

WAITING...FOR TISSUE TO GROW

Doctors Brand and Hollister in the definitive text, *Clinical Mechanics of the Hand*, explain the difference between “creep” and “growth.” (1) To paraphrase:

When composite cadaveric tissue (skin, for example) is stretched, it lengthens. Even if the tissue is not taken to the point of rupture, it will not return to its original length because it has undergone “creep.” Creep is a gradual but permanent lengthening of the tissue due to slippage of short collagen fibers.

Since human cadaveric tissue responds this way to the stress applied, one might assume the same type of stress (stretch) needs to be applied to living tissue to create permanent change. But living tissue undergoes microscopic tearing of the fibers and cells, resulting in inflammation and small hemorrhages which leads to fibrosis that limits tissue mobility even more.

Living tissue held at its easy elastic limit, however, will activate the collagen fibers to turnover in a way that modifies the cross-linking of the fibers, allowing greater length. There is no creep or inflammation but rather a response that can be called “growth.” Growth is unique to living tissue.

Growing Tissue

A symbol of status for the women of the Mursi tribe in the Omo Valley of southern Ethiopia is a large hole in the lip, created by inserting increasing diameter disks slowly over a long period of time. In western cultures, silicone balloon expanders are placed under the skin near an area of tissue to be repaired. Slowly over time the balloon is filled with

salt water, causing the skin to stretch and grow so it is large enough for the planned procedure.

In both of these examples, the element of time and the consistency of low stretch creates the tissue response of growth.

Clinical Suggestions

With the concept of tissue “growth” as a background, here are some clinical suggestions to consider:

- **Frequency of Serial Cast Changes**

Customary teaching about the application of serial casts to resolve flexion contractures of the small joints of the hand encourages changing the cast every few days. Clinical experience reveals that the first one or two casts usually brings about significant improvement but there is diminishing response to continued cast changes over time. When the time between cast changes is increased, a significant improvement in both range of motion and quality of motion is noted, even with the most stubborn joints. When the cast is left on for longer intervals, often the active range of motion is greater than the maximum passive motion at the time of cast application.

Why are increased intervals more effective? If one continues to change the cast every few days, the tissue response cannot keep pace. In other words, there is not enough time for the tissue to grow. A change of the first cast (or two) within a few days works well and slowly increasing the time between casts as the casting continues results in an improved response to each cast. If examination of the joint reveals a hard end-feel, one knows

WAITING...FOR TISSUE TO GROW, continued

immediately the intervals need to be longer to allow the collagen cross linking to be modified so more motion is possible. These longer intervals, in addition to decreasing resistance to motion, also appear to minimize/eliminate any inflammatory response. The concept is to avoid pushing the joint to change and to give the tissue time and opportunity to make its own change.

- **Exercise Frequency**

The more acute and inflamed the tissues, the more rest is needed, with exercises needing to be intermittent throughout the day but with a minimal number of repetitions. When a trigger finger or tenosynovitis develops during hand rehabilitation, excessive exercising is usually the culprit.

It is logical to increase the frequency of exercise sessions before increasing the number of repetitions. Observation of the tissue response to the exercise will signal when the tissue is, or is not, ready for more exercise. Perhaps it is helpful to explain rest and exercise to patients this way: "If you moved your uninjured hand all day it would be sore and swollen. Even uninjured tissues need a balance of movement and rest. Your injured hand needs more rest than exercise in the beginning. As you progress, your hand will tell you

when your exercises are excessive by responding with increased pain, swelling and/or inflammation. You want to sneak into more exercise and not be excessive. A good guideline is to not move your injured hand more than your uninjured hand would easily tolerate."

- **Tissue Maturity**

In many cases our patient treatment has a time limit imposed by third party payors (especially in the US). This discharge deadline may cause us to urge tissues to reach their maximum pliability before that date. Regardless of treatment, tissue maturity following injury requires approximately one year, assuring that our patients continue to improve after discharge (especially when discharge is only after a few months since injury.) For a less experienced therapist to become comfortable with a less-than-full result when the patient is discharged, it may be helpful to ask the patient to return for an unofficial visit a year after the injury to simply allow the therapist to see the final result. Being assured that time for tissue maturation brings continued improvement allows us to be more tolerant of discharging a patient when less than total motion is present.

1) Brand PW, Hollister AM. Clinical mechanics of the hand. 3 ed. St. Louis: Mosby, Inc.; 1999.