

Hand Impairments

HAND THERAPY CONCEPTS:

1. Tissue Healing
2. Antideformity Positioning
3. The Myth of No Pain, No Gain
4. Passive Range of Motion Can Be Injurious
5. Isolated Exercise, Purposeful Activity, and Therapeutic Occupation

1. Tissue Healing

- Tissue heals in phases as follows: **inflammation, fibroplasia, and maturation or remodelling.**
- The inflammation phase lasts several days. It includes vasoconstriction followed by vasodilation, with white blood cell migration to promote phagocytic removal of foreign bodies and dead tissue. Depending on the diagnosis, immobilization to provide rest is often advised during the inflammation phase.

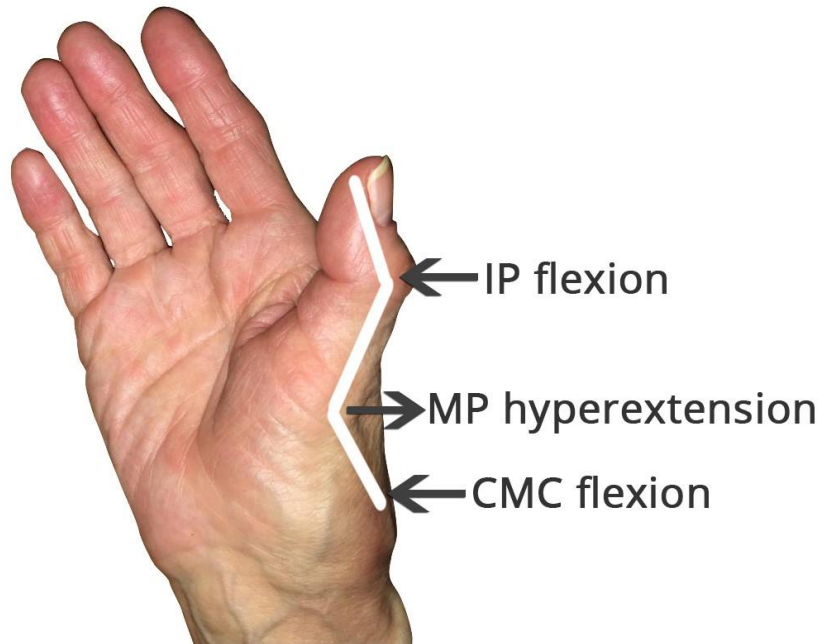
- The fibroplasia phase starts at approximately day 4 and continues for 2–6 weeks. In this phase, fibroblasts synthesize scar tissue.
- The wound's tensile strength increases gradually with the increase in collagen fibres.
- At this time, active range of motion (AROM) and orthotics may be appropriate to protect healing tissues and promote balance in the hand.

- The maturation, or remodelling, phase may last for years, but tissue is usually more responsive early rather than late in this period. The remodelling phase reflects the changing architecture and improved organization of collagen fibres and the associated increased tensile strength.
- **Gentle resistive activity may be appropriate during maturation**, but it may also generate inflammatory responses, which should be avoided. **Gentle application of corrective dynamic or static orthoses may also be appropriate.**
- Tolerance of tissues to controlled stress requires monitoring throughout all phases of intervention. As tissue continues to heal, the wound contracts, and the scar shrinks. Collagen continues to remodel, as it is constantly doing in uninjured tissue.

2. Antideformity Positioning

- Upper extremity injury and disuse are associated with predictable deforming hand positions. **Oedema**, which typically accompanies injury, **creates tension on extrinsic extensor structures. This leads to a zigzag** collapse with a resulting deformity position of flexed wrist, hyperextended metaphalangeals (MPs), flexed (IP) or (hyperextended proximal interphalangeals (PIPs) and flexed distal interphalangeals (DIPs)), and adducted thumb.

Zig Zag Deformity of the Thumb



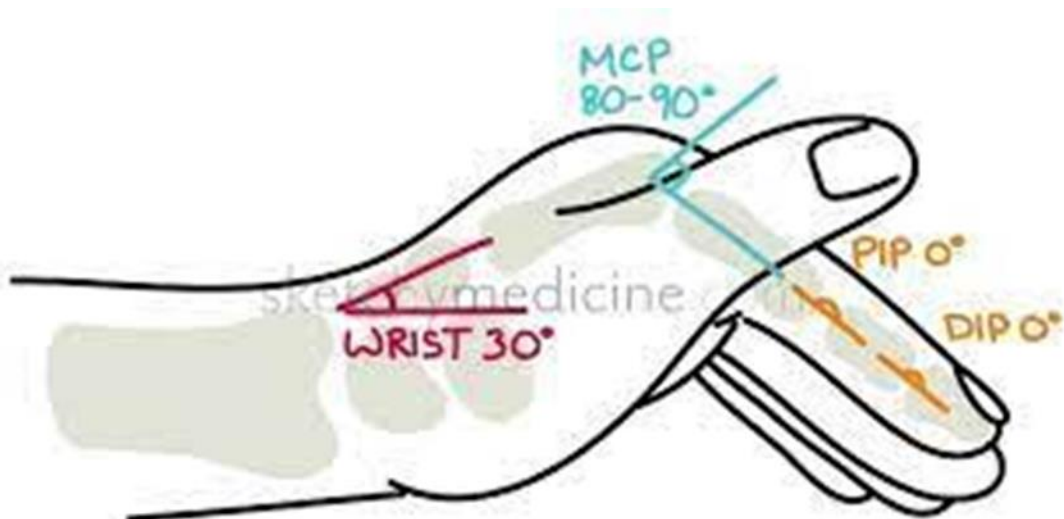


- Hand joints are anatomically destined to stiffen in predictable positions. Specifically, **the MP joint is prone to stiffen in extension.** This is because the protruding or cam shape of the metacarpal head causes the collateral ligament to be slack in MP extension and taut in MP flexion. Conversely, the **interphalangeal (IP) joints are prone to become stiff in flexion** because of shortening of the volar plate and collateral ligaments.

- When prolonged or constant immobilization is necessary **and range of motion (ROM) is at risk, it is usually best to splint the patient's hand in the antideformity position , also called the intrinsic-plus position.**
- This position places the **wrist in neutral or extension, the MPs in flexion, the IPs in extension, and the thumb in abduction and opposition.** The antideformity position allows the collateral ligaments at the MP joints and the volar plate at the IP joints to maintain their length, which counteracts the forces that promote zigzag collapse.



- Certain diagnoses, such as flexor or extensor tendon repair, are not compatible with antideformity positioning. The physician can assist in this determination.





3. The Myth of No Pain, No Gain

- Regarding tissue tolerances, the myth of “no pain, no gain” must be dispelled in hand therapy. A better mindset would be **no pain, more gain**. Well-intentioned therapists and overzealous family members of patients have too often caused irreversible damage by applying passive range of motion (PROM) forces beyond the tissues’ tolerances. Pain induced by therapy can also cause complex regional pain syndrome (CRPS).

- People with upper extremity problems often arrive at therapy prepared for painful intervention. Some patients do not tell the therapist when intervention hurts. It is essential to educate patients about this. In addition, watch the patient's body language and face for signs of pain.
- Wincing and withdrawing the upper extremity are obvious signals. Proximal guarding is another revealing response. Change the intervention accordingly, and if necessary, try a hands-off approach wherein the therapist coaches and instructs while the patient self-treats.

4. Passive Range of Motion Can Be Injurious

- PROM can be injurious to the delicate tissues of the hand. Specifically, PROM can disturb healing tissues and incite further inflammatory reactions, resulting in increased scar production. PROM can damage articular structures and can even trigger CRPS. A tissue's timeline for remodelling is maximized by non inflaming intervention and is cut short by intervention that is inflaming or provoking.
- For all of these reasons, **if PROM is clinically appropriate, be sure it is done gently and in a pain-free manner. Low load, long-duration splinting is a safer and more effective method for remodelling tissue and increasing PROM**

- The potential for harm may be compounded if PROM is performed following external application of heat. External application of heat, such as a hot pack, is a popular way to prepare tissues for stretching. Unfortunately, the clinical concerns of externally applied heat have received less attention than they deserve. Heat increases oedema, which acts like glue. Heat may degrade collagen and contribute to microscopic tears. Heat may also incur a rebound effect, with stiffening following its use.

- **Safety Message:** Do not use heat on patients who have oedema or sensory loss or whose limb appears inflamed. Overall, **it is safer to use aerobic exercise to warm up the tissues** of people with hand impairments. If external application of heat is used, elevate the upper extremity, be gentle with exercise, and promote active movement in conjunction with the heat. Continue to monitor for immediate and subsequent signs of inflammation.

5. Isolated Exercise, Purposeful Activity, and Therapeutic Occupation

- Technically, it is necessary to treat hand impairments with a structure-specific approach to isolate and care for the discrete components that are involved.
- Although some hand therapists do incorporate purposeful activity into intervention, more support is needed for an alternative approach to hand therapy that leads with concepts of therapeutic occupation. One way to achieve this is to integrate patient-directed goals and activities of daily living (ADL) into hand therapy intervention planning and implementation. Whenever possible, encourage upper extremity use in ordinary daily activities as appropriate to the diagnosis. Explore the capabilities in the clinic, and then teach patients to do activities at home. For example, folding socks and underwear can be upgraded to folding heavy towels and jeans, which require greater strength and endurance.

- Occupation elicits adaptive responses that do not occur with exercise alone. Compared to isolated exercise, purposeful activity or occupation promotes more coordination and better movement quality. An example of isolated hand therapy exercise to increase grip strength is gross grasp with therapy putty or exercise grippers. An example of purposeful activity to increase strength would be putting away groceries, starting with light items and progressing to heavier objects.
- The examples cited earlier become therapeutic occupation with the use of activity that is meaningful to the particular person to accomplish the therapeutic goal. If the patient enjoys baking, then rolling dough with a rolling pin would be a therapeutic occupation to promote grip function.

EVALUATION

- **History:**

History taking as part of the occupational profile offers an excellent opportunity to establish therapeutic rapport.

Assess deficits in the areas of occupation by asking what the patient cannot do that he or she wants to do, needs to do, or is expected to do. Also discuss the case with the physician.

For trauma, learn the date of injury, dates of any surgery, where and how injury occurred, mechanism of injury, posture of the hand when it was injured, and any previous intervention.

For nontraumatic problems, learn the date of onset, whether the symptoms are worsening, sequence of onset of symptoms, functional effects, and what worsens and/or lessens the symptoms

- **Pain**

Pain may be acute or chronic. **Acute pain** has a sudden and recent onset, usually has a limited course with an identifiable cause, and can last a few minutes to 6 months. Acute pain serves a physiological purpose, signalling the need to protect tissue from further damage. **Chronic pain** lasts months or years longer than expected and may not serve a physiological purpose. Myofascial pain, which may be chronic or acute, stems from local irritation in fascia, muscle, tendon, or ligament. It has specific reproducible pain patterns and associated autonomic symptoms.

Evaluation of pain may include a graphic representation of pain, in which the patient marks painful areas on a drawing of the human body; analog pain rating scales, joint or muscle palpation to identify areas of local pain or qualitative changes in soft tissue; and trigger point sensitivity

- **Physical Examination**

It is helpful to observe the positioning and use of the patient's upper extremity in the waiting area before the meeting. On examination, look at the entire unclothed upper extremity for posture, guarding and gesturing, atrophy, and oedema.

Because distal symptoms are often caused by proximal problems, it is important to perform a cervical screening, which is a proximal screening assessment of the neck and shoulder, to identify additional areas requiring intervention

- **Wounds**

Evaluate wound size in terms of length, width, and depth. Wound drainage (exudate) is bloody (sanguinous), serous (clear or yellow), purulent (pus), or deep or dark red (hematoma). Wound odour is absent or foul.

The three-color concept (**red, yellow, or black**) dictates wound care. Wounds can be one of or a combination of these three colours. A red wound is healing, uninfected, and composed of revascularization and granulation tissue. A yellow wound has an exudate that requires cleansing and debridement. A black wound is necrotic and requires debridement. **The goal of wound care is to convert yellow and black wounds to red wounds**

- **Scar Assessment**

Observe scar location, length, width, and height. **Hypertrophic scars** stay confined to the Keloids area of the original wound and usually resolve within a year. proliferate outside the area of the original wound and do not usually become smaller or less pigmented with time. Note any scar tethering or adherence of skin and tendon causing restricted movement. Any wound or scar crossing a joint may form a contracture, which restricts passive motion. **An immature scar has a red or purplish colour imparted by its vascularity.** It blanches to touch. A mature scar is flatter and softer. It has a neutral color and does not blanch to touch



- **Vascular Assessment**

Cyanosis, erythema, pallor, gangrene colour indicates vascular compromise. To test **digital capillary refill**, apply pressure to the fingernail or distal pad of the involved digit. Colour should return within 2 seconds of release of pressure. Compare the refill time to that of uninvolved digits



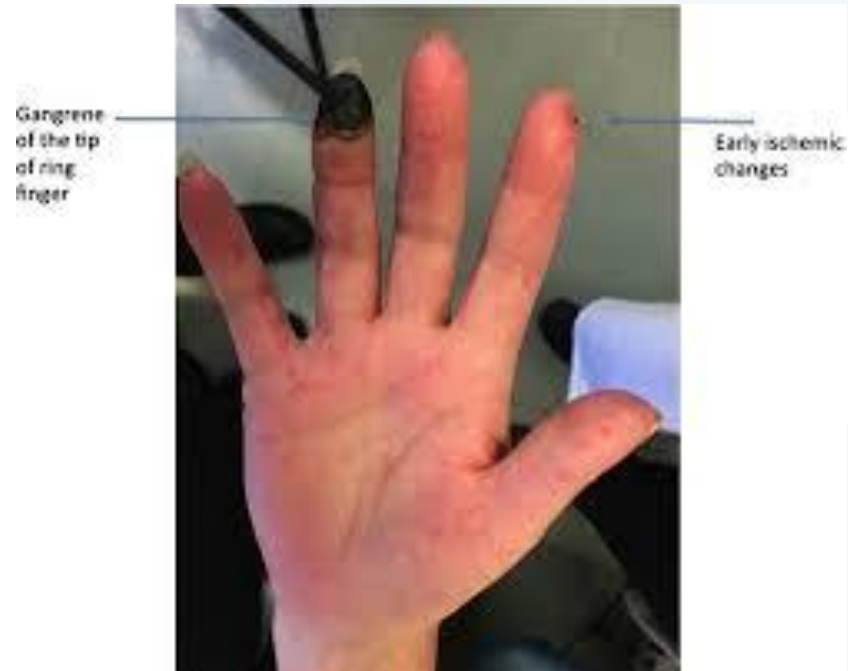
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- **Oedema**

Circumferential measurement is quick to perform and provides a good alternative when it is not possible to use a **volumeter**. Be consistent with measuring tape placement and tension. Volumetric measurement is contraindicated for open wounds, percutaneous pinning such as Kirschner wires, plaster casts, or vasomotor instability.



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- **Range of Motion**

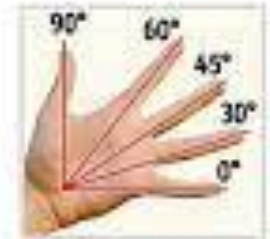
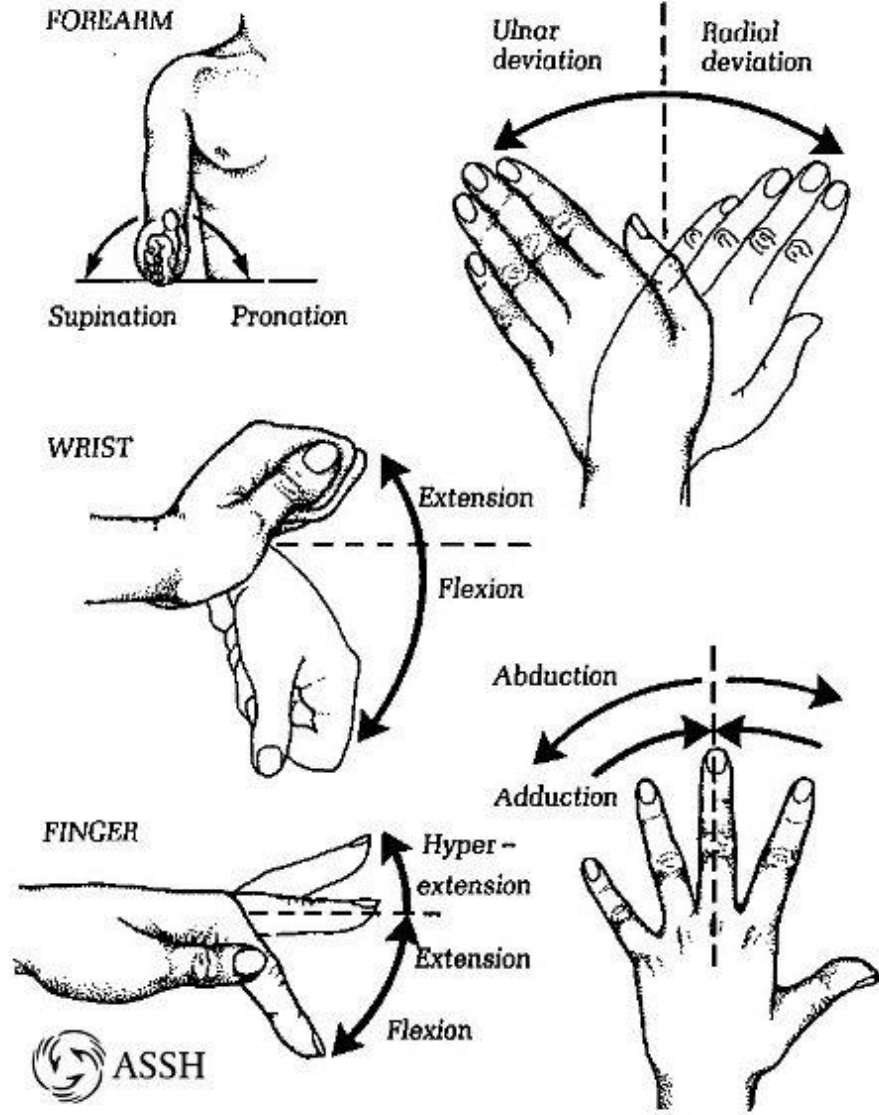
In hand therapy, both AROM and PROM should be evaluated and compared to the uninjured extremity. Facilities usually have their own guidelines for measuring ROM. As expected, consistency of retesting is important.

Total active motion (TAM) or total passive motion (TPM) measures the sum of composite digital flexion and extension. This measurement is used in some studies.

Normal TAM and TPM are 270°

Total Active Motion (TAM) and Total Passive Motion (TPM)

- Add the measurements for flexion of the MP, PIP, and DIP joints.
- Subtract the combined deficits in extension for those joints.
- For example, if the digital AROM is MP: 10–50, PIP: 20–70, DIP: 0–40, the total active motion (TAM) would be 160 (flexion total) minus 30 (extension deficits total) = 130 TAM.



- **Grip and Pinch**

When properly calibrated, the Jamar dynamometer is one of the best instruments to assess grip strength because of its reliability, face validity, and accuracy.

Hand therapy authorities recommend comparing scores with those of the contralateral extremity rather than using norms. Goals for grip and pinch strength depend on occupational factors and dominance. There may be approximately 10%–15% difference in strength between dominant and nondominant hands, with dominant hand usually being stronger. It is routine to measure three pinch patterns: lateral, three-jaw chuck, and tip. As with grip, compare pinch scores with those of the contralateral extremity.

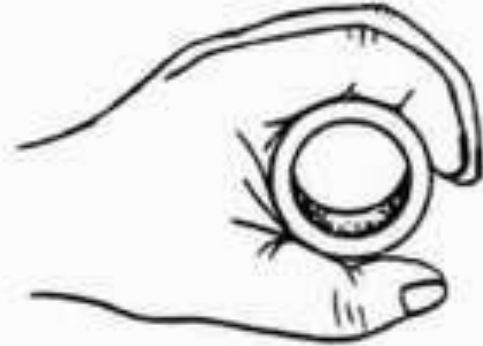


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Types of Prehension



Cylindrical Grasp



Tip



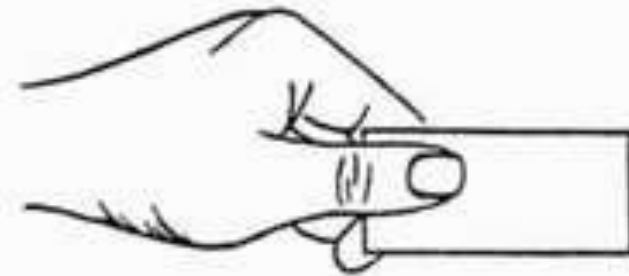
Hook or Snap



3 Jaw Chuck



Spherical Grasp



Lateral



3-Jaw Chuck
Grasp



Tripod Grasp

No linear relationship exists between improvement in grip and pinch strength and improvement in function. Rice, Leonard, and Carter (1998) noted that even debilitated, deformed hands could be surprisingly functional. These authors found only weak relationships between grip and pinch strength and the forces required to open six containers used commonly in the home. Thus, grip and pinch testing are not substitutes for ADL assessment with contextual relevance (Liepert, 2010). To promote occupational functioning of people with hand impairments, it is far better to have intervention and goals reflect personally meaningful ADL than grip or pinch strength measures.

- **Manual Muscle Testing**
- Manual muscle testing is particularly useful for monitoring progress following peripheral nerve lesions. Facilities usually have their preferred method of grading, which may be numerical or descriptive.