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Feldenkrais Method

BACKGROUND, RESEARCH, AND ORTHOPAEDIC CASE STUDIES

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In 1982 (when the author began his physical therapy education), motor learning as a treatment intervention was just on the horizon. It did not have a central place in the curriculum. In 1998, the *Guide to Physical Therapy Practice* listed *motor learning* among the standard set of therapeutic exercise interventions that physical therapists perform and suggested its use with all populations and most diagnostic groups.[19] In the standard text on therapeutic exercise by Kisner and Colby,[28] however, other than one page in the introduction that listed coordination, balance, and functional skills as a goal of therapeutic exercise and a short paragraph in the final chapter on exercises to increase skill, there was nothing devoted to the explanation, justification, understanding, use, and practice of motor learning, learning applied to the acquisition of coordination and skill. This is a basic and essential area of physical therapy intervention that is underappreciated and underused in orthopaedics.

In the area of rehabilitation, Feldenkrais method (FM) offers an approach to intervention that focuses on expanding kinesthetic awareness as a basis for improving function. FM offers guidelines for directing a learning experience for a patient that are individualized, yet based in common features of human anatomy and patterns of movement. Training in FM teaches the physical therapist to ask what a patient needs to learn to rehabilitate himself or herself and provides strong guideposts for selecting learning tasks and problems for patients. This article discusses some of the history and philosophy of FM and summarizes relevant scientific literature assessing its use. The article then describes how the use of FM is integrated into a physical therapy practice using descriptive outcome data and case studies.

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FELDENKRAIS METHOD

Historical Background

Moshe Feldenkrais was born in Russia and emigrated to Palestine at the age of 14. In Palestine, he worked in construction and tutored younger children with learning difficulties. He is also known for developing a system of hand-to-hand combat, which was used by settlers for self-defense. As a young man, he went to Paris and earned his doctorate in mechanical and electrical engineering, with later work in nuclear physics. While in Paris, Feldenkrais studied judo and became the first European black belt.[21, 34] He later published several books on judo.[13, 14] He was also a soccer player and in competition injured his left knee. This injury motivated Feldenkrais to study anatomy and physiology and develop his own process of rehabilitation to restore function of his knee. This was the beginning of his work that later developed into *Awareness Through Movement* and *Functional Integration*.[21] During World War II, Feldenkrais was in England working on development of antisubmarine technology. During this time, he taught a series of public judo classes, during which he began to develop his thinking on how people learned to move and act in the way that they do. He studied psychology and human development and became familiar with the work of Alexander and Gindler. Through these studies and teaching experiences, he formulated theories about development and postural control that are expressed in his book, *Body and Mature Behavior*, published in 1949.[15] After World War II, Feldenkrais returned to Israel, where he worked in research and continued teaching public classes, which now were focused more on giving people an opportunity to move more easily and comfortably. He also was developing a method of using his hands to help people to learn movement. Because of public demand, he began to teach people to do what he was doing. He trained a small group of Israeli students starting in 1968 and began his first large public training with 60 students in San Francisco in 1975.[45] Feldenkrais died in 1984 and was unable to complete his second major training program.

Philosophic and Theoretic Background

The basic philosophy of Feldenkrais' work is expressed in *Body and Mature Behavior*:[15]

> . . . [T]he human brain is such as to make . . . acquisition of new responses a normal and suitable activity. It is as if it were capable of functioning with any possible combination of nervous interconnections until individual experience forms the one which will be preferred and active. The active pattern of doing is therefore, essentially personal. This great ability to form individual nervous paths and muscular patterns makes it possible for faulty patterns to be learned. The earlier the fault occurs, the more ingrained it appears, and is. Faulty behavior will appear in the executive motor mechanisms which will seem later, when the nervous system has grown fitted to the undesirable motility, to be inherent in the person and unalterable. It will remain largely so unless the nervous paths producing the undesirable pattern of motility are undone and reshuffled into a better configuration.

Feldenkrais conceived the process of learning as producing new connections, pathways, and associations in the central nervous system. He understood learn-

ing further as both physical and interpersonal. This understanding suggested that psychologic factors, such as fear and anxiety, could limit the active experience of a child and limit the child's learning of a full range of development of physical and emotional expression.[15]

The idea that faulty functional patterns could be learned was new at the time. It was also accepted that the motor patterns, thought to be contained in the motor cortex, were stable. The idea that learning new patterns of movement might alter the organization of the motor cortex was radical.

Today it is understood that the brain and central nervous system are extremely plastic and that the refinements of organization and function are molded by experience. The evidence for this understanding has developed 25 years.[26] The ideas have been drawn together by Edelman[12] in his work, *Neural Darwinism: The Theory of Neuronal Group Selection*. Others have studied the learning process and suggested that there is a continuous interplay between the perceptual and motor processes in what Newell[35] refers to as the perceptual-motor workspace. Within this perceptual-motor workspace, exploratory activity guides the process of learning.[18,35] These elements have come together in several articles by Byl et al[5] showing that learning and performance of a repetitive task by a monkey can cause dedifferentiation of the representation of the hand in the sensorimotor cortex, resulting in focal dystonia–like symptoms, including loss of sensory discrimination and loss of motor control. The same kinds of problems are seen in humans with repetitive strain injuries or focal dystonias involving the hand.[7] It has also been shown that training can improve sensory discrimination level[31] and that a process of exploratory and variable movement and relearning sensory discrimination may be a successful approach to rehabilitation from this type of problem.[6]

For Feldenkrais, the question was not whether reorganization of motor patterns could be done but how best to do it. He drew on the developing field of psychology and summarized its efforts by saying that ". . . the adult personality is the result of adjustment of initial urges to the surrounding conditions."[15] He understood adjustment as a "successful act of learning, . . . the achievement of a proper response,"[15] whatever that proper response might be—from throwing a baseball, to getting along with one's mother-in-law, to having a satisfactory sex life. His attention became focused not on a particular style of adjustment (e.g., freudian, jungian) but on the process of adjustment itself, the process of learning. His work with judo had given him an image of ideal control of movement. This consisted of three elements: (1) posture, which allowed movement in any direction with the same ease; (2) ability to initiate movement without preliminary adjustments in posture; and (3) performance of movement with minimum effort and maximum efficiency.[15] With the learning and teaching of judo as his laboratory, Feldenkrais blended these ideas into a method of working in a rehabilitative way with people with physical and psychologic problems. At the heart of this process is the idea that people can learn new patterns of control best by participating in nonhabitual actions.

TRAINING AND PRACTICE

Feldenkrais developed two approaches to this process of somatic reeducation: Awareness Through Movement (ATM) and Functional Integration (FI). In FI,

the client is made as comfortable as possible, and outside sensory stimulation is reduced as much as possible to enhance the awareness of internal processes and to maximize the opportunity for new learning. The interaction between the practitioner and the client is essentially nonverbal, with the practitioner using his or her hands gently to guide the client through simple movements and changes in posture. Through this process, the practitioner gains an appreciation of resistance to movements where there might ideally be none. During FI, the client is presented with many opportunities to learn about how he or she controls posture and is given opportunities to experience novel postural configurations. Throughout the life span, each person organizes his or her nervous system to perform certain sets of activities. With injury, chronic disease, aging, or faulty learning, this process may become disorganized and reorganized to compensate for those chronic processes. The goal in FI is to help guide the client through a process of learning optimal patterns of control.[17]

In ATM, the practitioner uses verbal guidance to take a client through a series of changes in posture. In this process, the client is asked to repeat a small movement a number of times, and attention is directed toward detecting changes in the feeling of stability, effort, relationship of body segments, use of momentum, elements of timing, and relationship to breathing and toward the sense of the body in response to this process (e.g., larger, smaller, more or less comfortable, warmer or colder, closer to the floor). The intention is to make the movement an exploratory process, introducing nonhabitual elements, disconnecting the client from his or her habitual processes of goals and controls. In this way, it becomes possible for the client to discover and learn new patterns of control and to accept or reject them as useful within the range of possible behaviors and actions. The goal of ATM is the same as that of FI. The process is slightly different in that ATM requires more internally generated action. If a person is unable to generate a variety of exploratory movements or if the process of generating and performing movements is too difficult or painful, FI is the more satisfactory approach.

One advantage of ATM is that it can be done with many people at the same time, responding to the same set of verbal instructions. In this situation, people hear and interpret the instructions in slightly different ways as they are able to perform them and so involve themselves in slightly different ways with a lesson and take slightly different individually appropriate learning from the experience. The goal is not for all people to learn to do something in exactly the same way but to explore and discover the usefulness of new alternatives for movement and posture. The movement might be as simple as rolling from supine to the side. In the process, a person might discover that he or she habitually holds the head off the floor, stops breathing at the initiation of movement, or keeps a leg stiff when it would be easier to let it bend. Through the process of exploratory movement, the person learns to resolve these difficulties and control the movement in a manner that is closer to the clearest intention of the movement. This process may become a microcosm for life, in which a person discovers how he or she deals with the relationship between intentions and actions. It is possible to learn a lot more than how to learn a little more easily.[37] A sample of ATM lessons is available in the book by Feldenkrais.[16]

The process of training to become a practitioner of the Feldenkrais method is governed by a Training Accreditation Board of the Feldenkrais Guild of North

America (FGNA). This board oversees the content and quality of each training program. A training program includes the equivalent of 32 full-time weeks of class time, spread over 4 years to allow students time to integrate and practice developing observational and manual skills. The process is almost entirely experiential so that students develop an understanding of the biomechanics and learning processes involved in developing movement skills through a rich personal exploration of their own and others' movement processes. The individuality of solutions to movement problems is emphasized along with the idea that there may be multiple solutions to the same problem.

REVIEW OF RESEARCH LITERATURE ON FELDENKRAIS METHOD

DeRosa and Porterfield[11] have listed FM as one of the approaches that can be used to achieve their objective of enhancing neuromuscular function in the treatment of low back pain. The process of ATM also addresses the issues of introducing nondestructive forces to the injured area and giving the patient active instruction in optimal biomechanical function—addressing three of the four objectives DeRosa and Porterfield[11] suggest for low back pain rehabilitation. These activities may then also promote analgesia, achieving the fourth objective. The research suggests that FM may be used to address a variety of orthopaedic problems. The common feature is that all the results may somehow come down to modification of processes of motor control.

Pain Management

Although there are no large, randomized, controlled trials showing the effectiveness of FM on pain management, there are many small studies that suggest FM can be used successfully to reduce pain and improve function. Lake[29] published case summaries of six patients with back pain who had been unresponsive to other interventions. All these patients achieved relief from pain, and accompanying postural changes were documented. FI was used as a treatment, but there was no description of the specific processes of the interventions that were used and no information about the course of responsiveness or length of treatment. Dennenberg and Reeves[10] studied 15 patients, most of whom had back pain diagnoses, and used FM as an adjunct to physical therapy treatment. There was a reduction in pain and increased functional mobility. Another result was the demonstration of changes in the health locus of control in these patients. There was no control group, using only standard physical therapy, in this study.

Phipps et al[36] retrospectively studied 34 patients who had undergone a chronic pain program in which they received FM, yoga, or both as part of their program. Two years later, more than 70% of these patients reported moderately to completely reduced pain and a higher level of function and were continuing to use the skills they had learned during the program. There was no control group. Bearman and Shafarman[1] used an intensive 8-week program of ATM with seven chronic pain patients who were followed through the Santa Barbara Regional Health Authority. Participants showed significant decrease in pain and increase in functional mobility. There was also a decreased use of medica-

tions. All these changes were maintained at a 1-year follow-up. There was a 40% decrease in the cost of the care for these patients compared with the year before the ATM intervention.

Several other studies have been directed at more specific populations in which pain is a major problem. Dean et al[9] worked with five subjects with fibromyalgia using ATM lessons over a period of 8 weeks. They reported improvements in posture, gait, and body awareness and significant improvements in pain reduction, sleep, and fatigue levels. In an effort to repeat these results with a controlled design, Herrera et al[22] studied eight people with fibromyalgia using a repeated measures design with a baseline control period followed by 3 weeks of ATM. The variability in the baseline period made conclusions about the effects of ATM impossible; however, six of the eight people reported improvements in functional self-efficacy. In a single-subject design across four subjects with rheumatoid arthritis, Narula et al[32,33] found decreased kinetic energy for sit-to-stand, increased speed of walking, decreased levels of pain, and improved function after 6 weeks of ATM. All of these studies are too small to draw broad conclusions, but they suggest that FM can be used effectively as a method of pain management across a broad spectrum of people who have problems with pain.

Range of Motion and Muscle Activity

Feldenkrais' theory suggests that people can find more efficient ways of organizing their movement. In a group of 21 subjects, performance of a supine flexion task was found to require a decreased amount of flexor electromyographic activity and was perceived as being easier after a single ATM lesson. It was also shown that these changes were not a result of the imagery and suggestion used in the ATM process, suggesting that they were a result of performing the exploratory movements alone.[3] Another study of 30 subjects, using a single ATM lesson, reported an increase in supine neck flexion range of motion and a decrease in the perceived effort used to make this movement.[38] Ideberg and Werner[23] did a kinematic assessment of gait before and after 10 FI lessons in 10 patients with chronic back pain. Pelvic obliquity in the pain group was decreased compared with a healthy control group throughout the study, and pelvic rotation increased after FI in the pain group. Walking velocity was unchanged. There was no assessment of the effects of FI on the pain itself.

Several studies have been done to assess the effects of ATM lessons on hamstring length. In the first, 38 subjects were divided into control and ATM groups. Five ATM lessons were done over a period of 2 weeks. Only one of these lessons addressed hamstring function. Authors reported no change in hamstring length in the ATM group.[25] In another study, with 33 subjects divided between control and ATM groups, subjects worked with a variety of hamstring ATM lessons daily over a period of 3 weeks. Results showed a clinically and statistically significant increase in hamstring length. These results were not correlated with amount of practice time, suggesting learning rather than stretching as the agent of change.[43]

Posture and Breathing

The idea that motor control and organization can be altered suggests that posture can be modified. Changes in posture resulting from FM work have been reported

by Dean et al[9] in patients with fibromyalgia after 8 weeks of ATM lessons and by Lake[30] in 61 patients with low back pain compared with matched controls after a mean of four FI lessons. The use of FM for improving posture and balance has been suggested for patients with Parkinson's disease.[40] Shenkman et al[41] also describe the use of ATM and discuss the effects on posture, balance, breathing, and mobility in two patients with Parkinson's disease. Breathing has been shown to be improved by a series of ATM lessons, with increases in movement at the level of the abdomen, increase in erector spinae muscle activity, and increased peak flow rate compared with controls.[39]

Buchanan and Thelen[4] have shown that a single ATM lesson has effects that alter many standing posture variables compared with similar length interventions of relaxation or stretching. This effect was suggested to support the idea that an ATM lesson was able to destabilize the habitual postural control pattern and allow for a new pattern to be learned, as is postulated in dynamic systems theory.[27, 46]

Functional Mobility and Quality of Life

Improvements in functional mobility noted by Phipps et al[36] and Dennenberg and Reeves[10] in relation to successful pain management already have been mentioned. Chinn et al[8] have reported significantly reduced perceived exertion in a functional reach task compared with a control group after an ATM lesson. Jackson-Wyatt et al[24] reported a 94% increase in upward displacement of the center of mass and concomitant increases in acceleration, velocity, work, and power after an 8-week Feldenkrais Professional Training program in which jumping was not taught or addressed. In a group of 23 healthy elderly individuals (mean age 75 years), 12 individuals who participated in 6 weeks of ATM classes showed a significant improvement in the Timed Up-and-Go test compared with the control group.[2] Improvements also occurred in other functional measures. Another study reported improvements in functional mobility in a group of elderly people.[44]

The first research using FM was published in 1977. Gutman et al[20] looked at a series of physiologic, functional, and quality-of-life measures in a group of well elderly individuals before and after a 6-week series of ATM lessons. They found improvements in several physiologic and functional measures, which were matched by changes in another exercise group and a control group. They found no differences between any of the post-ATM groups. The strongest change reported as due to the ATM lessons was an improvement in a measure of quality of life. Stephens et al[44] also found significant improvements in a group of 18 healthy elderly individuals between the ages of 68 and 89 compared with an age-matched control group in the vitality and mental health subscales of the SF-36 after a 2-day ATM workshop. Stephens et al[42] reported improvements in quality of life in a group of four women with multiple sclerosis after 10 weeks of weekly ATM lessons, using the Index of Well Being.

ANALYSIS OF A FELDENKRAIS AND PHYSICAL THERAPY PRACTICE

The author has a small, independent, part-time physical therapy practice in which patients with orthopaedic, neurologic, and cardiopulmonary diagnoses

TABLE 1 Practice Distribution by Age and Gender

Age	Male	Female	Total
12–25	2	4	6
26–45	21	37	58
46–65	33	62	95
>66	7	14	21
Total	63	117	180

are seen. Patients are seen once a week or once every 2 to 3 weeks, and they are given major responsibility for an active home program of ATM or regular physical therapy exercises. Occasionally, patients are seen more frequently. The author works with each patient one-on-one for an hour. This process allows patients to achieve a maximum amount of learning and benefit in a session, then to continue exploring this lesson and its effect in their lives over a period of days to develop and incorporate the learning further.

The author has completed a utilization review of the practice over 10 years. There have been a total of 180 musculoskeletal patient-episodes of care. Twenty-three of these were consultations only. These patients were seen for evaluation or consultation (or both) and were seen only one or two times. The remaining 157 patients were seen through to discharge.

The utilization review is a simplified version of the data set created by FOTO, Inc, Knoxville, TN. It includes 20 variables. The gender distribution was 35% male and 65% female. The age range was 15 to 86 years, with a distribution as shown in Table 1. For purposes of description only, cases are divided into groups by primary body region involved. In treatment, this region is not approached as a single focus of intervention. The approach is to integrate sensorimotor function throughout the body as a whole as seen in the case descriptions. The body region variable contains 16 descriptive levels. Eleven body region variable levels are represented in the musculoskeletal cases. The most commonly seen body regions are listed in Table 2. A list of the range of the primary diagnoses by body region, by ICD-9, is shown in Table 3.

TABLE 2 Top Five Regions by Body Part of Primary Diagnosis

Body Part	Number of Cases
Low back	66
Neck	42
Whole body	41
Knee	13
Shoulder	11

TABLE 3 ICD-9 Codes of Primary Diagnoses by Region

Region	ICD-9 Code of Primary Diagnosis
Hand	727.04
Shoulder	719.41, 726.0, 726.1, 729.11, 840.0, 840.9
TMJ	524.6
Cervical	088.81, 720.2, 722.0, 722.4, 722.8, 723.1, 723.3, 723.4, 723.9, 728.2, 729.1, 738.4, 847.0
Thoracic	714.0, 722.5, 724.5, 729.1
Lumbar	715.85, 720.0, 721.0, 721.3, 721.9, 722.2, 722.5, 722.7, 722.73, 722.8, 724.02, 724.2, 724.3, 724.4, 724.9, 729.1, 738.4, 756.12, 846.0, 847.2
Hip	715.85, 715.95, 716.0, 716.8, 716.85
Knee	715.85, 715.96, 716.0; 716.6, 717.9, 726.6, 824.0, 836.3, 844.0,
Foot/ankle	726.71, 728.0, 729.4, 845.0
Whole body	353.0, 723.1, 714.0, 696.0, 729.1, 733.0, 733.99, 805.2, 812.12
Whole spine	737.3, 737.39, 756.12

TMJ = temporomandibular joint

Outcomes have been tracked in two ways: (1) percentage of goals met (Table 4) and (2) number of treatment sessions until discharge. It can be calculated from Table 5 that 91% of the cases were discharged having achieved most or all of their goals established at initial evaluation. This percentage ranged from 40% for cases involving the foot and ankle, to 71% for the thoracic spine, to greater than 86% for all the other regions. The average number of sessions per person for all cases and diagnoses together was 12.5. This average ranged from 4.0 for patients with primary referral for temporomandibular joint to 17.6 sessions for patients with diagnoses including rheumatic or other inflammatory types of processes. For several body regions, the median number of sessions is considerably less than the mean. This statistical finding indicates that the distribution of number of sessions is not normal but is negatively skewed, with a few people receiving a high number of sessions (see Table 5). The preferred practice patterns for musculoskeletal diag-

TABLE 4 Description of Outcomes: Percentage of Goals Met

Score	Description
1	Consult only, 1–2 sessions
2	<50%; few or no goals met
3	>50%; some goals met
4	>75%; most goals met
5	100% of goals met

TABLE 5 Outcomes by Area of Primary Diagnosis, not Including Consultations

Region	Outcome*	*n*	No. Sessions	
			Range	Mean
Hand	5	2	4–7	5.5
Shoulder	4	4	2–18	7.5
	5	5	2–33	11.8
TMJ	4	1	7	7
	5	1	1	1
Cervical	2–3	5	2–16	7
	4	12	1–82	26.1
	5	23	1–105	13.1
Thoracic	2–3	2	3–4	3.5
	4	1	16	16
	5	4	2–12	7.0
Lumbar	2–3	2	3–10	6.5
	4	12	2–80	18.2
	5	41	1–88	11.5
Hip	4	2	2–15	8.5
	5	6	8–30	13.8
Knee	2–3	1	6	6
	4	3	3–11	5.7
	5	8	1–10	3.6
Foot/ankle	2–3	3	2	2
	4	1	20	20
	5	1	6	6
Whole body	4	7	10–30	21.1
	5	3	9–10	9.3
Whole spine (scoliosis)	3	1	2	2
	4	1	16	16
	5	5	3–40	15.2
Total		157	1–105	12.5

* See Table 4 for definitions of outcomes.
TMJ = temporomandibular joint

noses[19] suggest a range of expected number of visits from 3 to 87, depending on which of the nine patterns is being considered. Of these cases, 80% are expected to achieve goals within these time frames. An overall analysis of the musculoskeletal cases in this practice, without reference to diagnosis or practice pattern, shows that 80% of patients achieve most or all of their goals and are discharged by 17 sessions. This is well within the expected range.

CASE PRESENTATIONS

The following cases are presented as an illustration of how FM can be used within the context of physical therapy and rehabilitation in orthopaedics. This

is a representative sample of cases illustrating problems involving different diagnoses and body regions. In each case, a question is presented that focuses the role of the Feldenkrais work in that case. Each presentation follows the format: presentation and history, physical findings, assessment, question, treatment plan, treatment progression, and outcome. Descriptions of ATM and FI are not exhaustive. It is recommended that readers review the discussions of ATM and FI (see "Training and Practice" section) in order to get a clearer sense of what is happening in each lesson.

CASE 1

M. D. presented with a diagnosis of DeQuervain's syndrome. She had pain in the left hand radiating into the wrist, arm, and shoulder with resulting loss of range of motion (ROM), strength, and function in the left upper extremity, which interfered with activities of daily living (ADL). M. D. is a 52-year-old woman who works as a playwright and loves to work in her flower garden. Both of these tasks as well as other ADL require a complex use of the hands, of which she had become incapable.

M. D. had strained her left wrist in an exercise class 1 year before the evaluation. She was treated with steroid injections, which gave temporary relief. The injury was exacerbated 3 months later while she was using crutches after surgery on her right foot. Her left wrist was strained again a month later while carrying a carpet over her shoulder. A subsequent series of physical therapy treatments focusing on strength and range of motion (ROM) of the left wrist did not help her. She visited a hand specialist, who suggested surgery to relieve the problem with pain; she rejected the option of surgery. Her medications included estrogen and antidepressant, which she had been taking for more than 10 years.

Evaluation showed inflammation and tenderness at the left radial styloid, the distal wrist flexors and extensors, and intrinsics of the left thumb. There was a decrease in left wrist flexion and extension ranges to 45°, but left thumb ROM was normal, although painful at all end ranges. There was mild weakness (Manual Muscle Test (MMT) grade, 4−/5) in the left wrist and thumb in all ranges with pain. Pain increased throughout the day and with all hand functions, including carrying, gripping, and twisting. Sensation was intact. There were unusual patterns of motor control in the hand. She did not use fingertip control in gripping, instead using lateral gripping patterns involving the thumb, which increased pain. She also maintained her wrist in a slightly flexed and ulnar deviated position with the thumb metacarpophalangeal in hyperextension in many ADL tasks. This also caused pain.

M. D.'s patterns of motor control and her determination to continue to do ADL, although admirable, were exacerbating her condition. The question for M. D. was: How could she become aware of the role of her habitual movement patterns and learn to change them and at the same time improve her function? It was most important to involve her as an active agent in her own rehabilitation.

The early treatment plan involved anti-inflammatories and icing to control inflammation, active motion of the thumb into abduction with the metacarpophalangeal and distal interphalangeal flexed (5 sets of 10 repetitions each day), use of thumb and fingertip control of objects

and development of awareness of the effort in the hand and wrist activities that increased and decreased strain, and new functional positions of the wrist and hand. After the second session, a tennis ball became her constant companion. Her task with the tennis ball was to hold, manipulate, and squeeze it using her finger tips to keep the thumb out of the adducted and hyperextended position and to move the ball around through space by moving the wrist through all ranges, while maintaining relaxation through the rest of the arm and shoulder. At the beginning of each session, the author would ask her what she had learned that week about using her hand. In this way, she began to develop awareness about how she organized her hand to do different tasks, and her use of fingertip control became more habitual. By the fourth session, inflammation was controlled, and progressive resistive exercise with wrist flexors was begun. This exercise was progressed over time to include all ranges of wrist movement done in positions that kept the thumb abducted. By the fifth week, pain was more localized around the radial styloid, and while weeding in the garden, she felt her thumb extensor tendon snap, "like something snapped back into place," after which she was able to do full ROM, pain-free wrist extension.

After seven sessions (9 weeks), M. D. was discharged with full function, ROM, and normal strength and only occasional twinges of localized pain. Her concluding remark was that she was "much more thoughtful and careful now about how I use my hand so as not to reinjure it. My activities are not limited. I just have many different strategies now for doing things."

CASE 2

F. D. presented with disabling low back pain and neck stiffness. Pain exacerbated when he would stand or sit for more than 5 minutes or with bending and twisting. He is a 63-year-old high school math teacher, so standing and sitting are critical to his work and life. His goals were to be comfortable in his teaching work, to be able to exercise, and to work in his garden.

F. D. was a stocky, muscular man whose past medical history included hypertension for 20 years, which was controlled by medication and diet, and polymyalgia rheumatica. Two years previously, he was treated for a frozen shoulder after an exercise injury, and 1 year previously he underwent arthroscopic cleaning of the right knee.

Evaluation revealed tenderness to palpation at C2-6 and L4-5. Range of motion was moderately limited (50%) in the cervical spine, severely limited in the trunk (forward flexion to 15 inches above the floor, lateral flexion 4 inches above the knee), and slightly limited at the right shoulder and both hips. Thomas, Ely, and Active Knee Extension tests were all positive, indicating very short hamstrings, hip flexors, and quadricep muscles. He had normal strength throughout except hip extension and abduction (4−/5). He fatigued rapidly with simple repetitive leg movements. His pain was disabling during prolonged (>5 min-

utes) sitting or standing activities but did not project down his legs. Sensation was normal. His standing posture showed a mild forward head and swayback, with the trunk slightly rotated to the right, head tilted to the right, and a mild C curve to the left in the thoracic spine. His mobility was independent at all levels with good dynamic balance. He had difficulty getting into and out of his car. His gait was slow and stiff with decreased trunk rotation and decreased lower extremity flexion in swing. When doing a floor transfer, he needed to use a lot of upper extremity support and strength and had considerable pain.

F. D. was rigid in the upright position, possibly as a result of muscular development or possibly related to protection from pain. The question for F. D. was: Could he learn to use his trunk more in his movements? What would be the best way to go about helping him to learn to do this to make his functional movement easier? Because the pain was not radicular in pattern, pain was not considered an issue from the beginning.

The long-term goal was to develop awareness of and normal control of trunk, posture, and mobility in a variety of tasks. In the second session, after evaluation, an ATM lesson in supine was begun, designed to improve control of flexors of the hips, neck, arms, and trunk. It quickly became clear that this was too difficult, and the movement goal became rolling to the side in a controlled manner using flexion. F. D.'s stiffness was so great that initially he was unable to do this without losing his balance. The result of learning to control this movement was that he felt more relaxed and had less back pain. His walking felt more fluid during the subsequent week. The third session continued using small movements of the hips, arms, and neck in concert with trunk, with some improvements in control of flexion movements in supine. In the fourth session, an ATM lesson moving from long sitting (he needed to support himself with his arms to maintain this position) to side sitting was begun. The entire session was spent doing small variations on this theme. During the next week, his movements became much easier. Pain was not much of a problem, and he said, "I feel like I can see the light at the end of the tunnel." The fifth session continued the fourth by extending the movement from side-sitting to standing through a half-kneel position. At each point in this movement, we needed to find ways to control balance and use momentum. This required thinking about the position of his hands and knees and the movement of his arms and head. By the end of the fifth session, he was able to do this activity (transfer floor to stand through half-kneel) easily, although not as a smooth continuous movement. Back pain was now much reduced; however, this activity was extremely tiring for his legs. The next session continued the work of refining the control of the sit-to-stand movement by reversing the direction and working with control of stand-to-sit using a spiral motion guided by placement of the hands to the floor. During this session, aerobic conditioning on a Schwinn bike was begun after clearing his cardiopulmonary function. At home, he began brief bouts (30 to 60 seconds) of squat walking to strengthen his legs and started walking to build his endurance. Over a week, he increased his walking distance to 1 mile.

At the beginning of the seventh week, he was able to flex laterally his trunk to 3 inches below the knee and forward bend to 8 inches above

the floor. He had no back pain, his walking was much easier (i.e., much less tiring), and he had started doing a little gardening. We continued working with the standing floor transfer. One of the strategies used in ATM is to work with similar movements in difficult postures in order to improve motor control. We then worked in quadruped with movement of the hips, knees, and ankles, began working with a movement of sitting and rolling back into supine. He had no pain with this movement but was unable to coordinate the control of the trunk to do the movement without loss of balance. The following week he reported feeling great, having no pain and doing lots of work in his garden. In the last session, we refined control of the sit-to-supine, roll, rolling up to sitting; continued work with the spiral movement of sit to stand to sit; and worked with some trunk rotation movements in standing. At the end of the eighth week, his forward bend reached 1 inch above the floor, he was not limited in standing or sitting, and he was discharged with a home exercise program of walking, gardening, and continuing to work with the spiral floor transfer movement until it was smooth and easy and the standing and turning ATM until he was able to place his palm on the wall directly behind him without difficulty. In eight sessions, F. D. was working without pain and had achieved all his other goals.

CASE 3

F. E. presented with a diagnosis of cervical and low back strain and a left frozen shoulder. She was referred by a colleague who, after 30 treatment sessions employing traditional stretching, strengthening modalities, and craniosacral treatments, was frustrated by being unable to resolve the injuries sustained in a motor vehicle accident. F. E. had watched in the rear-view mirror as she was hit from behind by a drunk driver who failed to stop at the light. She was not knocked unconscious, she sustained no head injury, and there were no rotational movements as she was thrown back against the seat then forward against the steering wheel. In the process, her left shoulder was jerked by the seat belt.

F. E. is a 38-year-old woman whose past medical history included asthma with pneumothorax on two occasions, removal of a benign breast tumor, and hysterectomy 10 years previously. Her medications included estrogen, theophylline (Slo-bid), and triamcinolone (Azmacort). The overall inpression of the initial evaluation was that F. E. was tired and agitated. She was tightly guarding the left side of her body, unable to do her normal activities and unable to sleep well. Specifically, in standing, her left shoulder was elevated and retracted and her lumbar spine was flat. She was comfortable only in sitting and supine positions. She was tender to palpation throughout the left neck, shoulder, and back, and her pain increased to a 6/10 level with walking or standing for 5 minutes and with all movements of the trunk. Cervical ROM was limited 50% in lateral flexion and painful at all end ranges. Trunk movement was limited greater than 50% in all ranges. The left shoulder showed a restricted capsular pattern with flexion 135°, abduction 120°, external rotation 60°, and internal rotation 70°. Sensation in the left arm was intact, and

strength appeared to be functional throughout, but F. E. complained of weakness in the left arm and hand and of dropping objects. Her breathing pattern was rapid, shallow, and guarded.

What F. E. needed immediately was to be able to find some comfortable resting positions and get some good sleep. Also, her history suggested that her rib cage had been traumatized in the past through asthma, pneumothorax, and breast surgery and that this might be a sensitive, difficult, or dangerous area for her psychologically. The question for F. E. was: How could she find some comfort and rest, then overcome her fear and pain and reestablish normal movement? How could she begin to have a normal, nontraumatized sense of her shoulder and ribcage?

The general treatment plan was to use FI to open up her breathing and to establish comfort in side-lying and prone as well as supine and sitting, then to develop ATM lessons that would lead her back to establishing normal movement patterns with the left upper extremity and trunk, developing strength in the process. In the first session after evaluation, we worked in supine using FI. Gentle pressure was used first on the right, then on the left to enhance the rib movements associated with breathing, then to improve the comfort of left lateral flexion in the thoracic spine and extension in the lumbar spine. At the end of this lesson, short pieces of ATM were introduced: (1) supine bridging with the left leg only and reaching (shoulder protraction) with the left arm and (2) prone, the beginning of a pushup using only the left arm. Both movements were within easy ranges of motion and were well within pain tolerance and introduced to give F. E. a taste of some comfortable movement and strength involving her left shoulder. She was asked to work with these 2 small movements as her home exercise program. At the end of this session, she was breathing fully and deeply and had more color in her face. She had full ROM of the left shoulder with pain at 2/10 and full pain-free extension and rotation of the trunk. No work had been done in this session that pushed or challenged the ROM of her left shoulder. Her next session was 2 weeks later. She reported being able to sleep comfortably and move much more easily, but that she still had soreness around her left shoulder, scapula, and midthoracic paraspinals. The author and F. E. worked with FI, this time starting in side-lying, then moving to prone. The author gently went through a series of movements with her left arm, taking the scapula through its range in each movement, then integrating the underlying rotation, flexion, and extension movements of the trunk and rib cage, which support the movements of the arm. We then moved to prone and developed the reaching movements into pushing power keeping the shoulder blades free, the breathing relaxed, and the head and neck resting. After this session, she was mostly pain-free but had soreness with higher levels of resistance in her pushup. She returned after 1 week of working with these movements at home and reported that her shoulder function was 90% of normal. We continued working with FI in sitting and standing, integrating the left shoulder into full overhead reaching movements with lateral flexion of the trunk and in prone working with full weight bearing and rotational movements of the neck

and trunk. At the end of the session, she was able to take her full body weight in a full pushup with scapular protraction and was pain-free in all movements. F. E. was discharged after this third treatment session. The key was to break through her fear, establish confidence, and establish a comfortable base of support for shoulder movements to build on.

CASE 4

V. J. is a massage therapist who spends hours each day leaning over a waist-high table, working on people with her hands. This is difficult work for people who have normal posture, but V. J. has a mild scoliosis. She is also a mother of two boys; the younger boy was delivered by cesarean section 9 years ago. She was referred for treatment of lumbar and thoracic pain with muscle spasms and possible sacroiliac joint involvement.

On initial evaluation she presented with a 25° to 30° right low thoracic C-curve scoliosis. Her left shoulder was lower than the right. Her left iliac crest was higher than the right, and her rib cage was rotated back to the right. Both sacroiliac joints were painful to palpation, but alignment appeared good. She also had pain with the compression of spinous processes and paraspinal muscles in the midthoracic and low lumbar regions bilaterally. Her strength by manual muscle test was normal except for hip flexors, 4−/5, both bilaterally; hip extensors, left 4−/5, right 3+/5, and adductors on the left, 4−/5 with pain. Her upper and lower abdominals were 3+/5. Functionally, she was able to do all ADL and work, but she was in pain all the time and not able to sleep well. V. J.'s past medical history was unremarkable, and there was no history of surgery except the cesarean section. She was taking no medications but was seeing a chiropractor biweekly, which she had been doing for more than a year.

V. J.'s goals were to reduce her pain so that she could work more easily and sleep better. The problem of pain management revolved around understanding the use of her spine and being able to use better biomechanics in work and life. The question for V. J. was: How could she learn to be more aware of her spinal movement so that she could organize her posture better and use good biomechanics consistently?

The treatment plan was to begin by addressing problems of abdominal weakness, then move into using ATM and FI to develop her awareness of spinal function and postural control. Treatment began with traditional supine strengthening of lower and upper abdominals. She then moved to an ATM lesson involving control of flexion in supine by bringing the elbow and knee together, then rolling toward the side. Initially, rolling to the right was much easier than rolling to the left. This lesson was supplemented by a supine lesson of reaching to the foot in hook-lying, then rolling to the side, which was also easier to control on the right. In each of these, she was initially unable to roll all the way to her side without losing her balance. As she developed more control in these movements, she began to report soreness in her neck as a result. At the beginning of the fourth session, she reported feeling much stronger and more flexible

and having much less back pain and sleeping better. The neck pain was addressed using FI to help her to organize the movement of her head, neck, and upper spine. Two new ATM lessons moved to more difficult use of the spine in rolling backward in supine to put her feet over her head (the plow in yoga). She was initially too weak in the abdominals to roll up without support from her arms and could not bring her knees to rest on her head. In this movement, she also had trouble maintaining her balance because of asymmetry of control. The other movement was supine bridging from the feet to the head using the arms to support and maintain balance. This was easier but caused pain in the low back and so was abandoned. At the end of this session, she reported that she felt like she had a "single body" that was no longer going in all different directions. At the beginning of the fifth session, she reported feeling much straighter in standing, but that it had taken 3 days for the soreness to go away, and her neck was hurting again. FI work was done in prone to continue the process of reorganizing movement of her neck and shoulders. Work with the supine backward roll to the plow position continued, and the movement became easier.

At the beginning of the sixth session, she reported that friends remarked on her straighter posture. Lower back pain was completely resolved at this point. She was able to do her massage work with no low back pain, but midthoracic and neck pain were still a problem. During this lesson, we worked with FI in sitting and prone to lengthen spine and to improve the ease of rotation toward the left and extension. These movements were then picked up in ATM lessons in prone lengthening the legs (lengthening here means moving the foot away from the head) and extending and rotating the spine left and right, slowly then quickly; in standing with weight shifting and lateral flexion of the trunk; and continuing to improve control of the plow to reach fully to the feet overhead and move the legs and head simultaneously. At the end of this session, all the thoracic and neck pain was resolved, and her breathing was much deeper and slower. The biomechanics of her working in standing and plantargrade positions was discussed. In the next session, a series of four brief ATM lessons started with rolling into the plow, which was now much easier, and prone of elbows alternately flexing the legs to the side and turning to look at the knee. This movement was initially much more difficult on the left with right lumbar pain but became easier, pain-free, and more symmetric. We then took a break and did an ATM lesson in hook-lying that was similar to progressive relaxation. The author asked V. J. to use her developing sense of control around her spine and to tighten muscles in the pattern that produced her scoliosis and pain. When she did this, she noticed small movements of rotation of the pelvis and left hip. The pattern was then relaxed and lengthened and tightened again alternately until she could do it easily. Two more brief ATM lessons in hook-lying occurred: actively rolling the pelvis left, center, and right and pushing with her feet to discover the minimum amount of effort needed to roll her pelvis left, center, and right.

She was initially unable to organize a pushing, rolling movement with her left foot. As she discovered how to do this movement, she felt her pelvis and sacrum lying flat in supine for the first time in her memory.

When she stood up, she reported feeling wonderful, as though she was not being twisted or pulled and her ribs were not straining against each other. She noted what a pleasure it was to bend over and tie her shoes and feel both sides of her pelvis working in a fluid way. She was discharged at the end of this session with these four ATM lessons as her home exercise program. A month later, she reported in a follow-up phone conversation that she was feeling even better and having no problems in her work.

CONCLUSIONS

Because of the extensive training program, practitioners are highly skilled at movement analysis and at developing movement sequences, using both ATM and FI, which lead to clients finding effective solutions to movement problems. The utilization review of the practice and the presentation of case studies show that FM can be used effectively within the context of physical therapy practice to address a variety of clinical diagnoses, with excellent outcomes.

Continued research in the area of clinical efficacy with a range of disorders will develop a richer understanding of the usefulness of FM in a variety of areas as the profession of physical therapy moves in the direction of evidence-based practice. Research in areas of the physiology and biomechanics of motor control and learning will also help clinicians to understand the process by which this method works and perhaps learn to practice and integrate it better with other disciplines.

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