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Vestibular Injury:

Compensation, Decompensation, and Failure to Compensate

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The balance system of the inner ear and brain can be damaged in many ways. Viral infections (labyrinthitis and vestibular neuritis), disorders that affect the fluid levels in the inner ear (Ménière's disease and endolymphatic hydrops), trauma from head injury, benign tumors (acoustic neuroma), and degeneration of the balance organ cells with aging can all cause permanent damage to the balance organ or balance nerve.

When the balance system is damaged, it has little ability to repair itself. The body recovers from the injury by having the part of the brain that controls balance re-calibrate itself to compensate for the unmatched signals being sent from the damaged and well ears. This compensation process occurs naturally in most people. Some patients require help from vestibular rehabilitation therapy in order to recover from an injury to the balance system.

Acute (Immediate) Compensation

When a sudden injury occurs to one side of the balance system, the patient may feel very sick for hours to a few days with a spinning feeling, unsteadiness, lightheadedness, and often sweating, nausea, and vomiting. This is because the signals being sent from the two balance organs are no longer equal and opposite, and the brain interprets the difference as constant movement. Researchers theorize that after this initial period, the brain recognizes that the signals being received from the ears are incorrect and turns the signals off through a process called the cerebellar clamp. When the clamp is in place, the spinning and much of the 'sick' feeling improve. The patient feels unsteady while standing though, because the balance organ signals normally used to maintain balance have been turned off. The patient may also report dizziness or blurred vision with movements. Vision and proprioception (the sense of pressure at the bottom of the feet) are also used to maintain balance, so the patient can walk but will feel unsteady and may fall in the dark or on soft or bumpy floors like thick carpet, grass, or gravel.

At this point, most patients are well enough to get out of bed and visit a doctor. The doctor sees a person who is not spinning but whose gait is ataxic. If the patient is not given an opportunity to clearly describe what has happened, he or she may be immediately referred to neurology to rule out stroke because of this ataxic gait.

If balance testing is performed during the acute (immediate) compensation phase,

test results may incorrectly suggest that the patient has damage to both sides of the balance system, because the cerebellar clamp reduces the eye movements that are looked for during balance testing. The cerebellar clamp may persist for days to a few weeks after the initial injury.

Chronic (Long-Term) Compensation

During the acute compensation phase, the cerebellum slowly releases the clamp, gradually allowing more signals from the balance organs to pass to the balance areas of the brain. As the brain receives these signals, it fine-tunes the mathematics performed to interpret the information, in order to account for the difference between the ears. The brain must receive signals from the balance organs to be able to modify its interpretation of these signals.

For most patients, the movements made during normal daily activities are enough to achieve chronic (long-term) compensation, usually in two to four weeks after the injury has occurred.
Once the chronic compensation process is complete, the patient is essentially symptom-free. If unsteadiness and/or motion provoked dizziness persist after that time, compensation is not complete and the physician may prescribe a program of vestibular rehabilitation therapy (VRT).

VRT is a treatment program administered by a specially-trained physical therapist. It is designed to provide small, controlled, and repeated 'doses' of the movements and activities that provoke dizziness in order to (1) desensitize the balance system to the movements, and (2) enhance the fine-tuning involved in long-term compensation. VRT is most effective when administered by a physical or occupational therapist who has special training and specializes in this unusual form of therapy.

Decompensation

It's important to remember that even after the symptoms go away, the balance system remains injured, and the brain has simply adapted to the injury. For many patients, dizziness will return months or years after compensating for a balance system injury. It is critical for the physician to find out what type of dizziness the patient has. If the patient describes another severe attack of spinning with unsteadiness and nausea lasting hours to days, this suggests that a second injury has occurred to the balance system, such as another viral infection or an attack of Ménière's or endolymphatic hydrops. These conditions require diagnosis and medical treatment. If the patient reports that dizziness occurs after particular movements and lasts seconds to a few minutes, this suggests decompensation.
Decompensation simply means that the brain has 'forgotten' the fine-tuning procedure it developed during the chronic compensation phase described above.

Events that can provoke decompensation include a bad cold or the flu, minor surgery, long vacations, or anything that stops normal daily activity for a few days. Recovery after decompensation is exactly like the recovery that occurs during the chronic compensation phase.
Movements and activities are the stimuli the brain needs to fine-tune the system. In our balance

center, we routinely counsel patients to keep their VRT exercise program instructions in a drawer even after they recover so that they can begin the exercises immediately if symptoms return. Usually recovery after decompensation is quicker than the recovery after the initial injury to the balance system.

Failure to Compensate

Two things are required in order to compensate for an injury. First, the brain must receive signals from the balance organs. This means that movements must not be avoided, because movements create the signals the brain needs to compensate for the injury. Secondly, the balance areas of the brain must be capable of change.

During the early stages of dizziness, many physicians counsel their patients to avoid quick movements and reduce their activities. Most patients will be prescribed one or more anti-dizziness medications such as Antivert (meclizine), Valium (diazepam), Xanax, Phenergan, or Compazine. This is fine during the acute stages of a dizziness problem in order to reduce the dizziness symptoms that persist for hours or days even when the patient is not moving. However, once the acute phase is past, inactivity and medications can interfere with the long-term compensation process. Any medication that makes the brain sleepy, including all of the anti-dizziness medications, can slow down or stop the process of compensation, so they are often not appropriate for long-term use. Most patients who fail to compensate are found to either be strictly avoiding certain movements, using anti-dizziness medications daily, or both. Treatment includes VRT, gradual reduction, and eventual elimination of these medications.

Brain damage caused by stroke, head injury, etc., can slow down or stop the natural compensation process. It is difficult to predict which patients with brain injury will improve or how much, so all patients should be given the chance to improve through a VRT program. In our balance center, we use several different measures of symptoms and functional capabilities in order to assess progress repeatedly as treatment goes on. As long as a patient continues to show improvement, even if it is gradual, treatment should be continued.