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For the Professional

Balance and Dizziness

Introduction to Benign Paroxysmal Positional Vertigo (BPPV)

Interacoustics

Interacoustics Acoustics Vestibular Audiology Team:
Amanda Edwards, AuD, CCC-A, Education and Training Specialist, Starkey Hearing Technologies
Michelle R. Petrak Ph.D. CCC-A, Director of Clinical Audiology
Cammy Bahner, Au.D., Senior Clinical Audiologist

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Introduction to BPPV

About 50% of all dizziness is caused by inner ear disturbances, about 5% by medical and neurological problems each, about 15% by psychological disturbances and for the remainder of patients (about 25%), the diagnosis is unknown. Of the cases caused by inner ear disturbances, approximately 50% are directly related to benign paroxysmal positional vertigo (BPPV).

BPPV can be simply defined as a displacement of the otoconia within the vestibular system. BPPV is usually unilateral and can be a very easy disorder to detect. Patients with BPPV will present with a specific cluster of symptoms:

- A transient burst of nystagmus occurs with a change of the patient's head position.
- When the patient changes position of the head, there is a delayed onset of nystagmus of 2-20 seconds.
- The nystagmus fatigues after a several seconds.
- The patient will give a subjective report of vertigo during the display of nystagmus.
- The nystagmus reverses direction when the patient sits up.
- The nystagmus is less intense when the patient is immediately retested.
- The nystagmus of BPPV affecting the posterior or anterior semicircular canals will have a "rotary" or "torsional" component, and the nystagmus affecting the lateral canals will have a horizontal component.
- The condition responds well to treatment.

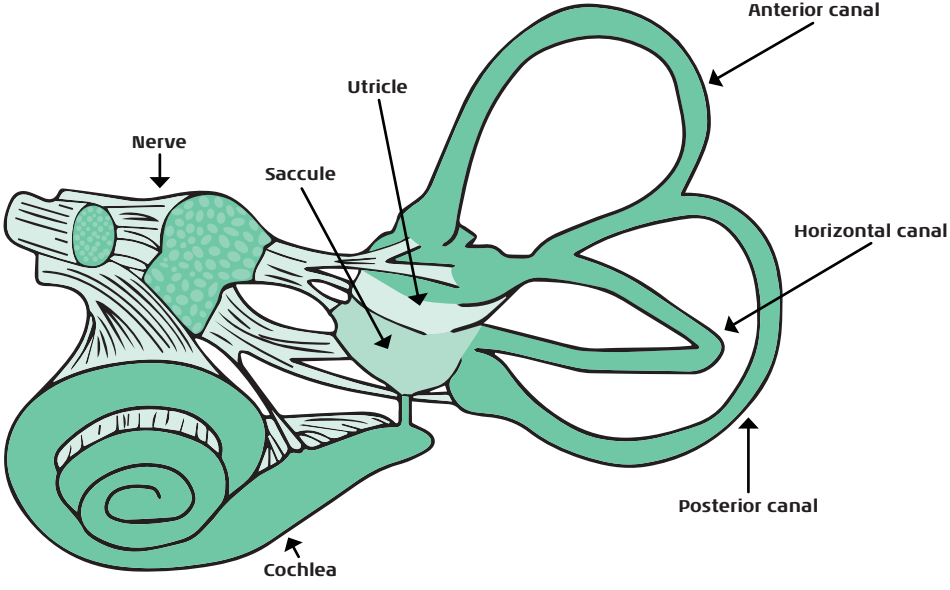
Anatomy of BPPV

To describe the pathology underlying BPPV, one must first understand basic vestibular anatomy. There are two vestibular systems housed within the skull – one on each side. These vestibular systems have an equal-but-opposite relationship that feeds information to the brain regarding the position of the head in space. In other words, if one of the vestibular systems is in an excitatory state, the vestibular system on the opposite side of the skull should be in an inhibitory state and should relay information to the brain that is equal in energy to that of the excited vestibular system.

The most obvious parts of the vestibular systems are the utricle, the saccule and the three semicircular canals. Each of these organs feeds information to nerve cells and nerve fibers which, in turn, relay information to the brain. The three semicircular canals are the anterior canal (sometimes called "superior"), the posterior canal and the horizontal (lateral) canal. Each canal is named for their position within the skull and each canal corresponds to the three dimensions in which we move – so each canal is responsible for detecting a particular movement.

Displaced otoconia are responsible for BPPV. Otoconia are defined as "calcareous particles which are inorganic crystalline deposits composed of calcium carbonate or calcite". Put more simply, Otoconia are tiny crystals that have enough mass and weight to sink to the bottom of whichever organ they happen to be in and put pressure on sensitive nerve fibers that relay information to the brain. To understand the underlying pathology of BPPV, you must understand that Otoconia are supposed to be contained within the utricle and the saccule – NOT in the semicircular canals. BPPV occurs when Otoconia escape from the utricle and/or saccule and fall into one of the semicircular canals, sending inappropriate sensory information to the brain.

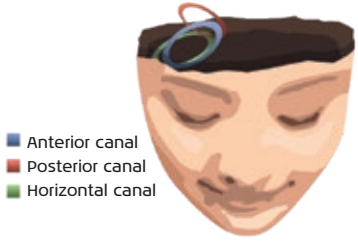
The Vestibular System

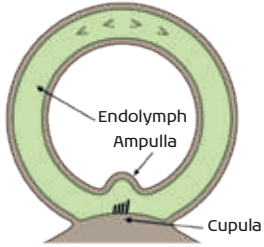


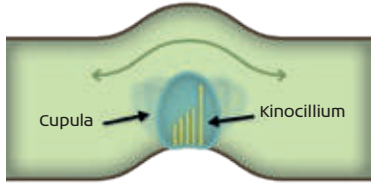
Anatomy of the Semicircular Canals

Each semicircular canal is loop-shaped and filled with a viscous fluid called "endolymph". This fluid has a consistency that is slightly thicker than that of blood. It is the motion of this endolymph and the resulting fluid displacement that tells our brains when we are moving.

Within each semicircular canal, there are motion-detecting systems comprised of the ampulla, the cupula and the kinocillium (hair cells) imbedded in the cupula. When there is a change in the speed of head movement, inertia causes the endolymph to lag behind and results in a "push" onto the cupula. Pushing in one direction causes an excitation of nerve fibers while pushing in the opposite direction will cause an inhibitory response of the nerve fibers. Remember, the bilateral semicircular canals have a push-pull relationship so that if one side is in an excited state, the other side should be in an inhibited state so that there is equal-but-opposite function.







Intake Interview

As an audiologist or physical therapist, you should be able to recognize when there is an abnormality within the patient's semicircular canals. In general, any time a patient mentions the term "dizziness" or "lightheadedness", you can suspect that may be wrong with at least one of the patient's semicircular canals. Common patient descriptions of BPPV are: "When I lie down at night, I feel dizzy", "When I roll over in bed, the room starts to spin" or "When I look upward, I lose my balance". All of these complaints involve a change in the position of the patient's head, which is causing changes in the status of the semicircular canals.

Factors that put a patient at greater risk for BPPV are head trauma, inner ear infections, recent illness and history of endolymphatic hydrops (commonly called "Meniere's Disease"). However, the greatest risk factor for BPPV is the patient's age. Elderly patients patients are more prone to BPPV because their vestibular system begins to break down (as do all other systems within their body), increasing the likelihood for Otoconia to escape from the utricle/saccule and to migrate into the semicircular canals.

Other factors that can increase the effects of BPPV are stress, depression, caffeine intake and alcohol.

Facts about BPPV

- BPPV is usually a unilateral condition with an 80-96% probability of posterior canal involvement.
- BPPV often co-exists with other vestibular disorders, such as Meniere's disease, migraine, vestibular neuritis, labrynthitis or a unilateral weakness of unknown etiology.
- Geriatric patients may still report feelings of imbalance, even after BPPV has been treated, due to normal neural degradation.

Preparation for the Diagnosis of BPPV

A video Frenzel goggle or a Videonystagmography (VNG) goggle is now accepted as the gold-standard product for testing for BPPV. Because of the minute and quick eye movements associated with BPPV, the higher the resolution of the video cameras, the better the quality of the resulting images and tracings. The goggle used should be light-tight. If the patient can see any light coming through the goggle, reposition the goggle.

Testing for BPPV should be done on a flat surface (usually a table) that will enable the patient to hang his/her head during the procedure. The surface should be wide enough for the patient to roll 360°, if necessary.

A thorough intake interview is imperative prior to beginning any of the BPPV maneuvers. Ensure that the patient has not eaten immediately prior to the examination. The examiner should have an emesis basin readily available. It is not unusual for the patient to have a strong reaction to the test procedure and sometimes they can vomit as a result. It is necessary to know whether the patient has a history of neck or spine injuries. It is important to probe for signs of neurological impairment such as blurred vision, numbness of the extremities, weakness in the arms/legs or mental confusion. If the patient reports neck/spine injuries, if the patient is not ambulatory or if the patient presents with neurological symptoms, it may be necessary to slightly alter the diagnostic process or to refer to a neurologist prior to the diagnostic process. Allow sufficient time for each of the maneuvers, considering that certain tests involve three or four individual steps that can take 2-3 minutes each.

Perhaps most importantly, remember that the patient can lose postural control during these maneuvers. You should always position yourself so that you can safely provide support to the patient throughout each maneuver.

Diagnosis of BPPV

NOTE: Most research suggests that, due to the nature of BPPV, you should begin your evaluation by testing the suspected side of involvement first.

The two most common maneuvers for diagnosing BPPV are the Dix-Hallpike Maneuver for assessing the posterior and anterior canals and the Head Roll Test for assessing the horizontal canals.

During any of these procedures, the examiner is looking for the presence of BPPV identifiers that were mentioned in the beginning of this booklet. As a reminder, they are:

- A transient burst of nystagmus that occurs with a change of the patient's head.
- The nystagmus will have a "rotary" or "torsional" component when the posterior or anterior canals are involved and a horizontal component when the lateral canals are involved.
- There is a delayed onset of nystagmus of 2-20 seconds.
- The nystagmus fatigues after several seconds.
- The patient will give a subjective report of vertigo during the display of nystagmus.
- The nystagmus reverses direction when the patient sits up.
- The nystagmus is less intense when the patient is immediately retested.

Left Beating Nystagmus

Upward Beating Nystagmus

Torsional Nystagmus

Dix-Hallpike Maneuver for the Diagnosis of Posterior/ Anterior Canal BPPV

- Begin with the patient sitting length-wise on the table with just enough room on the table to support the body and shoulders so that the head can hang to the appropriate angle. **Figure 1**
- Turn the patient's head to the right or left (depending on which ear you suspect to be affected) 45° and then briskly assist them into a supine position with the head hanging (at least 20 seconds) and observe eye movements. **Figure 2**
- Finally, the patient is returned to a sitting position. If nystagmus is observed, the test is repeated to evaluate fatigability of the response. **Figure 3**

Figure 1: Patient seated with head turned 45º

Figure 2: Assist patient to supine position with head hanging

Figure 3: Return patient to a sitting position

- Reminder: It is IMPERATIVE to provide physical support to the patient at ALL times during the maneuver!

Helpful Hints for the Dix-Hallpike Maneuver

- Before performing any positioning maneuver, it is important to determine whether the patient has current or past injuries of the neck or spine.
- If neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- It is important to remember that the consistency of fluid inside the vestibular system is relatively viscous; therefore, you should allow sufficient time within each of the Dix-Hallpike maneuvers for the otoconia to achieve maximum displacement. This condition may also be responsible for a delayed onset of nystagmus.
- It is most helpful to utilize Frenzel lenses or video goggles while performing the Dix-Hallpike maneuver. This reduces the ability of the patient to fixate during the procedure in an attempt to reduce the nystagmus response. This will also allow the examiner to see even very slight horizontal nystagmus.
- The patient can lose postural control at the completion of the procedure due to the otoconia briskly falling within the cupula. It is vital that the examiner is in a stance that will provide the patient with postural support in this situation.
- It is common for the patient to tell you during the intake interview which ear is affected and will describe accurately the symptoms of BPPV. Use this information to determine which ear is likely the affected ear.
- ALWAYS test both ears, even if the patient complains of only one side being affected.

Roll Test for Diagnosis of Horizontal Canal BPPV

- Begin with the patient sitting length-wise on the examination table.
- Guide the patient into supine position. A slight elevation of the head (approximately 20º) is helpful. **Figure 1**
- Have the patient turn his head 90º to either side. If the patient does not have enough cervical flexibility to provide maximum displacement, have the patient roll onto his shoulder.
- Carefully observe whether nystagmus is present. Make note of the severity and the direction of the nystagmus.
- Guide the patient back into a neutral, supine position.
- Repeat the maneuver for the opposite side. **Figure 2**

Figure 1

Figure 2

Helpful Hints for the Roll Test

- Before performing any form of positioning maneuver, it is important to ascertain whether the patient has current or past injuries of the neck or spine.
- If neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- It is important to remember that the consistency of fluid inside the vestibular system is relatively viscous; therefore, you should allow sufficient time within each of the positions for the otoconia to achieve maximum displacement. This condition may also be responsible for a delayed onset of nystagmus.
- It is most helpful to utilize Frenzel lenses or video goggles when performing positional maneuvers. This reduces the ability of the patient to fixate during the procedure in an attempt to reduce the nystagmus response. This will also allow the examiner to see even very slight torsional nystagmus.
- It is common for the patient to tell you during the intake interview which ear is affected and will describe accurately the symptoms of BPPV. Use this information to determine which ear is likely the affected ear.
- ALWAYS test both ears- even if the patient complains of only one side being affected.
- Patients are often very sensitive to horizontal canal BPPV, which can result in severe dizziness and vomiting. If the patient reacts violently during the roll test, immediately turn the patient to the opposite side and perform a Lempert 360° roll.

Repositioning Maneuvers for Treatment of BPPV

If either of the diagnostic maneuvers is positive for BPPV, it is very simple to move into a canalith repositioning maneuver so that you may offer the patient immediate relief.

The following lists a few of the maneuvers that can be utilized for the treatment of BPPV and the canal that each maneuver targets:

- Epley Canalith Repositioning Maneuver (sometimes called simply the "Epley" or "CRP") - Treats ipsilateral posterior canal BPPV. Can also be used to treat anterior canal BPPV of the contralateral ear.
- Semont Maneuver – Treats anterior or posterior canal BPPV.
- Lempert Roll – Treats horizontal canal BPPV.
- Brandt-Daroff Exercises – At-home treatment for posterior canal BPPV.

Epley Canalith Repositioning Maneuver (posterior canal or contralateral anterior canal BPPV)

- Begin with the patient sitting length-wise on the examination table.
- Have the patient turn his head to a 45º angle toward the side that you are going to treat (the affected side). **Figure 1**
- While maintaining the 45º head position, guide the patient in a continuous motion from sitting to lying with the head hanging off the table at approximately 20º. Hold this position for 30-60 seconds. **Figure 2**
- Maintain the 20º head extension and rotate the patient's head 90º toward the unaffected side so that the patient's head is approximately 45º toward the unaffected side. Hold this position for 30-60 seconds. **Figure 3**
- While still maintaining the 45º head position, guide the patient into a side-lying position on the shoulder of the unaffected side. The patient's nose should be pointed toward the floor. Hold this position for 30-60 seconds. **Figure 4**
- Instruct the patient to tuck his chin and maintain the 45º head position.
- Guide the patient back into a sitting position while ensuring that the patient's head remains at the 45º angle and the chin remains tucked. **Figure 5**

Epley Maneuver (cont.)

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Helpful Hints for the Epley CRP Maneuver

- It is most helpful to utilize Frenzel lenses or video goggles while performing CRP. This reduces the ability of the patient to fixate during the procedure in an attempt to reduce the nystagmus response. This will also allow the examiner to see even very slight torsional nystagmus.
- Before performing any positioning maneuver, it is important to determine whether the patient has current or past injuries of the neck or spine.
- If neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- Some publications state that the efficacy of the procedure is increased to >90% if CRP is performed twice in rapid succession.
- The patient can lose postural control at the completion of the procedure due to the otoconia briskly falling within the cupula. It is vital that the examiner is in a stance that will provide postural support to the patient.
- It is important to watch for changes in the nystagmus upon completion of the procedure: a reversal of nystagmus indicates that the otoconia fell back into the canal; an upbeat nystagmus indicates that the otoconia fell back into the cupula.

Semont Maneuver (anterior canal BPPV)

- Begin with the patient sitting on the examination table, facing the examiner, with the patient's head turned toward the affected side at a 45º angle. **Figure 1**
- Guide the patient into a side-lying position on the affected side. (This should be a rapid movement and the patient's nose should be pointing downward.) Hold this position for 2-3 minutes. **Figure 2**
- While maintaining the 45º head position, guide the patient in a continuous motion from side-lying on the affected side to side-lying on the unaffected side. (The patient's nose should be pointing upward.) Hold this position for 3-5 minutes. **Figure 3**
- Guide the patient back into a sitting position.

Figure 1

Figure 2

Figure 3

Note: These photos illustrate treatment of the left anterior canal. To treat the right canal, simply begin with the head turned toward the right shoulder.

Helpful Hints for the Semont Maneuver

- Before performing any form of positioning maneuver, it is important to determine whether the patient has current or past injuries of the neck or spine.
- If any neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- The patient should experience vertigo when moved to the face-down position. If not, it is often useful to perform a slight headshake in an effort to loosen the debris.

Lempert Roll Maneuver (horizontal canal BPPV)

- Begin by having the patient lie in the supine position with the head elevated at approximately 20º and head turned toward the affected side. Turn the head to center position and then toward the unaffected side.
- Roll the patient onto the shoulder of the unaffected side. Hold this position for 30-60 seconds. **Figure 1**
- Roll the patient into the prone position maintaining the 20º head position (this will require the patient to hang their head off the table as illustrated). Hold this position for 30-60 seconds. **Figure 2**
- Next, roll the patient onto their affected side while maintaining the 20º head position. Hold this position for 30-60 seconds. **Figure 3**
- Guide the patient back into a sitting position.

Figure 1

Figure 2

Figure 3

Helpful Hints for the Lempert Roll Maneuver

- Utilizing video Frenzels or video goggles while performing this maneuver is recommended to reduce the ability of the patient to fixate during the procedure in an attempt to reduce the nystagmus response. This will also allow the examiner to see even very slight horizontal nystagmus. If the treatment is successful, the nystagmus will beat in the same direction throughout the procedure.
- The success rate of this procedure in the treatment of horizontal canal BPPV is very high and success is usually immediate. If the procedure is successful, the patient may not exhibit symptoms during the last steps of the procedure.
- If the patient does not show marked improvement upon completion of the procedure, you should repeat the procedure. If there is still no improvement, it is possible that the wrong ear has been treated.
- It is important that the patient maintain the 20º head position to prevent the otoconia from reversing direction within the horizontal canal during the procedure.
- Refer to attached chart for specific details regarding diagnosis and treatment of each nystagmus condition.
- The patient's complaint will often be that he/she experiences "dizziness" when turning his/her head head in bed without turning their body.

Brandt-Daroff Excercises (posterior canal BPPV)

- Begin with the patient sitting on his bed.
- The patient will turn his head 45º toward either side. **Figure 1**
- The patient moves from sitting position to side-lying position while maintaining the 45º angle of the head (the patient's nose should be pointed upward). The patient lies in this position until his symptoms have subsided PLUS an additional 30 seconds. **Figure 2**
- The patient returns to the sitting position and waits for symptoms to subside PLUS an additional 30 seconds. **Figure 3**
- The patient should turn his head in the opposite direction and repeat the exercise.

Figure 1

Figure 2

Figure 3

Helpful Hints for the Brandt-Daroff Exercises

- Before recommending any form of positioning maneuver, it is important to determine whether the patient has current or past injuries of the neck or spine.
- If neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- In order for the exercise to be successful, the patient MUST remain in each position until the vertigo subsides PLUS an additional 30 seconds and the patient must perform all 10 revolutions of the exercise. This is time consuming and often traumatic for the patient due to intense vertigo. Therefore, it is vital that the patient is educated on what to expect during the exercise and has agreed to full compliance.
- Without the patient's commitment to full compliance, performing the Brandt-Daroff exercises might actually be counter-productive in that otoconia may travel to different parts of the vestibular system and cause a worsening of symptoms.
- You should instruct patients that if they are doing the exercise properly, their symptoms will likely lessen in severity with each repetition. However, they should always do the full set of 10 complete revolutions.

Gufoni Maneuver (lateral canal BPPV)

- Begin with the patient sitting on the edge of the examination table, facing the examiner. **Figure 1**
- With a rapid motion, guide the patient into a side-lying position toward the affected side. **Figure 2**
- While the patient is lying on his side, with a quick movement, turn the patient's head to a 45º angle (so that the patient's nose is pointing toward the table). Hold this position for 2-3 minutes. **Figure 3**
- Guide the patient back into a sitting position.

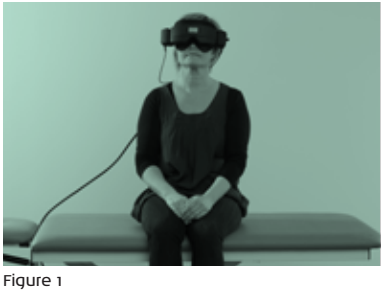


Figure 1

Figure 2

Figure 3

Helpful Hints for the Gufoni Maneuver

- Before performing any form of positioning maneuver, it is important to determine whether the patient has current or past injuries of the neck or spine.
- If any neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.
- This procedure is an alternative treatment for patients who cannot complete the Lempert 360° Roll, as well as for cases where an apogeotropic lateral canal variant may be present.

Vannucchi Maneuver (lateral canal BPPV)

- Have the patient sit length-wise on the examination table. **Figure 1**
- With rapid motion, guide the patient into a supine position and immediately rotate the patient's head away from the affected ear. **Figure 2, 3**
- While maintaining the turned head position, guide the patient back into a length-wise sitting position. **Figure 4**
- Repeat 6-8 times in rapid succession.


Figure 1


Figure 2


Figure 3


Figure 4

Helpful Hints for the Vannucchi Maneuver

- This maneuver may be used to convert apogeotropic nystagmus to geotropic nystagmus. If conversion is done successfully, the Lempert 360º Roll away from the affected side can be done to further remediate lateral canal BPPV.
- This maneuver requires brisk head movements and may not be well-tolerated by elderly patients.
- Before performing positioning maneuvers, it is important to determine whether the patient has current or past injuries of the neck or spine.
- It is most helpful to utilize Frenzel lenses or video goggles while performing the maneuver. This reduces the ability of the patient to fixate during the procedure in an attempt to reduce the nystagmus response. This will also allow the examiner to see even very slight nystagmus.
- If any neurological symptoms occur during the execution of positioning maneuvers, discontinue the procedure IMMEDIATELY and refer for a neurological evaluation. These symptoms might include: blurred vision, numbness, weakness of the arms or legs or confusion.

Conclusion

BPPV is the most common vestibular disorder known. Although, as medical professionals, we now have a solid understanding of what causes BPPV and how to treat it, BPPV can be a life-altering and very frightening experience for the patient.

Imagine waking one morning to find that you are unable to make major head movements without feeling as if everything was spinning. These patients can't bend over, look up, lie down or get up from bed, roll over in bed or even get their hair washed at the salon! Their life may be altered to the point that the patient stays in more and is afraid to drive. The patient's neck muscles will often become stiff from lack of mobility, resulting in neck pain. Many of these patients have visited two or three physicians, maybe even the emergency room, and are still undiagnosed or are misdiagnosed.

You now have the information and the skill to truly help these patients that, until now, have suffered from other's lack of knowledge. Not only is the diagnosis and treatment of BPPV quick and easy, it often provides immediate relief for the patient – instilling a confidence in your ability that is worth sharing with others and thereby building your practice... one "dizzy" at a time!

Interacoustics

Interacoustics A/S

Audiometer Allé 1
5500 Middelfart
Denmark

+45 6371 3555
info@interacoustics.com

interacoustics.com