HIGH DEFINITION PHYSICAL THERAPY
9785 S. Maroon Circle, STE 157, Englewood, CO 80112
phone: 303-792-0670 fax: 303-790-4576

WHAT IS THE VESTIBULAR SYSTEM & HOW DO YOU TREAT VESTIBULAR ISSUES?

Vestibular System Function

The primary function of the vestibular system is to tell your brain where you are in both space and time. The primary function of the brain is to control the body which it cannot do properly if it does not know where it is in space and time. The brain performs a variety of secondary functions such as thinking and processing information, but its primary role is to control the body. Due to the importance the brain puts on knowing where it is in space and time, the information produced by the vestibular system is of upmost importance to the brain.

Components of the Vestibular System

There are two main divisions of the vestibular system 1) the peripheral vestibular system, and 2) the central vestibular system.

The peripheral vestibular system is in the inner ear and consists of three fluid filled canals that inform the brain about where it is in space and whether the body is moving. Additionally, at the opening of these canals there is a membrane with crystals on it (think pebbles on top of Jello) that move with the body and inform the brain about acceleration, deceleration and position relative to gravity. With a large enough acceleration or deceleration force, like that of which a blow to the head can produce, these crystals may become dislodged and enter in to the canals. When the crystals enter the fluid filled canals it causes improper information about where the body is in space and time to the brain and the brain becomes confused. The incorrect signal to the brain causes dizziness, nausea and other symptoms.

The central vestibular system is located in the brainstem and is responsible for processing the information from the peripheral vestibular system and compares it to information from your vision to determine where we are at in space and time. When any part of this system gets disrupted, like what occurs from a large blow to the head or body, the communication between the vestibular system, the visual system and the brain is disrupted.

Effects of a Disrupted Vestibular System

The brain is very good at making up for disruptions in normal functioning and will use other systems to determine where it is in space when the vestibular system cannot. Typically, the brain will rely more heavily on vision and sensors in the joints of the body to make up for the lack of information being received from the vestibular system. When this occurs, the brain must use more energy to determine where it is in space as well as control the body leading to fatigue.

Every brain has a limit to how much energy it can use and how much stress it can tolerate. When we wake up in the morning our stress level is low, and our energy reserves are full, as the day progresses we respond to daily activities which move us closer to our maximum stress limit. In a

healthy brain, we never get close to reaching our maximum stress level, which allows us to function without difficulty. With vestibular dysfunction the energy needed to just run basic brain functions is more and we function closer to our maximum stress threshold. When we meet our maximum stress threshold the brain does its best to decrease the amount of stress we expose ourselves to by giving us headaches, poor concentration and other symptoms. This occurs because your brain is too busy trying to figure out where you are in space and time and has no capacity left for thinking and processing the environment.

The most interesting part about the brain, vestibular system and visual system relationship is it gets disrupted in predictable ways and can be put back together using these three systems. At HDPT we utlize diagnostic tests to determine where in the vestibular system (central or peripheral) the dysfunction occurs and how your body is compensating to make up for the incorrect information. With this informatin we are then able to create an individualized treatment plan to correct the dysfunction.

Diagnostic Testing

We use a videonystagmography (VNG) to determine if you have a central or peripheral vestibular dysfunction and a balance test to look at how your body is compensating. Further questions concerning diagnostic testing should be directed towards your therapist. From these tests we are able to establish a treatment plan unique to your dysfunction.

Treatment Process

After your initial evaluation we set up the necessary diagnostic tests for you and perform them. Once we get the results, we bring you in for a consultation concerning the results and outline your treatment plan. Although plans are individualized, here is a typical HDPT rehabilitation plan.

1. **Multi-axle rotational chair by Ultrathera:** This chair can spin 360 degrees forward and backward as well as 360 degrees side to side and is utilized to rehabilitate central and peripheral vestibular issues.
    a. **Peripheral vestibular dysfunction:** If a crystal is dislodged and goes in to the canal we use the chair to reposition it on the membrane by using gravity and momentum with a process called the Barany Maneuver. The Barany maneuver typically takes 2 treatment sessions to be effective with a minimum of one-day rest and a maximum of one-week rest in between treatment sessions. If there is a peripheral vestibular dysfunction we address this before we address any central vestibular dysfunction.
    b. **Central vestibular dysfunction:** In order to rehabilitate central dysfunction, we need to stimulate the brain to a point where it begins to heal itself (a process known as neuroplasticity). The brain will heal itself in response to appropriate stimulation by either repairing pathways or creating new ones. The chair allows us to stimulate the vestibular system while also stimulating the brain and visual systems to repair central dysfunction. We use a 3-2-2 treatment cycle (Central TRX) to accomplish this. The 3-2-2 treatment cycle occurs over a three-week time period in which we have 3 treatment sessions in 3 consecutive days the first week and 2 treatment sessions a week with a day of rest in between for the last 2 weeks.

2. **Exercises: Performed during the 3-2-2 cycle**

In order for full rehabilitation to occur, we also include exercises designed to rehabilitate the visual and balance systems that have been disrupted. This is done through a variety of exercises in the clinic and at home and will be directed by your treating therapist.

Below is an example of a treatment program for an individual with peripheral and central vestibular dysfunction

Week	Monday	Tuesday	Wednesday	Thursday	Friday
1	Evaluation		Diagnostic Tests	Free consult about results	
2	Barany Maneuver 1		Barany 2		
3		Central TRX 1	Central TRX 2	Central TRX 3	
4	Central TRX 4		Central TRX 5		
5	Central TRX 6		Central TRX 7		
6	Rest/No treatment	Rest/No treatment	Rest/No treatment	Rest/No treatment	Rest/No treatment
7	Repeat diagnostic Tests		Review of Results (free)		

Factors Impacting Recovery

There are some factors involved in recovery that we can control (for example time spent in front of TV screens) and some that are simple out of our control (for example how fast your body naturally heals). Below is a list of factors we have found can be barriers to speedy recovery and things we ask you to consider while undergoing treatment. If you have any further questions about this list, please ask your therapist.

- ✓ Compliance with treatment protocol: We have used evidence and past experience to develop this protocol and have found the best results when patients adhere to the above noted treatment schedule. We understand things come up and are ready and willing to work with you but understand our best results come with the above noted treatment schedule.
- ✓ Stress: Life continues even when you are recovering from an injury and to a certain extent we cannot eliminate stress from our lives completely; however too much stress can impede recovery. During your treatment cycle we ask that you try and limit stress to your brain to the best of your ability.
- ✓ Screen time: Light from screens (TV, computer, cell phone) is highly stressful to the brain. Although we understand that currently we cannot avoid screens completely, we ask that you try and reduce your screen time to allow for the greatest potential for recovery.
- ✓ Use of THC/marijuana and alcohol: Research suggests that use of THC/marijuana and alcohol can stunt the brains ability to heal itself after injury and we recommend that you refrain from using these substances throughout your entire treatment cycle.