Dr. Strachan was an expert in precise localization of force. He knew his anatomy. He taught a Sophomore class on "appendicular technique" and wrote a chapter on extremities in Fryette’s Osteopathic Principles book.

Dr. Strachan knew and used cranial and indirect techniques, but these were not taught formally to students.

The research of Fraser Strachan et. al. defined motion of the sacroiliac joint and pelvis in cadavers.
Objectives:

- How to deal with a pregnant athlete.
- How to perform diagnosis and treatment of the spine in a seated & supine position.
- How to work in a left side-lying position.
- How to deal with hypermobility of the joints.
- When and how to use HVLA in this type of patient.
CHIEF COMPLAINT

- 24 year old pregnant female marathon runner comes to your office complaining of knee discomfort.
HISTORY OF PRESENT ILLNESS

- She is in her second trimester
- Is feeling well and has not had any complications with the pregnancy
- Has had knee pain for the past 2 months
- Localized to lateral aspect of knee
- Jogs 30 miles per week
- Denies locking, catching, or swelling of the knee
PAST MEDICAL HISTORY

- Anterior cruciate ligament tear
- Patellofemoral pain syndrome
PHYSICAL EXAM

- Some general ligamentous laxity
- Positive patellar grind test
- Positive Ober's test
- Somatic dysfunction:
  - Lumbar spine
  - Sacrum
  - Pelvis
  - Lower extremity
DIFFERENTIAL DIAGNOSIS

- Patellofemoral Pain syndrome
- IT band syndrome
- Ligamentous laxity
PATELLOFEMORAL PAIN SYNDROME (PFPS)

- MOST COMMON knee problem encountered by primary care physicians and the most common injury in runners¹
- More than 2/3 of patients successfully treated through rehabilitation protocols¹
- Pain at the patellofemoral joint, often originating from supporting structures
  - Pain is aggravated by prolonged SITTING with flexed knees and climbing STAIRS
- *Distinct from chondromalacia*
- Abundant etiologies:
  - Quadriceps weakness; VMO is the single most important risk factor
  - Abnormal patellar tracking
  - Hypertonic quadriceps, gastrocnemius, psoas, or iliotibial band
  - Overuse of joint and supporting soft tissue
  - Gluteal muscle weakness, causing decreased hip Abductio, ER, and extension ²
  - Post surgical sequelae
  - Trauma
ILIOTIBIAL BAND SYNDROME

DUAL FUNCTION OF THE ILIOTIBIAL BAND AS KNEE FLEXOR AND EXTENSOR

(Straus, 2011)
ILIOTIBIAL BAND SYNDROME

- Most common cause of LATERAL knee symptoms in runners, incidence ranging from 1.6% – 12% (Strauss, 2011)
- Possible etiologies
  - Friction of ITB against lateral femoral epicondyle during repetitive flexion and extension
  - Compression of the fat and connective tissue deep to the ITB
  - Chronic inflammation of the ITB bursa
- Risk factors
  - Increased hip adduction and weak hip abductors
  - Increased knee internal rotation
  - Foot pronation
- History will show worsening symptoms when running outside, downhill, or with long strides

Originates at the greater trochanter as a coalescence of the tensor fascia latae and the gluteus muscles. Inserts on the anterolateral aspect of the proximal tibia at Gerdy's tubercle.
LIGAMENTOUS LAXITY AND PREGNANCY

- Increased ligamentous laxity during pregnancy
- Changes during pregnancy:
  ◦ Increased estrogen and relaxin
  ◦ 20% weight gain in healthy females
  ◦ Increase in femoral torsion and a wider pelvis, causing increased lateral motion of the patella during knee F/E
- End result:
  ◦ Additional weight may increase the force on a joint by as much as 100%
  ◦ Increased discomfort in joints that have had previous injury or instability
  ◦ Lower threshold for new injuries or increase the risk of injuries in individuals who already have ligamentous laxity
LIGAMENTOUS LAXITY OF THE KNEE

- Increased knee abduction, pivot, and anterior posterior translation
- Increased knee laxity may contribute to increased risk of ACL tear\(^1\)
  - Women suffer injury 4–6 times more often than men
- ANTERIOR knee pain is seen in up to 27% of patients who have chronic ACL deficiency, and in 48% of patients who have chronic PCL deficiency\(^2\)
- One study did not detect differences in rotational laxity or proprioception when comparing knee with reconstructed ACL and healthy knee 2 years after partial ACL reconstruction\(^3\)
DIAGNOSTIC SEQUENCE

- Gait
- Pelvic side shift
- Lumbar spine
- Ilium
- Hamstring
- Lower extremity
- Foot
- Muscular firing patterns of lower extremity
DIAGNOSTIC SEQUENCE

- **Gait**
  - Stability
  - Internal rotation of tibia
  - Over-pronation of foot
  - Unilateral flexion contracture at hip

- **Pelvic side shift**
  - Positive on ipsilateral side of long leg
  - Positive on contralateral side of hypertonic psoas
Pelvic Sideshift
Lumbar Spine

Diagnosis

Treatment
The Physiologic Cornerstone of Somatic Dysfunction.

Chicago has always been focused on single segment dysfunction, causing widespread effects.

Facilitation is the maintenance of a pool of neurons in a state of partial or sub-threshold excitation, a state of hyper-excitability.

Involves the general somatic nerves as well as the autonomies.

Causes:
- Sustained nociceptive input
- Aberrant patterns of afferent input
- Changes within the affected neurons themselves or their environment

They are manifestations of the same segmental general visceral afferent neurons but involve ascending spinal pathways.

The patient is conscious of referred pain. The patient need not be conscious of a viscerosomatic reflex.
Evaluate innominates
  - Anterior innominate
  - Posterior innominate
Evaluate Hip Abduction/Abduction
Consider muscular attachments
  - Tensor fascia lata
  - Vastus Medialis Obliquus
  - Glutues muscles
  - Semitendinosus, semimembranosis and biceps femoris
Ilium: Indirect / Combined

Diagnosis

Treatment
Popliteal Spread MFR
Kappler’s Hamstring Release

Diagnosis

Treatment
Fulford Articulation
Fibula / Interosseous Membrane

Diagnosis

Treatment
Loading the hamstring and calf allows the quadriceps and anterior knee to soften.
Foot: Navicular HVLA

Diagnosis

Treatment
MFR of the foot, combined
CS for P. Fascia and Arch

- Make a new fulcrum with your right thumb.
- Moderate plantar flexion of ankle, foot and toes.
Muscle Firing Patterns: Janda

1. Gluteus medius
2. Tensor fascia lata
3. Quadratus lumborum

Pathologic Firing Orders:
- 2, 1, 3 or 3, 2, 1
Hip abduction gives information about the lateral muscular corset and stabilization of the pelvis during walking. The relation between gluteus medius, tensor fascia lata and quadrates lumborum is essential.
REHABILITATION

- Ability of VMO to fire
  - Standing & seated VMO
- Stretch Tight Muscle groups
  - Standing Psoas, hamstrings, piriformis
  - Standing or side lying ITB
- Strengthen Weak, Inhibited Muscles
  - Abs and gluts (especially after delivery)
REHABILITATION

VMO strengthening exercises

- **Static Inner Quadriceps Contraction**
  - Tighten your quadriceps by pushing your knee down into a towel
  - Put your fingers on your inner quadriceps (VMO) to feel the muscle tighten during contraction. Hold for 15–30 seconds and return to neutral. Repeat 5–10 times on each side.

- **Resistance Band Knee Extension in Sitting**
  - Begin this exercise in sitting with your knee bent and a resistance band tied around your ankle as shown.
  - Keeping your back straight, slowly straighten your knee, tightening your quadriceps. Then slowly return back to the starting position. Perform 3 sets of 10 repetitions provided the exercise is pain free.
Psoas Stretch
- Tilt pelvis into a neutral position by tensing the abdominal and gluteal muscles. Hold this position.
- Shift the weight of your body forward onto the leg and foot in front of you until a stretch is achieved.
- Maintain position for 30–60 seconds. Repeat 2–3 times on each side.
Standing

- Maintain a neutral spine
- You may cross your legs
- Reach overhead and lean
- Let hip shift to the side
- Slowly apply stretch for 10–15 seconds
- Repeat 2–3 times on each side, 2–3 times per day
REHABILITATION

Piriformis stretch

- Perform a ½ squat with your butt contacting a wall
- Place the ankle of the involved leg on top of the opposite knee.
- Press down with your arms
Abdominal muscle strengthening:
- Reverse torso curls
- Start with a 90 degree bend at the hips and knees
- Perform a posterior pelvic tilt
- Move your hips inward
- Hold 3–5 seconds
- Returnn
Gluteus medius retraining
  - Leg lift sideways in the standing position to no greater than 30 degrees
  - Contraction are held from 5–7 seconds
Pregnant women with and without previously sedentary lifestyles should be encouraged to exercise!

- Decreases rate of gestational diabetes by at least 30%
- Decreases weight gain in overweight pregnant women
- Duration of labor is inversely related to aerobic fitness in nulliparous women who began labor spontaneously¹
- No adverse effect on newborn’s body size and general health²

Contraindications include: hypertensive disorders of pregnancy, placenta previa after 28th week, previous spontaneous abortion, anemia, malnutrition, etc.

(Davies, 2003)

<table>
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<th>Heart Rate Target Zone (beats/10 sec)</th>
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<tr>
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<td>125–140</td>
<td>20–22</td>
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RETURN TO RUNNING
CASE 1 REFERENCES


Case #2

Objectives

◦ How to work on a large patient with very thick muscles.
◦ How to not hurt your own back.
◦ How to use the table to your advantage.
Case #2

- 17 year old male high school weightlifter complains of right shoulder pain after performing weighted dips.
Case #2

- The pain is located over the Acromioclavicular joint and anterior shoulder.
- Worse with overhead reaching & reaching across his body.
- Denies neck pain or paresthesia’s into his arm.

On physical examination
  - He is tender in both pectorals, over the right sternoclavicular joint, the right acromioclavicular joint, and over the long head of the biceps.
  - He has positive impingement signs
  - No ligamentous laxity
  - Neurological examination is normal.
Anatomy of Anterior Shoulder

Ligaments of AC Joint

- Acromioclavicular Lig.
  - Horizontal Stability

- Coracoclavicular Ligs
  - Conoid
  - Resists superior disp.

- Trapezoid
  - Resists AC compression
Acromioclavicular Separation

Separated shoulders often occur in people who participate in sports such as football, soccer, ice hockey, horseback riding, and wrestling.

- The separation is classified into 6 types, with 1 through 3 increasing in severity, and 4 through 6 being the most severe.
- The most common mechanism of injury is a fall on the tip of the shoulder or also a fall on an outstretched hand (FOOSH). In falls where the force is transmitted indirectly, often only the acromioclavicular ligament is affected, and the coracoclavicular ligaments remain unharmed.
- In ice hockey, the separation is sometimes due to a lateral force, as when one gets forcefully checked into the side of the rink.
Acromioclavicular Separation vs. Somatic Dysfunction

- Separation usually involves traumatic event causing disruption of the ligaments
Sterno-clavicular: Superior Somatic Dysfunction

Sternal end of clavicle

**Superior**
- Shoulder is restricted in abduction. The shoulder is also restricted in extension and internal rotation.
- When the shoulder is shrugged the sternal end of the clavicle should move inferior.
Acromioclavicular Joint: Diagnosis

Acromioclavicular somatic dysfunction

- Is there a restriction of Glenohumeral flexion or extension?
- Is the acromioclavicular joint tender to palpation?
- Is a shoulder separation present?
- Did they ever fracture their clavicle?
- What is the scapular position and motion?

Consistent terminology for clavicular dysfunction does not exist.
In Chicago, these dysfunctions are thought to occur about a long axis down the clavicle. These dysfunctions are torsional in nature with the flat (superior) surface of the clavicle oriented more anteriorly than the adjoining flat surface of the acromion.
Acromioclavicular Somatic Dysfunction

Anterior Rotation Dysfunction: Diagnosis

- The superior flat surface of the lateral one-third of the clavicle faces more anteriorly in relation to the acromion and as compared to the opposite clavicle.
- The superior surface of the right clavicle has rotated anteriorly about a long axis down the clavicle (anterior acromioclavicular joint dysfunction). This can manifest as acromioclavicular pain.
- The supraclavicular space appears and feels wider from above downward and the cervical fascia covering the space is more tense.
- Restriction of humeral flexion is associated with anterior clavicle dysfunction
**Anterior Rotation Dysfunction: Treatment**

**Procedure:**

- Use the patient’s right humerus as a lever to rotate the acromion.
- Grasp the right elbow and flex the humerus anteriorly, thus rotating the clavicle posteriorly.
- Fix the clavicle in place with the physician’s left hand overlying the AC joint.
- While maintaining stabilizing pressure on the clavicle, abduct the patient’s right arm and apply a quick arc-like motion by extending and abducting the humerus.
- This motion will move the acromion to meet the clavicle and regain a proper relationship.
- Reassess acromioclavicular joint tenderness and motion.

**Treatment: HVLA**
Acromioclavicular Somatic Dysfunction

Posterior Rotation Dysfunction: Diagnosis

- The superior surface of the right clavicle has rotated posteriorly about a long axis down the clavicle (posterior acromioclavicular joint dysfunction). This can manifest as acromioclavicular pain.
- The superior surface of the later one-third of the clavicle faces more posteriorly.
- The supraclavicular space and fascial tension are decreased, and the medial portion of the clavicle is farther from the first rib. This latter is again variable.
- Restriction of humeral extension is associated with posterior clavicle dysfunction.
Posterior Rotation Dysfunction: Treatment

**Procedure:**

1. Use the patient’s right humerus as a lever to rotate the acromion.

2. Grasp the right elbow and extend the humerus posteriorly, thus rotating the clavicle anteriorly.

3. Fix the clavicle in place with the physician’s left hand overlying the AC joint.

4. While maintaining stabilizing pressure on the clavicle, abduct the patient’s right arm and apply a quick arc like motion by flexing and abducting the humerus.

5. This motion will move the acromion to meet the clavicle and regain a proper relationship.

6. Reassess acromioclavicular joint tenderness and motion.

**Treatment: HVLA**
Anatomy
Sternoclavicular Joint
A freely moveable synovial joint links the upper extremity to the torso, with the sternoclavicular (SC) joint participating in all movements of the upper extremity.

A significant direct or indirect force to the shoulder region can cause a traumatic dislocation of the SCJ.

- **Anterior dislocations** of the SCJ are much more common (by a 9:1 ratio), usually resulting from an indirect mechanism such as a blow to the anterior shoulder that rotates the shoulder backward and transmits the stress to the joint.
  - Ligamentous laxity, more common in young girls, is associated with recurrent atraumatic anterior dislocations of the sternoclavicular joint.
- **Posterior dislocations** have an estimated 25% complication rate.
  - Complications have included pneumothorax, laceration of the superior vena cava, occlusion of the subclavian artery or vein, and disruption of the trachea.

Patients typically present with their head tilted toward the affected side, and hold the affected arm across the trunk with the uninjured arm.
A specialized view, known as the serendipity view, described by Rockwood (1975), may reveal the medial clavicle position. For this technique, the beam is tilted to 40° from vertical and directed cephalad through the manubrium of the patient while in a supine position.
Sternoclavicular Sprain/Dislocation vs. Somatic Dysfunction

- Sternoclavicular Joint injuries are generally graded by three types
  - 1st degree injury – simple sprain. Incomplete tear or stretching of capsule and ligaments
  - 2nd degree – anterior or posterior subluxation from manubrial attachment with complete tear of sternoclavicular ligament
  - 3rd degree – complete rupture of sternoclavicular and costoclavicular ligaments. Complete dislocation.

- **Posterior dislocations** are a result of a direct posterior force to clavicle. (less common)
- **Anterior dislocations** result from an compressive force on the shoulder, pushing clavicle medial and anterior.
Diagnosis: Sterno-clavicular Joint

- With the patient supine, place your index fingers over the superior side of the medial portion of the clavicle.
- Ask your patient to shrug their shoulders.
- A positive finding is failure of one clavicle to move inferior as compared to the other side as the shoulders are shrugged.

Principles of Osteopathic Technique

- Treatment of an upward displacement of the sternal end of the clavicle.
- “The joint is commonly restricted also in attempted separation of the joint surfaces by traction in the long axis of the clavicle. This indicates an element of impaction as a part of the lesion.”

E. Fraser Strachan, D.O.
Alternative Position

- Patient supine
- Traction on the right arm, elevates distal clavicle.
- Inferior directed HVLA force on superior sterno-clavicular joint.
Sterno-clavicular: Anterior Somatic Dysfunction

Dysfunction

- Sternal end of clavicle

Anterior
- Shoulder is restricted in horizontal flexion
- Sternal end of the clavicle should move posteriorly when the supine patient reaches for the ceiling

Diagnosis
HVLA Technique for Anterior Displacement of sternal end of clavicle

Downward and lateral traction on the shoulder with your right hand

Downward /posterior pressure to medial 1/3 of clavicle through your left hand

William J. Walton, DO, FAAO
Treatment of an anterior displacement of the sternal end of the clavicle

Requires some dis–impaction (traction) of the joint.

E. Fraser Strachan, DO
Osteolysis of the distal clavicle

- **Arthritis** can occur as an isolated event in the AC joint: stiffness, aching, & swelling.
- **Distal clavicle osteolysis** (DCO) gives a similar picture, usually in young weightlifters (“weightlifter’s shoulder”).
- Arthroscopic surgery involves resection or removal of the end of the clavicle— a Mumford procedure.
  - If the joint becomes painful because of DCO or arthritis, or the separation is only minor, this technique can be very satisfactory.
- When the joint is severely displaced, then a more complex procedure is needed to restore the position of the clavicle— usually a Weaver-Dunn procedure.
  - The end of the clavicle is removed and ligament is transferred from the underside of the acromion into the cut end of the clavicle to replace the ligaments torn during the dislocation.

Cystic degenerative changes
Case #2 Sequence

1. Mid thoracic
2. T1,2,3
3. Thoracic inlet
4. Sternoclavicular joint
5. Neck
6. 1st rib
7. Acromioclavicular joint
8. Infraspinatus
9. Pec minor
10. Biceps
Mid-Thoracic Segmental dysfunction (T4,5,6,)

Diagnosis

Treatment
Upper Thoracic Segmental dysfunction (T1,2,3)

Diagnosis

Treatment
Cervical Spine (C2–7)

Diagnosis

Treatment
Thoracic Inlet: MFR

Diagnosis

Treatment
Pectoral Traction
SC Joint

Diagnosis

- Anterior Rotation Dysfunction: MET
- Superior Glide Dysfunction: MET
- Posterior Rotation Dysfunction: MET
- Anterior Dysfunction: MET

Treatment
AC Joint

Diagnosis

Treatment
Elevated First Rib: HVLA

Diagnosis

Treatment
Scapulothoracic Articulation
Pectoralis Minor; CS

Diagnosis

Treatment
Long Head of the Biceps: CS
Infraspinatus: CS

Diagnosis

Treatment
Pronator Teres and Elbow

- Pronator tension is related to upper thoracic segmental & rib dysfunction.
- Pronate flex wrist and elbow.
Firing Patterns: Shoulder Abduction

1. Supraspinatus
2. Deltoid
3. Infraspinatus
4. Mid- & lower trapezius
5. Contralateral quadratus lumborum
6. Common variation:
   - Levator scapulae
   - Upper trapezius
   - Early firing of quadratus lumborum
Rehabilitation

- Stretching
  - Pectoral Muscles
  - Latissimus Dorsi

- Strengthening
  - Lower Trapezius
  - Rhomboids

- “Cadillacs in front….Volkswagons in back”
  - Better get the Volkswagons ready to race!
Surgery for residual PAIN or unacceptable DEFORMITY in the joint after months of conservative treatment.

Orthopedists diagnose with the Rockwood classification system — a numerical scale from Type I–VI based on exam and x-ray.

Among competitive or elite athletes treatment is also guided by whether the problem arises pre–, during, or post–season.

Types I and II are treated non–operatively, with REST followed by PT for flexibility, ROM, strength. Types III + are complete separations. Type III treatment is somewhat controversial.

Surgical treatment of shoulder separation has a high success rate. Long–term results of arthroscopic procedures show comparable results to traditional open surgery.

INTERESTINGLY… patients with less severe forms of AC separation (Types I and II) may be at greater risk for developing the long–term complication of AC arthritis.

This is due to the disruption of the joint surfaces that occurs with the injury that may result in erosion of the articular cartilage and subsequent “wear and tear” arthritis.

In untreated type 3–6 separations, other long–term complications may ensue, but because there is no contact of the joint surfaces, the risk of developing separation–related arthritis is absent.
Distal Clavicle Osteolysis **Etiology**
- Repetitive overhead activity/ throwing can lead to microtrauma to the AC joint and osteolysis of the distal clavicle.
- Most often occurs in weightlifters & football players. Also occurs in hockey & lacrosse players. More often in men.

**Clavicle Anatomy**
- Diarthrodial joint which contains meniscus
- Multiple anatomic variations

**Diagnosis**
- **Cross-body adduction test**: arm is maximally adducted with the arm in 90 of forward elevation. Pain localized to the AC joint indicates AC joint pathology.
- AC joint best viewed with [Zanca view](#), [AP](#), [scapular lateral](#) & [axillary](#) XRAY views show spurring, sclerosis & narrowing of AC joint. Weighted views indicated if instability is a concern.

**Treatment**
- Non-operative treatment: NSAIDS, physical therapy, activity modifications, ACJ injections
- AC joint local anesthetic and corticosteroid injection often indicated to confirm diagnosis. Relief of symptoms after injection confirms AC joint pathology as the cause of symptoms.
- Sx indicated for failure of 6 months conservative treatment. (Charron KM, AJSM 2007;35:53).
Osteolysis of the clavicle: Summary

Distal Clavicle Osteolysis **Associated Injuries & Differential Diagnosis**
- SLAP Lesion:
- Posterior Capsular Contracture:
- RTC Tear:
- Anterior Shoulder Instability:
- Acromioclavicular Arthritis:
- Subacromial impingement

Distal Clavicle Osteolysis **Complications**
- Instability (excessive resection)
- Continued symptoms (inadequate resection)
- Ectopic calcification

Distal Clavicle Osteolysis **Follow-up Care**
- Post-op: sling as needed with pendulum ROM exercises.
- **1 week**: Start PT focused on ROM and strengthening. AAROM, PROM. AROM, free weights start to 3 weeks. Avoid cross-body adduction for 6 weeks.
- **6 weeks**: progressive sport specific activity.
- **3 months**: Return to sport / full activities.
- Outcomes: average 18.7 month followup 100% return to sport (average 3.2 days) and to their preoperative weight training program (average, 9.1 days). (Auge WK, AJSM 1998;26:189).
CASE 2 REFERENCES

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