



The following are summaries of published histologic studies, clinical studies, case studies and review articles related to the ASTYM treatment. If you would like a copy of any of the articles, please contact us at 800-333-0244 and we would be happy to furnish you with one.

When some of the articles were published, the treatment was called ASTM. The treatment name has since been changed to ASTYM system.

### **Histologic Studies**

**Davidson CJ, Ganion LR, Gehlsen GM, Verhoestra B, Roepke JE, Sevier TL. Rat tendon morphologic and functional changes resulting from soft tissue mobilization. *Medicine & Science in Sports & Exercise*. 1997;29(3):313-319.**

20 male Sprague-Dawley rats weighing between 225 and 263 gm were placed into 4 groups of 5 rats as follows: control, tendinitis, tendinitis plus ASTM treatment, and ASTM treatment alone. Tendinosis was induced via surgery to expose the Achilles tendon and an injection of collagenase to cause collagen degradation.

**Methods:** Gait analysis was done preoperatively, on the day prior to each ASTM treatment, and prior to harvesting the Achilles tendon at 6 weeks. Specimens were prepared for light and electron microscopy, and immunostaining for Type I and Type III collagen and fibronectin was performed. Fibroblast counts under light microscopy at 450x in ten microscopic fields showed increased fibroblast proliferation in the tendinosis plus ASTM treatment group ( $P < 0.05$ ). Electron microscopy revealed rough endoplasmic reticulum in both the tendinosis plus ASTM treatment and the ASTM treatment alone groups. The presence of rough endoplasmic reticulum within the cytoplasm is a feature of active synthesis of collagen. Statistical analysis (ANOVA) of stride length, stride frequency, and knee range of motion indicated a significant ( $P < 0.05$ ) difference for the tendinosis plus ASTM treatment group.

**Conclusion:** The findings of this study suggest that ASTM treatment may promote healing via increased fibroblast recruitment and activation.

**Gehlsen GM, Ganion LR, Helfst R. Fibroblast responses to variation in soft tissue mobilization pressure. *Medicine & Science in Sports & Exercise*. 1999;31(4):531-535.**

**Methods:** 30 male Sprague-Dawley rats were randomly assigned to 1 of 5 groups with 6 rats per group: tendinosis, tendinosis plus light ( $.5 \text{ N/mm}^2$ ) ASTM treatment, tendinosis plus medium ( $1.0 \text{ N/mm}^2$ ) ASTM treatment, tendinosis plus heavy ( $1.5 \text{ N/mm}^2$ ) ASTM treatment, and control with surgery only. Tendinosis was induced via surgery to expose the Achilles tendon and an injection of collagenase to induce tendon degeneration and scarring. For the three groups receiving ASTM treatment, the treatment was performed in three proximal to distal and three distal to proximal strokes on postoperative days 21, 25, 29, 33, 37 and 41.

**Conclusion:** The morphological evidence indicated that the application of heavy pressure ASTM treatment promoted fibroblast recruitment to a greater degree than light or moderate pressure as evidenced by fibroblasts counts in 10 fields at 450x under light microscopy ( $P < 0.05$ ). The group treated with heavy ASTM treatment also displayed an abundance of rough endoplasmic reticulum within the cytoplasm indicating fibroblast activation and collagen production.

## Clinical Trials

**Wilson JK, Sevier TL, Helfst RH, Honing EW, Thomann AL. Comparison of rehabilitation methods in the treatment of patellar tendinitis. *Journal of Sports Rehabilitation*. 2000;9(4): 304-314.**

**Inclusion criteria:** Physician-diagnosed patellar tendinopathy as the major diagnosis; however, the subject could have had other co-existing conditions.

**Exclusion criteria:** Open lesions in the area of treatment, anticoagulant therapy such as warfarin (coumadin) or heparin, known coagulation disorders, any previous knee surgery or internal knee pathology. Knee x-rays taken at three views were used to exclude any bony abnormality.

**Methods:** Of the 38 subjects that began the study, 18 were dropped due to lack of compliance with the rehabilitation protocol or did not return for physician follow-up. The remaining 20 (12 men and 8 women) had been randomized to either traditional treatment or ASTM treatment. The traditional treatment group performed stationary bicycling, stretching protocol, five minutes of cross friction on the patellar tendon, other modalities per the supervising therapist, therapeutic exercises and cryotherapy three times per week for four weeks (twelve total treatments). The ASTM treatment group was seen twice a week for four weeks (eight total treatments). Their treatment regimen involved the same stretching and exercise protocol but they received ASTM treatment to the extensor mechanism of the knee in place of the cross friction massage and other modalities.

**Resolution criteria:** No swelling, no pain upon palpation, and the ability to do the following with minimal pain (less than 3 on scale of 0 to10): six single leg hops, squat to thigh parallel, and eccentric load step down (step down with unaffected leg off of stepping stool).

**Outcome:** At the end of the sixth week, 100% (10/10) of ASTM treatment and 60% (6/10) of the traditional group had resolved. The unresolved subjects were crossed over to the ASTM protocol for additional therapy and testing. Upon completion of additional treatment, 50% (2/4) of the crossover traditional to ASTM treatment resolved. The clinical outcomes of the group receiving this ASTM treatment indicated a statistically significant ( $P < 0.05$ ) percentage of improvement in subjective pain and functional impairment ratings.

**Conclusion:** This study suggests that using ASTM results in improved clinical and functional outcomes with a decreased number of therapy sessions. The ASTM group had decreased impairment from pain during activity as well as increased function. ASTM treatment appears to be a viable intervention for patellar tendinopathy.

## Case Series

**Davies CC, Brockopp DY. Use of ASTYM<sup>®</sup> Treatment on Scar Tissue Following Surgical Treatment for Breast Cancer: A Pilot Study. *Rehabilitation Oncology*. 2010;28(3):3-12.**

Thickened scar tissue and hypersensitive soft tissue adhesions may develop following mastectomy and other treatment for breast cancer. These difficulties are often left untreated, leaving many women with tight scars, poor flexibility, swelling, decreased range of motion, and pain. ASTYM<sup>®</sup> treatment has been used to desensitize and remodel scar tissue thereby decreasing pain and improving function. This pilot study was designed to evaluate the effectiveness of ASTYM on range of motion and perception of functional ability in this population.

**Methods:** A retrospective, descriptive design was used to evaluate function in 18 subjects before and after ASTYM. Data retrieved from patients' charts included: demographics, ASTYM treatment use, range of motion, and perceived disability.

**Results:** Data analysis revealed significant ( $p < .000$ ) and clinically meaningful findings related to increased range of flexion and abduction motion and perception of physical disability in breast cancer patients following ASTYM treatment.

**Conclusion:** Problems with upper extremity motions, disability, and self perception are common in this population. ASTYM was effective in returning women to their prior functional status following surgery. Results of this study show that early incorporation of ASTYM treatment may increase AROM of flexion and abduction which would prevent functional limitations following surgical treatment for breast cancer. ASTYM also reduced hypersensitivity of postoperative scar tissue as noted by women subjectively reporting experiencing less clothing restrictions post treatment.

**McCrea EC, George SZ. Outcomes following augmented soft tissue mobilization for patients with knee pain: A case series. *Orthopaedic Physical Therapy Practice*. 2010;22(2):69-74.**

**Background:** The purpose of this case series was to describe outcomes of 11 consecutive patients with knee pain and associated tendon inflammation treated with ASTYM.

**Inclusion Criteria:** Patients were included in the study if they described a non-traumatic onset of symptoms including pain in a tendon around the knee and exhibited tenderness to palpation over one or more tendons around the knee.

**Exclusion Criteria:** Patients excluded for ligamentous laxity, chronic systemic inflammatory disease, pain syndromes such as fibromyalgia, anticoagulation therapy or chronic lower extremity sensory deficits.

**Methods:** 11 consecutive patients exhibiting signs and symptoms consistent with various knee tendinopathies (9 collegiate athletes, mean age 24.5 years). Patients completed 5 physical therapy sessions following ASTYM treatment protocols. Outcomes were assessed with Lower Extremity Functional Scale (LEFS) and Numeric Pain Rating Scale (NPRS) at base line and after 5th ASTYM treatment. 11 patients began the study. 8 patients completed the study. Mean improvement in pain score was 2.9. Mean improvement in LEFS was 7.3. 50% of patients exhibited clinically meaningful change in pain intensity scores, and 62.5% exhibited clinical meaningful improvement in LEFS score after 5 treatment sessions.

**Conclusion:** The primary results of this case study demonstrate the potential effectiveness of ASTYM treatment in patients with various knee tendinopathies. A randomized clinical trial of patients with specific knee tendinopathies would be useful in further determining the efficacy of ASTYM for patients with knee pain.

### Case Studies

**Slaven EJ, Mathers J. Management of chronic ankle pain using joint mobilization and ASTYM® treatment: a case report. *Journal of Manual and Manipulative Therapy*. 2011;19(2):108-112.**

**Article Abstract:** Treatment of ankle sprains predominately focuses on the acute management of this condition; less emphasis is placed on the treatment of ankle sprains in the chronic phase of recovery. Manual therapy, in the form of joint mobilization and manipulation, has been shown to be effective in the management of this condition, but the combination of joint mobilization and manipulation in tandem with ASTYM® treatment has not been explored. The purpose of this case report is to chronicle the management of a patient with chronic ankle pain who was treated with manual therapy including manipulation and ASTYM treatment. As a result of a fall down stairs 6 months previously, the patient sustained a severe ankle sprain. The soft tissue damage was accompanied by bony disruptions which warranted the patient spending 3 weeks in a walking boot. At the initial evaluation, the patient reported difficulty with descending stairs reciprocally and not being able to run more than 4 minutes on the treadmill before the pain escalated to the level that she had to stop running. After five sessions of therapy consisting of joint mobilization, manipulation and ASTYM, the patient was able to descend stairs and run 40 minutes without pain.

**Melham TJ, Sevier TL, Malnofski MJ, Wilson JK, Helfst RH. Chronic ankle pain and fibrosis successfully treated with a new non-invasive augmented soft tissue mobilization technique (ASTM): A case report. *Medicine & Science in Sports & Exercise.* 1998;30(6):801-804.**

A collegiate football player with a history of two ankle surgeries to initially remove bone chips and subsequently to address scar tissue formation had received five months of conventional treatment but was still unable to return to football.

**Outcome:** The patient was seen twice a week for 7 weeks of ASTM treatment, stretching, strengthening and functional progression. Upon completion of therapy he exhibited no pain and returned to full function. During the course of treatment his ankle active range of motion improved from 5° to 10° of dorsiflexion, from 35° to 47° of plantarflexion, from 15° to 26° of eversion, and 20° to 42° of inversion.

**Haller KH, Helfst RH, Wilson JK, Sevier TL. Treatment of chronic elbow pain. *Physical Therapy Case Reports.* 1999;2(5):195-200.**

A recreational cyclist and textbook salesperson with a history of chronic pain for 2.5 years was seen for physical therapy at an outpatient facility. She had received extensive conservative management including physical and occupational therapy, nonsteroidal anti-inflammatory medications, a course of oral prednisone and a steroid injection during the previous 2.5 years. She had been offered surgery as the only remaining treatment option.

The patient received ASTM treatment, stretching and progressive exercises twice a week for four weeks.

**Outcome:** The patient's pain with activity had reduced from 6/10 to 0/10. She reported improvement in recreational and work activities. She improved her grip strength with elbow flexed from 28.35 kg initially to 36 kg at discharge and with the elbow extended from 19.35 kg initially to 36 kg at discharge. She was also able to forgo the use of the tennis elbow strap she had relied on for over two years.

**Henry P, Panwitz B, Wilson JK. Treatment of a bilateral total knee replacement using ASTM. *Physical Therapy Case Reports.* 1999;2(1):27-30.**

A 56-year-old female with bilateral total knee replacement and patellectomy on right was referred for rehabilitation post-surgically. She was seen for 8 weeks of traditional management that did not include ASTM treatment. She required bilateral manipulation at that time and returned for 3 additional weeks of traditional rehab. Her discomfort, range of motion and ambulatory status remained much the same. Knee flexion on right was 85° and on left was 80°. At that point, the surgeon authorized the addition of ASTM treatment to her care.

**Outcome:** During the next three weeks, the patient's knee flexion improved to 100° bilaterally; her pain diminished from 3/10 at rest and 4/10 with activity to 0/10 for both. Her ambulation status improved from requiring a cane to independent ambulation without an assistive device.

**Baker D, Wilson JK. Bilateral carpal tunnel syndrome in a piano teacher. *Physical Therapy Case Reports.* 1999;2(2):73-76.**

A 42-year-old female piano teacher with an 8-year history of bilateral carpal tunnel syndrome complaining of constant pain, paresthesias and sleep disruption presented to physical therapy. She reported pain of 4/10 at rest and 8/10 with activity. Her previous treatment included wrist splints. She was seen for a total of 12 sessions in physical therapy including ASTM treatment.

**Outcome:** Upon discharge, the patient reported being able to sleep and reported her pain at rest as 0/10 and her pain with activity as 3/10.

**Henry P, Panwitz B, Wilson JK. Rehabilitation of a post-surgical patella fracture: A case study. *Physiotherapy*. 2000;86(3):139-142.**

A 20-year-old male was seen for 12 weeks of physical therapy following an open patellar fracture sustained in a motor vehicle accident and subsequent surgery. During that time, his pain rating with activity improved from 8/10 to 6/10. His active knee flexion improved from 48° to 95° and his passive knee flexion improved from 53° to 100°. At that time, ASTM was added to his plan of care and therapy was continued for 6 weeks.

**Outcome:** During the additional 6 weeks of therapy including ASTM treatment, the patient's pain rating improved from 6/10 to 0/10 with activity; his active knee flexion improved from 95° to 121° and his passive knee flexion improved from 101° to 121°.

### **Review Articles**

**Wilson JK, Sevier TL. A review of treatment for carpal tunnel syndrome. *Disability and Rehabilitation*. 2003;25(3):113-119.**

Common approaches to carpal tunnel syndrome are reviewed. Included in the review are: NSAIDs, injection, splinting, ultrasound, manipulation, ASTYM treatment, work hardening, stretching/strengthening, vitamin B6, multidisciplinary approaches and surgery. It was concluded that conservative management should be the primary approach to treatment of patients with carpal tunnel syndrome whenever feasible; however, future research needs to document the effectiveness of various conservative measures.

**Kipp D, Wilson JK. Carpal tunnel syndrome: A critical review. *Critical Reviews in Physical and Rehabilitation Medicine*. 2001;13(1):67-77.**

A review of evaluative procedures and treatment interventions for patients experiencing symptoms of carpal tunnel syndrome is undertaken in this article. The authors conclude with a series of questions yet to be answered by research.

**Fowler S, Wilson JK, Sevier TL. Innovative approach for the treatment of cumulative trauma disorders. *WORK: A Journal of Prevention, Assessment & Rehabilitation*. 2000;15(1):9-14.**

A brief review of cumulative trauma disorders (CTDs) and their impact in the workplace is followed by an introduction of the ASTM treatment and its efficacy in treating CTDs as part of a conservative rehabilitation program at an outpatient facility as well as in plant.

**Sevier TL, Wilson JK, Helfst RH, Stover SA. Tendinitis: A critical review. *Critical Reviews in Physical and Rehabilitation Medicine*. 2000;12:119-130.**

The authors discuss tendinitis beginning with overuse mechanisms followed by a discussion of the classification of tendinous injuries. A great deal of the article addresses the growing awareness of the fact that many tendon overuse injuries are degenerative (tendinosis) rather than inflammatory (tendinitis) and the possible reasons for this phenomenon. The article concludes with a discussion of the implications of treatment considering the degenerative nature of most tendon overuse injuries.

**Wilson JK, Sevier TL. Methods utilized in treating lateral epicondylitis. *Physical Therapy Reviews*. 2000;5:117-124.**

This article presents brief reviews of several approaches to the treatment of lateral epicondylitis. Included in the review are: bracing, injection, ultrasound, phonophoresis, iontophoresis, electrical stimulation, manipulation, soft tissue mobilization, neural tension, friction massage, ASTM treatment, stretching/strengthening, home program, laser, acupuncture, cryotherapy and surgery. A call is made for prospective randomized controlled studies to further evaluate the efficacy of each approach or combinations of approaches.

**Sevier TL, Helfst RH, Stover SA, Wilson JK. Clinical trends on tendinitis. *WORK: A Journal of Prevention, Assessment & Rehabilitation*. 2000;14(2):123-126.**

This article presents an interesting clinical case involving a 34-year-old female with a two-year history of elbow pain, which had been resistant to previous interventions. She responded well to ASTM treatment. The fact that she had not improved with other forms of treatment focused on reducing inflammation, but responded to ASTM treatment raises the question of whether she was suffering from a tendinitis or a degenerative tendinopathy.

**Sevier TL, Wilson JK. Treating lateral epicondylitis. *Sports Medicine*. 1999;28(5):375-380.**

A brief review of the approaches currently employed in treating lateral epicondylitis is undertaken.