Rehabilitation programs for patients with vestibular disorders have become popular in the past few years. Most programs are based on the Cawthorne-Cooksey protocol of graded, repetitive head movements that provide visual-vestibular interaction (Cawthorne, 1944; Cooksey, 1945; Cooksey, 1946). These programs have been described many times in the literature (Cohen, 1994; Cohen, Hatfield, Kane, & Miller, 1994; Dix, 1974; Dix, 1976; Dix, 1984; Gill-Body, Krebs, Parker, & O'Riely, 1994; Heckcr, Haug, & Herndon, 1974; Herdan, 1989; Horak, Jones-Rycewicz, Black, & Shumway-Cook, 1992; Norrè, 1990). Most vestibular rehabilitation programs use only repetitive exercise, the most common of which are derived from the original Cawthorne-Cooksey protocol. These exercises begin with head movements on a stationary body (e.g., upward and downward flexion and extension motions of the head or lateral flexion of the head), and are graded up through head movements combined with rapid body movements through space. Thus, the exercises are repeated and graded from slow movements through a small range of motion to rapid movements through a large range of motion.

Recently, selected purposeful activities have been shown to be effective as a treatment modality with this population (Cohen et al., 1994; Cohen, Kane, & Miller, 1993; Cohen, Kane-Wineland, Miller, & Hatfield, 1995). This article will describe the use of repetitive, graded occupations with three patients, all of whom had vestibular disorders.

Patients with vestibular disorders may have vertigo—the illusion of self-motion usually described as spinning or falling—disequilibrium, disorientation, blurred vision due to an impaired vestibulo-ocular reflex (VOR), and decreased independence in activities of daily living (ADL) (Cohen, 1992; Cohen & Keshner, 1989; Farber, 1989; Morris, 1991). Diagnosis of vestibular disorders usually includes objective tests of balance and tests of the VOR, during which eye movements are recorded, usually with electrooculography (EOG). The EOG battery typically includes caloric tests in which warm or cool water or air is put in the external ear while the patient is lying supine as well as tests in which the patient sits upright in a computer-controlled chair and is oscillated in a variety of visual conditions (Zane, Rauhut, & Jenkins, 1991).

The three patients described in this article were tested with part or all of such a battery. The facilities of the diagnostic laboratories in which these patients were tested differed in the type of equipment available and represented the range of facilities typically used by otolaryngologists and neurologists who treat patients with vestibular disorders. Unlike the typical clinical situation, however, in this study all referring otolaryngologists were affiliated with medical schools and teaching hospitals.

All subjects received biweekly 40-min therapy sessions at outpatient clinics for 6 weeks; all of them had to
drive their cars to the treatment facilities or were driven by others; no subjects were able to take public transportation. The therapists used a standard evaluation that included gait, transfers, range of motion, and functional muscle strength. Additionally, the intensity, duration, and frequency of vertigo were assessed. Vertigo intensity was evaluated with the following five-point qualitative scale: 1 = normal, no vertigo; 2 = just noticeable vertigo, no loss of balance; 3 = mild, slight loss of balance, no nausea; 4 = severe, loss of balance, possibly with nausea; 5 = extreme, complete loss of balance, with nausea, vomiting.

ADL independence was evaluated with a scale abridged from Cohen (1992). This instrument uses a five-point qualitative scale, from independent to dependent, and includes bed mobility, dressing, bathing, grooming, home management, and general mobility tasks. Static standing balance was assessed with the Clinical Test of Sensory Interaction on Balance (CTSIB), which has six different test conditions (see Table 1) (Cohen, Blatchly, & Gombash, 1993; Shumway-Cook & Horak, 1986). Each patient's responses to a variety of combinations of head movements and positions were systematically evaluated to determine which motions should be stressed during treatment activities. All subjects were given a simple home program of repetitive head movements in yaw (rotation of the head looking from side to side), pitch (neck flexion and hyperextension), and roll (lateral flexion to either side). Subjects were instructed to practice the exercises on the days when they did not attend therapy. None of the subjects took medications to control vertigo while participating in this treatment program, although two of them had been treated unsuccessfully prior to referral for therapy with medications that suppress the vestibular system.

Case Study 1

Mrs. M. was a 67-year-old homemaker who lived with her adult daughter in an inner city apartment. Her husband had died several years before, so she now lived with her daughter. She had a 2-year history of vertigo and disequilibrium, as well as a history of diabetes, hypertension, and arthritis that affected primarily her spine and lower extremities. She had normal EOG test results, but reduced hearing in the right ear. Magnetic resonance imaging showed nonspecific changes consistent with a diagnosis of cerebral atrophy. When referred for vestibular rehabilitation in a final attempt to reduce her symptoms and increase her ADL independence, she had already exhausted a variety of medical interventions, including the vestibular-suppressant medication Antivert (meclizine hydrochloride), with no significant effect on her symptoms.

**Therapy Evaluation**

Mrs. M. had functional range of motion and good strength with increased lumbar lordosis. She was unable to ambulate independently. Until 2 years before this study, she had been able to ambulate without assistance, but had gradually regressed from a cane to a walker to her present wheelchair for community distances and to the walker in the home as a result of the vertigo and disequilibrium.

When standing on the floor with feet together, Mrs. M. could perform the Romberg test (Baloh & Honrubia, 1990) — that is, she could stand with her feet together, eyes closed, shoulders flexed to 90° with arms held out in front of her, and Conditions 1, 2, and 5 of the CTSIB performed on the solid floor when the therapist provided the contact guarding necessary for her to assume a standing position. She could not stand on one leg or perform the CTSIB Conditions 4, 5, and 6, which require less reliance on kinesthesia as the subject shifts her weight while standing on compliant foam. She performed rapid alternating movements normally.

Mrs. M. rated her episodes of vertigo at Level 3. The episodes occurred many times daily, and she described the sensations as "spinning," elicted by holding her head in a downward position. When asked whether a specific event (i.e., head trauma, infection) had precipitated her first episode of vertigo, she could not recall one, but then confessed that she had suffered multiple blows to the head on numerous occasions more than 20 years ago, when her husband had beaten her. Before meeting this therapist, she had never told any health care professional of her husband's abuse because she had been too embarrassed. Her husband had died several years before, so she now felt safe in revealing this information. She wondered if the beatings she had suffered might have contributed to her current problems.

Positional testing elicited reports of Level 2 vertigo with movements that incorporated neck or trunk flexion or both. She required contact guarding for bed mobility and transfers except for tub transfers, for which she required minimal physical assistance. She was independent in feeding, dressing, and grooming, but had ceased all homemaking activities due to the episodes of dizziness and a distressing feeling of "closeness" that she felt when working in smaller rooms like her kitchen and bathroom. (Interestingly, several other subjects in this study spontaneously described the same claustrophobic feeling before beginning treatment.)

**Table 1**

<table>
<thead>
<tr>
<th>Conditions of the Clinical Test of Sensory Interaction on Balance</th>
<th>Visual Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Floor Conditions</strong></td>
<td>Eyes Open</td>
</tr>
<tr>
<td>Standing on level floor</td>
<td>Condition 1</td>
</tr>
<tr>
<td>Standing on medium density foam, on level floor</td>
<td>Condition 4</td>
</tr>
</tbody>
</table>
Mrs. M. had eliminated activities that she had previously enjoyed, including cooking, walking in her neighborhood, attending church services, and singing in the church choir, due to the unpredictability and severity of her vertigo. She believed that she was imposing on her daughter because she could not contribute to maintaining the household. She was also frustrated that no medical interventions had reduced her vertigo. She admitted that in the past, in addition to medication, her physician had given her an exercise program that incorporated the Cawthorne-Cooksey exercises, but she had not understood the reasons for the exercises, and therefore had never followed through with them. She described her health as “fair” and was not pleased with her life as a whole.

**Treatment Program**

Mrs. M. attended biweekly occupational therapy sessions in which functional treatment activities—graded by speed, range of motion, and duration of performance—incorporated the positions that elicited dizziness. The goal of these sessions was to reduce the frequency and intensity of vertigo, so that she could obtain increased independence in routine household tasks and other activities that she had abandoned. The choice of functional activities was based on desired movement parameters and her motivation for them (see Appendix A).

In addition to the therapeutic treatment sessions, Mrs. M. said that she practiced the home exercise program described earlier in this article on days when she did not receive occupational therapy. Her daughter, who usually accompanied her to therapy sessions, reported that Mrs. M. was improving in her tolerance for activities at home and that the therapy sessions seemed to give her confidence to try things that she had avoided.

**Posttreatment Evaluations**

After the second week of treatment, Mrs. M. noticed that she was having fewer episodes of vertigo. After 6 weeks of treatment, she reported that she had not had an episode of vertigo for more than 3 weeks. She still experienced the closed-in feeling in small rooms, but no longer had the accompanying dizziness that she had had previously. She had major functional improvements and was able to use a standard cane at home and during some community ambulation. Her daughter confirmed that she could walk around the block while using her cane with safety guarding and occasional contact guarding by a family member. Mrs. M. was pleased to be able to resume this leisure activity. She had also resumed some home management activities that she had abandoned, including doing light laundry, vacuuming the floor with the use of a walker for stability, reaching objects in the cupboard, and cooking special dishes. She had attended church services twice in the preceding 2 weeks, but had not resumed singing in the church choir because choir participation required sitting and standing in front of the congregation for long periods of time and she did not yet feel able to stand for very long. She rated her overall health as good, and felt pleased with her life as a whole.

When contacted by telephone 9 months after that evaluation, Mrs. M. had retained most of her functional gains. Unfortunately, she had regressed to relying on a walker rather than the cane that she had progressed to using during treatment. This change may have been due to her other medical problems; in the intervening period she had been hospitalized because of diabetes. She emphasized to the therapist that she had resumed using the walker because she felt weak, not because she felt dizzy. She reported that she had not had a significant episode of vertigo in several months. Overall, Mrs. M. reported satisfaction with her involvement in the program.

**Case Study 2**

Mr. J. was a 64-year-old bridge inspector who lived with his wife in their suburban house and enjoyed weight lifting and motorcycle riding in his spare time. They had several grown children who lived in the area. He was close to his family, who were supportive and concerned for his well-being. He had a 3-month history of vertigo with no other major medical problems. He was on disability leave from his job, which involved walking along each bridge while looking up and down and from side to side. These motions elicited vertigo and disequilibrium. Because his signs and symptoms interfered with his vocational tasks and his avocational activities, he was highly motivated to participate in therapy.

His EOG revealed an impairment of the vestibular function on the left side, known as a left unilateral weakness. Additionally, he had a positive Dix-Hallpike response. In the Dix-Hallpike test, which is used to assess function of the vertical semicircular canals, the patient is moved rapidly from sitting to lying prone, while keeping the head turned 45° to the right or left side. Normal persons have no vertigo or nystagmus when given this test. Patients with impairments of vertical canal function have vertigo and diagonal nystagmus.

**Therapy Evaluation**

Mr. J had normal range of motion and strength in both upper and lower extremities. He was able to ambulate independently on level surfaces when moving slowly, but had some disequilibrium when moving at his preferred pace. On the CTSIB he was able to perform the conditions given with eyes open on the stable and unstable surfaces (Conditions 1 and 4), but had difficulty with the conditions given with his eyes closed (Conditions 2 and 5). He was unable to perform the conditions given with
The visual-vestibular conflict (Conditions 3 and 6). During the initial evaluation, donning the visual conflict dome for the CTSIB caused him to feel claustrophobic. He could not stand on one leg with eyes open or closed.

Position changes, particularly rolling from side to side, evoked vertigo, and he reported that he had episodes of Level 4 and 5 vertigo approximately 8 to 10 times per day. Mr. J. was able to bathe himself and perform upper extremity dressing independently, but he required safety guarding for transfers and lower extremity dressing and he was unable to drive his car. He had disequilibrium when walking or standing in dimly lighted environments.

**Treatment Program**

Biweekly treatment sessions incorporated many activities that other patients might have found too vigorous but which Mr. J. enjoyed (see Appendix B). Treatment tasks were graded by speed, range of motion, and duration, and he was given a selection of tasks to maintain his interest and motivation.

In addition to the treatment sessions, Mr. J. reported that he had complied with the home program. After the first week of treatment he had also wanted to incorporate some of his weight-lifting exercises in his home program. Because Mr. J.’s wife requested instructions for providing safety guarding during these exercises, the therapist instructed her and one of their sons in safety guarding techniques.

By the end of the second week of treatment, Mr. J. reported that his vertigo episodes had decreased in frequency and were now at Level 3. By the end of the fourth week his vertigo was reduced to Level 2.

**Posttreatment Evaluations**

At the discharge evaluation, Mr. J. reported that he no longer had vertigo and was ready to return to work. The therapist was able to elicit vertigo with any position changes, and he was able to complete all conditions on the CTSIB normally and without complaints of claustrophobia. When contacted 1 month after discharge he was still symptom free and had returned to work and to his usual leisure activities.

**Case Study 3**

Mrs. A. was a 55-year-old homemaker and grandmother who lived in her own house with her husband. She had a 1-year history of periodic vertigo, as well as mild hypertension, recurrent temporomandibular joint problems, and Ehlers-Danlos syndrome, a connective tissue disorder. The vertigo episodes occurred daily with head movement and would last 2 to 3 min. Between episodes she was lightheaded, fatigued, sometimes nauseated, and unable to perform her usual ADL without modifications or frequent rest breaks. She was diagnosed with right peripheral vestibular impairment of unknown etiology, possibly related to the connective tissue disorder. Because the vertigo had not abated and her life-style was compromised, she was referred for vestibular rehabilitation.

**Therapy Evaluation**

Mrs. A. had functional range of motion and strength with some limitations in thoracic and lumbar range of motion secondary to a thoracic kyphosis and a complex scoliosis. Her gait was normal when she ambulated slowly with minimal head movements, but when ambulating more quickly or with deliberately repeated head movements, she reported increased vertigo and displayed mild ataxia, with step continuity slightly disrupted in timing and length. On the CTSIB, she had increased sway but could maintain her balance standing with arms folded and feet together on foam with eyes closed. When attempting to balance with visual-vestibular conflict while standing on foam (Condition 6), she could not maintain her balance for 30 sec on Trials 1 and 2 but she was successful on Trial 3. She could complete six tandem steps with eyes open and balance on either foot up to 30 sec with eyes open; she could do neither with eyes closed.

Her usual vertigo episodes were Level 3, but vertigo could become more severe with repeated or rapid head motions. She required safety guarding for all self-care activities, transfers, and mobility tasks to avoid inducing more severe vertigo. Activities that required moving her head while looking around the room or watching the visual scene increased the intensity of her vertigo; therefore, she had difficulty riding in a car, shopping for groceries, driving, and reading.

**Treatment Program**

During treatment sessions Mrs. A. was given graded, purposeful activities that incorporated repeated movements, which provoked vertigo and related symptoms during the assessment. Activities were designed to simulate movements required in certain daily activities. Treatment activities were graded by the speed, range of motion, complexity of the movement, or the length of time a task was performed. During the first treatment session, activities were performed in a sitting position. Over the course of treatment, she performed activities in a variety of positions and under conditions that exacerbated her vertigo. Appendix C lists sample treatment activities, presented in the order in which they were introduced in treatment.

Over 6 weeks of treatment, she reported gradual changes. For example, she no longer experienced vertigo after riding in a car for 30 min when driving to the medical center for therapy. Although she had Level 3 vertigo while performing repeated head movements, she no longer...
had residual lightheadedness, disequilibrium, or nausea after the movement was stopped. Before discharge, the therapist and Mrs. A. discussed the need for continuing some activities and exercises at home to maintain her level of recovery.

Posttreatment Evaluations
At 6 weeks of treatment, Mrs. A. reported that vertigo intensity was at Level 2; when she practiced the home program she no longer had lightheadedness, nausea, or discomfort afterward. While ambulating with head movements she was no longer ataxic. She reported being independent and comfortable while driving, shopping for groceries, playing with her grandchildren, and performing all household tasks. She could perform all six balance conditions on the CTSIB for up to 30 sec on the first trial, the maximum evaluation period for each condition.

During follow-up telephone conversations 1 month, 3 months, and 13 months after discharge from therapy, Mrs. A. reported that she could provoke vertigo with rapid repeated head movements, such as when doing her home program exercises, but she could perform the normal activities of her day without vertigo. If she sensed that the frequency of vertigo was increasing, she would do her home program exercises more frequently. This approach helped her control her vertigo, even during several months of recovery from extensive surgery to correct her scoliosis.

Summary
These three case reports are examples of the use of graded, purposeful activities in remediating the symptoms of vestibular disorders. Therapists can design individualized treatment plans for each patient by incorporating activities of interest to the patient. The treatment activities must include the particular head movements and positions that elicit vertigo during assessment. Additionally, activities must be interesting to the individual patient. Use of interesting activities may sustain the patient's interest and motivation for the treatment program and enable the patient to relate the learning process to real life experience.

The principle that graded, repetitive head movement exercise is efficacious in reducing vertigo and disequilibrium in patients with vestibular disorders is now well accepted among physicians and therapists who treat these patients. The principle of adding meaning or purpose to otherwise rote exercise is well accepted among occupational therapists who treat these patients. The principle of adding meaning or purpose to repetitive exercise may now be extended to the treatment of patients with peripheral vestibular disorders.

Appendix A
Sample Treatment Activities for Mrs. M

1. Unloading groceries from countertop level to storage areas under the sink.
2. Retrieving towels in a basket on the floor and hanging them on a clothesline overhead.
3. Completing an obstacle course from a position on a wheeled stool while retrieving cones from the floor and placing them on an elevated surface.
4. Ambulating in hallways while scanning and describing objects placed at various heights.
5. Tossing beanbags from standing position with beanbags placed on floor.
6. Playing balloon volleyball from a position on a wheeled stool.

Appendix B
Sample Treatment Activities for Mr. J

1. Riding an exercise bicycle with movable handlebars while looking side to side, and up and down.
2. Doing pegboard task requiring rapid head turning to either side and up and down.
3. Following timed obstacle courses with weight-shifting and position changes.
4. Tossing horseshoes.
5. Catching a small ball while sitting on a large therapy ball.
6. Playing badminton while standing on a narrow beam.

Appendix C
Sample Treatment Activities for Mrs. A

1. Sitting and dealing cards into two piles spaced about 3 ft apart.
2. Sitting and leaning to the floor to retrieve objects.
4. In supine position, rolling side to side to move bean bags from one side of the treatment mat to the other.
5. Standing and moving cups from a low shelf to an overhead shelf.
6. Playing catch in standing position.
7. Standing and dealing cards along a 6-ft counter.
8. Rotating and handing cards one at a time to the therapist.
9. Dribbling a ball back and forth across the room.
10. Walking back and forth across the room while bouncing a ball off the wall, alternating right and left.
11. Walking back and forth across the room while reading signs on the wall, alternating right and left.
12. Walking around the room and stooping to retrieve objects on floor.
13. Sidestepping back and forth across the room while reading signs on the wall first to the front, then over one shoulder.

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References


