Summary of July 2017 Topic: Vestibular Rehab in Concussion

Dizziness is a common symptom following concussion, according to one abstract occurrence rates are 67-77%. Imbalance, dizziness, visual and vestibular impairments were possible risk factors for prolonged recovery or worse outcomes following concussion.

The abstracts, including a systematic review, investigated whether vestibular therapy would reduce recovery time, improve outcomes, and is effective in the concussion population.

Overall, the research is limited in quality and breadth but suggest that vestibular therapy can be effective in treating this patient population.

The abstracts highlight that testing for vestibular impairments is warranted in the assessment of individuals with concussion. It is also recommended to treat those specific vestibular impairments. The abstracts also found that additional high quality research is needed to better determine the efficacy of vestibular intervention in concussion management.

Summary of August 2017 Topic: Relaxation/meditation Strategies for Balance & Vestibular Treatment

Abstracts in August looked at possible relaxation and meditation strategies that could be useful in persons with vestibular disorders. While the research is more limited in these treatment options, the abstracts showed possible interventions that may be beneficial.

The first abstract confirmed that Interdisciplinary treatment improves patient coping, functionality, and satisfaction and decreases overall health care utilization in vestibular patients (1). Breathing techniques were shown to be beneficial in two of the abstracts provided. The results suggest that regulation of the breathing pattern may have an influence on disability related to chronic vestibular disease, while proprioception exercises may improve postural control (2). It was found that diaphragmatic breathing subjects, compared to those in the control group, displayed significantly greater heart rate variability and reported feeling less motion sickness during exposure to the virtual reality experience than those in the control group (5).

Yoga practice can significantly reduce cognitive motor interference, which improves balance, by improving allocation and utilization of attentional resources for both balance control and executive cognitive functioning; thus resulting in better performance under dual task conditions (3).

Finally a study suggested mindfulness practice can promote effective heart rate regulation, and thereby promote effective recovery after a stressful event for individuals with headache conditions. Moreover, headache conditions may be associated with dysregulated stress recovery, thus more research is needed on the cardiovascular health and stress resilience of headache sufferers (4).

1. Naber CM, Water-Schmeder O, Bohrer PS, Matonak K, Bernstein AL, Merchant MA. Interdisciplinary

treatment for vestibular dysfunction: the effectiveness of mindfulness, cognitive-behavioral techniques, and vestibular rehabilitation. Otolaryngol Head Neck Surg. 2011 Jul;145(1):117-24.

2. Jáuregui-Renaud K, Villanueva Padrón LA, Cruz Gómez NS. The effect of vestibular rehabilitation

supplemented by training of the breathing rhythm or proprioception exercises, in patients with chronic

peripheral vestibular disease. J Vestib Res. 2007;17(1):63-72.

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

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

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

Summary of September 2017 Topic: Meniere's Disease

The September topic was Meniere's disease and the selected articles aimed to provide evidence to support clinical presentation of Meniere's disease.

One article assessed whether endolymphatic cavity enlargement could be detected in T2 weighted MRI and therefore used to indicate endolymphatic hydrops and confirm a diagnosis Meniere's Disease. The study found that subjects with Meniere's Disease had a statistically significant increased endolymphatic cavity size compared to controls. Therefore, the current protocols using T2 MRI of the temporal bone can be used to help diagnose Meniere's Disease. (2)

Another article used MRI to measure endolymphatic hydrops in order to differentiate between Meniere's Disease and Vestibular Migraine diagnoses. Meniere's Disease showed significant endolymphatic hydrops via 3D-real-IR MRI but not in subjects with Vestibular Migraine. Therefore, this type of MRI can be helpful to rule in/rule out Meniere's Disease or Vestibular Migraine. This is especially useful because the clinical vestibular presentation of the two diagnoses can be similar. (1)

The final study aimed to examine the role of the vestibular system's influence on postural hemodynamics through examination of patients with Meniere's Disease who experience syncope. The study reinforced the function of vestibular system on circulation regulation via the vestibular sympathetic reflex. (3)

These articles support proper diagnosis and therefore appropriate treatment of patients with Meniere's Disease.

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

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

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

Summary of October 2017 Topic: Pain and the Vestibular System

These past month's abstracts looked at the link between the vestibular system and pain. In the first abstract a specific link between the two was discussed. There are remarkable parallel neurochemical phenotypes for inner ear and trigeminal ganglion cells and these afferent channels appear to converge in shared central pathways for vestibular and nociceptive information processing. These pathways share expression of receptors targeted by anti-migraine drugs (1).

The second abstract assessed the incidence of vestibular dysfunction in patients receiving medication for chronic, noncancer pain or other underlying neurologic disorders and to determined associated follow-up therapeutic and diagnostic recommendations. It was found that patients being treated with medications for chronic, noncancer pain or other underlying neurologic disorders may have a higher-than-average incidence of vestibular dysfunction. Baseline assessment and monitoring of the vestibular apparatus may be indicated for these patients (2). Another study determined whether patients with fibromyalgia, compared to age-matched healthy controls, have differences in dynamic posturography, including sensory, motor, and limits of stability despite having a normal clinical neurological examination (3).

A final study sought to determine if reduced head-on-trunk movement alters VOR suppression and gaze accuracy similar to experiments involving normal subjects and if intentionally increasing head and neck movement affects these dynamics. In patients with chronic neck pain, the internal commands issued for combined eye-head movements have large enough amplitudes to create accurate gaze saccades; however, because of increased neck stiffness and viscosity, the head movements produced are smaller, slower, longer, and more delayed than they should be. VOR suppression is disproportionate to the size of the actual gaze saccades because sensory feedback signals from neck proprioceptors are non-veridical, likely due to prolonged coactivation of cervical muscles. The outcome of these changes in eye-head kinematics is head-on-trunk stability at the expense of gaze accuracy. In the absence of vestibular loss, the practical consequences may be dizziness in the short term and imbalance and falls in the long term (4).

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

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

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

4. Johnston JL, Daye PM, Thomson GT. Inaccurate Saccades and Enhanced Vestibulo-Ocular Reflex Suppression during Combined Eye-Head Movements in Patients with Chronic Neck Pain: Possible

Implications for Cervical Vertigo. Front Neurol. 2017 Jan 30;8:23. doi: 10.3389/fneur.2017.00023. eCollection 2017.

Summary of November 2017: Whiplash Associated Disorder (WAD)

The November Topic was Whiplash Associated Disorder (WAD). The five articles ranged in focus including oculomotor control, cervical spine proprioception, dizziness, and balance. Common to all of the articles was that the subjects had a whiplash injury.

One systematic review examined oculomotor control after whiplash injury. Overall the results varied but a main finding was that compensatory eye movements were common, especially in smooth pursuits. Based on this finding, it was proposed that this could negatively affect head and eye coordination. (1)

Four articles looked at the efficacy of physical therapy on reducing symptoms from WAD. The first suggested that neck exercises including a behavioral approach could reduce pain, dizziness and improve balance compared to just performing neck exercises. However, this intervention did not resolve these impairments fully. The authors suggested that the effect of specific exercises for the neck, dizziness and balance should be studied. (2)

An article examined the effect of vestibular physical therapy on neck pain and cervical spine range of motion. Vestibular therapy did not decrease pain intensity nor improve range of motion but it clearly did not worsen either of these. (4) Another article examined the potential benefits of vestibular physical therapy on balance and self-perceived dizziness and balance handicap, using the Dizziness Handicap Inventory. Both of these measures improved after six weeks of vestibular PT. (5)

Finally, an article summarized that known mechanisms for dizziness, imbalance, impaired oculomotor control, cervical spine proprioception exist due to cervical afferent dysfunction following a whiplash injury. This article recommended the examination and targeted treatment of these impairments. (3)

Overall, these articles verify the association between dizziness, imbalance and visual disturbances following a whiplash injury and suggest that targeted assessment and treatment of these impairments is important in the rehabilitation of these patients.

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

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

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

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

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

Summary of December 2017: Motion Sensitivity

Motion sickness is a common disturbance occurring in healthy people as a physiological response to exposure to motion stimuli that are unexpected on the basis of previous experience. The motion can be either real, and therefore perceived by the vestibular system, or illusory, as in the case of visual illusion. A multitude of studies has been performed in the last decades, substantiating different nauseogenic stimuli, studying their specific characteristics, proposing unifying theories, and testing possible countermeasures (1).

One study sought to look at the relationship between migraine and motion sickness. Migraine is associated with enhanced motion sickness susceptibility and can cause episodic vertigo, but the mechanisms relating migraine to these vestibular symptoms remain unclear. In this study a hypothesis was tested that the central integration of rotational cues (from the semicircular canals) and gravitational cues (from the otolith organs) is abnormal in migraine patients. They found eye movement responses in Vestibular Migraine patients differed from migraine and normal subjects in three ways: the VOR axis shifts were larger in Vestibular Migraine patients, the normalized axis shift and normalized dumping efficacy were not correlated in VM patients, and the residual conflict in Vestibular Migraine patients was positively correlated with motion sickness susceptibility (2).

Another study compared the rates of carsickness in patients with Vestibular Migraine, Non-vestibular migraine, and Meniere's disease.Overall, 78.4% of the Vestibular Migraine patients had experienced carsickness in their lifetime. 89.2% of the 'definite Vestibular Migraine' patients, and 70.5% of the 'probably Vestibular Migraine' patients had a history of carsickness compared to 43.6% of the Non-Vestibular Migraine patients, and 18.2% of the Meniere's patients. Among the patients who had experienced carsickness, most had experienced carsickness in childhood before the onset of Vestibular Migraine, Non-Vestibular Migraine, or Meniere's disease (3).

For more information The first abstract has a full text with many other studies cited for further review: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4753518/

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

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

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

Summary of January 2018: Psychological Disorders and Vestibular Dysfunction

January's five abstracts were on the topic of psychological disorders and vestibular dysfunction. One article looked at the correlation of patients with vestibular dysfunction and psychological disorders. This article found that about 20% of this patient population had significant psychological distress, depression and anxiety. The author's conclusion was that consideration of psychological evaluation is warranted in this population. (3)

Another article concluded that vestibular therapy with patients with psychological disorders is warranted and successful. However, these patients may not have as good of outcomes compared to those without psychological disorders. (1) An abstract examined the anxiety and depression severity of patients with acute and chronic dizziness. This article found that patients with chronic dizziness had significantly more anxiety and depression with correlated with a higher emotional subscale of the Dizziness Handicap Inventory. Based on their findings they hypothesized that emotional status may prolong recovery from dizziness. (4)

The next abstract looked at the correlation of anxiety and migraine and found that patients with vestibular migraines had increased anxiety compared to migraines without vertigo. (2). Lastly, an article studied patients with mild brain injury and to see if the post-concussive symptoms could be predicted based on psychological factors assessed by standardized testing. This article found that only affective symptoms could be reliably predicted by psychological factors but postconcussive symptoms of vestibular, somatic, anxiety, depression nor cognitive could not be predicted in this way. (5)

These articles highlight the close connection between vestibular disorders and psychological status and should be assessed by clinicians and appropriately addressed for optimal outcomes.

1) 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 vestibulardisorders. J Vestib Res. 2017 Nov 10. doi: 10.3233/VES-170627. [Epub ahead of print]

2) 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

3) 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.

4) 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.

5) Sullivan KA1, Edmed SL, Greenslade JH, White M, Chu K, Lukin B, Lange RT, Lurie JK. Psychological Predictors of Postconcussive Symptoms Following Traumatic Injury. J Head Trauma Rehabil. 2017 Oct 27. doi: 10.1097/HTR.0000000000000347. [Epub ahead of print]

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

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. 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 (1).

The second abstract discussed the diagnostic criteria for PPPD. 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 (2). Patients with PPPD also show significantly lower mean scores than normal individuals on conditions 2-6 of the Sensory Organization Test and the composite, and lower than patients recovered from an acute vestibular syndromes on conditions 2-3. Recovered patients had significantly lower mean scores than normal individuals on conditions 4-6 and the composite. Patients with PPPD had the greatest likelihood of abnormal sensory analyses (3).

Recent physiologic and neuroimaging data suggest that greater reliance on visual cues for postural control 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. This final abstract tested for altered activity in vestibular and visual cortices during self-motion simulation. 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 (4).

1. 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.

2. 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.

3. 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.

4. 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

Summary of March 2018 Topic: CSM Recap

There were four articles highlighting topics presented at CSM 2018. The first article describes a framework for clinical decision making in the acute setting. TiTrATE is an algorithim for assessing dizziness based on timing, triggers, targeted exam and tests. The goal of TiTrATE is to optimize accurate diagnoses. (1)

The next article addressed the question: Should youth who have sustained a concussion always be symptom free prior to returning to sport? The article established occurrence rates of symptoms such as excessive fatigue, headache and anxiety in the youth general population. The goal was to examine if youth who have who have sustained a concussion might have symptoms that occur typically post-concussion even at baseline. This study established that youth in general have do have post-concussion type symptoms at baseline; therefore it is not necessarily true that concussed youth should be symptom free prior to return to sport. (2)

The next was a systematic review, included 14 articles, looking at the potential benefits of treating posterior canal BPPV with multiple sessions as well as multiple Epley maneuvers in a single session. The rate of success increased to 100% after 5 sessions and success increased from 84% with one repositioning to 92% after 3 were performed in a single session. Overall, repeating the Epley at least twice and multiple sessions achieved the greatest benefit. (3)

The final article looked at the use of Maddox rod test to assess cyclotorsion. The study demonstrated the subjective test may have a high level of assessor and subject error and results could misinform the clinician's clinical decision making. (4)

1.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.

2. 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.

3. 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.

4. 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.

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

The benefits of exercise physical activity are widely known. This past month's abstracts sought to look at how physical activity may affect the vestibular system.

The first abstract looked at the effect of exercise in migraines. The aim of the study was to investigate the efficacy and possible anti-inflammatory benefits of exercise in patients with vestibular migraine. They found the group undergoing exercise training showed significant symptomatic improvement and demonstrated suppressed antioxidant enzyme activity (1).

The second abstract compared the effects of galvanic vestibular stimulation (GVS) on postural control for participants of different physical activity status - active and non-active. The main results indicated 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 study concluded active participants could identify the relevant sensory input, thought a better central integration, which enables them to switch faster between sensory inputs (2).

Another abstract investigated the relationships between motion sickness susceptibility (MSS) in adulthood and physical and sporting activities (PSA). Subjects having practiced a sport before the age of 18 have less MSS than the other subjects. By practicing PSA, subjects are less dependent on visual input and use vestibular afferences better (3).

The final abstract study aimed to evaluate physical activity-related benefit on vestibular function. They concluded starting physical activity has immediate beneficial effects on the vestibule, in terms of vestibular stimulation mechanisms these effects soon disappear if this activity is stopped (4).

1. 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.

2. 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.

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

4. 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.

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

The May topic was visual considerations in vestibular rehabilitation. The first article developed the Pediatric Visually Induced Dizziness Questionnaire (PVID) to measure the visually induced dizziness in children. Nearly 300 subjects were included, healthy subjects and those with vestibular or migraine disorders. The PVID was found to be a valid measure to identify visually induced vertigo. (1)

The next article examined the connection between migraine and convergence insufficiency. Four cases were used to highlight this connection in cases where patients with migraines reported difficultly reading and persistent eye strain; convergence insufficiency may have played a role. (2)

Next, the study sought information from the Vestibular/Ocular Motor Screening (VOMS) that could indicate a prolonged recovery post-concussion in youth. Based on a retrospective chart review of 167 patients, all VOMS domains except convergence and accommodation deficits were associated with prolonged recovery. It was proposed that the VOMS could be used to help prognosticate recovery in addition to quantify deficits. (3)

The next article aimed to use visual examination as a biomarker for the presence of concussion. Patients with concussion were compared to healthy controls. Average constriction velocity (ACV), average dilation velocity (ADV) and near point convergence were found to significantly affected in those with acute concussion and therefore could be used to help diagnose the presence of concussion. (4)

The final article looked at the role of contrast lighting in the adaptation of the VOR. They found that adaptation was optimized when using a contrast threshold of ~ 1000 during VOR retraining. They note that this optimal level of contrast is far greater than what typical room light provides. (5)

1. 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.

2. 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.

3. 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

4. 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.

5. 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.

Summary of June 2018 Topic: Migraine

This past month's studies focused various symptoms associated with migraine and the effects vestibular rehabiliation can have on those symptoms, as well as other disorders associated with migraine. The first study aimed to compare the effects of vestibular rehabilitation on headache and other outcomes relating to dizziness, and the psychological factors in patients with vestibular migraine, patients with dizziness and tension-type headache, and patients without headache. Vestibular rehabilitation contributed to improvement of headache both in patients with vestibular migraine and patients with dizziness and tension-type headache, in addition to improvement of dizziness and psychological factors (1).

The aim of the second study was to compare anxiety disorders in 3 groups: patients with vestibular migraine (VM), patients with migraine but without vertigo (MO) and healthy controls (HC). The study showed 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 (2).

Recent studies have looked at the response of patients with Mal de Debarquement Syndrome (MdDS) to management with migraine prophylaxis, including lifestyle changes and medical therapy. One study found that management of MdDS as vestibular migraine can improve patients' symptoms and increase the quality of life. In addition, 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(3).

Currently, there are no known definitive diagnostic tests that can reliably distinguish between Meniere's Disease and Vestibular Migraines, their differentiation is often difficult. Future studies are needed to help adequately distinguish the diagnosis of both diseases (4).

1. 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.

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

3. Ghavami Y1, Haidar YM1, Ziai KN1, Moshtaghi O1, Bhatt J1, Lin HW1, Djalilian HR1,2. Management of mal de debarquement syndrome as vestibular migraines. Laryngoscope. 2017 Jul;127(7):1670-1675. doi: 10.1002/lary.26299. Epub 2016 Oct 12.

4. 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.

Summary of July 2018 Topic: Unilateral Vestibular Hypofunction

The topic for July was unilateral vestibular hypofunction. The first article sought to assess the efficacy of vestibular rehabilitation with this patient population. The authors performed a systematic review including 39 articles representing over 2000 patients with unilateral vestibular hypofunction. The evidence was compelling that vestibular rehabilitation is effective in managing patients with unilateral vestibular hypofunction. (1)

The next article looked at the testing to diagnose hypofunction. It compared caloric testing, the historical gold standard, to video head impulse test (vHIT). 324 patients with unilateral hypofunction were given caloric and vHIT. 12% had an abnormal vHIT while 35% had an abnormal caloric testing. A positive vHIT had a high positive predictive value of an abnormal caloric test. Therefore, the vHIT does not replace caloric testing but is a good clinical test for screening of unilateral hypofunction. (2)

The next article aimed to gain information about the functional differences between those with unilateral or bilateral hypofunction and those who did not. 24 subjects were tracked in their gait

patterns and eye gaze during stair climbing and descending. Patients with hypofunction looked more at the structure, ie- stairs or ramp.(3)

The final study examined gait mechanic differences between those with unilateral vestibular hypofunction and healthy subjects. Subjects walked on a treadmill with over 30 joint position sensors. The hypofunction group had a wider step width and decreased stability. (4)

1. Is vestibular rehabilitation effective in improving dizziness and function after unilateral peripheral vestibular hypofunction? An abridged version of a Cochrane Review. Hillier S1, McDonnell M. Eur J Phys Rehabil Med. 2016 Aug;52(4):541-56. Epub 2016 Jul 12.

2. Determining vestibular hypofunction: start with the video-head impulse test. van Esch BF1, Nobel-Hoff GE2, van Benthem PP3, van der Zaag-Loonen HJ4, Bruintjes TD4. Eur Arch Otorhinolaryngol. 2016 Nov;273(11):3733-3739. Epub 2016 Apr 25.

3. Patients with chronic peripheral vestibular hypofunction compared to healthy subjects exhibit differences in gaze and gait behaviour when walking on stairs and ramps. Swanenburg J1,2, Bäbler E1,3, Adelsberger R4, Straumann D5, de Bruin ED3. PLoS One. 2017 Dec 18;12(12):e0189037. doi: 10.1371/journal.pone.0189037. eCollection 2017.

4. Characterizing Patients with Unilateral Vestibular Hypofunction Using Kinematic Variability and Local Dynamic Stability during Treadmill Walking. Liu P1,2, Huang Q2, Ou Y2, Chen L2, Song R1, Zheng Y2. Behav Neurol. 2017;2017:4820428. doi: 10.1155/2017/4820428. Epub 2017 Jul 13.

Summary of August 2018 Topic: Optometric Examination

This past month's abstracts covered topics related to eye movements that maybe helpful in determining vestibular pathology during examination.

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 is commonly caused by ischemia of the posterior paramedian pons, medial thalamus, or cerebellum. When the vestibular nuclei are involved, skew deviation may occur with acute vestibular syndrome. (1).

In addition to a skew deviation, ocular tilt reaction (OTR) may be present and 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 (2)

A review of literature published from January 2016 to August 2017, looked at nystagmus 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 (3).

Finally the use of video head impulse test (vHIT) gains and corrective saccades (CSs) at the acute and follow-up stages of vestibular neuritis were assessed. 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 (4)

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

2. 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.

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

4. 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.

Summary of September 2018 Topic: Vestibular Paroxysmia

The September abstracts' topic was vestibular paroxysmia (VP). One article outlines the diagnostic criteria for VP which requires: ten or episodes vertigo lasting less than 1 minute; stereotyped phenomenology; response to carbamazepine/oxcarbazepine; and not accounted for by another diagnosis. Important diagnostic differential include Meniere's disease, vestibular migraine, BPPV, stroke, fistula and others. The criteria for probable VP was also described. (2)

Another article described the clinical presentation of 3 pediatrics with VP. Nystagmus can be observed during an episode and MRI may reveal compression. VP Should be considered in pediatrics with multiple brief daily episodes of vertigo. (3)

The first article summarized the treatment of VP which primarily is medication, carbamazepine or similar. There are other medication classes available if the above mentioned is not successful. If the symptoms do not respond to medication, a decompression surgery is available to relieve the pressure of the 8th cranial nerve most commonly caused by a loop of the anterior inferior cerebellar artery. Surgery is reserved for intractable cases. (1)

The final article was a study to evaluate the efficacy of oxcarbazepine with a RCT, 18 patients included. The medication group had a significant reduction in episodes and no adverse side effects were revealed. (4)

1. 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.

2. 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.

3. 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.

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