Abstract
Surgical and nonsurgical management of upper extremity disorders benefits from the collaboration of a therapist, the treating physician, and the patient. Hand therapy plays a role in many aspects of treatment, and patients with upper extremity injuries may spend considerably more time with a therapist than with a surgeon. Hand therapists coordinate edema control; pain management; minimization of joint contractures; maximization of tendon gliding, strengthening, and work hardening; counseling; and ongoing diagnostic evaluation. Modalities used to manage hand injuries include ultrasound, splinting, Fluidotherapy (Chattanooga Group, Chattanooga, TN), cryotherapy, various electrical modalities, phonophoresis, and iontophoresis.

History of Hand Therapy
Upper extremity surgeons working in military hospitals during World War II treated a wide range of severe injuries; much of the early literature on treating hand injuries is based on these surgical experiences. It was at this time that the benefit of therapists dedicated to the treatment of upper extremity disorders became apparent. Together, surgeons and therapists developed protocols for the treatment of upper extremity war injuries. Despite the evidence from these experiences demonstrating the benefits of therapy after upper extremity injury, the first Rehabilitation of the Hand Conference was not held until 1975. The American Society of Hand Therapists was founded in the United States that same year.

Elements of Hand Therapy
Hand therapy addresses the physiologic stages that occur after injury, with the intent of maximizing functional recovery and decreasing pain (Table 1). There is often significant temporal overlap in the use of techniques designed to address these stages, and several stages may be addressed concurrently. Therapy after hand injury can be divided into sequential steps, with the goal of leading patients from injury to recovery.

Patient education is essential during all stages of care and should be initiated at the first patient encounter. Linking the importance of therapy to the eventual outcome of treatment enables better patient participation in ongoing care and enhances compliance with treatment protocols. Bruyns et al demonstrated that patients who completed a standardized therapy protocol following laceration of the median or ulnar nerves were 3.5 times more likely to return to work than patients who did not complete the therapy protocol.

Edema Control
Hand edema is the result of a collection of extracellular transudate and exudate. The presence of protein-laden exudate in the interstitial space at the site of injury leads to collagen
deposition, scarring, and restriction of movement. The increase in the volume of the hand via both transudate and exudate disrupts hand biomechanics by flattening the longitudinal and transverse arches, blocking motion on the volar surface, and restricting the pliable dorsal skin from moving with joint flexion.4

Edema control should begin immediately following the insult to the upper extremity. Compressive dressings, extremity elevation, and early range of motion (ROM) of the affected joint or joints are the primary methods used to prevent excessive swelling before referral to the therapist. A bulky compressive dressing should be applied with the upper extremity in a functional position, that is, one that maintains the transverse arch and positions the metacarpal (MP) joint in 70° of flexion and the proximal interphalangeal joint in 0° to 5° of flexion. Bulky dressings that maintain the hand in a functional position diminish ligament contractures, resulting in optimal mobility (Figure 1). Dressings are applied to exert even, gentle pressure on the extremity without restricting proximal blood flow. Optimal, elevation of the hand is maintained above the level of the right atrium. Splints are fabricated to allow motion and prevent deleterious contractures. Active and passive motion are encouraged as long as they do not damage the surgical repair. To stimulate venous return, motion is vigorous enough to enable transient blanching of the dorsal skin without causing undue pain. Forced manipulation is avoided because of the danger of increased inflammation and swelling.5

Although some swelling of the extremity after injury is normal and expected, edema that persists beyond 1 to 2 weeks may portend additional morbidity. Therapists employ multiple techniques to eliminate excess interstitial fluid. The most common approaches for reducing edema include wrapping the extremity, massage, use of antiedema gloves, intermittent compression, and continuous passive motion (CPM).6

Restrictive wrapping or string wrapping may be used on the involved extremity or digit. A restrictive dressing (eg, Coban [3M, St. Paul, MN]) is applied to the affected part distal to proximal, thereby increasing interstitial pressure and promoting lymphatic and venous drainage. ROM exercises are performed with the wrap in place (Figure 2). String wrapping is performed distal to proximal using a soft cord that is left in place for 5 minutes. After the cord is removed, the patient is encouraged to perform ROM exercises with the extremity maintained in an elevated position. String wrapping of edematous digits with and without retrograde massage has demonstrated efficacy in reducing hand edema. A combination of these techniques is significantly more effective than either alone (P < 0.05).7

Kinesio Tape (KMS, LLC, Albuquerque, NM) has elastic properties similar to those of skin and muscle. Optimal application of the tape is obtained by a 30% to 40% stretch of its original length to redistribute fluid, thereby reducing edema. Kinesio Tape combined with active motion redistributes fluid, improves lymphatic motility, and decreases nociceptor stimulation. Such therapy theoretically improves microvascular blood flow, facilitates lymphatic drainage, reduces inflammation, and mediates pain.5

With intermittent pneumatic compression, a pneumatic sleeve is placed over the edematous extremity, and the sleeve is sequentially inflated and deflated for 30 minutes to 2 hours. The pressure applied to the extremity must

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a The stages are not necessarily sequential. Multiple stages may be undertaken simultaneously.

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Illustration of a radial gutter splint, which is used to maintain the hand in a functional position.

Restrictive wrapping used to decrease edema in an amputated ring finger.
be greater than the interstitial pressure (25 mm Hg) but should not impede blood flow to the extremity. Compared with placebo, pneumatic sleeves decrease edema significantly in patients with posttraumatic hand swelling ($P = 0.004$). Intermit-
tent palmar pressure also decreases edema, improves ROM, and diminishes discomfort. Pulsed forces ap-
plied to the palm increase extracellular pressure and transiently dilate small vessels, which leads to im-
proved circulation and decreased pain. CPM reduces hand edema by increas-
ing lymphatic and venous drainage through the mechanical pumping mech-
anism of the hand (Figure 3). Limb el-

**Figure 3**

A continuous passive motion machine is used to decrease edema and increase range of motion during a hand therapy session.

**Wound Management**

Many therapists use a three-color wound classification system to aid in traumatic wound management and to evaluate the effect of therapy on healing and function (Table 2) (Figure 4). The goal is to eliminate black or necrotic tissue to facilitate the rapid progression to red or “beefy” granulating wound tissue that is capable of healing or suitable for grafting. The red wound is protected until wound closure. Mechanical débridement with soap and water, pulsed lavage, frequent dressing changes, and whirlpool therapy are the most common methods used to maintain fragile developing granulation tissue while eliminating necrotic or infected debris. Although the goal is to achieve a healthy granulating bed, ex-
uberant granulation tissue or “proud flesh” is the external manifestation of a richly perfused microvascular subsur-
face. Beefy red granulation tissue often is contaminated with bacteria, and cleansing is required to facilitate wound closure and grafting procedures. The ideal wound surface is a pale pink, smooth tissue bed characterized by brisk capillary refill.

Whirlpool therapy for mechanical débridement involves submerging the affected extremity into a bath of agi-
tated water and injected air. To be ef-
fective, the water temperature should

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### Table 2

<table>
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<th>Wound Color</th>
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<th>Predominant Physiology</th>
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| Black       | Thick, necrotic tissue                            | Macrophage débridement and early collagen synthesis. Inhib-
itor fibroblast migration.                                   | Decrease macrophage workload. Facilitate fibroblast migration. | Surgical or enzymatic débridement            |
| Yellow      | Yellow fibrous debris, drainage, and slough       | Bacterial stimulation of macrophage activity                 | Decrease macrophage workload. Progress to red wound. | Cleanse with soap and water, whirlpool treat-
ment, antibiotic application                  |
| Red         | Healing wound, pink or beefy red with clear borders | Endothelial angiogenesis, fibro-
blast collagen deposition, and myofibroblast wound contraction | Protect ongoing cellular activity.           | Clean dressings that prevent desiccation      |

Three wounds representing the three-color wound classification system: black (A), yellow (B), and red (C).
be between 33.3°C (92°F) and 35.5°C (96°F). Rinsing the open wound in clean water following agitated whirlpool treatment decreases bacterial counts; when this is followed by active motion and elevation, it can also reduce edema.\textsuperscript{6,12} The negative aspects of whirlpool therapy include the dependent position of the limb during treatment, the possibility of cross-contamination between patients using the same equipment, and the possibility of excessive débridement and destruction of healthy microvascular beds.\textsuperscript{13}

Ultrasound is used to facilitate healing and ROM; treat joint contractures, pain, and inflammatory conditions; and moderate scar formation. Ultrasound waves can be used to warm soft tissues at 1.0 to 1.5 W/cm\(^2\) (ie, thermal effect) to depths of 2 to 5 cm and are most helpful during the remodeling phase of wound healing. The proliferative phase of wound healing may be influenced by the nonthermal effects of ultrasound, at 0.3 to 1.0 W/cm\(^2\). Although this healing effect has been demonstrated in the laboratory, the results of clinical trials are mixed with regard to the true potential for ultrasound to affect wound healing.\textsuperscript{13} Ultrasound increases membrane permeability. Used in conjunction with topically applied triamcinolone as a coupling medium, ultrasound can encourage collagenase activity and the breakdown of existing scar.\textsuperscript{14}

**Scar Management**

Therapy can influence the remodeling phase of wound healing. Hypertrophic scar and keloid both result from abnormalities in the wound healing process, resulting in fibroproliferation and disorganized collagen deposition. Keloids differ from hypertrophic scars in that they extend beyond the zone of the initial insult, do not regress with time, have a high rate of recurrence, and are less amenable to therapeutic interventions.

Pressure therapy alters the structure of the extracellular matrix in hypertrophic scars.\textsuperscript{15} This is theorized to be secondary to the downregulation of cytokines and the induction of apoptosis of the hypertrophic scar derma, resulting in decreased scar proliferation.\textsuperscript{16} A pressure glove can be used to manage a hand wound (Figure 5). Custom and off-the-shelf gloves in various sizes are available. Daytime gloves are designed to extend only to the middle phalanges to allow sensory input and integration of the hand into activities of daily living. The hand also can be wrapped with an elastic bandage or placed in a padded splint with an elastic overwrap to provide compression into concave areas of the hand (ie, palm). Other methods of pressure application include self-adherent wraps that can be used for individual fingers. Alternatively, elastomer or other putty-type materials can be fitted into concave surfaces and secured with a splint or elastic wrap to provide pressure. To be effective, pressure therapy should be applied at a level of 24 to 30 mm Hg for 6 to 12 months. Pressure therapy is particularly effective for patients with burns and skin grafts.

**Range of Motion**

Therapy involving various combinations of active and passive ROM is initiated unless there is a specific contraindication. Early ROM, both active and passive, decreases the incidence of joint contracture, facilitates edema reduction, and decreases adhesion formation.\textsuperscript{17,18} With regard to flexor tendon protocols, early ROM leads to earlier recovery of tensile strength and better tendon nutrition than do protocols that immobilize tendons.\textsuperscript{19} Early passive motion protocols were advocated by both Duran and Kleinert for the treatment of flexor tendon repairs in zone II.\textsuperscript{20} In a randomized clinical trial, Bulstrode et al\textsuperscript{21} demonstrated improved early motion in patients with extensor tendon injuries following two different protocols that encouraged early active and passive ROM versus ROM begun at 4 weeks.

Following tendon repair, passive ROM may encourage tendon gliding, but it also has the potential for placing a repaired structure at risk for rupture. Aggressive passive motion should be avoided in patients with complex regional pain syndrome (CRPS) because of the potential for increased inflammation and edema.\textsuperscript{22} For these patients, active motion may be preferred because it may place less stress on the extremity than does passive motion. Numerous protocols for the management of both surgically and nonsurgically treated distal radius fractures advocate early passive and active ROM of the fingers or wrist.\textsuperscript{23} A systematic review confirmed improved outcomes after early mobilization following extra-articular metacarpal and phalangeal fractures.\textsuperscript{24}

**Splinting**

Splinting provides pain relief, protects the extremity from additional trauma, corrects or prevents deformity, facili-
tates maintenance of fracture reduction, and/or provides protection during functional activities. Splinting may be static or dynamic, or a combination of both. Static splints hold the affected motion segment in a functional position and protect injured structures at rest and during functional activities. Dynamic splints provide support and protection and allow motion during activities. Examples of static splints include palmar blocking splints, which are used to hold the wrist and fingers in extension after extensor tendon injury, and forearm-based wrist splints, which are used at night to avoid positions of wrist flexion during sleep.

Protective splints may support inflamed soft tissue and injured or compromised joints; stabilize weak muscles, thereby preventing damage; or neutralize unstable fractures. One such splint is the dorsal extension block splint, which is used after flexor tendon repair (Figure 6). Static positional splints stabilize fractures and dislocations, prevent deformity, and/or substitute for lost function. Examples of positional splints include web space abduction splints, which are used to prevent web space contracture, and MP flexion splints, which are used after release of MP extension contracture.

Static splints have no moving parts. Dynamic splints may include flexible components, hinges, and/or devices (eg, outriggers) that provide dynamic forces. Both types of splint are used for immobilization and support. Serial adjustment or alteration of static splints is referred to as static progressive splinting. This type of splinting is accomplished by locking and unlocking hinges or by the serial modification of solid splints. Examples of dynamic splints include MP extension splints, radial nerve palsy splints, and finger flexion splints used for the Kleinert flexor tendon protocol. Static progressive splints incorporate components that can be adjusted as ROM increases.

Desensitization and Sensory Reeducation

Depending on the nature of the injury, a patient may benefit from therapy that is specifically directed at sensory reeducation or desensitization. This process can be used during any phase of treatment and can begin almost immediately after injury. Hypersensitivity following nerve injury is characterized by severe irritability in response to normal stimulation. Hyperpathia, allodynia, and hypesthesia associated with CRPS complicate recovery and impair health-related quality of life and function. Desensitization is used to send nonnoxious signals to the central nervous system in an effort to cortically normalize nonpainful stimuli. The efficacy of this process is explained by the gate theory of pain.

Desensitization begins with a three-part hypersensitivity evaluation. First, patients are asked to determine the irritability of 10 different textures—ranging from moleskin to Velcro—mounted on dowels (Figure 7, A). Second, patients rank the irritability of various immersion particles (Figure 7, B). Finally, the irritability of a variety of vibratory frequencies is discerned. The results of the three-phase hand sensitivity test are used to determine the most appropriate level of stimulation to be used in initial therapy sessions.

Massage, percussion, heat, compression, contrast baths, Fluidotherapy (Chattanooga Group, Chattanooga, TN)
Sensory stimuli reinforces recognition patterns.

**Soft-tissue Mobilization**

Shortening of the soft tissue occurs as a result of collagen cross-linking and adaptation to muscle fiber resting length coincident with the decreased demand for joint motion. For example, maintenance of metacarpal joints in full extension results in shortening of the true and accessory collateral ligaments. In patients with spasticity and diminished joint ROM, muscle tendon units shorten to produce fixed contractures.

Soft-tissue mobilization (STM) of tissue planes relative to one another is believed to promote joint ROM, reduce tissue stress, and stimulate lubrication and nutrition. However, additional research is required to determine whether STM improves therapeutic outcomes. STM techniques are believed to optimize these factors during the healing process, minimize adhesions between adjacent tissue planes, and decrease adaptive shortening.

The clinical effects of STM include decreased fluid stasis, increased extensibility of shortened tissues, improved blood flow, and proprioceptive awareness at the treatment site. The goals of STM are to improve ROM and soft-tissue flexibility and to decrease pain. Gliding, that is, the movement of tendons within their sheaths or muscles within fascial compartments, is impeded by adhesions.

**Strengthening**

Strengthening protocols are initiated following healing of the wound and any repaired structures as well as successful pain control. The goals of strengthening include improved grip, tip pinch, key pinch, and function. Older patients with decreased grip strength (<40 lb) report dissatisfaction with health-related quality of life and function compared with patients with better grip strength (>60 lb). This reduction in grip strength may be linked to sarcopenia and generalized frailty, which is common in older patients. For patients with sarcopenia, therapeutic interventions that improve muscle mass and strength may prevent the onset of chronic disorders that negatively affect health-related quality of life.

The scope of a strengthening program depends on the nature of the injury, status of the soft tissue, level of pain, and biomechanics of the fracture fixation and/or soft-tissue repair. Strengthening protocols are graduated, with progressive loading and resistance; both eccentric and concentric muscle contractions are used. Strengthening or maintenance of muscle tone is incorporated into most active-motion protocols. Increasing muscle strength often improves ROM, facilitates lysis of adhesions, and improves excursion. Neuromuscular electrical stimulation can be used for patients who are unable to initiate muscle contractions to generate sufficient force. Exercises that incorporate functional activities of daily living have been shown to improve ROM and strength generation in young patients after hand injury.

The Jamar Hand Dynamometer (Asimow Engineering, Los Angeles, CA) is the most commonly used instrument to measure grip strength. Multiple studies have confirmed its validity and reproducibility. Repeated measurements of grip, key pinch, and tip pinch provide objective measures of improvement in both strength and function.

**Work Hardening and Conditioning**

For the patient who has been out of work for a prolonged period, an integrated therapy approach is often
necessary to ensure safe return to work. Work conditioning, in which an injured hand is incorporated into the process of completing a work task, encompasses the biomechanical, neuromuscular, and metabolic demands of the extremity. A program is developed to reestablish the required physical capacity within the context of job-specific requirements. Work hardening addresses the psychosocial functions, incorporating issues of behavior, safety, and efficiency, with the goal of returning the patient to work in a productive and safe role.37-40

### Modalities

The term “modalities” describes a variety of treatment agents and techniques used by hand therapists. Modalities may be classified as thermal (hot and cold), motion, and electrical.

#### Fluidotherapy

Fluidotherapy is a superficial heat modality that transfers heat to exposed tissue via heated air and cellx particles (corn cob particles ground to the approximate granularity of sand). The patient submerges the injured hand into an agitated bath of cellx through a sleeve. The hand remains submerged for 10 to 20 minutes with the temperature maintained at 46° to 49°C. Patients may perform active ROM exercises during the treatment. Fluidotherapy is primarily used to improve ROM in patients who experience hand stiffness during healing, to desensitize hypersensitive soft tissue, and to improve circulation.

The effects of heat on soft tissue are well documented. Borrell et al41 demonstrated that joint capsule and muscle temperatures increase significantly during Fluidotherapy compared with either paraffin bath treatment or hydrotherapy. Kelly et al42 documented significantly increased soft-tissue temperatures (P < 0.001) and decreased sensory nerve action potential latency in the radial nerve (P < 0.001) after Fluidotherapy treatment in healthy subjects. Randomized controlled trials evaluating the efficacy of treatment with Fluidotherapy are lacking.

#### Paraffin Therapy

Paraffin therapy involves submerging the involved hand in a bath of warm (53°C) paraffin wax. After a period of hand warming, ROM exercises and strengthening activities are performed. In a 2002 Cochrane review, paraffin wax baths combined with exercises provided short-term benefits for arthritic hands.43 However, evidence supporting the use of paraffin therapy is limited because of the poor quality of the trials used to evaluate its effects.

#### Cryotherapy

Cryotherapy involves the application of a cold substance to injured tissue to decrease tissue temperatures, thereby producing a therapeutic effect. Cooling is used to control edema in the acute injury phase, moderate pain, decrease inflammation, and affect soft-tissue extensibility. A Cochrane review published in 2002 did not identify any long-term objective or subjective benefits of cryotherapy for the management of rheumatoid arthritis.43

#### Continuous Passive Motion

The use of CPM in hand therapy is believed to encourage passive ROM, increase circulation, and decrease edema. However, one recent Cochrane review concluded that because of insufficient evidence, CPM therapy as a means to increase strength and ROM after metacarpophalangeal arthroplasty in patients with rheumatoid arthritis is not recommended.44 Another Cochrane review identified one study providing weak evidence of short-term increases in ROM in patients who underwent wrist CPM following the removal of external fixators to manage distal radius fractures.23 A third Cochrane review that evaluated the efficacy of various motion modalities for the management of flexor tendon injuries concluded that there was insufficient evidence to identify the most effective rehabilitation strategy.45

#### High-voltage Pulsed Galvanic Stimulation

High-voltage pulsed galvanic stimulation (HVPGS) involves the use of a pulsed direct current applied at high voltage; these are usually twin pulses of short duration. HVPGS can be used to decrease edema and accelerate wound healing. Basic science investigations have demonstrated that pulsed current therapy is associated with increased migration of neutrophils, macrophages, and fibroblasts. One study demonstrated improved collagen production and wound tensile strength compared with controls following HVPGS.46 Evidence from several randomized controlled trials indicates that these effects accelerate wound healing in vivo.47

Edema reduction following HVPGS is thought to be the result of a decrease in microvascular permeability after electrical stimulation.48 Griffin et al9 demonstrated a clinically significant decrease in edema in patients who received HVPGS after distal radius fractures compared with control patients who did not receive HVPGS. This decrease in edema was similar to that produced by intermittent pneumatic compression.9 Cheing et al49 demonstrated decreased swelling and improved ROM with pulsed electromagnetic fields plus cold therapy (ice, ice) after distal radius fractures compared with sham pulsed electromagnetic fields without ice.
Neuromuscular Electrical Stimulation

Neuromuscular electrical stimulation (NMES) is achieved by passing an electrical impulse from a device through electrodes placed on the skin over targeted muscles. Individual muscle bellies or muscle groups are stimulated to produce contraction with a pulsating alternating current. NMES selectively stimulates large muscle fibers and can be used to decrease edema, slow disuse atrophy associated with reinnervated muscles, retrain muscles following tendon transfer, and facilitate tendon gliding after tendon repair or tenolysis. NMES decreases edema by producing muscle contractions that promote increased circulation and improved lymphatic drainage.50

Transcutaneous Electrical Nerve Stimulation

A transcutaneous electrical nerve stimulation (TENS) unit emits a low-frequency pulsed current that interrupts painful sensations with electrical impulses. TENS units are used to manage pain in multiple anatomic locations. Hand therapists use TENS units primarily for the management of acute and chronic pain in the upper extremity. Patients may use the units at the therapist’s office or at home. TENS sessions typically last 30 to 40 minutes and are performed up to four times per day.

The evidence for the efficacy of TENS is mixed. Most studies provide inconclusive evidence because of the lack of statistical power. However, a few adequately powered studies have been designed to assess the effectiveness of TENS in the management of chronic and acute pain.51 Johnson and Martinson51 performed a meta-analysis including 38 randomized controlled trials to evaluate the efficacy of electrical nerve stimulation for the relief of chronic pain. A significant decrease in rest pain was demonstrated following the use of electrical nerve stimulation (P < 0.0005). They also reported increased efficacy with percutaneous electrical nerve stimulation versus TENS. However, this study included patients with several different pain locations (including the low back) who were treated with several different electrical modalities. A Cochrane review of the effect of TENS on pain associated with rheumatoid arthritis concluded that TENS was a valuable therapeutic modality for the management of upper extremity pain associated with rheumatoid arthritis.32

Phonophoresis and Iontophoresis

Phonophoresis and iontophoresis involve transdermal delivery of low-dose medication. Phonophoresis uses ultrasound to increase skin permeability and enhance delivery of topically applied medications. Typical medications used for phonophoresis include salicylates, lidocaine, hydrocortisone, and dexamethasone. Iontophoresis uses a low-voltage direct galvanic current to transfer topically applied ions into target tissue. Polarized substances are more easily transferred through tissue with iontophoresis. Common ions used for iontophoresis and phonophoresis include dexamethasone, saline, salicylates, and lidocaine. Both techniques may be used for pain, inflammation, and the prevention of scar formation.

Although both phonophoresis and iontophoresis have been shown to effectively increase tissue penetration of steroids,33,54 the results of clinical trials have been less convincing. A systematic review of the literature concluded that there was insufficient evidence to recommend iontophoresis for the treatment of inflammatory musculoskeletal conditions.51

The Therapist and Patient Care

Experienced hand surgeons recognize the importance of hand therapists and their knowledge of the use of clinical applications to promote patient recovery. The results of treatment using combined modalities employed by hand therapists are difficult to quantify. Positive interactions with other hand patients during their treatment, encouragement offered by therapists, and the ability of the therapist to objectively quantify and evaluate progress are important factors in encouraging patient compliance with therapy, and these variables have a positive impact on outcomes.

Compliance with therapy is an independent determinant for return to work after median, ulnar, and combined nerve injury.3 A randomized trial involving patients with Colles fractures demonstrated no significant difference in outcomes between patients who received therapy and those who did not.56 Although the randomization of patients to therapy versus no therapy in this study did not demonstrate a statistically significant difference in mean outcome measures, there may be a specific group of patients with Colles fracture who benefit from therapy. Experienced surgeons may be able to selectively prescribe therapy to patients who would benefit from it.

Therapists should have access to the surgical note, including information regarding the expected course of therapy and the surgeon’s expectations for patient outcomes. Availability of this note is particularly important for the therapist to properly appreciate the extent and severity of traumatic disorders. The quality of fixation of tendons and bone, the tension on a nerve or vessel, and the durability of the repair play a signifi-
Therapy after hand injury can be divided into sequential steps, with the goal of leading patients from injury to recovery. In the early phases, hand therapy addresses edema control and wound management. Depending on the injury, both passive and active ROM protocols may be initiated in these early phases. STM begins after the wound is healed; it is used to facilitate musculotendinous motion.

Sensory reeducation and desensitization are integral throughout the rehabilitation process following nerve injury. Strengthening, work conditioning, and work hardening make up the final stage of rehabilitation.

Although rigorous scientific validation of specific indications is lacking, there is uniformity of utilization of therapy for many indications (eg, tendon repair, chronic pain) and immense variation for other conditions. Patient education as well as communication between therapists and surgeons is critical for successful rehabilitation. Close coordination between surgeons and therapists specializing in the care and management of upper extremity disorders enables patients to progress as rapidly as is appropriate, with the goal of earlier recovery and maximized return of function.

**References**

**Evidence-based Medicine:** Levels of evidence are described in the table of contents. In this article, reference 56 is a level I study. References 9, 24, 32, 35, 44, 45, 47, 49-51, 53, and 54 are level II studies. References 8, 10, 11, 21, 23, 34, 37, 38, 42, 43, and 52 are level III studies. References 3, 7, 12, 13, 15-20, 36, 39, and 41 are level IV studies. References 5, 22, 25-27, 29, 31, 40, 46, and 55 are level V expert opinion.

Citation numbers printed in **bold type** indicate references published within the past 5 years.


26. Schulte-Johnson K: Static progressive


