Vestibular Rehabilitation SIG

American Physical Therapy Association/Neurology Section

In this Issue:

Message from the Chair

Susan L. Whitney
Vestibular SIG Chair

Dear Vestibular SIG members,

It was a pleasure to see so many members of the SIG present at CSM! The meeting was very busy thanks to the programming efforts of Drs. Anne Galgon and Julie Tilson, who was the former Vice Chair of the Vestibular SIG last year. Thanks go to both of them for the great programming - Julie for setting the ground work last year and to Anne for her follow thru and execution of the planned programming.

The Vestibular SIG has a great team working for you. We continue to publish the abstract of the week, thanks to Dr. Becky Olson-Kellogg and her talented team of abstract reviewers. In addition, April Hodge has joined us as the new director of our Facebook page. We are trying to communicate to people in multiple ways. We are starting to try to develop a line of communication through either the list serve or Facebook related to each abstract topic of the month. We hope that you either join in or "listen" to the conversation on the web.

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For more information go to:
http://www.neuropt.org/go/special-interest-groups/vestibular-rehabilitation

Combined Sections Meeting 2011
Vestibular SIG Programming Highlights

Pre-conference course:

- **Expanding Neurologic Expertise: Advanced Practice in Vestibular Physical Therapy**
  - Course speakers—Rene' D Crumley, PT, DPT, NCS; Michael Furtado, PT, DPT, NCS, CBIS; Colin R Grove, PT, MS, NCS; Janet O Helminski, PT, PhD; Janene M Holmberg, DPT, NCS; Kristen M Johnson, PT, MS, NCS; Karen H Lambert MPT, NCS; Laura O Morris, PT, NCS; Anne Mucha, PT, MS, NCS; Michael C Schubert, PT, PhD; Susan L. Whitney, PT, DPT, PhD, NCS, ATC, FAPTA

A diverse and experienced group of clinicians and researchers coordinated by Susan Whitney presented the preconference course at CSM 2011 on Advanced Practice in Vestibular Rehabilitation. The group dynamically discussed the latest advances in Vestibular Testing, including such novel devices as the Bucket Test of subjective visual vertical to the clinical application of accelerometers for gait and postural sway. The presenters further covered topics of atypical BPPV to complex central cases and concussion through case-based discussion. The course was designed to address advanced vestibular clinical practice from home care to specialized balance clinics, and is highly recommended to practicing therapists who wish to stay on top of the latest developments in research and clinical practice. Look for this course as a part of the Neurology Section's Advanced Clinical Practice series for upcoming dates and locations.

Vestibular SIG sponsored programming:

- Managing Vertiginous Migraine: Practical evidence-based care
  - Speaker: Janene Holmberg, PT, DPT, NCS

Dr. Holmberg presented a dynamic and informative talk covering the differential diagnosis and management of individuals with vertiginous migraine. She further offered considerations and insights to clinicians who may encounter these clients.

- *Thank you to all of our sponsors who donated the various door prizes at this year's SIG business meeting, from textbooks to journal subscriptions and infrared video goggles!*

- Vestibular Roundtable Discussion—Interpretation of Vestibular Function Tests: Applications in Vestibular Rehabilitation
  - Speakers: Richard Clendaniel, PT, PhD; and Michael Shubert, PT, PhD; Patrick Sparto, PT, PhD

Drs. Clendaniel, Shubert and Sparto rounded out the vestibular programming this year with a presentation on the practical understanding and interpretation of such vestibular tests as VNG, calorics, rotary chair testing and VEMP, with the focus of applying such knowledge to treatment considerations.

Cervicogenic Dizziness: Clinical Application of CSM 2011 Educational Programming

Donna Pelligrini, MSPT
Good Shepherd Penn Partners—
Penn Therapy and Fitness
Philadelphia, PA

Rob Landel, PT, DPT, OCS, CSCS presented at CSM 2011 on Cervical Pain and Cervicogenic Dizziness. As you may recall, Dr. Landel presented on this topic last year for the Vestibular SIG. This year, he presented a program sponsored by the Orthopedics section. Once again, this was a very popular and well attended session. Dr. Landel offered multiple ideas that were quite easy to take back to the clinic and start using immediately. I happened to be treating a patient with cervicogenic dizziness during that time, and was very happy with the new skills that I was able to bring back and use immediately. My objective in this article is to share with you my three favorite new areas of assessment and intervention for this patient population. This is not an attempt to cover all of the concepts that Dr. Landel addressed in his lecture.

As we go through these concepts, I will refer to the above-mentioned patient several times. To give you a little background, here is some more information about her: She is a 34 year old registered nurse who, prior to injury, worked full time on a heme/onc floor in a busy tertiary care hospital. She sustained a neck injury while at work, was moved to light duty in an administrative office. She had months of orthopedic physical therapy, and an epidural injection several months after injury. Interestingly, her dizziness began *after* the epidural. She continued to have outpatient orthopedic PT, and although her neck ROM and pain improved, her dizziness did not. When I met her for vestibular rehabilitation, she was having 7/10 dizziness for at least one fourth of each day. Her Disability score was a 4/5 and her Dizziness Handicap Inventory score was 24/100.

Among the main areas of assessment and intervention covered by Dr. Landel were a) postural control, b) balance, c) impaired muscle function, d) neck movement control, and e) joint position error. Most vestibular therapists have the first two down cold. Postural control and balance training ***are*** our specialties. In the other three areas, however, I at least, had some room for improvement.

Impaired Muscle Function—

The easiest concept for me to grasp regarding impaired muscle function was that patients with decreased cervical muscle endurance (primarily extensors) may also have increased sway (Stapely et. al. 2006). The idea of progressing beyond cervical isometrics to prolonged position-holding was new to me. Upon my return to the clinic, I immediately timed my patient's cervical extensor and flexor endurance, and we implemented the corresponding interventions into her routine. You can assess cervical extensor muscle endurance by having your patient in a prone-on-elbows position with the spine and head held in a neutral position, or flexor endurance by lying in supine with the neck flexed. Then time how long he or she can maintain the position. Can he hold the position for 30 seconds or two minutes? (There do not seem to be standardized norms for this measure, but it is anticipated, for example, that athletes will have or will require greater endurance than a sedentary retiree. So, we should consider our patients' daily activities when working on this area.) Although flexor muscle endurance has been deemed relevant, the emphasis in the educational program and research seemed to be on extensors. Therefore, in the short time I had with my patient, I chose to focus on extensor muscles. As described by Dr. Landel, we worked on cervical extensors in a prone-on-elbows position, keeping her head and neck in neutral alignment. Once she was able to hold this position for three minutes without difficulty, we progressed to using a yellow

Cervicogenic Dizziness, continued

Theraband over the back of her head which she held with her hands for mild resistance (see fig. 1). We also progressed to off-neutral positions with position holding in a slightly flexed or extended position (fig. 2a & 2b) and in small amounts of lateral flexion.

Figure 1

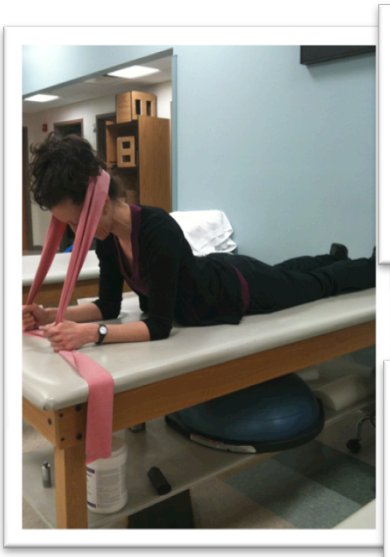


Figure 2a

Figure 2b

Neck Movement Control

The idea that the neck has fine motor control, like an ankle, was also an easy to understand take home message. In the way we train the muscles of our patients with ankle sprains, we may also want to consider the fine and nuanced movement that the neck must perform throughout the day. This is not a very difficult impairment to address. Using a laser pointer attached to your patient's head, you can have him or her trace any variety of designs you may scheme up – including the alphabet, just like those good old ankle exercises (fig. 3). Try this and see if your patient has any difficulty staying on the lines, fatiguing, or changing speeds. Since I did not yet have one of Dr. Landel's lovely laser pointer headlamps, I went to Wal-Mart, got a inexpensive laser pointer for about $5, and stuck it to my patient's head with an elastic headband (fig. 4). I just taped the "On" button down whenever we used it. As she got better at tracing, I made the designs more challenging and had her try to increase her speed.

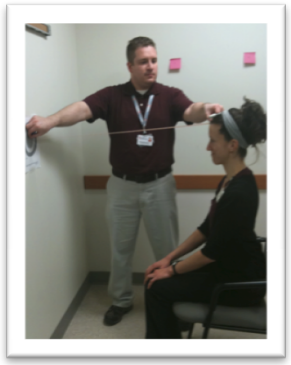
Figure 3

Figure 4

Joint Position Error

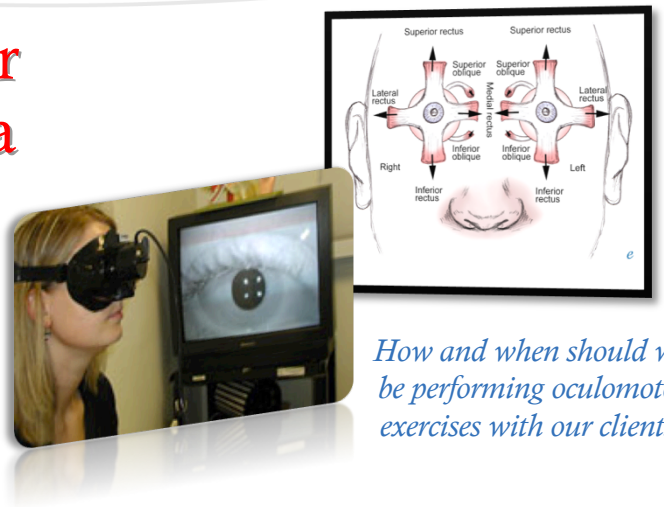
Joint position error (JPE) speaks directly to the notion of incorrect afferent information from the cervical spine contributing to a sensory mismatch which can result in dizzy symptoms. If you have rotated your head 10 degrees to the right, but your brain registers it as 15 degrees, this could cause a problem. Thankfully, Dr. Landel has provided us with a tool to easily assess JPE at his website: www.skillworks.biz/news?mode=PostView&bmi=520810.

Utilizing the calibrated target, which you can print from the above site, and your inexpensive laser pointer with headband, have your patient sit so that the crown of his head is 90cm from the target.



The patient starts by centering the laser on the bull's eye of the target, then closes his eyes and rotates his head all the way to the right. Then he tries to return his head to the initial position and get back to the center of the target without opening his eyes. Being 90cm from the target, greater than a 4.5 degree error (outside of the yellow area on the target) may indicate impairment. This same assessment tool can be used for training and for showing improvement (Revel 1994). Certainly you can have the patient work on right and left rotation; in addition, you can also try flexion and extension as well as multiple movement combinations (but your patients, like mine, may not appreciate this last one much). Concluded on page 8

Treatment of Oculomotor Disorders: Part three of a three part series on Oculomotor Control



How and when should we be performing oculomotor exercises with our clients?

Michael C. Schubert, PhD, PT
Associate Professor
Johns Hopkins School of Medicine
Dept of Otolaryngology Head and Neck Surgery

Physical therapists have long treated oculomotor disorders of varied pathologies using oculomotor exercises. The justification for this has likely been based on the adopted principal that 'repetition is the mother of learning'. And that is a safe motto to presume. Recent biomedical research is expanding our knowledge of mechanisms responsible for behavior and we have the opportunity to develop treatment strategies that are physiologically based, which may improve our clinical outcomes.

Recent data suggest a few guiding principles of motor learning within the oculomotor systems:

1) Multiple time scales of learning exist, with different rates of both learning and forgetting (seconds, minutes, hours, days, and months). Once those memories are forgotten, relearning a similar task may be faster.

2) Learning is influenced by the pattern of training, and rest periods appear to improve retention.

3) Different contexts require different motor behaviors; learning is often uniquely paired with the environmental circumstances it occurred in.

4) The brain has the difficult task deciding where blame resides when motor performance is impaired [i.e. is my oscillopsia the result of the environment (e.g. bumpy road) or damage to the eighth cranial nerve?].

5) The cerebellum is essential for adaptation of most motor control systems; data suggest at least some normal function of specific lobes in the cerebellum is responsible for modulating unique oculomotor learning (i.e. flocculus for vestibulo-ocular reflex gain, VOR).

Smooth pursuit

Evidence for adaptation within the pathways mediating smooth pursuit is clear. Various human and animal studies have shown pursuit can be modified within a short time of exposure to adapting stimuli. More studies have been conducted studying pursuit learning using healthy models, though some evidence exists in brain pathology and vestibular hypofunction.

Patients with unilateral visual spatial neglect, as a result of a right medial cerebral artery CVA, can improve their ability to read and perform certain writing tasks after completing 30 min of making active pursuit eye motions while being exposed to an optokinetic stimulus (e.g. rotating disco light pattern). In this study, data showed that the pursuit learning was robust enough to transfer to tasks not trained (Keller et al 2009).

An earlier study showed five patients with unilateral brain injury had improved pursuit gain (eye velocity/target velocity) compared with an untrained group, within 3-10 weeks of training. The control group showed no change (Gur and Ron 1992).

Patients with bilateral vestibular

Treatment of Oculomotor Disorders, continued

hypofunction (BVH) had a mean pursuit gain that was ~ 10% higher than controls. In addition, the BVH patients had higher pursuit velocities than the controls (Bockish et al 2004). Finally, patients with lateral rectus muscle paresis can increase acceleration in the paretic eye during pursuit tasks (Optican et al 1985).

One mechanisms alleged responsible for these training results in smooth pursuit include optokinetic nystagmus (OKN) pathways activating the undamaged left hemisphere and then—via callosal fibers—consecutively reactivating the damaged right hemisphere (Doricchi et al 2002). Another suggested neural mechanism involves recruitment of healthy central neurons from pathways mediating optokinetic afternystagmus within the brainstem (regardless of central or peripheral pathology). Did you know that neurons within the primate brainstem can continue to fire for more than 30 seconds after termination of OKN (Waespe and Henn 1977)? This too, might enable the recovery process, perhaps by providing a prolonged 'training' stimulus. Finally, signals modulating pursuit gain are also modified by VOR adaptation, which implicates the cerebellar floccular complex (Carey and Lisberger 2004; Medina and Lisberger 2009).

Saccades

Numerous human and animal studies verify the saccade oculomotor system too is exceptionally modifiable. Adaptation of the saccade system is commonly done by asking subjects to look quickly (i.e. make saccades) between two targets (horizontally or vertically placed). As the subject begins to move the eyes towards the second target, the target changes position. A target that is moved further away will increase the amplitude (gain) of the saccade; while a target that is placed closer will reduce the gain. Recently, healthy subjects were exposed to targets that asked them to move their eyes horizontally, towards a 2nd target that then 'jumped' vertically. Within minutes, the subjects learned to make oblique saccades in response to a horizontal target displacement (Chen Harris et al 2008). This system is also context specific, meaning different saccade gains can be recruited dependent upon a unique condition. For example, vertical eye position can be used to increase saccade gain when looking up and reduce the gain when looking down (Tian and Zee 2010).

Patients with vestibular hypofunction substitute compensatory saccades (CS) to augment the diminished VOR (Schubert et al. 2006; Weber et al 2009). CS reduce gaze position error associated with active or passive head impulses and occur spontaneously (Schubert et al 2010). The frequency and amplitude of CS increase as head velocity increases and are related to severity of vestibular hypofunction: Patients with unilateral vestibular hypofunction (UVH) due to intratympanic gentamycin injection generate about three times as many covert saccades as normal controls, but only half as many as patients with unilateral surgical deafferentation (Weber et al 2009). Those patients with transient vestibular hypofunction use much less CS when the vestibular nerve recovers (Schubert et al 2006). CS are also modifiable with training. During dynamic visual acuity testing, chronic UVH patients used a mean 40 ± 13% more CS during the acuity task than during no target head rotations (Schubert et al 2008). These findings support the notion that CS should become part of an adaptive strategy for vestibular loss, which can be recruited with rehabilitation exercises

Optometrists may also prescribe saccade exercises as part of an oculomotor exercise program. Data suggest reduced saccade latency (DiRusso et al 2003) and improved saccade function in reading (Seiple et al 2005) and sports (Jafarzadehpur et al 2007) with practice.

Changes in brainstem, superior colliculus, cerebellar vermis, and fastigial nuclei occur with saccade adaptation. Lesions in the oculomotor vermis, cerebellar hemispheres, and thalamic relay cause abnormal saccade adaptation (Kojima et al 2010).

Treatment of Oculomotor Disorders, continued

VOR

Image motion on the retina during head motion – retinal slip—is the primary error signal that drives adaptation of the VOR. The amplitude of the VOR can be made to increase or decrease depending on the direction of the motion of the target relative to the motion of the head. The duration of exposure is also important for the consolidation of new learned behavior; exposure to retinal slip for minutes to hours will increase the VOR gain from 10% – 35% vs. 60% to 100% when the adaptation stimulus lasts hours to days. Interestingly, learned low gains are more resilient; they required hours of up training for restoration, to baseline. Learned high gains, however decay spontaneously, only requiring minutes of down training to return to baseline (Boyden and Raymond 2003; Kuki et al 2004). These data suggest the VOR has two time scales for learning and reversal, in part, depending on whether the adaptive change is up or down (Boyden and Raymond 2003). Adaptive changes in the VOR gain to retinal slip are greater when the error signal is gradually incremented than presented in its entirety (Schubert et al 2008a).

Other VOR adaptation error signals include position errors, imagined motion of the target, and after images (images flashed that remain imprinted on the retina after removal). Exposure to persistent optokinetic stimulation without concurrent head rotation may also drive VOR adaptation. Current hypotheses propose both the brainstem and the cerebellum are important regions for VOR adaptation. Experimental animals undergoing VOR adaptation show changes in neural activity in the flocculus and nodulus (vestibulocerebellum) of the cerebellum, as well as portions of the vestibular nuclei that receive projections from Purkinje cells. Lesions in the cerebellar flocculus impair adaptation of the gain and the direction of the VOR, while lesions in the nodulus abate the ability of the brain to store the head motion signal.

The oculomotor systems show a remarkable degree of adaptive flexibility. Data suggest when the VOR is inadequate pursuit, saccades, and any residual VOR can work together to maximize gaze stability. Animal studies suggest retinal slip during head rotation is necessary to increase the gain, and new memory persists with continued exposure. Human data suggests the deficient VOR can be entrained up using small retinal slip error signals, yet how long this learned behavior can be retained without additional training is unknown. As expert clinicians managing gaze instability, our challenge is to design training regimens that optimize these adaptive strategies.

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Message from the Chair, continued from page 1

Our newest efforts relate to developing pod casts. Dr. Rachel D. Trommelen recently joined us and is working with Dr. Bob Wellman and Laura Morris to bring you some exciting pod casts. They are in the planning stages but watch for them to come to the web soon. The pod casts will be announced on www.neuropt.org <http://www.neuropt.org/> and also on the abstract of the week.

The physician fact sheets have been posted thanks to the very hard work of Dr. Shannon Hoffman. She pushed all of us to do a good job with the fact sheets. We hope that you are using them to educate physicians about what a physical therapist has to offer for a person with balance and vestibular deficits.

The patient fact sheets are available to you in English, Arabic, Spanish, Portuguese and Chinese. We hope that you use them in your practice to help patients better understand their vestibular disorders. We have new fact sheets planned based on your feedback from a doodle survey that we conducted in the fall. The pod cast idea and new fact sheets were generated from the feedback of the respondents.

Dr. Gottshall has been working on pushing out the word about payment for the new CPT code for the canalith repositioning procedure. Look for information on www.neuropt.org <http://www.neuropt.org/> . She has posted the most up to date information with the help of the APTA staff from the Department of Practice.

The advanced pre-instructional vestibular course had close to 200 people registered. It was a great crowd who were very interested in the content. Thanks go to the 13 speakers and Dr. Fell and Dr. McCulloch who worked so hard to make this course happen in New Orleans. There are tentative plans for the course to be offered again in the fall in Denver and Boston.

This has been a very fast 3 years for me since I was elected as Chair of the Vestibular SIG. I have greatly enjoyed working with the entire team and have learned so much from all of my friends.

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Cervicogenic Dizziness, continued from page 4

Conclusion

This article includes just a small sample of the concepts and skills taught by Dr. Landel at this year's CSM Educational programming. However, the techniques described above were, from my perspective, the ones that were easiest to implement immediately. They also seemed to prove quite effective, when I discharged the young woman I described to you earlier, she stated, "This stuff really works!" Her symptoms were not completely eradicated but her Dizziness Handicap Inventory did decrease from a 24/100 to a 6/100 (meeting the MDC of 18), her Disability Score was reduced to a 1/5, and her symptom intensity rating went down to a 4/10 lasting less than five seconds and occurring less than one time per week. Most importantly, she was able to return to work as a floor nurse and resume an active lifestyle with her husband.

Recognizing impairments and incorporating treatments aimed at making improvements in neck muscle endurance, movement control and joint position error seem to play a huge part, not only in the care of this young woman, but in the rehabilitation of many of our patients with cervicogenic dizziness.

Call for Nominations for Spring 2012!

Melissa Bloom, PT, DPT, NCS

It's about that time of year again, when the summer days are long and hot and you find yourself thinking about how to get more involved in your Vestibular Rehabilitation (VR) SIG. If you are looking for a way to get more involved, serving as VR SIG officer is a great way to do so!

The positions of Secretary and a member of the Nominating Committee are up for election next year. Volunteering as VR SIG officer is an excellent opportunity to get involved in the APTA leadership and to grow as a clinician. It is an exciting time to get involved with the SIG as we have taken on several new projects recently. In the upcoming year we will be working on VR specific podcasts and cell phone Apps.

Meetings occur monthly in the form of conference calls. During these calls we discuss information affecting vestibular rehabilitation and the therapists who perform it. Past topics have included: billing, Medicare rules, current laws and research, patient/physician fact sheets, the International Neurological Physical Therapy Association, CSM program planning, and new guidelines for clinical practice. We also continually work to make the VR SIG useful for our members.

If you are interested in running, or if you know someone you would like to nominate, for one of these positions, contact any member of the nominating committee and we will send you an application. We look forward to hearing from you!

The SIG Secretary is responsible for:

- Maintaining records of all SIG meetings and conference calls
- Submits minutes of all SIG meetings to SIG officers and the Executive Officer
- Attends the SIG meeting with the section Vice President at CSM
- Assists the Chair in preparation and submission of a yearly plan for the SIG to the Board of Directors
- Coordinates updating of Policy and Procedures Manual with the Vice President of the Neurology Section

The Nominating Committee is responsible for:

- Preparing a slate of candidates for open SIG positions each year
- Helping to coordinate and facilitate the election process
- The senior member of the Committee serves as Chair of the Committee (the third year of service

Both positions require that candidates have been Neurology Section members for at least two years.

Thank you and Welcome!

Melissa Bloom, PT, DPT, NCS

The Vestibular Rehabilitation (VR) SIG would like to recognize Debbie Struiksma, PT, NCS for her recently completed 3-year term as Nominating Committee Chair. We would like to thank her for all of her hard work, leadership, time, and dedication to the VR SIG. Debbie has been an invaluable resource to the team. She is planning to remain active in the VR SIG to assure its' continued growth. Thank you Debbie, for all that you have done!

We would also like to thank Susan Whitney, PT, PhD, NCS, ATC, FAPTA for her past 3-years of service as SIG Chair. Sue has also been an invaluable leader and resource for the VR SIG. We would like to congratulate on her on her re-election for another term. She has been instrumental in the development of multiple projects, VR SIG advancement, and has been a strong advocate for the VR SIG membership.

The VR SIG is excited to welcome our newest officer, Jennifer (Jen) Nash, PT, DPT, NCS, who has been elected as Nominating Committee member. She will join the team in recruiting the future leadership of the VR SIG. Jen has worked in various neurological PT settings over the past 12 years in Scottsdale, Arizona and more recently Henderson, Nevada. Within the past 2 years, she has narrowed her focus to patients with vestibular impairments. This August she will take on a new role, with her first academic position as assistant professor in the School of Physical Therapy at Touro University in Nevada. She is excited for this new path in her career and eager to increase her contribution to the VR SIG. Outside of work, Jen enjoys spending time with her family and participating in triathlons—the next of which will be her first half ironman in July. Welcome Jen to the VR SIG leadership team!

VR SIG now on Facebook!

April Hodge, PT
VR SIG Communications Coordinator

The Vestibular Rehab SIG is now on **Facebook!!** You can use Facebook to easily track what's new with the SIG.

To become a follower of the page, type in "Vestibular Rehab SIG" in your Facebook search engine and click "Like" once you get to the page. We hope this resource helps you stay up to date with the latest SIG information.

Looking ahead…