COILS

Clinical Osteopathically Integrated Learning Scenarios

Patient with
Carpal Tunnel Syndrome

Prepared by: AACOM's Educational Council on Osteopathic Principles

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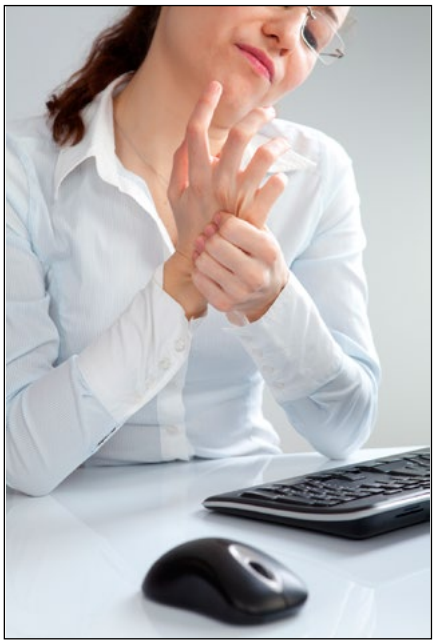
Part 2: Chapter 1

Musculoskeletal Clinical Osteopathically Integrated Learning Scenario:

Patient With Carpal Tunnel Syndrome



Description

This Clinical Osteopathically Integrated Learning Scenario (COILS) focuses primarily on the palpatory evaluation and supportive osteopathic manipulative treatment for carpal tunnel syndrome (CTS).

The COILS is divided into two sections:

Section One

The **Roundtable Discussion Workshop** includes a discussion and evaluation of the patient's case history, diagnosis, pathophysiology, osteopathic principles involved, functional anatomy, treatment options, contraindications, and (if time permits) a demonstration of manipulative treatment techniques applicable to the patient's homeostatic needs.

Section Two

The **Patient-Based Application Workshop** is the supervised application of manipulative treatment techniques for a patient with this diagnosis. The workshop is designed to evaluate the student's or physician's diagnostic and psychomotor skills when providing an osteopathic manipulative treatment for an actual (or simulated) patient.

If time permits, the instructor may deliver the entire two-section program at one time. Ideally, however, Section One should be taught several days before Section Two to allow time for the student or physician to review and practice appropriate techniques. If an actual patient is not available for Section Two, a simulated patient may be used.

Section One: Roundtable Discussion Workshop

I. Description

This section is a roundtable-type presentation and discussion on the osteopathic approach to the treatment of a patient who has CTS.

II. Cognitive Components

A. Case Presentation

A 34-year-old administrative assistant, G2P1, in her 32nd week of pregnancy, complains of pain and paresthesia in her right thumb, index finger, and middle finger beginning one month ago. She has experienced an ache in her forearm. The pain is intermittent and worse at night. She also has woken up with numbness in her hands. Shaking or rubbing the hands lessens the symptoms. During the day, she experiences similar symptoms while driving the car. She also describes some weakness in opening jars and grasping objects.

The patient suffers from seasonal allergies, gastroesophageal reflux disease (GERD) and is allergic to penicillin, which results in hives. She take Tums® as needed for GERD symptoms, prenatal vitamins and Tylenol as needed for pain. The patient had an Appendectomy in her mid-20's, with no complications.

The patient does not smoke, drink alcohol or use illicit drugs. Nor, does she exercise. She is a secretary at a contracting firm. She lives with her husband and one child. The patient has no significant family history.

Physical Examination

Vital signs:	Heart Rate, 93; Respiratory Rate, 18; Blood Pressure 130/85,;Height:,5',4"; Weight,140 lbs
General:	Denies fevers, chills, night sweats
Head:	Normocephalic, atramautic
Ears:	Tympanic membrane are clear with good cone of light; no erythema
Eyes:	PERLA; conjunctiva with injection; retinal exam without hemorrhage or exudate
Nose:	Denies congestion, rhinorrhea; Nares patent without erythema or edema
Throat:	No thyromegaly; no lymphadenopathy
Cardiac:	No murmur; no S3 or S4 gallop
Lungs:	CTA with no abnormal lung sounds

Abdominal:	Gravid uterus palpated just below the xiphoid; bowel sounds in all quadrants; non-tender; no other abnormal masses palpated
Extremities:	+1/4 edema in the lower extremities at the ankles bilateral; pulses +2/5 bilaterally
Lungs:	CTA with no abnormal lung sounds
Neuro:	UE DTR's +2/4 equal and symmetric at biceps, triceps and brachioradialis, UE strength intact and +5/5 to direct testing at all myotomes with mild weakness of right thumb abduction. Sensation is intact to light touch in all UE dermatomes except loss of sensation of the thumb, index and medial aspect of the middle finger of the right hand. Negative Spurlings maneuver. Positive Tinel's and Phalen's tests which reproduce symptoms.
Musculoskeletal:	Finkelstein's test is negative, no noted carpal, metacarpal or phalangeal joint swelling, crepitus or decreased in range of wrist AROM and PROM in flexion, ulnar or radial deviation with mild decrease in extension and normal pronation and supination. Mild tenderness at the pronator teres and flexor digitorum**.**
Genitourinary :	Deferred
Rectal:	Deferred

Osteopathic Structural Examination

- Slumped posture, with shoulders protracted and forward carriage of the head
- Increased lumbar lordosis with anterior pelvic tilt, bilateral pes planus
- Bilateral hemidiaphragm flattening
- T2 is ERSr, and T3 is ERSl
- Right pectoralis minor muscle tender and hypertonic
- Right first and second ribs elevated
- C3 ERSr, C/T junction rotated right
- Right scalene muscles ropy and tender
- Right posterior radial head with a right wrist flexion dysfunction
- Right pronator teres tender point
- Right transverse carpal ligament restriction

Diagnostics

- Nerve conduction: Prolonged distal latency of the median motor and sensory nerve

Diagnosis

1. Carpal Tunnel Syndrome
2. Pregnancy
3. Somatic Dysfunction
    a. Neck
    b. Thorax
    c. Ribs
    d. Upper Extremity

Other differentials that should be considered include:

1. Metabolic disorders such as thyroid disease or diabetes
2. Cervical radiculitis of C6 or C7
3. Trigger points including wrist flexors, pronatory teres and scalenes
4. Connective Tissue Disorder
5. Inflammatory disorders such as RA

B. Pathophysiology

1. Pathophysiology of carpal tunnel syndrome has been illustrated to be caused by anatomic compression or inflammation. Increased pressure on the median nerve may directly injure the nerve, impair axonal transport, or compress vessels in the perineurium to cause median nerve ischemia.[1] Pathologic specimens has demonstrated edema and thickening of the vessel walls in the endoneurium and perineurium, fibrosis, myelin thinning and nerve fiber degeneration and regeneration.[3]
2. Compression of the carpal tunnel may be caused by congenitally small anatomic space, mass lesion, edema or inflammatory conditions from systemic illness such as diabetes or thyroid disease.[1] Hormonal changes in pregnancy may also cause retention of fluid leading to congestion in the carpal tunnel. Additionally, somatic dysfunction in the neck, thorax, ribs, upper extremity and diaphragm may lead to cause or further exacerbate CTS symptoms.
3. Right-sided upper thoracic and rib dysfunction with consequent increased upper-extremity sympathetic tone produces arm and hand symptoms. Some arm symptoms are nerve related, while others may relate to lymphatic dysfunction, located in the same distribution as the median nerve.
4. Increased sympathetic influences to the lymphatics causes a reduction in the size of lymphatic channels, producing tissue congestion and a “hard” tissue edema.
5. Repetitive motion with wrist flexion and poor postural mechanics will predispose a patient to developing CTS. The carpal tunnel has lowest pressures when the wrist is neutral or slightly flexed and pressures increase with deviation from this position.[1]
6. Fascial, and muscular tension in the neck, thorax and UE including the forearm, pronator teres, flexor digitorum superficialis and profundus, which may cause compression on the nerve itself.

C. Functional Anatomy

Includes knowledge of structure and physiology necessary to properly carry out the osteopathic manipulative treatment support.

1. The median nerve comes from the brachial plexus and has contributions from C6, C7, C8 and T1 nerve roots. The median nerve supplies sensory information of the volar surface of the first three fingers and the lateral half of the forth finger of the hand.[3] It supplies motor information that assists in wrist and finger flexion. It also supplies the first and second lumbricals, opponens pollicis, abductor pollicis brevis and flexor pollicis brevis.[3] There are several areas where anatomic compression and somatic dysfunction may be involved with CTS pathology.
2. Nerve compression is commonly seen in patients with poor posture and protracted shoulders.

   The 6 areas for potential nerve compression are:
   a. At the Cervical foramina as the nerve roots exit
   b. Between the anterior and middle scalene
   c. Under the clavicle in the costoclavicular space
   d. Under the pectoralis minor muscle and coracoid process
   e. At the pronator teres muscle in the forearm
   f. Under the transverse carpal ligament in the wrist
3. Compression at two or more of the above listed areas may contribute to a “double-crush” phenomenon.
4. The transverse carpal ligament attaches to the hamate, pisiform on the ulnar side, to the trapezium, and scaphoid tuberosity on the radial side.[3] Dysfunction in these anatomic relationships may cause restriction in the carpal tunnel dimensions and tension across the ligament.
5. Evaluation of the carpal and metacarpal bone motion as displacement and restriction, especially of the Lunate may affect compression of the median nerve.[10]
6. Swelling or hypertrophy of the flexor tendons themselves or bony overgrowth of the carpals can narrow the available space for the median nerve.
7. Forearm muscles may be tight and irritable and may contain myofascial triggers. These may include wrist flexors, and pronator teres. Trigger points including scalenes may have a referral pattern which mimics signs and symptoms of CTS.

D. Goals for Osteopathic Manipulative Management

Includes a review of treatment pearls; a general plan for manipulative treatment of the patient; and a discussion of treatment options, contraindications, and plans for follow-up evaluation and treatment.

An OMT approach includes:

1. "Treatment aimed at stretching soft tissues, releasing tissue adhesions, eliminating restricted motion of carpal and metacarpal bones, increase the length of the TCL to enlarge the carpal tunnel and lower intra tunnel pressure, increase range of motion, strengthen muscles and reduce edema". [10]
2. Decrease upper thoracic and rib dysfunction, which will decrease sympathetic tone to the upper extremity. Counterstrain is recommended for rib tender points.
3. Improve motion restrictions at the forearm, wrist, and hand. Especially tightness associated with pronator dysfunction, tension in the flexor retinaculum, and trigger points associated with the forearm flexors.
4. Treatment of the transverse carpal ligament and attachment points. A gentle direct myofascial release of the ligament is appropriate.
5. Treat the thoracic inlet fascia, scalene muscles, and cervical spine. These areas are typically the proximal end of a "double-crush" phenomenon.
6. Treatment techniques may include, myofascial release, opponens roll, HVLA to the carpals, MCP, CMC, muscle energy for pronation, supination and radial head dysfunction, interosseous treatment for the membrane and forearm muscles.[10]
7. Recommended follow-up bi-weekly with conservative management, OMT, home stretches of the wrist and transverse carpal ligament and night splinting. Additional home stretching of scalenes, pectoralis major and minor and forarm flexors may prove beneficial.
8. Re-evaluation post-delivery for resolution of symptoms.

In addition to OMT, CTS may be treated by:

1. Obtain a detailed occupational history. Occupational hazards, ergonomics, and repetitive overuse can exacerbate CTS symptoms. The patient should avoid provocative activities.
2. Mild to Moderate CTS may be treated conservatively with splinting, oral steroids, injected steroids, ultrasound, gliding exercises, or yoga.[3,8]
3. Moderate to severe CTS is suggested to obtain EMG/Nerve conduction studies to delineate dysfunction and proceed to surgery.[3]
4. CTS that occurs in pregnancy is recommended night splinting. CTS in this population rarely requires decompressive surgery since symptoms usually resolve post partum.[3]

E. Contraindications and Cautions Regarding Treatment

See contraindications to treatment, Foundations, pp. 1015–1024.

1. Avoid using high-velocity techniques in the cervical region. A cervical radiculothapy may be the cause of the CTS symptoms.
2. Progressive muscle atrophy of the thenar muscles is an indication for surgery.

F. Instructor's Notes

Personal clinical pearls and lessons learned from previous COILS presentations.

1. The median nerve is usually impinged upon traveling under the flexor retinaculum. The challenge is to determine why there is insufficient space in the carpal tunnel. An EMG may determine where, along its course, the median nerve obstruction is occurring.
2. Several common occupations and preexisting conditions, predispose a patient to CTS, including postal work, carpentry, pregnancy, and certain cervical root problems. Physicians must determine why there is insufficient carpal tunnel space. CTS can be due to inflammation, arthritis, hydration of the median nerve, cervical ribs, tendonitis, myofascial triggers, or lymphatic congestion.
3. Epidemiology and risk factors for CTS includes:[1]
    a. Obesity
    b. Female gender
    c. Pregnancy
    d. Diabetes
    e. Rheumatoid arthritis
    f. Hypothyroidism
    g. Connective tissue diseases
    h. Preexisting median mononeuropathy
    i. Genetic predisposition
    j. Aromatase inhibitor use
    k. Workplace factors
4. Additional risk factors may be broken down into anatomic factors such as:[10]
    a. Dislocation of lunate
    b. Recent or malhealed fracture
    c. Multiple myeloma
    d. anomalous flexor tendons
    e. Lipoma
    f. Rangion cyst
    g. Radial artery thrombosis

5. Other systemic causes may include:[10]
    a. Hand vibration syndrome
    b. Myxedema
    c. Ameloid
    d. Sarcoid
    e. CHF
    f. Acromegaly
    g. Hyperparathyroid
    h. Lyme disease
    i. hemochromatosis
6. Benjamin Sucher, DO demonstrated by MRI that myofascial release and exercises directed at the wrist enlarged the carpal tunnel and decompressed the median nerve. Symptoms and nerve conduction velocity improved as well.[5]
7. Kenneth A. Ramey, DO studied patients with CTS using MRI and nerve conduction velocity. He deliberately avoided treatment of the wrist and focused attention to the upper thoracic findings. In the study, all patient symptoms improved with OMM/OMT. A decreased swelling of the median nerve was seen on MRI in correlation with patient improvement.[4]

III. Psychomotor Components

If time permits, this part can be carried out on a simulated patient.

1. Practice palpatory diagnosis. See techniques under Section D above. Diagnoses procedures include cervical, upper thoracic and ribs, thoracic inlet, anterior chest wall, forearm, wrist, and hand.
2. Demonstrate key treatment techniques in the body regions involved, including gentle release techniques for the upper thoracics and ribs, OA myofascial release or indirect techniques, cervical techniques, myofascial and muscle energy techniques for the forearm, and counterstrain.
3. Evaluate the plan for treating the patient in the appropriate position, localization of gentle forces, and activation.

IV. References

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V. Examination Questions

These multiple-choice questions involve the treatment of a patient with CTS.

(denotes answer)*

1. Treatment of which area would be most likely to decrease excessive sympathetic tone to the upper extremity?

A. OA
B. C3–C5
C. T2–T8
D. T10–T12
E. L4–L5

2. Treatment of which area would have the greatest effect on lymphatic drainage from the upper extremity?

A. Paraspinal inhibition to T6–T10
B. Myofascial release to the thoracic inlet
C. Muscle energy to OA somatic dysfunction
D. High-velocity low amplitude to the mid-thoracic spine
E. Rocking of the sacrum

3. Where are the myofascial trigger points located that have been found to be related to CTS?

A. Pectoralis major
B. Latissimus dorsi
C. Serratus anterior
D. Scalenes
E. Forearm flexors

4. The wrist flexor muscles have their origin from which anatomic structure?

A. Medial epicondyle
B. Radial head
C. Olecranon process
D. Supracondylar ridge
E. Phalanges

5. Where is a positive Tinel's test elicited?

A. Flexor muscles
B. Distal to the flexor retinaculum
C. Proximal to the transverse carpal ligament
D. Anterior axillary line
E. Over the carpal tunnel

Section Two: Patient-Based Application Workshop

I. Description

This section includes the practical application of osteopathic treatment techniques to support the patient with CTS.

II. Psychomotor Components

(Refer to Section One for regions of the body that are involved.)

1. Examination of the patient using TART, including postural screen, palpation, segmental motion testing, and diagnosis of somatic dysfunction.
2. Application of philosophy and treatment technique.
3. Re-evaluation of the patient after treatment is completed to assess results. If a simulated patient is used, then the student or physician should verbalize length of treatment and future treatment goals.

III. Cognitive Components

1. Documentation in the medical record.
2. Post-treatment discussion.

Note. It is recommended to use the standardized outpatient form included in each of these chapters for documentation

Physician:_____ Date: _____

Title: [ ] Resident (Specialty) _____

[ ] Intern [ ] OMS III [ ] OMS IV

Critical Actions Evaluation Checklist of Osteopathic Principals Applicable to a Patient with Carpal Tunnel Syndrome

CRITICAL ACTION	COMPLETED		COMMENTS
	Yes	No	
Become familiar with the patient's history physical examination findings, laboratory and other diagnostic findings.			
Perform an osteopathic structural examination.			
Determine significant areas of somatic dysfunction.			
Determine body region(s) to be treated with OMT.			
Apply OMT to at least the body region determined to be the most in need of treatment at present time.			
Treat other significant somatic dysfunctions if feasible.			
Document treatment and immediately observable effects.			

Trainer:_____

Osteopathic Musculoskeletal Examination

EXAMINER: SIGNATURE DATE OF EXAMINATION

EXAMINER: SIGNATURE DATE OF EXAMINATION

CHIEF COMPLAINT:

Required

Ant.Post.Spinal Curves:

Cervical Lordosis

☐ Increased ☐ Normal ☐ Decreased

Thoracic Kyphosis

☐ Increased ☐ Normal ☐ Decreased

Lumbar Lordosis

☐ Increased ☐ Normal ☐ Decreased

Scoliosis (Lateral Spine Curves)

☐ None ☐ Functional ☐ Mild ☐ Modeate ☐ Severe

Assessment Tools

☐ T= Tenderness

☐ A= Asymmetry

☐ R= Restricted Motion ☐ Active ☐ Passive

☐ T= Tissue Texture Change

For coding purposes only

Abbreviation Key

OA Occipito-Atlantal joint

Sympathetic Ganglia:

C Celiac

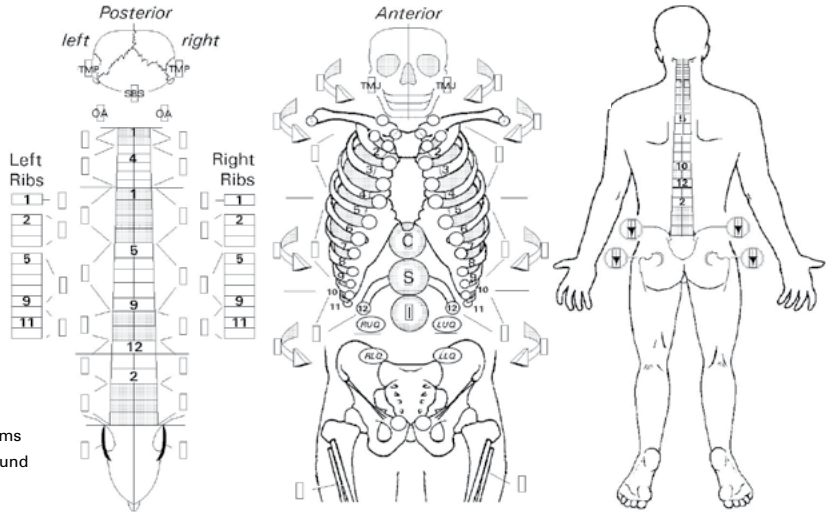
S Superior Mesenteric

I Inferior Mesenteric

TMJ Temporomandibular joint

TMP Temporal Bone

SBS Sphenobasilar symphysis



Severity Key

0 No SD or background (BG) levels

1 Minor TART more than BG levels

2 TART obvious (R&T esp) +/- symptoms

3 Symptomatic, R and T very easily found "key lesion"

Region Evaluated		Severity 0	1	2	3	Specific Major Somatic Dysfunctions
Head		☐	☐	☐	☐	
Neck		☐	☐	☐	☐	
Thoracic	T1-4	☐	☐	☐	☐	
	T5-9	☐	☐	☐	☐	
	T10-12	☐	☐	☐	☐	
Lumbar		☐	☐	☐	☐	
Pelvis/Sacrum		☐	☐	☐	☐	
Pelvis/Innominate		☐	☐	☐	☐	
Extremity Lower	R	☐	☐	☐	☐	
	L	☐	☐	☐	☐	
Extremity Upper	R	☐	☐	☐	☐	
	L	☐	☐	☐	☐	
Ribs		☐	☐	☐	☐	
Other/Abdomen		☐	☐	☐	☐	

Major Correlations with:

☐ Traumatic ☐ Orthopedic ☐ Neurological ☐ Viscerosomatic ☐ Primary Musculoskeletal ☐ Cardiovascular

☐ Rheumatological ☐ EENT ☐ Cardiovascular ☐ Pulmonary ☐ Activities of Daily Living ☐ Genitourinary

☐ Other: _____