Objectives

• Vestibular Assessment
• Vestibular Rehabilitation
• Progression of Vestibular Exercise
Vestibular System

- Vestibulo-spinal Reflex (VSR)
- Vestibulo-ocular Reflex (VOR)

Functions
- Postural Stability
- Gaze Stability
- Sensory Integration

Impairments
- Dizziness
- Unsteadiness/sense of motion
- Blurred Vision
- Headache
- Nausea
Prevalence of Vestibular Symptoms with Concussion

• 90% of children with concussion had 1 or more abnormal balance and vestibular findings (Zhou et al)

• 69% of adolescents with concussion also had a visual diagnosis (Master et al)
  – Accommodative Disorder (Focusing)
  – Convergence Dysfunction (Viewing near target without double vision)
  – Saccadic Dysfunction (eye motion)
• Dizziness
  – Motion Provoked: Head movement, Bending, changing direction
  – Visually provoked: Busy patterns, watching motion, busy environments
  – Positional Sensitivity: supine<>sit, sit<>stand
  – Eye Motion: Visual tracking

• Imbalance

• Difficulty Reading
  – Blurred vision
  – Eye strain
  – Headache and fatigue

• Neck Pain: Cervicogenic Dizziness
# Vestibular Ocular Motor Screen

<table>
<thead>
<tr>
<th>VOMS Test</th>
<th>Not Tested</th>
<th>Headache 0-10</th>
<th>Dizziness 0-10</th>
<th>Nausea 0-10</th>
<th>Fogginess 0-10</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Symptoms</td>
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<tr>
<td>Smooth Pursuits (eyes move, head still) stand 3 ft away, follow PT fingertip in H pattern, 2 reps, 2 seconds/rep-eyes only</td>
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<tr>
<td>Saccades - Horizontal (eyes move, head still) stand 3 ft away, PT 2 fingertips 3 ft apart 10 reps as quickly as possible-eyes only L/R</td>
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<tr>
<td>Saccades - Vertical (eyes move, head still) stand 3 ft away, PT 2 fingertips 3 ft apart 10 reps as quickly as possible-eyes only up/down</td>
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<tr>
<td>Convergence (Near Point) PT/pt holds 14 point font &quot;x&quot; on tongue depressor move slowly until sees double or eyes turn out measure 3x in cm from end of nose</td>
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<tr>
<td>VOR-Horizontal (eyes on target, head moves) pt holds 14 point font &quot;x&quot; on tongue depressor 10 reps, rotates head 20 deg R/L @ 180 bpm</td>
<td>&lt; 5 cm = normal</td>
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<tr>
<td>VOR-Vertical (eyes on target, head moves) pt holds 14 point font &quot;x&quot; on tongue depressor 10 reps, rotates head 20 deg up/down @ 180 bpm</td>
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<tr>
<td>Visual Motion Sensitivity (VMS) 5 reps, rotate thumb/eyes/head/trunk together 80 deg @ 50 bpm</td>
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</table>
• Ability of the eyes to smoothly follow a slow moving target with the head stationary

• Normal eye pursuit is smooth
• Abnormal pursuit is choppy and can increase symptoms
Saccades

• Ability of the eyes to move quickly and accurately between targets with the head stationary

• Normal – good ability to track without symptoms

• Abnormal – poor symmetry, nystagmus, increase in symptoms
Convergence

- Ability to view a near target without double vision
- 14 point font target on a tongue depressor
- Abnormal is when one eye turns outward or the patient reports double vision > 5 cm from the end of nose
The ability to stabilize vision as the head moves

Screen
- Head turns 20 deg R/L at 180 beats/min while maintaining focus on target
  - Test is abnormal if eyes slip off target or reports blurred vision and target motion
  - Repeat in vertical direction
- Dynamic Visual Acuity Test (DVAT)
  - Using Snellen eye chart the patient reads the lowest line within their comfort
  - 20 deg of head turns R/L are performed at 120 bpm
  - A 3 three line or greater move on the Snellen chart is considered abnormal
Visual Motion Sensitivity

- Test visual motion sensitivity
- Head, eyes and trunk all move together while following a visual target
- The patient stands with feet shoulder width apart
Vestibulo-spinal Assessment Tools

- SOP
- Functional Gait Assessment
- DGI
- BESS
- Positional Sensitivity Assessment
Gans Sensory Organizational Performance Test

- Feet together EO, EC
- Tandem EO, EC
- Foam EO, EC
- FUKUDA – 20 to 50 marches. Abnormal = spin or drift
### PROVOKED VERTIGO TEST

**FUNCTIONAL MOVEMENTS AND POSITION CHANGES**

**Name:** __________________________  **Date:** __________________________

<table>
<thead>
<tr>
<th>Baseline Symptoms</th>
<th>Comment</th>
<th>Intensity</th>
<th>Duration</th>
<th>Nystagmus</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sitting→head rotation</td>
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<tr>
<td>2. Sitting→head flex. And ext.</td>
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<tr>
<td>3. Sitting→supine</td>
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<td>4. Supine→left side</td>
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<td>5. →right side</td>
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<td>6. Supine→sitting</td>
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<td>7. Sitting→nose to left knee</td>
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<tr>
<td>8. →Sitting right ear on right shoulder</td>
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<tr>
<td>9. Sitting→nose to right knee</td>
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<tr>
<td>10. →Sitting left ear on left shoulder</td>
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<tr>
<td>11. Sit→stand</td>
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<tr>
<td>12. Standing→turn right 360°</td>
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<tr>
<td>13. Standing→turn left 360°</td>
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<tr>
<td>14. Standing→bend to floor left</td>
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<tr>
<td>15. →standing</td>
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<tr>
<td>16. Standing→bend to floor right</td>
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<tr>
<td>17. →standing</td>
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<tr>
<td>18. Left Hallpike (modified/standard)</td>
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<td>19. →sitting</td>
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<tr>
<td>20. Right Hallpike (modified/standard)</td>
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<td>21. →</td>
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<td>22. Other</td>
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</table>

**Intensity:** Scale from 0-10 (0= no sx, 10= severe sx)  **Total # positive:** _______

**Duration:** Scale from 0-3 (5-10 sec= 1, 11-30 sec= 2, >30 sec= 3)

__________________________

Therapist Signature

Vestibular-ocular Assessment

- VOMS
- DVAT
Goals of Vestibular Therapy

- Decrease Dizziness and Visual Symptoms
- Improve Balance
- Increase Activity Level
- Return to Work, Academics, Reading
- Return to Sport
Principles of Vestibular Therapy

- Individualized Program
- Transient increase in symptoms are expected
- Modify exercise intensity as needed
- Sports specific/work specific
Cervico-vestibular Rehab

- Non-provocative ROM
- Postural education
- Strengthening and stretching for muscular imbalance
- Upper cervical manipulation?
- Upper cervical joint mobilization
General Guidelines for Vestibular Exercise

- Perform 2-3 times per day
- Exercise should not increase headache a ½ level on the pain scale
- Exercise may provoke dizziness.
- If dizziness reaches a level of 5-7/10 make modifications to reduce intensity of exercise
  - Decrease reps
  - Decrease speed
  - Perform sitting vs standing
VOR Progression

- Sitting
- Standing
- Decrease base of support (stand shoulder width to feet together, modified tandem to true tandem etc.)
- Altered surface
Balance Progression

- Level surface
- Base of support
- Altered surface
- Single leg stance
- Static to dynamic
Clinician-Directed Program

• Adaptation
ROLL BODY AGAINST WALL

1. Have the patient stand with their back against a wall. Instruct them to take their right shoulder off the wall and turn to the left until the front of their body is against the wall.

2. In a similar manner have the patient take their left shoulder off the wall and turn to the left until their back is again against the wall.

3. Have the patient continue Steps 1 and 2 until they have moved down the wall to its end. At this point instruct the patient to stop and regain their balance.

4. Have the patient return to the starting position and repeat this activity for a specified number of times.

NOTE: This protocol is most effective when the patient rolls into the side of the weaker vestibular system.
1. Have the patient sit comfortably in a chair and begin moving their head in a circular motion with their eyes open.

2. Specifically, the patient is to first place their chin on their chest, then left ear on their left shoulder, move their head to a backward (looking up) position, right ear on right shoulder, and finally return their chin to their chest.

3. Assist the patient in making this motion as fluid as possible for a specified number of head rotations.

4. After the patient becomes comfortable with this activity have them reverse the direction of rotation.

5. With time the patient is to attempt the above procedure with eyes closed.
RAMP

1. Assist the patient onto the ramp.

2. Instruct them to gradually step, shifting their weight side to side, up the ramp while keeping their feet slightly apart.

4. The patient is to try not to look down.

5. When they get to the ramp's edge the patient is to look down and carefully step off.

6. The protocol may be performed in reverse.
OBSTACLE COURSE

1. Set up an obstacle course using chairs, pillows, trash can, and whatever else might be readily available. Some of the objects should be small enough so that the patient can step over them and still see them to turn at.

2. The patient is then instructed to walk the obstacle course in a specified route or pattern.

3. As the patient progresses, have them pick up and carry the smaller objects.

4. In time change the course so that it doesn't become routine and to add difficulty you may, following instruction, toss a ball to the patient for them to catch as they walk.
WALK - STOP

1. Have the patient begin walking approximately 10 feet and then have them stop abruptly at your command.

2. Allow the patient sufficient time to regain their balance.

3. Have the patient repeat this activity a specified number of times.
1. Instruct the patient to begin walking at normal speed.

2. After three steps have the patient turn their head and look to the right while continuing to walk straight ahead.

3. After three steps have the patient turn their head and look to the left while continuing to walk straight ahead.

4. Have the patient repeat this activity a specified number of times.
Progressive Walking Program

Your therapist has asked you to begin a walking program. This card is designed to help you begin your program and progress yourself to a maintenance level walking program. When you walk, walk briskly, but slow enough so you could carry on a conversation. Make sure your walk includes a warm-up and cool-down period. The warm-up period serves to help "warm-up" your heart in preparation for exercise. The cool-down period is extremely important in allowing your heart to gradually slow down to resting level. Finally, make sure you walk in a good pair of walking shoes.

WEEK 1

Goal: Walk 4 out of 7 days, build up to an 18 minute walk.

Day 1: Walk for 15 minutes straight, no more. Walk slowly (warm-up period) for 2 minutes, briskly for 11 minutes, and slowly (cool-down period) for 2 minutes.

Day 2 through 4: At a comfortable pace, walk one minute longer on each consecutive day so that by day 4 you are walking 18 minutes. Make sure you remember to spend the first and last 2 minutes walking slowly (your warm-up and cool-down periods).

WEEK 2

Goal: Walk 4 out of 7 days, build up to a 22 minute walk.

This week continue adding a minute each day until you are walking a total of 22 minutes per walk. Don't forget your warm-up and cool-down periods.

WEEK 3

Goal: Walk 4 out of 7 days, build up to 30 minute walk.

This week continue walking at your own pace, add 2 minutes each day until you are walking a total of 30 minutes. Your warm-up and cool down periods should be 3 minutes each. For example: walk slowly for 3 minutes, walk briskly for 24 minutes, and slowly for 3 minutes, 4 times a week.

WEEK 4

Goal: Maintenance walking progress with head exercises.

This week, continue your maintenance walking program and add gentle head exercises. Head exercises should be done twice during the "brisk pace" portion of your walk. Begin with your 3 minute warm-up period. During the first part of your 20 minute brisk pace walk, turn your head and look over your left shoulder, turn back to center. Repeat this motion 5 times. Continue walking 10 minutes, repeat the above head exercise.

NOTE: This protocol is to be used only with patients who have no medical contraindications.
VISUAL TRACKING EXERCISE

1. Give the patient a small index card with several words written on it and have the patient sit in a comfortable position. Instruct the patient to hold the card about 12 inches in front of their eyes. Another good target card is a playing card, preferably a face card, e.g., king or queen.

2. While keeping their head still and following the card only with their eyes, have the patient slowly move the card horizontally to the right, to the left, and back to center. Have the patient perform this action a set number of times, typically 15 - 20 times. This protocol should then be performed moving the card on vertical and diagonal planes.

3. As the patient progresses in ability have them move their arm at faster and faster speeds until they can no longer read the words. Remember they are to keep their head still during this exercise and follow the card only with their eyes.

(sample card)

I love chocolate
HORIZONTAL HEAD MOVEMENTS

1. Have the patient sit in a comfortable position, with their feet flat on the floor, hands on table or lap, and head facing straight forward.

2. While keeping their trunk still, have the patient quickly turn their head and look to the right, then turn and look to the left, and then return to center to the forward looking position.

3. Have the patient maintain this forward looking position for 5 seconds. After a pause have the patient repeat the action for a specified number of times.

4. For best results, the patient should focus on an object or target in each direction of the head turn including the forward position.
FOCUSING WHILE TURNING HEAD

1. Have the patient sit in a comfortable position and bring their index finger to approximately 10 inches from the front of their nose.

2. While focusing on their finger, have the patient turn their head from side to side.

3. Gradually have the patient increase the speed of the head turns.
TARGETS

1. Place the first of three targets 48 inches from the floor, on a wall opposite a chair located in the room. The remaining two targets should be positioned at the same height to the extreme right and the other to the extreme left of the chair, but not behind the chair.

2. Seat the patient in the chair referenced in Step 1.

3. Point out the three targets to the patient. Have the patient, turning only their head, look at the target to the left, then the one at center, and then to the target located to the right.

4. Have the patient repeat this activity 10 to 15 times without stopping.

5. When the patient is ready have them repeat the same exercises except they are to stop at each target.
1. Have the patient sit in a comfortable position, holding a small playing card, e.g., king or queen, in each hand, level with their eyes and about 18 inches apart.

2. Keeping their head still and without stopping between cards, have the patient look quickly from one card to the other. Have the patient perform this action for a specified number of times, typically 15 - 20 repetitions.

3. As the patient becomes familiar with this exercise have them perform the same action but in horizontal and diagonal directions.

4. Another way to increase difficulty is to have the patient focus on smaller details, i.e., noses, eyes, or mouth of the face on the picture card.
BALANCE BALL - EYES FIXED ON TARGET

1. Assist the patient to a sitting position on large physio ball. The patient's feet should be touching the floor and hands on side of the ball.

2. Once they feel comfortable sitting on the ball, have the patient slowly bounce on the ball. (You may want to have an assistant stand behind the patient.)

3. After the patient is comfortable with this activity, hold a small object approximately 12 inches in front of patient's eyes and tell them to focus only on this object while they resume the bouncing action.
GAZE STABILIZATION - VARIED SURFACES

1. While the patient is standing on an uneven or movable surface (i.e., trampoline, vestibular board, foam mat) have them focus on an object that you move in front of their field of vision.

2. Instruct the patient to maintain their balance while focusing on the object.

3. As the patient becomes confident in this activity very the exercise by moving the object in a vertical or diagonal motion.
BALL - CIRCLES

1. Have the patient stand in a relaxed, upright posture, weight equal on both feet. Instruct them to hold a ball with both hands, arms straight out from the body, and to keep their eyes on the ball at all times.

2. While keeping arms straight the patient is to move the ball in a large, complete, smooth, and continuous circle. The patient is permitted to move their head as well as their eyes in this activity, but is at all times to keep their eyes on the ball.

5. If dizziness increases with this activity, the patient should stop movement until feeling subsides, and then begin again.

6. This protocol is most effective when the patient moves into the direction of the weaker vestibular system.
Clinician-Directed Program

• Adaptation and Substitution
CIRCLE SWAY

1. Have the patient stand with their feet shoulder distance apart. Placing the patient with their back near a wall will provide additional security.

2. Patient should breath deeply and be encouraged to relax. The patient is to focus their thoughts on the feeling of their feet in contact with the floor.

3. Without bending at the hips the patient is to practice swaying their body in a small circle. The patient is to repeatedly sway forward, to the right side, to the rear, to the left side and forward again.

5. Have the patient gradually increase the size of the circle by moving their body farther each way, and without bending their hips or taking a step.

6. This protocol may be performed first with eyes open and then with eyes closed.
TRAMPOLINE WALK

1. Instruct the patient to slowly step up onto the trampoline, and provide assistance when necessary.

2. The patient is to keep their head up and eyes focused on a specified, fixed object that is located at eye level.

3. Beginning with small steps at first the patient is to gradually increase the stepping height and speed until they are almost marching.

4. Once the patient feels comfortable with the stepping motion, have them continue to step and then march with their eyes closed.
TRAMPOLINE - ANKLE SWAY

1. Assist the patient to the center of the trampoline.

2. Position the patient so that their feet are shoulder distance apart, with equal weight on both feet, arms relaxed at their side, and looking straight ahead.

3. Have the patient slowly and carefully shift their weight forward and then backward. All movement should be at the ankles and the patient should be encouraged not to bend at the hips.

4. Next, have the patient shift their weight from side to side, placing more weight first on the right side and then on the left. Again, encourage the patient not to bend at the hips.

5. This protocol may be performed first with eyes open and then with eyes closed.
BALL - SITTING

1. Carefully assist the patient into a sitting position on the ball.

2. Allow the patient to get their balance and to become as comfortable as possible.

3. The patient is to perform a rolling motion. First to the front and back, and then side to side.

4. After the patient is comfortable with the ball have patient lift their feet off the floor while maintaining balance.

5. Be sure to spot the patient from behind.
Clinician-Directed Program

• Substitution
BALANCE BEAM

1. Patient is to place their right foot onto the beam while instructor provides assistance.

2. Assist patient onto the beam and have them place their left foot in front of the right in a heel-to-toe pattern.

3. Have patient follow the path of the beam keeping one foot in front of the other.

4. If needed, allow the patient to extend arms out to their side for balance.
BALANCE BOARD EXERCISE

1. Making sure that their feet are placed in the center of the board, assist the patient to a standing position on the balance board.

2. While keeping their body erect and preventing bending at the hips, have the patient gradually lean forward. (The board will move forward with the patient.)

3. Have the patient gradually lean back on their heels and come back to the center position.

4. Have the patient continue leaning back farther on their heels while the front of the board comes up.

5. Have the patient lean forward without bending at the hips and come back to the center position.

6. To use as a horizontal protocol versus anterior-posterior, simply reposition the board. The patient proceeds through Steps 1-5 from side to side.
BALL - KICKING

1. Place the patient in a corner of the room, near the wall, with a foam mat as a backdrop to help ensure their safety.

2. Instruct the patient that a ball will be slowly rolled toward them and that upon approach of the ball they are to kick it back to you with the side or top of their foot, whichever is most comfortable for them. Advise them that it is important that they keep a wide stand and find their center of gravity before attempting to kick the ball.

3. Once the patient is comfortable and well balanced, gently roll the ball toward them.

4. Upon successfully completing this action and once the patient feels comfortable with it, instruct the patient to try taking two steps to the side before kicking the ball back.
BALL TOSS

1. Following instruction, standing off to the side and at a moderate distance from the patient, gently toss a ball across the patient’s front.

2. The patient is to attempt to catch the ball as it passes before them.

3. As the patient gains success in catching, toss the ball to different positions so that the patient must take additional action before catching the ball, i.e., taking a step, bending, stepping side to side.
CROSS OVER STEP

1. Have the patient stand near a wall with their feet slightly apart.

2. Instruct the patient to cross their right foot in front of the left, hold it there for 5 seconds, and then return the foot to its starting position.

3. Repeat this action with the left foot.

4. Have the patient repeat Steps 2 and 3 repetitively for a specified number of times.
1. Place numbered 3x5 inch labels on the floor and arrange them according to one of the patterns shown below.

2. Instruct the patient to stand behind the base line as shown, to place the designated foot on the specified card as its number is called out, and then return their foot to the starting position.

3. Tell the patient which foot to use and call out number series of 2, 3, 4, or 5 numbers in a row while changing the number pattern with each repetition.
References


• Schneider et al Cervicovestibular rehabilitation in sport-related concussion: a randomized controlled trial. Br J Sports. 2014.


• Gans R, Vestibular Rehabilitation Seminar, The American Institute of Balance. 2005
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• Delete this slide.
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