



# Functional Soft Tissue

Evaluate for, Treat with and Train proper Movement

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1

## Functional Soft Tissue

- ▶ Class combining evaluation, soft tissue treatment and rehabilitation
  - Evaluation: Movement and Functional Positions
  - Soft Tissue: FAKTR Concepts
  - Rehabilitation
    - Theraband: Bands, Balls, Stability Pads, etc
    - Suspension Trainers: TRX

2



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with contributions from

MANY DC's and PT's

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3

## Gua Sha Tools



4

## Common IASTM Organizations/Techniques

### Graston Technique



ASTYM



SASTM

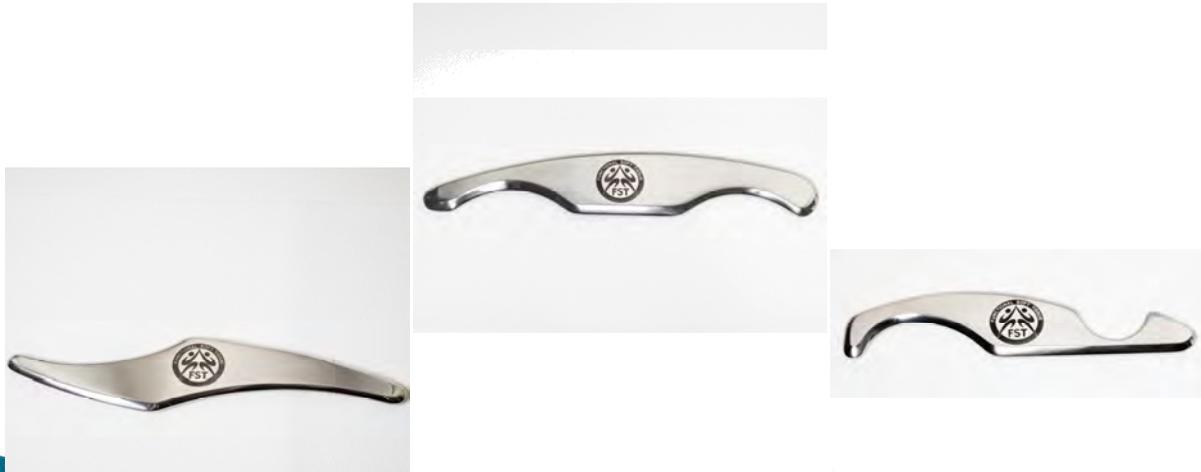
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## Third Generation IASTM Tools



6

## Multi-instrument designs



7

## Introduction

### ▶ Brief History

- Developed by Greg Doerr DC and Tom Hyde DC
- Contributed to by PTs and DCs
- Originated from Graston® Technique
- Directly addresses patient complaints of pain and incorporates movement into treatment

8

8

## 5 FAKTR CONCEPTS

1. Positions of Provocation
2. Motions of Provocation
3. Resistance (adding load)
4. Functional Positions or Activities
5. Adding Proprioception

9

## Introduction

- ▶ Algorithm
  - Test
  - Treat
  - Re-Test / Re-Treat
  - Train (Exercises / Adjuncts)

10

10

## Introduction

### ▶ 1. Test

- Determine provocative position; rate pain 1–10
- Add active movement (note change in pain)
- Add resistive movement (note change in pain)
- Add functional movement (note change in pain)
- Add proprioception (note change in pain)

11

11

## Introduction

### ▶ 2. Treat

- Treat soft tissue in painful position (with or without motion, resistance or proprioception)
- May also treat areas of reduced ROM or function
- 30 seconds to 2 minutes

12

12

## Introduction

- ▶ 3. Re-test / Re-treat
  - Reassess provocative position/activity; rate pain 1-10
  - Re-treat up to 3 times
  - Continue to move up or down kinetic chain
  - Progressively add more complex testing positions with improvement

13

13

## Introduction

- ▶ 4. Train
  - Restore muscle balance
  - Train movement patterns
  - Apply adjuncts (Kinesiology taping, etc)

14

14

## Introduction

### ▶ Indications

- Tendinopathies
  - Tennis elbow
  - Rotator cuff tendinopathy
  - Achilles tendinopathy
  - Patella tendinopathy
- Fascial Syndromes
  - ITB Syndrome
  - Trigger Finger

### ▶ Indications

- Entrapment Syndromes
  - Carpal Tunnel Syndrome
  - Thoracic Outlet Syndrome
- Ligament Pain
  - MCL Sprain
  - Ankle Sprain
  - AC Ligament Sprain
- Scar Tissue / Adhesions
- Edema

15

15

## Introduction

### ▶ Contraindications

- Cancer
- Burn scars
- Unhealed fractures
- Kidney dysfunction
- Pregnancy
- Anticoagulant medications
- Rheumatoid arthritis/AS
- Uncontrolled hypertension

### ▶ Contraindications

- RSD/CRPS
- Lymphedema
- Polyneuropathies
- Diabetes
- Open wounds/unhealed suture sites/sutures
- Osteomyelitis
- Varicose veins
- Thrombophlebitis

16

## Introduction

- ▶ Clinical Decision Making
  - Use in both assessment and treatment
  - Perform comprehensive clinical examination
  - Integrate in treatment ; no protocols or boundaries
  - If patient improves, then symptoms return, do not treat more than 2–4X without further assessment, 2<sup>nd</sup> opinion, etc.
    - Indicates FAKTR may not be appropriate treatment

17

17

## Potential Treatment Response

1. Pain & Discomfort
2. Pettichia/Bruising
3. Spontaneous Fascial Release  
(Hypothesis: The release of hardened scar tissue from healthy soft tissue)

*A well informed patient is a MUST prior to instituting a treatment.*



*Control pain & tissue response with Modalities*

- Ice
- Interferential, etc.

18



### ▶ Pro-inflammatory Treatment

- Purpose is to initiate fibroblastic proliferation and increase collagen synthesis
- Heavier and Deeper Treatment Strokes
- Faster treatment strokes, maybe slower with increased depth to stay on tissue
- DESIGNED TO CREATE INFLAMMATION

19



### ▶ Pro-inflammatory Treatment

- Used in 4 situations
  - Tendinopathy
    - Focuses on Concept 3 Resistance using eccentric loading
  - Ligament Injuries
    - Focus on Concept 1 Position applying strain along the line of the ligament
  - Post surgical and traumatic scars
    - Focus on all Concepts depending on injury but use of fillet strokes
  - Deep Facial Lesions (Stecco Points)
    - Focus on all Concepts but 4 Functional positions when possible. Must use deep pressure and friction until "knot" breaks up

20



- ▶ Pro-inflammatory Treatment
  - While designed to create inflammation follow the 7/10 rule. Let the patient determine the amount of discomfort before you must stop
  - Treatment time should be in 10–30 second bursts

21

**INSTRUMENT-ASSISTED CROSS FIBER MASSAGE ACCELERATES KNEE LIGAMENT HEALING:** Dept of anatomy and cell biology, Indiana University. Loghmani, MT et al., 2006

- ▶ Controlled study: 20 rats underwent surgical bilateral transection of the MCL.
- ▶ 7 days postoperatively GT was used on the left MCL for one minute 3x per week for 3 weeks.
- ▶ Results: “Ligaments treated with IACFM were found to be 31% stronger and 34% stiffer than untreated ligaments.”
- ▶ Article will appear in JOSPT.

22

## Methods Intervention

- ▶ Treatment Onset 1 wk after surgery to allow wound closure and acute inflammation to subside
- ▶ Instrument GT6 as used for similar sized area clinically
- ▶ Average Pressure similar pressure as used clinically for similar sized structure (250–300g per force plate)



### SHORT TERM EFFECTS

(n=31)

IACFM X 1 min 3x/wk X 3wks  
Total Number of Treatments: 9

### LONGER TERM EFFECTS

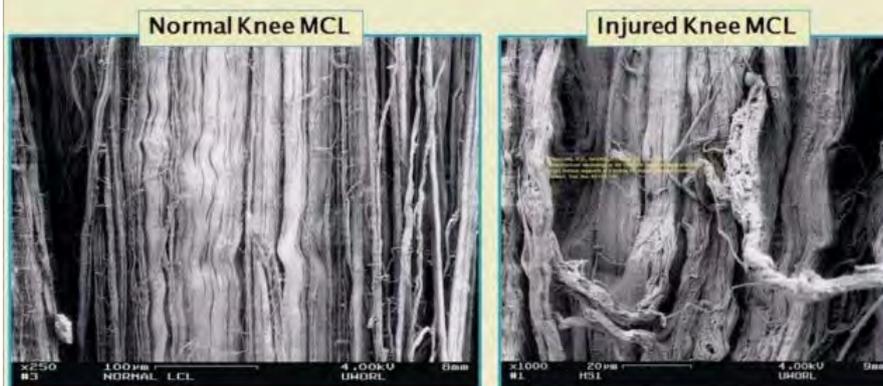
(n=20)

IACFM X 1 min 3x/wk X 10 wks  
Total Number of Treatments: 30

Institutional Animal Care & Use Committee at Indiana University approval were obtained *a priori* for all studies

23

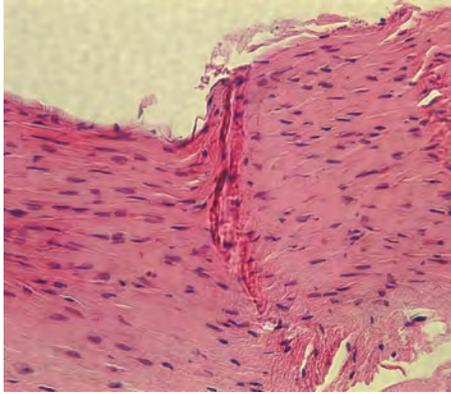
## Hallmark of tendon & ligament injury is collagen fiber disruption and mal-alignment



–Provenzano PP. *Connective Tissue Research* 2001

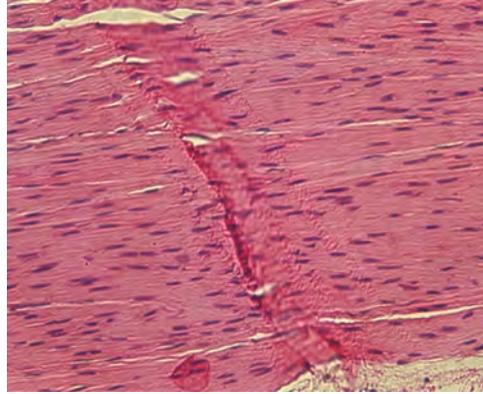
24

## Effect of IASTM on Ligamentous Healing



20R 506004 4wk untreated 20R PH2

Before Treatment: Irregularly oriented and diminished amount of fibroblasts



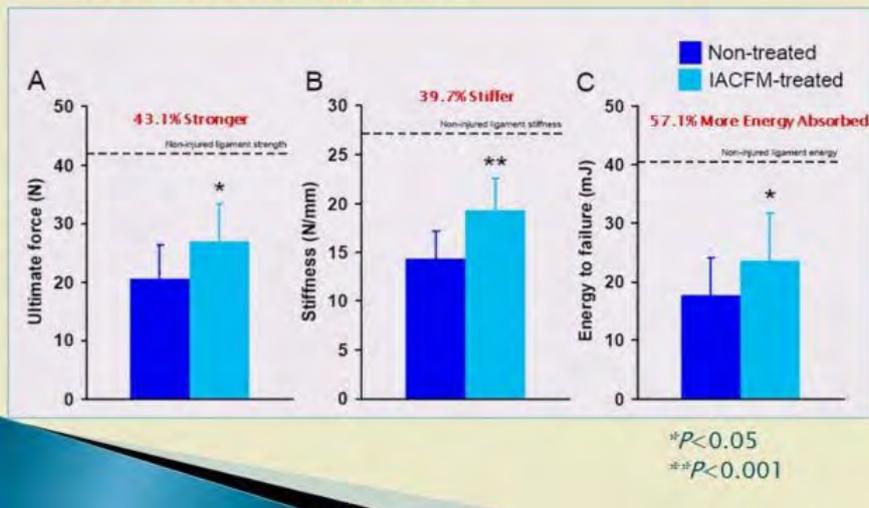
20L 506004 4wk treated 20L PH2 4wk treated

The treated appears to have increased cellularity and more regularly oriented, elongated fibroblasts.

25

## Results

### Ligament mechanical properties (4 weeks) (9 IACFM treatments)

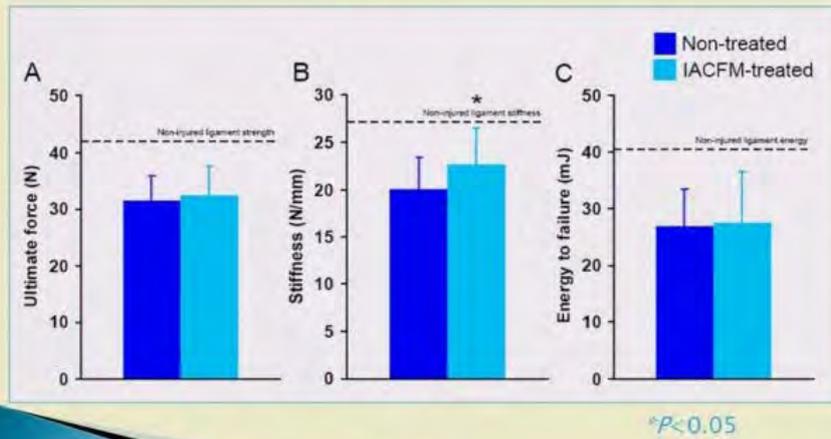


26

## Results

### Ligament mechanical properties

(12 weeks) (30 IACFM treatments)



27

## Results

### Ligament microscopic morphology

SEM (4 wks) (25X)

CAGE CONTROL

UNTREATED

TREATED

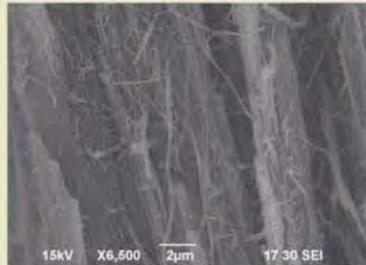


28

## Results

### Ligament microscopic morphology SEM (4 wks) (6500X)

TREATED



UNTREATED



29

## Discussion

### Summary of preliminary findings

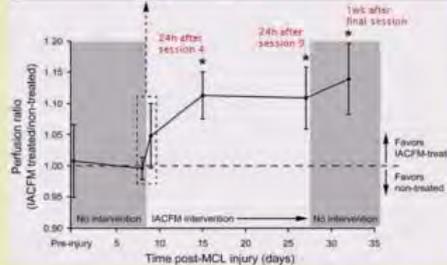
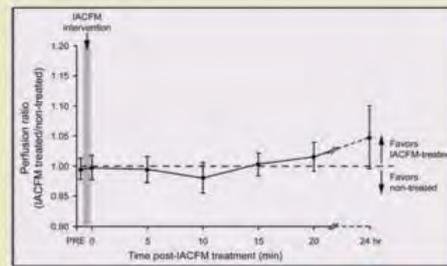
- **Short term**
  - IACFM accelerates ligament healing
  - **Biomechanical Testing**  
Stronger • Stiffer • Absorbed more energy to failure
  - **Light Microscopy & SEM**  
Qualitative improvements in collagen alignment
- **Longer-term**
  - IACFM may augment ligament healing
  - **Biomechanical Testing**  
Stiffer. Still deficient. May need longer treatment.

30

## Results

### LDI

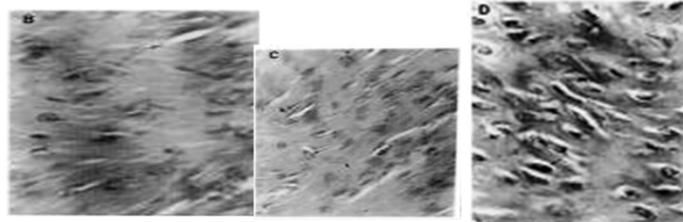
- ▶ IACFM had no immediate effect on tissue perfusion ratios (treated/untreated)
  - immediately prior (PRE) to treatment or at 5, 10, 15 or 20 min post treatment at any assessment point, or at 24h after 1<sup>st</sup> treatment session
  - Perfusion Ratio > 1 indicates greater perfusion in IACFM-treated hindlimb.
- ▶ Significantly greater perfusion 24h after treatment sessions and 1 week after final treatment



\*  $p < 0.05$

31

## Instrument-Assisted Soft Tissue Mobilization (IASTM)



Light IASTM  
pressure

Moderate  
IASTM  
pressure

Heavy  
IASTM  
pressure

Increased pressure increased the amount of fibroblasts.

Gehlsen, G. M., Ganion L. R., et al. (1999). Fibroblast responses to variation in soft tissue mobilization pressure." *Medicine & Science in Sports & Exercise*, 31(4): 531-5.

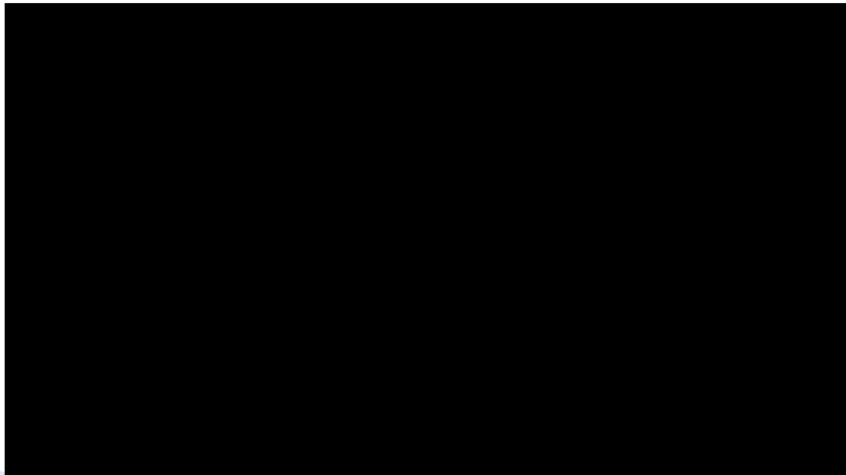
32

**FAKTR CONCEPT 1:  
POSITION OF PROVOCATION:  
Inversion Sprain Position**



33

**FAKTR CONCEPT 5:  
ADDING PROPRIOCEPTION:  
Ankle Ligaments on BOSU**

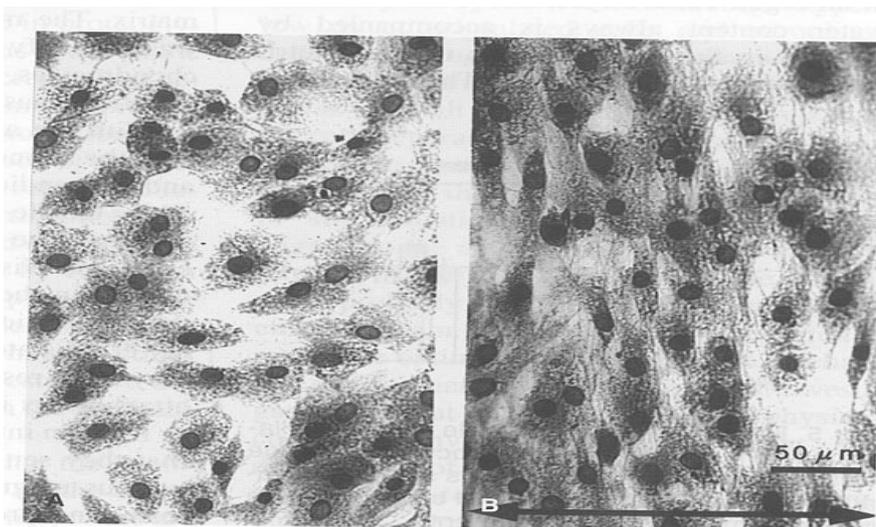


34



## on Tendons

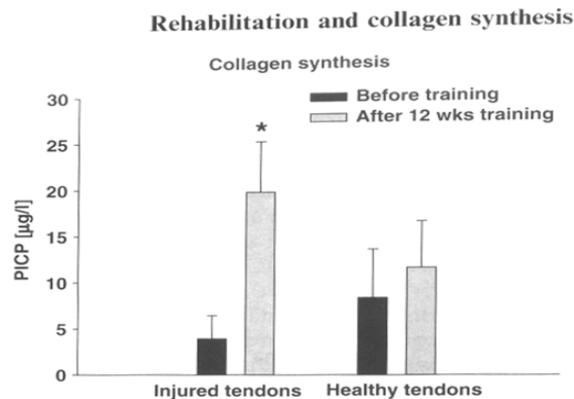
35



Cyclic tensile load for 24 hours causing changes in shape and alignment of chondrocytes. (A) Before loading; (B) After loading. Toyoda T et al. The effects of tensile load on the metabolism of cultured chondrocytes. Clin Orth Rel Res 359:221-228, 1999

36

## Achilles Tendinosis



*Fig. 1.* Eccentric training and collagen type I synthesis. Carboxyterminal propeptide of type I collagen (PICP) was determined in the tissue around the Achilles tendon before and after 12 weeks of eccentric training. Interstitial tissue concentrations were calculated from microdialysis determinations. In the previously injured tendons ( $n = 6$ ), eccentric training was found to increase collagen synthesis, whereas the synthesis was unchanged in the healthy tendons ( $n = 6$ ) (mean  $\pm$  SEM) (\* $P < 0.05$  vs rest).

Langberg H, et al Eccentric rehabilitation exercise increases peritendinous type I collagen synthesis in humans with Achilles tendinosis. Scand J Med Sci Sports 2007;17:61-66.

37

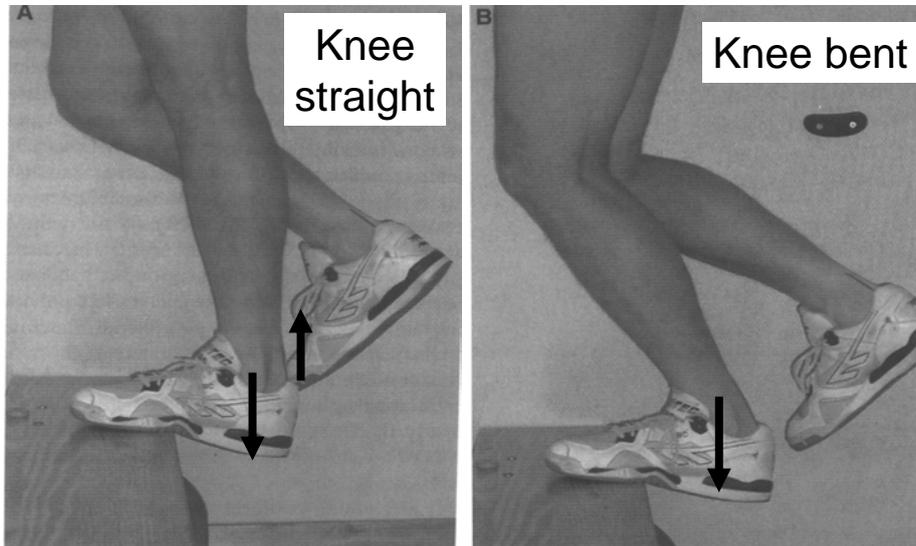
## Training Schedule for Chronic Achilles Tendinosis

- ▶ Two times daily for 12 weeks, 3 sets of 15 heel raises (eccentric)
- ▶ Wear a backpack containing 20% of body weight.
- ▶ Increase weight as soon as no pain immediately after training or the next morning.
- ▶ Expect pain to increase during first 3–4 weeks. Continue even if pain persists.
- ▶ Continue with sport if pain does not increase.

Langberg H. et al. Eccentric rehabilitation exercise increases peritendinous type I collagen synthesis in humans with Achilles tendinosis. Scand J Med Sci Sports 17;2007:61–66.

38

## Eccentric Loading for Achilles Tendinosis



Alfredson H. Chronic midportion achilles tendinopathy: an update on research and treatment. *Clin Sports Med*. 22:4;2003:727-741.

39

## Eccentric Contraction without Concentric Contraction



40



## ***PAINFUL ECCENTRIC WRIST FLEXION***

*2 sets of 15 reps two times per day*

41

## Rehab Tools

### ▶ Eccentric FlexBar for Tennis Elbow

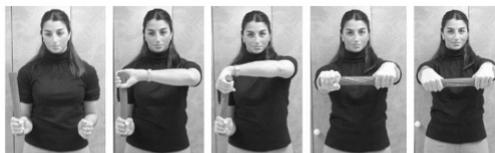


Figure 1A: Rubber bar held in involved (right) hand in maximum wrist extension.

Figure 1B: Other end of rubber bar grasped by noninvolved (left) hand.

Figure 1C: Rubber bar held by flexing the noninvolved wrist while holding the involved wrist in extension.

Figure 1D: Arms brought in front of body with elbows in extension while maintaining wrist in extension while holding rubber bar by holding with noninvolved wrist in full flexion and the involved wrist in full extension.

Figure 1E: Rubber bar slowly unloaded by allowing involved wrist to move into flexion i.e. eccentric contraction of the involved wrist extensors.

<http://info.therabandacademy.com/FlexbarElbow>

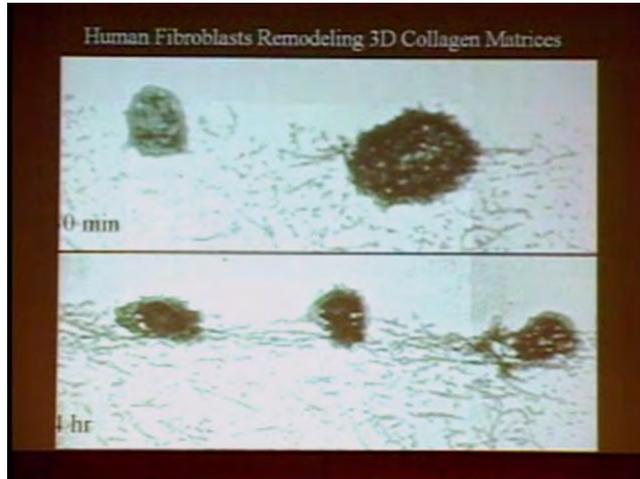
42

42

## Connective Tissue Healing in 3-D Matrix

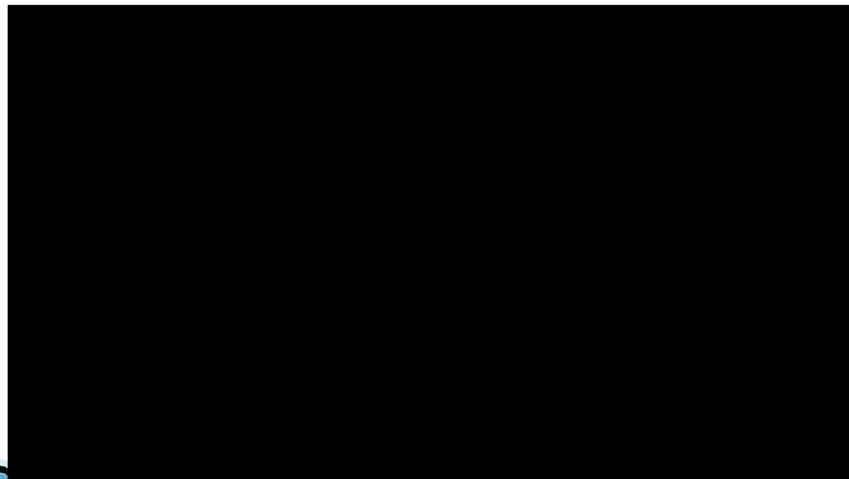
### Grinnell F "Fibroblast Mechanics in 3-D Collagen Matrices"

- Actual Remodeling following 1 hour of migration
- In a high tension state, the cell body size of the fibroblast enlarges and becomes metabolically active producing collagen and ECM
- In a low tension state, fibroblasts cell body is smaller and it is in a dendritic state with many interconnections



43

## FAKTR CONCEPT 3: RESISTANCE OF PROVOCATION: Eccentric Supra, Post Cuff, Biceps



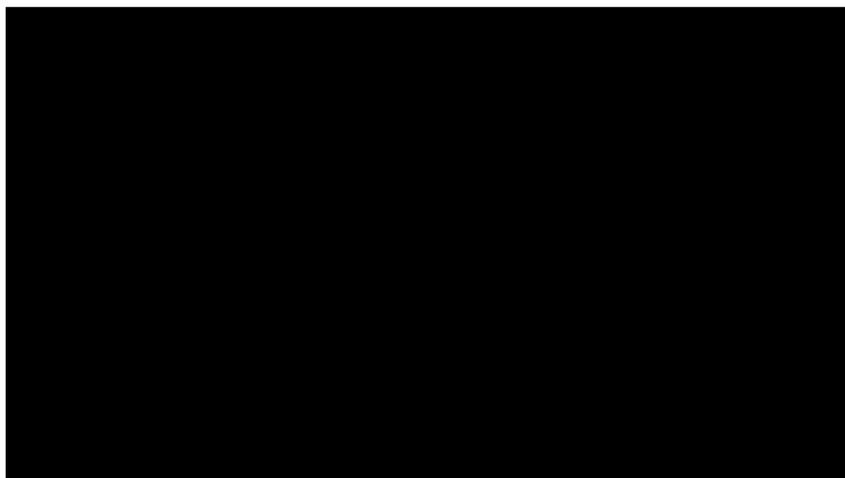
44

### FAKTR CONCEPT 3: RESISTANCE OF PROVOCATION: Achillies with Eccentric Loading



45

### FAKTR CONCEPT 3: RESISTANCE OF PROVOCATION: Tennis Elbow



46

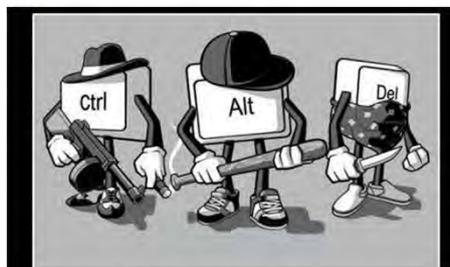


- ▶ Neurosensory Treatment
  - Purpose to reset the tone of the tissue
  - Lighter treatment strokes
  - Slightly faster treatment strokes
  - Large majority of work we do (balance the see saws and normalize the tone of tissue)
  - NOT DESIGNED TO CREATE INFLAMMATION

47



### Neurosensory Treatment



**ADMIT IT**

You always call them when you have a problem...

48

## Fascia is everywhere!!!!

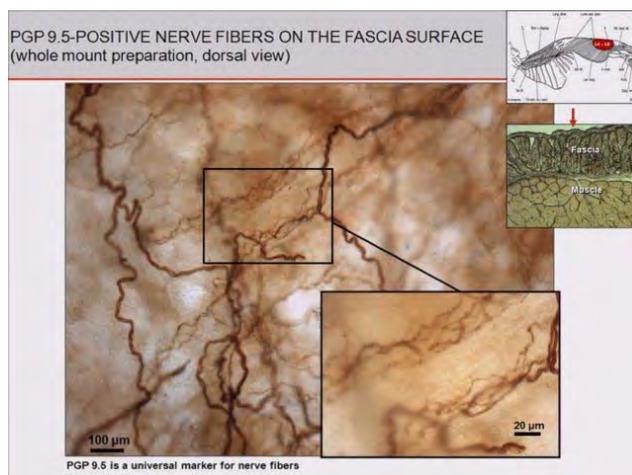


49

## Nerve Fibers in Fascia

Siegfried Mense, MD

- Dense Network of Nerve Fibers
- In close association with vascular tissue

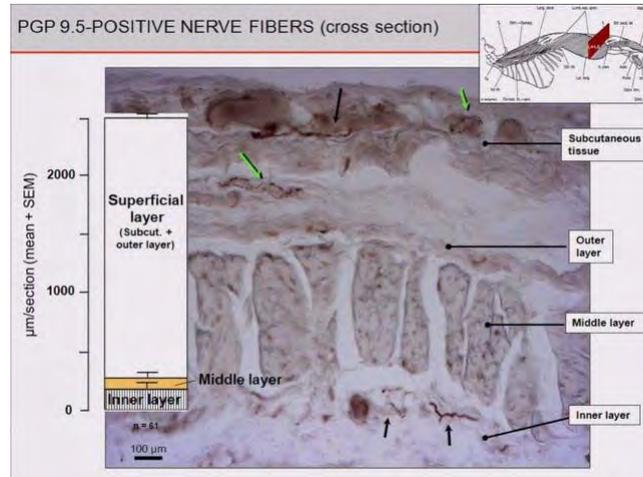


50

## Innervation by layers of TLF

Siegfried Mense, MD

- 90% of all nerve fibers were located in the superficial layer of TLF
- Middle layer composed of dense collagen bundles with few fibers
- Inner layer was likewise few nerve fibers

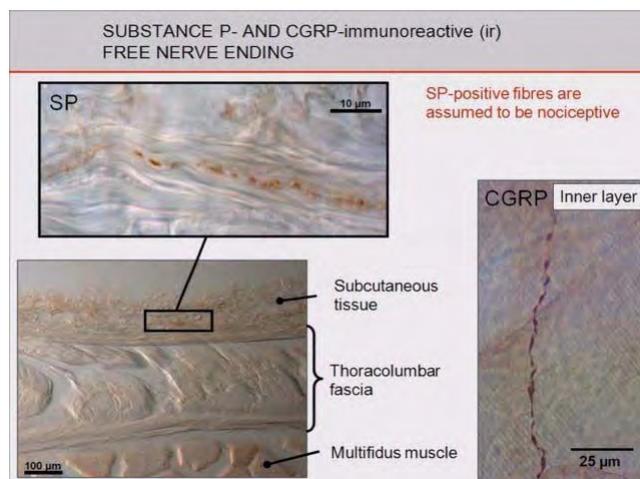


51

## Types of Fibers found in the TLF

Siegfried Mense, MD

- Substance P and CGRP Free nerve endings were discovered in abundance in superficial layers
- No substance P ending in the middle layer

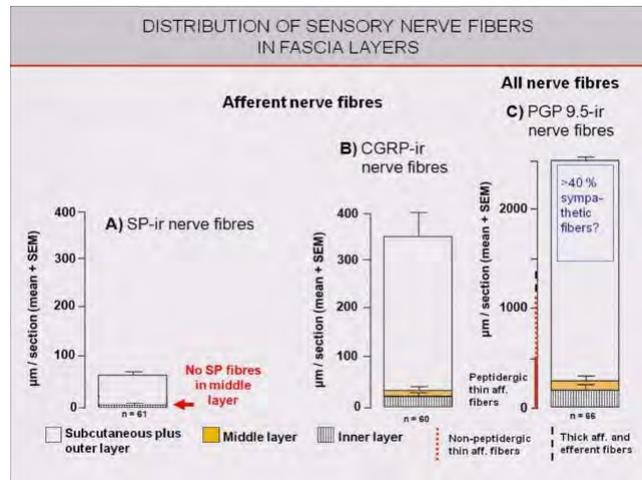


52

## Distribution of Nerve Fibers in TLF

Siegfried Mense, MD

- Greater than 90% in Superficial Layer
- Over 40% of nerve fibers were Sympathetic EFFERENT endings
- Effectively leading to a possible pathway for CNS mediated event leading to vasoconstriction and a change in viscosity of the TLF

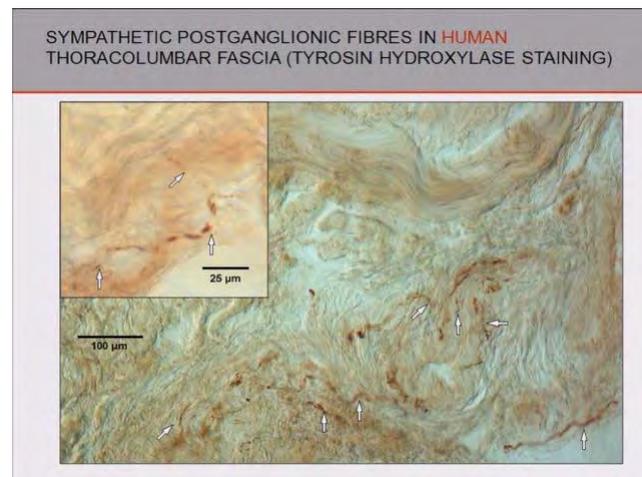


53

## Are Humans Rats?

Siegfried Mense, MD

- On cross sectional analysis of Human TLF the findings of Nerve Endings in Rat TLF was found to be of equal proportions to that of Human TLF
- Rat = Human

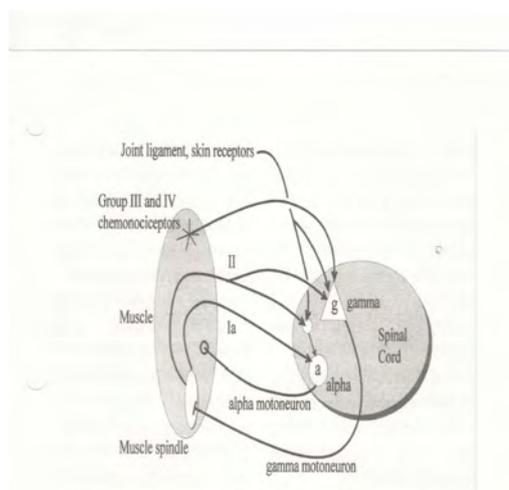


54

## Neurologic Hypothesis

- ▶ Johansson: Gamma/Alpha Loop
- ▶ Schleip: Mechanoreceptor stimulation
  - Vascular
  - Neurologic
  - Endocrine
  - Fascial smooth muscle cells

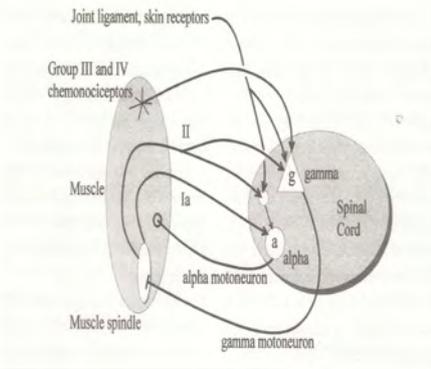
55



**Muscle Spindle Theory**  
(Johansson and Sojka)

- ▶ Johansson et al have proposed it is the gamma motor neurons that chiefly influence the alpha system, through extensive interconnections in the spinal cord.
- ▶ The sensory afferents from the skin, ligaments, muscles and tendons have extensive interconnections on the gamma motor neurons in the cord....not the alpha motor neurons.

56



**Muscle Spindle Theory**  
(Johansson and Sojka)

- ▶ These soft tissues are constantly relaying messages to the gamma motor neurons, which feedback onto the intrafusal fibers of the muscle spindles and therefore set the reaction time of the muscle.
- ▶ We stimulate the skin, fascia and ligaments over a joint and start to introduce normal motion (FAKTR)
- ▶ Creating a barrage of proprioceptive input that alters muscle reaction time and "resets" normal tone in the muscles.
- ▶ End Result of FAKTR may not be the break down of adhesions as much as proprioceptive reflex on the gamma-alpha loop

57

## Fascia; "interstitial myofascial receptors"

Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.

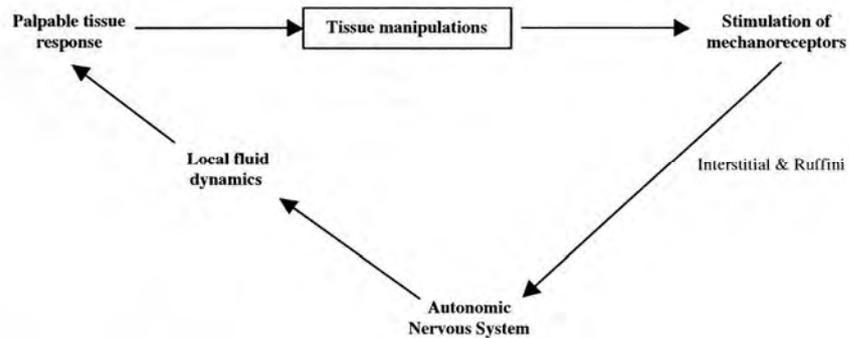
- ▶ A neuro and vascular cascade of events occur from soft tissue manipulation
  - changes in muscle tone via stimulation of the gamma motor system.
  - Ruffini endings lowers sympathetic tone...affecting vasodilation
  - Type III/IV receptors may stimulate extrusion of blood plasma from blood vessels into the interstitial fluid matrix...resulting in a change of extracellular matrix viscosity.

[www.worldofwallpapers.nuche.org](http://www.worldofwallpapers.nuche.org)

58

## Fascia; “intrafascial circulatory loop”

Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.



59

## Fascia; “interstitial myofascial receptors”

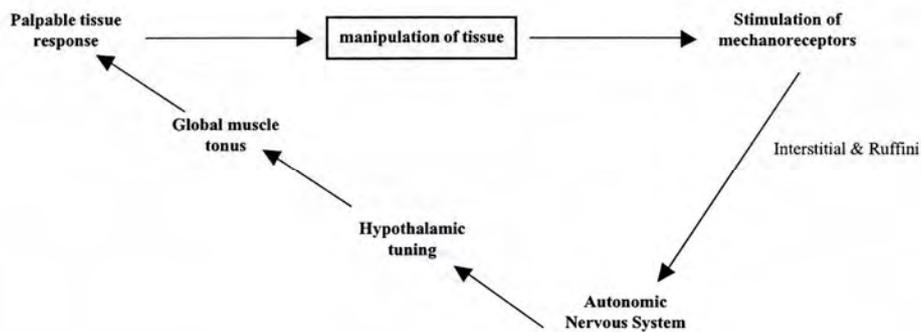
Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.

- ▶ It is thought that the interstitial receptors may affect the hypothalamus resulting in a “deep and healthy” change of the global;
  - neuromuscular system
  - emotional state and
  - cortical and endocrine function
- ▶ The “Hypothalamus Loop”

60

## Fascia; “the hypothalamus loop”

Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.



61

## Fascia; “the ACTIVE adaptive organ”

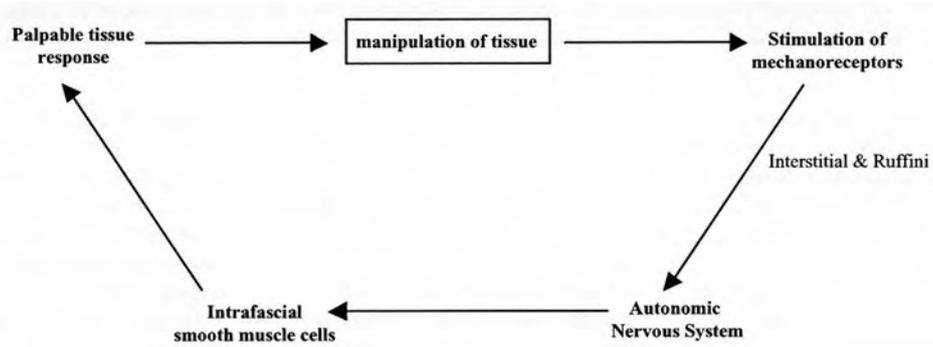
Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.

- ▶ Yahia et al, 1993 & Chaitow & Delany 2000 describe a “ligament contraction”
  - lumbodorsal fascia was discovered to stiffen (increase its resistance) when held on length isometrically...similarly to visceral muscle (Price, 1981)
- ▶ Electron microscopy by Staubesand and Li 1996 found smooth muscle cells in fascia.
  - this work also confirmed findings of an elaborate network of vascular tissue, autonomic and sensory endings

62

# Fascia; “fascial contraction loop”

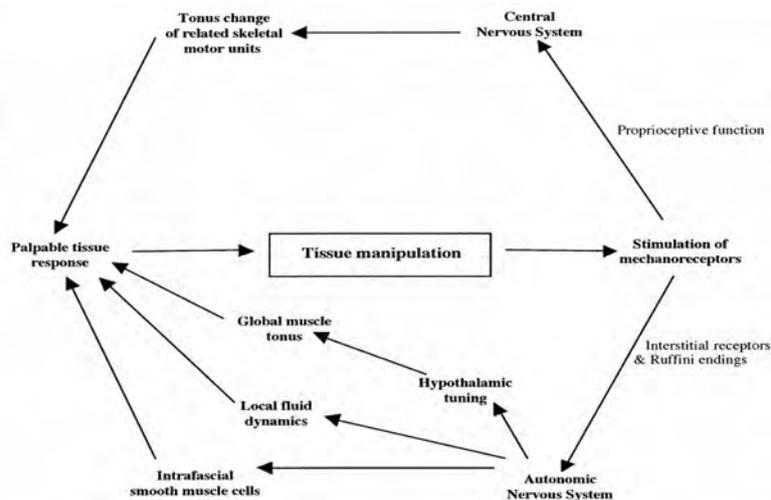
Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.



63

# Fascia; “rationale of short-term plasticity; summary”

Robert Schleip, Journal of Body Work and Movement Therapies. Apr 2003.



64

## STM Conceptual Framework

Mechanical Stimulus = load x frequency

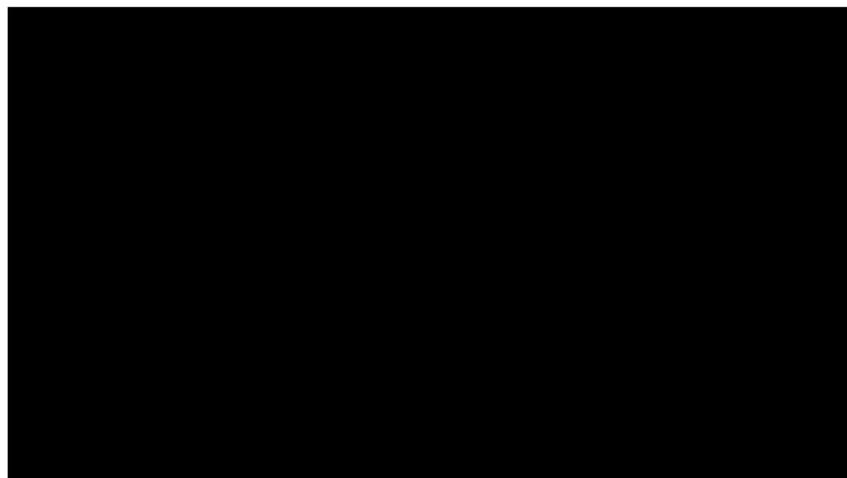
Would facilitate clinical practice guidelines and research

|                             | High Load<br>High Frequency                                       | High Load<br>Low Frequency                                          | Low Load<br>High Frequency                                                | Low Load<br>Low Frequency                    |
|-----------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------|
| STM Approach                | CFM<br><u>IACFM</u><br>Petissage                                  | IC* deep pressure<br>Slow, deep sweeping techniques<br><u>IASTM</u> | Cutaneous brushing or stroking techniques<br>Effeirage<br><u>IASTM</u>    | IC light pressure<br><u>IASTM</u>            |
| Possible Indications        | Tendinosis<br>Chronic muscle holding<br>Chronic scar mobilization | Deep, latent trigger points<br>Chronic fascial tightness            | Tendinitis<br>Scar desensitization<br>Acute edema<br>Active trigger point | Active trigger points<br>Acute, painful scar |
| Desired Treatment Responses | Pro-inflammatory<br>Increased tissue extensibility                | Non-inflammatory<br>Increased tissue extensibility                  | Non-inflammatory<br>Fluid movement<br>Desensitization                     | Non-inflammatory<br>Desensitization          |

\*IC = ischemic compression

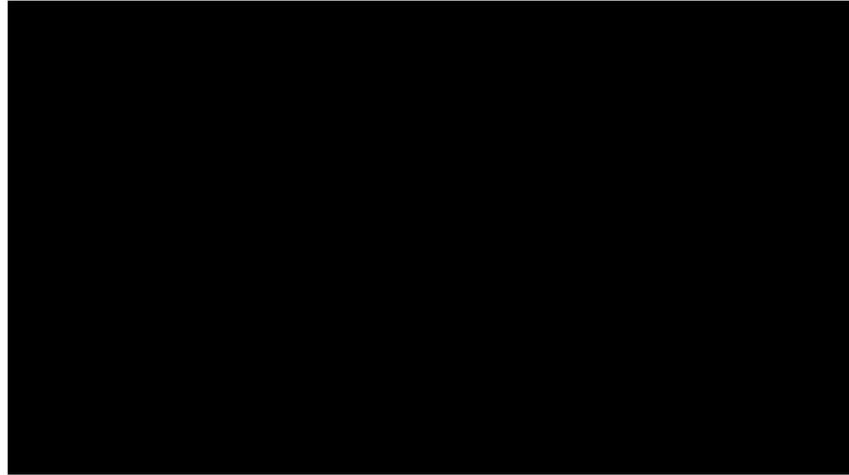
65

## FAKTR CONCEPT 2: MOTION OF PROVOCATION CS



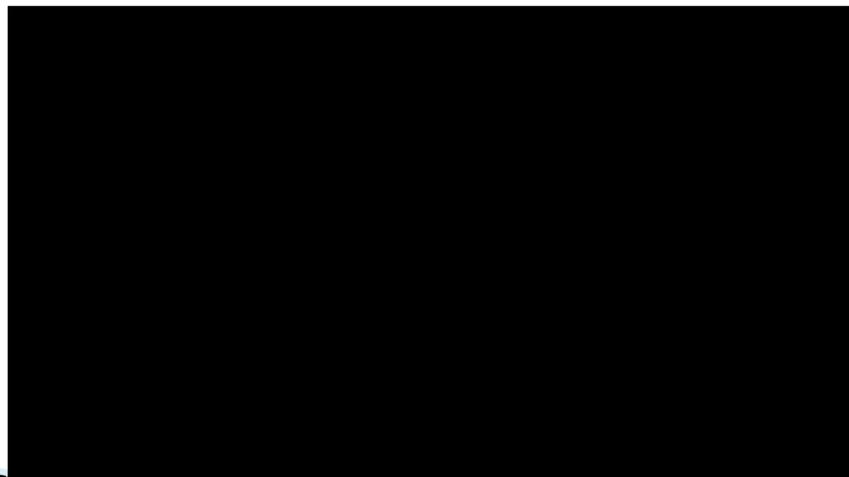
66

**FAKTR CONCEPT 2:  
MOTION OF PROVOCATION: Scapula Dyskinesia**



67

**FAKTR CONCEPT 4:  
FUNCTIONAL ACTIVITY OF PROVOCATION:  
Squat**



68



### ▶ Anti-inflammatory Treatment

- Purpose is to:
  - Improve superficial blood perfusion
  - Improve viscosity of extracellular matrix
  - Reduce edema, bruising, bursitis, hyperesthesias
- Extremely light Treatment Strokes
- Quicker treatment strokes for anti-inflammatory, at times slow when “milking” swelling out of a region
- DESIGNED TO BE ANTI-INFLAMMATION

69

## Edema Reduction Strokes



70

## Acute Ankle Sprain

