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# Instrument-assisted Soft Tissue Manipulation: Evidence for its Emerging Efficacy

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## Abstract

Instrument-assisted soft tissue mobilization (IASTM) is a form of mechanotherapy used frequently by clinicians in the treatment of common musculoskeletal disorders. The purpose of this short review was to provide an overview of the literature related to modern day IASTM practice approaches. Thirty-seven articles were included which, although difficult to compare due to differences in techniques and study designs, indicate the beneficial effects of IASTM. Various levels of emerging evidence suggest the efficacy of IASTM as a mechano-therapeutic intervention, however, more well-designed studies with larger samples sizes, including randomized controlled clinical trials, are needed to further substantiate its efficacy and establish its effectiveness.

**Keywords:** Instrument-assisted soft tissue mobilization; Augmented soft tissue mobilization; Soft tissue mobilization; Soft tissue manipulation; Therapeutic massage; Massage; Medical device; Manual therapy; Physical therapy

## Introduction

Musculoskeletal (MS) disorders are common, affecting approximately 100 million adults in the US per year [1,2]. Soft tissue mobilization/manipulation (STM) is a type of manual therapy frequently used by clinicians to address the pain and dysfunction associated with a multitude of MS conditions.

In fact, 87% of clinicians report using manual therapy on a daily basis [3] STM is a massage-based modality that can be administered by hand alone or with rigid devices [4].

Instrument-assisted STM (IASTM) uses rigid devices that can be made of different materials (e.g. wood, stone, jade, steel, ceramic, resin) to examine and treat the soft tissue (Figure 1).

Regardless of the method/approach or instrument material or design, IASTM, if not all types of STM interventions, are in essence forms of mechanotherapy that impart a mechanical stimulus to the tissue with an end goal of improved healing [5]. Although STM, including IASTM, has been used since ancient times, much remains to be understood about its mechanisms and outcomes [6]. The purpose of this short review is providing an overview of the literature related to current IASTM practice.

## Methods

Several databases were searched (PubMed, Ovid Medline, CINAHL), from 1990 to present, using the following All forms of modern day IASTM approaches were considered.

**Figure 1:** An example of instrument-assisted soft tissue manipulation (IASTM) to the low back region using a specifically designed stainless steel device (GT4, Graston Technique®, Indianapolis IN).

## Results

Only peer-reviewed publications were reviewed (n=37). Pre-clinical and clinical research articles were included; whereas book chapters, textbooks, training manuals, non-peer reviewed articles, abstracts, commentaries and editorials were excluded. A variety of IASTM devices and approaches were found in the literature, with Graston Technique® (Graston Technique, GT, Indianapolis, IN, USA), the forerunner in modern IASTM practice, and Astym® (Performance Dynamics, Muncie, IN, USA), being most frequent. The intent of this short review was not to be comparative, all-inclusive or exhaustive.

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## Discussion

Pre-clinical studies have demonstrated positive effects of IASTM on connective tissue lesions. One study showed IASTM administered to chemically-induced injured rat Achilles tendon resulted in fibroblast proliferation and activation, which may be associated with enhanced healing [7]. In a subsequent study, using the same model to investigate various IASTM pressures, significant increased fibroblast proliferation and activation was found at a greater pressure (1.5 $N{\cdot}mm^{-2}$) compared to light pressure (.5 $N{\cdot}mm^{-2}$) [8]. Loghmani and Warden [9] found IASTM-treated injured knee medial collateral ligaments demonstrated improved biomechanical properties and structure compared to contralateral uninjured ligaments in a rodent model. Follow-up studies demonstrated increased blood flow and possible angiogenesis in the vicinity of the IASTM-treated injured rat knee ligament as compared to the untreated limb [10]. More recent animal model studies have employed mechatronic IASTM devices to explore the time and dose-pressure dependent response effects of massage-based modalities; which have not been adequately considered in human subjects studies [11-17].

Multiple case reports have demonstrated positive IASTM treatment outcomes for numerous diagnoses, including post-natal chronic calf pain [18], ankle pain/fibrosis [19], knee arthrofibrosis and quadriceps insufficiency after a patellar tendon repair [20], plantar fasciitis [21], trigger thumb [22], tendinopathies [23-25], epicondylopathy [26,27] and other conditions [28-30]. In one case study [31], a male guitarist with chronic pain and functional limitations following a traumatic sprain of his left second finger proximal interphalangeal joint realized significant gains in finger flexion range of motion immediately following only one GT IASTM treatment at the first session. After six sessions, the patient experienced positive outcomes in self-reported pain and function, each reaching a minimum clinically important difference. Physical measures also improved, including improved finger range of motion and grip strength. Most importantly, he was able to play the guitar with minimal to no pain as desired. In another case [32], a young male who had re-strained his quadriceps rectus femoris while playing soccer 12 months after his original injury sustained while cycling, reported improvements in pain and function after 5 GT IASTM treatments. He was able to return to playing soccer without pain or limitations, and musculoskeletal diagnostic ultrasound imaging showed decreased edema in the area of the soft tissue lesion; although, the size of fibrotic scar did not notably change. Case series reports also suggest the benefit of IASTM intervention. Looney et al. [33] found GT IASTM-treated patients with heel pain experienced clinically meaningful improvement in self-reported pain and function levels. McCrea et al. [34] found Asytm IASTM benefited individuals with knee tendinopathy pain.

In a pilot study by Vardimer et al. [35], 11 healthy, young males received one treatment of GT IASTM to one calf while the opposite calf served as an untreated, internal control. No significant differences were found in the passive properties of treated vs. untreated calf muscles before, immediately after or at 24 h, 48 h or 72 h post-intervention; nor was there a difference in physical measures or muscle biopsy inflammatory markers. However, a significant increase in self-reported pain and decrease in function were found at 72 h post treatment. It is important to note that only one treatment session was provided in this study, whereas common clinical practice typically involves at least 4-8 sessions for conditions affecting the calf region. Although subjects did not have a clinical condition, findings mirror a common clinical response of increased soreness within 2-3 days post-treatment; which typically resolves and improves during the course of subsequent treatments. Portillo-Soto et al. [36] demonstrated both GT IASTM and massage increases skin temperature which is associated with increased blood flow. One pilot study suggests the benefit of Aystm IASTM in improving post-operative total knee arthroplasty stiffness and function [37]. In another study, Davies et al. [38] importantly found women treated post-mastectomy with Asytm IASTM had improved motion and function.

A small clinical trial by Burke et al. [39], in which 22 patients with carpal tunnel syndrome were randomly assigned to two treatment groups to compare the effects of two forms of manual therapy (GT IASTM vs. STM by hand-alone), for 10 treatment sessions, demonstrated improved nerve conduction latencies, wrist strength and motion, and decreased pain in each treatment group, but no statistically significant differences were found between groups. Although this study demonstrated the clinical efficacy of manual therapy in this patient population, a larger sample size was needed to detect difference between groups. A recent, randomized controlled clinical trial demonstrated subjects with lateral epicondylitis had improved outcomes with Aystm IASTM alone and after failed eccentric exercise [40]. Other clinical trials using Aystm IASTM demonstrated increased lower extremity maximum force output during an isometric squat test immediately following treatment in subjects with lower extremity pain [41], and greater improvements were realized with IASTM in combination with eccentric exercise than with exercise alone in subjects with Achilles tendinopathy [42]. Interestingly, no systematic reviews on massage-based therapies that included IASTM were found.

Based on the literature, it seems apparent that the rationale for using IASTM and how it's implemented depends on several factors, e.g. the stage of tissue healing and repair; overall patient condition and co-morbidities; the underlying pathology, disease process or condition; tissue structure, type and location; and importantly, the desired treatment response (e.g. pro-inflammatory vs. non-inflammatory). The effects of the IASTM approach may be influenced by the instrument(s) shape and/or material. Furthermore, results are directly related to the magnitude and application of the treatment pressure, i.e. the characterization of the mechanical stimulus. Fundamentally, the key to positive outcomes is optimal tissue loading within a therapeutic window; however, a limitation in the literature is the difficulty in comparing results between studies since the quantification of IASTM force was most often not established. Another limitation when interpreting the literature is potential author bias.

Future directions in IASTM research include: force quantification of the mechanical stimulus delivered with IASTM to standardize care and better compare treatment outcomes; tissue imaging to determine the effects of treatment on soft tissue structure and condition; dose-response studies in animals and humans; effects of IASTM mechanotherapy on facilitating the regenerative healing capacity and tissue properties and function of all tissue types; and necessarily, clinical outcome studies. Although many IASTM approaches now exist, it should be noted that no comparative studies have been completed to date confirming that one is superior to another. IASTM supposedly allows for precise and targeted delivery of force, greater sensitivity during palpation examination of the tissue and is often used to enhance the clinician's mechanical advantage and ergonomics, but additional studies are needed to validate these claims. For example, studies comparing different IASTM approaches, instrument designs, materials and methods and to STM by hand-alone need to be completed. More studies comparing IASTM to other modalities and

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exercise, either in combination or alone are also warranted. Finally, all articles reviewed focused on the use of IASTM for treatment only; none considered its use in the evaluation of soft tissue dysfunction, which opens a new avenue of exploration.

## Conclusions

This short literature review revealed animal model, case reports/series, pilot studies and a few clinical trials indicating the beneficial effects of IASTM for several musculoskeletal conditions, suggesting its efficacy as a mechano-therapeutic modality; however, more research is required to determine its effectiveness. Pre-clinical research is still needed to gain greater insight into the molecular, cellular and tissue mechanisms underlying observed clinical benefits. Ongoing clinical studies, including randomized controlled-clinical trials, are needed to determine optimal IASTM outcomes as a function of dose, age and disease. Manual therapies, such as IASTM, are non-invasive, cost-effective and readily available interventions, thus it is imperative to establish their effectiveness as viable treatment options for a variety of disorders in an aging population.

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