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Effects of Feldenkrais Awareness Through Movement on Balance in Adults With Chronic Neurological Deficits Following Stroke: A Preliminary Study

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The Feldenkrais Method is a complementary approach to motor learning that purports to induce change in chronic motor behaviors. This preliminary study describes the effects of a Feldenkrais program on balance and quality of life in individuals with chronic neurological deficits following stroke. Two male (48 and 53 years old) and 2 female participants (61 and 62 years old), 1 to 2.5 years poststroke, participated as a group in a 6-week Feldenkrais program. Pretest and posttest evaluations of the Berg Balance Scale (BBS), the Dynamic Gait Index (DGI), and the Stroke Impact Scale (SIS) were administered. Data were analyzed using a Wilcoxon signed-rank test. DGI and BBS scores improved an average of 55.2% ($p = .033$) and 11% ($p = .034$), respectively. SIS percentage recovery improved 35%. Findings suggest that gains in functional mobility are possible for individuals with chronic stroke using Feldenkrais movement therapy in a group setting.

Keywords: Feldenkrais; balance; stroke; complementary medicine

Of the 700,000 Americans who suffer a stroke every year, two thirds sustain chronic neurological impairments (American Heart Association, 2003). Of these, impaired postural control may have the greatest negative impact on balance in activities of daily living (ADL; Fong, Chan, & Au, 2001; Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). Addressing balance deficits is an important aspect of stroke rehabilitation (Nichols, 1997). Training in improving balance, however, is challenging. Standard care for rehabilitation of balance deficits poststroke has included a variety of interventions, with none emerging as the most effective (Pollock, Baer, Pomeroy, & Langhorne, 2004). The Feldenkrais Method (FM) is a complementary approach to perceptual-motor learning (Buchanan & Ulrich, 2001), evolved by Moshe Feldenkrais (1904-1988), physicist, judo martial arts educator, and movement educator. The FM purports to induce change in chronic patterns of motor behavior by asking people to attend to the sensations and perceptions embedded in highly detailed, guided

TABLE 1. Characteristics of Stroke Patients Participating in the Feldenkrais Awareness Through Movement Training in 2005

Participant	Age	Cerebrovascular Accident Side and Type	Time Since Event (months)	Mini-Mental Status Examination Score ^a	Movement Imagery Questionnaire ^b	Falls Reported Since Stroke
1	61	Left hemorrhagic	27	29	67	0
2	60	Left ischemic	25	29	61	0
3	48	Right hemorrhagic	10	29	48	1
4	58	Left ischemic	9	28	52	0

a. Mini-Mental Status Examination measures cognitive ability.

b. Movement Imagery Questionnaire measures ability to imagine physical movements.

movement explorations (Stephens, 2000). There are two components to the FM: Functional Integration (a one-on-one, hands-on form of guided movement communication) and Awareness Through Movement (ATM), verbally guided, structured movement explorations delivered in a group format (Feldenkrais Guild, 2005). Although the FM has been shown to improve balance in persons with multiple sclerosis (Stephens, DuShuttle, Hatcher, Shmunes, & Slaninka, 2001), no studies have been conducted on its effects on persons poststroke. The purpose of this study was to explore feasibility and compare pre- and postintervention measures of balance and quality of life in individuals 1 year or more following stroke who received a 6-week pilot trial of group delivery of Feldenkrais ATM. The importance of this study is that it suggests that gains in functional mobility are possible for individuals with chronic stroke using movement therapy in a group setting.

METHOD

Participants

A single group pretest-posttest design was used. Five participants were referred from neurologists at the University of North Carolina at Chapel Hill School of Medicine. Eligibility criteria included (a) first stroke; (b) duration of no more than 3 years; (c) ambulation for 50 feet, with or without assistive device and/or supervision; and (d) rehabilitation completed. Persons were excluded if (a) a medical condition interfered with the participants' ability to participate, (b) they scored lower than 23 on the Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975), (c) they scored lower than 25 on the Movement Imagery Questionnaire (MIQ; Hall & Pongrac, 1983), or (d) they had impairments in hearing or speech that interfered with their ability to attend to and follow detailed movement instructions in English. Four participants (see Table 1) met the criteria and gave informed consent according to institutional review board standards. They presented with a variety of sensorimotor deficits. Two participants (1 and 3) lacked upper-extremity function on the affected side. Participant 1 also presented with mild expressive aphasia, and Participant 3 presented with unilateral neglect. Participant 2 had completed a trial of constraint-induced movement therapy 6 months prior but demonstrated persisting sensory impairments and balance deficits. Participant 4 presented with altered tonus and pain on weight bearing in the affected lower limb.

Participants were screened within 1 month prior to the intervention. Preintervention screens included the MMSE for cognition and the MIQ, a subjective measure of ability to imagine movement from a visual (seeing) and kinesthetic (feeling) perspective. The MIQ has been validated in previous studies using mental imagery protocols poststroke (Page, Levine, Sisto, & Johnston, 2001). This instrument was important to use at baseline because the verbal descriptions of movement in ATM lessons often involve kinesthetic and visual imagery.

Outcome Measures

Clinical outcome measures were chosen for their ease of application, clinical economy, reliability, validity, and responsiveness to self-reported difficulties for persons recovering from stroke. Two primary outcome measures were administered, as well as one secondary outcome on quality of life. The two clinical tests of balance were the Berg Balance Scale (BBS; Berg, Wood-Dauphinee, Williams, & Gayton, 1989) and the Dynamic Gait Index (DGI; Wrisley, Walker, Echternach, & Strasnick, 2003). The BBS is a reliable and valid balance instrument for elderly persons poststroke (Berg et al., 1989). It consists of 14 items measuring the ability to assume and/or maintain positions commonly involved in ADL (sitting, transfers, stairs). Various challenges are embedded in the questions, such as eyes closed in static standing and picking up an object from the floor. The ordinal scale ranges from 0 to 4, with 4 reflecting total ability to complete the task. The top score is 56, and scores lower than 44 are associated with fall risk (Shumway-Cook, Baldwin, Polissar, & Gruber, 1997). To be 90% confident that a meaningful clinical change has occurred, persons with stroke must demonstrate a 6-point change in score (gain or loss; Stevenson, 2001). Intrarater and interrater reliability have been computed as excellent, both for participants with stroke and elderly participants without neurologic disabilities. Excellent reliability (intraclass correlation coefficient = .97 and .98) was shown in a combined group of 113 nonneurologically impaired elderly participants (mean age = 83.5 years, $SD = 5.3$) and 70 participants with stroke (mean age = 71.6 years, $SD = 10.1$; Berg, Wood-Dauphinee, & Williams, 1995). Construct validity has been established for 60 patients with stroke over a 12-week period in which strong correlations between BBS scores and both the Barthel Index of Activities of Daily Living scores ($r = .87-.93$) and Fugl-Meyer Sensorimotor Assessment scores ($r = .70-.82$) were reported (Berg et al., 1995).

The DGI also was included as a functional gait scale because of its brevity (eight tasks), ease of administration, and increasing task demands that require differentiated head-on-body movement while walking (e.g., horizontal and vertical head rotation). The DGI was developed to assess dynamic postural stability in older adults with risk for falls (Wrisley et al., 2003). Although not developed specifically to evaluate patients with suspected vestibular disorders, the DGI includes tasks that perturb the vestibular system, such as moving the head while walking and turning quickly. An ordinal scale ranging from 0 to 4 is used, with 4 being "normal" walking within the task demand. Of a possible score of 24, a score of 19 or less indicates increased risk of falls in the elderly. Clinical significance is attributed to a change in score of 3 points (Whitney, Hudak, & Marchetti, 2000). Researchers have shown the DGI to be a useful, reliable index in balance examinations in community-dwelling elderly patients who exhibit balance disorders (Chiu, Light, Fritz, Kornetti, & Velozo, 2003) and in distinguishing between elderly persons with vestibular disorders (Whitney, Wrisley, & Furman, 2003). Excellent interrater reliability (.96) was shown in a study in which five physical therapists conducted the DGI on a sample of 5 community-dwelling elderly persons

TABLE 2. Awareness Through Movement—Component Activities in a Typical 40-Minute Lesson

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- Body scanning (10-30 minutes) focuses on perceiving the alignment of the body with respect to itself and to the supporting surface. This method is used to form a perceptual baseline of the body schema and is repeated as a way of observing body alignment changes after exploration of movement tasks.
 - Awareness Through Movement lessons in the context of tasks that included variations on rolling, sit to stand, standing, and sitting at a table with hands supported. Individuals are instructed to attend to the force and effort generated and their effects on postural support mechanisms, while aspects of a movement are practiced. The goal is to produce the movement with the least amount of effort and force. Attention (awareness) is trained by having individuals move slowly and deliberately. Trials may be brief (2-3 minutes per variation), but movement themes are repeated with slight variations, requiring that individuals maintain focus on themselves in movement for approximately 45 minutes, with rests as needed.
 Component movements are practiced with variations in body segment initiation, alignment, and speed. Imagery is often used to modify the movement pattern.
 Emphasis is placed on self-perturbations of balance with respect to gravity, using ground reaction forces as the cues.
 - Rest intervals of 30 seconds to 2 minutes are interspersed between trials of each task. The ratio of active movement to rest approximates 3:1 (minutes). Here, there should be no intentional actions or thoughts, so as to allow for processing of previous movements.
 - Repetition of body scan or Awareness Through Movement in the context of the motor task with intermittent resting and/or body scanning, until the lesson is completed.
-

with varying motor abilities. Two weeks later, test-retest reliability was found to be excellent (.98) between two physical therapists using the same method of analysis (Whitney et al., 2003).

A secondary clinical outcome measure, the Stroke Impact Scale (SIS), was also administered: This stroke-specific, self-reported, quality-of-life instrument has been well validated across populations in various stages of stroke (Duncan et al., 1999).

Intervention

The 6-week intervention began within 1 month of the baseline testing. A physical therapist certified in the FM was recruited from the community to conduct all ATM lessons. The therapist did not know the impairment level of the participants in advance. All 4 participants (and their caregivers) attended 15 sessions over 6 weeks. In each group session, two 35-minute ATM lessons were conducted, involving guided body awareness and movement exploration tasks (see Table 2). Feldenkrais ATM lessons share similar features to the motor-learning model of rehabilitation (Carr, Shepherd, Gordon, Gentile, & Held, 1987), which emphasizes focused, intensive, task-specific training; variability within task repetitions; and summary feedback (Pomeroy & Tallis, 2002). Fundamental differences exist, however. Although

movements practiced are task based (i.e., they incorporate components of common ADL movements, such as rolling and sit-to-stand activities), the goal of each task is hidden. Attention is drawn not to the goal of the movement but rather to the sensations arising from moving as easily and effortlessly as possible. Participants are instructed to move slowly and comfortably as they explore multiple degrees of freedom with attention to movement detail. No hands-on manipulation is employed unless the participant's safety appears at risk. In this ATM series, lessons began with exploring supine rolling and weight shifting in sitting and progressed to involve more complex tasks of mobility and balance. Two days after the conclusion of the study, the BBS, DGI, and SIS were readministered to all participants by the principal investigator. All participants were phoned 1 month later to obtain information on perceived carryover of benefits from the study.

Analysis

Descriptive statistics, using percentage change, were calculated for all dependent variables. Pre- and posttest raw-score differences for the primary outcome variables were analyzed using a Wilcoxon signed-rank test with an alpha level of .05 (Portney & Watkins, 2000).

RESULTS

Participants improved 56.4% on the DGI ($z = -1.826, p = .034$) and 11.8% on the BBS ($z = 1.841, p = .033$; Table 3). The average improvement on the SIS scores was 35% ($z = 1.604, p = .055$).

DISCUSSION

For these 4 participants with diverse sensorimotor deficits following hemispheric strokes, a trial of Feldenkrais ATM resulted in statistically significant improvements in balance. Clinically significant changes were achieved by 2 participants on the BBS (a score change of 6) and by 3 participants on the DGI (a score change of 4). Participants' perception of improvement approached statistical significance, and subjective feedback included feelings of improved body half integration, symmetry, and ease of movement. The participant with the most impairments (including unilateral neglect) exhibited the largest gains (a 7-point improvement in the DGI and an 11-point improvement in the BBS). We speculate that the ATM learning environment allowed each individual to explore his or her own movement experience without a sense of competitiveness or other visual or verbal distractions created by group dynamics or the environment. We speculate as well that group delivery was an important variable in the delivery of the intervention, providing emotional and social support, important predictors in functional outcomes after stroke (McCullagh, Brigstocke, Donaldson, & Kalra, 2005). The group and their caregivers attended 100% of the lessons, and participation of caregivers alongside participants contributed to the therapeutic environment. Theoretical support for group process has been substantiated in physical therapy for its cost-effectiveness as well as for its social and psychological value (Eng et al., 2003).

TABLE 3. Results of Clinical Measures Before and After Feldenkrais Awareness Through Movement Training in 2005 in 4 Participants With Stable Neurologic Deficits Following a Stroke

Participant	Dynamic Gait Index			Berg Balance Scale			Stroke Impact Scale			
	Pre	Post	% Change Significance ^a (<i>p</i>)	Pre	Post	% Change Significance ^a (<i>p</i>)	Pre	Post	% Change Significance ^a (<i>p</i>)	
1	14	18	28.6	48	53	9.4	50	90	40	
2	9	15	66	44	46	4.3	30	75	45	
3	6	13	116	30	41	30	50	70	20	
4	20	23	15	53	55	3.6	75	75 ^b	0 ^b	
Average			56.4			11.8			35	.055

a. Significance is based on the Wilcoxon signed-rank test with alpha = .05.

b. Stroke Impact Scale survey not returned.

CONCLUSION

To our knowledge, this is the first reported study describing the use of the FM implemented late in stroke recovery. These preliminary findings are very encouraging and form the basis for future research on the role of FMs using larger numbers of participants and credible control groups.

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