Responses to Ten Feldenkrais Awareness Through Movement Lessons by Four Women with Multiple Sclerosis: Improved Quality of Life

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Four women with multiple sclerosis who were ambulatory and worked full-time participated in 10 Awareness Through Movement classes over 10 weeks. Assessment before and after the series of classes included the Incapacity Status and the Environmental Status Scales of the Minimal Record of Disability, the Fatigue Severity Scale, and the Index of Well-Being. Before each class and at the final data collection, each person was asked several questions about her medical and functional status. Analyses of walking and supine-to-stand were done using the PEAK Motus video motion analysis system. A follow-up interview was done with two women one year after the classes ended. Three of the four participants experienced an increase in symptoms at some time during the 10 weeks; nonetheless, all made improvements. Outcomes show that two broad areas of improvement were ease and steadiness of daily movements, and sense of well-being. These outcomes suggest that Awareness Through Movement is beneficial for some people with multiple sclerosis, although in different ways for each person. **KEY WORDS:** Multiple sclerosis, Feldenkrais, motor learning, balance, coordination, quality of life.

Literature Review

With a prevalence of approximately 1 in 1,000, multiple sclerosis (MS) is the most common chronic disease of the central nervous system affecting young adults in the United States. Diagnosis is at a mean age of 30 years, although symptoms are often experienced much earlier, with women affected almost twice as often as men.[1]

The course of the disease is unpredictable. Symptoms may involve impairment of balance, coordination, and functional mobility; impairment of sensation and vision; involvement of bowel, bladder, and sexual function; cognitive changes; and spasticity, weakness, and fatigue.[1] Many people with MS experience gait and mobility impairments.[2] Gait is typically slower, with abnormal step length, cadence, and base of support; an increased forward trunk lean; and abnormal displacement of the center of gravity.[3,4] Movement from supine to stand has been shown to be slower and composed of a greater number of acceleration units.[5]

Changes from the normal, preferred biomechanical pattern of gait that affect the vertical displacement of the sacrum[6] or that alter the normal stability of the head[7] cause an increase in energy consumption. People with MS have been shown to have an energy cost of walking three to four times greater than normal.[8]

Excess energy consumption during normal activity may be a major factor contributing to the fatigue that is such a common symptom of MS. This fatigue affects activity during the day, often causing people to avoid activity, and may also disrupt sleep patterns.[9] The cause of this fatigue is unknown but may be related to problems with oxygen utilization in skeletal muscle.[10,11]

While drugs are being developed to address problems with immune function, the medical management of MS is primarily symptomatic. Medications are available that help control spasticity, urinary frequency, pain, depression, and fatigue. Use of these medications has improved the quality of life in people with MS. However, medications often have side effects, such as

weakness or drowsiness, that may make their use less desirable.[12] Exercise is also recommended and has beneficial effects on the quality of life.[13] A submaximal approach to strength and endurance training has been found to be beneficial,[14,15] and a motor learning approach to movement problems has been recommended.[16]

Quality of life is a construct that encompasses a range of life activities, including the physical, emotional, mental, and social domains.[17] This has been documented by assessment of general well-being[18] and by use of perceived health status measures based on the SF-36.[17-19] Quality of life has been improved in people with MS with the use of a variety of interventions, including a community nursing program providing education on self-care and recognition of MS-related problems,[18] a physical rehabilitation program,[20] exercise programs,[13] and Awareness Through Movement (ATM).[21]

Based on previous clinical work at the Jimmie Heuga Center (Edwards, CO), where many people who experienced ATM said it helped them, we decided to use ATM as a motor learning-based approach to improving motor control and functional mobility. ATM is a process that uses movement as a method for developing the kinesthetic sense. Feldenkrais believed that physical and psychological habits could best be changed by first becoming aware of the elements of the activity being done, then learning new behavior by exploring novel patterns of movement and action with expanded awareness as the goal. During this process, alternative strategies for movement are developed that grow out of the student's experience and capability.[22]

This process is very similar to the theoretical description of motor learning by Newell,[23] in which cycles of perception and action are tightly coupled in the learning process. Newell describes motor learning as an active exploratory process in which the learner is attempting to optimize goal success and comfort within the constraints of the body, the task, and the environment. This process has been described as the basis for motor development.[24]

Awareness through movement has been used to help people with a variety of diagnoses, including cerebral palsy,[25] rheumatoid arthritis,[26] and eating disorders.[27] We hypothesized that by learning new movement strategies and using and perhaps improving kinesthetic awareness through ATM, people with MS would improve their control of functional movement, decrease their energy expenditure, decrease their fatigue, and improve their quality of life.

Case Descriptions

Eighteen individuals responded to an advertisement in *Impressions*, the newsletter of the Greater Delaware Valley chapter of the National Multiple Sclerosis Society. Of these, four met our inclusion criteria and were able to attend ATM classes regularly. Inclusion criteria were a diagnosis of MS (all four had the relapsing/remitting form), ability to walk 75 feet independently with or without canes, and ability to rise from supine to stand unassisted several times. All four participants were women between the ages of 29 and 47 (average 38.5 years) with MS symptom onset three to nine years ago (average seven years). All were employed full-time outside the home. The group was selected to be fairly homogeneous so that they would be able to participate at a relatively equal level in the ATM classes. None of the participants had any experience with ATM, and none started any new therapies during the course of the intervention.

Case #1 (KC) was a 36-year-old woman who was married and lived with her husband. She had been diagnosed with MS 8.5 years ago. She completed a high school education and had a full-time job as a computer programmer. She had significant spasticity and mild weakness in both lower extremities that affected her functional mobility. Because of ataxia, she usually walked with two canes, and her transfers were slow and uncertain. She reported a frequency of falling greater than once per week. At the start of the intervention, she was doing a daily stretching and mild strengthening program for her legs. Her medications included baclofen, tizanidine (Zanaflex), and oxybutynin (Ditropan). She reported that no medical or physical therapy intervention had previously helped her balance.

Case #2 (LK) was a 30-year-old woman who was married and lived with her husband. She had been diagnosed with MS eight years ago. She completed four years of college and worked full-time in an office in a management capacity. She had moderate weakness in her trunk and lower extremities that affected her sitting and standing balance and her mobility. She reported falling infrequently. Her gait, with two canes, was slow but reciprocal with assistance from her arms to clear each lower extremity. There was mild spasticity in her lower extremities. She transferred independently but slowly and with difficulty. Three months before the beginning of classes, she had an exacerbation and arthroscopic surgery on the left knee but had recovered from both at the start of classes. Her medications included interferon (Avonex), baclofen, oxybu-

tynin, and paroxetine (Paxil). Her involvement in a program of hippotherapy continued throughout the course of the study.

Case #3 (CR) was a 42-year-old woman who lived with her significant other. She had been diagnosed with MS 2.8 years ago. She had a master's-level education and worked full-time as a member of the managerial staff of a labor union local. Her most recent exacerbation was six months before the start of ATM classes. Initially, her strength, endurance, and mobility were normal. She reported that she used a cane only when she felt weakness in her legs. She had no history of falling. She had hypertension that was being successfully treated and received monthly chiropractic treatments for low back stiffness. She took no medications and was not involved in any structured exercise or therapy program.

Case #4 (LB) was a 46-year-old woman who lived with her husband and two teenaged children. She had been diagnosed with MS 7.5 years ago. She had a master's-level education and was employed as a nurse at a university clinic. There was no report of a recent exacerbation. She had weakness and mild spasticity in her left leg and used a walking stick to assist her with distance and balance. Her transfers were slow, with compensation for the left leg weakness. She reported occasional falls. Other medical diagnoses included hypothyroidism and pituitary adenoma, which were successfully treated. Her medication regimen included baclofen. She was not involved in any other structured exercise or therapy program.

Measurements and Instrumentation

Background and demographic information was collected using the Incapacity Status Scale and Environmental Status Scale of the Minimal Record of Disability.[28] Fatigue was assessed using the Fatigue Severity Scale.[29] The Fatigue Severity Scale was developed to differentiate normal fatigue from fatigue associated with chronic medical conditions. Its internal consistency, validity, and sensitivity to change in fatigue over time has been established with people with MS. Quality of life was measured using the Index of Well-Being.[30] This instrument was developed to assess overall quality of life in the general population. The sensitivity, validity, and consistency of this instrument have been established for people with MS.[18]

A number of objective measurements were done. Two types of movement were assessed using the PEAK Motus video motion analysis (Englewood, CO). In the supine-to-stand movement, participants were set up with a 1" reflective ball on the top of their heads and given one practice trial. Next they were asked to stand up at their normal comfortable pace, and then to stand up as fast as they could. The movement was scored for total time and for number of acceleration units[31] as measures of coordination. An acceleration unit denotes a change in velocity of the ongoing movement and reflects a change in the underlying muscular recruitment pattern. For gait analysis, participants were set up with eight reflective markers. Each person was asked to do several trials of walking across a 15-foot walkway. The video was analyzed for velocity, cadence, forward trunk lean, head stability,[7] and vertical displacement of the sacrum.[6]

At the beginning of each ATM class and at the final data collection session, each participant was asked to complete an open-ended questionnaire commenting on any changes in her medical or functional status she had noted since the previous session. Finally, two of the participants were interviewed by telephone to assess their status and the impact of the ATM one year following the intervention (Table 1). Both of these women had engaged another Feldenkrais practitioner to do another series of eight ATM classes for them during the spring and summer of 1998.

All data collection and ATM classes were held in air-conditioned classrooms at Widener University's Institute for Physical Therapy Education in Chester, PA. All data collection was done at the same time of day. Participants first filled out the questionnaires, then a marker was placed on their heads and their supine-to-stand movements were videotaped. Other markers were then added and gait was videotaped. Each

TABLE 1 Subjective Questions Asked

Weekly questions before ATM

1. Have you had an exacerbation or any increase in symptoms since the last ATM class? If yes, briefly explain what the symptoms are and how they affect your function in daily activities.
2. Have you noticed any changes in your functional ability since the last ATM class? If yes, briefly explain.

Interview questions after 1 year

1. Have you continued using or doing ATM in any way?
2. Can you reflect on your experience of the ATM classes and what they meant to you? Physically. Psychologically.
3. Do you feel any differently about your ability to manage MS problems?

participant was allowed as much rest as she needed between trials. The entire data collection process took less than 30 minutes per individual. Quantitative data were compared for changes from before the intervention to after the intervention. Only changes of more than 10% were considered significant.

Intervention

Ten weekly ATM classes were held through the summer and early fall of 1997. Each participant attended all 10 classes. Each class was approximately 90 minutes long and focused on a specific sequence of functional movements. Participants were encouraged to rest as needed throughout the class. All classes were taught by the principal author (JS), a certified Feldenkrais practitioner.

The first class was an introduction to the principles of ATM. Using an active movement process, the participants explored the kinesthetic sense associated with small changes in position and posture. Attention was directed to the following:

1) How much effort was needed to achieve and maintain a position through a series of changes,
2) Where that effort was being made,
3) Whether breathing continued normally or was held during the process,
4) Where the base of support was in relation to the organization of the other body segments,
5) How changes in the base of support related to effort, and
6) How the speed of movement and different environmental features affected the sense of the body.

Each individual participated in her own way and at her own pace, resting whenever necessary. Occasionally, when there was confusion about the meaning of a verbal instruction, manual guidance was given by the instructor, or another participant's movement was used as a demonstration.

The nine subsequent classes were organized around exploration of movement possibilities in a variety of positions (Table 2). The lesson topics were selected based on what the participants wanted to improve in their performance. As an example, an excerpt from the lesson on week 3 is included (Table 3).

The instructor's goal during the class was not to improve movement performance per se, but to improve the participants' ability to become aware of how they organize their movement, to sense what their body feels like under different conditions, and to experience the possibility of using a variety of strategies to approach a movement problem. Participants were instructed to search for comfort and ease in their exploratory process. It was emphasized that there was no single correct way of doing any movement.

TABLE 2 Topics of Awareness Through Movement Classes

Week	Topic
1	Organization, effort, breathing, base of support, speed of movement, environmental factors
2	Sitting in a chair, pelvic movements "pelvic clock"
3	Long sitting, hook lying: pelvic movements
4	Pelvic movements and rolling
5	Supine, rolling to sitting
6	Sitting in a chair; transfer to standing
7	Standing; weight shifting and balance
8	Long sitting; pelvic tilting; side lying: leg swinging and balance
9	Standing up from supine on the floor
10	Walking; side lying, supine, standing

Outcomes

Six themes emerged from the weekly subjective feedback (Table 4):

1) There was an increase in the awareness of many aspects of movement. This included sensing the center of gravity, the center of pressure, the position of the limbs, the size and speed of movements, and the process of breathing or holding the breath. This last was not written about in comments but was a frequent topic of discussion and even joking during the classes.
2) There was an increase in flexibility and a decrease in stiffness.
3) There was an improvement in balance as related to the performance of daily activities and an improvement in the control of movement.
4) There was an increase in the awareness of the effort involved in doing things, with comments related to increased ease of movement and more energy available to do activities.
5) There was recognition and understanding of the possibility of the reorganization of movement, noted by such things as using smaller steps or putting the center of gravity over the feet in a different way.
6) There was an improved mental outlook.

TABLE 3 Transcript of a Segment of ATM Lesson 3

Speaker	Dialogue
JS	Sit on the mat, leaning back on your hands behind you, with your legs straight out ... If you get tired shift your hands around ... and any time you need to lie on your back and rest ... Try different positions and notice how much strain there is on your wrist ... Notice the comfort of different areas of your body, your back, shoulders, neck ...
S	I feel pressure at my elbows ...
JS	Bring your hands close to your body so that you are sitting straighter up ... Notice the pressure on your hands ... Notice how your back feels ... Notice your breathing ... Find a position where you are most comfortable and again start pushing into your arm so that your head goes up ... Can you feel your shoulder blades moving?
S	I feel some tightness in the middle of my back.
JS	Yes, there are muscles there that pull your shoulder blades up and down ... Notice your breathing ... If it has stopped, just breathe normally again ... Notice how your legs are resting on the floor ... Without looking, can you imagine what direction your left and right toes are pointing? ... Now start slowly rolling your right leg so that the outside of the foot goes toward the floor and then rolls back ... Don't try to push it all the way ... Just move it some distance in that direction that's easy ... Notice if your left leg is moving ... Just let it lie there and be heavy ... Move the right leg whatever you can without the left leg moving at all ... Rest ... Now let the left leg roll in the same way ... Notice if the knee bends as the side of the foot goes toward the floor ... As your leg turns like that, let the knee bend a little more ... not much, just what's easy ... Notice your breathing ... Lie down and rest ... Feel how your back and legs are resting on the floor and how your toes are pointing ... Come up to sitting again like before ... Think about the pelvic clock we worked with before ... Begin rolling your pelvis forward toward 12 and back toward 6 ... left toward 9 and right toward 3 ... Now roll toward 9 and back to the middle ... Does the pressure change on your hands?
S	... More pressure on my right hand going toward 9.
JS	What does that mean?
S	I'm pushing with my right hand.
JS	Does it feel like your hand is pushing, or is your hand supporting you and your body is pushing against your arm into your hand? ...
S	At the beginning, the body pushes the arm ... at the end my hand pushes me a little further ...
JS	... Rest ... Now keep moving toward 9 and back ... and notice what your left leg does ... Does your weight shift to your left hip? ... Does your left knee stay straight, or stiffen, or bend?
S	It bends a little when I go toward 9 ... and the right leg straightens.
JS	Rest on your back ... (at this point, we take the lesson into supine)

JS = the practitioner (principal investigator); S = one of the women doing the class. This segment took 8 minutes.

All of the participants except KC experienced an increase in the level of their symptoms during the 10-week period but were still able to participate fully in the ATM lessons.

The nature of changes seen in the objective measures (Tables 5–8) suggests that each person benefited in her own way. Two people improved considerably in the supine-to-stand task coordination measures; two people declined. Interestingly, the individual who improved the most (CR) was the one who initially performed at the highest level. Although gait velocity increased in only one case, in all cases there were noticeable changes in timing and movement of cadence, trunk lean, head stability, and vertical displacement (see Tables 5–8, bottom section).

In one person (KC), the Incapacity Status Scale score improved; in two (CR, LB) it declined. The Fatigue Severity Scale score improved in one person (LK). Three of the four participants had large increases on the Index of Well-Being. Interestingly, the only person who did not have a positive change on the Index of Well-Being (CR) was the person who performed at the highest level, had the highest Index of Well-Being score at the outset, and was diagnosed most recently.

In the 1-year follow-up interviews (Table 9),] the two major themes were greater ease of movement and better functional balance (KC did not fall for eight months following the third ATM class), and a pervasive sense of improved quality of life and mental outlook.

Discussion

Although in the selection process we attempted to identify a group of people who performed at

TABLE 4 Subjective Comments About Each Week's Activities

Week	Patient No.	Responses
1	1	Change in awareness of how to do things
	2	Able to identify my center of gravity better during hippotherapy ... felt surprisingly stable for a fleeting moment. That is the exact moment I gained hope for the future. I suddenly remembered what it felt like to be steady
	3	Changes in thinking about how to support myself
	4	Increased awareness of the base of support while initiating movement
2	1	Better sitting balance ... easier to put on socks and panty hose
	2	Increase in MS symptoms ... increase in knee weakness and decrease in balance
	4	Attempting to minimize efforts required for activities
3	1	Increased flexibility of hip movements
	3	Increased awareness of the movement and placement of my legs
	2	More control when leaning and reaching in a chair
	4	Walking with awareness of pelvic movements and by taking smaller steps
4	1	Improved hip movements ... better standing balance ... had a fall, knee a little stiff
	3	Gallbladder surgery ... increased awareness of movements needed to turn and roll and get out of bed without pain
	4	Increase in movement planning to transition from supine to sitting
5	1	Did not fall this week
	4	Increased pain in left knee and improved awareness of weaker leg
6	1	Numbness in both legs below knees after sitting in the chair too long
	2	Increased stiffness from urinary tract infection ... increased dose of Baclofen and Paxil ... Improved awareness of standing balance
	3	Increased numbness on the left side ... increased level of fatigue
	4	Started using MAFO which was previously being serviced
7	1	Better standing balance ... improved steadiness in the shower
	2	Started taking Amantidine for fatigue ... more aware of pressure on feet while maintaining standing balance
	3	Able to do standing, weight shifting movements of the lesson without feeling unsteady
	4	Increased awareness of keeping my weight over my feet
8	1	Movements of walking easier
	2	Decrease in left foot drop ... decrease in upper body balance
	3	Ease in walking due to improved movements of the hips and shoulders
	4	Increased awareness of keeping my weight over my feet
9	1	Better standing balance and shifting of weight
	2	Stopped Amantidine due to drowsiness
	4	Change of position from standing to lying down and reverse was improved
10	1	Improved confidence in getting around without losing my balance ... no falls for 6 weeks
	2	Able to stand still for longer periods of time without using a crutch ... able to walk more easily with less assistance using smaller steps
	3	Smaller movements are better for conserving energy ... more aware of how my body moves and how to explore alternate ways to accomplish a task ... psychologically, the classes helped to imagine how to move in different ways
	4	Feeling of more energy and improvement of balance ... more creative solutions to the movement challenges that MS presents

the same level, this did not occur. The performance levels varied from one person who could run up and down the stairs without any assistance to another person who needed two canes and an elevator to get to the classroom. In addition, three participants had periods of increased symptom expression during the 10-week period.

During the ATM classes, many suggestions were made to direct attention in a variety of ways for all people, but no one was told that any particular way of walking, sitting, or transferring was better for her. Because the intervention process is one of self-discovery, each person was free to learn at her own pace and to deal with her

TABLE 5 Case 1

Type of Measure	Pre-ATM	Post-ATM	% Change	Nature of Change
Fatigue Severity Scale	39	40	+2.9	0
Index of Well Being	149.32	165.44	+10.9	+
Incapacity Status Scale (MRD)	17	14	−17.6	+
Supine to stand time: seconds (normal speed)	12.17	9.1	−25.2	+
Supine to stand time: seconds (fast)	10.47	8.47	−19.1	+
Supine to stand: acceleration units (normal)	17	16	−5.9	0
Supine to stand: acceleration units (fast)	18	12	−33.3	+
Gait: velocity (mph)	1.1	1.2	+13.5	+
Gait: cadence (steps per minute)	88.9	88.9	0	0
Gait: forward lean (min-max) (degrees)	15.9–21.0	16.1–21.5		
Gait: forward trunk lean (range) (degrees)	5.1	5.4	+5.8	0
Gait: head stability	0.461	0.475	+3.0	0
Gait: vertical displacement × weight (in · lb)	106.8	133.3	+24.8	−

A change of greater than 10% is considered a significant change for the purposes of this study. Nature of change: + = improvement in function; − = decline in function; 0 = no change.

own specific problems in each lesson. For this reason, each person may have taken a different lesson away from the same class. All the participants seemed to appreciate the idea that there was no right way to do anything. The possibility of working in groups in this way reduces the cost to each person and allows people to learn from each other. In addition, the possibility of working with people at different functional levels together makes the group process even more appealing.

We make the claim, and our participants told us, that their awareness improved. What evidence supports this? The video data show, and all participants reported, a reorganization of their movements (e.g., gait and supine-to-stand movements, documented in Tables 5–8). This was mostly experienced outside of the classroom and on their own initiative following suggestions with which they had experimented in class. To do this, they needed to recognize how they performed a task and then to do it a different way.

TABLE 6 Case 2

Type of Measure	Pre-ATM	Post-ATM	% Change	Nature of Change
Fatigue Severity Scale	50	43	−14.0	+
Index of Well Being	89.15	140.77	+57.9	+
Incapacity Status Scale (MRD)	11	11	0	0
Supine to stand time: seconds (normal speed)	44.80	46.6	+4.0	0
Supine to stand time: seconds (fast)	22.10	27.1	+34.8	−
Supine to stand: acceleration units (normal)	59	60	+1.6	0
Supine to stand: acceleration units (fast)	19	32	+68.4	−
Gait: velocity (mph)	0.77	0.83	+7.9	0
Gait: cadence (steps per minute)	52.2	52.8	+0.6	0
Gait: forward lean (min-max) (degrees)	17.1–35.8	20.5–31.2		
Gait: forward trunk lean (range) (degrees)	18.7	10.7	−42.7	+
Gait: head stability	0.288	0.325	+12.8	−
Gait: vertical displacement × weight (in · lb)	469.0	252.0	−46.2	+

A change of greater than 10% is considered a significant change for the purposes of this study. Nature of change: + = improvement in function; − = decline in function; 0 = no change.

TABLE 7 Case 3

Type of Measure	Pre-ATM	Post-ATM	% Change	Nature of Change
Fatigue Severity Scale	28	30	+7.1	0
Index of Well Being	209.87	196.10	−6.2	0
Incapacity Status Scale (MRD)	2	3	+50.0	−
Supine to stand time: seconds (normal speed)	5.3	4.8	−10.0	+
Supine to stand time: seconds (fast)	4.7	3.9	−15.5	+
Supine to stand: acceleration units (normal)	7	5	−28.5	+
Supine to stand: acceleration units (fast)	5	2	−60.0	+
Gait: velocity (mph)	2.4	2.32	−3.3	0
Gait: cadence (steps per minute)	121.7	123.2	+1.2	0
Gait: forward lean (min-max) (degrees)	12.3–16.1	14.5–19.5		
Gait: forward trunk lean (range) (degrees)	3.8	5.0	+31.5	−
Gait: head stability	0.305	0.337	+10.5	−
Gait: vertical displacement × weight (in · lb)	224.3	229.3	+2.3	0

A change of greater than 10% is considered a significant change for the purposes of this study. Nature of change: + = improvement in function; − = decline in function; 0 = no change.

This process requires awareness. These were not changes that they made on their own before participating in the classes, so they may have developed this use of their awareness during the classes. There is experimental evidence also suggesting that ATM[32] and kinesthetic training[33] improve the accuracy of motor control, and that ATM is associated with changes in body image.[34] The role of awareness in the exploratory and learning process may be to recognize an attractor around which a new coordinative structure for movement might be organized.[35]

The idea of working with awareness as an intended outcome, which might later be transformed into improved performance, may seem like a strange concept to many physical therapists. The process does not direct people toward a specific outcome, but suggests that they explore a variety of movements to develop a kinesthetic understanding of how they can organize their movement in different ways. This is a perception–action cycle of searching for what feels more comfortable, stable, or useful. A variety of outcomes could emerge from this process.

TABLE 8 Case 4

Type of Measure	Pre-ATM	Post-ATM	% Change	Nature of Change
Fatigue Severity Scale	54	53	−1.8	0
Index of Well Being	170.87	197.45	+15.6	+
Incapacity Status Scale (MRD)	5	8	+60.0	−
Supine to stand time: seconds (normal speed)	8.0	9.70	+21.3	−
Supine to stand time: seconds (fast)	6.4	6.63	+3.6	0
Supine to stand: acceleration units (normal)	8	11	+37.5	−
Supine to stand: acceleration units (fast)	8	9	+12.5	−
Gait: velocity (mph)	1.83	1.01	−44.9	−
Gait: cadence (steps per minute)	105.25	75.5	−28.4	−
Gait: forward lean (min-max) (degrees)	19.2–24.0	22.2–26.6		
Gait: forward trunk lean (range) (degrees)	4.8	4.4	−8.3	0
Gait: head stability	0.478	0.422	−11.7	+
Gait: vertical displacement × weight (in · lb)	313.0	140.0	−55.3	+

A change of greater than 10% is considered a significant change for the purposes of this study. Nature of change: + = improvement in function; − = decline in function; 0 = no change.

TABLE 9 Comments from Follow-up Interview After 1 Year

Patient No.	Comment
1 (KC)	"My balance is better as long as I keep up the movements. I still do the pelvic clock every day. It helps a lot with sitting and standing. I'm able to recover my balance. Yesterday I fell, but I was trying to carry 6 pairs of shoes and using only one crutch. That's the first time I've fallen in 8 months."
	"I stopped taking the Baclofen. It makes me too tired. I think I can manage the stiffness using the Awareness Through Movement."
	"It's easier to move. I can do standing activities longer."
	"It (the ATM) gives me a lighter mental attitude. When I do it I feel better mentally. I feel more relaxed ... I have better control and it's easier to do things. Tension is so easy to build up ... This is a way I use to relieve tension in my upper body and that helps my walking."
4 (LB)	"Being someone who always moved quickly, I became aware that quick and large movements aren't good for me now, and have learned to move with smaller movements more slowly and gracefully. I have better balance."
	"I am better emotionally and mentally. It's very challenging to do this method. I have found that I could do things that I didn't believe I could do. I could get that little toe to move a little. I could calm down and breathe and just feel the movement. It was very empowering. But I guess it's not for everyone. My sister came to one class and said, 'This is too hard, just give me a pill that will make me better.'"
	"I had an exacerbation. I was driving my daughter to camp and got stuck in traffic in NYC. I had trouble getting my foot from the gas to the brake. It was very scary. I did a steroid burst. The doctor wanted to put me in the hospital for a Solumedrol treatment, but my husband had planned a 25th anniversary trip to Hawaii. I decided to go to Hawaii. I never would have been able to do this if I didn't feel that understood my body well enough to somehow get it to do what I needed to do ... I went snorkeling. I jumped off the side of the boat not knowing if I could even swim. The water was amazing. Nothing but me and the sound of my breathing. I never would have attempted it if I didn't have the confidence that I knew how to move from A to B."
	"I use the ideas all the time now. It is a lifelong education. I use it with my children. It has really stimulated my creativity. I feel better. I work better. I have the attitude now that I can do things. People around me, my family and friends, don't see much progress. I'm not cured from the MS, but they see this attitude and they appreciate it."

It does not require the performance of many repetitions, although it may use many. It does not require the use of resistance or excessive effort ("no pain, no gain"), although it may use resistance in a task and draws attention to recognizing the effort that is used. The focus is on an internal cognitive process and not on performance, although performance enhancement often occurs. It is an inquisitive and exploratory process more akin to play than work or exercise; for this reason, it is difficult for some adult patients to understand. As noted by LB (Table 9), it is a cognitively challenging process that not everyone is willing or able to do. It is very similar to the learning style described by Langer called "mindful learning."[36] We are beginning to understand that a process like this may be important for motor learning[36,37] and rehabilitation.[38] In this context, there appears to be a transfer of learning from one type of activity to another. Perhaps awareness of the process of learning is the key to transfer of learning. For example (Tables 2,4), in week 3, a lesson done in long sit and hook lying and using pelvic movements, was reported to be related to awareness of hip movements (KC) and leg placement (CR) in walking, better sitting balance (LK), and easier walking (LB). Clearly, we need to develop a better understanding of the factors that affect transfer and generalization of learning.

We did not assess balance in any formal way. When we assessed gait, using the pooled group data, it appeared that there were only individualized and inconclusive changes. The head stability data and vertical displacement data may be in conflict. Both should change in a negative direction to indicate increased stability and decreased effort.[6,7] However, the research on this in people with MS may be inconclusive. Gehlsen et al.[3] stated that vertical displacement may either increase or decrease when people with MS make adaptive changes in their gait. Why did our participants report that their walking was easier and their balance better? As noted in the outcomes (Tables 5–8), each participant had a different pattern of changes in her gait. However, in every case except CR, the direction of change of the components could be used to explain easier,

more efficient, and more stable walking. As an example, in the case of LB, a decrease in velocity and cadence was accompanied by an increase in head stability and a decrease in vertical displacement (Tables 8–9). An increase in velocity is not always better.

We also need to remember that a formal video motion analysis assessment of gait is not a real-life situation, with its changing textures, surprises, and distractions. The same can be said for the formal video analysis of supine-to-stand in its relationship to balance. Although it may be a good measure of coordination for this movement, it is not clear that a faster movement with fewer acceleration units would be a safer or better movement for a person with MS or someone who is elderly.[7,39]

Pope and Tarlov[40] include quality of life as an area of major significance in disability assessment. The clearest and perhaps most interesting finding of this study is the subjective reporting of improvement in factors related to quality of life and large increases in the Index of Well-Being scores, except in one case. This has been reported before with studies using ATM in people with MS[21] and with the well elderly.[39,41] What is this phenomenon? Why would there be a pervasive psychological outcome from an intervention such as this? What is the importance of this for physical therapy treatment and outcome assessment? The phenomenon is best described by participants in the 1-year follow-up interview (Table 9):

KC: "It [ATM] gives me a lighter mental attitude. When I do it, I feel better mentally. I feel more relaxed . . . I have better control and it's easier to do things."

LB: "I am better emotionally and mentally. It's very challenging to do this method. I have found that I could do things that I didn't believe I could do. I could get that little toe to move a little. I could calm down and breathe and just feel the movement. It was very empowering. . . It has really stimulated my creativity."

Enhanced imagination of moving in different ways and increased confidence and ability to find creative solutions to problems are factors that are related to improving quality of life. This is directly related to Bandura's definition of perceived self-efficacy: "the belief that one has the capability to organize and execute a particular course of action."[42] Self-efficacy has been shown to be directly related to success in rehabilitation in the sense that those who have a higher self-efficacy going into the process generally have a better outcome.[43] As physical therapists, we try to instill confidence in our patients. We try to empower them and bring them to the point of being independent, creative problem-solvers. Perhaps ATM is a good way to achieve those goals and address the performance issues at the same time.

The outcomes of this intervention have raised some interesting questions and provide a novel view of aspects of physical therapy practice with people with MS. This study serves as a pilot for future research. A future study should be based on a larger sample and would use a true experimental design. This level of internal validity is important due to the natural variation of symptoms and performance seen in MS. We would use different measures, such as an MS quality of life instrument to assess general health status, a measure of self-efficacy to look for association with the Index of Well-Being, a functional assessment balance, a prospective record of falls, and a physiologic assessment of energy expenditure using oxygen consumption. It would be valuable to repeat the qualitative aspects using a more formal procedure of qualitative data analysis. It would also be important to find out if the outcomes suggested here can be extended to a wider range of functional levels within the MS population rather than just the independent ambulators represented in this project. ATM seems to be a very helpful type of intervention to add to the rehabilitation process for people with MS.

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