



**Vestibular Rehabilitation SIG
Archived Abstract of the Week
For the year 2018**

Summary of December 2018 Topic: Concussion

No 454: December 26, 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.

Abstract

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



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Link to free full text:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5189228/>

No 453: December 20, 2018

Vander Vegt CB, Register-Mihalik JK, Ford CB, Rodrigo CJ, Guskiewicz KM, Mihalik JP. **Baseline Concussion Clinical Measures Are Related to Sensory Organization and Balance.** Med Sci Sports Exerc. 2018 Sep 19. doi: 10.1249/MSS.0000000000001789. [Epub ahead of print]

Abstract

PURPOSE: To examine relationships among baseline demographics, symptom severity, computerized neurocognitive outcomes, and balance performance in collegiate athletes.

METHODS: Collegiate varsity athletes (N=207, age=19.3 ± 1.0 years) participating in an ongoing clinical research program who completed concussion baseline assessments including a demographic questionnaire, graded symptom checklist, neurocognitive assessment, and the Sensory Organization Test (SOT) were included in this study. The SOT composite equilibrium score (COMP) and three sensory ratio scores-vestibular (VEST), visual (VIS), and somatosensory (SOM)-were used to describe athletes' overall sensory organization and ability to utilize input from each sensory system to maintain balance. Separate stepwise multiple linear regression models were performed for each SOT outcome. Total symptom severity level and CNS Vital Signs domain scores served as predictor variables.

RESULTS: Stepwise regression models for COMP (R = 0.18, F_{4,201} = 11.29, P <0.001), VEST (R = 0.14, F_{4,201} = 8.16, P <0.001), and VIS (R = 0.10, F_{4,201} = 5.52, P <0.001) were all significant. Faster reaction times and higher executive function scores were associated with higher COMP and VEST scores in separate models. Those with faster reaction times also had significantly higher VIS scores.

CONCLUSION: Reaction time and executive function demonstrated significant relationships with SOT balance performance. These cognitive processes may influence athletes' ability to organize and process higher order information and generate appropriate responses to changes in their environment, with respect to balance and injury risk. Future investigations should consider these relationships following injury and clinicians should be mindful of this relationship when considering concussion management strategies

PMID: 30239494



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No 452: December 12, 2018

Leddy J, Baker JG, Haider MN, Hinds A, Willer B. **A Physiological Approach to Prolonged Recovery From Sport-Related Concussion.** J Athl Train. 2017 Mar;52(3):299-308. doi: 10.4085/1062-6050-51.11.08.

Abstract

Management of the athlete with postconcussion syndrome (PCS) is challenging because of the nonspecificity of PCS symptoms. Ongoing symptoms reflect prolonged concussion pathophysiology or conditions such as migraine headaches, depression or anxiety, chronic pain, cervical injury, visual dysfunction, vestibular dysfunction, or some combination of these. In this paper, we focus on the physiological signs of concussion to help narrow the differential diagnosis of PCS in athletes. The physiological effects of exercise on concussion are especially important for athletes. Some athletes with PCS have exercise intolerance that may result from altered control of cerebral blood flow. Systematic evaluation of exercise tolerance combined with a physical examination of the neurologic, visual, cervical, and vestibular systems can in many cases identify one or more treatable postconcussion disorders.

PMID: 28387557

No 451: December 7, 2018

Mucha A, Fedor S, DeMarco D. **Vestibular dysfunction and concussion.** Handb Clin Neurol. 2018;158:135-144. doi: 10.1016/B978-0-444-63954-7.00014-8.

Abstract

The assessment and treatment of sport-related concussion (SRC) often requires a multifaceted approach. Vestibular dysfunction represents an important profile of symptoms and pathology following SRC, with high prevalence and association with prolonged recovery. Signs and symptoms of vestibular dysfunction may include dizziness, vertigo, disequilibrium, nausea, and visual impairment. Identifying the central and peripheral vestibular mechanisms responsible for pathology can aid in management of SRC. The most common vestibular disturbances after SRC include benign paroxysmal positional vertigo, vestibulo-ocular reflex impairment, visual motion sensitivity, and balance impairment. A variety of evidence-based screening and assessment tools can help to identify the various types of vestibular pathology in SRC. When vestibular dysfunction is identified, there is emerging support for applying targeted vestibular rehabilitation to manage this condition

PMID: 30482341



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Summary of November 2018 Topic: vHIT

No 450: November 28, 2018

McCaslin DL1, Jacobson GP, Bennett ML, Gruenwald JM, Green AP. **Predictive properties of the video head impulse test: measures of caloric symmetry and self-report dizziness handicap.** Ear Hear. 2014 Sep-Oct;35(5):e185-91

Abstract

OBJECTIVES: The purpose of this investigation was to determine whether a predictable relationship existed between self-reported dizziness handicap and video Head Impulse Test (vHIT) results in a large sample of patients reporting to a dizziness clinic. Secondary objectives included describing the characteristics of the vHIT ipsilesional and contralesional vestibulo-ocular reflex slow-phase velocity in patients with varying levels of canal paresis. Finally, the authors calculated the sensitivity and specificity of the vHIT for detecting horizontal semicircular canal impairment using the caloric test as the "gold standard."

DESIGN: Participants were 115 adults presenting to a tertiary medical care center with symptoms of dizziness. Participants were administered a measure of self-report dizziness handicap (i.e., Dizziness Handicap Inventory) and underwent caloric testing and vHIT at the same appointment.

RESULTS: Results showed that (1) there were no significant group differences (i.e., vHIT normal versus vHIT abnormal) in the Dizziness Handicap Inventory total score, (2) both ipsilesional and contralateral velocity gain decreased with increases in caloric paresis, and (3) a caloric asymmetry of 39.5% was determined to be the cutoff that maximized discrimination of vHIT outcome.

CONCLUSIONS: The level of self-reported dizziness handicap is not predicted by the outcome of the vHIT, which is consistent with the majority of published reports describing the poor relationship between quantitative tests of vestibular function and dizziness handicap. Further, the study findings have demonstrated that vHIT and caloric data are not redundant, and each test provides unique information regarding the functional integrity of the horizontal semicircular canal at different points on the frequency spectrum. The vHIT does offer some advantages over caloric testing, but at the expense of sensitivity. The vHIT can be completed in less time, is not noxious to the patient, and requires very little laboratory space. However, the study data show that a caloric asymmetry of 39.5% is required to optimize discrimination between an abnormal and normal vHIT. It is the authors' contention that the vHIT is a complementary test to the balance function examination and should be viewed as such rather than as a replacement for caloric testing.

PMID: 24801960



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No 449: November 21, 2018

Khater AM, Afifi PO. Int J Pediatr Otorhinolaryngol. **Video head-impulse test (vHIT) in dizzy children with normal caloric responses.** 2016 Aug;87:172-7.

Abstract

OBJECTIVE: The caloric test and the video head-impulse test are diagnostic tools to examine dizzy patients through assessing the function of the semicircular canals. There are major differences between the two tests as regards stimulus characteristics, methodology, and function examined. The aim of this study is to evaluate the results of vHIT in children and adolescents with normal caloric test.

MATERIALS AND METHODS: This work was performed on 63 patients, but 14 were excluded because of technical problems in the caloric test. So, this is a prospective work in 49 patients (27 females and 22 males) with different types of vestibular disease seen because of vertigo in which both procedures were performed the same day. The caloric test was performed with air at two different temperatures in which both ears were irrigated alternately. Then, the video head-impulse test was carried out. Main outcome measures were the gain of vestibulo-ocularreflex, gain asymmetry, and refixation saccades in the vHIT.

RESULTS: in all studied cases, caloric test was normal. The mean age of patients was 16 years. By vHIT, in 8 patients (16%) no abnormality was detected, while abnormal findings were found in 41 patients. Single canal affection was seen in 29 patients whereas 12 patients had combined canal affection. The right side was affected in 27 and left side in 22 patients. In single canal affection, isolated horizontal canals were affected in 4, anterior canals in 5 and posterior canals in 20 patients. While in combined canal affection, the affection is seen in the same ear. Moreover the most common pattern seen is affection of left anterior and left posterior canals.

CONCLUSION: The caloric and vHIT is very important tests in diagnosis of dizzy patients. The information from both methods is redundant in some cases but complementary in most. vHIT is a "child friendly," relatively easy-to-use, and simple tool to evaluate each of the 6 semicircular canals.

PMID: 27368467

No 448: November 14, 2018

Alhabib SF, Saliba I. **Video head impulse test: a review of the literature.** Eur Arch Otorhinolaryngol. 2017 Mar;274(3):1215-1222.

Abstract



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Video head impulse test (vHIT) is a new testing which able to identify the overt and covert saccades and study the gain of vestibulo-ocularreflex (VOR) of each semicircular canal. The aim of this study is to review the clinical use of vHIT in patients with vestibular disorders in different diseases. PubMed and Cochrane databases were searched for all articles that defined vHIT, compared vHIT with another clinical test, and studied the efficacy of vHIT as diagnostic tools with vestibular disease. 37 articles about vHIT were reviewed. All articles studied the vHIT in English and French languages up to May 2015 were included in the review. Editorial articles or short comments, conference abstracts, animal studies, and language restriction were excluded from the review. Four systems were used in the literature to do the vHIT. vHIT is physiological quick test, which studied the VOR at high frequency of each semicircular canal by calculating the duration ratio between the head impulse and gaze deviation. vHIT is more sensitive than clinical head impulse test (cHIT), especially in patient with isolated covert saccades. vHIT test is diagnostic of vestibular weakness by gain reduction and the appearance of overt and covert saccades. If the vHIT is normal, then caloric test is mandatory to rule out a peripheral origin of vertigo. It is recommended to test each semicircular canal, as isolated vertical canal weakness was identified in the literature. More investigation would be required to determine the evolution of the VOR gain with the progression of the vestibular disease.

PMID: 27328962

Summary of October 2018 Topic: ICVR Recap

No 447: October 31, 2018

Keshavarz B, Riecke BE, Hettinger LJ, Campos JL. **Vection and visually induced motion sickness: how are they related?** Front Psychol. 2015 Apr 20;6:472. doi: 10.3389/fpsyg.2015.00472. eCollection 2015

Abstract

The occurrence of visually induced motion sickness has been frequently linked to the sensation of illusory self-motion (vection), however, the precise nature of this relationship is still not fully understood. To date, it is still a matter of debate as to whether vection is a necessary prerequisite for visually induced motion sickness (VIMS). That is, can there be VIMS without any sensation of self-motion? In this paper, we will describe the possible nature of this relationship, review the literature that addresses this relationship (including theoretical accounts of vection and VIMS), and offer suggestions with respect to operationally defining and reporting these phenomena in future.

PMID: 25941509

Full Text Link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4403286/>



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No 446: October 24, 2018

Kim CH, Hong SM. **Is the modified cupulolith repositioning maneuver effective for treatment of persistent geotropic direction-changing positional nystagmus?** Eur Arch Otorhinolaryngol. 2018 Jul;275(7):1731-1736. doi: 10.1007/s00405-018-5006-4. Epub 2018 May 26.

Abstract

OBJECTIVE: Clinicians sometimes see patients with relatively persistent geotropic direction-changing positional nystagmus (DCPN) as a variant of lateral semicircular canal-benign paroxysmal positional vertigo (LSCC-BPPV). Recently, the concept of a "light cupula" in the lateral semicircular canal, exhibiting persistent geotropic DCPN, has been introduced. However, the underlying pathogenesis of light cupula is not known. We investigated the efficacy of a modified cupulopathy repositioning maneuver (mCuRM), designed to reduce light debris attached to the cupula in patients with persistent geotropic DCPN.

STUDY DESIGN: Retrospective cohort study.

METHODS: Participants included 65 patients with a persistent geotropic DCPN: 35 underwent treatment (mCuRM group), and 30 were followed-up but received no treatment (No CuRM group). We compared the therapeutic and survival rate of persistent geotropic DCPN between two groups.

RESULTS: On Day 1, the persistent geotropic DCPN did not resolve in either group. On the first and second follow-up days, persistent geotropic DCPN was observed in 28 (80%) and 21 (60%) of patients, respectively, in the mCuRM group, and in 28 (93.3%) and 24 (80%) patients, respectively, in the no mCuRM group. The differences between groups were not statistically significant. Furthermore, no between-group differences were found in the time from diagnosis to resolution of nystagmus, or the time from symptom onset to resolution of nystagmus. Kaplan-Meier analysis of the time course of persistent geotropic DCPN resolution from the day of diagnosis and day of symptom onset revealed no significant differences between the groups.

CONCLUSION: Our findings indicate that mCuRM had no therapeutic benefit for a persistent geotropic DCPN and suggest that the pathophysiology of persistent geotropic DCPN is less likely to be a light debris attached to the cupula.

PMID: 29804128

No 445: October 17, 2018

Hoppes CW, Sparto PJ, Whitney SL, Furman JM, Huppert TJ. **Changes in cerebral activation in individuals with and without visual vertigo during optic flow: A functional near-infrared spectroscopy study.** Neuroimage Clin. 2018 Sep 5;20:655-663. doi: 10.1016/j.nicl.2018.08.034. eCollection 2018.

Abstract



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BACKGROUND AND PURPOSE: Individuals with visual vertigo (VV) describe symptoms of dizziness, disorientation, and/or impaired balance in environments with conflicting visual and vestibular information or complex visual stimuli. Physical therapists often prescribe habituation exercises using optic flow to treat these symptoms, but it is not known how individuals with VV process the visual stimuli. The primary purpose of this study was to use functional near-infrared spectroscopy (fNIRS) to determine if individuals with VV have different cerebral activation during optic flow compared with control subjects.

METHODS: Fifteen individuals (5 males and 10 females in each group) with VV seeking care for dizziness and 15 healthy controls (CON) stood in a virtual reality environment and viewed anterior-posterior optic flow. The support surface was either fixed or sway-referenced. Changes in cerebral activation were recorded using fNIRS during periods of optic flow relative to a stationary visual environment. Postural sway of the head and center of mass was recorded using an electromagnetic tracker.

RESULTS: Compared with CON, the VV group displayed decreased activation in the bilateral middle frontal regions when viewing optic flow while standing on a fixed platform. Despite both groups having significantly increased activation in most regions while viewing optic flow on a sway-referenced surface, the VV group did not have as much of an increase in the right middle frontal region when viewing unpredictable optic flow in comparison with the CON group.

DISCUSSION AND CONCLUSIONS: Individuals with VV produced a pattern of reduced middle frontal cerebral activation when viewing optic flow compared with CON. Decreased activation in the middle frontal regions of the cerebral cortex may represent an alteration in control over the normal reciprocal inhibitory visual-vestibular interaction in visually dependent individuals. Although preliminary, these findings add to a growing body of literature using functional brain imaging to explore changes in cerebral activation in individuals with complaints of dizziness, disorientation, and unsteadiness. Future studies in larger samples should explore if this decreased activation is modified following a rehabilitation regimen consisting of visual habituation exercises.

PMID: 30211002

Link to Free Article:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6129736/>

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.



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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-



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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

Summary of September 2018 Topic: Vestibular Paroxysmia

No 442: September 26, 2018

Bayer O, Brémová T, Strupp M, Hübner 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),



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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,



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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

Summary of August 2018 Topic: Optometric Examination

No 438: August 29, 2018



**Vestibular Rehabilitation SIG
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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.



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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



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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



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Summary of July 2018 Topic: Unilateral Vestibular Hypofunction

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, Bähler 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,



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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, Brintjes 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 $15^\circ/s$ 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



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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

Summary of June 2018 Topic: Migraine

No 430: June 27, 2018

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

Abstract

OBJECTIVE: Mal de débarquement 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



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

No 429: June 21, 2018

Kutay Ö, Akdal G, Keskinoglu P, Balci BD, Alkin 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.



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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,



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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/>

Summary of May 2018: Topic: Visual Considerations in Vestibular Rehabilitation

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



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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



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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 \pm 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



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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 [



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$\chi^2(2) = 11.014, p = 0.004$] 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

Summary of April 2018: Exercise, Physical Activity and the Vestibular System

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, Bossier 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



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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/>



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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

Summary of March 2018 Topic: CSM Recap

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.



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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



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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 $r_s = 0.143$, number of concussions $r_s = .084$). 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.



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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/>

Summary of February 2018: Persistent Postural-Perceptual Dizziness (PPPD)

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.



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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



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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



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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 neurological, 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

Summary of January 2018: Psychological Disorders and Vestibular Dysfunction

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 (F10,42 = 2.80, P = .009, Rchange = 0.27) but not other postconcussion symptom 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.



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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



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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 symptoms 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.



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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