Vestibular Rehabilitation Therapy (VRT)

Mohsen Ahadi
PhD Candidate in Audiology
Iranian Association of Audiology
www.iranaudiology.com
Definitions

• Vestibular Rehabilitation
• Vestibular Adaptation
• Vestibular Compensation
• Vestibular Habituation
Conventional Approaches

• Medical Treatment
• Surgical Stabilization techniques
• Observation, Reassurance & Counseling
VRT
an Alternating approach

• History

- Terrance Cawthorne, 1945
- Dr. F.S. Cooksey, 1945
- Hood, 1970
- Mc Cabe, 1970
- Hecker et al, 1974
- Norre & De Weert, 1980
- Margaret Dix, 1984

Basics: intended provocation of symptoms
Cawthorne-Cooksey

• Exercises scaled
  – From simple to difficult
  – From isolated parts (eye movement only, e.g.)
  – To generalized movement (eye & head, whole body)
Controversies in VRT

• Critical Period of Compensation
• Rehabilitation vs. Repositioning
• Vestibular Rehabilitation vs. Medication
• Generic vs. Customized Exercise
Basic Physiology

Actual Head Rotation

Leftbeating Nystagmus

Right Labyrinth

Left Labyrinth

A SCC
P SCC
L SCC

Vestibular Nuclei

Neural Firing Rate
per Nerve Fiber

Spikes/sec
Time

Spikes/sec
Time
Effects of UVD

- **Static Symptoms**
  - Spontaneous Nystagmus (Alex. Law)
  - Subjective Sensation of Vertigo
  - Postural Instability
  - Ataxia
  - Ocular Tilt Reaction (OTR)

- **Dynamic Symptoms**
  - Dysfunction of VOR
    - Oscillopsia
    - Visual-provoked disequilibrium
    - Motion-provoked disequilibrium
Treatment Strategies

• **Goals:**
  – To minimize symptoms and Functional disability
  – To Increase Mobility and Independence
  – To reduce the Risk of Fall and Injury
Treatment of Unilateral Vestibular Loss (UVD)

- Adaptation Therapy
- Goals
  - Promote tonic rebalancing
  - Decreasing symptoms through habituation therapy
  - Increasing Gaze Stability
  - Increasing Postural Stability
- Exercises
Exercises to Promote Recovery from Unilateral Loss*

Saccades: To promote accuracy and decrease latency of saccadic eye movements

Tracking: To promote smooth pursuit tracking ability and increase dynamic visual acuity with moving objects

Head movements: To promote habituation and (VOR) stability

Head movements with targets: To promote visual suppression of the VOR through a combination of saccadic and smooth-pursuit tracking

Focus head turns: To modify VOR gain and increase the stability of the VOR

Focus head turns, ×2: To modify VOR gain and promote VOR stability and interaction with the smooth-pursuit system

Ankle sways: To promote the appropriate use of ankle strategy for fall prevention, increase the limits of stability (LOS), increase leg strength, and increase translational VOR stability and center of gravity (COG) control

Circle sways: Same as ankle sways

Balance-ball bounce: To promote vertical VOR stability and hip strategy

Balance board: To promote the proper use of ankle and hip strategies for fall prevention; to increase awareness of proprioceptive input; to increase VOR stability and COG control

Ball circles: To promote VOR stability; postural stability and habituation

Ball kick: To promote eye–foot coordination; COG training for fall prevention (weight shifting) and visual tracking ability

Ball toss: To promote eye–hand coordination; COG training and visual tracking

Bend and reach: To promote VOR stability and habituation to vertical movements

Ball sitting: To promote vertical VOR stability and proper use of hip strategy

Crossover step: To promote gait control and one-legged balance for walking or climbing stairs

Face to knee: To promote habituation of movement and position induced vertigo

Foam walk: To promote gait control on an uneven surface

Obstacle course: To promote gait stability in real life situations

Roll against wall: To promote VOR stability and habituation

Sit to stand: To promote habituation of movement related dizziness; increase VOR stability and leg strength.

Standing: To promote static postural stability and COG control

Trampoline ankle sway: To promote use of ankle strategy on a compliant or uneven surface

Trampoline circle sway: Same as above

Trampoline walk: To promote gait stability on a compliant or uneven surface

Walk stop: To promote gait stability and standing balance when walking is interrupted

Walking with head turns: To promote habituation, VOR stability, sensory integration, and gait stability

Walking turns: To promote habituation, VOR stability, and gait stability
Treatment of Bilateral Vestibular Loss

• Substitution Therapy

• Goals
  – Promote the use of alternative sensory inputs
  – Promote Alternative gaze Stabilization Strategies
  – Teach the patient to recognize situation when alternative sensory information is unavailable
  – Provide information regarding fall hazards

• Exercises
Exercises to Promote Recovery from Bilateral Vestibular Loss

Walk stop: See Table 6–2
Ankle sways: See Table 6–2
Balance board: See Table 6–2
Balance beam: To promote increase in awareness of proprioceptive input and use of hip strategy
Ball circles: See Table 6–2
Ball toss and kick: See Table 6–2
Bend and reach: See Table 6–2
Crossover step: See Table 6–2
Foam walk: See Table 6–2
Imaginary targets: To potentiate the cervicoocular reflex.
Head movements: See Table 6–2
Moving saccades: To promote alternative gaze stability strategies.
Standing: See Table 6–2
Obstacle course: See Table 6–2
One-leg stand: To promote postural stability through weight shifting.
Roll against wall: See Table 6–2
Sit to stand: See Table 6–2
Stepping patterns: To promote eye-foot coordination and one legged standing.
Trace the alphabet: Same as above
Targets: See Table 6–2
Walking with head turns: See Table 6–2
Walking turns: See Table 6–2
Walk with your eyes open.

Walk with your eyes closed.

Walk with your eyes open, tilting your head up and down.

Walk with your eyes closed, titling your head up and down.
Walk on pillows, with your eyes open.

Walk on pillows, with your eyes closed.

Walk on pillows, with your eyes open, tilting your head up and down.

Walk on pillows, with your eyes closed, tilting your head up and down.
While seated, with eyes open, turn your head from side to side. First slowly, and then gradually increase speed according to your own pace.

While seated, with your eyes closed, turn your head from side to side. First slowly, and then gradually increase speed according to your own pace.

While seated, with eyes open, move your head up and down. Slowly and then gradually increase speed at your own pace.

While seated, with eyes closed, move your head up and down. Slowly and then gradually increase speed at your own pace.
While seated, with eyes open, turn your head to the right 45 degrees. Shake your head up and down.

While seated, with eyes closed, turn your head to the right 45 degrees. Shake your head up and down.

While seated, with eyes open, turn your head to the left 45 degrees. Shake your head up and down.

While seated, with eyes closed, turn your head to the left 45 degrees. Shake your head up and down.
Adaptive Strategies

• Cervical – Ocular Reflex Input ( COR )
• Modification of Saccades
• Modification of Smooth Pursuit
• Substitution of Sensory Inputs
• Decreasing Head Movement
Limits of Vestibular Rehabilitation

- Correcting Retinal Slip @ Head Speed > 2 Hz
- Unstable Lesions
- Cerebellar dysfunctions
- Other CNS abnormalities
- Visual, Musculoskeletal & Cognitive Deficits
- Patient Compliance
Benign Paroxysmal Positional Vertigo

Diagnosis of BPPV

History

- Rotatory vertigo
- Lasts < 30 seconds
- Precipitated by head movements

Dix–Hallpike manoeuvre (posterior canal BPPV)

- Brief latency (1–5 seconds)
- Limited duration (< 30 seconds)
- Torsional nystagmus toward downmost ear
- Reversal of nystagmus upon sitting
- Fatiguability of the response

Lateral head turns (horizontal canal BPPV)

- Geotropic nystagmus
- Apogeotropic nystagmus

Subjective BPPV

- Classic vertigo during positioning
- No nystagmus seen — repositioning manoeuvres still effective
• **Pathophysiology**

  Theory of *Cupulolithiasis*. (Schuknecht, 1969)

  Theory of *Canalithiasis*. (Hall, Ruby and McClure, 1979)
- Sequential computer-regenerated photographs taken from an intra-operative video of a fenestrated posterior semicircular canal.
- Note the single white conglomerate mass within the membranous duct (arrow) (left). Note how the mass has fragmented into tiny particles 2–3 minutes later, after the membranous duct has been probed (right).
Treatment of **Cupulolithiasis**

- **Semont / Liberatory Maneuver.**  (Semont, Freyss & Vitte. 1988)
- The “slam dunk” maneuver
Treatment of Canalithiasis

1. CRP (Canalith Repositioning Procedure)
2. CRM (Canalith Repositioning Maneuver)
3. Particle Repositioning Maneuver
4. Eply Maneuver (Eply, 1992)

Eply’s (1992) Original Description of CRP is as follows:

- Preliminary
- Preparation
- Maneuvers
- Oscillation
- Follow-up
Canalith Repositioning

• Posterior Canal (85-95% success)
  – Epley
  – Semont

• Horizontal Canal (100% success)
  – Barbecue Roll
  – Appiani
  – Casani (2002)
Treatment of Horizontal canal BPPV
Home Treatment of BPPV

- Brandt – Daroff Exercises (BDE)
Modified Eply Procedure ( MEP )
Table 2: Efficacy of the particle repositioning manoeuvre for posterior canal BPPV

<table>
<thead>
<tr>
<th>Reference</th>
<th>No. of patients</th>
<th>Success rate, %</th>
<th>Recurrence rate, %</th>
<th>Treatment sessions</th>
<th>No. of manoeuvres per session</th>
<th>Post-manoeuvre instructions</th>
<th>Mastoid vibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epley(^42)</td>
<td>30</td>
<td>80</td>
<td>30</td>
<td>Single</td>
<td>Multiple</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Epley(^42)*</td>
<td>30</td>
<td>100</td>
<td>NR</td>
<td>Repeated</td>
<td>Multiple</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Epley(^42)</td>
<td>14</td>
<td>93</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Li(^47)</td>
<td>10</td>
<td>30</td>
<td>NR</td>
<td>Single</td>
<td>Single</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Li(^47)</td>
<td>27</td>
<td>92</td>
<td>NR</td>
<td>Single</td>
<td>Single</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Blakley(^48)</td>
<td>16</td>
<td>94</td>
<td>NR</td>
<td>Single</td>
<td>Single</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Smouha(^49)</td>
<td>27</td>
<td>93</td>
<td>NR</td>
<td>Multiple</td>
<td>Multiple</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Wolf et al(^50)</td>
<td>102</td>
<td>93</td>
<td>5</td>
<td>Single</td>
<td>Single</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Herdman et al(^39)</td>
<td>30</td>
<td>90</td>
<td>10</td>
<td>Single</td>
<td>Single</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Parnes and Price-Jones(^43)</td>
<td>34</td>
<td>88(^+)</td>
<td>17</td>
<td>Multiple</td>
<td>Multiple</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Weider et al(^33)</td>
<td>44</td>
<td>88</td>
<td>9</td>
<td>Multiple</td>
<td>Multiple</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Steenerson and Cronin(^45)</td>
<td>20</td>
<td>85</td>
<td>NR</td>
<td>Multiple</td>
<td>Multiple</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Welling and Barnes(^51)</td>
<td>25</td>
<td>84</td>
<td>NR</td>
<td>Multiple</td>
<td>Single</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Harvey et al(^52)</td>
<td>25</td>
<td>68</td>
<td>20</td>
<td>Multiple</td>
<td>Single</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Lynn et al(^46)</td>
<td>18</td>
<td>61</td>
<td>NR</td>
<td>Single</td>
<td>Single</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: NR = not reported. Table adapted from Haynes et al.\(^31\)

*Multiple entries from the same reference indicate data extracted from a single study that used different treatments for different groups of patients.

\(^+\)Excluding patients lost to follow-up.
BPPV - Results

• Semont
  • 84% after one tx, 93% after two tx

• Epley
  • 100% with multiple maneuvers, Herdmann - 90%

• Brandt & Daroff
  • 98% after 3-14 days of tx

• Norre
  • 32% after one wk, 100% at 6 wks
VR Improves Daily Life Function

![Graph showing mean disability scores for various daily activities before and after VR treatment.](chart)
Outcome measurement

- Dizziness Handicap Inventory (DHI)
- Motion Sensitivity Quotient (MSQ)
- Berg Balance Scale
- The Activities-Specific Balance Confidence Scale (ABC)
- Vertigo Score Card
- Vertigo Symptom Scale
- Vertigo Handicap Questionnaire