAP)

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Introduction: In children, hearing loss has adverse effects on the development of communication, in vocabulary, syntax, and expressive language, in speech production, and social and emotional development. Assessment of hearing loss can be performed quantitatively with psychoacoustic audiometric testing, such as pure tone audiometry, or physiological tests, such as otoacoustic emissions, and electrophysiological tests like auditory evoked potentials of the brainstem that allow quantitative assessment and topographic diagnosis. Qualitative assessment of hearing loss can use specific scales, such as Early Listening Function (ELF) developed by Anderson (2002), which is used by parents or caregivers of infants and children from 4 months to 3 years old.

Objectives: The main goal was to translate and adapt the ELF questionnaire into European Portuguese and test the reliability/internal consistency (Cronbach's alpha) and the validity for publication of the final European Portuguese translation.

Methods: The tool was translated into European Portuguese by a forward and backward technique, as established by the International Quality of Life Assessment (IQOLA) project. There was double translation and adaptation of the European Portuguese ELF questionnaire, double retroversion to English, and a consensus version. The work was done by 4 researchers (2 audiologists with previous similar work, one Ear Nose and Throat surgeon who was an American native language speaker, and a secondary school teacher of English). The questionnaire, called *Função Auditiva Precoce* (FAP), was administered as a sample test for semantic validation; later the FAP questionnaire was administered to a larger sample for statistical validation.

Results: The FAP is a self-administered questionnaire composed of 12 sound activities. Its positive attributes are brevity, accessibility, cheapness, simplicity, and ease of interpretation.

Conclusions: The FAP is a valid tool for parents and caregivers of children for hearing loss screening, i.e. in identifying if a child is able to detect certain types of sounds from different distances in both quiet and noise.

Comparison of Attention and Memory Between Smokers and Non-Smokers

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Introduction: Several studies show that nicotine has pharmacological proprieties related to the improved cognitive processing, namely attention and auditory memory. This performance can be evaluated though electrophysiological tests such as the P300, which is highly dependent on cognitive skills, including attention and discrimination, and the Mismatch Negativity (MMN), dependent on auditory memory.

Objective: To evaluate the effect of nicotine through tobacco consumption, in terms of attention and auditory memory, in a group of smokers and non-smokers.

Methodology: The electrophysiological P300 and MMN tests were performed in a group of 15 smoking individuals and a group of 20 non-smokers, both aged between 18 and 28 years old. In the case of the smokers they were asked to smoke a cigarette minutes before performing these tests. To obtain the P300 and MMN, the same protocol was used on all subjects. Both tests were evoked by an *oddball paradigm* and stimulation was binaural. For P300 and MMN, each individual had to mentally count the rare stimulus; in MMN, the individuals had to watch a movie in silence.

Results: A Student *t*-test for independent samples showed there were no statistically significant differences in the results obtained. However, lower latency averages were obtained in smoking individuals, in both ears, on the P300 test compared to the non-smoking group; also the average MMN amplitude was higher in smokers, in both ears, compared to non-smokers. From correlation between the number of years that an individual in the smoking group had smoked and P300 amplitude, we found that P300 amplitude, both in the right and left ear, decreased as the number of years of smoking increased. However, in both ears the average amplitude of P300 in smokers was higher than the average amplitude in non-smokers. It was also found that the MMN average latency was higher in smokers.

Conclusions: Although there were no results with statistically significant differences, we can suggest that nicotine affects P300 and MMN. The average P300 latency in smokers appeared to be earlier and MMN amplitude was higher. The reduction in P300 latency in smokers can be interpreted as a decrease in reaction time, improving attention. In the case of the increase in MMN amplitude in smokers, this may suggest further information decoding, promoting the formation of auditory memory.

The Effect of Caffeine on Balance

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Introduction: Balance is a neurological function that relies heavily on sensorimotor systems and the vestibular system is one of the most important systems involved in equilibrium. The central nervous system, integrated with the vestibular, visual, and proprioceptive systems, receives information from the external environment, causing the body to remain in balance. Caffeine is a substance that acts as a stimulant of the central nervous system. When consumed regularly and in exaggerated quantities, it can cause significant damage to various systems. When consumed, coffee acts on the central nervous system and may change the postural balance of a subject.

Objective: This study aims to analyze, through the Modified Clinical Test of Sensory Interaction on Balance, if caffeine ingested in large quantities through coffee causes changes of balance on subjects.

Methodology: This study consisted of a sample of 30 subjects of both genders aged between 18 and 25 and divided into two groups. One group consisted of 14 subjects who consumed two or more daily coffees and the other of 16 subjects who did not consume any coffee. For both groups the Modified Clinical Test on Interaction of Sensory Balance (m-CTSIB) was carried out. Individuals who were part of the group that did not drink coffee performed the test right away and the subjects from the study group were handed a coffee test (a tablet of 6.0 g of roasted ground coffee with intensity 10 from Delta) with approximately 2 g of sugar and ingested half an hour after lunch. In the subjects from the study group, 7 performed the m-CTSIB test about 30 minutes after taking the coffee test, and the other 7 performed it 60 minutes after.

Results: After applying the Mann-Whitney test, the results of this study revealed that there were no statistically significant differences in both the oscillation speed (p=0.912) and in COG alignment (p=0.938) among the subjects who drank coffee and those who did not. Although it was not the aim of this study, an analysis was performed between the group of individuals who did not drink coffee with the study group that was divided into two subgroups according to the time the coffee test was ingested. After applying the Mann-Whitney and Student t-tests, there were no statistically significant differences in both the oscillation speed and in the COG alignment among the groups (p values higher than 0.05: p=0.454, 0.861; 0.570, 0.969; 0.355, 0.925).

Conclusions: It was found that both the oscillation speed and the COG alignment had no statistically significant differences between the groups. There are also no statistically significant differences when analyzing the absorption time of caffeine between the subgroups, and between each of these and the group that did not ingest caffeine. It is concluded that caffeine ingested through coffee in the quantities used in this study does not cause any changes in postural balance.

Influence of Hearing Disorders on Children's Balance

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Introduction: Body balance or postural control is a prerequisite for children's daily activities. For it to happen smoothly, there must be conformity between the three sensory systems: visual, proprioceptive, and vestibular.

Objective: To analyse body balance in children with severe to profound hearing loss (with and without hearing support products) and children who can hear normally with ages between 12 and 17 years old.

Methodology: Data collection was made through Computerized Posturography (CP) which included a Clinical Test of Sensory Integration and Balance (mCTSIB) and a one-leg support test. Furthermore, a Fukuda/Unterberger test on top of a piece of carpet (four concentric circles, with 0.25 m radius difference between them and divided into 12 equal parts, with crosses in the centre making a 30º angle), a Subjective Visual Vertical (SVV) test through a pocket with measurement in degrees of deviation, and a study of spontaneous and decentered nystagmus (through Fresnel glasses which increase 20 dioptres and prevent visual fixation).

Results: In the study of *spontaneous nystagmus*, no child in either group had nystagmus. However, in the study of *decentred nystagmus*, two children with hearing disorders had horizontal nystagmus when facing right. In the *Fukuda/Unterberger* test, the value of median oscillation was greater in the hearing disorders group, in contrast to deviation, where the values were nearly the same. In the *SVV*, the median in the group with hearing disorders was higher than the group with normal hearing. On the *one-leg support* test, it was found that the median velocity of oscillation was greater in children with hearing disorders. For the *mCTSIB* test, in condition number 4 (unstable platform, eyes closed), it was found that the median oscillation velocity was greater in children with hearing disorders. These results suggest that it is harder to maintain body balance with no visual system and with the proprioceptive system changed. When results of both groups were compared between children who practice sport two or three times per week and those who do not, statistically significant differences were found on the mCTSIB test, which means that regular sport helps provide better body balance, both in children with normal hearing and children with hearing disorders.

Conclusions: The results revealed no significant differences between children with hearing disorders and normal hearing in any of the tests. In this study, the children who were hard of hearing (with or without hearing support products), in spite of certain differences, do not have higher body instability.

Hearing Implants, a Current Solution for Hearing Rehabilitation

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Introduction: Cochlear implants (CIs), along with osseointegrated implants (BAHAs) and, more recently, middle ear active implants, can play a fundamental role in the rehabilitation of patients with hearing loss. CIs are the first ever example of successfully recovery of a human sensory system using electronic devices. To achieve this, many attempts were made, but it was not until 1957 that direct stimulation of the auditory nerve to generate hearing was executed. Years of experimenting went by before William F. House attempted, in 1961, the first mono-channel cochlear implant in a patient with profound deafness. Later on, in 1984, House developed the House3M implant. From then on, CI devices evolved greatly. Nowadays, it is estimated that, in the last three decades, more than 220,000 adults and children have received a CI. BAHAs owe their existence to a discovery carried out by Branemark in the 1950s, a concept which he named "osseointegration". Later, Tjellstrom introduced the concept of direct osteoconduction. In 1977, Tjellstrom introduced the first osseointegrated system. It is estimated that around 200,000 patients with hearing loss have directly benefited from osteoconduction devices based on the concept of osseointegration.

Objective: Analyze factors such as gender, implant side, implants per year, and implants per age group.

Methods: A retrospective study of patients admitted to the Hearing Implants Center of the CUF Infante Santo Hospital, who had an osseointegrated hearing implant between 2005–15 and cochlear implant surgery between 2007–15.

Results: 61 patients were identified as having had CI surgery, 35 (57%) of which were female and 26 (43%) male. Of the total number of patients, 36 (59%) were subjected to right ear surgery, 19 (31%) to left ear surgery, and 6 (10%) to bilateral surgery. Of the 71 patients who had BAHA surgery, 40 (56%) were female and 32 (44%) were male. Of the total number of patients, 37 (51%) were subjected to right ear surgery, 31 (43%) to left ear surgery, and 4 (6%) to bilateral surgery. The mean age for CI implants was 48.6 years old with a standard deviation of 25.5, median of 55.0, and mode of 47.0 (varying between a minimum of 7 months and a maximum of 81 years). For BAHA, the mean age was 47.7 years old with a standard deviation of 16.0, median of 50.5, and mode of 53.0 (varying between a minimum of 9 years and a maximum of 71 years).

Conclusions: CI and BAHA are a proven solution with high rates of success in hearing rehabilitation in both pediatric and adult populations. The hearing performance of implanted patients can vary depending on multiple factors, such as age at the beginning of hearing loss, duration and etiology of hearing loss, implanted age, communication method, cognitive ability, motivation, and psychosocial support system. In the vast majority of cases, a positive impact is verified in the life of patients.

Middle Ear Alterations in Military Pilots

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Introduction: This study aims to raise awareness among military pilots to the audiological risks they expose themselves to, particularly those related to the middle ear. In aviation, the noise can cause loss of hearing – noise-induced hearing loss (NIHL) – and close supervision is essential. Although noise can have a large spectrum of frequencies, NIHL manifests, in its initial state, between 4 and 6 kHz, which reflects the sound energy increase in the natural resonance frequency region of the external hearing canal. Usually NIHL is noticeable after 3.5 years of exposure. Besides NIHL, other effects may arise due to pressure differences that occur in the hearing system of military pilots. Pressure changes and air composition can cause severe injury. Different mechanisms may be involved: barotrauma in all parts of the hearing system, audiovestibular decompression disease, and compliance changes due to pressure differences during flight and/or the offset pressure manoeuvres that pilots have to perform frequently.

Objective: The aim of this study was to investigate whether there are any audiological changes in military pilots, particularly of their middle ear, and prompting them to adopt strategies to preserve hearing.

Methodology: The sample used consisted of 16 pilots from Air Base no. 5, all male, aged between 20 and 40 years old. Information was collected from each pilot via a questionnaire, as well as by otoscopy, tympanogram, tonal simple audiogram, and percentage exceedence of 40 dB in each ear.

Results: Only one pilot from the sample showed a tympanogram of type B. There was a relation between the peak maximum compliance and the percentage with thresholds above 40 dB, although it was not statistically significant ($p>0.05$). In terms of flying time, one pilot, having worked for 5–10 years, had the highest compliance value. There are no significant correlations between hearing thresholds and flying time. One pilot, with more than 10 years of flying time, had a threshold of 30 dB at a frequency of 6000 Hz in the right ear. For the left ear, however, there were four pilots, with more than 10 years of flying time, who had a threshold of 15 dB at a frequency of 125 Hz. Although this threshold was the highest for this frequency, it is still considered normal.

Conclusions: It was concluded that military pilots do not show statistically significant alterations to their hearing thresholds and middle ear. However, in more senior pilots, as well as with pilots with the highest compliance values, there was the lowest percentage breakdown of 40 dB in both right and left ears.

• **Free Papers** •

Vestibular Evoked Myogenic Potentials: Studies in a Portuguese Population

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Introduction: Vestibular evoked myogenic potentials (VEMPs) are inhibitory electrical responses from the saccule, produced by acoustic stimulation or vibration of high intensity. This non-invasive and painless technique makes it possible to evaluate the integrity of the saccule, the inferior vestibular nerve, and its central connections. It is thus important in finding the etiology of vertigo. cVEMP serves as a complement to tests such as electronystagmography/videonystagmography.

Objectives: Find an average parameters for the latency of waves P1 and N1, the amplitude of the complex, and its asymmetry in a Portuguese population aged 18 to 30 years old. As a secondary objective, we wanted to investigate differences between stimuli (500 Hz tone-burst and click) and the patient's gender (male or female).

Methods: Quantitative experiments in which only individuals with normal otoscopy, type A tympanogram, present estapedic reflexes, and a normal audiometry (BIAP 02/1) were included. These exams were done to verify the absence of any hearing or vestibular deficit. The volunteers could not show signs of tinnitus, neurological dysfunction, cervical issues, history of exposure to noise, or use of ototoxic medication. cVEMP was conducted with 500 Hz tone-burst and click stimulation of intensities 100, 95, and 90 dB nHL in both ears. The volunteer's skin was cleaned with alcohol and abrasive paste and then surface electrodes were placed on the vertex (neutral), sternoclavicular joint (active/non-inverted), and on the medial portion of the sternocleidomastoid muscle (reference). The patient was in the supine position with head slightly raised (30°) and rotated it for contralateral stimulation. To decrease muscle fatigue, there was a pause between stimulations.

Results: 32 individuals (19 females; 13 males) were evaluated and differences were found compared to other studies already carried out: at 100 dBnHL intensity, the average latency of P1 and N1 was found to be 14.89±1.35 ms and 22.33±3.02 ms in the right ear; and 15.35±1.45 ms and 22.91±2.64 ms in the left ear. The amplitude of P1-N1 was 369.4±227.9 μV (right) and 268.5±189.4 μV (left). The amplitude of the P1N1 complex tended to decrease with decreasing intensity and values were different between right and left sides. The results indicate significant differences in the paths of 500 Hz tone-bursts and clicks. As for the relationship between VEMP and gender, no significant differences were found.

Conclusions: Stimulation with a 500 Hz tone burst gives a better extent and quality of waveform compared with a click stimulus. Gender is not a factor in VEMP. Larger normative studies using a wider age range and comparing right and left ears are suggested.

'Burnout' in Portuguese Audiologists

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Introduction: Lack of resources and the pressure to achieve results are moving working people closer to physical and emotional breakdown. An OECD study stresses the connection between psychological issues and labor conditions in between 15% to 20% of the working population. Among 34 countries, Portugal is the seventh worst country. 'Burnout' is the final stage of a chronic professional stress situation, having its focus on emotional exhaustion, depersonalization (lack of personal identity), and on low professional accomplishment. This term was introduced by Freudenberger in 1974.

Objective: The purpose of this study was to evaluate the extent of burnout in Portuguese audiologists. Furthermore, it was intended to investigate the association between burnout and some sociodemographic variables and indicators of employment status, and assess the impact on quality of life of these professionals.

Methodology: Three questionnaires were used to collect data, created in the Study Center of the University of Coimbra: to analyze personal features, *LimeSurvey,* a professional and sociodemographic data questionnaire; to analyze *burnout* levels, a Portuguese version of the *Copenhagen Burnout Inventory* (CBI); and to analyze everyday impact, a questionnaire to evaluate quality of life. The Portuguese Audiologists Association and Coimbra's Technology and Health Higher School supported use of the data retrieval questionnaire. Data were analyzed by the statistical analysis program Statistical Package for Social Sciences (SPSS) version 21 for Windows. Concerning the population in question (n=241), 94 individuals (39%) answered the questionnaire. The final sample comprised 86 Portuguese audiologists; 77.2% of the sample was female, the average respondent's age was 22.8 years; 73.1% of the professionals were single; 59.3% worked in auditory rehabilitation; and the average time in the profession was 5.3 years.

Results: Average *burnout* levels on the personal *burnout* scale were 35.0; in work-related *burnout* 41.3; and on the patient-related *burnout* scale the average was 29.5. In terms of the family situation, married people presented higher personal and work-related *burnout* levels, with significant statistical differences. The more hours a professional worked at his main job location, the bigger was the *burnout* level. Higher *burnout* levels were directly related to lower quality of life indicators.

Conclusions: This data points to a low *burnout* level among Portuguese audiologists, with the variables family status and number of weekly work hours influencing *burnout* levels, which results in a lower quality of life.

From Clinic to Videonystagmography: Presbivertigo

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Introduction: Imbalance is one of the reasons patients seek an ENT. It becomes more frequent with age. With a suggestive anamnesis and observation it is possible to infer a diagnosis, but with more complex symptoms or in case of clinical doubts, one must consider a videonystagmography (VNG). Presbivertigo still does not have a clear definition, although for many authors it could be defined as vertigo of the elderly due to degenerative lesions in the vestibule.

Objectives: Clinical characterization and correlation of VNG and audiometric results in a population over 60 years old.

Methods: Retrospective study regarding a clinical series and respective complementary diagnostic exams focusing on VNGs, from 01/01/2014 to 31/07/2015. Data were analyzed using SPSS 22 for Mac.

Results: The study included 111 patients, with a mean age of 71.3 years old, of which 74% were women. Regarding personal history: 47.2% had hypertension, 7.5% had thyroid pathology, and 3.8% admitted suffering from depression. In terms of medication, 27.8% were taking benzodiazepines, 11.3% were taking antidepressants, and 50.9% were taking betahistine. Comparing to the total VNG pool, normal tests dropped from 25% to 18.8%, respecting people over 60. Audiometric results showed a type of curve corresponding to a strial aging process, according to Schuknecht. The pure tone average loss was 32.4 dB and the average threshold at 8000 Hz was 58.4 dB. In this study it was not possible to identify a statistically significant relation between tinnitus and other variables.

Conclusions: 1) There was a statistically significant correlation between the audiometric results and: a) the type of curve (classification of Schunecht); b) pure tone average loss; and c) thresholds at 8000 Hz. 2) There was a statistically significant relation between patients with vestibular hyporeflexia on the VNG and their thresholds at 8000 Hz, which suggests a specific anatomical location of the aging process.

From Clinic to Videonystagmography: Results from the HSJ ENT Department

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Introduction: Balance disorders are frequent complaints in daily clinical practice, described by patients as vertigo, instability, dizziness, gait instability, and feeling of being in a boat, among others. The literature estimates that symptoms of vertigo and dizziness are present in 5–10% of the world population, and more common in people over 65 years, in whom it is estimated that prevalence reaches 85%. It is important to note that falls are frequent in this population and the consequences can lead to death. Such disturbances have a major impact on the patient's quality of life because of its unpredictability, causing anxiety, depression, and social isolation. Videonystagmography (VNG) is a complementary diagnostic test that identifies, through an eye movement record, disorders of different systems, whatever its cause and nature. This examination plays an important role in the diagnosis of vertigo.

Objectives: Clinical characterization of patients that underwent VNG, the analytical differentiation of VNG, and its correlation with audiometric tests.

Methods: We conducted retrospective clinical and complementary tests focusing on VNGs between 01/01/2014 to 31/07/2015 totaling 192 patients. Data were analyzed using SPSS 22 for Mac.

Results: There were 25% men and 75% women aged between 21 and 90 (mean 61.1 years). 28% patients had bilateral vestibular hyporeflexia, 21.7% had left vestibular hyporeflexia, 19.4% had right vestibular hyporeflexia, 2.9% had suspicion of positional vertigo, 2.9% had suspicion of central causes, and 25.1% had normal responses.

Conclusions: The main conclusion of this study is that a good clinical history and an appropriate physical examination are fundamental to select the right patients to perform VNG. With this kind of procedure it is easier to select the group of patients with indications for VNG and those with no indications, having to continue therapy and follow up. A balance disorder consultation is essential as well as a standard medical history and a VNG protocol.

Posturographic Assessment in Yoga Practitioners and Non-Practitioners: Balance Benefits

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Introduction: Balance is a complex process resulting from the interaction between the following systems: sensorial (input), central nervous system (coordinator), and motor (output).The aging of the vestibular system, central nervous system, and the rest of the body systems may contribute to balance dysfunction. Balance dysfunction is the main symptom in the population aged over 70 years (47% men and 66% women).Treatment can be pharmacologic, chirurgic, or balance rehabilitation. Additionally, there are some balance improvement exercises like pilates, shiatsu, tai chi, and yoga. Yoga is an old discipline originating from India. According to *Baptista & Dantas* 2002, each physical posture adopted in yoga practice

generates organic, physical, emotional, and energetic effects, improving physical balance. Recently, yoga was classified as a way of complementary and alternative medicine by *The National Center for Complementary and Alternative Medicine, USA*.

Objective: The aim of this project was to investigate the relationship between balance and yoga through computerized dynamic posturography (CDP). Further, what was the relation between sensory inputs (vestibular, visual, and proprioceptive) and yoga practicing time.

Methods: For this study were selected 50 participants aged between 50 and 80 years: 25 yoga practitioners (experimental group, EG) and 25 non-practitioners (control group, CG) according to exclusion and inclusion criteria. The exclusion criteria for both groups was health-based: no motor, neurologic, visual, or vestibular problems, no hearing loss, and no medication affecting the central nervous system. The inclusion criteria was the practising of at least 2 hours of yoga per week. The evaluation of balance was performed with a computerized dynamic posturography NeuroCom System Version 8.0.1, which included the modified Test of Sensory Interaction and Balance (mCTSIB) and limits of stability test (LOS). The mCTSIB is a simplified variation of the sensorial organization test (SOT) that analyses the patient's functional balance control to quantify postural sway velocity during four sensory conditions. The LOS quantifies the maximum distance a person can intentionally displace their center of gravity (COG) in 8 positions. The measured parameters were: reaction time (RT), COG movement velocity (MV), directional control (DC); end-point excursion (EPE), and maximum point excursion (MPE).

Results/Conclusions: The statistical analysis revealed significant differences between groups for most variables – RT, MV, EPE, and MPE for anterior movements ($p<0.05$). Proprioception was the most significantly input for balance in CG, but in EG it was the vestibular input; in both groups vision contributed the least to balance. The increase of yoga practicing time gave an RT decrease and a MV increase. These results suggest that yoga practice gives an improvement in the maintenance of orthostatic balance. Yoga could be used as a prevention for balance disorders in the elderly.

Subjective Patient Benefits from Hearing Aid Technology Developments in the Last 20 Years

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Introduction: Self-assessment questionnaires are now considered an important tool in the evaluating listening skills and in gauging how well patients adapt to hearing aids. The APHAB questionnaire is an essential tool that assesses the difficulty in communication or noise in everyday situations and has been used in studies of hearing aids, bone anchored implants, middle ear performance, and electroacoustic stimulation.

Objectives: 1) Determine normative values of the APHAB for the current population. 2) Assess changes in the patient's subjective benefit of wearing hearing aids, considering the technological advances of the past 20 years.

Methodology: A cross-sectional study was performed on 35 patients over 60 years old, binaurally adapted with digital hearing aids and with a minimum experience of hearing aid use of 6 months and a maximum of 18 months. Patient selection was independent of whether the prosthetic adaptation had been better or worse and also of the type of hearing aid (CIC, IC, ITE, RITE, RIC, BTE). Data was collected between January and June 2015. The APHAB results were compared with previously published studies (1995–2010).

Results: Our results show an overall improvement in subjective benefit in each of the subscales, FC (47%), RF (16%), and RV (20%). Regarding noise aversion AV, patients experience less discomfort (8%) than obtained on previous studies. However, the difficulties of communication under environments with background noise and reverberation remain stable. Patients experience difficulties at a rate of 40%.

Conclusions: The benefits, gauged by hearing aid users on the various APHAB sub-scales, have improved in the last 20 years. Communication difficulty in favorable conditions, and in the presence of background noise, situations with reverb, and discomfort caused by noise environments, are lower than those reported previously. Advances in technology provide more comfort and convenience to hearing aid users. On the other hand, hearing aid users still have difficulties, so it is important to continue looking for new ways to improve the benefits in noisy and reverb environments.