No 444: October 10, 2018

Geraghty AWA, Essery R, Kirby S, Stuart B, Turner D, Little P, Bronstein A, Andersson G, Carlbring P, Yardley L. **Internet-Based Vestibular Rehabilitation for Older Adults With Chronic Dizziness: A Randomized Controlled Trial in Primary Care.** Ann Fam Med. 2017 May;15(3):209-216. doi: 10.1370/afm.2070.

Abstract

PURPOSE: Vestibular rehabilitation is an effective intervention for dizziness due to vestibular dysfunction, but is seldom provided. We aimed to determine the effectiveness of an Internet-based vestibular rehabilitation program for older adults experiencing dizziness in primary care.

METHODS: We undertook a single-center, single-blind randomized controlled trial comparing an Internet-based vestibular rehabilitation intervention (Balance Retraining, freely available from https://balance.lifeguidehealth.org) with usual primary care in patients from 54 primary care practices in southern England. Patients aged 50 years and older with current dizziness exacerbated by head movements were enrolled. Those in the intervention group accessed an automated Internet-based program that taught vestibular rehabilitation exercises and suggested cognitive behavioral management strategies. Dizziness was measured by the Vertigo Symptom Scale-Short Form (VSS-SF) at baseline, 3 months, and 6 months. The primary outcome was VSS-SF score at 6 months.

RESULTS: A total of 296 patients were randomized in the trial; 66% were female, and the median age was 67 years. The VSS-SF was completed by 250 patients (84%) at 3 months and 230 patients (78%) at 6 months. Compared with the usual care group, the Internet-based vestibular rehabilitation group had less dizziness on the VSS-SF at 3 months (difference, 2.75 points; 95% CI, 1.39-4.12; P <.001) and at 6 months (difference, 2.26 points; 95% CI, 0.39-4.12; P = .02, respectively). Dizziness-related disability was also lower in the Internet-based vestibular rehabilitation group at 3 months (difference, 6.15 points; 95% CI, 2.81-9.49; P <.001) and 6 months (difference, 5.58 points; 95% CI, 1.19-10.0; P = .01).

CONCLUSIONS: Internet-based vestibular rehabilitation reduces dizziness and dizziness-related disability in older primary care patients without requiring clinical support. This intervention has potential for wide application in community settings.

PMID: 28483885

Link to Free Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5422081/

No 443: October 3, 2018

Popkirov S, Staab JP, Stone J. **Persistent postural-perceptual dizziness (PPPD): a common, characteristic and treatable cause of chronic dizziness.** Pract Neurol. 2018 Feb;18(1):5-13. doi: 10.1136/practneurol-2017-001809. Epub 2017 Dec 5.

Abstract

Persistent postural-perceptual dizziness (PPPD) is a newly defined diagnostic syndrome that unifies key features of chronic subjective dizziness, phobic postural vertigo and related disorders. It describes a common chronic dysfunction of the vestibular system and brain that produces persistent dizziness, non-spinning vertigo and/or unsteadiness. The disorder constitutes a long-term maladaptation to a neuro-otological, medical or psychological event that triggered vestibular symptoms, and is usefully considered within the spectrum of other functional neurological disorders. While diagnostic tests and conventional imaging usually remain negative, patients with PPPD present in a characteristic way that maps on to positive diagnostic criteria. Patients often develop secondary functional gait disorder, anxiety, avoidance behaviour and severe disability. Once recognised, PPPD can be managed with effective communication and tailored treatment strategies, including specialised physical therapy (vestibular rehabilitation), serotonergic medications and cognitive-behavioural therapy.

PMID: 29208729

No 442: September 26, 2018

Bayer O, Brémová T, Strupp M, Hüfner K. **A randomized double-blind, placebo-controlled, cross-over trial (Vestparoxy) of the treatment of vestibular paroxysmia with oxcarbazepine.** J Neurol. 2018 Feb;265(2):291-298. doi: 10.1007/s00415-017-8682-x. Epub 2017 Nov 27.

Abstract

OBJECTIVE: Vestibular paroxysmia (VP) is characterized by short, often oligosymptomatic attacks of vertigo which occur spontaneously or are sometimes provoked by turning the head. Despite the description of the disease almost 40 years ago (first termed "disabling positional vertigo"), no controlled treatment trial has been published to date. The Vestparoxy trial was designed as a randomized, placebo-controlled, double-blind cross-over trial to examine the therapeutic effect of oxcarbazepine (OXA) in patients with definite or probable VP.

METHODS: Patients were recruited from August 2005 to December 2011 in the outpatient Dizziness Unit of the Department of Neurology of the Munich University Hospital, and randomized to receive OXA (first week: 300 mg once per day, second week: 300 mg b.i.d., third week: 300 mg t.i.d. until the end of the third month), followed by placebo or vice versa with a 1-month wash-out period in between. The primary endpoint was the number of days with one or more attacks. Secondary endpoints were the number of attacks during the observed days, and the median (for each day) duration of attacks. All these endpoints were assessed using standardized diaries collected at the end of each treatment phase.

RESULTS: Forty-three patients were randomized, 18 patients provided usable data (2525 patient days) for at least one treatment phase and were included in the main (intention-to-treat) analysis. The most common reasons for discontinuation documented were adverse events. The risk of experiencing a day with at least one attack was 0.41 under OXA, and 0.62 under placebo

treatment, yielding a relative risk of 0.67 (95% CI 0.47-0.95, p = 0.025). The number of attacks during the observed days ratio was 0.53 (95% CI 0.42-0.68, p < 0.001) under OXA compared to placebo. Median attack duration was 4 s (Q25: 2 s, Q75: 120 s) under OXA, and 3 s (Q25: 2 s, Q75: 60 s) under placebo treatment. When days with no attacks, i.e., duration = 0, were included in the analysis, these figures changed to 0 (Q25: 0, Q75: 3 s), and 2 (Q25: 0, Q75: 6 s). No serious adverse events or new safety findings were identified during the trial.

CONCLUSIONS: The Vestparoxy trial showed a significant reduction of VP attacks under OXA compared to placebo treatment, confirming the known and revealing no new side effects.

PMID: 29204964

No 441: September 19, 2018

Lehnen N, Langhagen T, Heinen F, Huppert D, Brandt T, Jahn K. **Vestibular paroxysmia in children: a treatable cause of short vertigo attacks.** Dev Med Child Neurol. 2015 Apr;57(4):393-6. doi: 10.1111/dmcn.12563. Epub 2014 Aug 22.

Abstract

Vestibular paroxysmia due to neurovascular compression is a syndrome consisting of frequent short episodes of vertigo in adults that can be easily treated. Here we describe the initial presentation and follow-up of three children (one female, 12y; two males, 8y and 9y) who experienced typical, brief, vertiginous attacks several times a day. Nystagmus was observed during the episodes. Cranial magnetic resonance imaging revealed arterial compression of the eighth cranial nerve. The attacks ceased after administration of low-dose carbamazepine (2-4mg/kg daily). Vestibular paroxysmia must be considered in the differential diagnosis of children with brief vertiginous episodes.

PMID: 25146998

No 440: September 12, 2018

Strupp M, Lopez-Escamez JA, Kim JS, Straumann D, Jen JC, Carey J, Bisdorff A, Brandt T. **Vestibular paroxysmia: Diagnostic criteria.** J Vestib Res. 2016;26(5-6):409-415. doi: 10.3233/VES-160589.

Abstract

This paper describes the diagnostic criteria for vestibular paroxysmia (VP) as defined by the Classification Committee of the Bárány Society. The diagnosis of VP is mainly based on the patient history and requires: A) at least ten attacks of spontaneous spinning or non-spinning vertigo; B) duration less than 1 minute; C) stereotyped phenomenology in a particular patient; D) response to a treatment with carbamazepine/oxcarbazepine; and F) not better accounted for by another diagnosis. Probable VP is defined as follows: A) at least five attacks of spinning or non-spinning vertigo; B) duration less than 5 minutes; C) spontaneous occurrence or provoked by

certain head-movements; D) stereotyped phenomenology in a particular patient; E) not better accounted for by another diagnosis.Ephaptic discharges in the proximal part of the 8th cranial nerve, which is covered by oligodendrocytes, are the assumed mechanism. Important differential diagnoses are Menière's disease, vestibular migraine, benign paroxysmal positional vertigo, epileptic vestibular aura, paroxysmal brainstem attacks (in multiple sclerosis or after brainstem stroke), superior canal dehiscence syndrome, perilymph fistula, transient ischemic attacks and panic attacks. Current areas of uncertainty in the diagnosis of VP are: a) MRI findings of vascular compression which are not diagnostic of the disease or predictive for the affected side because they are also observed in about 30% of healthy asymptomatic subjects; and b) response to treatment with carbamazepine/oxcarbazepine supports the diagnosis but there are so far no randomized controlled trials for treatment of VP.

PMID: 28262641

No 439: September 6, 2018

Brandt T, Strupp M, Dieterich M. **Vestibular paroxysmia: a treatable neurovascular cross-compression syndrome.** J Neurol. 2016 Apr;263 Suppl 1:S90-6. doi: 10.1007/s00415-015-7973-3. Epub 2016 Apr 15.

Abstract

The leading symptoms of vestibular paroxysmia (VP) are recurrent, spontaneous, short attacks of spinning or non-spinning vertigo that generally last less than one minute and occur in a series of up to 30 or more per day. VP may manifest when arteries in the cerebellar pontine angle cause a segmental, pressure-induced dysfunction of the eighth nerve. The symptoms are usually triggered by direct pulsatile compression with ephaptic discharges, less often by conduction blocks. MR imaging reveals the neurovascular compression of the eighth nerve (3D constructive interference in steady state and 3D time-of-flight sequences) in more than 95% of cases. A loop of the anterior inferior cerebellar artery seems to be most often involved, less so the posterior inferior cerebellar artery, the vertebral artery, or a vein. The frequent attacks of vertigo respond to carbamazepine or oxcarbazepine, even in low dosages (200-600 mg/d or 300-900 mg/d, respectively), which have been shown to also be effective in children. Alternative drugs to try are lamotrigine, phenytoin, gabapentin, topiramate or baclofen or other non-antiepileptic drugs used in trigeminal neuralgia. The results of ongoing randomized placebo-controlled treatment studies, however, are not yet available. Surgical microvascular decompression of the eighth nerve is the "ultima ratio" for medically intractable cases or in exceptional cases of non-vascular compression of the eighth nerve by a tumor or cyst. The International Barany Society for Neuro-Otology is currently working on a consensus document on the clinical criteria for establishing a diagnosis of VP as a clinical entity.

PMID: 27083889

No 438: August 29, 2018

Naoi T, Morita M, Kawakami T, Fujimoto S. **Ipsiversive Ocular Torsion, Skew Deviation, and Hearing Loss as Initial Signs of Anterior Inferior Cerebellar Artery Infarction.** Intern Med. 2018 Jul 1;57(13):1925-1927. doi: 10.2169/internalmedicine.0283-17. Epub 2018 Feb 9.

Abstract

A 67-year-old man with hypertension and type 2 diabetes mellitus was admitted to our hospital because of left hearing loss and vertical diplopia. A neurological examination showed ocular torsion, skew deviation, and sensorineural hearing loss in the left ear. Brainstem and cerebellar neurological signs were not observed. Left middle cerebellar peduncle infarction was evident on magnetic resonance imaging. He was treated with antiplatelet, however, the infarct progressed after this administration. Ocular tilt reaction (OTR) involves the triad of ocular torsion, skew deviation, and head tilt. Ipsiversive OTR components associated with hearing loss can be early diagnostic signs of anterior inferior cerebellar artery infarction.

PMID: 29434137

No 437: August 22, 2018

Yang CJ, Cha EH, Park JW, Kang BC, Yoo MH, Kang WS, Ahn JH, Chung JW, Park HJ. **Diagnostic Value of Gains and Corrective Saccades in Video Head Impulse Test in Vestibular Neuritis.** Otolaryngol Head Neck Surg. 2018 Aug;159(2):347-353. doi: 10.1177/0194599818768218. Epub 2018 Apr 10.

Abstract

Objectives We investigated changes in video head impulse test (vHIT) gains and corrective saccades (CSs) at the acute and follow-up stages of vestibular neuritis to assess the diagnostic value of vHIT. Study Design Case series with chart review. Setting Tertiary medical center.

Subjects and Methods Sixty-three patients with vestibular neuritis who underwent vHIT at an initial presentation and an approximately 1-month follow-up were included. vHIT gains, gain asymmetry (GA), peak velocities of CS, and interaural difference of CS (CSD) were analyzed.

Results Mean vHIT gains increased significantly from the acute stage to the follow-up exam. The mean GA, peak velocities of CS, and CSD had decreased significantly at the follow-up. The incidence of CSs was also significantly decreased at the follow-up. The abnormal rate (87%) considering both gain and CS value was significantly higher than that (62%) considering vHIT gain only at the follow-up, although the abnormal rates did not differ at the acute stage (97% vs 87%).

Conclusion The abnormal rates based on both vHIT gains and CS measurements are similar at the acute stage of VN but are considerably higher at the follow-up stage compared with the abnormal rates based on vHIT gains alone. It is thus advisable to check both CS and vHIT gain while performing vHIT to detect vestibular hypofunction.

PMID: 29631490

No 436: August 17, 2018

Tarnutzer AA, Straumann D1**. Nystagmus. Curr Opin Neurol. 2018 Feb;31(1):74-80.** doi: 10.1097/WCO.0000000000000517.

Abstract

PURPOSE OF REVIEW: The clinical and laboratory assessment of nystagmus in patients with neurologic disorders can provide crucial elements for a state-of-the-art differential diagnosis. An increasing number of publications in the fields of neuro-otology and neuro-ophthalmology have nystagmus in the center of interest, which makes frequent updates on the diagnostic and therapeutic relevance of these contributions indispensable. This review covers important clinical studies and studies in basic research relevant for the neurologist published from January 2016 to August 2017.

RECENT FINDINGS: Current themes include vestibular nystagmus, positional nystagmus, optokinetic nystagmus and after-nystagmus, vibration-induced nystagmus, head-shaking nystagmus, postrotatory nystagmus, caloric nystagmus, nystagmus in cerebellar disorders, differential diagnosis of nystagmus and treatment approaches (whereas infantile nystagmus syndrome is not addressed in this review). These studies address mechanisms/pathomechanisms, differential diagnoses and treatment of different forms of nystagmus.

SUMMARY: In clinical practice, a structured description of nystagmus including its three-dimensional beating direction, trigger factors and duration is of major importance. The differential diagnosis of downbeat nystagmus is broad and includes acute intoxications, neurodegenerative disorders and cerebrovascular causes amongst others. In patients with positional nystagmus, the distinction between frequent benign peripheral and rare but dangerous central causes is imperative.

PMID: 29120919

No 435: August 8, 2018

Hernowo A, Eggenberger E. **Skew deviation: clinical updates for ophthalmologists**. Curr Opin Ophthalmol. 2014 Nov;25(6):485-7. doi: 10.1097/ICU.0000000000000105.

Abstract

Background: Skew deviation can be defined as vertical misalignment of the eyes that does not map to any of cyclovertical muscles, in association with neurologic symptoms and signs and with posterior fossa lesion. It can be differentiated from trochlear nerve palsy by the direction of ocular torsion and the change in the degree of vertical deviation with upright and supine head position. It is commonly caused by ischemia of the posterior paramedian pons, medial thalamus, or cerebellum. Other less common mechanism being demyelinating lesion, mass effect,

infection, hemorrhage, or intracranial hypertension. When the vestibular nuclei are involved, skew deviation may occur with acute vestibular syndrome. Ground-in or Fresnel prism may alleviate diplopia in relatively small vertical deviation; however, patient with larger deviation or with the presence of ocular torsion may benefit from surgery of the cyclovertical muscles.

Objective: This article discusses the current approach in diagnosing skew deviation, as well as recent findings in the lesion localization.

Design: Descriptive

Summary: Skew deviation can be appropriately diagnosed from the nature of the ocular torsion and the vertical deviation, along with the presence of lesion involving posterior paramedian pons and/or medial thalamus.

PMID: 25250734

No 434: August 1, 2018

Armstrong RA. **Visual problems associated with traumatic brain injury.** Clin Exp Optom. 2018 Feb 28. doi: 10.1111/cxo.12670. [Epub ahead of print]

Abstract

Traumatic brain injury (TBI) and its associated concussion are major causes of disability and death. All ages can be affected but children, young adults and the elderly are particularly susceptible. A decline in mortality has resulted in many more individuals living with a disability caused by TBI including those affecting vision. This review describes: (1) the major clinical and pathological features of TBI; (2) the visual signs and symptoms associated with the disorder; and (3) discusses the assessment of quality of life and visual rehabilitation of the patient. Defects in primary vision such as visual acuity and visual fields, eye movement including vergence, saccadic and smooth pursuit movements, and in more complex aspects of vision involving visual perception, motion vision ('akinopsia'), and visuo-spatial function have all been reported in TBI. Eye movement dysfunction may be an early sign of TBI. Hence, TBI can result in a variety of visual problems, many patients exhibiting multiple visual defects in combination with a decline in overall health. Patients with chronic dysfunction following TBI may require occupational, vestibular, cognitive and other forms of physical therapy. Such patients may also benefit from visual rehabilitation, including reading-related oculomotor training and the prescribing of spectacles with a variety of tints and prism combinations.

PMID: 29488253

No 433: July 25, 2018

Liu P, Huang Q, Ou Y, Chen L, Song R, Zheng Y. **Characterizing Patients with Unilateral Vestibular Hypofunction Using Kinematic Variability and Local Dynamic Stability during**

Treadmill Walking. Behav Neurol. 2017;2017:4820428. doi: 10.1155/2017/4820428. Epub 2017 Jul 13.

Abstract

Here, we aimed to compare the unstable gait caused by unilateral vestibular hypofunction (UVH) with the normal gait. Twelve patients with UVH and twelve age-matched control subjects were enrolled in the study. Thirty-four markers were attached to anatomical positions of each participant, and a three-dimensional (3D) motion analysis system was used to capture marker coordinates as the participants walked on a treadmill. The mean standard deviation of the rotation angles was used to represent gait variability. To explore gait stability, local dynamic stability was calculated from the trunk trajectory. The UVH group had wider step width and greater variability of roll rotation at the hip than the control group ($P < 0.05$). Also, the UVH group had lower local dynamic stability in the medial-lateral (ML) direction than the control group ($P < 0.05$). By linear regression analysis, we identified a linear relationship between the short-term Lyapunov exponent and vestibular functional asymmetry. The result implies that UVH-induced asymmetry can increase posture variability and gait instability. This study demonstrates the potential for using kinematic parameters to quantitatively evaluate the severity of vestibular functional asymmetry. Further studies will be needed to explore the clinical effectiveness of such approaches.

PMID: 2878513

No 432: July 19, 2018

Swanenburg J, Bäbler E, Adelsberger R, Straumann D, de Bruin ED**. Patients with chronic peripheral vestibular hypofunction compared to healthy subjects exhibit differences in gaze and gait behaviour when walking on stairs and ramps.** PLoS One. 2017 Dec 18;12(12):e0189037. doi: 10.1371/journal.pone.0189037. eCollection 2017.

Abstract

OBJECTIVE: The aim of this study was to compare gaze behaviour during stair and ramp walking between patients with chronic peripheral vestibular hypofunction and healthy human subjects.

METHODS: Twenty four (24) patients with chronic peripheral vestibular hypofunction (14 unilateral and 10 bilateral) and 24 healthy subjects performed stair and ramp up and down walks at self-selected speed. The walks were repeated five times. A mobile eye tracker was used to record gaze behaviour (defined as time directed to pre-defined areas) and an insole measurement device assessed gait (speed, step time, step length). During each walk gaze behaviour relative to i) detection of first transition area "First TA", ii) detection of steps of the mid-staircase area and the handrail "Structure", iii) detection of second transition area "Second TA", and iv) looking elsewhere "Elsewhere" was assessed and expressed as a percentage of the walk duration. For all variables, a one-way ANOVA followed by contrast tests was conducted.

RESULTS: Patients looked significantly longer at the "Structure" ($p<0.001$) and "Elsewhere" ($p<0.001$) while walking upstairs compared to walking downstairs ($p<0.013$). Patients looked significantly longer at the "Structure" ($p<0.001$) and "Elsewhere" ($p<0.001$) while walking upstairs compared to walking downstairs ($p<0.013$). No differences between groups were observed for the transition areas with exception of stair ascending. Patients were also slower going downstairs ($p = 0.002$) and presented with an increased step time ($p = 0.003$). Patients were walking faster up the ramp ($p = 0.014$) with longer step length ($p = 0.008$) compared to walking down the ramp ($p = 0.050$) with shorter step length ($p = 0.024$).

CONCLUSIONS: Patients with chronic peripheral vestibular hypofunction differed in time directed to pre-defined areas during stair and ramp walking and looked longer at stair and ramp areas of interest during walking compared to healthy subjects. Patients did not differ in time directed to pre-defined areas during the stair-floor transition area while going downstairs, an area where accidents may frequently occur.

PMID: 2925388

No 431: July 11, 2018

van Esch BF, Nobel-Hoff GE, van Benthem PP, van der Zaag-Loonen HJ, Bruintjes TD. **Determining vestibular hypofunction: start with the video-head impulse test.** Eur Arch Otorhinolaryngol. 2016 Nov;273(11):3733-3739. Epub 2016 Apr 25.

Abstract

Caloric testing is considered the 'reference standard' in determining vestibular hypofunction. Recently, the video-head impulse test (vHIT) was introduced. In the current study we aimed to assess the diagnostic value of the vHIT as compared to caloric testing in determining vestibular function. In a cross-sectional study between May 2012 and May 2013, we prospectively analysed patients with dizziness who had completed caloric testing and the vHIT. For the left and right vestibular system we calculated the mean vHIT gain. We used a gain cut-off value of 0.8 for the vHIT and presence of correction saccades to define an abnormal vestibular-ocular reflex. An asymmetrical ocular response of 22 % or more (Jongkees formula) or an irrigation response with a velocity below 15°/s was considered abnormal. We calculated sensitivity, specificity, positive and negative predictive values with 95 % confidence intervals for the dichotomous vHIT. Among 324 patients [195 females (60 %), aged 53 ± 17 years], 39 (12 %) had an abnormal vHIT gain and 113 (35 %) had an abnormal caloric test. Sensitivity was 31 % (23-40 %), specificity 98 % (95-99 %), positive predictive value was 88 % (74-95 %), and negative predictive value 73 % (67-77 %). In case of vHIT normality, additional caloric testing remains indicated and the vHIT does not replace the caloric test. However, the high positive predictive value of the vHIT indicates that an abnormal vHIT is strongly related to an abnormal caloric test result; therefore, additional caloric testing is not necessary. We conclude that the vHIT is clinically useful as the first test in determining vestibular hypofunction in dizzy patients.

PMID: 27113255

No 430: June 27, 2018

Ghavami Y, Haidar YM, Ziai KN, Moshtaghi O, Bhatt J, Lin HW, Djalilian HR. **Management of mal de debarquement syndrome as vestibular migraines**. Laryngoscope. 2017 Jul;127(7):1670-1675. doi: 10.1002/lary.26299. Epub 2016 Oct 12.

Abstract

OBJECTIVE: Mal de debarquement syndrome (MdDS) is a balance disorder that typically starts after an extended exposure to passive motion, such as a boat or plane ride. Management is typically supportive (e.g. physical therapy), and symptoms that persist beyond 6 months have been described as unlikely to remit. This study was conducted to evaluate the response of patients with MdDS to management with migraine prophylaxis, including lifestyle changes and medical therapy.

STUDY DESIGN: Prospective review. SETTING: Ambulatory setting at a tertiary care medical center.

METHODS: Clinical history, detailed questionnaires, and audiograms were used to diagnose patients with MdDS. Those patients with the diagnosis of the MdDS were placed on our institutional vestibular migraine management protocol. Treatment response was assessed with a quality-of-life (QOL) survey and visual analog scale.

RESULTS: Fifteen patients were diagnosed with MdDS, with a predominance of females (73%) and a mean age of 50 ± 13 years. Eleven patients (73%) responded well to management with a vestibular migraine protocol, which included lifestyle changes, as well as pharmacotherapy with verapamil, nortriptyline, topiramate, or a combination thereof. In comparison, a retrospective control group of 17 patients demonstrated a lower rate of improvement when treated with vestibular rehabilitation and physical therapy.

CONCLUSION: Management of MdDS as vestibular migraine can improve patients' symptoms and increase the QOL. Nearly all the patients suffering from MdDS had a personal or family history of migraine headaches or had signs or symptoms suggestive of atypical migraine.

PMID: 27730651

Link to free article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5823515/

No 429: June 21, 2018

Kutay Ö, Akdal G, Keskinoğlu P, Balcı BD, Alkın T. **Vestibular migraine patients are more anxious than migraine patients without vestibular symptoms.** J Neurol. 2017 Oct;264(Suppl 1):37-41. doi: 10.1007/s00415-017-8439-6. Epub 2017 Mar 9.

Abstract

The link between vertigo and anxiety is well known. The aim of this study is to compare anxiety disorders in 3 groups: patients with vestibular migraine (VM), patients with migraine but without vertigo (MO) and healthy controls (HC). We performed cross-sectional analysis of following tests: (a) Hamilton Anxiety Rating Scale (HAMA); (b) State-Trait Anxiety Inventory (STAI-X1 and STAI-X2); (c) Beck Depression Inventory (BDI); (d) Panic-Agoraphobic Scale and (e) Penn State Worry Questionnaire (PSWQ). ANOVA, Kruskal-Wallis and Chi-square tests were used for comparisons and least significant difference was used for further post-hoc analysis. There were 35 definite VM patients, 31 MO patients and 32 volunteer HC. There were no significant differences between three groups in age, total years of education or duration of headaches in VM and MO patients. On the other hand, vertigo severity was moderately and positively correlated with headache severity and with headache duration. There were significant differences in scores of HARS, BDI, PSWQ, and various PAS-R sub-scales between the three groups. Our study shows that VM patients are significantly more anxious and agoraphobic than MO patients and HC, displaying higher sensitivity to separation and being more prone to seeking medical reassurance.

PMID: 28280987

No 428: June 13, 2018

Sugaya N, Arai M, Goto F. **Is the Headache in Patients with Vestibular Migraine Attenuated by Vestibular Rehabilitation?** Front Neurol. 2017 Apr 3;8:124. doi: 10.3389/fneur.2017.00124. eCollection 2017.

Abstract

BACKGROUND: Vestibular rehabilitation is the most effective treatment for dizziness due to vestibular dysfunction. Given the biological relationship between vestibular symptoms and headache, headache in patients with vestibular migraine (VM) could be improved by vestibular rehabilitation that leads to the improvement of dizziness. This study aimed to compare the effects of vestibular rehabilitation on headache and other outcomes relating to dizziness, and the psychological factors in patients with VM patients, patients with dizziness and tension-type headache, and patients without headache.

METHODS: Our participants included 251 patients with dizziness comprising 28 patients with VM, 79 patients with tension-type headache, and 144 patients without headache. Participants were hospitalized for 5 days and taught to conduct a vestibular rehabilitation program. They were assessed using the Dizziness Handicap Inventory (DHI), Headache Impact Test (HIT-6), Hospital Anxiety and Depression Scale (HADS), and Somatosensory Catastrophizing Scale (SSCS) and underwent center of gravity fluctuation measurement as an objective dizziness severity index before, 1 month after, and 4 months after their hospitalization.

RESULTS: The VM and tension-type headache groups demonstrated a significant improvement in the HIT-6 score with improvement of the DHI, HADS, SSCS, and a part of the objective dizziness index that also shown in patients without headache following vestibular rehabilitation. The change in HIT-6 during rehabilitation in the VM group was positively correlated with

changes in the DHI and anxiety in the HADS. Changes in the HIT-6 in tension-type headache group positively correlated with changes in anxiety and SSCS.

CONCLUSION: Vestibular rehabilitation contributed to improvement of headache both in patients with VM and patients with dizziness and tension-type headache, in addition to improvement of dizziness and psychological factors. Improvement in dizziness following vestibular rehabilitation could be associated with the improvement of headache more prominently in VM compared with comorbid tension-type headache.

PMID: 28421034

PMCID: PMC5377541

Free PMC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5377541/

No 427: June 6, 2018

Tabet P, Saliba I. **Meniere's Disease and Vestibular Migraine: Updates and Review of the Literature.** J Clin Med Res. 2017 Sep;9(9):733-744. doi: 10.14740/jocmr3126w. Epub 2017 Jul 27.

Abstract

The diagnosis of Meniere's disease (MD) and vestibular migraine (VM) is primarily based on clinical criteria and their differentiation is often difficult. Currently, there are no known definitive diagnostic tests that can reliably distinguish the two conditions. Patients with MD and patients with VM are treated differently, therefore improving the diagnosis of these two pathologies should avoid errors in management. A systematic review was conducted according to PRISMA guidelines. Medline-Ovid and Embase databases were used to conduct a thorough search of English-language publications dating from 1948 to March 2016. The primary search objective was to identify all papers explicitly comparing MD and VM in order to clarify and validate the diagnosis of these two diseases. A total of 13 articles out of 831 were reviewed. Among other differences, MD showed later age of onset, more hearing loss, tinnitus, aural fullness, abnormal nystagmus, abnormal caloric testing results, abnormal vestibular evoked myogenic potential and endolymphatic hydrops. VM showed more headaches, photophobia, vomiting and aura. Even though differences were noted between the two diseases, only one study focused on assessing the differences between VM, MD and patients fulfilling both diagnostic criteria (MDVM). This study showed no difference between the three groups. Since the introduction of the new International Headache Society and Barany Society criteria for VM, no studies have focused on comparing these three groups. We strongly encourage authors to focus on comparing MD and VM from MDVM in future studies to help adequately distinguish the diagnosis of both diseases.

PMID: 28811849

PMCID: PMC5544477

Free PMC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5544477/

No 426: May 30, 2018

Muntaseer Mahfuz M, Schubert MC, Todd CJ, Figtree WVC, Khan SI, Migliaccio AA. **The Effect of Visual Contrast on Human Vestibulo-Ocular Reflex Adaptation.** J Assoc Res Otolaryngol. 2018 Feb;19(1):113-122. doi: 10.1007/s10162-017-0644-6. Epub 2017 Nov 6.

Abstract

The vestibulo-ocular reflex (VOR) is the main retinal image stabilising mechanism during rapid head movement. When the VOR does not stabilise the world or target image on the retina, retinal image slip occurs generating an error signal that drives the VOR response to increase or decrease until image slip is minimised, i.e. VOR adaptation occurs. Visual target contrast affects the human smooth pursuit and optokinetic reflex responses. We sought to determine if contrast also affected VOR adaptation. We tested 12 normal subjects, each over 16 separate sessions. For sessions 1-14, the ambient light level (lx) during adaptation training was as follows: dark, 0.1, 0.2, 0.3, 0.5, 0.7, 1, 2, 8, 16, 32, 64, 128 and 255 lx (light level for a typical room). For sessions 15-16, the laser target power (related to brightness) was halved with ambient light at 0 and 0.1 lx. The adaptation training lasted 15 min and consisted of left/right active head impulses. The VOR gain was challenged to increment, starting at unity, by 0.1 every 90 s for rotations to the designated adapting side and fixed at unity towards the non-adapting side. We measured active and passive VOR gains before and after adaptation training. We found that for both the active and passive VOR, there was a significant increase in gain only towards the adapting side due to training at contrast level 1.5 k and above (2 lx and below). At contrast level 261 and below (16 lx and above), adaptation training resulted in no difference between adapting and non-adapting side gains. Our modelling suggests that a contrast threshold of ~ 1000, which is 60 times higher than that provided by typical room lighting, must be surpassed for robust active and passive VOR adaptation. Our findings suggest contrast is an important factor for adaptation, which has implication for rehabilitation programs.

PMID: 29110135

No 425: May 23, 2018

Capó-Aponte JE, Beltran TA, Walsh DV, Cole WR, Dumayas JY. **Validation of Visual Objective Biomarkers for Acute Concussion.** Mil Med. 2018 Mar 1;183(suppl_1):9-17. doi: 10.1093/milmed/usx166.

Abstract

Objective: Despite an increase in the awareness and diagnosis of mild traumatic brain injury (mTBI), there remains a paucity of data examining the comparative efficacy of available assessments. This study aims to validate visual functions as potential biomarkers for mTBI.

Methods: This case-control correlational design utilizes military personnel diagnosed with acute (≤72 h post-injury) mTBI (n = 100) and age-matched controls (n = 100) to examine the relative effectiveness of the pupillary light reflex (PLR), near point of convergence (NPC) break, King-Devick (KD) test time, and Convergence Insufficiency Symptom Survey (CISS) score to discriminate between participants with mTBI.

Results: Three of the eight PLR parameters (i.e., average constriction velocity (ACV), average dilation velocity (ADV), and 75% re-dilation time; all $p < 0.001$) were affected in mTBI participants. Similarly, NPC break, KD test time, and CISS scores showed a statistically significant difference between groups (all $p < 0.001$). Area under the curve showed that ADV (0.82) and NPC (0.74) have the higher predictive values of all objective parameters.

Conclusions: ADV, ACV, and NPC break are objective visual functions markedly affected in the acute mTBI group compared with controls; therefore, we proposed that they could be used as biomarkers for acute mTBI.

PMID: 29635572

Free full text: https://academic.oup.com/milmed/article/183/suppl_1/9/4959946

No 424: May 16, 2018

Anzalone AJ, Blueitt D, Case T, McGuffin T, Pollard K, Garrison JC, Jones MT. **A Positive Vestibular/Ocular Motor Screening (VOMS) Is Associated With Increased Recovery Time After Sports-Related Concussion in Youth and Adolescent Athletes**. Am J Sports Med. 2017 Feb;45(2):474-479. doi: 10.1177/0363546516668624. Epub 2016 Oct 28

Abstract

BACKGROUND: Vestibular and ocular motor impairments are routinely reported in patients with sports-related concussion (SRC) and may result in delayed return to play (RTP). The Vestibular/Ocular Motor Screening (VOMS) assessment has been shown to be consistent and sensitive in identifying concussion when used as part of a comprehensive examination. To what extent these impairments or symptoms are associated with length of recovery is unknown.

PURPOSE: To examine whether symptom provocation or clinical abnormality in specific domains of the VOMS results in protracted recovery (time from SRC to commencement of RTP protocol).

STUDY DESIGN: Cohort study (prognosis); Level of evidence, 2.

METHODS: A retrospective chart review was conducted of 167 patients (69 girls, 98 boys; mean ± SD age, 15 ± 2 years [range, 11-19 years]) presenting with SRC in 2014. During the initial visit, VOMS was performed in which symptom provocation or clinical abnormality (eg, unsmooth eye movements) was documented by use of a dichotomous scale (0 = not present, 1 = present). The VOMS used in this clinic consisted of smooth pursuits (SMO_PUR), horizontal

and vertical saccades (HOR_SAC and VER_SAC), horizontal and vertical vestibular ocular reflex (HOR_VOR and VER_VOR), near point of convergence (NPC), and accommodation (ACCOM). Domains were also categorized into ocular motor (SMO_PUR, HOR_SAC, VER_SAC, NPC, ACCOM) and vestibular (HOR_VOR, VER_VOR). Cox proportional hazard models were used to explore the relationship between the domains and recovery. Alpha was set at $P \leq .05$.

RESULTS: Symptom provocation and/or clinical abnormality in all domains except NPC (P = .107) and ACCOM (P = .234) delayed recovery (domain, hazard ratio [95% CI]: SMO_PUR, 0.65 [0.47-0.90], P = .009; HOR_SAC, 0.68 [0.50-0.94], P = .018; VER_SAC, 0.55 [0.40-0.75], P < .001; HOR_VOR, 0.68 [0.49-0.94], P = .018; VER_VOR, 0.60 [0.44-0.83], P = .002). The lowest crude hazard ratio was for ocular motor category (0.45 [0.32-0.63], P < .001).

CONCLUSION: These data suggest that symptom provocation/clinical abnormality associated with all domains except NPC and ACCOM can delay recovery after SRC in youth and adolescents. Thus, the VOMS not only may augment current diagnostic tools but also may serve as a predictor of recovery time in patients with SRC. The findings of this study may lead to more effective prognosis of concussion in youth and adolescents.

PMID: 27789472

No 423: May 9, 2018

Singman EL, Matta NS, Silbert DI. **Convergence insufficiency associated with migraine: a case series**. Am Orthopt J. 2014;64:112-6. doi: 10.3368/aoj.64.1.112.

Abstract

BACKGROUND AND PURPOSE: The appearance of convergence insufficiency in migraineurs suggests a possible link between migraine and convergence insufficiency.

PATIENTS AND METHOD: Relevant patients reporting to our neuro-ophthalmology clinic complained of symptoms consistent with convergence insufficiency and had a history of migraine. Patients underwent thorough neuro-ophthalmic evaluations including history, physical exam, and cranial imaging. Four illustrative cases are presented in this report.

RESULTS: Convergence insufficiency may develop after migraine. In some cases, it may be a persistent cause of reduced visual functioning. In patients with persistent asthenopia, orthoptic therapy has proven successful.

CONCLUSIONS: A history of migraine should be sought in patients complaining of reading difficulties secondary to new onset convergence insufficiency. Furthermore, migraineurs should be asked about whether they suffer asthenopia. Finally, a larger scale, prospective study should be considered to further explore a possible link between migraine and convergence insufficiency.

PMID: 25313120

No 422: May 2, 2018

Pavlou M, Whitney SL, Alkathiry AA, Huett M, Luxon LM, Raglan E, Godfrey EL, Bamiou DE. **Visually Induced Dizziness in Children and Validation of the Pediatric Visually Induced Dizziness Questionnaire.** Front Neurol. 2017 Dec 5;8:656. doi: 10.3389/fneur.2017.00656. eCollection 2017.

Abstract

AIMS: To develop and validate the Pediatric Visually Induced Dizziness Questionnaire (PVID) and quantify the presence and severity of visually induced dizziness (ViD), i.e., symptoms induced by visual motion stimuli including crowds and scrolling computer screens in children.

METHODS: 169 healthy (female n=89; recruited from mainstream schools, London, UK) and 114 children with a primary migraine, concussion, or vestibular disorder diagnosis (female n=62), aged 6-17 years, were included. Children with primary migraine were recruited from mainstream schools while children with concussion or vestibular disorder were recruited from tertiary balance centers in London, UK, and Pittsburgh, PA, USA. Children completed the PVID, which assesses the frequency of dizziness and unsteadiness experienced in specific environmental situations, and Strength and Difficulties Questionnaire (SDQ), a brief behavioral screening instrument.

RESULTS: The PVID showed high internal consistency (11 items; $\alpha = .90$). A significant between-group difference was noted with higher (i.e., worse) PVID scores for patients vs. healthy participants ($U = 2,436.5$, $z = -10.719$, $p < 0.001$); a significant difference was noted between individual patient groups [$\chi 2(2) = 11.014$, $p = 0.004$] but post hoc analysis showed no significant pairwise comparisons. The optimal cut-off score for discriminating between individuals with and without abnormal ViD levels was 0.45 out of 3 (sensitivity 83%, specificity 75%). Self-rated emotional ($U = 2,730.0$, $z = -6.169$) and hyperactivity ($U = 3,445.0$, $z = -4.506$) SDQ subscale as well as informant ($U = 188.5$, $z = -3.916$) and self-rated ($U = 3,178.5$, $z = -5.083$) total scores were significantly worse for patients compared to healthy participants ($p < 0.001$).

CONCLUSION: ViD is common in children with a primary concussion, migraine, or vestibular diagnosis. The PVID is a valid measure for identifying the presence of ViD in children and should be used to identify and quantify these symptoms, which require specific management incorporating exposure to optokinetic stimuli.

PMID: 29259575

No 421: April 25, 2018

Gauchard GC, Vançon G, Gentine A, Jeandel C, Perrin PP. **Physical activity after retirement enhances vestibulo-ocular reflex in elderly humans**. Neurosci Lett. 2004 Apr 22;360(1-2):17-20.

Abstract

Vestibular information decreases in sensitivity with ageing, and its role becomes less important in the regulation of postural control. In addition, the practice of physical activity (PA) helps to improve vestibular sensitivity. This study aimed to evaluate PA-related benefit on vestibular function in 36 subjects split into four groups according to the period of practice. Caloric and rotatory vestibular testings showed that the performance of subjects who had begun practising PA recently were close to those of subjects active for a long time, whereas those of subjects who had stopped practising at an early age were close to those of inactive subjects. Although starting to practise PA has immediate beneficial effects on the vestibule, in terms of vestibular stimulation mechanisms these effects soon disappear if this activity is stopped.

PMID: 15082168

No 420: April 18, 2018

Caillet G, Bosser G, Gauchard GC, Chau N, Benamghar L, Perrin PP. **Effect of sporting activity practice on susceptibility to motion sickness.** Brain Res Bull. 2006 Apr 14;69(3):288-93. Epub 2006 Jan 19.

Abstract

The theory of visuo-vestibular conflict is the most commonly accepted to explain motion sickness. Visual, vestibular and proprioceptive afferences are involved in balance control and this function can be improved by physical and sporting activities (PSA). The purpose of the present survey was to investigate the relationships between motion sickness susceptibility (MSS) in adulthood and PSA, and especially proprioceptive PSA. A questionnaire concerning MSS and PSA was filled in by 1829 students (22.3+/-3.4 years of age, 799 males). Subjects having practised a sport before the age of 18 have less MSS than the other subjects ($P<0.001$). It should be noted that subjects who practised proprioceptive PSA before the age of 18 have less MSS than subjects who practised bioenergetic PSA before this age. By practising PSA, subjects are less dependent on visual input and use vestibular afferences better. A process of habituation can be involved in better managing conflicting sensory afferences reducing susceptibility to motion sickness. The practice of proprioceptive PSA develops the proprioceptive afferences and improves their treatment by the central nervous system. This additional appropriate input associated with an increase in vestibular weight compared to vision helps overcome visuo-vestibular conflict.

PMID: 16564424

This abstract can be found on Pub Med http://www.ncbi.nlm.nih.gov/sites/entrez by entering the PMID number listed above into the "Search" field

No 419: April 12, 2018

Maitre J, Paillard T. Postural Effects of **Vestibular Manipulation Depend on the Physical Activity Status**. PLoS One. 2016 Sep 14;11(9):e0162966. doi: 10.1371/journal.pone.0162966. eCollection 2016.

Abstract

The purpose of this study was to compare the effects of galvanic vestibular stimulation (GVS) on postural control for participants of different physical activity status (i.e. active and non-active). Two groups of participants were recruited: one group of participants who regularly practised sports activities (active group, n = 17), and one group of participants who did not practise physical and/or sports activities (non-active group, n = 17). They were compared in a reference condition (i.e bipedal stance with eyes open) and four vestibular manipulation condition (i.e. GVS at 0.5 mA and 3 mA, in accordance with two designs) lasting 20 seconds. The centre of foot pressure displacement velocities were compared between the two groups. The main results indicate that the regular practice of sports activities counteracts postural control disruption caused by GVS. The active group demonstrated better postural control than the non-active group when subjected to higher vestibular manipulation. The active group may have developed their ability to reduce the influence of inaccurate vestibular signals. The active participants could identify the relevant sensory input, thought a better central integration, which enables them to switch faster between sensory inputs.

PMID: 27627441

Link to free article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5023127/

No 418: April 4, 2018

Lee YY, Yang YP, Huang PI, Li WC, Huang MC, Kao CL, Chen YJ, Chen MT. **Exercise suppresses COX-2 pro-inflammatory pathway in vestibular migraine.** Brain Res Bull. 2015 Jul;116:98-105. doi: 10.1016/j.brainresbull.2015.06.005. Epub 2015 Jul 4.

Abstract

Migraine and dizziness are relatively common disorders. Patients with dizziness have a higher incidence of migraines than the general population. The discomfort experienced by these patients is often poorly controlled by medication. However, the pathophysiology of vestibular migraine (VM) remains unclear. We hypothesized that patients with VM would experience remission from symptoms after exercise training and that this effect may be mediated through the suppression of cyclooxygenase-2 (COX-2)-mediated inflammation. Thus, the aim of the present study was to investigate the efficacy and possible anti-inflammatory benefits of exercise in patients with VM. We assessed the level of soluble inflammatory mediators in plasma from VM patients and

control subjects. Our analysis of cytokine expression in the patients with VM undergoing exercise treatment revealed a significant reduction in pro-inflammatory cytokines and/or cytotoxic factors, such as tumor necrosis factor-α, interleukins, nitric oxide (NO), inducible NO synthase, and reactive oxygen species. In contrast, we found an increase in the level of anti-inflammatory cytokines after exercise. Moreover, the group undergoing exercise training showed significant symptomatic improvement and demonstrated suppressed antioxidant enzyme activity. To summarize, our data suggest that exercise significantly inhibits COX-2 activity, leading to the suppression of pro-inflammatory cytokines and changes in redox status. These results suggest that there is a molecular link between the central nervous system and the immune system. Furthermore, elucidation of the neurobiological mechanisms underlying VM could potentially lead to the development of novel therapeutic interventions for these patients.

PMID: 26151770

No 417: March 28, 2018

Marsh JD, Durkin MW, Hack AE, Markowitz BB, Cheeseman EW. **Accuracy of Double Maddox Rod with Induced Hypertropia in Normal Subjects.** Am Orthopt J. 2014;64:76-80. doi: 10.3368/aoj.64.1.76.

BACKGROUND AND PURPOSE: The double Maddox rod is a commonly used instrument to test for cyclotorsion in the clinical setting. This paper assesses the ability of patients without torsional complaint to accurately demonstrate torsional status with varying degrees of induced hypertropia as tested by double Maddox rod.

METHODS: Thirty-seven orthophoric subjects underwent double Maddox rod testing with vertical prism of 3(Δ), 10(Δ), 16(Δ), 20(Δ), and 30(Δ). Subjective torsion was recorded for each prism diopter.

RESULTS: Mean subjective torsion was recorded as 0.95°, 1.6°, 1.9°, 2.1°, and 2.2° for 3(Δ), 10(Δ), 16(Δ), 20(Δ), and 30(Δ), respectively. Torsion increased in a logarithmic manner as modeled by R™ software version 2.15.2.

CONCLUSIONS: The double Maddox rod test as commonly used in clinical practice is both subjective and prone to administrator and subject error. Subjects have more difficulty properly aligning the double Maddox rod as distance between images is increased. It is also possible that recruitment of the oblique muscles during attempted vertical fusion leads to subjective torsion during double Maddox rod testing in otherwise normal participants.

PMID: 25313115

No 416: March 21, 2018

Reinink H, Wegner I, Stegeman I, Grolman W. **Rapid systematic review of repeated application of the epley maneuver for treating posterior BPPV.** Otolaryngol Head Neck Surg. 2014 Sep;151(3):399-406. doi: 10.1177/0194599814536530. Epub 2014 May 29.

Objective: To evaluate the effect of repeated application of the Epley maneuver on patient-reported symptom relief and resolution of nystagmus in patients with posterior benign paroxysmal positional vertigo (p-BPPV).

Methods: A systematic search was conducted. Studies reporting original study data were included. Relevance and risk of bias (RoB) of the selected articles were assessed. Studies with low relevance, high RoB, or both were excluded. Success percentages and mean values were extracted.

Results: A total of 955 unique studies were retrieved. Fourteen of these satisfied the eligibility criteria. All of the included studies carried a high relevance and a moderate RoB. The majority of studies were 1-armed trials, in which the Epley was repeated only in case previous attempt(s) had failed. The maneuver was not repeated if it was successful. In 32% to 90% of patients, the first treatment session was successful. Reported cumulative success percentages ranged from 40% to 100% after the second session, 67% to 98% after the third session, 87% to 100% after the fourth session, and 100% in the studies in which patients received 5 sessions. One study evaluating the effect of multiple maneuvers in a single session showed a rise in success percentages from 84% for 1 maneuver to 90% after 2 maneuvers and 92% after 3 maneuvers.

Conclusion: Multiple studies with moderate RoB show a beneficial effect of multiple sessions of the Epley maneuver in pBPPV patients who are not fully cleared of symptoms after the first session.

PMID: 24876167

No 415: March 14, 2018

Hunt AW, Paniccia M, Reed N, Keightley M. **Concussion-Like Symptoms in Child and Youth Athletes at Baseline: What Is "Typical"?** J Athl Train. 2016 Oct;51(10):749-757. doi: 10.4085/1062-6050-51.11.12. Epub 2016 Nov 11.

CONTEXT: After a concussion, guidelines emphasize that an athlete should be asymptomatic before starting a return-to-play protocol. However, many concussion symptoms are nonspecific and may be present in individuals without concussion. Limited evidence exists regarding the presence of "typical" or preinjury (baseline) symptoms in child and youth athletes.

OBJECTIVE: To describe the frequency of symptoms reported at baseline by child and youth athletes and identify how age, sex, history of concussion, and learning factors influence the presence of baseline symptoms.

DESIGN: Cross-sectional cohort study.

SETTING: Baseline testing was conducted at a hospital research laboratory or in a sport or school setting (eg, gym or arena).

PATIENTS OR OTHER PARTICIPANTS: A total of 888 child (9-12 years old, n = 333) and youth (13-17 years old, n = 555) athletes participated (46.4% boys and 53.6% girls, average age = 13.09 ± 1.83 years).

MAIN OUTCOME MEASURE(S): Demographic and symptom data were collected as part of a baseline protocol. Age-appropriate versions of the Post-Concussion Symptom Inventory (a self-report concussion-symptoms measure with strong psychometric properties for pediatric populations) were administered. Demographic data (age, sex, concussion history, learning factors) were also collected.

RESULTS: Common baseline symptoms for children were feeling sleepier than usual (30% boys, 24% girls) and feeling nervous or worried (17% boys, 25% girls). Fatigue was reported by more than half of the youth group (50% boys, 67% girls). Nervousness was reported by 32% of youth girls. Headaches, drowsiness, and difficulty concentrating were each reported by 25% of youth boys and girls. For youths, a higher total symptom score was associated with increasing age and number of previous concussions, although these effects were small (age rs = 0.143, number of concussions rs = .084). No significant relationships were found in the child group.

CONCLUSIONS: Children and youths commonly experienced symptoms at baseline, including fatigue and nervousness. Whether clinicians should expect complete symptom resolution after concussion is not clear.

PMID: 27834505

Free PMC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5189228/

No 414: March 7, 2018

Newman-Toker DE, Edlow JA. TiTrATE: **A Novel, Evidence-Based Approach to Diagnosing Acute Dizziness and Vertigo.** Neurol Clin. 2015 Aug;33(3):577-99, viii. doi: 10.1016/j.ncl.2015.04.011.

Diagnosing dizziness can be challenging, and the consequences of missing dangerous causes, such as stroke, can be substantial. Most physicians use a diagnostic paradigm developed more than 40 years ago that focuses on the type of dizziness, but this approach is flawed. This article proposes a new paradigm based on symptom timing, triggers, and targeted bedside eye examinations (TiTrATE). Patients fall into 1 of 4 major syndrome categories, each with its own differential diagnosis and set of targeted examination techniques that help make a specific diagnosis. Following an evidence-based approach could help reduce the frequency of

misdiagnosis of serious causes of dizziness. In the spirit of the flipped classroom, the editors of this Neurologic Clinics issue on emergency neuro-otology have assembled a collection of unknown cases to be accessed electronically in multimedia format. By design, cases are not linked with specific articles, to avoid untoward cueing effects for the learner. The cases are real and are meant to demonstrate and reinforce lessons provided in this and subsequent articles. In addition to pertinent elements of medical history, cases include videos of key examination findings.

PMID: 26231273

Free PMC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4522574/

No 413: February 28, 2018

Riccelli R, Passamonti L, Toschi N, et al. **Altered Insular and Occipital Responses to Simulated Vertical Self-Motion in Patients with Persistent Postural-Perceptual Dizziness.** Frontiers in Neurology. 2017;8:529. doi:10.3389/fneur.2017.00529

BACKGROUND: Persistent postural-perceptual dizziness (PPPD) is a common functional vestibular disorder characterized by persistent symptoms of non-vertiginous dizziness and unsteadiness that are exacerbated by upright posture, self-motion, and exposure to complex or moving visual stimuli. Recent physiologic and neuroimaging data suggest that greater reliance on visual cues for postural control (as opposed to vestibular cues-a phenomenon termed visual dependence) and dysfunction in central visuo-vestibular networks may be important pathophysiologic mechanisms underlying PPPD. Dysfunctions are thought to involve insular regions that encode recognition of the visual effects of motion in the gravitational field.

METHODS: We tested for altered activity in vestibular and visual cortices during self-motion simulation obtained via a visual virtual-reality rollercoaster stimulation using functional magnetic resonance imaging in 15 patients with PPPD and 15 healthy controls (HCs). We compared between groups differences in brain responses to simulated displacements in vertical vs horizontal directions and correlated the difference in directional responses with dizziness handicap in patients with PPPD.

RESULTS: HCs showed increased activity in the anterior bank of the central insular sulcus during vertical relative to horizontal motion, which was not seen in patients with PPPD. However, for the same comparison, dizziness handicap correlated positively with activity in the visual cortex (V1, V2, and V3) in patients with PPPD.

CONCLUSION: We provide novel insight into the pathophysiologic mechanisms underlying PPPD, including functional alterations in brain processes that affect balance control and reweighting of space-motion inputs to favor visual cues. For patients with PPPD, difficulties using visual data to discern the effects of gravity on self-motion may adversely affect balance control, particularly for individuals who simultaneously rely too heavily on visual stimuli. In

addition, increased activity in the visual cortex, which correlated with severity of dizziness handicap, may be a neural correlate of visual dependence.

PMID: 29089920

No 412: February 21, 2018

Söhsten E, Bittar RS, Staab JP. **Posturographic profile of patients with persistent postural-perceptual dizziness on the sensory organization test**. J Vestib Res. 2016 Jul 2;26(3):319-26.

BACKGROUND/OBJECTIVE: Persistent postural-perceptual dizziness (PPPD) was defined by expert consensus for the forthcoming International Classification of Diseases, 11th edition. Its diagnostic criteria were derived from phobic postural vertigo and chronic subjective dizziness. Two key symptoms are postural unsteadiness and visually induced dizziness. We observed that patients with PPPD tended to perform poorly on multiple conditions of the EquiTest® Sensory Organization Test (SOT) and sought to investigate this phenomenon systematically.

METHODS: We examined cross-sectional, pair-wise group differences in mean scores from SOT conditions 1-6 and composite scores among 20 patients with PPPD, 15 patients recovered from acute vestibular syndromes, and 15 normal individuals (all female, 43 ± 9 years old). We also compared proportions of patients in each group with abnormal sensory analyses, and poor performance across multiple conditions.

RESULTS: Patients with PPPD had significantly lower mean scores than normal individuals on conditions 2-6 and the composite, and lower than recovered patients on conditions 2-3. Recovered patients had significantly lower mean scores than normal individuals on conditions 4-6 and the composite. Patients with PPPD had the greatest likelihood of abnormal sensory analyses.

CONCLUSIONS: Patients with PPPD had difficulties with postural control across multiple sensory challenges, consistent with postulated neurophysiologic mechanisms of this condition.

PMID: 27392836

No 411: February 14, 2018

Staab JP, Eckhardt-Henn A, Horii A, Jacob R, Strupp M, Brandt T, Bronstein A. **Diagnostic criteria for persistent postural-perceptual dizziness (PPPD): Consensus document of the committee for the Classification of Vestibular Disorders of the Bárány Society**. J Vestib Res. 2017;27(4):191-208. doi: 10.3233/VES-170622.

This paper presents diagnostic criteria for persistent postural-perceptual dizziness (PPPD) to be included in the International Classification of Vestibular Disorders (ICVD). The term PPPD is new, but the disorder is not. Its diagnostic criteria were derived by expert consensus from an

exhaustive review of 30 years of research on phobic postural vertigo, space-motion discomfort, visual vertigo, and chronic subjective dizziness. PPPD manifests with one or more symptoms of dizziness, unsteadiness, or non-spinning vertigo that are present on most days for three months or more and are exacerbated by upright posture, active or passive movement, and exposure to moving or complex visual stimuli. PPPD may be precipitated by conditions that disrupt balance or cause vertigo, unsteadiness, or dizziness, including peripheral or central vestibular disorders, other medical illnesses, or psychological distress. PPPD may be present alone or co-exist with other conditions. Possible subtypes await future identification and validation. The pathophysiologic processes underlying PPPD are not fully known. Emerging research suggests that it may arise from functional changes in postural control mechanisms, multi-sensory information processing, or cortical integration of spatial orientation and threat assessment. Thus, PPPD is classified as a chronic functional vestibular disorder. It is not a structural or psychiatric condition.

PMID: 29036855

No 410: February 7, 2018

Popkirov S, Staab JP, Stone J. **Persistent postural-perceptual dizziness (PPPD): a common, characteristic and treatable cause of chronic dizziness**. Pract Neurol. 2018 Feb;18(1):5-13. doi: 10.1136/practneurol-2017-001809. Epub 2017 Dec 5.

Persistent postural-perceptual dizziness (PPPD) is a newly defined diagnostic syndrome that unifies key features of chronic subjective dizziness, phobic postural vertigo and related disorders. It describes a common chronic dysfunction of the vestibular system and brain that produces persistent dizziness, non-spinning vertigo and/or unsteadiness. The disorder constitutes a long-term maladaptation to a neuro-otological, medical or psychological event that triggered vestibular symptoms, and is usefully considered within the spectrum of other functional neurological disorders. While diagnostic tests and conventional imaging usually remain negative, patients with PPPD present in a characteristic way that maps on to positive diagnostic criteria. Patients often develop secondary functional gait disorder, anxiety, avoidance behaviour and severe disability. Once recognised, PPPD can be managed with effective communication and tailored treatment strategies, including specialised physical therapy (vestibular rehabilitation), serotonergic medications and cognitive-behavioural therapy.

PMID: 29208729

No 409: January 31, 2018

Roh KJ, Kim MK, Kim JH, Son EJ. **Role of Emotional Distress in Prolongation of Dizziness: A Cross-Sectional Study**. J Audiol Otol. 2017 Dec;22(1):6-12. doi: 10.7874/jao.2017.00290. Epub 2017 Dec 29.

OBJECTIVE: To determine the contribution of demographics, injury type, pain, and psychological factors on postconcussive symptoms.

SETTING AND PARTICIPANTS: Recently injured (n = 54) and noninjured (n = 184) adults were recruited from a hospital emergency department or the community. Thirty-eight individuals met the diagnostic criteria for a mild traumatic brain injury and 16 individuals received treatment for a minor traumatic non-brain injury.

MAIN MEASURES: Standardized tests were administered to assess 4 postconcussion symptom types and theorized predictors including a "physiogenic" variable (injury type) and "psychogenic" variables (symptoms of anxiety, depression, and stress) within 1 month of the injury.

RESULTS: In the injured sample, after controlling for injury type, demographics, and pain (chronic and current), a hierarchical regression analysis revealed that the combination of psychological symptoms predicted affective ($F_{10,42} = 2.80$, $P = .009$, $R_{change} = 0.27$) but not other postconcussion symptoms types. Anxiety ($\beta = .48$), stress ($\beta = .18$), and depression ($\beta = -.07$) were not statistically significant individual predictors ($P > .05$). Cognitive and vestibular postconcussion symptoms were not predicted by the modeled factors, somatic sensory postconcussion symptoms were predicted by demographic factors only, and the pattern of predictors for the symptom types differed for the samples.

CONCLUSIONS: Traditional explanatory models do not account for these findings. The predictors are multifactorial, different for injured versus noninjured samples, and symptom specific.

PMID: 29084098

No 408: January 24, 2018

Roh KJ, Kim MK, Kim JH, Son EJ. **Role of Emotional Distress in Prolongation of Dizziness: A Cross-Sectional Study**. J Audiol Otol. 2017 Dec;22(1):6-12. doi: 10.7874/jao.2017.00290. Epub 2017 Dec 29.

BACKGROUND AND OBJECTIVES: Dizziness is a common condition in outpatient clinics. Comorbid conditions such as anxiety and/or depression often complicate a patient's ability to cope with dizziness. The purpose of the present study was to explore the extent of psychiatric distress using the Hospital Anxiety and Depression Scale (HADS) and to compare the results with the subjective severity of dizziness.

SUBJECTS AND METHODS: The cross-sectional study included a total of 456 consecutive patients presenting with acute (n=327) and chronic (n=127) dizziness symptoms. The HADS was used to estimate emotional distress and compare between patients with acute and chronic dizziness symptoms. Also, we calculated correlations between subjective dizziness handicap

scores and emotional distress using the total and subscale scores of the Dizziness Handicap Inventory (DHI), Disability Scale (DS), and HADS.

RESULTS: The HADS total and subscale scores were significantly increased in patients with chronic dizziness ($p<0.01$) compared with those with acute symptoms. In patients with symptoms of both acute and chronic dizziness, moderate correlations were evident between the DHI and HADS total scores. When we compared DHI subscale scores with the HADS scores, the emotional DHI subscale scores correlated more highly with the HADS total scores and the scores on the anxiety and depression subscales, than did the functional or physical DHI subscale scores.

CONCLUSIONS: Increased levels of distress measured using the HADS in patients with chronic symptoms suggest that emotional status of the patients may contribute to prolongation of dizziness symptoms from the acute phase.

PMID: 29325393

No 407: January 17, 2018

Kim SK, Kim YB, Park I-S, Hong SJ, Kim H, Hong SM. **Clinical Analysis of Dizzy Patients with High Levels of Depression and Anxiety.** Journal of Audiology & Otology. 2016;20(3):174-178. doi:10.7874/jao.2016.20.3.174.

BACKGROUND AND OBJECTIVES: Some patients experiencing dizziness also report psychological distress. However, the association between vestibular deficits and psychological symptoms remains controversial. Thus, the aim of this paper is to report the proportion of patients who complained of dizziness who also had high depression and anxiety indices. Also we investigated the severity of their dizziness and the distribution of the diseases underlying this symptom.

SUBJECTS AND METHODS: We assessed the dizziness and psychological distress of 544 patients experiencing dizziness using the Korean versions of the Dizziness Handicap Inventory (DHI), the Beck Depression Inventory (BDI), and the Spielberger State-Trait Anxiety Inventory (STAI). We also reviewed the audio-vestibular symtoms of patients with high levels of depression and anxiety.

RESULTS: The incidences of high depression and anxiety scores were 11% (60/544) and 18% (98/544), respectively. Patients with vestibular migraine were most likely to have high depression and anxiety indices. Patients in the high-BDI or high-STAI groups (117/544) obtained significantly higher DHI scores than those in neither the high-BDI nor the high-STAI group (427/544). We noticed that about 20% of the patients experiencing dizziness had high levels of psychological distress in this study; this group also suffered from various vestibular diseases and more symptoms of dizziness.

CONCLUSIONS: The results of the study suggest that psychological evaluation should be considered when assessing patients with vertigo.

Link to free full text: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5144818/

PMID: 27942604

No 406: January 12, 2018

Kutay Ö et al. **Vestibular migraine patients are more anxious than migraine patients without vestibular symptoms.** J Neurol. 2017 Oct;264(Suppl 1):37-41. doi: 10.1007/s00415-017-8439-6. Epub 2017 Mar 9

The link between vertigo and anxiety is well known. The aim of this study is to compare anxiety disorders in 3 groups: patients with vestibular migraine (VM), patients with migraine but without vertigo (MO) and healthy controls (HC).We performed cross-sectional analysis of following tests: (a) Hamilton Anxiety Rating Scale (HAMA); (b) State-Trait Anxiety Inventory (STAI-X1 and STAI-X2); (c) Beck Depression Inventory (BDI); (d) Panic-Agoraphobic Scale and (e) Penn State Worry Questionnaire (PSWQ). ANOVA, Kruskal-Wallis and Chi-square tests were used for comparisons and least significant difference was used for further post-hoc analysis. There were 35 definite VM patients, 31 MO patients and 32 volunteer HC. There were no significant differences between three groups in age, total years of education or duration of headaches in VM and MO patients. On the other hand, vertigo severity was moderately and positively correlated with headache severity and with headache duration. There were significant differences in scores of HARS, BDI, PSWQ, and various PAS-R sub-scales between the three groups. Our study shows that VM patients are significantly more anxious and agoraphobic than MO patients and HC, displaying higher sensitivity to separation and being more prone to seeking medical reassurance.

PMID: 28280987

No 405: January 3, 2018

MacDowell SG, Trommelen R, Bissell A, Knecht L, Naquin C, Karpinski A. **The impact of symptoms of anxiety and depression on subjective and objective outcome measures in individuals with vestibular disorders.** J Vestib Res. 2017 Nov 10. doi: 10.3233/VES-170627. [Epub ahead of print]

BACKGROUND: Anxiety and depression are common in individuals with vestibular disorders and anecdotally symptoms of these disorders have been associated with poorer scores on subjective outcome measures of dizziness and balance. It is unknown if symptoms of psychological distress impact individual outcomes with vestibular rehabilitation therapy (VRT).

OBJECTIVE: To compare subjective and objective outcome measures in subjects with vestibular disorders who have symptoms of anxiety and/or depression to those who do not exhibit those symptoms.

METHODS: A retrospective chart review was performed at two outpatient vestibular rehabilitation clinics. Data recorded included demographics, scores on the Positive and Negative Affective Scale (PANAS), and subjective and objective outcome measures of balance and gait.

RESULTS: The PANAS scale was utilized to group subjects (N=118) into two groups: Subjects with abnormal affect (SAA) (18.6%; N=22) and subjects with normal affect (SNA) (81.4%; N=96). Both groups demonstrated a statistically significant improvement in all outcome measures ($p<0.001$) from evaluation to discharge. SAA subjects took longer than SNA subjects to achieve goals ($p<0.05$). SAA subjects tended to have poorer outcome measure scores at both initial and final assessment, but this was not statistically significant ($p>0.05$).

CONCLUSIONS: Results from this study indicate that VRT is effective in treating vestibular disorders in individuals with symptoms of psychological distress such as anxiety and depression. However, individuals with these symptoms may not achieve as high of outcomes as those that do not report symptoms of psychological distress.

PMID: 29125530

No. 405: December 20, 2017

Chang TP, Hsu YC**. Vestibular migraine has higher correlation with carsickness than non-vestibular migraine and Meniere's disease.** Acta Neurol Taiwan. 2014 Mar;23(1):4-10.

Abstract

Background: A close relationship between migraine and vertigo has been postulated for decades, however, it has only been studied extensively in the last 10 years. Vestibular Migraine remains a diagnostic challenge for most clinician's. The prevalence of motion sickness is about 28% in the general population, however there are differences between carsickness, seasickness, and airsickness. It has been recognized for many years that motion sickness and migraine share some common features including female-predominance, similar symptoms, and the same triggers.

Objective: This study compares the rates of carsickness in patients with Vestibular Migraine, Non-vestibular migraine, and Meniere's disease.

Design: Correlational

Methods: Subjects: Consecutive patients with a diagnosis of vestibular migraine, non-vestibular migraine, or Meniere's disease were recruited from Dizziness and Headache Special Clinics from September 2010 to April 2011. All patients underwent a comprehensive history taking and neurological examination. Patients were excluded from the study if: they had an intracranial

lesion; if their vestibular symptoms resulted from other vestibular disorders; if they were unable to describe their headache or vertigo well; those with mixed-type headache; and those with major central nervous system disease. All patients were interviewed by two neurologists specializing in vestibular disorders and headache. Carsickness was defined as dizziness, nausea, and/or vomiting provoked by riding in an automobile or a bus. Statistical Analysis: ANOVA was used to analyze age between the groups. Comparisons of gender and the rate of carsickness between the groups were analyzed by chi-square test. The odds ratios of carsickness among each group was also calculated.

Results: Overall, 78.4% of the Vestibular Migraine patients had experienced carsickness in their lifetime. 89.2% of the 'definite Vestibular Migraine' patients, and 70.5% of the 'probably Vestibular Migraine' patients had a history of carsickness compared to 43.6% of the Non-Vestibular Migraine patients, and 18.2% of the Meniere's patients. Among the patients who had experienced carsickness, most had experienced carsickness in childhood before the onset of Vestibular Migraine, Non-Vestibular Migraine, or Meniere's disease.

Conclusion: In the current study, the carsickness rate was highest in those with dVM, followed by pVM and NVM, and lowest in those with MD. The high percentage of lifetime carsickness in the dVM (89.2%) and pVM (70.5%) groups implies that motion sickness is a characteristic of vestibular migraineurs. The high odds ratios of carsickness rate comparing VM to NVM or MD further advocates this viewpoint.

PMID: 24833209

Free PMC Article: http://www.ant-tnsjournal.com/Mag_Files/23-1/002.pdf

No. 404: December 13, 2017

Bertolini G, Straumann D. **Moving in a Moving World: A Review on Vestibular Motion Sickness.** Front Neurol. 2016 Feb 15;7:14. doi: 10.3389/fneur.2016.00014. eCollection 2016.

Abstract

Background: Motion sickness is a common disturbance occurring in healthy people as a physiological response to exposure to motion stimuli that are unexpected on the basis of previous experience. The motion can be either real, and therefore perceived by the vestibular system, or illusory, as in the case of visual illusion. A multitude of studies has been performed in the last decades, substantiating different nauseogenic stimuli, studying their specific characteristics, proposing unifying theories, and testing possible countermeasures. Several reviews focused on one of these aspects; however, the link between specific nauseogenic stimuli and the unifying theories and models is often not clearly detailed. Readers unfamiliar with the topic, but studying a condition that may involve motion sickness, can therefore have difficulties to understand why a specific stimulus will induce motion sickness. So far, this general audience struggles to take advantage of the solid basis provided by existing theories and models. This review focuses on

vestibular-only motion sickness, listing the relevant motion stimuli, clarifying the sensory signals involved, and framing them in the context of the current theories.

Objective: This article reviews theories on motion sickness, classifications of motion sickness, describes the vestibular system's involvement, and gives everyday life examples of vestibular motion sickness.

Design: This is a descriptive article focusing on vestibular-only motion sickness.

PMID: 26913019

Free PMC Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4753518/

No. 403: December 6, 2017

Wang J, Lewis RF. **Contribution of intravestibular sensory conflict to motion sickness and dizziness in migraine disorders.** J Neurophysiol. 2016 Oct 1;116(4):1586-1591. doi: 10.1152/jn.00345.2016. Epub 2016 Jul 6.

Abstract

Background: Migraine is associated with enhanced motion sickness susceptibility and can cause episodic vertigo, but the mechanisms relating migraine to these vestibular symptoms remain unclear.

Objective: To test the hypothesis that the central integration of rotational cues (from the semicircular canals) and gravitational cues (from the otolith organs) is abnormal in migraine patients.

Design: Semi-Experimental

Methods: Ten vestibular migraine, migraine, and normal subjects were studied. Subjects sat in a padded chair in complete darkness and were restrained with a harness, and their head was immobilized in the upright orientation with its center aligned with the earth vertical yaw rotational axis. They were accelerated about this rotational axis at 120°·s1·s1 toward their right (clockwise when viewed from above) over 1 s, maintained at a constant angular velocity of 120°/s for 90 s, and then symmetrically decelerated to a stop. Two trials were performed on each subject. Subjects were instructed to tilt their heads as rapidly as possible. At the end of the trial, head orientation was measured with a linear accelerometer to verify that it was upright or tilted in roll by 45 degrees.
Results: Subjects differed significantly with magnitude of eye movement and motion sickness parameters only for motion sickness susceptibility and the normalized axis shift. In both cases, vestibular migraine patients had significantly larger means than migraine or normal subjects, whereas the latter two groups did not differ.

Conclusion: Eye movement responses in Vestibular Migraine patients differed from migraine and normal subjects in three ways: the VOR axis shifts were larger in Vestibular Migraine patients, the normalized axis shift and normalized dumping efficacy were not correlated in VM patients, and the residual conflict in Vestibular Migraine patients was positively correlated with motion sickness susceptibility.

PMID: 27385797

No. 402: November 29, 2017

Ekvall Hansson E, Månsson NO, Ringsberg KA, Håkansson A. **Dizziness among patients with whiplash-associated disorder: a randomized controlled trial.** J Rehabil Med. 2006 Nov;38(6):387-90.

Abstract

OBJECTIVE: To investigate whether vestibular rehabilitation for patients with whiplash-associated disorder and dizziness had any effect on balance measures and self-perceived handicap.

DESIGN: Randomized, controlled trial.

SUBJECTS: Twenty-nine patients, 20 women and 9 men, age range 22-76 years.

METHODS: The patients were randomized to an intervention group or a control group. The intervention comprised vestibular rehabilitation. All patients were assessed at baseline, after 6 weeks and after 3 months with 4 different balance measures and the Dizziness Handicap Inventory.

RESULTS: After 6 weeks, the intervention group showed statistically significant improvements compared with the control group in the following measures: standing on one leg eyes open ($p=0.02$), blindfolded tandem stance ($p=0.045$), Dizziness Handicap Inventory total score ($p=0.047$), Dizziness Handicap Inventory functional score ($p=0.005$) and in Dizziness Handicap Inventory physical score ($p=0.033$). After 3 months, the intervention group showed statistically significant improvements compared with the control group in the following measures: standing on one leg eyes open ($p=0.000$), tandem stance ($p=0.033$) and Dizziness Handicap Inventory physical score ($p=0.04$).

CONCLUSION: Vestibular rehabilitation for patients with whiplash-associated disorder can decrease self-perceived handicap and increase postural control.

PMID: 17067973

No. 401: November 22, 2017

Hansson EE, Persson L, Malmström EM. **Influence of vestibular rehabilitation on neck pain and cervical range of motion among patients with whiplash-associated disorder: a randomized controlled trial.** J Rehabil Med. 2013 Sep;45(9):906-10. doi: 10.2340/16501977-1197.

Abstract

OBJECTIVE: To describe how vestibular rehabilitation influences pain and range of motion among patients with whiplash-associated disorder and dizziness, and to describe whether pain or range of motion correlated with balance performance or self-perceived dizziness handicap.

SUBJECTS: A total of 29 patients, 20 women and 9 men, age range 22-76 years.

METHODS: Patients with whiplash-associated disorder and dizziness were randomized to either intervention (vestibular rehabilitation) or control. Neck pain intensity, cervical range of motion (CROM), balance and self-perceived dizziness handicap were measured at baseline, 6 weeks and 3 months.

RESULTS: There were no differences in neck pain intensity or CROM between the 2 groups either at baseline, 6 weeks or 3 months (p=0.10-0.89). At baseline, neck pain intensity correlated with CROM (-0.406) and self-perceived dizziness handicap (0.492). CROM correlated with self-perceived dizziness handicap and with 1 balance measure (-0.432). Neck pain intensity did not correlate with balance performance (-0.188-0.049).

CONCLUSION: Neck pain intensity and CROM was not influenced by vestibular rehabilitation. Importantly, the programme did not appear to increase pain or decrease neck motion, as initially thought. Neck pain intensity and CROM correlated with self-perceived dizziness handicap. CROM also correlated with 1 balance measure.

PMID: 23974698

No. 400: November 15, 2017

Treleaven J. **Dizziness, Unsteadiness, Visual Disturbances, and Sensorimotor Control in Traumatic Neck Pain.** J Orthop Sports Phys Ther 2017;47(7):492-502. Epub 16 Jun 2017. doi:10.2519/jospt.2017.7052

Abstract

Synopsis There is considerable evidence to support the importance of cervical afferent dysfunction in the development of dizziness, unsteadiness, visual disturbances, altered balance, and altered eye and head movement control following neck trauma, especially in those with persistent symptoms. However, there are other possible causes for these symptoms, and secondary adaptive changes should also be considered in differential diagnosis. Understanding the nature of these symptoms and differential diagnosis of their potential origin is important for

rehabilitation. In addition to symptoms, the evaluation of potential impairments (altered cervical joint position and movement sense, static and dynamic balance, and ocular mobility and coordination) should become an essential part of the routine assessment of those with traumatic neck pain, including those with concomitant injuries such as concussion and vestibular or visual pathology or deficits. Once adequately assessed, appropriate tailored management should be implemented. Research to further assist differential diagnosis and to understand the most important contributing factors associated with abnormal cervical afferent input and subsequent disturbances to the sensorimotor control system, as well as the most efficacious management of such symptoms and impairments, is important for the future.

PMID: 28622488

No. 399: November 8, 2017

Treleaven J, Peterson G, Ludvigsson ML, Kammerlind AS, Peolsson A. **Balance, dizziness and proprioception in patients with chronic whiplash associated disorders complaining of dizziness: A prospective randomized study comparing three exercise programs.** J Orthop Sports Phys Ther. 2017 Jul;47(7):492-502. doi: 10.2519/jospt.2017.7052.

Abstract

BACKGROUND: Dizziness and unsteadiness are common symptoms following a whiplash injury.

OBJECTIVE: To compare the effect of 3 exercise programs on balance, dizziness, proprioception and pain in patients with chronic whiplashcomplaining of dizziness.

DESIGN: A sub-analysis of a randomized study.

METHODS: One hundred and forty subjects were randomized to either a physiotherapist-guided neck-specific exercise (NSE), physiotherapist-guided neck-specific exercise, with a behavioural approach (NSEB) or prescription of general physical activity (PPA) group. Pre intervention, 3, 6 and 12 months post baseline they completed the University of California Los Angeles Dizziness Questionnaire (UCLA-DQ), Visual Analogue Scales (VAS) for, dizziness at rest and during activity and physical measures (static and dynamic clinical balance tests and head repositioning accuracy (HRA)).

RESULTS: There were significant time by group differences with respect to dizziness during activity and UCLA-Q favouring the physiotherapy led neck specific exercise group with a behavioural approach. Within group analysis of changes over time also revealed significant changes in most variables apart from static balance.

CONCLUSION: Between and within group comparisons suggest that physiotherapist led neck exercise groups including a behavioural approach had advantages in improving measures of dizziness compared with the general physical activity group, although many still complained of

dizziness and balance impairment. Future studies should consider exercises specifically designed to address balance, dizziness and cervical proprioception in those with persistent whiplash.

PMID: 26678652

No. 398: November 1, 2017

Ischebeck BK, de Vries J, Van der Geest JN, Janssen M, Van Wingerden JP, Kleinrensink GJ, Frens MA. **Eye movements in patients with Whiplash Associated Disorders: a systematic review.** Man Ther. 2016 Apr;22:122-30. doi: 10.1016/j.math.2015.10.017.

Abstract

BACKGROUND: Many people with Whiplash Associated Disorders (WAD) report problems with vision, some of which may be due to impaired eye movements. Better understanding of such impaired eye movements could improve diagnostics and treatment strategies. This systematic review surveys the current evidence on changes in eye movements of patients with WAD and explains how the oculomotor system is tested.

METHODS: Nine electronic data bases were searched for relevant articles from inception until September 2015. All studies which investigated eye movements in patients with WAD and included a healthy control group were screened for inclusion. Qualifying studies were retrieved and independently assessed for methodological quality using the Methodology Checklists provided by the Scottish Intercollegiate Guidelines Network.

RESULTS: Fourteen studies out of 833 unique hits were included. Ten studies reported impaired eye movements in patients with WAD and in four studies no differences compared to healthy controls were found. Different methods of eye movement examination were used in the ten studies: in five studies, the smooth pursuit neck torsion test was positive, in two more the velocity and stability of head movements during eye-coordination tasks were decreased, and in another three studies the cervico-ocular reflex was elevated.

CONCLUSIONS: Overall the reviewed studies show deficits in eye movement in patients with WAD, but studies and results are varied. When comparing the results of the 14 relevant publications, one should realise that there are significant differences in test set-up and patient population. In the majority of studies patients show altered compensatory eye movements and smooth pursuit movements which may impair the coordination of head and eyes.

PMID: 27769215

No. 397: October 25, 2017

Johnston JL, Daye PM, Thomson GT. **Inaccurate Saccades and Enhanced Vestibulo-Ocular Reflex Suppression during Combined Eye-Head Movements in Patients with Chronic Neck Pain: Possible Implications for Cervical Vertigo.** Front Neurol. 2017 Jan 30;8:23. doi: 10.3389/fneur.2017.00023. eCollection 2017.

Abstract

BACKGROUND: The primate ocular motor system is designed to acquire peripheral targets of interest by coordinating visual, vestibular, and neck muscle activation signals. The vestibulo-ocular reflex (VOR) is greatly reduced at the onset of large eye-head (gaze) saccades and resumes before the end of the saccades to stabilize eye-in-orbit and ensure accurate target acquisition. Previous studies have relied on manipulating head movements in normal individuals to study VOR suppression and gaze kinematics. We sought to determine if reduced head-on-trunk movement alters VOR suppression and gaze accuracy similar to experiments involving normal subjects and if intentionally increasing head and neck movement affects these dynamics.

METHODS: We measured head and gaze movements using magnetic search coil oculography in eight patients with cervical soft tissue disorders and seven healthy subjects. All participants made horizontal head-free saccades to acquire a laser dot target that stepped pseudorandomly 30-65° to either side of orbital mid-position, first using typical head and eye movements and again after being instructed to increase head amplitudes as much as possible.

RESULTS: Compared to healthy subjects, patients made smaller head movements that contributed only 6% to total gaze saccade amplitudes. Head movements were also slowed, prolonged, and delayed. VOR suppression was increased and prolonged. Gaze saccades were inaccurate and delayed with long durations and decreased peak velocities.

CONCLUSION: In patients with chronic neck pain, the internal commands issued for combined eye-head movements have large enough amplitudes to create accurate gaze saccades; however, because of increased neck stiffness and viscosity, the head movements produced are smaller, slower, longer, and more delayed than they should be. VOR suppression is disproportionate to the size of the actual gaze saccades because sensory feedback signals from neck proprioceptors are non-veridical, likely due to prolonged coactivation of cervical muscles. The outcome of these changes in eye-head kinematics is head-on-trunk stability at the expense of gaze accuracy. In the absence of vestibular loss, the practical consequences may be dizziness (cervical vertigo) in the short term and imbalance and falls in the long term.

PMID: 28194135

PMCID: PMC5278258

Free full text article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5278258/

No. 396: October 18, 2017

Jones KD1, King LA, Mist SD, Bennett RM, Horak FB. **Postural control deficits in people with fibromyalgia: a pilot study.** Arthritis Res Ther. 2011 Aug 2;13(4):R127. doi: 10.1186/ar3432.

Abstract

INTRODUCTION: Postural instability and falls are increasingly recognized problems in patients with fibromyalgia (FM). The purpose of this study was to determine whether FM patients, compared to age-matched healthy controls (HCs), have differences in dynamic posturography, including sensory, motor, and limits of stability. We further sought to determine whether postural instability is associated with strength, proprioception and lower-extremity myofascial trigger points (MTPs); FM symptoms and physical function; dyscognition; balance confidence; and medication use. Last, we evaluated self-reported of falls over the past six months.

METHODS: In this cross-sectional study, we compared middle-aged FM patients and age-matched HCs who underwent computerized dynamic posturography testing and completed the Fibromyalgia Impact Questionnaire-Revised (FIQR) and balance and fall questionnaires. All subjects underwent a neurological and musculoskeletal examination. Descriptive statistics were used to characterize the sample and explore the relationships between variables. The relationships between subjective, clinical and objective variables were evaluated by correlation and regression analyses.

RESULTS: Twenty-five FM patients and twenty-seven HCs (combined mean age ± standard deviation (SD): 48.6 ± 9.7 years) completed testing. FM patients scored statistically lower on composite sensory organization tests (primary outcome; $P < 0.010$), as well as with regard to vestibular, visual and somatosensory ratio scores on dynamic posturography. Balance confidence was significantly different between groups, with FM patients reporting less confidence than HCs (mean ± SD: 81.24 ± 19.52 vs. 98.52 ± 2.45; $P < 0.001$). Interestingly, 76% to 84% of FM patients had gastrocnemius and/or anterior tibialis MTPs. Postural stability was best predicted by dyscognition, FIQR score and body mass index. Regarding falls, 3 (11%) of 27 HCs had fallen only once during the past 6 months, whereas 18 (72%) of 25 FM patients had fallen at least once. Fifteen FM patients (60%) reported falling at least three times in the past six months.

CONCLUSIONS: In this study, we report that middle-aged FM patients have consistent objective sensory deficits on dynamic posturography, despite having a normal clinical neurological examination. Further study is needed to determine prospective fall rates and the significance of lower-extremity MTPs. The development of interventions to improve balance and reduce falls in FM patients may need to combine balance training with exercise and cognitive training.

PMID: 21810264

PMCID: PMC3239367

Free full text article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3239367/

No. 395: October 11, 2017

Gilbert JW, Vogt M, Windsor RE, Mick GE, Richardson GB, Storey BB, Herder SL, Ledford S, Abrams DA, Theobald MK, Cunningham D, Kelly L, Herring KV, Maddox ML. **Vestibular dysfunction in patients with chronic pain or underlying neurologic disorders**. J Am Osteopath Assoc. 2014 Mar;114(3):172-8. doi: 10.7556/jaoa.2014.034.

Abstract

CONTEXT: Individuals with vestibular dysfunction are at increased risk for falling. In addition, vestibular dysfunction is associated with chronic pain, which could present a serious public health concern as approximately 43% of US adults have chronic pain.

OBJECTIVE: To assess the incidence of vestibular dysfunction in patients receiving medication for chronic, noncancer pain or other underlying neurologic disorders and to determine associated follow-up therapeutic and diagnostic recommendations.

METHODS: The authors conducted a retrospective medical record review of consecutive patients who were treated in their private neuroscience practice with medications for chronic pain or underlying neurologic disorders in 2011. All patients underwent a series of tests using videonystagmography for the assessment of vestibular function. Test results and recommendations for therapy and additional testing were obtained.

RESULTS: Medical records of 124 patients (78 women, 46 men) were reviewed. Vestibular deficits were detected in 83 patients (66.9%). Patient ages ranged from 29 through 72 years, with a mean age of 50.7 years for women and 52.5 years for men. Physician-recommended therapy and follow-up testing were as follows: 32 patients (38.6%), neurologic examination and possible magnetic resonance (MR) imaging or computed tomography (CT) of the brain; 26 patients (31.3%), vestibular rehabilitation therapy only; 22 patients (26.5%), vestibular and related balance-function rehabilitation therapy, further neurologic examination, and possible MR imaging or CT; 2 patients (2.4%), balance-function rehabilitation therapy and specialized internal auditory canal high-magnification MR imaging or CT to assess for acoustic neuroma; and 1 patient (1.2%), specialized internal auditory canal high-magnification MR imaging or CT to evaluate for possible intracanalicular acoustic neuroma.

CONCLUSION: Patients being treated with medications for chronic, noncancer pain or other underlying neurologic disorders may have a higher-than-average incidence of vestibular dysfunction. Baseline assessment and monitoring of the vestibular apparatus may be indicated for these patients.

PMID: 24567270

No. 394: October 4, 2017

Balaban CD. **Migraine, vertigo and migrainous vertigo: Links between vestibular and pain mechanisms.** J Vestib Res. 2011;21(6):315-21. doi: 10.3233/VES-2011- 0428.

Abstract

This review develops the hypothesis that co-morbid balance disorders and migraine can be understood as additive effects of processing afferent vestibular and pain information in pre-parabrachial and pre-thalamic pathways, that have consequences on cortical mechanisms influencing perception, interoception and affect. There are remarkable parallel neurochemical

phenotypes for inner ear and trigeminal ganglion cells and these afferent channels appear to converge in shared central pathways for vestibular and nociceptive information processing. These pathways share expression of receptors targeted by anti-migraine drugs. New evidence is also presented regarding the distribution of serotonin receptors in the planum semilunatum of the primate cristae ampullaris, which may indicate involvement of inner ear ionic homeostatic mechanisms in audiovestibular symptoms that can accompany migraine.

PMID: 22348936

No. 393: September 29, 2017

Pyykkö I, Manchaiah V, Zou J, Levo H, Kentala E. **Vestibular syncope: A disorder associated with drop attack in Ménière's disease.** Auris Nasus Larynx. 2017 May 3. pii: S0385-8146(17)30088-3.

Abstract

OBJECTIVE: Experiments in humans and animals indicate that vestibular influx through vestibular sympathetic reflex is an important and vital part of the regulatory system of circulation. The otolith organ adjusts the circulatory responses through the vestibular sympathetic reflex during an upright stance and may trigger a vasovagal attack of syncope. The aim of the present study was to evaluate the prevalence and association of syncope attacks among patients with Ménière's disease (MD). Vestibular syncope was defined as a sudden and transient loss of consciousness, which subsides spontaneously in people with vestibular disorders and without localizing neurological deficit.

METHODS: During clinical interactions, we encountered 5 patients with syncope during a Tumarkin attack of MD. Thereafter we evaluated data from 952 patients collected with a questionnaire from the Finnish Ménière Association (FMA). The data contained case histories with special attention to Tumarkin attacks, participation restriction, migraines, and syncope attacks. The mean age of the subjects participating in the study was 60.6 years (range 25-75 years). The duration of the disease was on average 9.8 years (range 0.5-35 years).

RESULTS: In the current study sample, attacks of syncope were reported by 38 patients (4%) in association with the vertigo attack. Syncope was associated with Tumarkin attacks ($X2=16.7$, $p<0.001$), migraine ($X2=7.4$, $p<0.011$), history of ischemic heart disease ($X2=6.0$, $p<0.025$), and history of cerebrovascular disease ($X2=11.7$, $p<0.004$). Duration of MD was correlated with syncope. Syncope was provoked by physical strain and environmental pressure, and was associated with impairment of the visual field (i.e., visual blurring). In logistic regression analysis, syncope was significantly associated with Tumarkin attacks (odds ratio 3.2), migraines (odds ratio 2.3) and nausea (odds ratio 1.3). The attack of syncope was experienced as frightening, and general health related quality of life (HRQoL) was significantly worsened. Also, the patients suffered more from fatigue.

CONCLUSION: The current study indicates that patients with MD who suffer from Tumarkin attacks can suffer from syncope. It confirms the role of the otolith organ in controlling the

circulatory homeostasis of the body. The actions are mediated through the vestibular sympathetic reflex.

PMID: 28478076

No. 392: September 20, 2017

Keller JH et al. **Detection of endolymphatic hydrops using traditional MR imaging sequences.** Am J Otolaryngol. 2017 Apr 6. pii: S0196-0709(16)30622- 6.

Abstract

PURPOSE: The purpose of this study was to determine whether Meniere's disease (MD) produces endolymphatic cavity size changes that are detectable using unenhanced high-resolution T2-weighted MRI.

MATERIALS & METHODS: This retrospective case-control study included patients with documented MD who had a high-resolution T2-weighted or steady-state free procession MRI of the temporal bones within one month of diagnosis, between 2002 and 2015. Patients were compared to age- and sex- matched controls. Cross sectional area, length, and width of the vestibule and utricle were measured in both ears along with the width of the basal turn of the cochlea and its endolymphatic space. Absolute measurements and ratios of endolymph to perilymph were compared between affected, contralateral, and control ears using analysis of variance and post-hoc pairwise comparisons.

RESULTS: Eighty-five case-control pairs were enrolled. Mean utricle areas for affected, contralateral, and control ears were 0.038cm2, 0.037cm2, and 0.033cm2. Mean area ratios for affected, contralateral, and control ears were 0.32, 0.32, and 0.29. There was a statistically significant difference between groups for these two variables; post-hoc comparisons revealed no difference between affected and contralateral ears in Meniere's patients, while ears in control patients were different from the ears of patients with MD. All other measurements failed to show significant differences.

CONCLUSIONS: Enlargement of the endolymphatic cavity can be detected using non-contrast T2-weighted MRI. MRI, using existing protocols, can be a useful diagnostic tool for the evaluation of MD, and intratympanic or delayed intravenous contrast may be unnecessary for this diagnosis.

PMID: 28413076

No. 391: September 13, 2017

Keller JH et al. **Detection of endolymphatic hydrops using traditional MR imaging sequences.** Am J Otolaryngol. 2017 Apr 6. pii: S0196-0709(16)30622- 6.

Abstract

PURPOSE: The purpose of this study was to determine whether Meniere's disease (MD) produces endolymphatic cavity size changes that are detectable using unenhanced high-resolution T2-weighted MRI.

MATERIALS & METHODS: This retrospective case-control study included patients with documented MD who had a high-resolution T2-weighted or steady-state free procession MRI of the temporal bones within one month of diagnosis, between 2002 and 2015. Patients were compared to age- and sex- matched controls. Cross sectional area, length, and width of the vestibule and utricle were measured in both ears along with the width of the basal turn of the cochlea and its endolymphatic space. Absolute measurements and ratios of endolymph to perilymph were compared between affected, contralateral, and control ears using analysis of variance and post-hoc pairwise comparisons.

RESULTS: Eighty-five case-control pairs were enrolled. Mean utricle areas for affected, contralateral, and control ears were 0.038cm2, 0.037cm2, and 0.033cm2. Mean area ratios for affected, contralateral, and control ears were 0.32, 0.32, and 0.29. There was a statistically significant difference between groups for these two variables; post-hoc comparisons revealed no difference between affected and contralateral ears in Meniere's patients, while ears in control patients were different from the ears of patients with MD. All other measurements failed to show significant differences.

CONCLUSIONS: Enlargement of the endolymphatic cavity can be detected using non-contrast T2-weighted MRI. MRI, using existing protocols, can be a useful diagnostic tool for the evaluation of MD, and intratympanic or delayed intravenous contrast may be unnecessary for this diagnosis.

PMID: 28413076

No. 390: September 6, 2017

Sun W, Guo P, Ren T, Wang W. **Magnetic resonance imaging of intratympanic gadolinium helps differentiate vestibular migraine from Ménière disease.** Laryngoscope. 2017 Feb 21.

Abstract

OBJECTIVES/HYPOTHESIS: To study the differential diagnosis of vestibular migraine (VM) and Ménière disease (MD) by using magnetic resonance imaging (MRI) of intratympanic gadolinium.

STUDY DESIGN: Prospective cohort study.

METHODS: Definite MD patients (n = 30) and definite or probable VM patients (n = 30) were included, and the two groups were age and sex matched. Three-dimensional real inversion recovery (3D-real-IR) MRI was performed 24 hours after bilateral intratympanic gadolinium to assess the presence and degree of endolymphatic hydrops (EH). Response rates, amplitudes, latency, and response threshold of cervical and ocular vestibular evoked myogenic potentials

(c/oVEMPs) were tested by using air-conducted sound. Pure tone audiometry was used to evaluate the level of hearing loss.

RESULTS: Different degrees of EH were observed in the cochlea and vestibule in the affected ears of MD patients, but only suspicious cochlear hydrops and no vestibular hydrops was noted in the VM patients. The correlation between the degree of EH and low-frequency hearing loss was statistically significant. Only the response threshold for c/oVEMP differentiated the MD-affected side from VM. The latency and amplitude for c/oVEMP showed no significant difference between groups.

CONCLUSIONS: Characteristic pathological changes of MD include EH in the inner ear, and 3D-real-IR MRI helps differentiate VM from MD. VM and MD behaved similarly in vestibular dysfunction and their transduction pathway, but MD appeared to be more severe than VM. An association in their pathophysiology may play a part in these responses.

LEVEL OF EVIDENCE: 4 Laryngoscope, 2017.

PMID: 28220492

No. 389: August 31, 2017

Stromberg SE, Russell ME, Carlson CR. **Diaphragmatic breathing and its effectiveness for the management of motion sickness.** Aerosp Med Hum Perform. 2015 May;86(5):452-7.

Abstract

BACKGROUND: Motion sickness is an unpleasant physiological state that may be controlled via nonpharmacological methods. Controlled breathing has been shown to maximize parasympathetic nervous system (PNS) tone and may have the ability to decrease motion sickness symptoms.

METHODS: The effects of slow diaphragmatic breathing (DB) in a motion sickness-inducing environment were examined within motion sickness susceptible individuals. Subjects (N = 43) were assigned randomly to either an experimental group trained in slow DB or a control group breathing naturally at a normal pace. The experimental group was trained using a digital video that helped them pace their diaphragmatic breathing at six breaths/min. During the study, subjects viewed a virtual reality (VR) experience of a boat in rough seas for 10 min. Motion sickness ratings along with heart rate and respiration rate were collected before, during, and after the VR experience.

RESULTS: Results indicated that the experimental group was able to decrease their breathing to eight breaths/min during the VR experience. This breathing rate was significantly slower than those in the control group. We found that DB subjects, compared to those in the control group, displayed significantly greater heart rate variability and reported feeling less motion sickness during exposure to the VR experience than those in the control group.

DISCUSSION: Results indicate possible benefits of using slow DB techniques in a motion sickness inducing environment.

PMID: 25945662

No. 388: August 23, 2017

Azam MA, Katz J, Mohabir V, Ritvo P. **Individuals with tension and migraine headaches exhibit increased heart rate variability during post-stress mindfulness meditation practice but a decrease during a post-stress control condition - A randomized, controlled experiment.** Int J Psychophysiol. 2016 Dec;110:66-74.

Abstract

BACKGROUND: Current research suggests that associations between headache conditions (migraine, tension) and imbalances in the autonomic nervous system (ANS) are due to stress-related dysregulation in the activity of the parasympathetic-sympathetic branches. Mindfulness meditation has demonstrated effectiveness in reducing pain-related distress, and in enhancing heart rate variability-a vagal-mediated marker of ANS balance. This study examined HRV during cognitive stress and mindfulness meditation in individuals with migraine and tension headaches.

METHODS: Undergraduate students with tension and migraine headaches (n=36) and headache-free students (n=39) were recruited for an experiment involving HRV measurement during baseline, cognitive stress-induction, and after randomization to post-stress conditions of audio-guided mindfulness meditation practice (MMP) or mindfulness meditation description (MMD). HRV was derived using electrocardiograms as the absolute power in the high frequency bandwidth (ms2). A three-way ANOVA tested the effects of Group (headache vs. headache-free), Phase (baseline, stress, & post-stress), and Condition (MMP vs. MMD) on HRV.

RESULTS:ANOVA revealed a significant three-way interaction. Simple effects tests indicated: 1) HRV increased significantly from stress to MMP for headache and headache-free groups ($p<0.001$), 2) significantly greater HRV for headache ($p<0.001$) and headache-free ($p<0.05$) groups during MMP compared to MMD, and 3) significantly lower HRV in the headache vs. headache-free group during the post-stress MMD condition ($p<0.05$).

DISCUSSION: Results suggest mindfulness practice can promote effective heart rate regulation, and thereby promote effective recovery after a stressful event for individuals with headache conditions. Moreover, headache conditions may be associated with dysregulated stress recovery, thus more research is needed on the cardiovascular health and stress resilience of headache sufferers.

PMID: 27769879

No. 387: August 16, 2017

Subramaniam S, Bhatt T. **Effect of Yoga practice on reducing cognitive-motor interference for improving dynamic balance control in healthy adults.** Complement Ther Med. 2017 Feb;30:30-35.

Abstract

OBJECTIVE: The purpose of our study was to investigate the effects of Yoga on reducing cognitive-motor interference (CMI) for maintaining balance control during varied balance tasks.

METHODS: Yoga (N=10) and age-similar non-practitioners (N=10) performed three balance tasks including the Limits of Stability test (LOS - Intentional balance), Motor Control test (MCT - Reactive balance), and Sensory Organization Test (SOT -condition 6: inducing both somatosensory and visual conflicts) under single-task (ST) and dual-task (DT, addition of a cognitive working memory task) conditions. The motor performance was assessed by recording the response time (RT) and movement velocity (MV) of the center of pressure (CoP) on LOS test, weight symmetry (WS) of CoP on the MCT test and equilibrium (EQ) of CoP on the SOT test. Cognitive performance was recorded as the number of correct responses enumerated in sitting (ST) and under DT conditions. The Motor cost (MC) and cognitive cost (CC) were computed using the formula ([ST-DT]/ST)*100 for all the variables. Greater cost indicates lower performance under DT versus ST condition.

RESULTS: The Yoga group showed a significantly lesser MC for both MCT and SOT tests ($p<0.05$) in comparison to their counterparts. The CC were significantly lower on LOS and MCT test for the Yoga group ($p<0.05$).

CONCLUSION: Results suggest that Yoga practice can significantly reduce CMI by improving allocation and utilization of attentional resources for both balance control and executive cognitive functioning; thus resulting in better performance under DT conditions.

PMID: 28137524

No. 386: August 9, 2017

Jáuregui-Renaud K, Villanueva Padrón LA, Cruz Gómez NS. **The effect of vestibular rehabilitation supplemented by training of the breathing rhythm or proprioception exercises, in patients with chronic peripheral vestibular disease.** J Vestib Res. 2007;17(1):63-72.

OBJECTIVE: To assess the effect of performing vestibular rehabilitation using the Cawthorne & Cooksey exercises supplemented by training of the breathing rhythm or proprioception exercises on self-reported disability and postural control, in patients with chronic, peripheral, vestibular disease.
METHODS: Fifty one patients with peripheral vestibular disease and abnormal caloric test participated in the study (mean age 43 +/- S.D. 9 years). They were assigned to one of 3 treatment groups: I. Cawthorne &} Cooksey exercises with training of the breathing rhythm (n=17); II. Cawthorne & Cooksey exercises with proprioception exercises (n=17) and III.

Cawthorne & Cooksey exercises with no additional intervention (n=17). The Dizziness Handicap Inventory and static posturography were evaluated prior to treatment and at week 8 of follow-up.
RESULTS: Prior to treatment, composite scores on the Dizziness Handicap Inventory and static posturography were similar in the 3 groups. After treatment, a decrease of the composite score of at least 18 points was observed more frequently in patients of the respiration group (94%), compared to the proprioception group (53%) and the Cawthorne & Cooksey group (70%) (p=0.03); while the proprioception group showed a significant decrease of oscillation during all sensory conditions of static posturography (p< 0.05).
CONCLUSION: The results suggest that regulation of the breathing pattern may have an influence on disability related to chronic vestibular disease, while proprioception exercises may improve postural control. However, further studies are needed to evaluate if training of the breathing rhythm could be an additional tool for vestibular rehabilitation.
PMID: 18219105

No. 385: August 2, 2017

Naber CM, Water-Schmeder O, Bohrer PS, Matonak K, Bernstein AL, Merchant MA. **Interdisciplinary treatment for vestibular dysfunction: the effectiveness of mindfulness, cognitive-behavioral techniques, and vestibular rehabilitation.** Otolaryngol Head Neck Surg. 2011 Jul;145(1):117-24.

OBJECTIVE: To investigate whether an interdisciplinary program for vestibular patients improved health outcomes and health care utilization.
STUDY DESIGN: Case series with chart review.
SETTING: Outpatient neurotology clinic.
SUBJECTS AND METHODS: Patients (N = 167) with dizziness attended an interdisciplinary neurotology clinic; 129 were offered group treatment. After an introductory session, group treatment included 5 sessions incorporating mindfulness, cognitive-behavioral techniques, and vestibular rehabilitation. Physical and emotional functioning, depression, anxiety, dizziness, impairment, coping, skill use, and patient satisfaction were measured with rating scales pre- and post-group treatment. Data from 51 patients (male/female = 14/37; age range, 25-82 years) were analyzed with paired t tests or nonparametric tests. Logistic regression analyzed predictors of outcome and utilization for 116 patients (male/female = 81/35; age range, 11-86 years) attending the interdisciplinary clinic, introductory session, and/or group.
RESULTS: After group treatment, patients reported better mood (P = .0482); better physical (P = .0006) and mental (P = .0183) health; better functionality, coping, and skill use (Ps< .0001); less impairment (P < .0001); and fewer limitations from dizziness (P < .0001). Higher pretreatment levels of depression (P =.0216), poorer initial mental (P = .0164) or physical (P = .0059) health, and peripheral diagnosis (P = .0220) predicted better outcome. Group treatment decreased utilization more than the interdisciplinary clinic with (P = .0183) or without (P = .0196) the introductory session; 78% of patients with any level of participation showed less utilization. Clinic patients had fewer radiology procedures than group patients (P = .0365). Patients were highly satisfied with the program and found it more effective than previous treatment.
CONCLUSION: Interdisciplinary treatment improves patient coping, functionality, and satisfaction and decreases overall health care utilization in vestibular patients.
PMID: 21493331

No. 384: July 26, 2017

Kontos AP1, Deitrick JM1, Collins MW1, Mucha A2. **Review of Vestibual and Oculomotor Screening and Concussion Rehabilitation**. J Athl Train. 2017 Mar;52(3):256-261

Vestibular and oculomotor impairment and symptoms may be associated with worse outcomes after sport-related concussion (SRC), including prolonged recovery. In this review, we evaluate current findings on vestibular and oculomotor impairments as well as treatment approaches after SRC, and we highlight areas in which investigation is needed. Clinical researchers have intimated that recovery from SRC may follow certain clinical profiles that affect the vestibular and oculomotor pathways. Identifying clinical profiles may help to inform better treatment and earlier intervention to reduce recovery time after SRC. As such, screening for and subsequent monitoring of vestibular and oculomotor impairment and symptoms are critical to assessing and informing subsequent referral, treatment, and return to play. However, until recently, no brief-screening vestibular and oculomotor tools were available to evaluate this injury. In response, researchers and clinicians partnered to develop the Vestibular/Ocular-Motor Screening, which assesses pursuits, saccades, vestibular ocular reflex, visual motion sensitivity, and convergence via symptom provocation and measurement of near-point convergence. Other specialized tools, such as the King-Devick test for saccadic eye movements and the Dizziness Handicap Inventory for dizziness, may provide additional information regarding specific impairments and symptoms. Tools such as the Vestibular/Ocular-Motor Screening provide information to guide specialized referrals for additional assessment and targeted rehabilitation. Vestibular rehabilitation and visual-oculomotor therapies involve an active, expose-recover approach to reduce impairment and symptoms. Initial results support the effectiveness of both vestibular and visual-oculomotor therapies, especially those that target specific impairments. However, the evidence supporting rehabilitation strategies for both vestibular and oculomotor impairment and symptoms is limited and involves small sample sizes, combined therapies, nonrandomized treatment groups, and lack of controls. Additional studies on the effectiveness of screening tools and rehabilitation strategies for both vestibular and oculomotor impairment and symptoms after SRC are warranted.
PMID: 28387548

No. 383: July 19, 2017

Murray DA1, Meldrum D2, Lennon O1. **Can vestibular rehabilitation exercises help patients with concussion? A systematic review of efficacy, prescription and progression patterns.** Br J Sports Med. 2016 Sep 21. pii: bjsports-2016-096081

OBJECTIVE: Concussion symptoms normally resolve within 7-10 days but vertigo, dizziness and balance dysfunction persist in 10-30% of cases causing significant morbidity. This study systematically evaluated the evidence supporting the efficacy, prescription and progression patterns of vestibular rehabilitation therapy (VRT) in patients with concussion.
DESIGN: Systematic Review, guided by PRISMA guidelines and presenting a best evidence synthesis.
DATA SOURCES: Electronic databases PubMed (1949 to May 2015), CINAHL (1982 to May 2015), EMBASE (1947 to May 2015), SPORTDiscus (1985 to May 2015), Web of Science (1945 to May 2015) and PEDRO (1999 to May 2015), supplemented by manual searches and

grey literature.
ELIGIBILITY CRITERIA FOR STUDY SELECTION: Article or abstract of original research, population of patients with concussion/mild traumatic brain injury (mTBI) with vestibular symptoms, interventions detailing VRT, measurement of outcomes pre-VRT/post-VRT. Study type was not specified.
RESULTS: Following a double review of abstract and full-text articles, 10 studies met the inclusion criteria: randomised controlled trial (n=2), uncontrolled studies (n=3) and case studies (n=5). 4 studies evaluated VRT as a single intervention. 6 studies incorporated VRT in multimodal interventions (including manual therapy, strength training, occupational tasks, counselling or medication). 9 studies reported improvement in outcomes but level I evidence from only 1 study was found that demonstrated increased rates (OR 3.91; 95% CI 1.34 to 11.34; p=0.002) of medical clearance for return to sport within 8 weeks, when VRT (combined with cervical therapy) was compared with usual care. Heterogeneity in study type and outcomes precluded meta-analysis. Habituation and adaptation exercises were employed in 8 studies and balance exercises in 9 studies. Prescription and progression patterns lacked standardisation.
CONCLUSIONS: Current evidence for optimal prescription and efficacy of VRT in patients with mTBI/concussion is limited. Available evidence, although weak, shows promise in this population. Further high-level studies evaluating the effects of VRT in patients with mTBI/concussion with vestibular and/or balance dysfunction are required.
PMID: 27655831

No. 382: July 12, 2017

Schneider KJ1, Meeuwisse WH2, Nettel-Aguirre A3, Barlow K4, Boyd L5, Kang J6, Emery CA7. **Cervicovestibular rehabilitation in sport-related concussion: a randomised controlled trial.** Br J Sports Med. 2014 Sep;48(17):1294-8.

BACKGROUND/AIM: Concussion is a common injury in sport. Most individuals recover in 7-10 days but some have persistent symptoms. The objective of this study was to determine if a combination of vestibular rehabilitation and cervical spine physiotherapy decreased the time until medical clearance in individuals with prolonged postconcussion symptoms.
METHODS: This study was a randomised controlled trial. Consecutive patients with persistent symptoms of dizziness, neck pain and/or headaches following a sport-related concussion (12-30 years, 18 male and 13 female) were randomised to the control or intervention group. Both groups received weekly sessions with a physiotherapist for 8 weeks or until the time of medical clearance. Both groups received postural education, range of motion exercises and cognitive and physical rest until asymptomatic followed by a protocol of graded exertion. The intervention group also received cervical spine and vestibular rehabilitation. The primary outcome of interest was medical clearance to return to sport, which was evaluated by a study sport medicine physician who was blinded to the treatment group.
RESULTS: In the treatment group, 73% (11/15) of the participants were medically cleared within 8 weeks of initiation of treatment, compared with 7% (1/14) in the control group. Using an intention to treat analysis, individuals in the treatment group were 3.91 (95% CI 1.34 to 11.34) times more likely to be medically cleared by 8 weeks.
CONCLUSIONS: A combination of cervical and vestibular physiotherapy decreased time to medical clearance to return to sport in youth and young adults with persistent symptoms of

dizziness, neck pain and/or headaches following a sport-related concussion.
PMID: 24855132

No. 381: July 6, 2017

Valovich McLeod TC1, Hale TD. **Vestibular and balance issues following sport-related concussion.** Brain Inj. 2015;29(2):175-84

PRIMARY OBJECTIVE: To review relevant literature regarding the effect of concussion on vestibular function, impairments, assessments and management strategies. REASONING: Dizziness and balance impairments are common following sport-related concussion. Recommendations regarding the management of sport-related concussion suggest including tests of balance within the multifactorial assessment paradigm for concussive injuries.
ANALYSIS: The literature was searched for guidelines and original studies related to vestibular impairments following concussion, oculomotor and balance assessments and treatment or rehabilitation of vestibular impairments. The databases searched included Medline, CINAHL, Sport Discus and the Cochrane Database of Systematic Reviews through October 2013.
MAIN OUTCOMES AND RESULTS: Dizziness following concussion occurs in ~67-77% of cases and has been implicated as a risk factor for a prolonged recovery. Balance impairments also occur after concussion and last 3-10 days post-injury. Assessments of balance can be done using both clinical and instrumented measures with success. Vestibular rehabilitation has been shown to improve outcomes in patients with vestibular impairments, with one study demonstrating success in decreasing symptoms and increasing function following concussion.
CONCLUSIONS: Best practices suggest that the assessment of vestibular function through cranial nerve, oculomotor and balance assessments are an important aspect of concussion management. Future studies should evaluate the effectiveness of vestibular rehabilitation for improving patient outcomes.
PMID: 25291297

No. 380: June 28, 2017

Chiarella G, Petrolo C, Riccelli R, Giofrè L, Olivadese G, Gioacchini FM, Scarpa A, Cassandro E, Passamonti L,. **Chronic subjective dizziness: Analysis of underlying personality factors.** J Vestib Res. 2016 Nov 3;26(4):403-408.

BACKGROUND: Chronic subjective dizziness (CSD) is characterized by persistent dizziness, unsteadiness, and hypersensitivity to one's own motion or exposure to complex visual stimuli. CSD may be triggered, in predisposed individuals with specific personality traits, by acute vestibular diseases. CSD is also thought to arise from failure to re-establish normal balance strategies after resolution of acute vestibular events which may be modulated by diathesis to develop anxiety and depression.
OBJECTIVE: To confirm the role of personality traits linked to anxiety and depression (i.e., neuroticism, introversion, low openness) as predisposing factors for CSD and to evaluate how individual differences in these personality traits are associated with CSD severity.
METHODS: We compared 19 CSD patients with 24 individuals who had suffered from periferal vestibular disorders (PVD) (i.e., Benign Paroxysmal Postural Vertigo or Vestibular Neuritis) but

had not developed CSD as well as with 25 healthy controls (HC) in terms of personality traits, assessed via the NEO-PI-R questionnaire.
RESULTS: CSD patients, relative to PVD patients and HCs, scored higher on the anxiety facet of neuroticism. Total neuroticism scores were also significantly associated with dizziness severity in CSD patients but not PVD patients.
CONCLUSIONS: Pre-existing anxiety-related personality traits may promote and sustain the initial etiophatogenetic mechanisms linked with the development of CSD. Targeting anxiety-related mechanisms in CSD may be therefore a promising way to reduce the disability associated with CSD.
PMID: 27814314

No. 379: June 21, 2017

Bittar RS, Lins EM. **Clinical characteristics of patients with persistent postural-perceptual dizziness.** Braz J Otorhinolaryngol. 2015 May-Jun;81(3):276-82

INTRODUCTION: Persistent postural-perceptual dizziness is the dizziness that lasts for over three months with no clinical explanation for its persistence. The patient's motor response pattern presents changes and most patients manifest significant anxiety.
OBJECTIVE: To evaluate the clinical characteristics of patients with persistent postural and perceptual dizziness.
METHODS: statistical analysis of clinical aspects of patients with persistent postural-perceptual dizziness.
RESULTS: 81 patients, average age: 50.06±12.16 years; female/male ratio: 5.7/1; main reasons for dizziness: visual stimuli (74%), body movements (52%), and sleep deprivation (38%). The most prevalent comorbidities were hypercholesterolemia (31%), migraine headaches (26%), carbohydrate metabolism disorders (22%) and cervical syndrome (21%). DHI, State-Trait Anxiety Inventory - Trait, Beck Depression Inventory, and Hospital Anxiety and Depression Scale questionnaires were statistically different ($p<0.05$) when compared to controls. 68% demonstrated clinical improvement after treatment with serotonin reuptake inhibitors.
CONCLUSION: Persistent postural-perceptual dizziness affects more women than men, with a high associated prevalence of metabolic disorders and migraine. Questionnaires help to identify the predisposition to persistent postural-perceptual dizziness. The prognosis is good with adequate treatment.
PMID: 25382427

No. 378: June 14, 2017

Holle D, Schulte-Steinberg B, Wurthmann S, Naegel S, Ayzenberg I, Diener HC, Katsarava Z, Obermann M. **Persistent Postural-Perceptual Dizziness: A Matter of Higher, Central Dysfunction?** PLoS One. 2015 Nov 16;10(11):e0142468

OBJECTIVE: Persistent postural-perceptual dizziness (PPPD) is the most common vestibular disorder in the age group between 30 and 50 years. It is considered to be based on a multisensory maladjustment involving alterations of sensory response pattern including vestibular, visual and motion stimuli. Previous data supported a link between vestibular and pain mechanism. The aim

of the study was to investigate whether other sensory inputs such as pain stimuli might be altered in terms of a more widespread central perception dysfunction in this disorder.
METHODS: Nociceptive blink reflex was measured in 27 patients with PPPD and compared with 27 healthy, age and gender matched controls. The habituation of the R2 component of the blink reflex was evaluated as the percentage area-under-the curve (AUC) decrease in ten consecutive blocks of five averaged rectified responses. Additionally, clinical characteristics were evaluated.
RESULTS: In patients with PPPD a lack of habituation was observed compared to healthy controls. Relative AUC decreased between the first and the tenth block by 19.48% in PPPD patients and by 31.63% ($p = 0.035$) in healthy controls. There was no correlation between clinical data (course of disease, comorbid depression, medication, trigger factors) or electrophysiological data (perception threshold, pain threshold, stimulus intensity) and habituation pattern. No trigeminal sensitization in terms of facilitation of absolute values could be detected.
CONCLUSION: Our study results supports the hypothesis of the multisensory dimension of impaired sensory processing in patients with PPPD extends beyond vestibular/visual motion stimuli and reflexive postural/oculomotor control mechanisms to other sensory inputs such as pain perception in terms of a more generalized disturbed habituation pattern.
PMID: 26569392
PMCID: PMC4646356

No. 377: June 4, 2017

Dieterich M, Staab JP. **Functional dizziness: from phobic postural vertigo and chronic subjective dizziness to persistent postural-perceptual dizziness.** Curr Opin Neurol. 2017 Feb;30(1):107-113.

PURPOSE OF REVIEW: Functional dizziness is the new term for somatoform or psychogenic dizziness. The aim of this study is to review arguments for the new nomenclature, clinical features, possible pathomechanisms, and comorbidities of functional dizziness.
RECENT FINDINGS: The prevalence of functional dizziness as a primary cause of vestibular symptoms amounts to 10% in neuro-otology centers. Rates of psychiatric comorbidity in patients with structural vestibular syndromes are much higher with nearly 50% and with highest rates in patients with vestibular migraine, vestibular paroxysmia, and Ménière's disease. Pathophysiologic processes seem to include precipitating events that trigger anxiety-related changes in postural strategies with an increased attention to head and body motion and a cocontraction of leg muscles. Personality traits with high levels of neuroticism and low levels of extraversion appear as risk factors for anxiety and depressive disorders and increased morbidity in functional disorders.
SUMMARY: Correct and early diagnosis of functional dizziness, as primary cause or secondary disorder after a structural vestibular syndrome, is very important to prevent further chronification and enable adequate treatment. Treatment plans that include patient education, vestibular rehabilitation, cognitive and behavioral therapies, and medications substantially reduce morbidity and offer the potential for sustained remission when applied systematically
PMID: 28002135

No. 376: May 31, 2017

Isaac V, Olmedo D, Aboitiz F, Delano PH. **Altered Cervical Vestibular-Evoked Myogenic Potential in Children with Attention Deficit and Hyperactivity Disorder.** Frontiers in Neurology. 2017;8:90.

OBJECTIVE: Emerging evidence suggests that children with attention deficit and hyperactivity disorder (ADHD) present more difficulties in standing and walking balance than typically developing children. Most of previous studies have assessed these functions using postural and sensory organization tests showing differences in balance performance between control and ADHD children. However, to date, it is unknown whether these balance alterations are accompanied with vestibular dysfunction. The principal aim of this study is to evaluate vestibular otolith function in ADHD and matched control children.
METHODS: We assessed vestibular otolith function in children with ADHD and controls using the subjective visual vertical (SVV) bucket test and cervical vestibular-evoked myogenic potentials (cVEMPs). In addition, gait and balance were evaluated using the dynamic gait index (DGI) and computerized posturography.
RESULTS: Non-significant differences between groups were obtained in SVV evaluation. DGI results show lower scores for overall test performance in children with ADHD ($p<0.001$), while computerized postural recordings showed significant differences for the limit of stability between groups ($p=0.02$). cVEMPs in response to 500 Hz tone bursts presented at 100dB were absent or reduced in children with ADHD, as revealed by differences in P1 and N1 peak-to-peak amplitudes between groups ($p<0.01$).
CONCLUSION: These findings suggest that vestibular brainstem reflexes are altered in a subset of children with ADHD. We propose to include cVEMP reflexes in the clinical evaluation of ADHD patients.
PMID: 28348547

No. 375: May 24, 2017

Hunter JB et al. **Cervical and Ocular VEMP Testing in Diagnosing Superior Semicircular Canal Dehiscence.** Otolaryngol Head Neck Surg. 2017 Feb 1:194599817690720.

Objective To determine the sensitivity and specificity of ocular and cervical vestibular evoked myogenic potentials (VEMPs) in the diagnosis of superior semicircular canal dehiscence (SCD) and to describe the VEMP response characteristics that are most sensitive to SCD and compare the findings to previous reports. Study Design Case series with chart review. Setting Two tertiary neurotologic referral centers. Subjects and Methods Cervical and ocular VEMP peak-to-peak amplitudes and thresholds from 39 adult patients older than 18 years with surgically confirmed SCD were compared with 84 age-matched controls. Results Using receiver operating characteristic (ROC) curves, cervical VEMP (cVEMP) amplitudes, cVEMP thresholds, and ocular VEMP (oVEMP) amplitudes had areas under the curve of 0.731, 0.912, and 0.856, respectively, all of which were statistically significant ($P < .0001$). For cVEMP thresholds, at the clinical equivalent ≤85-dB normalized hearing level (nHL) threshold, the sensitivity and specificity were 97.3% and 31.3%, respectively. At the ≤70-dB nHL threshold, the sensitivity and specificity were 73.0% and 94.0%, respectively. For oVEMP amplitudes >12.0 μV, the

sensitivity and specificity were 78.6% and 81.7%, respectively. Conclusion Data from this multicenter study suggest that both cVEMP thresholds and oVEMP amplitudes remain good diagnostic tests for identifying SCD, with each test dependent on a number of factors. The sensitivity and specificity of these individual tests may vary slightly between centers depending on testing parameters used.
PMID: 28168887

No. 374: May 17, 2017

Dabiri S et al. **Analysis of Saccular Function With Vestibular Evoked Myogenic Potential Test in Meniere's Disease.** Acta Med Iran. 2017 Feb;55(2):123-127.

The aim of this study was to compare vestibular evoked myogenic potentials (VEMP) and video head impulse test (vHIT) results in patients presenting with vertigo and dizziness. We retrospectively analyzed data of all patients with the chief complaint of vertigo, dizziness, or imbalance that underwent VEMP and vHIT from January 2015 to January 2016. A total of 117 patients (73 females, mean age 53.92±16.76) fulfilled inclusion criteria: group 1 included patients with the final diagnosis of vestibular neuritis (VN) (N=31 (16 right and 15 left VN)), group 2 included patients with the final diagnosis of vertigo of central origin (N=23) and group 3 included patients with the final diagnosis of unspecified dizziness (N=63). There was significant correlation between oVEMP asymmetry and asymmetry of the lateral canals 60ms gains on vHIT ($r=0.225$, $p=0.026$). Significant correlation between oVEMP and vHIT asymmetry was present in VN patients ($r=0.749$, $p<0.001$), while no correlation was found in the groups 2 and 3. oVEMP and vHIT lateral canals asymmetries were significantly greater in patients with vestibular neuritis. Furthermore, positive correlations of oVEMP amplitudes with 60ms gain of the lateral semicircular canal and slope of the anterior semicircular canal on vHIT, and cVEMP with slope of the posterior semicircular canal on the vHIT were found. These changes were significantly more pronounced in patients with vestibular neuritis. In conclusion, VEMPs and vHIT data should be used complementarily; asymmetry on both tests strongly supports peripheral vestibular system involvement.
PMID: 28242131

No. 373: May 11, 2017

Dabiri S et al. **Analysis of Saccular Function With Vestibular Evoked Myogenic Potential Test in Meniere's Disease**. Acta Med Iran. 2017 Feb;55(2):123-127.

Meniere's disease is the disorder of inner ear characterized by vertigo, tinnitus and sensorineural hearing loss. The vestibular evoked myogenic potential (VEMP) test could be useful in the analysis of saccular function, and diagnosis of Meniere's disease. In this study, we've analyzed the saccular function, using VEMP test in different groups of Meniere's disease. Patients were categorized as possible, probable or definite Meniere's disease groups according to the guideline of American Academy of Otolaryngology-Head and Neck Surgery. The exclusion criteria were neuromuscular system diseases, diseases of central nervous system, inner ear disorders, conductive hearing loss, a history of ototoxic drug consumption, being a drug abuser and a positive history of inner ear surgery or manipulations. The VEMP test is the recording of positive

and negative waves from sternocleidomastoid muscle that is made by an auditory click to the ear. From the total of 100 patients, the waves of VEMP test was seen in 59 patients which 19 patients had abnormal amplitude, and latency and 40 patients were with normally recorded waves. There was a significant relationship between the severity of hearing loss and a VEMP test without any recorded waves. Most of the cases with 'no wave recorded' VEMP test, were patients with severe hearing loss. However, there wasn't any relation between the pattern of hearing loss and 'no wave recorded' VEMP test. VEMP test could be a valuable diagnostic clue especially in patients with definite Meniere's disease.
PMID: 28282709

No. 372: May 3, 2017

Crnosija L et al. **Vestibular evoked myogenic potentials and MRI in early multiple sclerosis: Validation of the VEMP score**. J Neurol Sci. 2017 Jan 15;372:28-32.

BACKGROUND: To validate the VEMP score as a measure of brainstem dysfunction in patients with the first symptom of multiple sclerosis (MS) (clinically isolated syndrome (CIS)) and to investigate the correlation between VEMP and brainstem MRI results.
METHODS: 121 consecutive CIS patients were enrolled and brainstem functional system score (BSFS) was determined. Ocular VEMP (oVEMP) and cervical VEMP (cVEMP) were analyzed for latencies, conduction block and amplitude asymmetry ratio and the VEMP score was calculated. MRI was analyzed for the presence of brainstem lesions as a whole and separately for the presence of pontine, midbrain and medulla oblongata lesions.
RESULTS: Patients with signs of brainstem involvement during the neurological examination (with BSFS ≥1) had a higher oVEMP score compared to patients with no signs of brainstem involvement. A binary logistic regression model showed that patients with brainstem lesion on the MRI are 6.780 times more likely to have BSFS ≥1 ($p=0.001$); and also, a higher VEMP score is associated with BSFS ≥1 ($p=0.042$). Furthermore, significant correlations were found between clinical brainstem involvement and brainstem and pontine MRI lesions, and prolonged latencies and/or absent VEMP responses.
CONCLUSIONS: The VEMP score is a valuable tool in evaluation of brainstem involvement in patients with early MS.
PMID: 28017229

No. 371: April 26, 2017

Yahia A, Ghroubi S, Jribi S, Mâlla J, Baklouti S, Ghorbel A, Elleuch MH. **Chronic neck pain and vertigo: Is a true balance disorder present?** Ann Phys Rehabil Med. 2009 Sep-Oct;52(7-8):556-67.

OBJECTIVE: We sought to establish whether chronic neck pain patients suffering from vertigo and instability have true balance disorders.
PATIENTS AND METHODS: Ninety-two patients having suffered from chronic neck pain for at least 3 months were enrolled in the present study. Patients with a history of neck trauma or ear, nose and throat, ophthalmological or neurological abnormalities were excluded. The patients were evaluated in a clinical examination (neck mobility) and a test of dynamic and static balance

on the Satel((R)) platform in which mediolateral (Long X) and anterior-posterior deviations (Long Y) were monitored. Our patients were divided into three groups: a group of 32 patients with neck pain and vertigo (G1), a group of 30 patients with chronic neck pain but no vertigo (G2) and a group of 30 healthy controls.
RESULTS: All groups were comparable in terms of age, gender, weight and shoe size. Osteoarthritis was found in 75% and 70% of the subjects in G1 and G2, respectively. Neck-related headache was more frequent in G1 than in G2 (65.5% versus 40%, respectively; p=0.043). Restricted neck movement was more frequent in G1 and concerned flexion (p<0.001), extension (p<0.001), rotation (p<0.001), right inclination (p<0.001) and left inclination (p<0.001). Balance abnormalities were found more frequently in G1 than in G2 or G3. Static and dynamic posturographic assessments (under "eyes open" and "eyes shut" conditions) revealed abnormalities in statokinetic parameters (Long X and Long Y) in G1.
CONCLUSION: Our study evidenced abnormal static and dynamic balance parameters in chronic neck pain patients with vertigo. These disorders can be explained by impaired cervical proprioception and neck movement limitations. Headache was more frequent in these patients.
PMID: 19747892
Free full text: http://www.sciencedirect.com/science/article/pii/S1877065709001225

No. 370: April 19, 2017

Juul-Kristensen B, Clausen B, Ris I, Jensen RV, Steffensen RF, Chreiteh SS, Jørgensen MB, Søgaard K. **Increased neck muscle activity and impaired balance among females with whiplash-related chronic neck pain: a cross-sectional study**. J Rehabil Med. 2013 Apr;45(4):376-84

OBJECTIVE: To investigate neck muscle activity and postural control in patients with whiplash-associated disorder compared with healthy controls.
DESIGN: Cross-sectional study with convenience sampling.
SUBJECTS: Ten females with whiplash-associated disorder (age 37.7 years (21-58), neck pain >2 years and neck disability index (NDI) >10) and 10 healthy female controls (age 35.9 years (21-53), NDI <6).
METHODS: Surface electromyography measured muscle activity of the anterior scalene, sternocleidomastoid, neck extensors and upper trapezius muscles, expressed as mean relative activity related to maximum voluntary electromyography (%MVE). On a force plate, 3 balance tasks (Romberg stance with open and closed eyes, 1-legged stance) and a perturbation task with sudden unloading, were performed. The total area, areas from slow and fast components, and range of displacements were calculated from decomposed centre of pressure anterior-posterior and medial-lateral signals.
RESULTS: During balance tasks with closed eyes and one-legged stance, the relative mean activity of all 4 muscles was significantly increased in whiplash-associated disorder compared with healthy controls. Postural sway was also significantly increased.
CONCLUSION: Increased neck muscle activity and increased postural sway during simple balance tasks indicate disturbed sensory feedback patterns in people with whiplash-associated disorder, which may have negative consequences when performing daily activities.
PMID: 23467989
Free full text: https://www.medicaljournals.se/jrm/content/abstract/10.2340/16501977-1120

No. 369: April 12, 2017

Kogler A, Lindfors J, Odkvist LM, Ledin T. **Postural stability using different neck positions in normal subjects and patients with neck trauma.** Acta Otolaryngol. 2000 Mar;120(2):151-5.
Subjects with neck problems, such as whiplash injuries, often complain of disturbed equilibrium and, in some instances, provocation of the neck position can elicit such problems. The importance of neck proprioceptors for maintaining balance is gaining increased interest, moreover the function or malfunction of the otoliths may disturb equilibrium in certain head positions. The aim of the study was to create a reference material for postural control and its dependence on head position in healthy subjects and to compare this with a set of patients with known neck problems and associated vertiginous problems. A total of 32 healthy subjects (16 men, 16 women, age range 21-58 years) as well as 10 patients age range 27-62 years (mean 44 years) with neck problems and associated balance problems since a whiplash injury were tested for postural control using the EquiTest dynamic posturographic model. The normal subjects were initially split into four age groups in order to estimate the effects of age on performance. The postural stability was evaluated for dependence of support surface conditions (stable or sway-referenced), visual input (eyes open or closed) and head position (neutral, left rotated, right rotated, extended backwards or flexed forward) using analysis of variance (ANOVA) with Tukey's post hoc test in case of a significant factor effect. As expected, visual cues as well as stable support surface improve postural stability ($p < 0.001$). Postural stability is statistically different in the head extended backwards condition compared with the other four head positions ($p < 0.001$ in all cases) in both patients and controls. Eliminating this test condition from the analysis, only a slight ($p < 0.05$) difference between head forwards and head turned left remained. This pattern of results remained if the normal subjects were only split into two age groups instead of four. Finally, the patient group exhibited significantly lower postural performance than all the groups of normal subjects ($p <0.01$), but none of the normal groups differed significantly from each other. It is concluded that the postural control system is significantly challenged in the head extended backwards condition in both normal subjects and patients with previous whiplash injury and persistent neck problems. The patient group differed statistically from all groups of normal subjects. This suggests that neck problems impair postural control, and that the head extended position is a more challenging task for the postural system to adapt to. Whether this is due to utricular malpositioning, central integrative functions or cervical proprioceptive afferents is not within the scope of this study to answer.
PMID: 11603761

No. 368: April 7, 2017

Treleaven J. **Sensorimotor disturbances in neck disorders affecting postural stability, head and eye movement control.** Man Ther. 2008 Feb;13(1):2-11. Epub 2007 Aug 16.

The receptors in the cervical spine have important connections to the vestibular and visual apparatus as well as several areas of the central nervous system. Dysfunction of the cervical receptors in neck disorders can alter afferent input subsequently changing the integration, timing and tuning of sensorimotor control. Measurable changes in cervical joint position sense, eye movement control and postural stability and reports of dizziness and unsteadiness by patients with neck disorders can be related to such alterations to sensorimotor control. It is advocated that

assessment and management of abnormal cervical somatosensory input and sensorimotor control in neck pain patients is as important as considering lower limb proprioceptive retraining following an ankle or knee injury. Afferent information from the cervical receptors can be altered via a number of mechanisms such as trauma, functional impairment of the receptors, changes in muscle spindle sensitivity and the vast effects of pain at many levels of the nervous system. Recommendations for clinical assessment and management of such sensorimotor control disturbances in neck disorders are presented based on the evidence available to date.
PMID: 17702636

No. 367: March 29, 2017

Leddy JJ, Baker JG, Merchant A, Picano J, Gaile D, Matuszak J, Willer B. **Brain or strain? Symptoms alone do not distinguish physiologic concussion from cervical/vestibular injury.** Clin J Sport Med. 2015 May;25(3):237-42

OBJECTIVE: To compare symptoms in patients with physiologic postconcussion disorder (PCD) versus cervicogenic/vestibular PCD. We hypothesized that most symptoms would not be equivalent. In particular, we hypothesized that cognitive symptoms would be more often associated with physiologic PCD.
DESIGN: Retrospective review of symptom reports from patients who completed a 22-item symptom questionnaire.
SETTING: University-based concussion clinic.
PATIENTS: Convenience sample of 128 patients who had symptoms after head injury for more than 3 weeks and who had provocative treadmill exercise testing.
INDEPENDENT VARIABLES: Subjects were classified as either physiologic PCD (abnormal treadmill performance and a normal cervical/vestibular physical examination) or cervicogenic/vestibular PCD (CGV, normal treadmill performance, and an abnormal cervical/vestibular physical examination).
MAIN OUTCOME MEASURES: Self-reported symptoms. Univariate and multivariate methods, including t tests, tests of equivalence, a logistic regression model, k-nearest neighbor analysis, multidimensional scaling, and principle components analysis were used to see whether symptoms could distinguish PCD from CGV.
RESULTS: None of the statistical methods used to analyze self-reported symptoms was able to adequately distinguish patients with PCD from patients with CGV.
CONCLUSIONS: Symptoms after head injury, including cognitive symptoms, have traditionally been ascribed to brain injury, but they do not reliably discriminate between physiologic PCD and cervicogenic/vestibular PCD. Clinicians should consider specific testing of exercise tolerance and perform a physical examination of the cervical spine and the vestibular/ocular systems to determine the etiology of postconcussion symptoms.
CLINICAL RELEVANCE: Symptoms after head injury, including cognitive symptoms, do not discriminate between concussion and cervical/vestibular injury.
PMID: 25051194

No. 366: March 22, 2017

Nielsen G, Buszewicz M, Stevenson F, Hunter R, Holt K, Dudziec M, Ricciardi L, Marsden J, Joyce E, Edwards MJ. **Randomised feasibility study of physiotherapy for patients with functional motor symptoms.** J Neurol Neurosurg Psychiatry. 2016 Sep 30. pii: jnnp-2016-314408.

OBJECTIVE:
To determine the feasibility of conducting a randomised controlled trial of a specialist physiotherapy intervention for functional motor symptoms (FMS).
METHODS:
A randomised feasibility study was conducted recruiting patients with a clinically established diagnosis of FMS from a tertiary neurology clinic in London, UK. Participants were randomised to the intervention or a treatment as usual control. Measures of feasibility and clinical outcome were collected and assessed at 6 months.
RESULTS:
60 individuals were recruited over a 9-month period. Three withdrew, leaving 29 intervention and 28 controls participants in the final analysis. 32% of patients with FMS met the inclusion criteria, of which 90% enrolled. Acceptability of the intervention was high and there were no adverse events. At 6 months, 72% of the intervention group rated their symptoms as improved, compared to 18% in the control group. There was a moderate to large treatment effect across a range of outcomes, including three of eight Short Form 36 (SF36) domains (d=0.46-0.79). The SF36 Physical function was found to be a suitable primary outcome measure for a future trial; adjusted mean difference 19.8 (95% CI 10.2 to 29.5). The additional quality adjusted life years (QALY) with intervention was 0.08 (95% CI 0.03 to 0.13), the mean incremental cost per QALY gained was £ 12 087.
CONCLUSIONS:
This feasibility study demonstrated high rates of recruitment, retention and acceptability. Clinical effect size was moderate to large with high probability of being cost-effective. A randomised controlled trial is needed.
PMID: 27694498

No. 365: March 15, 2017

Cha YH. **Mal de debarquement syndrome: new insights.** Ann N Y Acad Sci. 2015 Apr;1343:63-8. doi: 10.1111/nyas.12701

Mal de Debarquement Syndrome (MdDS) is an enigmatic neurotological disorder with high morbidity, psychosocial burden, and few treatment options. Fortunately, there has been recent growth in scientific interest in understanding the biological basis of and in treating MdDS. Recent studies using functional neuroimaging have shown increased glucose metabolism in the left entorhinal cortex (EC) and amygdala in the setting of decreased prefrontal and temporal cortex metabolism in subjects with persistent MdDS. The EC is a key player in processing and gating spatial information to be stored in the hippocampus and is a major driver of brain oscillations. A limbic focus may also be key to spontaneous MdDS-like symptoms occurring in individuals with a history of anxiety or chronic stress. Treatment with repetitive transcranial magnetic stimulation over the dorsolateral prefrontal cortex can decrease the rocking dizziness of MdDS, with successful responses associated with decreases in the coherence between brain

networks with nodes in the parietal and occipital lobes. A new theory of MdDS is proposed as pathology secondary to entrainment of intrinsic brain networks driven by oscillatory motion exposure coupled with an inability to subsequently desynchronize the activity of these nodes. Future treatment strategies may be directed toward unyoking these networks.
PMID: 25726862
PMCID: PMC4409476
Link to free Article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4409476/

No. 364: March 8, 2017

Yetiser S, Ince D. Diagnostic Role of Head-Bending and Lying-Down Tests in Lateral Canal Benign

OBJECTIVES: To compare the diagnostic value of the head-bending test (HBT), lying-down positioning test (LDPT) and patient's report to identify the affected canal in video-nystagmographically (VNG) confirmed patients with lateral canal benign paroxysmal positional vertigo (LC-BPPV).
STUDY DESIGN: Case series with chart review.
SETTING: Head-bending, lying-down positioning and the head-roll maneuver (HRM) under VNG guidance. The data were collected in a referral community hospital.
PATIENTS: Seventy-eight patients (32 apogeotropic and 46 geotropic nystagmus) with LC-BPPV who had been recruited between 2009 and 2013 were enrolled in the study.
MAIN OUTCOME MEASURES: Patients were tested with the HRM and then were asked about subjectively worse side. Later, they were subjected to HBT when sitting and the LDPT. The results were compared and studied with the 1-way ANOVA and chi-square tests. Statistical significance was set at $p < 0.05$.
RESULTS: Affected side was identified by HRM in 75% of patients with apogeotropic nystagmus and 95.6% of patients with geotropic nystagmus. Approximately 65.6% of patients with apogeotropic and 52% of patients with geotropic nystagmus had nystagmus during LDPT. However, its comparability with HRM was low. However, treatment plan based on LDPT results alone provided relief of symptoms in additional 12.5% of patients with apogeotropic and in 2.2% of patients with geotropic nystagmus. Approximately 63% of patients with apogeotropic and 56% of patients with geotropic nystagmus were able to tell the worse side. Nystagmus comparable with HRM during HBT was low and not diagnostic.
CONCLUSION: HRM has the greatest diagnostic value of positioning tests in LC-BPPV in this study. LDPT provides some contribution in the diagnosis of LC-BPPV but much less than HRM. Patients' subjective feeling of vertigo was also a useful test. However, HBT was not as sensitive as other measures in uncertain cases.
PMID: 25938792
Link to free article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5030422/

No. 363: March 1, 2017

Ichimura A, Otsuka K. Persistent Down-Beating Torsional Positional Nystagmus: Posterior Semicircular Canal Light Cupula? Case Rep Otolaryngol. 2016;2016:1249325. doi: 10.1155/2016/1249325. Epub 2016 Sep 7.

A 16-year-old boy with rotatory positional vertigo and nausea, particularly when lying down, visited our clinic. Initially, we observed vertical/torsional (downward/leftward) nystagmus in the supine position, and it did not diminish. In the sitting position, nystagmus was not provoked. Neurological examinations were normal. We speculated that persistent torsional down-beating nystagmus was caused by the light cupula of the posterior semicircular canal. This case provides novel insights into the light cupula pathophysiology.
PMID: 27668113
PMCID: PMC5030422
Link to free article: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5030422/