Fascia is a connective tissue: All connective tissue is derived from embryological mesoderm layer.

LEVEL 1: DEEP FASCIA AND EPIMYSIAL LAYER

LEVEL 2: DEEP FASCIA AND RETINACULA

LEVEL 3: SUPERFICIAL FASCIA INTERNAL DYSFUNCTION

---

Diagram overview:

- CATEGORIES OF THE PAIN AND MOVEMENT REASONING MODEL
  - LOCAL STIMULATION
  - REGIONAL INFLUENCES
  - CNS MODULATION

---
Convergence
• Somatic-somatic
• Viscero-somatic
(Level 3 FMID)

Kinetic chain
• Hypermobility
• Hypomobility
• Proprioception

Patho-neuro-dynamics
• Weakness
• Parasthesias
• Reflexes
• Neural/connective tissue interface

KINETIC CHAIN

SUGGEST DYSFUNCTION REMOTE TO THE SITE OF PAIN

• Biomechanically-related tissues such as proprioception, hypermobility, and hypomobility
• Assumption is that when elements of the “chain” are not providing normal support or alternatively, flexibility, then movement along the chain can be adversely effected
• Takes into consideration that muscles, joints, and connective tissues are a continual matrix and their movements are inter related

“There is evidence of central nervous system sensitization and of hyperalgesia and temporal summation of pain in a specific area. Another hypothesis would suggest a facilitated processing of pain messages in the central nervous system, perhaps manifested by neural reorganization in the brain, brainstem, and spinal cord.”

The peripheral theory suggests, in contrast, that myofascial pain is due to an alteration of innervations or of nerve stimulation of muscles or of fascia. This theory is based to the hypothesis that the fascia could be considered as a proprioceptive organ, and that it could be altered by trauma, overuse and surgery.

SOME QUESTIONS

- Why do muscles insert onto or originate from fascia?
- Fascia has an intricate structure, so why only described as having a role for containment?
- Can muscles perform more than one movement, and is fiber activation task oriented?
- Could fascia play an active role in motor control?

CLASSIFICATIONS

- Proper connective tissue
- Loose connective tissue
- Dense connective tissue
- Elastic
- Irregular
- Regular
- Collagen fibers all parallel
- Multilayered organization

Ligaments
Tendons
Aponeuroses
Aponeurotic fascia
Epimysial fascia

1. Fascial Layers
2. Histology
3. Innervation
FASCIAL LAYERS (Perimysium and endomysium)

► The retinacula cutis provide an anchorage of skin to underlying tissues and of the superficial fascia to the deep fascia.
► In this way a flexible and yet resistant mechanism of transmission of the mechanical loads from multi-directional forces could be recognized.
► Regional specializations determine the variations in mobility of the skin with respect to underlying tissues.

SUPERFICIAL FASCIA

Classification of the deep fascia
DEEP FASCIA

• NAMED FOR THE SEGMENT IT SURROUNDS; i.e brachia fascia, crural fascia

• LOOKS LIKE A SECOND SKIN BENEATH THE SUPERFICIAL FASCIA

DEEP FASCIA

• IT’S CONTINUOUS WITH LIGAMENTS, RETINACULA, TENDONS AND EPIMYSIS

• IN PART IT IS FREE TO GLIDE OVER MUSCLES, AND IN PART IT IS FIRMLY ANCHORED TO BONE

DEEP FASCIA

• IT’S INNER SURFACE PROVIDES INSERTIONS FOR MUSCLE FIBERS

• pectoralis major fascia in continuity with the brachial fascia
DEEP FASCIA

Histological study of the deep fasciae of the limbs

Carla Stecco, MD, Andrea Porzionato, MD, Luca Lancerotto, MD, Antonio Stecco, MD, Veronica Macchi, MD, Julie Ann Day, PT, Raffaele De Caro, MD

1Section of Anatomy, Department of Human Anatomy and Physiology, University of Padova, Via L. Gubellini 65, 35127 Padova, Italy
2Physical Medicine and Rehabilitation, University of Padova, Padova, Italy
3Centro Socio Sanitario del Codi, Physiotherapy, Abetone Via 74, Padova, Italy

Received 31 March 2008; revised in revised form 4 April 2008; accepted 28 April 2008

• UNDULATED PARALLEL COLLAGEN FIBERS, FEW ELASTIC FIBERS ARRANGED IN LAYERS WITH DIFFERENT ORIENTATION

• LOOSE CONNECTIVE TISSUE BETWEEN THE LAYERS

Both the fasciae are formed by two to three layers of collagen fibre bundles separated by a thin layer of loose connective tissue (LCT) that permits the different layers to slide over one another.
Both the fasciae are formed by two to three layers of collagen fibre bundles separated by a thin layer of loose connective tissue (LCT) that permits the different layers to slide one on the other.

**DEEP FASCIA**

The presence of loose connective tissue interposed between adjacent layers permits local sliding, and so from a mechanical point of view the single layers could be considered independently.
FASCIA IS WELL INNERVATED


<table>
<thead>
<tr>
<th>Layer</th>
<th>Brachial fascia</th>
<th>Scapular fascia</th>
<th>Thoracolumbar fascia</th>
<th>Transversus fascia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free nerve endings</td>
<td>48.57</td>
<td>27.39</td>
<td>44.37</td>
<td>13.98</td>
</tr>
<tr>
<td>Pacini corpuscles</td>
<td>0.43</td>
<td>0.26</td>
<td>0.26</td>
<td>0.66</td>
</tr>
<tr>
<td>Ruffini corpuscles</td>
<td>0.29</td>
<td>0.1</td>
<td>0.26</td>
<td>0.55</td>
</tr>
</tbody>
</table>

Others agree...
Tesarz J et al 2011 Neuroscience
Sensory innervation of thoracolumbar fascia in rats and humans
Corey S M et al 2011 Cell Tissue Organs Sensory innervation of the nonspecialized connective tissue in the back of the rat

What we find in fascia

Myelinated Axon  Nonmyelinated n. axon  Schwann cells
MUSCLE SPINDLES  FREE NERVE ENDINGS
Myofibroblast  Elastic fibers  Collagen and Fibroblasts
RUFINI CORPUSCLES  PACINI CORPUSCLES

THORACOLUMBAR FASCIA

Myofascial muscle compartment

Journal of Anatomy
Epimysium

In series, at the end of each muscle to form the paratenon, and continues into the periosteum.

Aponeurotic Fascia Covers the Extremities

Envelopes muscles and connects them by way of myofascial expansions (insertions) around joints. Inserts into the periosteum, paratenon, neurovascular sheath and fibrous capsules of the joints.

Slides on muscle due to loose connective tissue between the "Aponeurosis" and epimysium.

Transmits forces generated by whole muscle.

Connects to underlying muscle only at myofascial expansions. These occur generally at joints and can merge with epimysium and paramysium.

HUMAN ANATOMY

The anatomical and functional relation between gluteus maximus and fascia lata

Stecco Antonio, MD, Gilliar Wolfgang, DO, Hill Robert, PhD, Brad Fullerton, MD, Stecco Carla, MD

1 Department of Internal Medicine, University of Padova, Padova, Italy
2 Department of Osteopathic Manipulative Medicine, New York College of Osteopathic Medicine, New York Institute of Technology, Old Westbury, NY, USA
3 Department of Physical Medicine, University of Padova, Padova, Italy
4 Department of Osteopathic Medicine, University of Texas, Austin, TX, USA
5 Department of Osteopathic Medicine, University of Texas, Austin, TX, USA

Available online at www.sciencedirect.com
ScienceDirect
THE ANATOMICAL AND FUNCTIONAL RELATION BETWEEN GLUTEUS MAXIMUS AND FASCIA LATA

- The distal insertions of the gluteal muscles are more fascial than osseous
- Suggest that vastus lateralis and biceps femoris work together to stabilize the limb
- The fascia lata forms the intermuscular septum between hamstrings and vasti
- Septum is not just a separating element
- Assists with movement coordination

Pectoral and femoral fasciae: common aspects and regional specializations

A. Barco - V. Mascelli - S. Masiero - A. Peresianti
C. Frigo - C. Sterco - V. Belinas - R. De Caro
**MYOFASCIAL SEQUENCE**

Due to the innervation (and structure) observed, Luigi and Carla Stecco, hypothesized... a proprioceptive role of the deep fascia. "It's structure is ideal for the perception of direction tension."
MECHANICAL BEHAVIOR

- MUST CONSIDER THE SUPERFICIAL AND DEEP RETINACULA CUTIS
- WITH SKIN MOVEMENT, THE SUPERFICIAL ADIPOSE TISSUE MOVES MORE THAN THE DEEP ADIPOSE LAYER
- IF THE RETINACULA ARE SHORT, STRONG AND VERTICAL, ALLOWS FORCE TRANSMITTED TO THE DEEPER PLANES
- IF THE RETINACULA ARE THIN, LONG AND OBLIQUE, THEY HAVE GREATER CAPACITY TO MUTE FORCE TRANSMISSION TO DEEPER PLANES
- IMPORTANT TO PROTECTING VESSELS AND NERVES THAT CROSS THE DEEP FASCIA
- MOST NOTABLY, ASSURES THE RECEPTORS IN THE DEEP FASCIA WILL NOT BE ACTIVATED DURING NORMAL STRETCHING OF THE SKIN

MECHANICAL BEHAVIOR

- IN ADDITION TO MUTING SKIN STRESSES TO SUBQ TISSUES, HELP PREVENT HARMFUL EFFECTS FROM MUSCULAR CONTRACTIONS TO THE SKIN
- NORMALLY WHEN MUSCLE CONTRACT THEY SLIDE EASILY UNDER THE SUBQ TISSUES AND THE SKIN IS NOT INVOLVED
- OCCURS BECAUSE, MUSCLE MOVEMENT ALWAYS STRETCHES SPECIFIC PORTIONS OF THE DEEP FASCIA, AND THEIR ACTION INTO THE SKIN IS MITIGATED BY THE DAT AND THE SUPERFICIAL FASCIA

MECHANICAL BEHAVIOR

- RETINACULA CUTIS MUST BE FUNCTIONING NORMALLY FOR SLIDE GLIDE AND SEPARATION BETWEEN DF AND SF
- ALLOWS FOR SEPARATION OF ROLES
- SUPERFICIAL FASCIA: THERMOREGULATORY, LYMPHATIC FLOW, VENOUS/ARTERIAL PROTECTION, NERVE PATHWAYS TO PERIPHERY
- DEEP FASCIA: PROPRIOCEPTION, PERIPHERAL MOTOR CONTROL
- DEEP ADIPOSE TISSUE (DAT) FEWER NERVES, SERVES AS A WATERSHED BETWEEN THE EXTEROCEPTIVE AND THE PROPRIOCEPTIVE SYSTEMS
- WHERE THE DAT DISSAPPEARS, AND THE DEEP FASCIA AND SUPERFICIAL FASCIA FUSE, THE EXTEROCEPTIVE AND PROPRIOCEPTIVE SYSTEMS UNITE
- REASON FOR HAND AND FOOT DEXTERITY: FACILITATES PERCEPTION OF FORM, VOLUME, AND STRUCTURE GUARANTEEING ADEQUATE MOVEMENT
WHAT HAPPENS WHEN THERE IS NOT NORMAL SLIDE/GLIDE BETWEEN THESE LAYERS?

WHAT HAPPENS WHEN A SCAR FORMS AND JOINS THE SUPERFICIAL FASCIA WITH THE DEEP FASCIA?

- IN THESE SITUATIONS WHERE DENSE AND/OR FIBROUS TISSUE IS "FUSING" TOGETHER SKIN, SF AND DF
- STRETCHING THE DEEP FASCIA COULD AFFECT THE SUPERFICIAL FASCIA AND VICE VERSA.
- IN THESE CASES, EVEN NORMAL MUSCLE CONTRACTION OR SKIN STRETCHING COULD RESULT IN OVERSTIMULATION OF EXTEROCEPTORS AND/OR PROPRIOCEPTORS

SO.....

- Fascia is an intricate structure
- Muscles insert onto and originate from fascia
- Could play an active role in motor control

FASCIAL MANIPULATION ADOPTING REASONING AND ASSESSMENT BASED ON:

DIRECTION OF MOVEMENT

CLASSICAL ANATOMY HAS SOME CONTRADICTIONS WITH REGARDS TO MOVEMENT DIRECTION AND TERMS

- I.E. HIP FLEXION OCCURS IN THE SAME DIRECTION AS KNEE EXTENSION
- PRONATION/SUPINATION ARE SIMILAR TO INVERSION/VERSION

Traditionally we think that our motor cortex refers to muscles with origins and insertions that move bones... but we will see how thinking in terms of movement direction serves us better
PROPRIOEPTION
BUILDING BLOCKS

JOINT REPLACEMENT SURGERY
-CAPSULE REMOVED

JOINT RECEPTORS
-PRIMARILY AT END RANGE, "LIMIT DETECTORS"
-UNABLE TO SIGNAL DIRECTION OF MOVEMENT OR POSITION IN "NORMAL RANGE"
-SLOW RESPONDING

SKIN RECEPTORS
-4 TYPES OF RECEPTORS
-SKIN STRETCH ALONE COMMONLY PRODUCED ILLUSORY MOVEMENTS

• CNS CONCEIVES MOVEMENTS AS FINALIZED GESTURES OR PATTERNS OF MOVEMENTS, STORED AS MULTIPLE REPRESENTATIONS IN THE CEREBRAL CORTEX, AND NOT IN SINGLE MUSCLE ACTIVITY

• THE NERVOUS SYSTEM INTERPRETS AND PROGRAMS MOVEMENTS IN TERMS OF SPATIAL DIRECTIONS AND ANGLES

MOTOR EQUIVALENCE
FINAL GESTURES
Defining new boundaries on the human body

Each segment is controlled by 6 myofascial units (MFU) In 6 directions- 3 spatial planes

THE MYOFASCIAL (MF) UNIT

1. Motor units, innervating fibres in monoarticular and biarticular muscles, to move a body segment in a specific direction
2. the joint that is moved
3. nerve and vascular components
4. the fascia that connects these elements together

MOTOR UNITS INNERVATE MUSCLE FIBRES

A Motor Unit = one alpha-motorneurone and the muscle fibres it innervates.

May innervate 10 to 1000 muscle fibres.

When activated all of its fibres contract.
PARTITIONING HYPOTHESIS

THE MYOFASCIAL (MF) UNIT
Each MFU has a:

- Centre of Coordination (CC)
  where vectors from muscle fibre contraction converge.

- Centre of Perception (CP)
  where movement occurring at the joint is perceived

CENTER OF PERCEPTION (CP)
Each MFU has a CENTER OF PERCEPTION (CP), where movement occurring at the joint is perceived.

- A vectoral center
- Resultant traction onto the joint capsule, tendons and ligaments

A CP can become painful if,

- the unidirectional forces of the MFU are not synchronized
- Mechanoreceptors in the capsule, ligaments and tendons are subjected aberrant forces
CENTERS OF COORDINATION HYPOTHESIS

COULD BE POSSIBLE BECAUSE:

1. Part of the deep fascia is fixed to bone
2. Part of the deep fascia is free to glide

1. The fascia is tensioned by myotendinous insertions onto the fascia, and muscle fibers inserting directly onto fascia

FUNCTION OF THE MYOFASCIAL UNIT

THE CC OF A SEGMENT CORRESPONDS TO THE CENTER OF VECTORS FORMED BY THE CORRECT:

• TRACTIONS FROM MUSCLE FIBERS OF THAT MOTOR UNIT
• TENSION THROUGH THE ENDOMYSIUM AND PERIMYSIUM
• TENSION OF THE LOCAL SEGMENT OF DEEP FASCIA (APONEUROTIC FASCIA OR EPIMYSIAL FASCIA)

“A PHYSIOLOGICAL SLIDING SYSTEM IN THE CC IS NECESSARY TO CREATE A CORRECT FINAL VECTOR”
**CENTER OF FUSION (CF)**

- CC-regulates unidirectional motor units of a single MFU.

- CF-coordinates intermediate motor units, activated during movement between MFUs in different spatial planes.

- Fascia acts as a rheostat/regulator for activation.

---

**DIAGONALS**

CFs coordinate decreasing activity of one MFU and increasing activity of another.

---

**DIAGONALS**

- A diagonal is a series of centers of fusion that coordinate two adjacent sequences during a movement in an intermediate direction.
CF LOCATIONS

CENTERS OF FUSION ARE LOCATED IN:
• THE RETINACULA NEAR JOINTS,
• THE TENDONS, AND
• THE TRUNK, ALONG LINES OF UNION OF SOME MUSCLES

DIFFERENCES BETWEEN CCs and CFs

CENTERS OF COORDINATION
• OVER MUSCLE BELLIES
• ALONG LINES OF SPATIAL PLANES
• RECRUITED BY FORCEFUL UNIDIRECTIONAL MOVEMENTS

CENTERS OF FUSION
• OVER RETINACULA AND PERIARTICULAR STRUCTURES
• INTERMEDIATE POSITIONS
• RECRUITED BY GESTURES OR COMPLEX MOVEMENTS

Hyaluronic Acid

• HA is a large simple carbohydrate polymer of the ECM
• differs from other GAG in ECM as has no protein
• HA acts as a hydrating, space filling polymer
• Located within and between the interface of tissues (i.e deep fascia layers, muscle spindle capsule)
• A LUBRICANT for fascia to glide
• Under conditions of stress, HA becomes depolymerized- PROMOTES INFLAMMATION
• Inflammatory phase of wound repair is abundant in HA
• HA acts as a promoter of early inflammation, which is crucial in the whole skin wound-healing process, W. Y. John Chen and Giovanni Abatangelo, Wound Repair and Regeneration, 1999, 7: 72–80
DIFFERENCES

FIBROSIS-

- fibrotic tissue whenever the dense connective tissue component is altered
- correlates with a macroscopic rearrangement of the composition and conformation of the entire fascia tissue.

DENSIFICATION-

- alteration of the loose connective tissue (adipose cell, GAG, and HA). Can involve one or all three.
- alteration of the quantity or quality of the component of the loose connective tissue may change the viscosity and therefore the function of the lubricant that the loose connective tissue facilitates.

DYSFUNCTION

- VISCOSITY CHANGE
- DECREASED GLIDE
- CHANGE IN VECTOR
- JOINT INCOORDINATION
- COMPENSATION
- SYMPTOMS

SEQUENCES OF MYOFASCIAL UNITS

- “3 dimensional movement and stabilization of each segment is guaranteed by synergy and synchrony between the proximal and the distal, and the agonist and the antagonist MF units”
- “Unidirectional MF units linked by myofascial insertions form the myofascial sequences”
TECHNIQUE

• Elbow, knuckles or fingers adhere to the skin
• Pressure must be sufficient enough to cross loose connective tissue
• DEEP FASCIA AND ITS DERIVATIVES ARE THE TARGET TISSUE
• Treatment is applied away from the site of pain
• Visualize muscle anatomy and bony landmarks to locate deep fascia to be treated.

TREATMENT TIME

<table>
<thead>
<tr>
<th>TECHNIQUE</th>
<th>TREATMENT TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYALURONIC ACID</td>
<td>How much time is required to modify a fascial fibrosis?</td>
</tr>
</tbody>
</table>

HYALURONIC ACID

- 0-15min
  Onset of inflammatory reaction
- 15min-12h
  Increase in inflammatory reaction: Heat, edema, pain
- 12h-24
  Peak of inflammatory reaction
- 24h
  Resolving of inflammatory reaction

The smallest products of the HA catabolic cascade can turn about and suppress the action of larger predecessors, and thereby modifying their effects

Stern R 2006
THANK YOU

For More Information

- www.fascialmanipulation.com
- www.myopainseminars.com
- myofascialphysiocare@gmail.com