

# Injury Rehabilitation through Active Isolated Stretching and Strengthening

By Ben Benjamin, Ph.D. and Jeffrey Haggquist, D.O.

Active Isolated Stretching and Strengthening (AIS) is a uniquely effective exercise system developed by Aaron Mattes. In a recent article<sup>1</sup>, we gave a general introduction to the stretching component of AIS, explaining the physiological principles underlying the techniques and the various ways in which this modality could benefit our clients. In this article, we're going to discuss the ways in which AIS (including both stretching and strengthening) can play a role in injury rehabilitation — therapy aimed at restoring function that has been lost through physical trauma or other types of soft-tissue damage. A large proportion of our clients require some degree of rehabilitative work, and since we began using AIS, our effectiveness in helping them has increased greatly. In speaking with various AIS practitioners and their clients, we have also collected many other reports of restored neuromuscular functioning; we'll incorporate some of their stories throughout the article as well.

Specialists in the field recognize five key components in the rehabilitation process: 1. Addressing the pain; 2. Restoring the full range of motion; 3. Neuromuscular reeducation; 4. Rebuilding strength; 5. Restoring full function. I'll address each of these, one at a time.

## 1. Addressing the Pain

The first step in rehabilitation is to relieve whatever pain the client is feeling. This makes intuitive sense — you can't effectively move or strengthen an injured structure until it stops hurting. Among other problems, pain usually causes a protective contracture, which ultimately increases the problem rather than solves it. To help resolve the pain, you need to determine what the cause is. We separate three kinds of causes: the precipitating event; direct cause; and indirect cause.

For example, suppose a person begins experiencing shoulder pain when lifting a suitcase after returning from a vacation. Lifting a suitcase uses a small, fairly weak muscle called the supraspinatus, which sits on top of the shoulder beneath the trapezius muscle. (See Image 1.) A person in decent shape can lift about 10–15 pounds using this muscle. When we go on vacation our suitcases usually weigh a good deal more than that

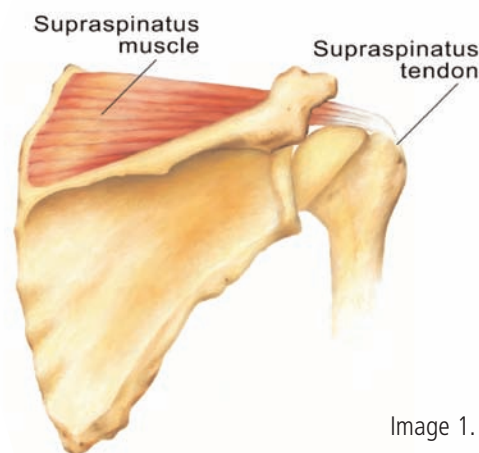


Image 1.

## Using AIS to Address Pain & Resolve Injury

AIS practitioner Roger McNear tells the story of one client, a sophomore in college, who had such severe shoulder pain that he couldn't concentrate, study, or sleep through the night. He rated his level of pain as 10 out of 10. This young man had previously been highly active. In addition to competing as a distance swimmer, he also did triathlons, played tennis, and played the mandolin.

Roger realized that all of these activities developed the muscles on the front of the client's body (referred to as the anterior chain), specifically the muscles on the front of the chest and shoulder. None of them helped to strengthen the opposing muscles at the back of the shoulder area (part of the posterior chain). Moreover, earlier treatment may have made the situation worse; the client's first therapist had worked almost exclusively with the anterior shoulder muscles.

Through an assessment process, including AIS range of motion tests, it became clear that this individual was suffering from chronic injuries to two important muscle-tendon regions: the supraspinatus and the biceps. Damage to these structures was the direct cause of his pain.

After performing the AIS exercise protocols on his neck, shoulder, and upper back area (attending to both the anterior and the posterior chains), the pain decreased significantly (from a 10 to a 6 or 7). After several more hours of work the next day, his pain level was down to a 2 or a 3. Roger taught him AIS stretching and strengthening techniques to do on his own, and then saw him again 10 days later. The pain had remained at a level 2, and by the end of the session the shoulder was no longer painful.

In summary, this treatment not only resolved the direct cause of pain, but also helped begin the process of establishing muscular balance that would prevent similar damage from occurring in the future.



Image 2. The first AIS hyperextension stretch, and three additional starting positions

(often 30–40 pounds). It is likely that dealing with the suitcase — lifting it, carrying it around, putting it into the trunk of a car, lifting it up to place it in the plane’s overhead bin, etc. — was the *precipitating event* that directly led to the injury. What is causing the pain now (the *direct cause*) is the result of that event: tears in the supraspinatus muscle and/or tendon and the resulting adhesive scarring. There may also be additional factors that predisposed this person to injury, such as a lack of strength or flexibility, muscle tension, or poor body alignment. These are *indirect causes*.

Whether or not you can identify a specific precipitating event, it is important to resolve the direct cause of the pain. The necessary treatment may range from hands-on work to exercise therapy to injections or surgery, depending on the nature and severity of the injury. While AIS does not work in every case, it is a good place to start. AIS is noninvasive, and for some mild to moderate cases, it may be the only form of therapy required. Gentle progressive stretching and strengthening exercises in the AIS protocols can help modify adhesive scar tissue and restore pain-free movement. In treating the supraspinatus muscle-tendon unit, the process would include a series of stretches referred to as hyperextension of the shoulder. In these stretches, the AIS practitioner assists the client to extend the arm straight back with the arm rotated in four different positions. (See Image 2.) The strengthening component would start with a standing abduction exercise (moving the arm away from the body sideways, using a light weight), and then progress to the same movement done side-lying, which is much more challenging (see Image 3).

Note that by starting to improve flexibility, such AIS techniques may begin to resolve one indirect cause of injury and help prevent future damage from occurring. Ongoing stretching and strengthening work, in stages 2 through 5 of rehabilitation, will also be beneficial in this regard.



Image 3.

## 2. Restoring the Full Range of Motion

After you have addressed the client’s pain, the next challenge is to restore the full range of motion in the muscles, fascia, and joint structures. This includes not just the immediate site of injury, but also other structures that may have been affected. When people are injured, they tend to compensate with other parts of the body, which can decrease the range of motion in these areas. For instance, a person who has an injury in her foot may compensate by walking in an unbalanced way, leading to pain and loss of mobility in her hip. The structures most likely to be affected are those in the same kinetic chain as the injured tissues. For example, if someone has a shoulder injury, both the neck and the elbow will likely be affected as well.

Often it’s necessary to work on other parts of the kinetic chain before we can improve the range of motion in the injured area. This relates back to the idea of indirect causes. A client with a knee injury may have an underlying problem with one of his arches collapsing and placing strain on both the hip and the knee on that side. In that

## Using AIS to Restore Range of Motion & Resolve Longstanding Problems

One individual came to AIS with an extremely limited range of motion in his left shoulder; he couldn't rotate his arm to put on his coat, had trouble reaching his head to brush his hair, and could not put his hand in his back pocket without a lot of pain. After his first 90-minute session, he was amazed that he could put his blazer on by himself. Some discomfort still remained, but after two more sessions his mobility was fully restored.

That wasn't the end of the treatment. As is often the case, there were longstanding problems in other, adjacent areas of this person's body. His AIS practitioner, Paul John Elliot, had noticed dysfunctional patterns in the way he moved his head and neck, and asked if he had any neck pain or if he ever got headaches. The client replied that he suffered from debilitating migraines, particularly when traveling. Paul taught him a series of AIS neck stretches that he could do on his own. Now, whenever he travels or feels a headache coming on in another situation, he does these stretches and the headache quickly resolves.

case, before you could truly correct the knee dysfunction, you'd need to first strengthen and restore functional integrity to the foot. It's also possible to have a kinetic chain dysfunction in the hip that causes an uneven distribution of weight through the knee, leading to knee injury and pain. Whenever you don't get results from working directly on an injured area, try looking elsewhere to see what other factors may be preventing a full recovery.

### Normal Range of Motion in the Hip



Single-leg pelvic tilt, bringing the knee to the chest: 75–80°



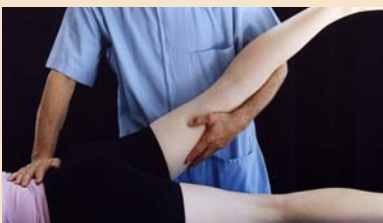
Medial rotation of the hip: 50–60°



Lateral rotation of the hip: 75–90°



Abduction of the hip: 50–60°



Extension of the hip: 25–30°

In order to test for any limitations in mobility, you need to know the normal range of motion for the joint you're testing. (See sidebar for examples.) It's also important to consider the client's performance goals. For instance, an elite swimmer or baseball player may require a greater capacity for internal rotation of the shoulder than the average individual.

Once you've identified the area(s) where range of motion needs to be restored, there are various methods of stretching you could use. As discussed in the previous article [reference], AIS is a highly efficient approach; it develops maximum flexibility in the shortest amount of time by taking into account key principles of human physiology.

One advantage of AIS is its specificity, isolating individual muscles and ensuring that each one is stretched in the correct functional position and plane of movement. For example, to stretch the hamstring muscles by lifting the leg straight up, you need to stay on the mid-sagittal plane (keep the legs parallel). If the leg rotates out to the side, you lose much of the hamstring stretch and start affecting other muscles instead. The same is true with stretching the rectus femoris in the anterior thigh; once you move off the mid-sagittal plane, you may lose the stretch in that muscle and begin to stretch the lateral quadriceps (vastus lateralis) instead. AIS techniques clearly specify these positions, and also differentiate between different fibers of specific muscle groups. You can pinpoint restrictions very precisely, in the proximal or distal portion of a given muscle, and then focus your stretching on whichever area is most limited. For instance, one stretch of the hamstring works the distal half (from mid-thigh to the knee) and another works the proximal half (between



the back of the hip to the middle of the thigh). (See Image 4.)

### 3. Neuromuscular reeducation

The next step is to reestablish normal communication between the muscles and the brain. After a prolonged period of disuse following an injury, you may see various signs of decreased neuromuscular control. For instance, the client may exhibit co-contraction (when one muscle contracts, the opposing muscle also contracts at the same time) or a muscle may shake or tremble on eccentric contraction (muscle contraction that occurs while the muscle is lengthening). Restoring normal functioning may require activating tissues and neural pathways that have remained latent for some time; establishing new pathways; and/or stimulating neurogenesis (the creation of brand new nerve tissues).

There are three basic guidelines for facilitating neuromuscular reeducation, based on constructivist learning theory — each supported by AIS practices:

1. **Using active, rather than passive motion.** Throughout an AIS session, the client actively initiates each movement and maintains continuous focus on performing the movement.
2. **Going slightly beyond the comfort range.** The practitioner increases the range of motion at the end of each stretch with a gentle assist, so the muscles are continually moving into novel territory.
3. **Repeating the process.** By repeating every movement six to eight times, we reinforce the neural pathways and solidify the learning in the nervous system.

### 4. Rebuilding Strength

While restoring mobility and flexibility is an important step forward, we must be careful not to stop there. Increasing the range of motion without developing strength in that range makes a client more susceptible to injuries and joint dysfunction. Only by actively building strength can you achieve balance and resilience.

There are several principles to keep in mind when working to rebuild strength. First, you want to make sure that a person's strength extends beyond the demands of his or her normal activities. Most people are strong enough to meet the basic demands of daily life, but don't have reserves of strength. Therefore, in an unusually challenging situation (such as lifting a particularly heavy object or slipping on ice and using their arms to catch themselves), they may easily get injured.

#### AIS for Neuromuscular Reeducation

Often the clients in greatest need of neuromuscular reeducation are those struggling with chronic degenerative diseases. AIS therapist Al Meo told us about one woman he's worked with who has multiple sclerosis (MS). About 15 years ago she was diagnosed with relapsing/remitting MS — a form of the disease in which relapses (periods in which new symptoms appear and old ones resurface or get worse) alternate with periods of full or partial recovery. Her neurologists told her that her condition would slowly worsen after every relapse; they estimated that she'd lose 1 to 3% of her neuromuscular functionality each time.

Determined to stay as high-functioning as she could for as long as she could, the woman committed to a regular schedule of AIS work — receiving AIS sessions twice a week and doing it on her own for 30 minutes every day. So far she has exceeded all expectations, losing no functionality at all since her diagnosis. Al remembers one relapse in which her legs were greatly debilitated. She began doing AIS two days later, and surprised her doctors with a full and remarkably quick recovery (5 or 6 days).

With ongoing AIS work, this person continues to maintain an active, busy life. Not only can she carry on basic daily activities; she is also able to work a full schedule as a clinical massage therapist, seeing seven patients a day, five days a week.

## Using AIS to Rebuild Strength

Developing and maintaining strong muscles is important for everyone, but particularly crucial for those suffering from atrophy due to neuromuscular disease or trauma. As we've used AIS with clients, we've been surprised at how effective it can be in reversing such declines.

For instance, with a client of Ben's who has Parkinson's disease, there appears to be a direct correlation between the strength she builds and the lessening of her tremors and pain. Over the course of a few months, she has reported great improvements in her ability to write, walk without dragging her foot, and sleep through the night. She says that whenever she begins to feel pain, she does the arm strength protocol and the pain goes away within five minutes.

While AIS is a gentle modality and builds strength in small increments, the end results can be quite dramatic. One of the AIS practitioners mentioned earlier, Roger McNear, worked with a young man who had suffered a brain trauma in a head-on motorcycle collision. His left arm and both hands lacked mobility and were in a continual contraction, and a year of treatment had failed to restore functioning to his legs; he was told by his doctors that he would probably never walk again.

Roger used AIS to help develop strength throughout this client's body. In the first two or three months he used only manual resistance. Then, as the client grew stronger, he had him start to use resistance bands and weights. Through the course of the treatment, the contractions in the client's hands and arm were resolved to a point where he could grasp and move. Moreover, after three additional months of regular sessions (one to two hours, three times a week), he was able to walk with crutches. After six months, he could walk either with a cane or unaided.

This means that it's important both to develop each muscle more fully and to develop a wider range of muscle groups. AIS protocols incorporate the full spectrum of muscles in a particular area — including those responsible for rotating, bending, extending, and flexing — so you don't focus solely on the most frequently used structures.

Another source of risk is having uneven levels of strength in a given muscle. Generally, a muscle is much weaker and more vulnerable at the end of its range of motion. As a result, a sudden or strong exertion from a position of full stretch (e.g., getting up suddenly from a lunge or starting to use a pectoral weight machine from the most stretched position) can result in injury. (See Image 5.) AIS exercises limit this risk by working each muscle throughout its full range of motion, starting with very light weights.

Along the same lines, you want to be sure that the person has adequate strength in eccentric contraction, not just concentric contraction. In concentric contraction, the muscle shortens while it contracts, as when you lift a weight in a biceps curl. Slowly releasing from a biceps curl involves eccentric contraction, in which the muscle is simultaneously contracting and lengthening. As mentioned earlier, some individuals experience difficulty with eccentric contraction following an injury. AIS places a strong emphasis on eccentric contraction, which actually builds strength 30 to 40 percent more efficiently than concentric contraction. In many cases, we use manual resistance (resisting the client's motion with our own strength, rather than a weight), which enables us to directly feel where the muscles are weaker and then adjust the exercise regimen accordingly. Because AIS is so specific, we can make targeted adjustments that isolate the precise areas that need the most work.

One final consideration is the need to combine strength with endurance. It's possible to be strong enough to lift a relatively large amount of weight, but lack the endurance to carry it for any length of time. In AIS, we simultaneously build endurance and strength by performing many repetitions of an exercise, very slowly, with a relatively low weight. The gentle, repetitive motion enhances metabolism within the soft tissues, improving nutrient delivery and the circulation of blood and lymph.



Image 5. A muscle is generally much weaker at the end of its range of motion, in a full stretch (above). To limit the risk of injury, it is important to start with very light weights when building up strength from this position.

## 5. Restoring Full Function

All the work we do in the first four stages lays the groundwork to prepare clients for whatever training is necessary to resume their normal level of activity — which will be somewhat different for each individual. At this point, a lot of the progress may be made outside the treatment room, sometimes with the help of a physical therapist, personal trainer, or coach. For instance, in working with a runner, we'd get that person ready to go back to track practice. We can provide some guidance on how to proceed (e.g., starting slowly and building up gradually), and then it's the process of actually running and doing training drills that will ultimately restore full function. In other cases, an individual may need help in preparing to return to a physically challenging job. Physical therapy clinics have special sections devoted to “work hardening,” using real or simulated work activities to mimic the demands of various types of jobs — from driving to custodial duties to heavy manual labor.

Back in the treatment room, we can play an important role in this stage of rehabilitation by tracking clients' progress and helping to ensure that they don't reinjure themselves by doing too much too quickly. As people resume more strenuous activities, they may develop new accommodation patterns (using stronger muscles to compensate for the ones that have just recently healed) or fall back into old, unconstructive ways of moving that contributed to their injury in the first place. If any setbacks do occur, we can facilitate healing and help prevent minor strains from developing into larger, chronic problems.

### A Personalized Process

While the five guidelines we've discussed provide a good general outline of the rehabilitation process, the details will vary depending on each person's individual needs. That process won't necessarily be linear; you might find yourself circling back to earlier steps, particularly if the client incurs any new injuries or has other setbacks in the healing process. At times it may also make sense to change the order of the steps. For instance, with a person who is hypermobile (excessively flexible), you typically want to introduce strengthening early on in the rehabilitation protocol. A hypermobile joint is less stable and more vulnerable to injury, so it's important for the surrounding musculature to be strong.

The time needed for recovery will also vary from person to person, depending in part on the individual's overall health and fitness. A client whose body is relatively strong, flexible, and healthy (apart from the injury) will tend to heal much more quickly than someone who is in generally poor shape. Healing time is also highly dependent upon the nature and severity of the injury and/or accompanying disease conditions. While some clients take months or years to regain functionality, others recover very quickly once they receive the appropriate treatment.

In the interviews we conducted for this article, several practitioners reported that it was witnessing or experiencing one of those rapid recoveries that first got them excited about AIS. Paul John Elliott says he was inspired by observing Aaron Mattes (the creator of this system) as he worked with a woman who had severe scoliosis. When she first came in, her torso was rotated about 20 degrees and bent about 20 degrees to the left.

### Using AIS to Restore Full Function

Rehabilitation treatment is always a personalized process, since the goals depend heavily upon the individual's lifestyle and patterns of activity. One client we interviewed began receiving AIS work in the aftermath of a horseback riding accident in Costa Rica; the horse had lost its footing and actually landed on him, leaving him with a broken wrist and severely damaged knee (including a torn meniscus and tears in many surrounding ligaments and muscles). At the time he had a very active lifestyle — living on a farm and staying fit with running, biking, skiing, and working with a personal trainer. It became clear that he would need reconstructive surgery to regain full function in his knee, but the surgeon said he would not recommend it for someone his age (48 years old); he performed the procedure primarily on competitive athletes and other highly active younger people.

Intent on getting his joints back, this client persisted and went ahead with the surgery. “I'm 48, not 84,” he said. He received intensive AIS stretching and strengthening work both before and afterward, three to four times per week. The results exceeded both his and his surgeon's expectations. His knee is now at 100%, and he has been able to resume all of his normal physical activity. (AIS work with his wrist also restored full flexibility and strength to that area.) Now, he tells us, aside from a scar on his knee, you would never know he had any problem with it at all. It's as good as it was before the accident — and maybe even a little bit more flexible.

## What it Takes to Practice AIS

For those seeking to achieve full mastery, AIS is best learned in small increments, amounting to at least 8 to 12 days of study over a four- to eight-month period. The techniques are not overly strenuous or complex, but it takes some time for a person to develop a facility with this type of work — for instance, to become sensitive to the end feel of each movement; to be able to stretch just beyond a client's level of comfort, without pushing too hard or creating strain; and to develop a sense of the timing and pacing that will be optimally beneficial for each individual. It's also important to have a solid working knowledge of the anatomy and physiology of the body.

Many AIS practitioners are massage therapists, doctors, physical therapists, exercise specialists, or personal trainers. Some physicians/osteopaths, chiropractors, and physical therapists learn AIS themselves and then go on to supervise others in their offices and clinics; they take responsibility for performing the initial assessments and prescribing the protocols that will be most useful. In general, more highly skilled professionals will be better able to customize AIS programs to suit people's individual needs, particularly for those with serious diseases or injury conditions.

Whatever your background, it's helpful to learn AIS in a clinical setting where you get exposure to clients with various challenging conditions. Many accomplished therapists have started out by working under Aaron Mattes's supervision in his clinic in Sarasota. Others have worked for or apprenticed under other experienced AIS practitioners — for instance, in Jeffrey Haggquist's clinic in Washington, D.C. Another option is attending the day-long clinics in Cambridge, Mass, where therapists work in two-person teams under Ben Benjamin's supervision.

Over the course of several days, she straightened out dramatically. (This practitioner now sees that same woman as a client; the bend in her spine has been reduced to roughly four degrees, and the rotation is virtually gone.) Another practitioner, Kathy Shadrick, was impressed by the healing of her own injury. Her carpal tunnel pain had become so intense that it was waking her up in the middle of the night, and she had begun to worry that she'd have to give up doing massage. She attended a five-day AIS workshop, and Aaron treated her at his clinic, in-between clients. By the end of the workshop her pain was gone.

Of course, most musculoskeletal problems will not resolve quite so rapidly. It's important for clients to keep doing AIS work regularly until the healing is complete. However, once they have received instruction from a skilled therapist, they can often do much of this work on their own. This is particularly beneficial for individuals who cannot afford to come for frequent sessions. So long as they are compliant — consistently doing the stretches and strengthening exercises they've been taught — they can go a long way toward healing themselves. In our minds, the ability to empower clients in this way is one of the greatest assets of AIS. Other practitioners we spoke with feel the same way. In Kathy Shadrick's words, "It proves it's not about me as a therapist; it's about the work. It's AIS, not me. That keeps me humble."

### Notes

<sup>1</sup> "Active Isolated Stretching: The Mattes Method." *Massage and Bodywork Magazine*, Nov/Dec 2009 & Jan/Feb 2010.

For AIS training courses offered by Ben Benjamin, visit <http://benbenjamin.com/sched.html> or call 617.576.0555.

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