The Postural Pronation Syndrome:

Restoring the Hinge Function of the Ankle

Most therapists have at least some clients with foot problems. Knowledge of excessive foot pronation, and the following techniques, will provide you with new and effective therapeutic strategies.

By Robert K. King
Photos by Marc Harris

When your feet hurt, you hurt all over. This adage seems not only culturally accurate, but structurally and energetically true as well. As the architectural foundations for the human frame, the feet play a vital role in providing a platform of support for upright structure. Postural distortions emanating from the feet can be insidious and commonly overlooked sources of pain and dysfunction throughout the body. Indeed, the feet are tattletales, observed Ida Rolf: "Every imbalance at higher levels shows unmistakably in the feet and ankles."[1] Before postural distortions elsewhere in the body can be alleviated, the feet and ankles must be freed of chronic strain patterns, creating a more efficient myofascial support system.

Our feet function by providing a stable base of support. Feet adapt to uneven surfaces, provide balance over an ever-changing center of gravity, act as a propulsive lever for movement, and absorb shock through ground reaction forces. The three arches of the feet connect us both physically and energetically to the ground beneath us. Not surprisingly, a client feeling "ungrounded" is usually expressing more than a vague feeling of psychological disconnection. Visual inspection will often reveal an unstable foot with myofascial strain patterns throughout the four layers of intrinsic musculature on the sole of the foot. "Ungrounded" now assumes observable and specific connotations as a clinical entity.

Like the knee, the ankle is a hinge joint. Like a door hinge, it works best in a single plane of movement, providing plantar flexion and dorsiflexion. Ideal functioning of the knee and ankle joints supports elegant gait. Since 80 percent of the human gait cycle occurs while being supported on one leg, the clinical importance of optimal hinge functioning becomes apparent. While the ankle and foot are separate anatomical entities, considering them together honors their structural and functional interdependence. Together, they provide a stable platform of support. However, when the foot loses its structural integrity and the ankle loses its functional capacity, soft tissue pain and distortion may appear throughout the body.

Manual therapists who comprehensively analyze posture and gait commonly see the link between collapsed arches and knee, hip and (especially) low back pain. Performing a postural analysis, we can readily observe the interconnection between all body segments and how their integrity and function are influenced by the feet as a base of support. Ania O'Conner, a clinical massage therapist from Newburyport, Massachusetts, estimates that more than 50 percent of her physically active clients have some degree of foot strain or arch collapse. She observes, "As boomers and weekend warriors go through the aging process, I notice an increasing number of chronic pain and postural problems are directly related to the feet."

Perhaps the most common clinical manifestation of this compromised platform of support is the Postural Pronation Syndrome. Originally termed the Postural Complex, this syndrome was presented as a distinct clinical entity by Laurence Jones, M.D., at the national convention of the American Medical Association in 1948. Jones asserted that this hyper-pronating foot imbalance produced a predictable series of anatomical distortions transmitted throughout the body. His 1955 book, *The Postural Complex*[2], details the nerve tension and serial distortions caused by this condition.

At this mid-century point in time, many osteopaths were also discussing hyper-pronation as a serious clinical entity. In 1950, Angus G. Cathie, D.O., wrote a brilliant article entitled, "The Influence of the Lower Extremities upon the Structural Integrity of the Body."[3] Cathie describes in remarkable detail how vital support structures such as the postural fascia, the sacroiliac joint, the sacrotuberous ligament, and the psoas and piriformis muscles are abnormally stressed by the unstable foot.

I would like to provide the reader with a more detailed look at this condition. Then I will present a series of manual techniques designed to address one aspect of this syndrome—that of reduced ankle dorsiflexion. My premise is that massage therapists can play a vital role in restoring the hinge function of the ankle as part of a comprehensive clinical approach.

Signs And Symptoms Of The Postural Pronation Syndrome

When external forces imposed upon the foot exceed the body's level of structural integrity, the result is symptomatic joint stress, micro-tearing of soft tissues, and the beginning of serial distortion and kinetic breakdown. Tissue repair cannot keep up with the perpetuating strain factors of micro-trauma, overload and fatigue. Walking, that uniquely human function, and most vital of exercise activities, now becomes a perpetuating factor in the spiral of dysfunction, pain and altered biomechanics. Let's take a closer look.

Ideal functioning of the foot includes optimal tissue integrity between the plantar fascia, the tendons, ligaments and muscles of the leg and foot. Pronation is a three-dimensional movement that occurs during the stance phase of gait. The medial arch flattens to accommodate compressive loads from above. This inward rocking occurs at the subtalar joint, which is the three-point contact between the calcaneus and the talus. Abnormal pronation is perhaps the most common of all biomechanical problems noted in podiatric practice. Why is this?

During weight-bearing gait, hyperpronation produces both regional and reverberational consequences. A visual clue for this collapse can be observed through the Standing Footprint Technique (see *Figure 1*, below). As the medial arch loses its ligamentous support, there is often muscular strain of the tibialis anterior and posterior muscles, both charged with lifting the medial arch as the prime movers of inversion of the foot. Tendinitis and tendinosis[4*] problems may occur as chronic overuse conditions develop. As the invertor muscles weaken, their functional antagonists fibularis longus and brevis[5**] can be palpated as hard, rigid and unyielding.

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Upon closer examination there are other significant signs and symptoms. The talus and navicular bones, no longer stabilized by ligamentous support, drop medially and distally, often indicating a "wider" and "longer" foot than its counterpart. Clients trying on new shoes will often comment that the hyper-pronating foot fits more snugly (sometimes an entire shoes size!). As osteo-ligamentous support unravels, the forefoot will often splay outward during gait, setting the stage for bunion formation or chronic joint strain.

Shock absorption is significantly diminished in the Postural Pronation Syndrome. Shock waves pass through our physical structure at more than 200 miles per hour[6] impacting the entire musculoskeletal system. When compromised, this vital foot function now transmits escalating shock forces throughout the body. Earl Conner, a Wisconsin-based sports massage therapist, observes a frequency in knee injuries, hypertonic hamstrings, and iliotibial band problems when shock absorption is compromised in the feet. "Sports performance and running efficiency are negatively affected," Conner notes. "Everyday walking can become a perpetuating factor."

More signs and symptoms become clinically apparent in the Postural Pronation Syndrome. Tightness of the two main plantarflexors, gastrocnemius and soleus are common, often limiting dorsiflexion range of motion. In particular the soleus, the largest of the leg muscles, is often riddled with trigger points along the medial and lateral borders of gastrocnemius. Their functional antagonists, the four dorsiflexors, are usually stretch-strained and subject to repetitive strain injury.

Biomechanical pathology undermines the body's ability to maintain intrinsic equilibrium. The muscles of the knee, hip, and lumbar region must now orchestrate load distribution. The feet as a stable platform of support are no longer competent.

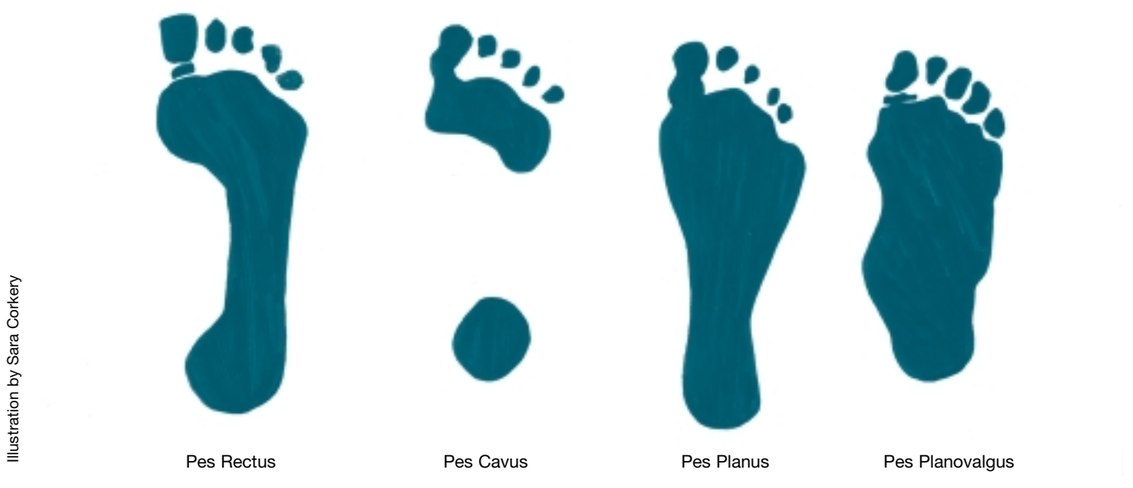

Illustration by Sara Corkery

Figure 1: Testing For Excessive Pronation
One method of testing for excessive subtalar foot pronation is to apply oil to the bottom of the client's feet and have him/her stand on a piece of construction paper while on one leg for 10 seconds. Since 80 percent of the gait cycle is born on one leg, this simple test provides a clue as to the client's pedal integrity. Pes Planus and Pes Planovalgus indicate a lack of competency in the medial longitudinal arch.

*Orthopedic massage therapist and author Whitney Lowe provides research suggesting that many so-called "tendinitis" conditions, in fact, have no classic inflammatory characteristics and are more accurately termed "tendinosis" pathologies. Lowe provides research asserting that collagen breakdown may be the significant component of tendon pathology.

**The Latin root (*fibular*, *fibularis*) is more anatomically correct but the Greek root *perone*, as in peroneals or peroneus longus is still common in clinical terminology.

Adaptation, accommodation and serial patterns of strain attempt to take up the slack. The Postural Pronation Syndrome has become ubiquitous and pervasive. Feet become sore, arches ache and familiar shoes no longer feel comfortable.

Compensation Patterns

Walking, running and physical activities add to the chronicity of the Postural Pronation Syndrome. With each step taken, destructive forces are at work. During the stance phase of gait on the hyper-pronating foot, the following compensational patterns commonly occur:

- The medial arch collapses inward;
- The calcaneus tilts medially;
- The Achilles tendon is functionally stressed;
- The forefoot splays outward;
- The talus and navicular drop medially and distally;
- The plantar fascia is mechanically stressed;
- The dorsiflexors and invertors are functionally strained;
- The intrinsic foot muscles weaken;
- Elastic recoil during toe off is diminished;
- Foot tendons and ligaments are functionally stressed;
- Misalignment and subluxation of the tarsal bones is common;
- Calluses develop on the foot due to altered gait patterns;
- Fascial thickening occurs at the extensor retinaculum;
- The hinge function of the ankle is restricted;
- The tibia is twisted medially;
- Patellar tracking is disrupted;
- An abnormal Q angle develops;
- The femur rotates medially and drops inferiorly;
- The psoas and piriformis are eccentrically strained;
- The pelvis assumes a "corkscrewed holding pattern";
- The sacral base is unleveled;
- The spine assumes abnormal compensatory curves;
- Postural distortions become manifest in the upper quarter.

This distortion pattern is escalated by a profound sense of fatigue and energy drain. Tired of overuse injury, relentless pain and postural strain, the client often assumes a sedentary lifestyle, which magnifies overall deconditioning. The hands-on practitioner is now presented with a daunting clinical challenge!

Clinical Strategies

The pervasive effects of the Postural Pronation Syndrome may require a team approach between a massage therapist, chiropractor, podiatrist and athletic or personal trainer. Any ominous symptoms in the feet such as numbness, abnormal swelling or sharp radiating nerve pain, should be referred for medical evaluation prior to any manual therapy. In my experience, physical therapists and podiatrists with sports medicine credentials are often valuable allies in the therapeutic process.

Clinical strategies are geared toward rebalancing the legs and feet through myofascial reorganization, therapeutic muscle stretching, self-care measures, elimination of perpetuating factors, functional restoration, and a program of bodywork maintenance. This strategy suggests working through and beyond clinical interventions toward a goal of optimal and ongoing maintenance. Healing takes time. It usually does not occur in a formula or according to a manual. Identifying, correcting and maintaining outcome-based results are not "quick fix" protocols. However, getting to the underlying causal factors for chronic postural pain is a rewarding and exhilarating clinical experience—both for the client and the practitioner!

Clinical massage therapy approaches include normalizing the muscular imbalances found in the leg. Precise application of finger, knuckle or forearm pressure applied to the tendons, fascia and adhered connective tissue of the legs and feet is the first challenge. Restoration or enhancement of the ankle hinge functioning is vital. Then the extrinsic muscles of the leg, having their terminal attachments in the feet, must be balanced and released to support foundational stability. Common areas of postural shortening include the lateral leg compartment, the posterior gastrocnemius and soleus and the chronically shortened heel cord. Also, by stretching hypertonic hip flexors a more balanced pelvis results, diminishing the excessive force loads generated onto the feet from an anteriorly tilted pelvis.

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Freeing The Ankle Joint: The Clinical Significance Of The Extensor Retinaculum

In the vicinity of the ankle joint, the tendons of the leg muscles are bound down by localized thickenings of the fascia known as retinaculum or retinacular bands. Retinaculum comes from Latin, meaning a brace or halter, and that is precisely the function it performs at the ankle where we find dorsal, medial and lateral retinacular investments. These fascial anchors allow for a symmetrical line of pull across the joint and prevent the tendons from "bowstringing." (Bowstringing is a term describing the pulling away of tendons from a joint or an attachment resulting in a weakened muscular contraction.)

Although the retinacular bands are all fascially interwoven, this article will focus on the two divisions of the extensor retinaculum as having the most clinical significance in the hinge functioning of the ankle joint. The superior extensor retinaculum binds down the tendons of tibialis anterior, extensor digitorum longus, extensor hallucis longus and fibularis tertius.

As the tendons leave the anterior leg compartment, they traverse the ankle joint and attach onto the foot. The deep fibular nerve and anterior tibial artery also pass beneath these fascial investments. Only the tendon of tibialis anterior has a synovial sheath at this location, slightly proximal to the ankle joint.

Figure 2. The numerous tendons in the dorsal section of the foot are primarily dorsiflexors. The inferior and superior retinaculum are fascial bands holding the tendons in proper juxtaposition to one another. Retiniculum comes from the Latin meaning "a brace or halter." On the hypermobile pronating foot, these fascial bands thicken and cement the underlying tendons into weakened positions of strain. Disengagement of the retinaculum from underlying tendons is necessary for anterior compartment strengthening and increased dorsiflexion at the ankle.

Illustrations by Sara Corkery

Figure 3. The ankle functions as a hinge joint. Restricted dorsiflexion is a common symptom of the Postural Pronation Syndrome.

FOOT FACTS

- The human foot has 26 bones, 55 articulations, 107 ligaments and 19 intrinsic muscles.[8]
- Walking at a normal pace for most people is about 100 steps per minute.[8]
- Each foot will strike the ground between 10,000 to 15,000 times daily for most people,[6] absorbing the equivalent of 639 tons of metric pressure.
- 80 percent of the gait cycle is performed on one leg. While running there is no double limb support.[6]
- Most people will walk an average of 115,000 miles in a lifetime—more than four times around the circumference of the earth.
- While walking, the gait cycle lasts approximately one second[6]—60 percent for the stance phase and 40 percent for the swing phase.
- While running, each foot strike puts pressure on the leg equal to four or five times the body's weight. A 170-pound runner transmits 680 pounds of shock with each strike.[9]
- Shock travels through the body at a speed of 200 miles per hour.[6]
- Of the more than 4,000 species of mammals, only humans are fully bipedal when walking. Kangaroos, ostriches and penguins are bipedal—sort of.[10] But they are built on an entirely different structural design and are not, strictly speaking, reliant only on their legs for transport.
- Saint Crispin is the patron saint of shoemakers.[11] October 25 is the traditional shoemakers holiday.
- The Achilles tendon is the largest, strongest and most commonly injured tendon in the body.
- The anterior talo-fibular ligament is the most commonly injured ligament in the human body.
- The talus bone in the foot has no muscular attachments.

Photo A. Massage therapist Frances Salvato applies palmar compression to client Latresia Harris while gently plantarflexing the ankle joint. This is an effective warming and stretching technique for releasing the ankle.

Photo B. A loosely held fist provides specific pressure when combined with slow stretching.

Inferior to the ankle joint is the Y-shaped inferior retinacular band. Attaching to the calcaneus, it forms a strong loop with two fascial layers securing the dorsiflexor tendons on the dorsal side of the foot. (See *Figure* 2, page 89.)

Why are these fascial wrappings at the ankle so clinically important to the massage therapist? When subjected to abnormal or destructive forces as found in the Postural Pronation Syndrome, these fascial bands undergo patho-physiological changes, eventually becoming "cemented" into a hardened configuration locking the underlying tendons into aberrant positions of strain and altered function. The tendons can be palpated as depleted, stringy and spatially displaced. Since fascia physiologically responds to the stresses placed upon it, we now find abnormally thickened fascial adhesions exhibiting a random buildup of collagen encroaching upon the very tendons they are designed to protect! One might add that a "rusty hinge in need of lubrication" has developed.

Ankle dorsiflexion, normally about 20 degrees, will become restricted. Some manual medicine authors suggest that restricted dorsiflexion is the most common limited body movement after dysfunction of the lumbosacral joint.[7] It will disrupt the anterior glide of the tibia on the talus, adding to plantar flexor tightness, genu recurvatum at the knee, anterior thigh tension and lumbosacral joint strain. At this point merely trying to stretch the tight plantar flexors will not be clinically effective. I have worked with many runners who were stretching gastrocnemius and soleus two and three times a day without positive results. Outcomes improved dramatically when the hinge function of the ankle (see *Figure* 3, page 89) was myofascially addressed.

Enhanced dorsiflexion cannot occur until these fascial adhesions now acting as mechanical barriers are softened and released. I have witnessed clinical breakthroughs when applying the following techniques to the commonly stuck bands of extensor retinaculum. The ankle joint often shows improved range of motion after one or two sessions. Clients report that the ankle joints "unlock," feel more lubricated and function more effectively during gait. Athletes in particular seem to experience a newfound alignment between the ankle and knee. Some of my athletic clients use the term "rejuicification" to describe the increased blood flow, tissue softening and improved ankle range of motion. As fascia returns to a more optimal state, the four dorsiflexor tendons regain their functional integrity.

Clinical Applications: Restoring The Hinge Function Of The Ankle

The following manual techniques are clinically effective for restoring the hinge function of the ankle and for releasing mechanical strain in the extensor retinaculum. Performed on both feet, this protocol takes about 20 minutes. It is, of course, impor-

Photo C. Fingertip pressure to the retinacular bands can soften adhesions and help restore optimal ankle range of motion.

Photo D. Apply transverse friction to the dorsiflexor tendons while stabilizing the foot. Linger on areas of strain or adhesion.

tant to personalize your treatment to the individual needs of your client. The approach I am presenting is not merely a set of random techniques. Our goal is to awaken awareness and participation on the part of the client. Generating small, incremental functional change can profoundly influence the stability and support system of the person suffering from postural pain. My general advice would be to significantly slow down the tempo of your application. The use of any lubricant is not recommended as this will act as a barrier to maintaining a secure fascial engagement.

By adding these techniques to your overall massage therapy approach, I believe you will greatly assist your clients in achieving improved gait and optimal functioning of the ankle.

A. Palmar Ankle Engagement with Passive Plantar Flexion

After warming the tissues of the legs and feet, this is a good introductory technique to restore ankle dorsiflexion. Stand at the foot of the table as shown in *Photo A* (page 90). Apply open handed palmar compression to the ankle, keeping your arms relaxed and utilizing a lunge-based shifting of your bodyweight for adequate pressure. With your free hand, grasp the client's foot and initiate passive plantar flexion while your compressing hand travels proximally three or four inches. In other words, the heel of your hand compresses into the inferior and superior retinacular bands (about one inch distal and one inch proximal to the medial malleolus) and slowly drags upward while the foot is "unlocked" into gentle plantar flexion. Repeat at least 10 times, gradually increasing the amount of pressure.

B. Fist with Active Plantar Flexion

Now we work even more specifically. Dorsiflex your client's ankle and place a gently held fist directly onto the ankle joint as shown in *Photo B* (page 91). Assume a secure biomechanical stance, keeping your arms extended by the leverage of your bodyweight. Be careful not to pronate your radioulnar joint. Apply the flat of your fist into the ankle and have your client actively plantar flex as your application glides upwards about two or three inches. This combination of pinning and active ankle movement is an excellent technique for myofascial release. You may need to stabilize or assist the client's ankle on the first few repetitions. Perform 10 or more slow repetitions.

C. Digital Ankle Engagement with Active Hinge Movements

Wedge both thumbs on the sole of the foot for stabilization. Then, dorsiflex the ankle to the motion barrier. (Note: In many cases clients will be unable to bring the foot in a neutral 90 degree angle to the leg.) At the motion barrier, wedge your remaining eight fingers into the ankle as shown in *Photo C* (shown above left). Have the client raise his or her toes and the foot upward, then bend the foot and the toes downward. In other words, the client is isolating hinge movements at both the toes and the ankles while you apply digital pressure into the ankle and/or the retinacular bands. Applying fingertip pressure you might ask for "toes up…foot up…hold it…now foot down…then toes down." Utilizing these slow micro-movements with direct pressure encourages free range of motion.

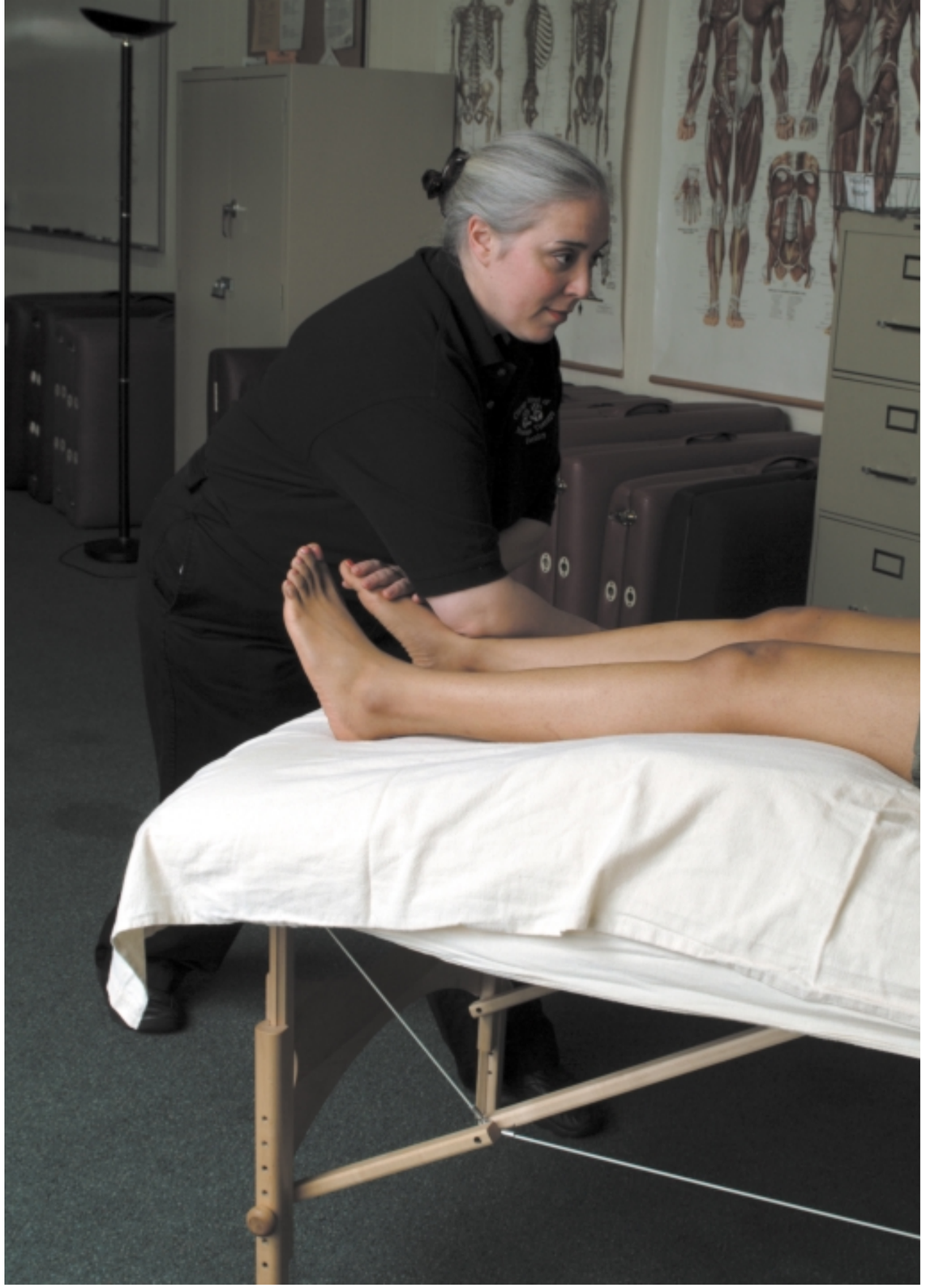

Photo E. Slowly performed forearm compression combined with subtle angle movement provides myofascial impact at the ankle joint.

Photo F. Digital cleaning of retinacular bands while the standing client performs slow half knee bends is a powerful myofascial release technique for restoring the hinge function of the ankle joint.

One variation that I like to use is having the client bend the knees, while I perform the same technique. It seems to encourage clinical accuracy and deeper engagement. Perform at least 10 repetitions with variations of active toe and ankle movements for best results.

D. Transverse Friction to Dorsiflexor Tendons and Retinacular Bands

Stabilize the client's foot with an overgrip. From the side of the table, apply the four fingers of your palpating hand to both the superior and inferior extensor retinacula as shown in *Photo D* (page 92). Apply small micro-frictioning movements on the four tendons traversing the joint. Palpate for hardened areas, fibrosis or glued down fascial tissue. To avoid hand strain, you may find it more biomechanically sensible to move the foot from side to side about one inch rather than generating all the force with your hand. Effective micro-frictioning of the fascia and tendons is performed with adequate pressure and anatomical precision. Work from three to five minutes on each ankle lingering on adhesions or scar tissue formation.

E. Myofascial Lengthening: Forearm Variation

Stand at the foot of the table as shown in *Photo E* (page 93), and gently bring the client's ankle into maximum plantar flexion. With the ankle joint decompressed in this position, carefully apply forearm pressure to the ankle using the proximal two inches of your ulna, taking care to avoid the tibia with your olecranon process. Have the client repeat the sequential toe and ankle hinge movements in a slow, coordinated fashion as you apply steady pressure. As with the palmar, digital and fist variations this is another effective myofascial release technique combining movement with sustained pressure. For optimal "rejuicification," perform 10 repetitions, taking care to stay within the tissue tolerance of the client.

F. Standing Retinacular Release Technique

The client stands in front of the therapist with the feet shoulder width apart. The therapist lies prone on the floor as shown in *Photo F* (left) and applies fingertip pressure into the ankle joint between the medial and lateral malleoli. With the elbows resting on the floor, the therapist applies deep pressure into the retinaculum at the ankle. The client is then instructed to perform half-squat movements while tracking the patella over the second toe. During the half squat, the therapist's fingers move medially and laterally under each malleolus. This application allows for myofascial engagement of all three retinacular bands. Be sure the client is standing upright and looking straight ahead. Apply three applications to each ankle, then have the client walk around, noticing any changes in gait. This weight-bearing technique is an excellent method to awaken the conversation between the ankle and knee hinge joints.

I hope these six specific clinical massage techniques will provide you with more effective tools for your toolbox. Furthermore, I hope the discussion of the Postural Pronation Syndrome and the clinical significance of the ankle as a well-lubricated hinge joint will provide you with insightful clues when working with stubborn athletic injuries or postural pain problems. Best wishes for successful clinical outcomes!

Author Robert King poses with Latresia Harris (center) and Frances Salvato (right). Both are massage therapists affiliated with Chicago School of Massage Therapy.

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