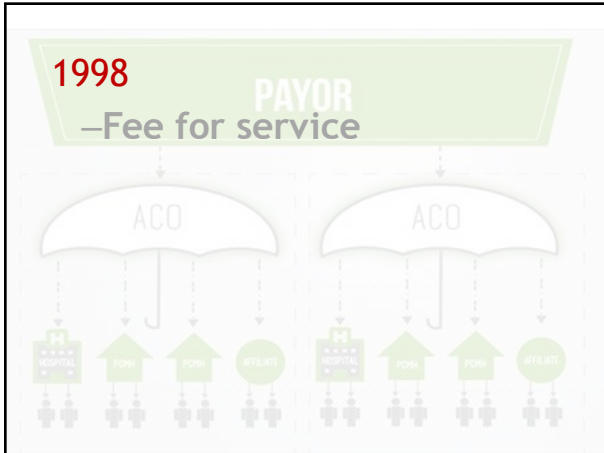


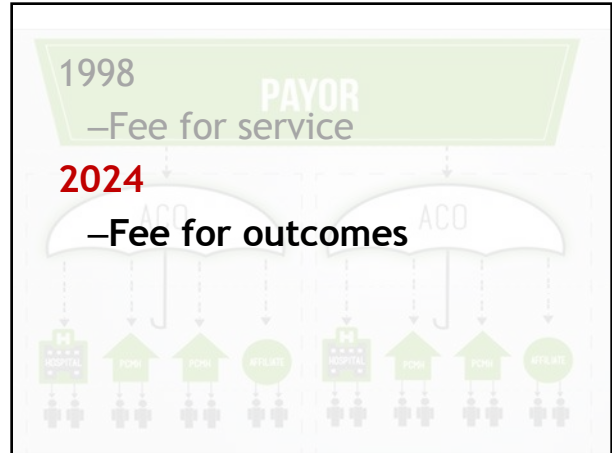
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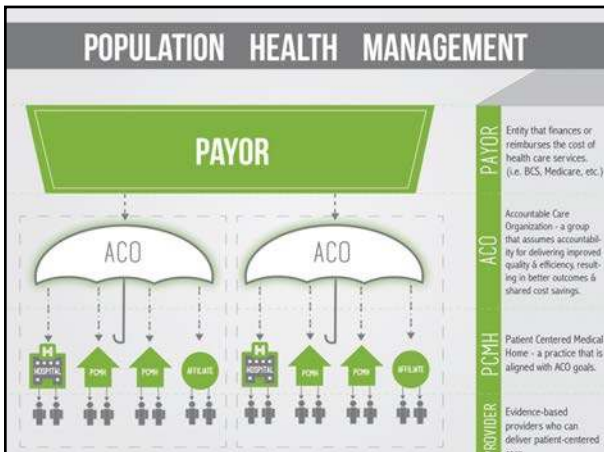
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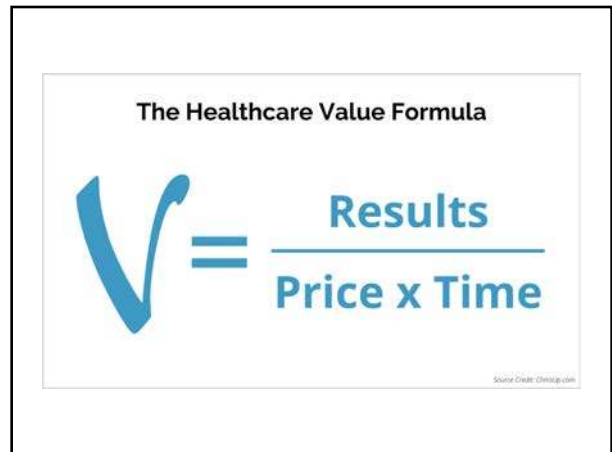
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Neurogenic Pain Outline

- Nerve tension tests
- Nerve flossing maneuvers
- Peripheral neuropathies
 - TOS
 - Radial tunnel
 - Cubital tunnel
 - Pronator teres syndrome
 - Carpal tunnel
 - Meralgia paresthetica
 - Ischiofemoral impingement
 - Piriformis syndrome
 - Tarsal tunnel syndrome
 - Cervicogenic headache

10

COPS	
Top 3 Chiropractic Diagnoses per Region	
Shoulder 1. Scapular dyskinesia 2. Rotator cuff strain/ tendinopathy 3. Shoulder anterior impingement syndrome	Hip 1. Hip abductor weakness 2. Piriformis syndrome 3. Gluteal tendinopathy/ GTPS
Elbow 1. Lateral epicondylopathy (tennis elbow) 2. Medial epicondylopathy (golfer's elbow) 3. Cubital tunnel syndrome (funny-bone irritation)	Knee 1. Patellofemoral pain syndrome (Runners knee) 2. Iliotibial band syndrome 3. Knee osteoarthritis - Tibiofemoral
Hand/Wrist 1. Carpal tunnel syndrome 2. Pronator teres syndrome (carpal tunnel-like symptoms) 3. DeQuervain's tenosynovitis (texting thumb)	Foot/Ankle 1. Plantar fasciitis 2. Foot hyperpronation 3. Lateral (inversion) ankle sprain
Head/Face 1. Cervicogenic headache 2. TMD 3. Migraine headache	Other 1. Thoracic outlet syndrome 2. Scoliosis 3. Chronic pain

11

Rotator Cuff

An RCT of 80 **shoulder impingement** patients evaluated the effectiveness of adding nerve mobilization to standard therapy. The study found that patients receiving nerve mobilization had a nearly **two-point greater VAS improvement** (lower mean pain score 2.15 vs. 4.90).

Akhtar M, Karimi H, Gilani SA, Ahmad A, Raza A. The effectiveness of routine physiotherapy with and without neuromobilization on pain and functional disability in patients with shoulder impingement syndrome; a randomized control clinical trial. BMC Musculoskeletal Disorders. 2020 Dec;21(1):1-9.

12

Tennis Elbow

In addition to improving outcomes for neck and back pain, neuromobilization may have merit for lateral epicondylalgia via *“significant improvements in pressure pain threshold, pain-free grip strength, neurodynamic test ROM, and pain scores.”*

Basson A, Olivier B, Ellis R, Coppieters M, Stewart A, Mudzi W. The effectiveness of neural mobilization for neuromusculoskeletal conditions: a systematic review and meta-analysis. *Journal of orthopaedic & sports physical therapy.* 2017 Sep;47(9):593-615

13

Carpal Tunnel

“Neurodynamics therapy was superior [to exercise] in improving function and strength and in decreasing pain.”

Hamzeh H, Madi M, Alghwiri AA, Hawamdeh Z. The long-term effect of neurodynamics vs exercise therapy on pain and function in people with carpal tunnel syndrome: A randomized parallel-group clinical trial. *Journal of Hand Therapy.* 2020 Jul 30

14

“The mobility of the entire median nerve was significantly restricted in cases of CTS compared to healthy participants.”



Hara Y, Tajiri Y, Kawano K, Hoshikawa S. Evaluation of Restricted Motion Area of the Median Nerve in Patients with Carpal Tunnel Syndrome: A New Measurement Method Using an Ultrasonographic Video Image. *The journal of hand surgery Asian-Pacific volume.* 2021 Dec;26(4):635-43.

15

Carpal Tunnel

“Neural mobilizations can aid in the reduction of neural edema, neural mobility, and neural adhesion while improving nerve conduction. Splinting is only effective when combined with neurodynamics.”

Wise S, Bettleyon J. Neurodynamics Is an Effective Intervention for Carpal Tunnel Syndrome. *Journal of Sport Rehabilitation.* 2022 Dec 30;1(aop):1-4.

16

Carpal Tunnel

“This study highlights the effectiveness of...neurodynamic mobilizations, in isolation, on pain, physical function, and nerve conduction studies in patients with CTS.”

Jiménez-del-Barrio S, Cadellans-Arróniz A, Ceballos-Laíta L, Estébanez-de-Miguel E, López-de-Celis C, Bueno-Graña E, Pérez-Bellmunt A. The effectiveness of manual therapy on pain, physical function, and nerve conduction studies in carpal tunnel syndrome patients: a systematic review and meta-analysis. *International Orthopaedics.* 2021 Dec 3:1-2.

17

Carpal Tunnel

“Desensitization maneuvers of the central nervous system resulted in similar outcomes to surgery.”

Fernández-de-Las-Peñas C, Arias-Burja JL, Cleland JA, Pareja JA, Plaza-Manzano G, Ortega-Santiago R. Manual Therapy Versus Surgery for Carpal Tunnel Syndrome: 4-Year Follow-Up From a Randomized Controlled Trial. *Physical Therapy.* 2020 Nov;100(11):1987-96.

18

Neurodynamic Fundamentals

19



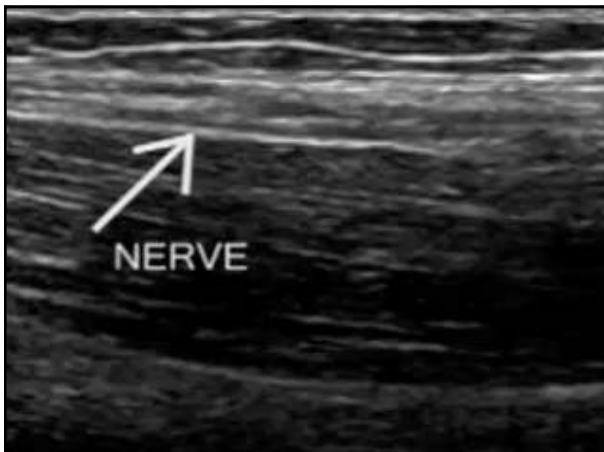
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23

Neurodynamic Actions During Stretch Movement

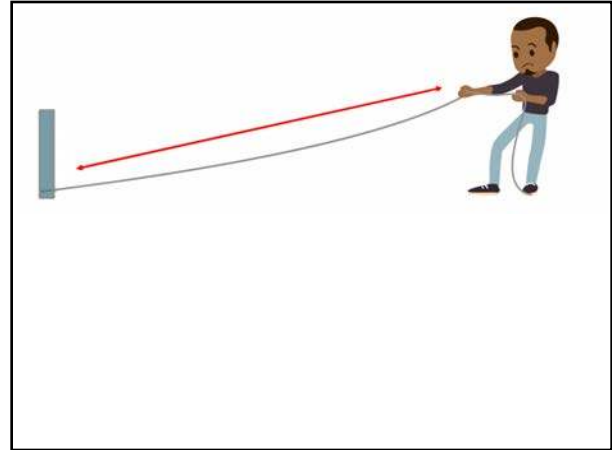
- Take up slack
- Rapid neural sliding
- Stretch
- Tension

A diagram of a tube with a blue arrow pointing through it.

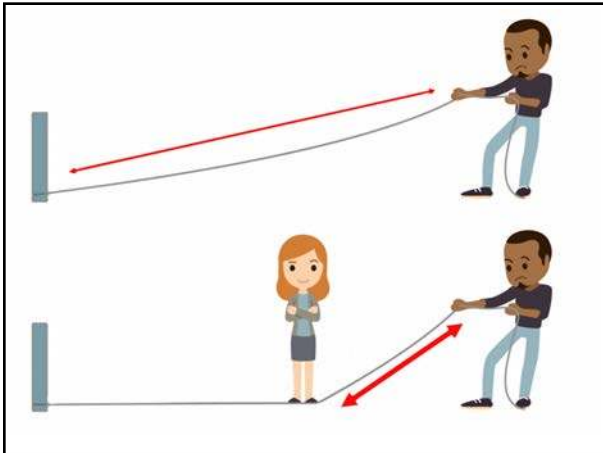
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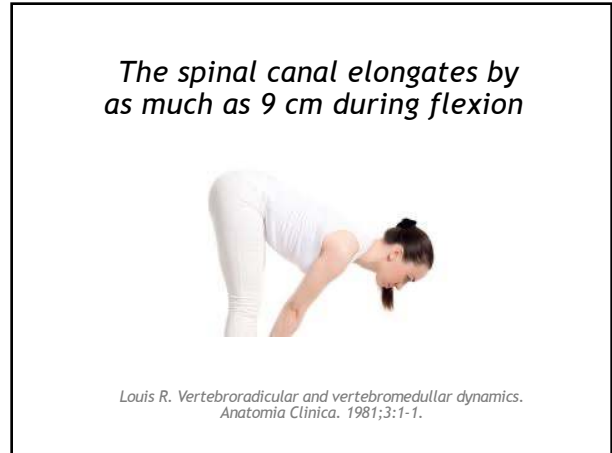
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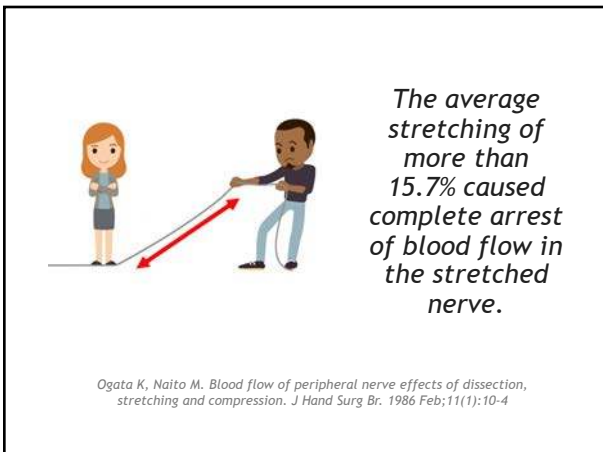
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30

A mild mechanical obstruction of venous return triggers a neuropathy that, if sustained, may progress.

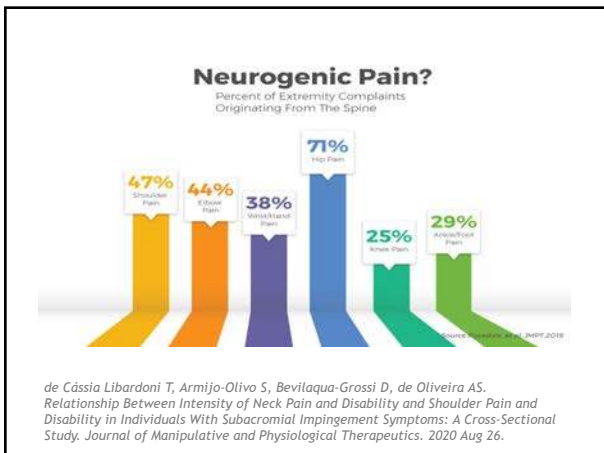
Shacklock M. *Clinical Neurodynamics*. Elsevier 2005 Chapter 3, p.55.

31

In the spine, the opening mechanism around a nerve root may be abnormally reduced due to stiffness in the local motion segment. In this case, the nerve root may never be completely relieved of pressure and may become sensitized and painful due to subtle perturbations in blood flow.

Shacklock M. *Clinical Neurodynamics*. Elsevier 2005 Chapter 3, p.54.


32



33



34



Within minutes of a disc protrusion, chemicals seep into the nerve roots, thereby triggering edema and impaired conduction as opposed to frank pressure.

Shacklock M. *Clinical Neurodynamics*. Elsevier 2005 Chapter 3, p.59.

35



36

Nerve Irritation

Compression, Stretch or Irritation

Magnitude

Time

37

Neurodynamics

Assessment

(ULTT)

- Median
- Radial
- Ulnar

Treatment

- Median
- Radial
- Ulnar

38

Self Tests

Median

Radial

Ulnar

39

Median Nerve Test

The clinician stabilizes the top of the supine patient's shoulder with one hand and grasps the patient's hand with the other. The patient's elbow is flexed to about 90 degrees, forearm supinated, fingers pointing upward. The clinician "walks" the patient's arm into 90 degrees of abduction, then extends the patient's wrist, then fully externally rotates the patient's shoulder. The clinician then extends the elbow. If complaints are reproduced, the clinician may remove wrist extension or have the patient ipsilaterally flex their neck to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues).

40

Radial Nerve Test

The patient is lying supine with their elbow flexed to 90 degrees, fingers pointing upward. The clinician uses their thigh to depress the patient's shoulder and extends the patient's elbow. The clinician fully internally rotates the patient's straightened arm, then flexes their wrist and thumb. The clinician maintains this wrist/ elbow position and abducts the patient's straightened arm toward 90 degrees. If complaints are reproduced, the clinician may release shoulder depression to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues).

41

Ulnar Nerve Test

The patient begins in a supine position with their arm at their side. The clinician flexes the patient's elbow to 90 degrees and extends their wrist. The clinician then pronates the patient's extended wrist and further flexes the elbow so that the patient's finger tips are touching their shoulder. Next, the clinician (may need to switch hands) stabilizes the top of the supine patient's shoulder and fingers with one hand, while the other hand externally rotates the patient's arm (wrist crease moves from pointing up, to pointing sideways). Finally the patient's shoulder is abducted. If complaints are reproduced, the clinician may have the patient ipsilaterally flex their neck to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues).

42

Greater strain in the nerves occurs at the site that is moved first.



Tsai Y-Y. Tension change in the ulnar nerve by different order of upper limb tension test. Master of Science Thesis, Northwestern University, Chicago 1995.

43

Positive Test

A neurodynamic test is considered positive if it reproduces (ipsilateral) neurogenic symptoms that would not normally occur with that movement and are consistent with the patient's history and clinical evaluation.

44

Testing vs Treatment



Upper Extremity Nerve Tension

45

Testing vs. Treatment



Upper Extremity Nerve Glide/ Floss

46

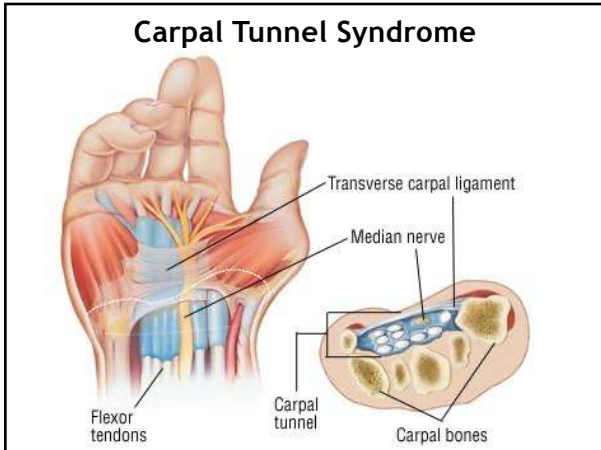
Provider & Home Care

Nerve	Provider Treatment	Patient Home Care
Radial	Nerve Floss	Self Floss
Median	Nerve Floss	Self Floss
Ulnar	Nerve Floss	Self Floss

47

Carpal Tunnel Syndrome

48



49

- Affects **3-5%** of the general population
- More common in **dominant** hand
- **Female** to male ratio of at least 2 or 3:1
- Adults age **45-60**
- **White** adults are affected 2-3 times more commonly than black adults

50

Intrinsic Risk Factors

- Age, race, and gender
- Diabetes
- Hypothyroidism
- Rheumatoid arthritis
- Alcoholism
- Increased BMI
- Renal disease
- Short stature
- Prior trauma
- Pregnancy
- Thickened transverse ligament

51

“A significant positive correlation was observed between CAD and a previous diagnosis of carpal tunnel syndrome.”

Chang YC, Chiang JH, Lay IS, Lee YC. Increased Risk of Coronary Artery Disease in People with a Previous Diagnosis of Carpal Tunnel Syndrome: A Nationwide Retrospective Population-Based Case-Control Study. Biomed Res Int. 2019;2019:3171925. Published 2019 Mar 3.

52

“Up to 20% of carpal tunnel syndrome CTS patients demonstrate cutaneous findings involving the affected digits.”

Egger A, Tosti A. Carpal Tunnel Syndrome and Associated Nail Changes: Review and Examples from the Author's Practice. Journal of the American Academy of Dermatology. 2020 Mar 19.


53




54

Extrinsic Risk Factors

- **Prolonged** wrist flexion or extension
- **Repetitive** wrist movements
- Exposure to **vibration** or cold



55



"I hear there's a new ICD-10 code for carpal tunnel syndrome caused by clicking too many times in an EMR system."

56


Symptoms

- **Paresthesia** or aching in the distribution of the median nerve
- May extend proximally **toward the elbow**
- **Nocturnal** progressing to constant
- Aggravated by **gripping** activities
- Relieved by "shaking the hands out"
- Weakness or atrophy
- **Tight/swollen** feeling
- Skin color changes or hand temperature changes

57

Sensitivity

Paresthesia in a median nerve distribution with nocturnal awakening - **77.4%**
 Phalen sign - **52.8%**
 Hoffman-Tinel sign - **37.7%**



Heermann KT et al. Median Nerve Symptoms, Signs, and Electrodiagnostic Abnormalities Among Working Adults. J Am Acad Orthop Surg. 2018 Jul; 19.

58

Carpal Tunnel Syndrome


My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Square Wrist Sign	STM- Pronator Teres	Median Nerve Flex
Phalen Test	STM- Wrist Flexors	Scalene Stretch
Reverse Phalen Test	Manipulation-Cervical	Unilateral Peo Stretch
Manual Carpal Compression	Manipulation-Hand & Wrist	Median Nerve Glide
Tinel's Sign	Nerve Release- Median Nerve at the Wrist	Wrist Flexor Stretch
Upper Extremity Neurologic Evaluation	Support Brace- Wrist	
Median Nerve Test (UNLT 1)	Elastic Therapeutic Tape Carpal Tunnel	
Walmer CPR for Carpal Tunnel Syndrome		

59

Phalen Test

The patient performs sustained full wrist flexion by pressing the backs of their hands together for one minute. Reproduction of paresthesia in the distribution of the median nerve is fairly specific for the diagnosis of CTS.



60

Reverse Phalen Test

The patient performs sustained full wrist extension by pressing their palms together for one minute (i.e. praying). Reproduction of paresthesia in the distribution of the median nerve is suggestive of CTS.



61

Manual Carpal Compression

The clinician applies 30 seconds of sustained compression over the patient's carpal tunnel. Reproduction of median nerve pain or paresthesia is a positive test. This maneuver has a reported sensitivity of 89% and specificity of 96% for CTS. AKA Durkan Test.



62

Median Nerve Test

The clinician stabilizes the top of the supine patient's shoulder with one hand and grasps the patient's hand with the other. The patient's elbow is flexed to about 90 degrees, forearm supinated, fingers pointing upward. The clinician "walks" the patient's arm into 90 degrees of abduction, then extends the patient's wrist, then fully externally rotates the patient's shoulder. The clinician then extends the elbow. If complaints are reproduced, the clinician may remove wrist extension or have the patient ipsilaterally flex their neck to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues).



63

Tinel's Sign

The clinician taps the skin over a peripheral nerve with a reflex hammer. Reproduction of neurologic complaints suggests irritation. Commonly used in the diagnosis of peripheral neuropathies involving the median, radial, ulnar, peroneal or posterior tibial nerves.



64

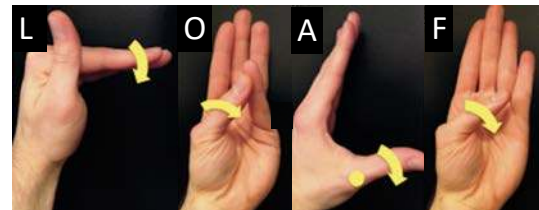
Square Wrist Sign

The clinician uses an x-ray caliper or other measuring device to quantify the thickness and width of the patient's wrist. A ratio of wrist thickness to wrist width greater than 0.7 defines a "square wrist", which is associated with a higher incidence of carpal tunnel syndrome. aka Johnson's Index.



65

Pinch Grip



Lumbricales
Opponens pollicis
Abductor pollicis brevis
Flexor pollicis brevis

66



67

Problem #	Hand / Wrist / R. / L.	Initial Visit	Re-Visit 1	Re-Visit 2	Re-Visit 3
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68

Carpal Tunnel Syndrome

My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Square Wrist Sign	STM- Pronator Teres	Median Nerve Floss
Phalen Test	STM- Wrist Flexors	Scalene Stretch
Reverse Phalen Test	Manipulation- Cervical	Unilateral Pec Stretch
Manual Carpal Compression	Manipulation- Hand & Wrist	Median Nerve Glide
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Upper Extremity Neurologic Evaluation	Support Brace- Wrist	
Median Nerve Test (UNLT 1)	Elastic Therapeutic Tape Carpal Tunnel	
Wainner CPR for Carpal Tunnel Syndrome		

69

American Academy of Neurology:

“Employ conservative management before considering surgical alternatives”

American Academy of Neurology Practice parameter for carpal tunnel syndrome (summary statement) Neurology, Vol 43 pp. 2406-2409

70

STM - Wrist Flexors

The wrist flexor muscle group consists of the flexor carpi radialis, flexor carpi ulnaris, flexor digitorum superficialis, and palmaris longus. The muscles originate on and near the medial epicondyle and attach to the carpals, metacarpals, and phalanges. The actions of the muscle include wrist and finger flexion. Trigger points commonly develop in muscle bellies. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. IASTM is an alternate means of stripping the muscle. Movement stripping may be performed by contacting the muscle trigger points and applying pressure while passively moving the muscle from a shortened state into wrist and elbow extension. Contract/ relax stretching is performed by tensioning the muscle, then asking the patient to flex their wrist and fingers against resistance, followed by increased stretch.

71

Nerve Release - Median Nerve at the Wrist

Entrapment of the median nerve at the wrist is termed “Carpal tunnel syndrome”. Compression may result in radiating pain or paresthesia into the palm and first three digits of the hand. Nerve release may help resolve adhesions and restore normal mechanical function. The patient should be sitting or supine with their elbow flexed to 90 degrees. Grasp the affected wrist with both hands. The clinician’s thumbs should support the dorsum of the wrist with index fingers grasping the thenar and hypothenar regions. Tension the palm laterally while the hand is placed passively in thumb and fifth finger opposition. Slowly open the hand while holding tension on the thenar and hypothenar aspects. Mobilization should be done 4-5 times consecutively without eliciting lasting symptoms in the distribution of the nerve. Alternately, IASTM may be utilized judiciously in a proximal to distal stroking fashion. Clinicians should avoid “strumming” nerves.

72

Nerve Floss - Median

The median nerve provides sensation to the anterior shoulder, lateral forearm, and 1st-3rd digits. Adhesions along the course of the nerve may develop secondary to any traumatic or inflammatory process. "Nerve flossing" may help release adhesions and restore normal neurodynamics. Median nerve flossing is performed by laying supine with the shoulder elevated and elbow flexed. The patient is asked to slowly depress the shoulder and externally rotate the arm with fingers and wrist in extension. Lastly, the arm is abducted. Flossing motions should not create or intensify any radicular complaints. The flossing pattern should be repeated 10 times, from the starting position to the end position. The patients may benefit by continuing self-flossing exercises at home.



73

Neurodynamic Evaluation Principles

- Use the minimal level of force
- Do not sustain forces for more than a few seconds
- Move slowly

74

"An RCT of patients with mild to moderate carpal tunnel syndrome concluded "the use of neurodynamic techniques in conservative treatment for mild to moderate forms of carpal tunnel syndrome has significant therapeutic benefits."

Specifically, neurodynamic techniques produced significant improvements in nerve conduction, pain, symptom severity, and functional status."

Wolny T et al. Is manual therapy based on neurodynamic techniques effective in the treatment of carpal tunnel syndrome? A randomized controlled trial. Clin Rehabil. 2018 Oct 11:269215518805213.

75



"Manual therapy, including desensitization maneuvers of the central nervous system, has been found to be equally effective but less costly (i.e., more cost-effective) than surgery for women with CTS."

Fernandez-De-Las-Penas C, Ortega-Santiago R, Diaz HF, Salom-Moreno J, Cleland JA, Pareja JA, Arias-Burila JL. Cost-Effectiveness Evaluation of Manual Physical Therapy Versus Surgery for Carpal Tunnel Syndrome: Evidence From a Randomized Clinical Trial. Journal of orthopaedic & sports physical therapy. 2019 Feb;49(2):55-63.

Fernández-de-Las-Peñas C, Arias-Burila JL, Cleland JA, Pareja JA, Plaza-Manzano G, Ortega-Santiago R. Manual Therapy Versus Surgery for Carpal Tunnel Syndrome: 4-Year Follow-up From a Randomized Controlled Trial. Physical Therapy. 2020 Aug 6.

76

Repetitive mechanical stimulation is likely to increase intraneural blood flow and, if excessive, create an inflammatory or edematous response in the nerve.

Shacklock M. Clinical Neurodynamics. Elsevier 2005 Chapter 1, p.16.

77

"We found no clinically significant benefit from ultrasound treatment for CTS"

Jothi KP, Bland JD. Ultrasound Therapy Adds No Benefit to Splinting in Carpal Tunnel Syndrome. Muscle & nerve. 2019 Jul 30.

78


“ESWT is an effective and noninvasive treatment method for mild to moderate carpal tunnel syndrome.”



Gesslbauer C, et al. Effectiveness of focused extracorporeal shock wave therapy in the treatment of carpal tunnel syndrome. Wiener klinische Wochenschrift. 2020 Dec 22:1-0

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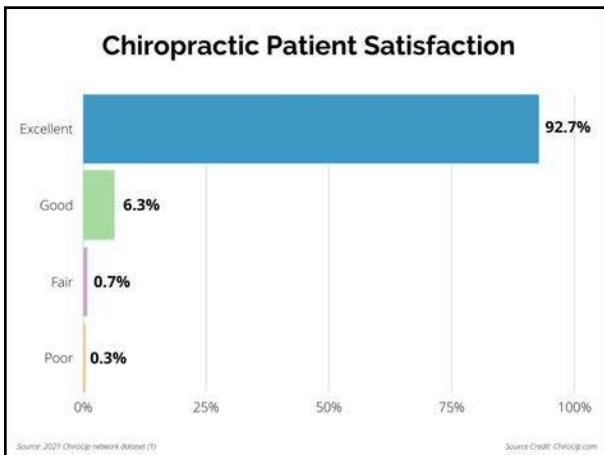
Average Improvement 30 Days After Initiating Chiropractic Care (All Diagnoses)



80.24%

Source: 2021 ChiroUp network dataset (1) Image Credit: ChiroUp.com

80




81



82

Average Chiropractic Patient's Likelihood to Refer Others



96.7%

Source: 2021 ChiroUp network dataset (1) Image Credit: ChiroUp.com

83

MD Initial Report

To Dr. _____
 cc: Dr. _____
 Patient _____
 Date of Presentation _____

Dear Dr. *;

Thank you for your referral of/ Your patient *, presented to my office today with a chief complaint of **. Here is a brief summary of the attached detailed narrative initial report.

The history & physical revealed findings consistent with a diagnosis of *.

My treatment recommendations include; *.

The patient will be treated * at which point I would expect in excess of *% improvement.

I will provide you with updates on the progress of your patient. If you would like any additional information, please do not hesitate to contact my office. Once again, thank you for allowing me to participate in the care of your patient.

84

MD Release Report

To Dr. _____
 Patient _____
 Date of Release _____
 Date of Initial Visit _____
 # of Treatments _____
 _____% Overall Improvement/ Resolution

Dear Dr. *;

This is a letter to update you on the status of your patient *, who was most recently evaluated in my office on *.

This patient initially presented to my office on * with a chief complaint of **. My initial diagnosis was**. Treatment included**.

The patient was treated a total of * times and has responded favorably. Currently, the patient reports approximately * % overall subjective improvement. Objective findings have improved proportionately. I have enclosed my most recent evaluation for your review.

At this time, I feel that the patient has reached maximum therapeutic benefit and will be released to an as needed basis per your discretion. If I may provide any additional information, please call. Once again, thank you for allowing me to participate in the care of your patient.

85

Documentation vs. Behavior

“Only 38.5% of the review of systems and 53.2% of the physical examination documented in the EHR were corroborated by direct observation”

Berdahl CT, Moran GJ, McBride O, Santini AM, Verzhbinsky IA, Schriger DL. Concordance Between Electronic Clinical Documentation and Physicians’ Observed Behavior. JAMA Netw Open. Published online September 18, 2019(9)

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Carpal Tunnel Syndrome


My Version My Notes

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Square Wrist Sign	STM- Pronator Teres	Median Nerve Floss
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Wainner CPR for Carpal Tunnel Syndrome		

87

Median Nerve Floss


Begin with your elbow, wrist, and fingers bent with your hand at chest level, palm up. Your head should be leaning toward the side of the arm that you are flossing. As you simultaneously move your head toward the opposite shoulder, also move your arm down across the front of your chest out to the side of your hip. As your wrist and fingers move into extension, follow your hands motion with your eyes. Return to the start position and repeat three sets of 10 repetitions twice per day or as directed.



88

Median Nerve Glide

Begin by making a fist. First, flex your fist downward, then bring your wrist back to a neutral position. Straighten your fingers and thumb so that all five tips are pointing forward. Bend your wrist back/up as to make a “stop” motion and move your thumb away from your palm. Turn your wrist palm up. Use your opposite hand to pull your thumb further away from your palm. Perform 20 repetitions twice per day or as directed.



89



“Myofascial stretching of the carpal ligament showed statistically significant improvements...in numbness, tingling, pinch strength, and symptom severity.”

Shem K, Wong J, Dirlikov B. Effective self-stretching of carpal ligament for the treatment of carpal tunnel syndrome: A double-blinded randomized controlled study. Journal of Hand Therapy. 2020 May 1.

90

Scalene Stretch

While sitting or standing, reach down with your right arm, grasping your thigh or the bottom of a chair for stability. While looking straight ahead, place your left hand on top of your head, and gently pull your head sideways toward the left. Against the resistance of your hand, attempt to laterally flex your right ear toward your right shoulder for seven seconds. Relax and stretch further toward the left. "Lock in" to each new position, and do not allow any slack. Repeat three contract/relax cycles on each side twice per day or as directed.



91

Unilateral Pec Stretch

Stand with your arm straight out at shoulder level reaching backwards, thumb up. Position yourself so that your hand is against a door frame or wall. Gently turn your body away from the wall, until you feel a gentle stretch in your chest and shoulder. Against the resistance of the wall or door frame, attempt to rotate your arm forward in front of your body for seven seconds. Relax and rotate your body away from the door frame or wall to increase the stretch on your shoulder. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.



92

Wrist Flexor Stretch

Straighten your arm in front of you with your hand at chest level, palm up. Keep your elbow locked and use your opposite hand to grasp your fingers and gently pull down on your fingers until you feel a stretch in your forearm. Keep your elbow straight throughout the exercise. Against the resistance of your opposite hand, contract your wrist and fingers upward for seven seconds. Relax and increase the stretch on your wrist and forearm by pulling downward and backward on your fingers. "Lock in" to the new position and repeat three contract/relax cycles twice per day or as directed.



93

Home Advice

- Avoid repetitive wrist flexion or extension
- Nighttime wrist splint
- 100-200mg of Vitamin B6 (68% of patients taking 100mg of vitamin B6 BID, experienced symptom alleviation vs 14% of the control group)

94

"Intraneural blood flow velocity is dependent on median nerve function and wrist posture such that patients with mild CTS are more susceptible to the effects of non-neutral wrist postures."

Zuniga AF, Ghavanini AA, Israelian G, Keir PJ. Blood flow velocity but not tendon mechanics relates to nerve function in carpal tunnel syndrome patients. *Journal of the Neurological Sciences*. 2020 Jan 21:116694.

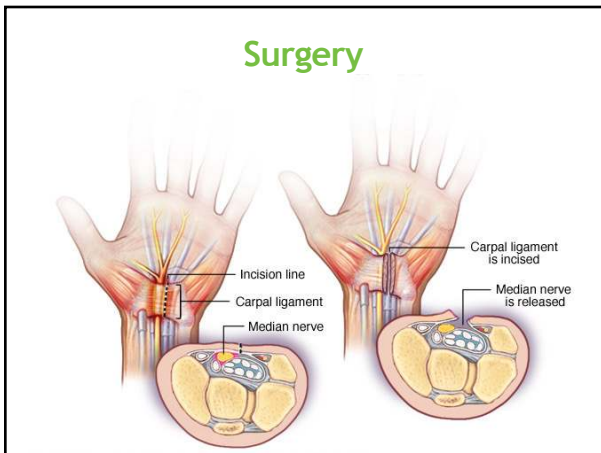
95

"A wrist splint has short-term effectiveness in treating symptoms of carpal tunnel syndrome but may not be more effective than other conservative therapies."



Sprouse RA et al. Braces and Splints for Common Musculoskeletal Conditions. *Am Fam Physician*. 2018 Nov 15;98(10):570-576.

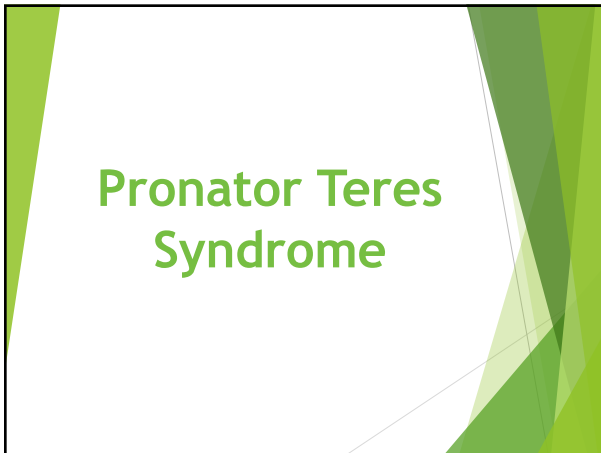
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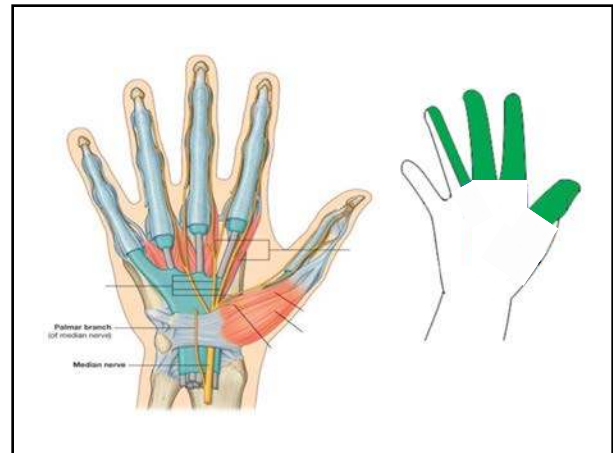
97

- * CTS is more common in the **dominant hand**.
- * **Bilateral** CTS is **unlikely** and should suggest central cord involvement, until disproven by MRI.
- * The condition often begins with **nocturnal symptoms**.
- * Transient symptoms may present during **pregnancy**.
- * Often part of a **double crush syndrome** (i.e. cervical radiculopathy, TOS, Pronator Syndrome)

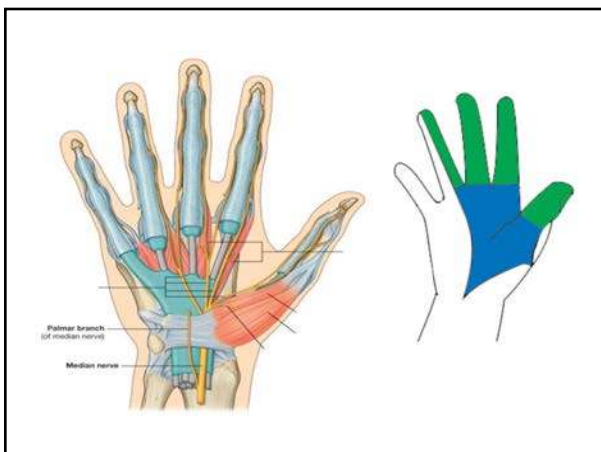
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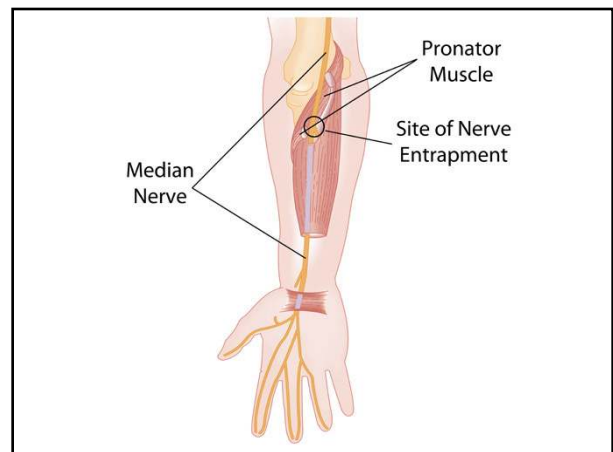
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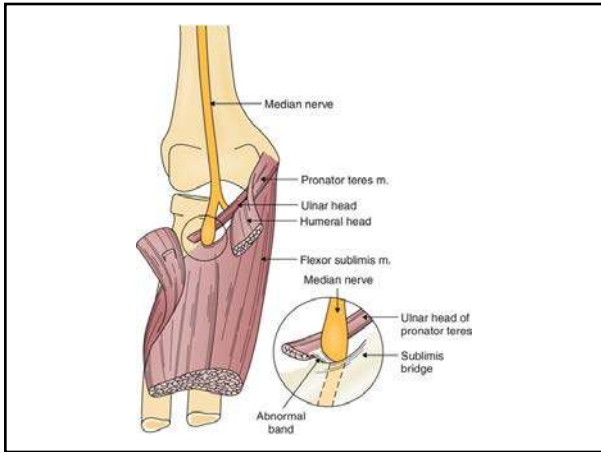
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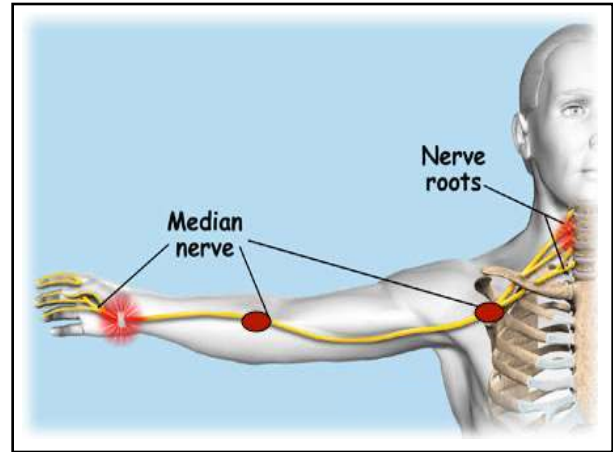
101



102



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104

Pronator Teres Syndrome


My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Pronator Compression Test	STM - Pronator Teres	Median Nerve Floss
Pronator Teres Syndrome Test	Manipulation-Cervical	Wrist Flexor Stretch
Tinel's Sign	Nerve Floss-Median	Pronator Teres Stretch
Median Nerve Test (UNLT 1)		

105

STM - Pronator Teres

The pronator teres muscle originates on the medial epicondyle of the humerus and coronoid process of the ulna and attaches to the lateral radius mid shaft. The actions of the muscle include forearm pronation. Trigger points commonly develop in muscle belly. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. Movement stripping may be performed by contacting the muscle trigger points and applying pressure while extending and supinating the forearm. Contract/ relax stretching is performed by tensioning the muscle, then asking the patient to pronate their forearm against resistance, followed by increased stretch.



106

Pronator Teres Syndrome


My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Pronator Compression Test	STM - Pronator Teres	Median Nerve Floss
Pronator Teres Syndrome Test	Manipulation-Cervical	Wrist Flexor Stretch
Tinel's Sign	Nerve Floss-Median	Pronator Teres Stretch
Median Nerve Test (UNLT 1)		

107

Pronator Teres Stretch

Begin with your elbow bent 90 degrees touching the front of your abdomen with your forearm pointing straight forward. Your palm should be facing up. With your opposite hand, apply a torque to rotate your involved hand outward (thumb moving down.) Gently straighten your elbow to increase tension. Against your own resistance, attempt to rotate your involved hand inward (palm down) for seven seconds. Relax and increase the stretch, locking into each new position. Perform as directed.

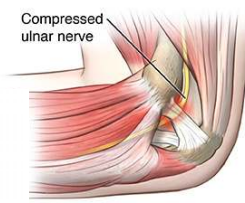


108

Cubital Tunnel Syndrome

109

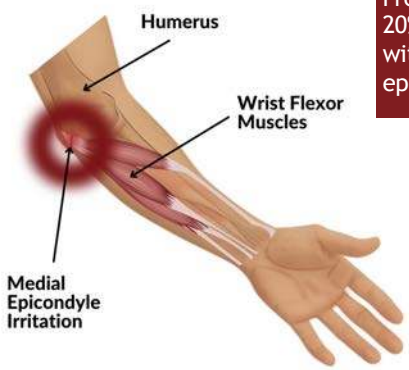
DDx: Cubital Tunnel Syndrome (20%)



Compressed ulnar nerve

- Paresthesia to the 4th or 5th digit
- Nocturnal symptoms
- Positive Tinel's sign
- Elbow flexion test

110



Humerus

Wrist Flexor Muscles

Medial Epicondyle Irritation

Present in up to 20% of patients with medial epicondylopathy

111

Cubital Tunnel Syndrome


My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Tinel's Sign	STM- Wrist Flexors	Ulnar Nerve Floss
Upper Extremity Neurologic Evaluation	Manipulation-Cervical	Wrist Flexor Stretch
Ulnar Nerve Test (UNLT 3)	Nerve Release- Ulnar Nerve at the Elbow	Pronator Teres Stretch
Ulnar Nerve Self Test	Nerve Floss- Ulnar	
	Support Brace- Cubital Tunnel Pad	
	Support Brace- 45 Degree Elbow Brace	

112

Ulnar Nerve Self-Test

The patient performs shoulder abduction while flexing the elbow past 90 degrees, supinating their forearm, extending their wrist with thumb and index finger tips touching, ending with their fingers in a "monocle" position around the ipsilateral eye. This test may be positive in Cubital Tunnel Syndrome or other ulnar nerve entrapments. (aka Elbow Flexion Test)



113

Cubital Tunnel Syndrome

My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Tinel's Sign	STM- Wrist Flexors	Ulnar Nerve Floss
Upper Extremity Neurologic Evaluation	Manipulation-Cervical	Wrist Flexor Stretch
Ulnar Nerve Test (UNLT 3)	Nerve Release- Ulnar Nerve at the Elbow	Pronator Teres Stretch
Ulnar Nerve Self Test	Nerve Floss- Ulnar	
	Support Brace- Cubital Tunnel Pad	
	Support Brace- 45 Degree Elbow Brace	

114

Nerve Release - Ulnar Nerve at the Elbow

Entrapment of the ulnar nerve at the elbow is termed "Cubital tunnel syndrome". Compression may result in radiating pain or paresthesia into the medial elbow and 4th/5th digits. Nerve release may help resolve adhesions and restore normal mechanical function. The patient should be seated with their affected arm in slight flexion. Contact the site of adhesion and tension the medial border of the wrist flexors. Slowly flex the patient's elbow while extending their 4th and 5th digits. An alternate site of ulnar nerve entrapment is at the medial intramuscular septum, 3 cm superior to the medial epicondyle. Mobilization should be performed 4-5 times consecutively without eliciting lasting symptoms in the distribution of the nerve. Alternately, IASTM may be utilized judiciously in a proximal to distal stroking fashion. Clinicians should avoid "strumming" nerves.



115

Cubital Tunnel Syndrome

My Version My Notes

Evaluation	Management	Exercises (Phase 1)
<ul style="list-style-type: none"> Finkel's Sign Upper Extremity Neurologic Evaluation Ulnar Nerve Test (UNLT 2) Ulnar Nerves Self Test 	<ul style="list-style-type: none"> STM- Wrist Flexors Manipulation-Cervical Nerve Release- Ulnar Nerve at the Elbow Nerve Floss- Ulnar Support Brace- Cubital Tunnel Pad Support Brace- 45 Degree Elbow Brace 	<ul style="list-style-type: none"> Ulnar Nerve Floss Wrist Flexor Stretch Pronator Teres Stretch

116

Ulnar Nerve Floss

Hold your arm in front of you with your elbow, wrist, and fingers straight as though you are getting ready to shake hands. Touch the tips of your thumb and first finger together to make a ring. Slowly flex your elbow until your hand reaches your face. The ring position should be maintained and your forefinger should be just beneath your eye socket. Slowly raise your elbow to flip the ring up into a "monocle" around your eye. Lower your arm back to the starting position and repeat 10 repetitions three times per day or as directed.



117

Wrist Flexor Stretch

Straighten your arm in front of you with your hand at chest level, palm up. Keep your elbow locked and use your opposite hand to grasp your fingers and gently pull down on your fingers until you feel a stretch in your forearm. Keep your elbow straight throughout the exercise. Against the resistance of your opposite hand, contract your wrist and fingers upward for seven seconds. Relax and increase the stretch on your wrist and forearm by pulling downward and backward on your fingers. "Lock in" to the new position and repeat three contract/relax cycles twice per day or as directed.



118

Pronator Teres Stretch

Begin with your elbow bent 90 degrees touching the front of your abdomen with your forearm pointing straight forward. Your palm should be facing up. With your opposite hand, apply a torque to rotate your involved hand outward (thumb moving down.) Gently straighten your elbow to increase tension. Against your own resistance, attempt to rotate your involved hand inward (palm down) for seven seconds. Relax and increase the stretch, locking into each new position. Perform as directed.



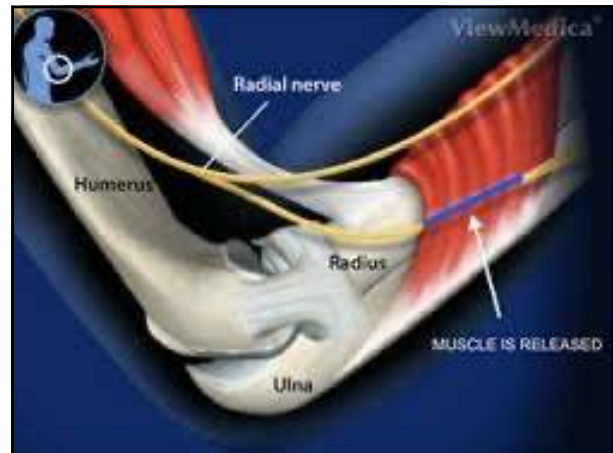
119

Radial Tunnel Syndrome

120

Radial Tunnel Syndrome

Symptoms generated from *irritation or compression of the radial nerve* in the posterior forearm somewhere between the radiocapitellar joint and the supinator muscle



121

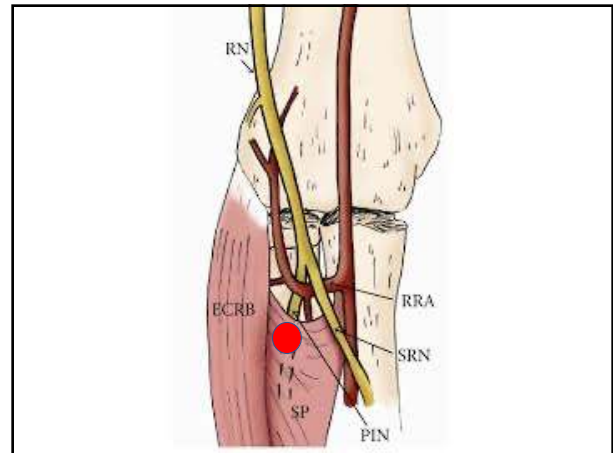
122

Supinator

Origin: Lateral epicondyle of humerus, supinator crest of ulna

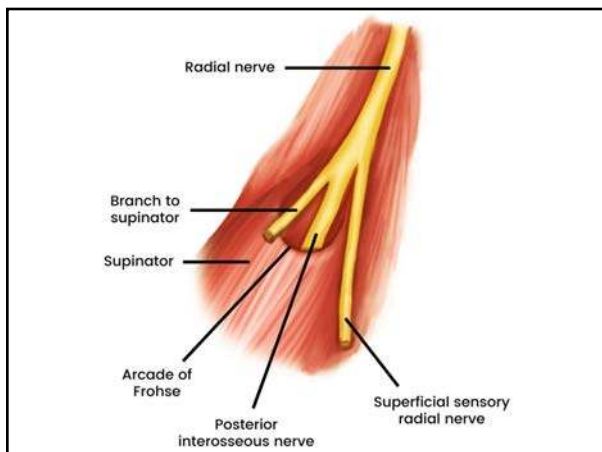
Insertion: Lateral surface and posterior border of radius

Action: Supinates forearm



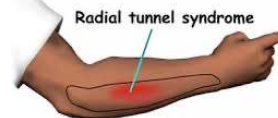
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124



125

Superficial Sensory Branch



- Pain, paresthesia, or diminished sensitivity along the dorsal aspect of the forearm
- Sometimes radiating to the hand, including the first web space and back of the thumb and index finger.
- Deep, aching, and diffuse and frequently mimic lateral epicondylopathy.

126

Posterior Interosseous Branch



- Weakness of metacarpophalangeal joint extension and thumb extension, also called “finger drop.”
- Wrist extension is generally not affected as noticeably because of cross-innervation.

127

RTS Causes

Overuse/ Repetitive:

- Wrist extension
- Pronation
- Supination



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Radial Tunnel Syndrome

My Version My Notes

Evaluation	Management	Exercises (Phase 1)
Radial Tunnel Compression	STM- Brachioradialis	Radial Nerve Floss
Resisted Long Finger Extension Test	STM- Wrist Extensors	Clasp Stretch
Resisted Forearm Supination Test	STM- Supinator	Wrist Extensor Stretch- Table
Radial Nerve Test	Manipulation-Cervical and Thoracic	Brachioradialis Stretch
	Nerve Release- Radial Nerve at the Elbow	Supinator Stretch
	Nerve Floss- Radial	

129

Radial Tunnel Compression

The examiner rolls their fingers perpendicularly over the radial nerve, approximately four finger breaths distal to the lateral epicondyle. Elicitation of local tenderness or radicular complaints along the course of the radial nerve suggests radial nerve irritation or Radial Tunnel Syndrome.



130

Basics of Orthopedic Assessment

- Push it
- Pull it
- Make it work



131

Radial Nerve Test

The patient is lying supine with their elbow flexed to 90 degrees, fingers pointing upward. The clinician uses their thigh to depress the patient's shoulder and extends the patient's elbow. The clinician fully internally rotates the patient's straightened arm, then flexes their wrist and thumb. The clinician maintains this wrist/ elbow position and abducts the patient's straightened arm toward 90 degrees. If complaints are reproduced, the clinician may release shoulder depression to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues.



132

Resisted Long Finger Extension

With the patient's forearm and fingers extended, the examiner resists middle finger extension. Reproduction of radial nerve pain during this test suggests compression of the radial nerve by the extensor carpi radialis brevis. This test may also be positive in lateral epicondylitis but **radial tunnel irritation is the likely diagnosis when this test is more painful than passively flexing the fingers and wrist of an extended elbow**, aka Middle Finger Sign.



133



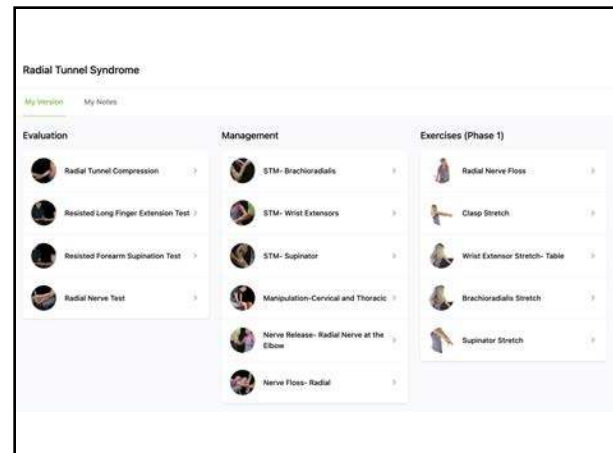
134

Resisted Forearm Supination Test

With the patient's arm and wrist in extension, the examiner resists forearm supination. Reproduction of radial nerve symptoms suggests compression of the radial nerve at the Arcade of Froese, i.e. Radial Tunnel Syndrome/Supinator Syndrome.



135



136

Management

- Activity modification/ Rest
- Anti-inflammatory measures; ice, NSAIDS
- E-stim, Ultrasound
- STM
- Nerve flossing
- Cervicothoracic manipulation

137

STM- Wrist Extensors

The wrist extensor muscle group consists of the extensor carpi radialis longus and brevis, extensor digitorum, and extensor carpi ulnaris. The wrist extensors originate on the distal humerus and lateral epicondyle and attach to the metacarpals and phalanges. The combined action of the muscles includes wrist extension. Trigger points commonly develop in muscle bellies. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. IASTM is an alternate means of stripping the muscle. Movement stripping may be performed by contacting the muscle trigger points and applying pressure while passively moving the muscle from a shortened state into elbow extension and wrist flexion. Contract/relax stretching is performed by tensioning the muscle, then asking the patient to extend their wrist against resistance, followed by increased stretch.



138

STM- Supinator

The supinator muscle originates on the lateral epicondyle and proximal ulna and attaches to the proximal radius. The action of the muscle includes forearm supination. Trigger points commonly develop in muscle belly. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. IASTM is an alternate means of stripping the muscle. Movement stripping may be performed by contacting the muscle trigger points and applying pressure while passively extending the elbow and pronating the wrist. Clinicians should recognize the presence of the Radial nerve in this region and be judicious when performing STM. Contract/ relax stretching is performed by tensing the muscle, then asking the patient to supinate their forearm against resistance, followed by increased stretch.



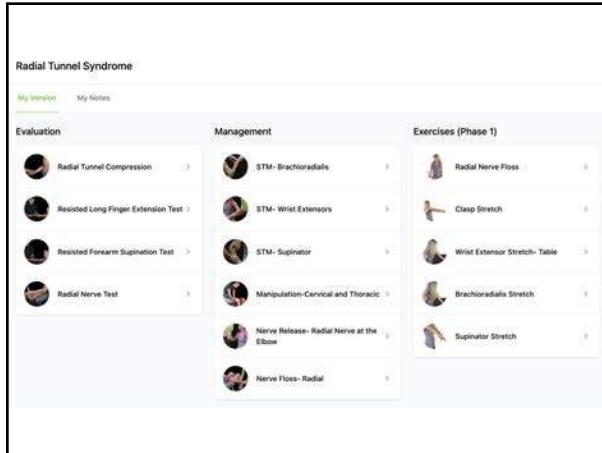
139

Nerve Release - Radial Nerve at the Elbow

Entrapment of the radial nerve at the elbow is termed "Radial tunnel syndrome". Compression of the posterior interosseous branch beneath the arcade of Froese is sometimes referred to as "Supinator syndrome" and accounts for almost 70% of all radial tunnel presentations. Other sites of entrapment include the distal border of the supinator muscle and beneath the origin of the extensor carpi radialis brevis muscle. Compression may result in radiating pain or paresthesia into the lateral forearm and radial dorsal hand. Nerve release may help resolve adhesions and restore normal mechanical function. The patient should be seated or lying supine with their arm at their side. The affected arm should be in slight elbow and wrist flexion. Contact the site of adhesion and tension the supinator distally and medially while slowly extending the elbow, pronating the forearm, and passively flexing the wrist and fingers. Mobilization should be done 4-5 times consecutively without eliciting lasting symptoms in the distribution of the nerve. Alternately, IASTM may be utilized judiciously in a proximal to distal stroking fashion. Clinicians should avoid "strumming" nerves.



140



141

Wrist Extensor Stretch

Begin standing with your arm straightened in front of you at chest level. Keep your elbow straight and flex your wrist so that your fingers are pointed toward the floor. With your opposite hand, grasp the back of your hand and bend your wrist and fingers downward into flexion. You may rotate your wrist toward your small finger to further increase the stretch. Against the resistance of your opposite hand, attempt to straighten your wrist for seven seconds. Relax and stretch your wrist and fingers further. "Lock in" to this new position and repeat three contract/relax cycles twice per day or as directed.



142

Radial Nerve Floss

Begin in a standing position with your head straight and your affected hand on your chest. Simultaneously tip your head toward the opposite side while straightening your affected elbow and rotating your hand/wrist into a "Butler tip" position. You may increase this floss by "dropping" your affected shoulder at the start of each repetition. Perform three sets of 10 repetitions twice per day or as directed.



143

Supinator Stretch


Begin with your affected arm straightened in front of you, palm down. Stack your other hand, palm down, on the back of your affected hand. Clasp the fingers and thumb of your upper hand around your lower hand and twist your lower hand so that your lower thumb is pointing downward. Against the resistance of your top hand, attempt to rotate your affected palm back upward for 7 seconds. Relax and use your unaffected hand to increase the stretch. "Lock in" to this new position and repeat 3 contract relax cycles, twice per day or as directed.



144



145



"63.2% of limbs with lateral epicondylitis had an associated sensory disturbance of the superficial radial nerve [i.e., radial tunnel syndrome]."

Satake H, Naganuma Y, Honma R, Shibuya J, Maruyama M, Takagi M. The Effect of Elbow and Forearm Position on the Resisted Wrist Extension Test and Incidence of Sensory Disturbance of the Superficial Radial Nerve in Patients with Lateral Epicondylitis. The Journal of Hand Surgery (Asian-Pacific Volume). 2022 Aug 11;27(04):665-71.

146

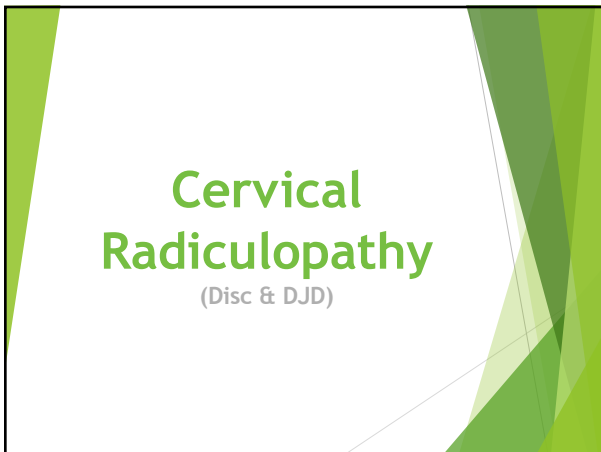
Tennis Elbow vs. Radial Tunnel Syndrome		
	Lateral Epicondylitis	Radial Tunnel Syndrome
Peak Tenderness	Lateral epicondyle	4 cm distal to the lateral epicondyle
Paresthesia & Hypoesthesia	Uncommon	Common along the dorsal forearm, sometimes radiating to the hand, 1st web space, or back of the thumb and index finger
Nocturnal symptoms	Possible	Common
Motor weakness	None	Weakness of wrist extension, metacarpophalangeal joint extension, or thumb extension can occur in significant cases
Middle finger sign	Negative/ Mild	Positive
Winkler test	Negative	Positive (in significant cases)
Radial nerve test	Negative	Positive
Mills test	Positive	Negative
Cosman test	Positive	Negative
EMG	Indicated	Indicated
Myofascial	100% of the lateral epicondyle EMG of the extensors and supinator	None release and nerve flex of the radial nerve EMG of the brachioradialis, extensors, and supinator
Counterforce brace	Yes	No
Exercises	Self-mobilization, wrist extension stretch, eccentric strengthening, Tyler test	Radial nerve flex, clasp stretch, brachioradialis stretch, supinator stretch, wrist extension stretch

147

Clinical Pearls

- *Radial nerve compression occurs most commonly (70%) beneath the proximal edge of the supinator muscle at the **Arcade of Froese**.
- * 10% of patients with lateral epicondylitis have **co-existent radial tunnel syndrome**.
- * 70% of patients with lateral elbow pain demonstrate symptoms or positive clinical findings in the **cervical or upper thoracic** regions.
- * Use of a **counterforce brace is contraindicated** for radial tunnel patients.
- * **Nocturnal pain** is common in radial tunnel syndrome but not in lateral epicondylitis.

148



149

Rule in Cervical Radiculopathy

- Spurling test
- Distraction test
- Upper-Limb Tension Test 1
- Ipsilateral cervical rotation <60 degrees. (2)

4 positive- 90% probability of cervical radiculopathy
3 positive- 65% probability

• Wainner RS, Fritz JM, Irrgang JJ, Boninger ML, Delitto A, Allison S. Reliability and diagnostic accuracy of the clinical examination and patient self-report measures for cervical radiculopathy. Spine 2003; 28(1):52-62
 • Rubinstein SM, Pool JJ, van Tulder MW, Riphagen II, de Vet HC. A systematic review of the diagnostic accuracy of provocative tests of the neck for diagnosing cervical radiculopathy. Eur Spine J. 2007; 16: 307-319.

150

Spurling's Test

Standing behind a seated patient, the clinician laterally flexes the patient's head and applies a compressive downward force. The test may also be performed with the addition of slight contralateral rotation. Reproduction of arm pain is positive for radiculopathy. Ipsilateral local pain may arise from facet irritation. Also called Lateral Foraminal Compression.



151

Cervical Distraction

On a seated or supine patient, the clinician grasps the patient's head and applies progressive traction, up to 30 lbs. Relief of arm pain is suggestive of radiculopathy.



152

Shoulder Abduction Sign

Relief of radicular symptoms is noted when the patient places their symptomatic arm on top of their head. Suggestive of cervical spondylosis or disc lesion. (aka Bakody Sign)



153

Median Nerve Test

The clinician stabilizes the top of the supine patient's shoulder with one hand and grasps the patient's hand with the other. The patient's elbow is flexed to about 90 degrees, forearm supinated, fingers pointing upward. The clinician "walks" the patient's arm into 90 degrees of abduction, then extends the patient's wrist, then fully externally rotates the patient's shoulder. The clinician then extends the elbow. If complaints are reproduced, the clinician may remove wrist extension or have the patient ipsilaterally flex their neck to remove nerve tension (helping to differentiate between nerve irritation vs (non-neural) irritation of neighboring soft tissues).



154

Neurologic Evaluation

Level	Root	Sensory	Motor	Reflex
C0/1	C1	None		
C1/2	C2	Head		
C2/3	C3	Upper neck		
C3/4	C4	Lower neck		
C4/5	C5	Lateral upper arm	Shoulder abduction, elbow flexion	Biceps
C5/6	C6	Thumb & index finger	Elbow flexion, wrist extension	Brachioradialis
C6/7	C7	Posterior forearm, middle finger	Elbow extension, wrist flexion, finger extension	Triceps
C7/T1	C8	5th finger	Finger flexors	
T1/2	T1	Medial arm	Interossei	

155

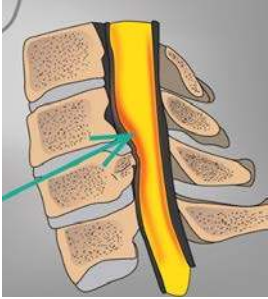


90% of symptomatic disc herniations occur at C5-6 or C6-7.

Constantoyannis C, et al. Intermittent cervical traction for cervical radiculopathy caused by large-volume herniated disks. Journal of manipulative and physiological therapeutics. Mar 1;25(3):188-92.

156

Myelopathy Symptoms




- Gait changes
- Loss of hand dexterity
- Frequent falls
- Bowel or bladder dysfunction

157

Myelopathy Signs


- Hyperreflexia
- Diffuse weakness
- Spasticity
- Pathologic reflexes (Ankle clonus, Babinski sign, Hoffman sign, and Lhermitte's test)



158

Pathologic Reflexes


- Ankle Clonus
- Babinski Sign
- Hoffman Sign
- Lhermitte's



159


Pathologic Reflexes

- Ankle Clonus
- Babinski Sign
- Hoffman Sign
- Lhermitte's



160


Ankle Clonus



The patient is seated or supine with their knee slightly flexed. The clinician gently plantarflexes and dorsiflexes the patient's ankle and then briskly dorsiflexes the ankle to stretch the Achilles tendon, holding that position for several seconds. Involuntary rhythmic plantarflexion and dorsiflexion of 2-3 "beats" signifies a pathologic reflex suggesting upper motor neuron pathology.

161

Babinski



The clinician firmly strokes the sole of the patient's foot, from heel to toe, with a bluntly pointed reflex hammer. No reaction or "Downgoing" toe flexion are normal responses. "Upgoing" great toe extension and toe "fanning" is indicative of a pathologic reflex suggesting upper motor neuron lesion involving the corticospinal tract. This reflex is normally present in children under the age of two. AKA Babinski reflex, Plantar reflex.

162

Hoffman's Sign



The clinician pinches the patient's middle finger tip and quickly "flicks" it into a flexed position. Involuntary thumb adduction and finger flexion by the patient is a pathologic reflex suggesting upper motor neuron lesion from spinal cord compression. The reflex may be exacerbated by positioning the patient's neck in extension, or in some cases flexion. AKA Hoffman's reflex

163

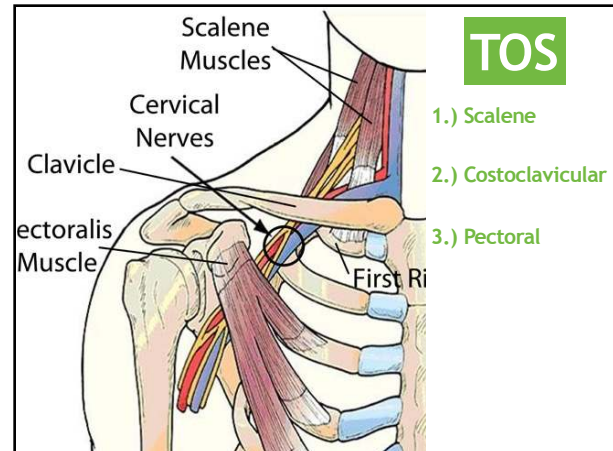
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164

Thoracic Outlet Syndrome

165



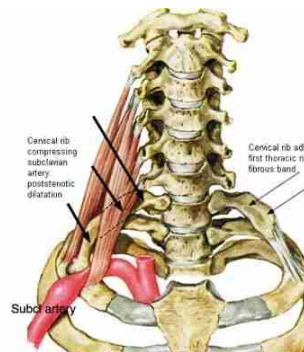
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- Ages of **20-60**
- Peak incidence in the **fourth decade**
- More common in **women- up to 9:1**



167

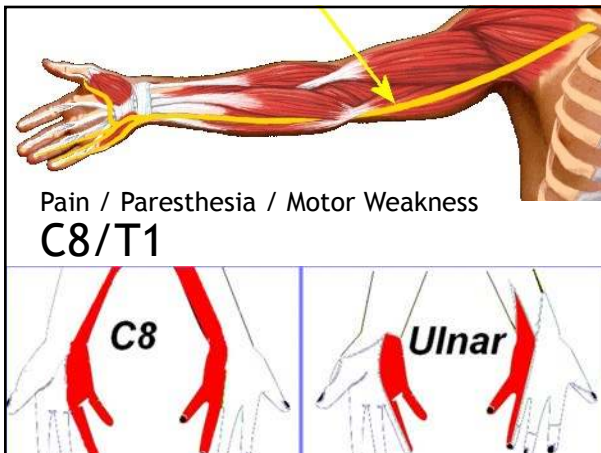
Cervical Rib?



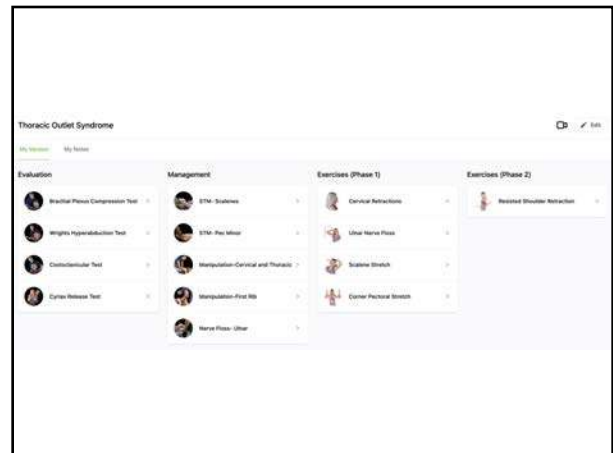
<1% of the Population

Bilateral in 80%

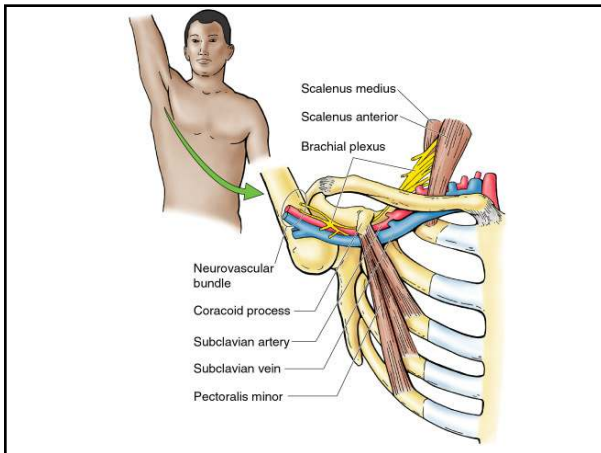
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169



170



171

Brachial Plexus Compression Test

Positive when deeper palpation of the supraclavicular fossa elicits distal symptoms.

Positive in up to 68% of TOS patients. aka Morley test

172

Costoclavicular Test

Clinician monitors radial pulse while the patient is seated with shoulder in extension, chest in exaggerated military posture. This maneuver is believed to compress the costoclavicular space. A positive test results in diminution of pulse intensity and reproduction of distal symptoms.

173

Wright's Test

The clinician monitors the patients radial pulse while the seated patients arm is taken into in hyperabduction and external rotation. A positive test results in diminution of pulse intensity and reproduction of distal symptoms. Reproduction of TOS complaints implicates pectoral involvement. aka stress hyperabduction test.

174

Cyriax Release Maneuver

The clinician stands behind the seated patient and grasps beneath both forearms, holding the elbows at 80 degrees of flexion with the forearms and wrists neutral. The clinician leans the patient's trunk posteriorly then passively elevates their shoulder girdles. This position is held for up to 3 minutes. A positive result includes either symptom reproduction or paresthesia secondary to a neurovascular release phenomenon.

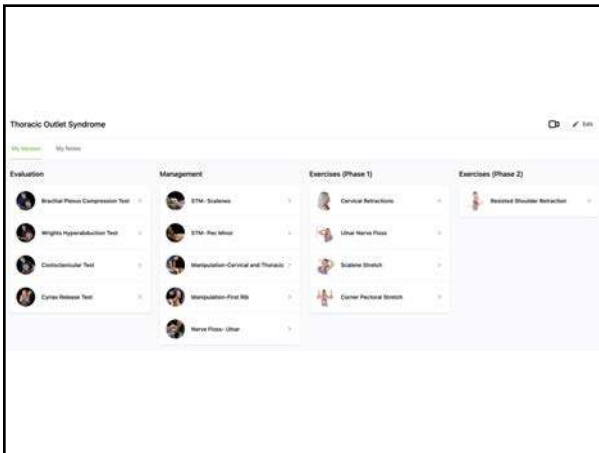


175

C/S vs. TOS



176



177

Ulnar Nerve Floss

The ulnar nerve provides sensation to the medial forearm and 4th/5th digits. Adhesions along the course of the nerve may develop secondary to any traumatic or inflammatory process. "Nerve flossing" may help release adhesions and restore normal neurodynamics. Ulnar nerve flossing is performed by laying supine with the shoulder elevated and elbow extended. The patient is asked to slowly depress the shoulder and internally rotate their arm with fingers and wrist in extension. The arm is externally rotated and passively stretched into elbow flexion. The shoulder is then abducted and flexed. Flossing motions should not create or intensify any radicular complaints. The flossing pattern should be repeated 10 times, from the starting position to the end position. The patients may benefit by continuing self-flossing exercises at home.



178

STM- Pec Minor

The pectoralis minor muscle originates on ribs 3-5 and attaches to the coracoid process. The actions of the muscle include scapular depression and rotation. Trigger points commonly develop in the muscle belly. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. Movement stripping may be performed by contacting the trigger points and applying pressure while passively moving the muscle from a shortened to lengthened state.



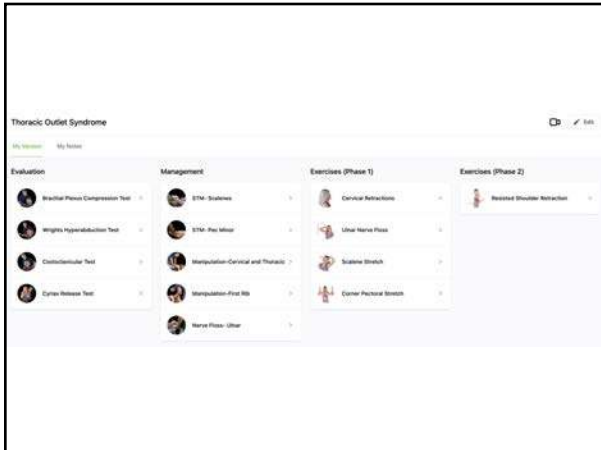
179

STM- Scalenes

The scalene muscles (anterior, middle and posterior) originate on the transverse processes of C2-7 and attach to the first and second rib. The actions of the muscle include lateral flexion of the cervical spine and assistance with inspiration. Trigger points commonly develop in the inferior muscle bellies. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. Clinicians should recognize the presence of the Carotid artery in this region and be judicious when performing STM. Care should be taken to avoid carotid sinus stimulation. Movement stripping may be performed by contacting the trigger points and applying pressure while passively moving the muscle from a shortened to lengthened state. Contract/ relax stretching is performed by tensioning the muscle, then asking the patient to laterally flex their head against resistance, followed by increased stretch.



180



181

Cervical Retractions

Sit or stand looking forward with good posture. Tuck your chin to create a double chin. Hold this position for 3-5 seconds. Return to the starting position. Focus your vision on a spot on the wall to avoid neck flexion or extension. To progress, place a finger on your chin, and apply backwards pressure at end range. Imagine that your head is on drawer slides. Keep your mouth closed. Perform 1 set of 10 repetitions 3-10 times per day. Alternately, this exercise may be performed standing with your back against a wall. Your buttocks and shoulder blades should be in contact with the wall. Tuck your chin to make a "double chin" until the base of your skull contacts the wall, relax and repeat as directed.



182

Ulnar Nerve Floss

Hold your arm in front of you with your elbow, wrist, and fingers straight as though you are getting ready to shake hands. Touch the tips of your thumb and first finger together to make a ring. Slowly flex your elbow until your hand reaches your face. The ring position should be maintained and your forefinger should be just beneath your eye socket. Slowly raise your elbow to flip the ring up into a "monacle" around your eye. Lower your arm back to the starting position and repeat 10 repetitions three times per day or as directed.



183

Scalene Stretch

While sitting or standing, reach down with your right arm, grasping your thigh or the bottom of a chair for stability. While looking straight ahead, place your left hand on top of your head, and gently pull your head sideways toward the left. Against the resistance of your hand, attempt to laterally flex your right ear toward your right shoulder for seven seconds. Relax and stretch further toward the left. "Lock in" to each new position, and do not allow any slack. Repeat three contract/relax cycles on each side twice per day or as directed.



184

Corner Pectoral Stretch

Begin standing, facing a corner with your palms on the walls above head level. Step toward the corner and "lean in" to stretch your chest muscles. Against the resistance of the wall, attempt to push your hands into the wall and toward each other for 7 seconds. Relax and "lean in" to increase the stretch. Lock into this new position and repeat 3 contract/relax cycles, twice per day or as directed.

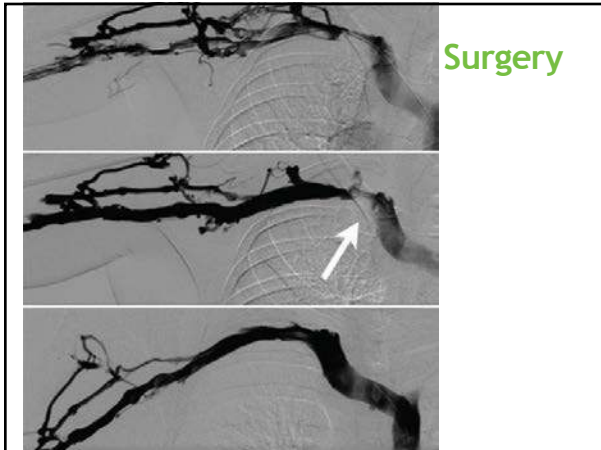


185

- Avoid carrying heavy loads
- Heavy shoulder bags should be lightened
- Workstation modification
- Bra straps may need additional padding or sports bra



186



Surgery

187

*Weakness, coldness, fatigability, and diffuse arm pain may be **arterial TOS** and should be referred out. (<1%)

* Repetitive arm abduction creating edema, cyanosis, and venous dilation may be a sign of **venous TOS** (<5%)

* Symptoms follow an **ulnar** distribution 90% of the time.

* TOS is more common in **women** with some estimates as high as 9:1

* Clinicians should assess for potential **double crush** partners. i.e. cubital tunnel, carpal tunnel, etc.

* Up to **23%** of **cervical soft tissue injuries** may include a TOS component.

Clinical Pearls

188

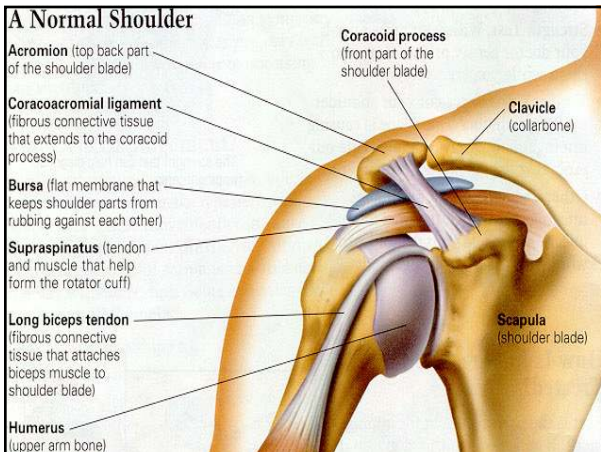


189

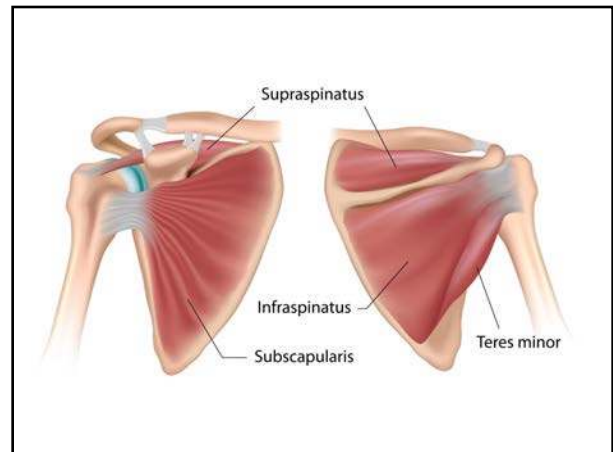
The Shoulder Dysfunction Continuum

- Scapular Dyskinesia
- Anterior Impingement Syndrome
- Rotator Cuff Tear
- Rotator Cuff Rupture

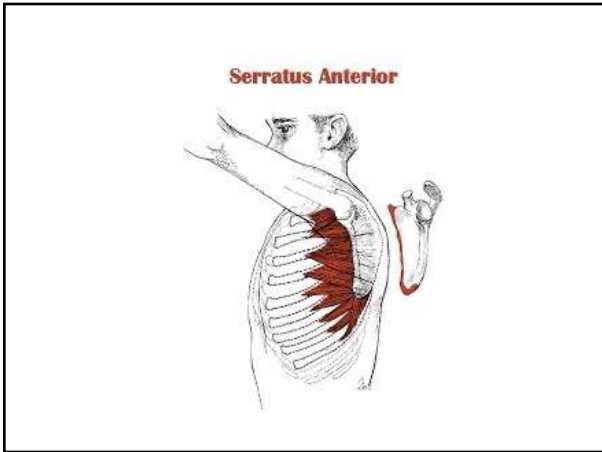
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191



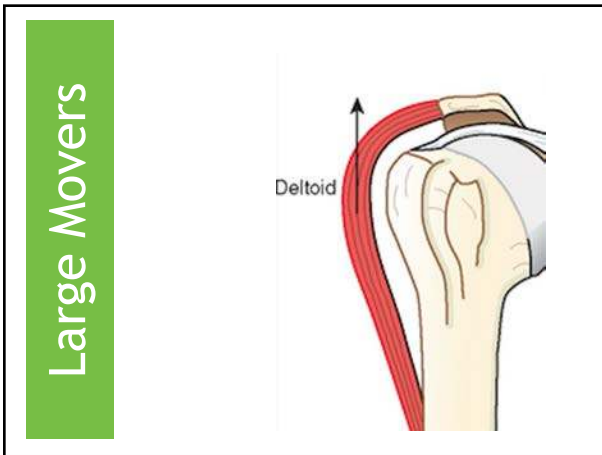
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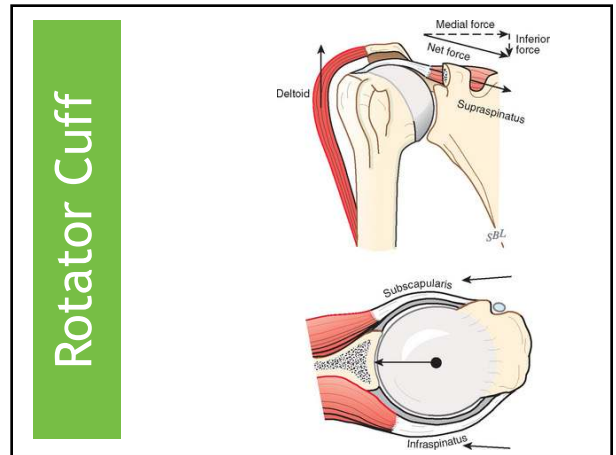
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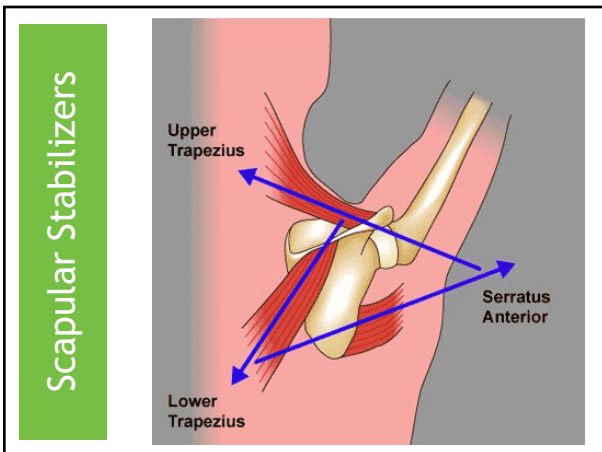
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195




196



197

“SICK” Scapula

- **S**capular malposition
- **I**nferior angle prominence
- **C**oracoid tenderness/malposition
- **dysK**inesis



198

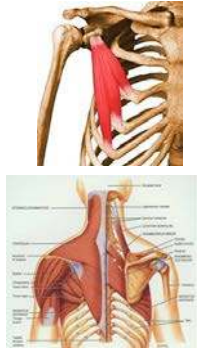
Scapular Dyskinesia (SD)

Tightness:

- Pec
- Biceps (short head)

Weakness:

- Lower trapezius
- Serratus anterior

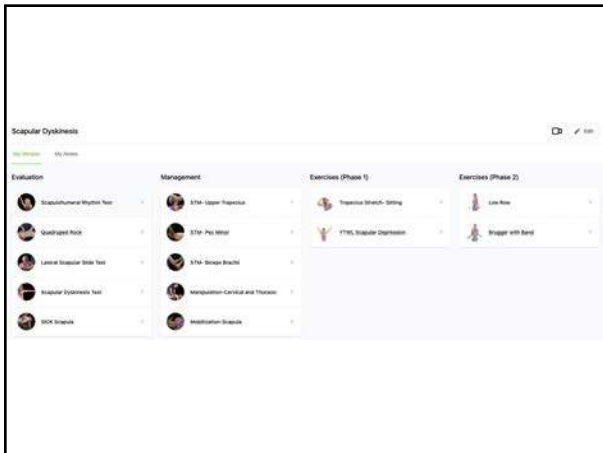


199

SD Symptoms

- Pain in the anterior or posterosuperior aspect of the shoulder
- May radiate inferiorly toward the lateral deltoid or superiorly into the trapezius region
- Pain over the coracoid (pec minor tightness)

200

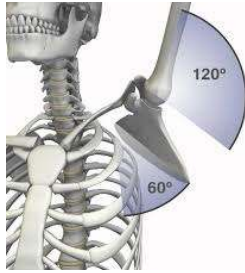


The screenshot shows a clinical management plan for Scapular Dyskinesia. It is organized into four columns: Evaluation, Management, Exercises (Phase 1), and Exercises (Phase 2). Evaluation includes tests like Scapulohumeral Rhythm Test, Quadrant Pick, Lateral Scapular Slide Test, Scapular Dyskinesia Test, and NCK Screen. Management includes techniques like STM Upper Trapezius, STM Pso Minor, STM Serratus Brachii, Manipulation Cervical and Thoracic, and Mobilization Scapula. Exercises (Phase 1) include Triceps Stretch-Sitting and YTW Scapular Depression. Exercises (Phase 2) include Low Row and Snapper with Band.

201

SD Dynamic Assessment


- Limited IR
- Scapulohumeral rhythm test
- Scapular dyskinesia test.



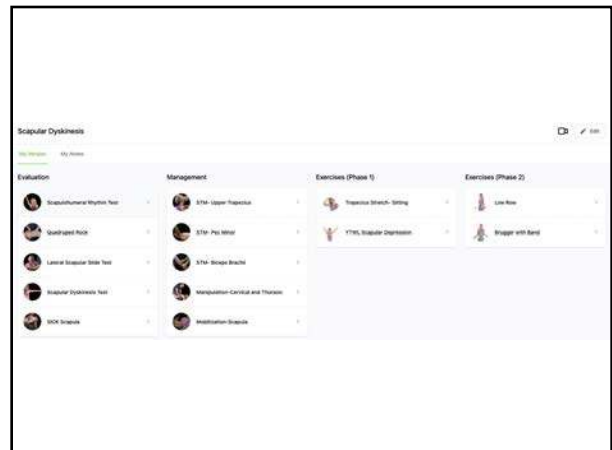
202

Scapulohumeral Rhythm Test

Observe a standing patient perform active forward shoulder abduction. The first 30 degrees of shoulder elevation should be primarily glenohumeral with minimal scapulothoracic movement. Beyond the first 30 degrees of shoulder elevation the glenohumeral and scapulothoracic joints should move simultaneously at a 2:1 ratio (180 abduction = 120 degrees of glenohumeral motion + 60 degrees of scapulothoracic motion). Palpation of the inferior pole of the scapula and acromion may be used as landmarks for measurement.



203



This screenshot is identical to the one in slide 201, showing a clinical management plan for Scapular Dyskinesia with evaluation, management, and exercise phases.

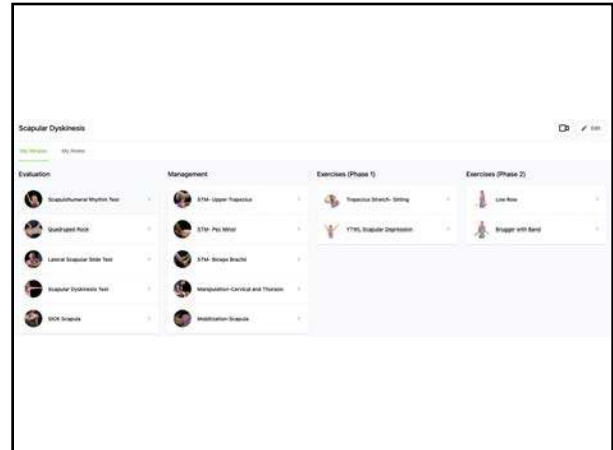
204

Scapular Mobilization

The patient is prone. The clinician supports the patients abducted and relaxed arm and stabilizes the shoulder. Scapular mobilization is performed by grasping the patient's scapula and progressively moving it superiorly, inferiorly, and laterally, to include movements of rotation and distraction from the thorax.



205



206

YTWL Scapular Depression

Stand with your straight arms raised above your head in a "Y" position. Squeeze your shoulder blades together and downward throughout the following sequence of movements. Lower your straightened arms to shoulder level, into a "T" position. Next bend your elbows so that your fingers are pointing straight up while slightly lowering your elbows to make a "W". Finally, while keeping your elbows bent 90 degrees, lower your arms to your sides so that your elbows are touching your ribs to form an "L" on each side and squeeze. Hold each position for 1-2 seconds and repeat 3 sets of 10 repetitions, twice per day or as directed.



207

Trapezius Stretch

Place your right arm behind your back and grasp your right wrist with your left hand. Laterally flex your neck to move your left ear toward your left shoulder as you pull your right arm. Against the resistance of your left hand, attempt to shrug your right shoulder for seven seconds. Relax and stretch your right arm downward as you bend your neck further toward the left. "Lock in" to this new position and perform three contract/relax cycles on each side twice per day or as directed.



208

Corner Pec Stretch

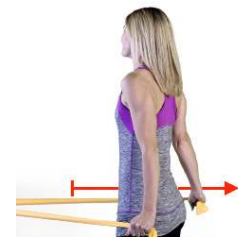
Begin standing, facing a corner with your palms on the walls above head level. Step toward the corner and "lean in" to stretch your chest muscles. Against the resistance of the wall, attempt to push your hands into the wall and toward each other for 7 seconds. Relax and "lean in" to increase the stretch. Lock into this new position and repeat 3 contract/relax cycles, twice per day or as directed.



209

Low Row

Attach the center of an elastic exercise band to a doorknob or other sturdy object in front of you. Grasp one end of the band in each hand and with straight arms at your side, stretch the band backwards. Keep your palms facing backward and arms pointed straight down throughout the exercise. Return to neutral and repeat 3 sets of 10 repetitions daily, or as directed.



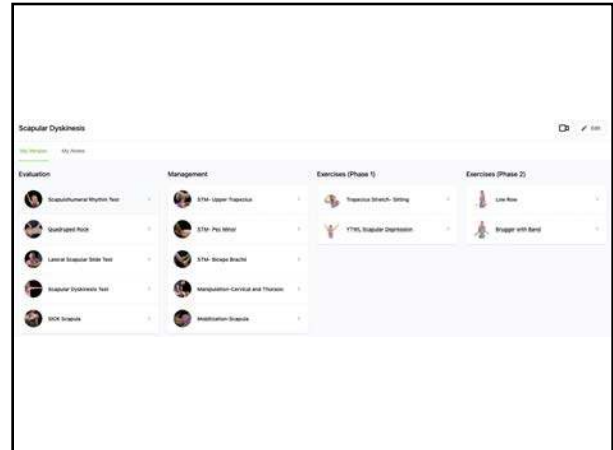
210

Brugger with Band

Begin sitting or standing with an elastic exercise band wrapped and secured around your palms. Begin with your arms at your side, elbows bent, forearm's pointing forward. Move your hands apart from each other to maximally stretch the band while simultaneously rotating your palms out, straightening your arms, and pinching your shoulder blades together as your hands move behind your hips. Return to the start position and repeat 3 sets of 10 repetitions daily, or as directed.



211



212

Shoulder Anterior Impingement Syndrome



213

Hawkins- Kennedy

Seated patient's arm placed into 90 degrees of forward flexion with 90 degrees of elbow flexion. Clinician stands in front and stabilizes patients scapula with one hand while gradually rotating patients arm downward, into internal rotation. Used to assess for impingement as well as the integrity of the rotator cuff tendons and glenoid labrum.



214

Neer Test

Clinician stands behind patient, stabilizes the scapula with one hand and grasps the patients elbow with the other hand, moving their straightened arm into forward flexion until pain is reported. Used to assess for impingement as well as the integrity of the rotator cuff tendons and glenoid labrum.



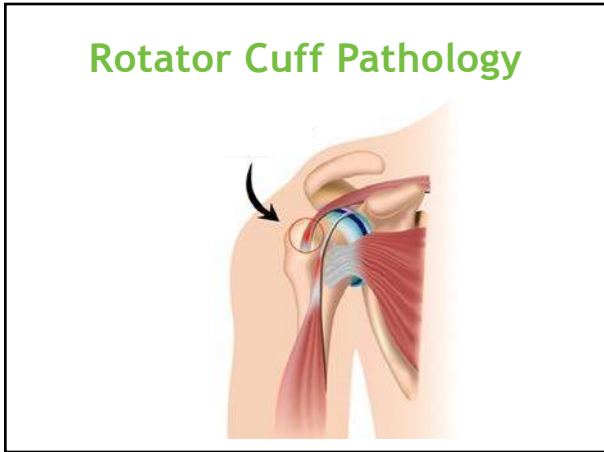
215

Empty Can

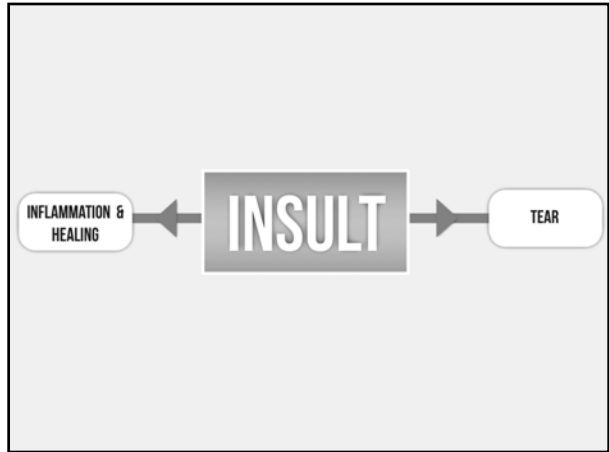
Aka Jobe Test Patients straight arm placed at 90 degrees of elevation and 45 degrees anterior to the scapular plane. Patient points thumb down (as to empty a can). Clinician stabilizes scapula and provides downward pressure on the patients outstretched arm. Pain or weakness signifies possible rotator cuff pathology involving the supraspinatus.



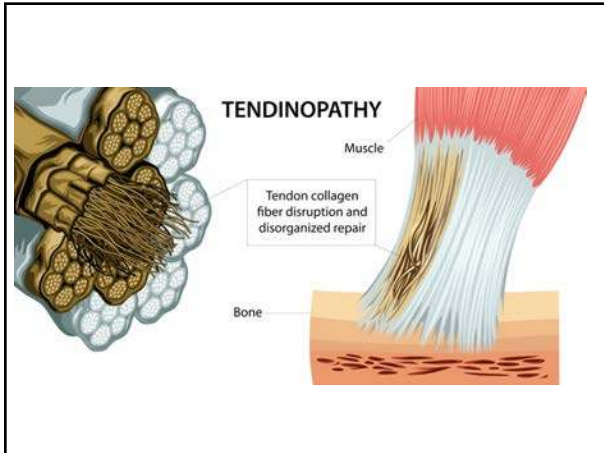
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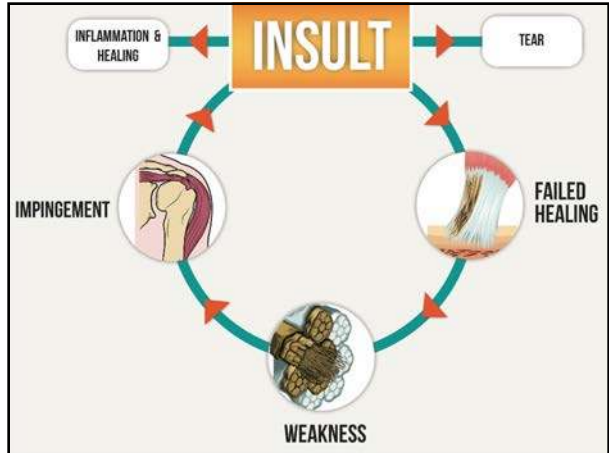
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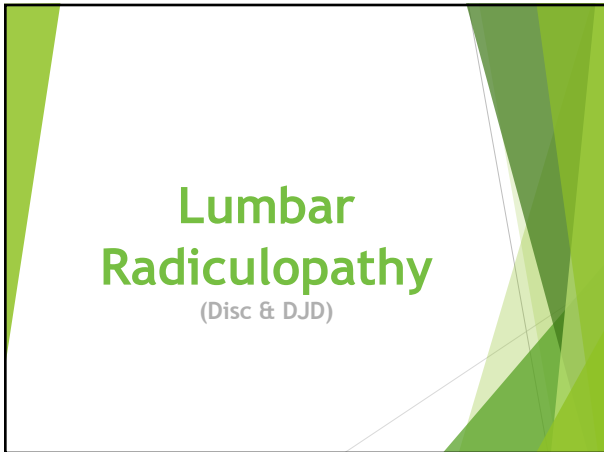
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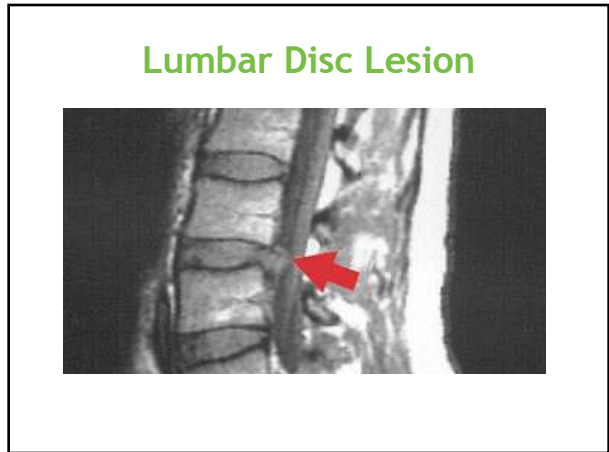
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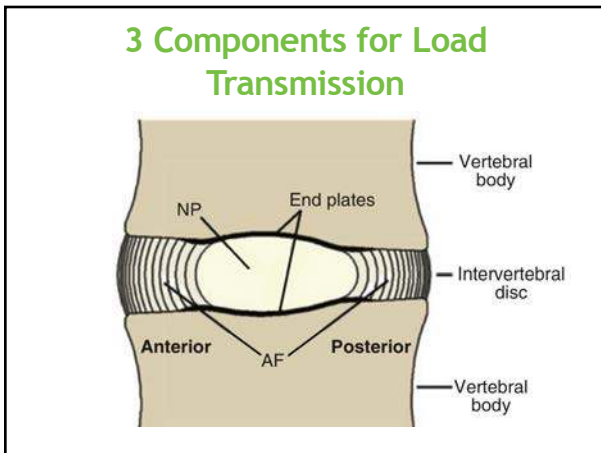
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221



222



223



224



225



226

Annulus Fibrosus

- 20-30 concentric laminated bands
- Oriented at 30° to the disc plane
- Alternating directions

The diagram shows a cross-section of the annulus fibrosus, illustrating its structure as concentric, laminated bands. The bands are arranged in a circular pattern around the nucleus pulposus.

Figure 2.3 The detailed structure of the annulus fibrosus. Collagen fibres are arranged in 10-20 concentric, circumferential lamellae. The orientation of fibres alternates in successive lamellae, but their orientation with respect to the vertical (N) is always the same, and measures about 65°.

227

“Bowing” Cartilage End-Plates

The diagram shows a cross-section of a vertebra. The 'Nucleus pulposus' is the central, oval-shaped structure. The 'Vertebral endplate' is the layer of cartilage between the vertebral body and the intervertebral disc. The 'Annulus fibrosus' is the fibrous ring surrounding the nucleus pulposus. The endplates are shown bowing inward, compressing the nucleus pulposus.

- Shock Absorption
- Transfer of Energy
- Transfer of Nutrients

228



229

Nutrition

- IVD is the largest avascular structure
- The cartilage end-plate begins to calcify with age

230

Compression to the Disc

Typically the first structure to fail due to compression is the end-plate, such failure is generally associated with an audible “pop”.

231

Endplate Fracture

Figure 4.8 Under compressive loading the nucleus pressurizes, causing the end plate to bulge into the vertebral body. With excessive radial-tensile stress the end plate will fracture and the viscous nucleus will squirt through the crack into the vertebral body.

232

Load Rate

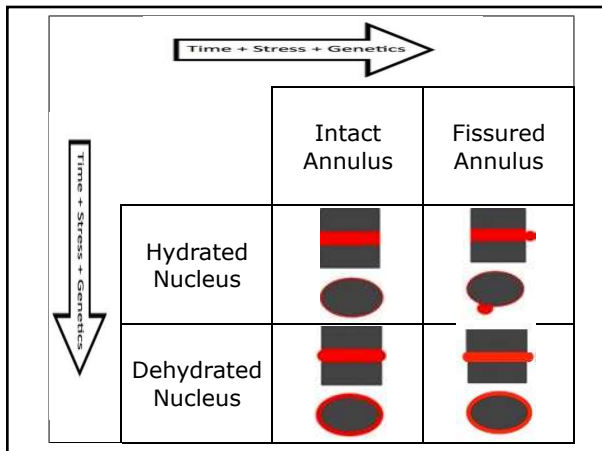
“A log-linear relationship between IVD stiffness and strain rate was observed.”

Newell N et al. Material properties of human lumbar intervertebral discs across strain rates. Spine J. 2019 Jul 18. pii: S1529-9430(19)30893-9.

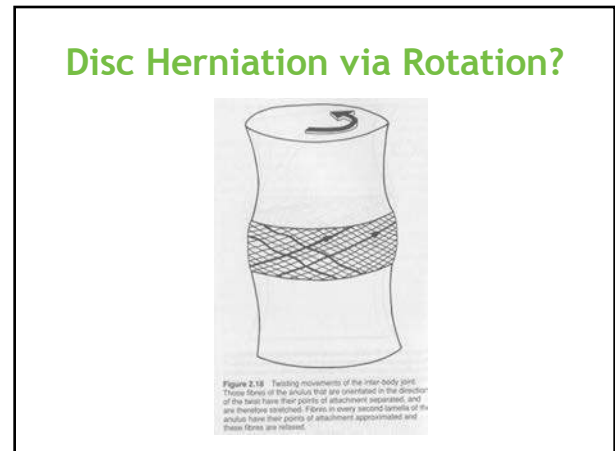
233

Bending Load to the Disc

234



235



236

“Clinicians' beliefs about the risk for acute LDH associated with chiropractic SMT varied systematically across professions, in spite of a lack of scientific evidence to inform these beliefs.”

Hincapie CA, et al. Chiropractic spinal manipulation and the risk for acute lumbar disc herniation: a belief elicitation study. [Eur Spine J.](#) 2017 Sep 18.

237

- ### Perceived Risk of Disk Herniation via Manipulation
- **Chiropractor:** 66% reduced incidence
 - **Family Physician:** Neutral
 - **Orthopedic Surgeon:** 30% increased risk

238

The risk for acute LDH with early surgery associated with chiropractic visits was no higher than the risk associated with PCP visits.

Both chiropractic and primary medical care were associated with an increased risk for acute LDH requiring ED visit and early surgery. Our analysis suggests that patients with prodromal back pain from a developing disc herniation likely seek healthcare from both chiropractors and PCPs before full clinical expression of acute LDH.”

Hincapié, C.A., Tomlinson, G.A., Côté, P. et al. [Eur Spine J](#) (2018) 27: 1526.

239

Disc Lesion Presentation

Local

- Pain, or sensory disturbances that radiate into the buttock or thigh

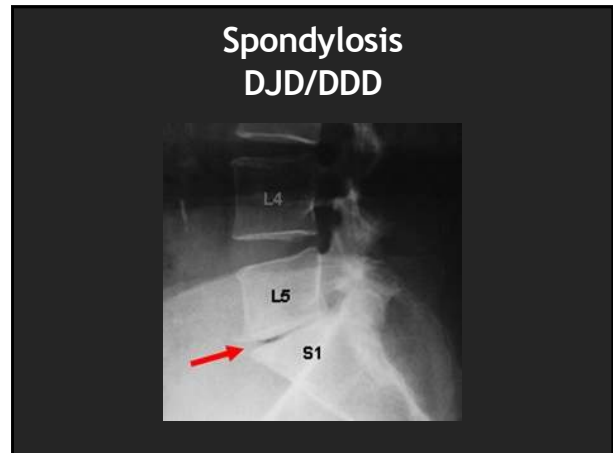
Radicular

- Sharp pain, or sensory disturbances that radiate toward the foot
- Motor deficits
- Diminished reflexes

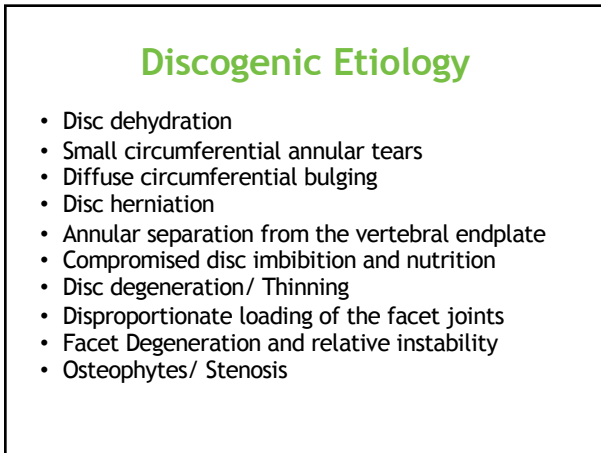
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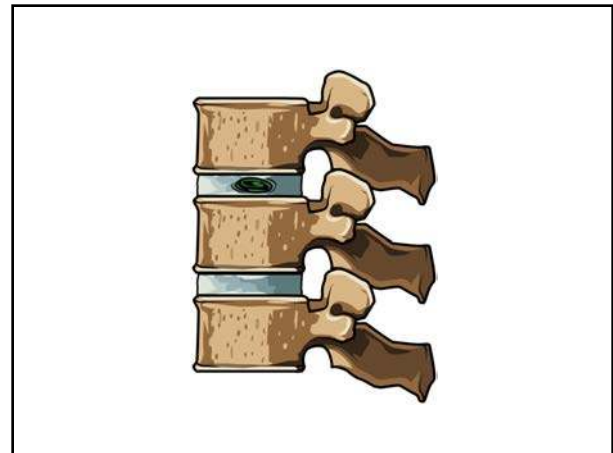
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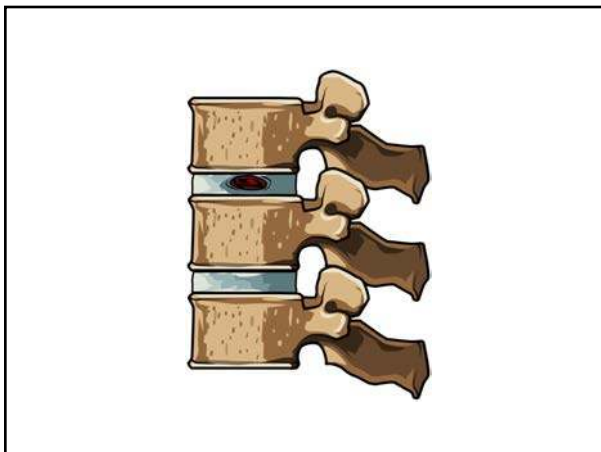
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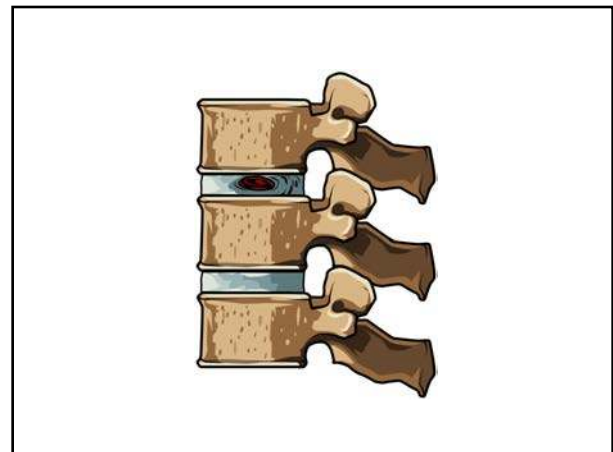
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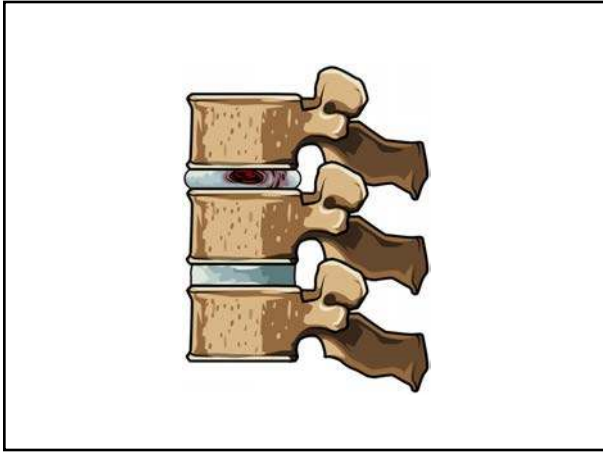
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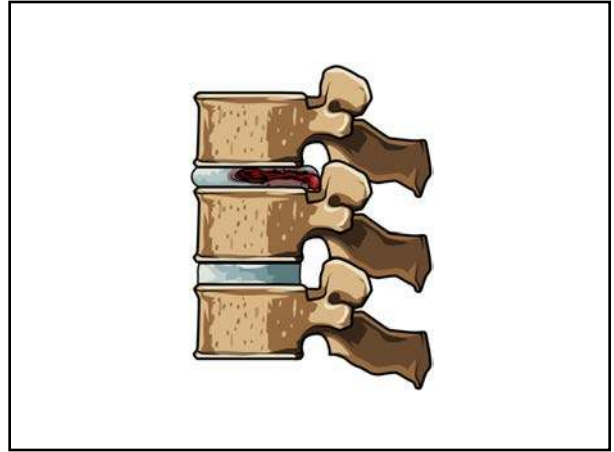
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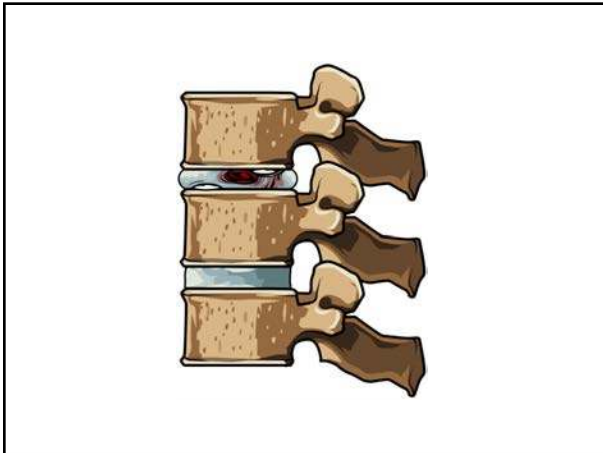
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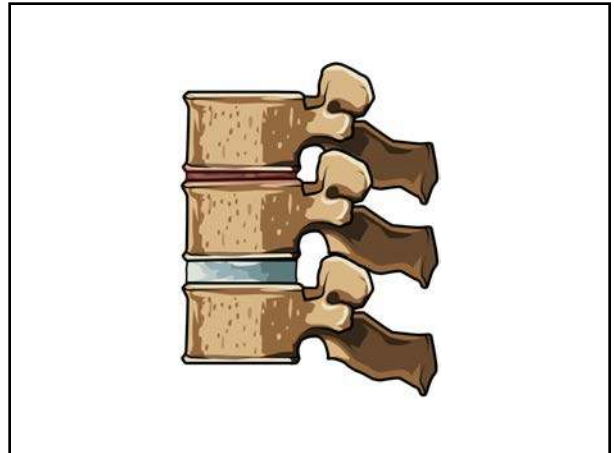
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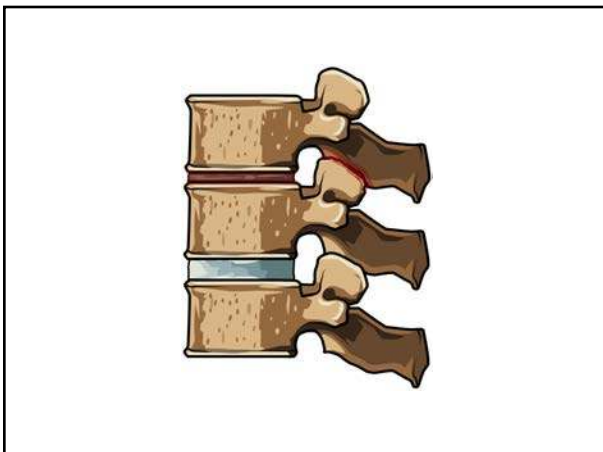
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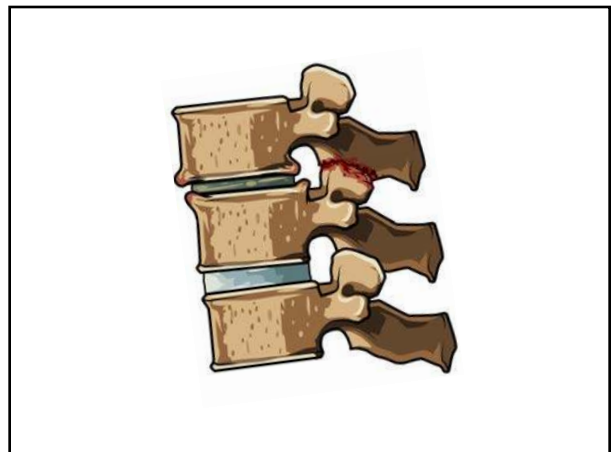
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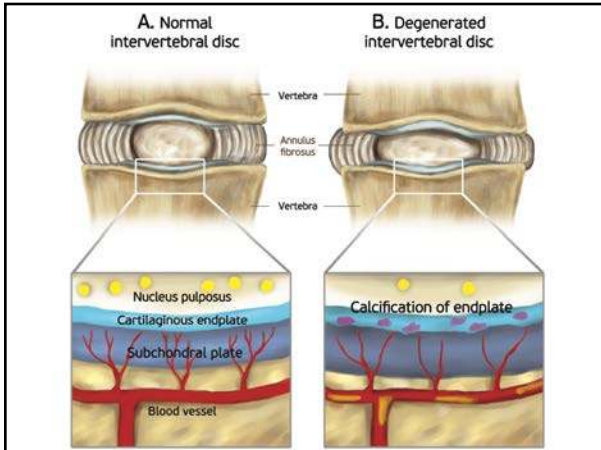
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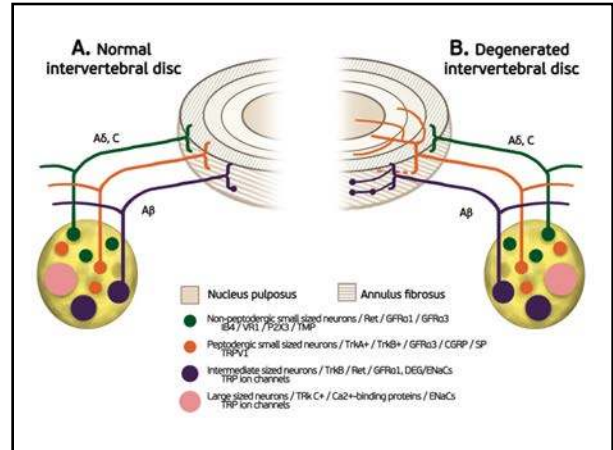
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252



253



254

Sphinx



The prone patient is instructed to perform a press-up, resting on their forearm/elbows for 15-30 seconds or until symptoms are reproduced. Hyperextension may provoke facet symptoms immediately and sustained extension may reproduce the symptoms of stenosis and neurogenic claudication. a.k.a. Prone press up.

255

Straight Leg Raise (SLR)



The clinician progressively lifts the supine patients straightened leg until symptoms are reported. Reproduction of radicular symptoms in the 30-70 degree range, suggests involvement of the L4/5 or L5/S1 nerve roots from radiculopathy or dural irritation. Also called Lasegue's Test.

256

Well Leg Raise



This test is a standard straight leg raise that reproduces symptoms in the opposite lower extremity. A positive test is strongly suggestive of radiculopathy from disc lesion. AKA *Crossed Straight Leg Raise*.

257

Braggard



This test is performed as an adjunct following a positive Straight Leg Raise (SLR). Lower the patients leg 10 degrees below the point of SLR symptom reproduction and dorsiflex the patients ankle. Reproduction of similar symptoms is a positive test indicating radiculopathy or dural tension.

258

Femoral Nerve Stretch Test



The Femoral Nerve Stretch Test is performed on a prone patient by passively extending the hip while flexing the knee. Reproduction of anterior thigh radicular complaints suggests involvement of the L2/3 or L3/4 nerve roots. This test may also elicit symptoms related to stenosis, SI and lumbar facet irritation. a.k.a. *Yeoman Test*

259

Bechterews



This test is a passive seated straight leg raise. The patient sits on the edge of a table while the clinician passively extends the knee. Reproduction of symptoms after 45 degrees of knee extension is indicative of neural irritation. Very similar maneuver to Kernig test and Flip test.

260

Milgrams



The supine patient elevates both straightened legs off of the table 6 inches and holds this position for 30 seconds or until symptoms are reproduced. This maneuver increases intrathecal pressure and reproduction of pain suggests space occupying lesion

261

Valsalva



Instruct a seated patient to "bear down" as though straining for a bowel movement. Reproduction of symptoms suggests space occupying lesion, i.e. disc bulge, osteophyte, neoplasm, etc.

262

Soto-Hall

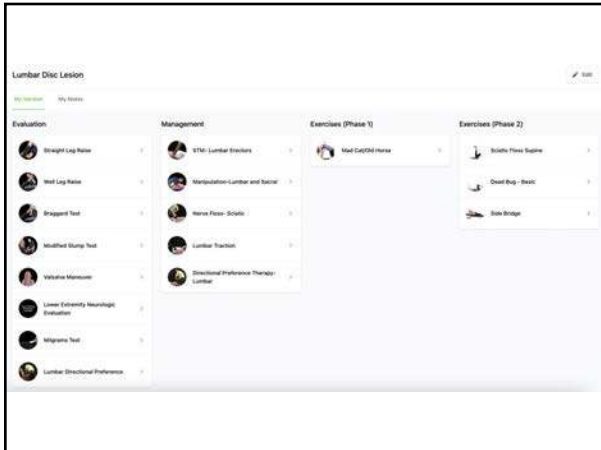


With the patient in a supine position, the clinician stabilizes their sternum with a downward pressure while passively flexing their chin toward their chest.

263

Level	Root	Sensory	Motor	Reflex
L2/3	L2	Just below groin crease		
L3/4	L3	Anterior thigh to the medial knee		
L4/5	L4	Lateral hip, Anterior thigh & leg	Quad extension (Single raise squat)	Patella
L5/S1	L5	Posterolateral thigh & leg, dorsum of the foot	Great toe dorsiflexion (Heel walk)	Medial Hamstring
S1/2	S1	Posterior thigh & leg and lateral foot	Plantarflexion (Toe walk)	Achilles

264



265

“Our results suggest that the majority of lumbar disc herniation patients (97%) are successfully managed non-operatively.”

Lilly DT, Davison MA, Eldridge CM, Singh R, Montgomery EY, Bagley C, Adogwa O. An Assessment of Nonoperative Management Strategies in a Herniated Lumbar Disc Population: Successes Versus Failures. *Global Spine Journal.* 2020 Jul 7;2192568220936217.

266

Distraction/ Traction

267

“Meta-analyses indicated that supine mechanical traction added to [manual] treatments had significant effects on pain and disability”

Vanti C, Panizzolo A, Turone L, Guccione AA, Violante FS, Pillastrini P, Bertozzi L. Effectiveness of Mechanical Traction for Lumbar Radiculopathy: A Systematic Review and Meta-analysis. *Physical Therapy.* 2020 Dec 31.

268

- **Position:** Typically lying supine with the knees and hips flexed to 90 degrees on sliding split table
- **Frequency:** 2 times per week to daily
- **Intensity:** 20-50% of body
 - Begin with the lowest amount needed to induce intervertebral separation
- **Duration:** 10-20 minutes
- **Pull:** Intermittent

269

Disc Herniation CPR for Lumbar Traction

- Sudden onset of symptoms
- Short duration of symptoms
- No segmental hypomobility
- Limited lumbar extension
- Low-level fear-avoidance beliefs

Hirayama K et al. Developing a clinical prediction rule to identify patients with lumbar disc herniation who demonstrate short-term improvement with mechanical lumbar traction. *Phys Ther Res.* 2019 Apr 20;22(1):9-16.

270

SMT produced results equal to surgical decompression in 60% of LDL patients who had failed earlier medical management population

McMorland G, Suter E, Casha S, du Plessis SJ, Hurlbert RJ. Manipulation or microdiscectomy for sciatica? A prospective randomized clinical study. J Manipulative Physiol Ther. 2010 Oct;33(8):576-84.

271



“Spinal manipulation improves [outcomes] over a period of 3 months for patients with subacute or chronic lumbar radiculopathy. Between-group analyses showed significantly better outcomes for manipulation in all measurements”

Vanti C, Panizzolo A, Turone L, Guccione AA, Violante FS, Pillastrini P, Bertozzi L. Effectiveness of Mechanical Traction for Lumbar Radiculopathy: A Systematic Review and Meta-analysis. Physical Therapy. 2020 Dec 31.

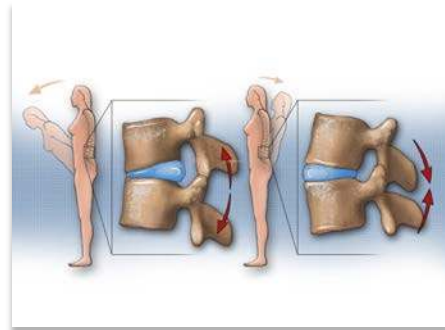
272

“We recommend the use of centralization of symptoms during physical examination.”

Peterson T, Laslett M, Juhl C. Clinical classification in low back pain: best-evidence diagnostic rules based on systematic reviews. BMC Musculoskeletal Disorders. May 12, 2017, 18:188

273

Directional Preference



274



“For disability [and pain,] there was no difference in the short, medium, or long term between physiotherapy and control interventions. There is inadequate evidence to make clinical recommendations on the effectiveness of physiotherapy interventions for people with clinically diagnosed sciatica.”

Dove L, Jones G, Kelsey LA, Cairns MC, Schmid AB. How effective are physiotherapy interventions in treating people with sciatica? A systematic review and meta-analysis. European Spine Journal. 2022 Dec 29:1-7.

275

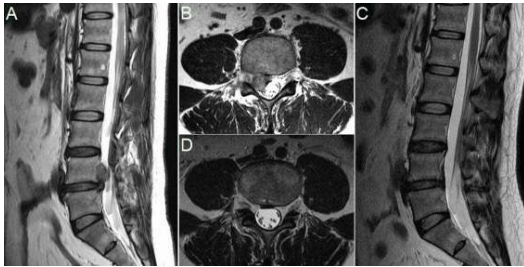
Sciatic Nerve Floss



The patient should be supine with their affected leg extended. The clinician begins by flexing the patient’s hip (SLR) while the patient holds their neck in extension until symptoms are reproduced in the leg. The patient is instructed to flex their neck as the clinician lowers the patient’s leg. Alternately, sciatic nerve floss may be performed with the patient seated. Flossing motions should not create or intensify any radicular complaints. The flossing pattern should be repeated 10 times, from the starting position to the end position.

276

67- 82% Spontaneous Resorption



Zhong M, Liu JT, Jiang H, Mo W, Yu PF, Li XC, Xue RR. Incidence of Spontaneous Resorption of Lumbar Disc Herniation: A Meta-Analysis. Pain Physician. 2017;20(1):E45-E52.

277

Recovery



Chiu CC, Chuang TY, Chang KH, Wu CH, Lin PW, Hsu WY. The probability of spontaneous regression of lumbar herniated disc: a systematic review. Clin Rehabil. 2015 Feb;29(2):184-95.

278

Maigne Syndrome

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280

Maigne Syndrome



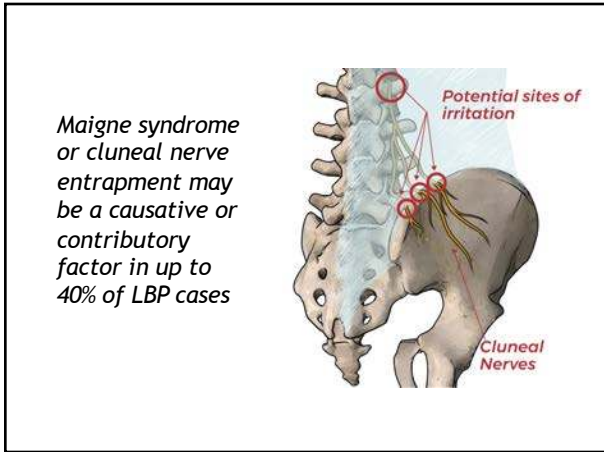
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Maigne Syndrome

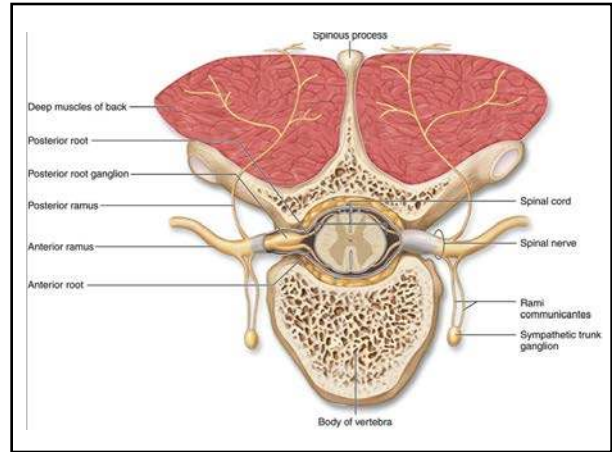


- Thoracolumbar junction syndrome
- Lumbodorsal syndrome
- Posterior ramus syndrome

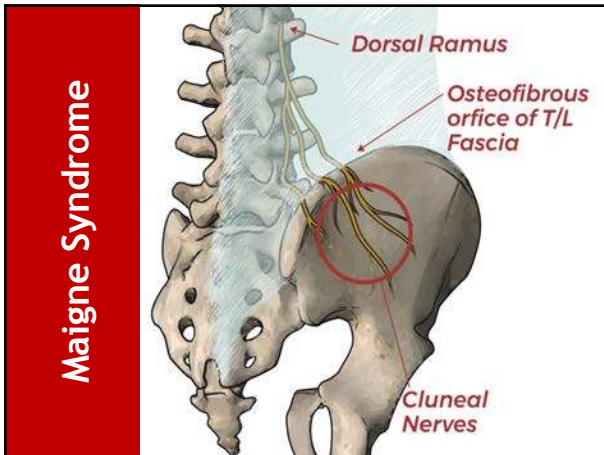
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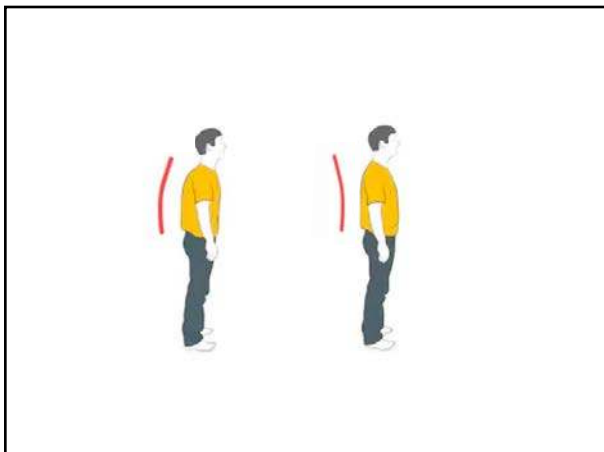
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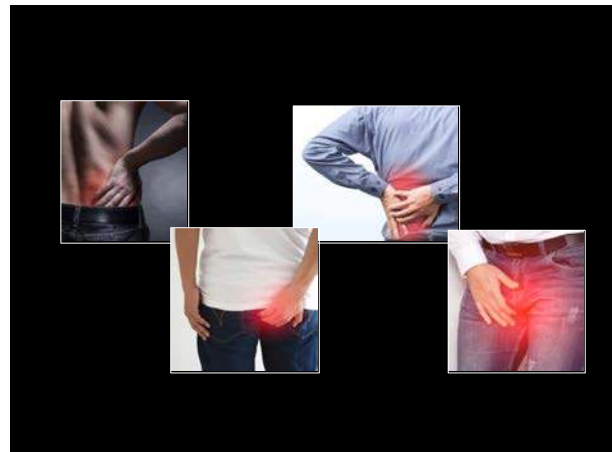
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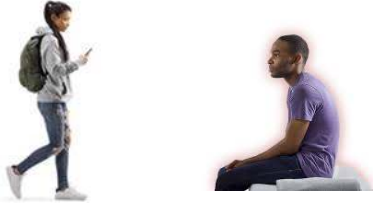
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Maigne Syndrome Complaints

- Lumbosacral pain, numbness, or paresthesia
- May refer to the iliac crest or groin



289

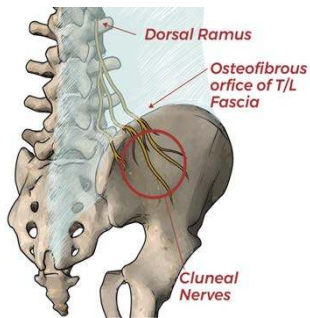
Maigne Syndrome Findings

- Contralateral bending may provide relief
- Thoracolumbar provocation maneuvers
 - Lower thoracic lateral translation
 - Deep palpation
 - Shearing of the thoracolumbar facet joints

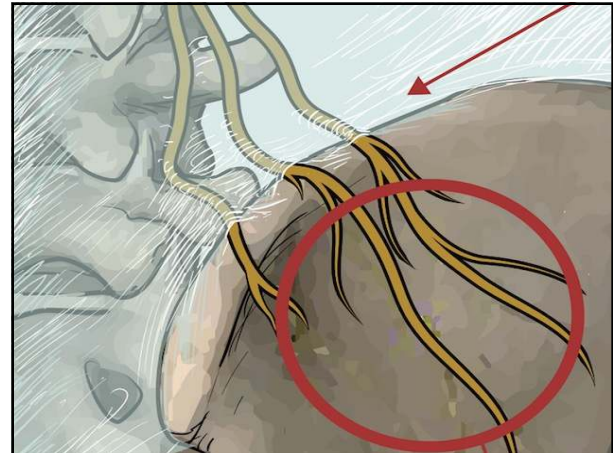


290

Palpation



291



292

Spring Test/ PA Shear



With the patient lying in the prone position, gently palpate the facet joint (Spring) or Spinous (PA shear). Using approximately 2 lbs of force, challenge the joint in a posterior to anterior direction. Each joint should be assessed individually for joint play, end feel and pain. Limited end feel or reproduction of pain is a positive test and suggests joint dysfunction at that level.

293

Sphinx



The prone patient is instructed to perform a press-up, resting on their forearm/elbows for 15-30 seconds or until symptoms are reproduced. Hyperextension may provoke facet symptoms immediately and sustained extension may reproduce the symptoms of stenosis and neurogenic claudication. a.k.a. Prone press up.

294

Kemp's



This test may be performed with the patient standing and/or seated, arms crossed on their chest. While standing behind the patient, the clinician stabilizes the lumbosacral area with one hand. The other forearm is placed across the patient's shoulders and passively moves the patient into extension, ipsilateral lateral flexion and ipsilateral rotation for 3 seconds. Axial compression may be applied to increase pressure. Local pain on the side being tested indicates facet irritation while radicular pain suggests nerve root involvement. AKA Lumbar Quadrant Test

295

Modified Slump Test



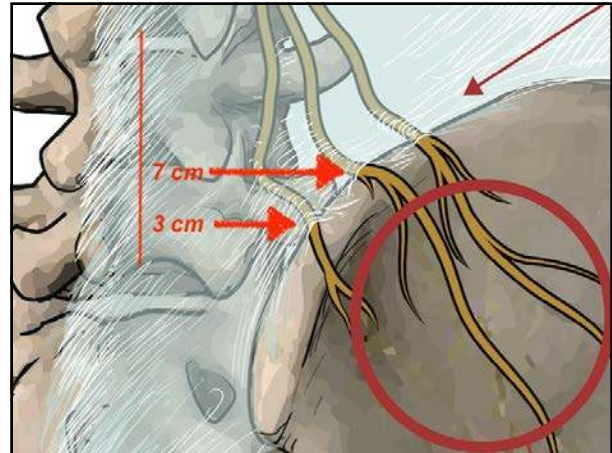
The modified slump test combines most provocative neural tension maneuvers into a single test by performing a seated bilateral SLR with ankle dorsiflexion, trunk & neck flexion with practitioner overpressure and a Valsalva maneuver. Reproduction of lower extremity complaints suggests radiculopathy or dural tension.

296

Skin Rolling



297



298

Breathing Assessment



Breathing may be assessed with the patient lying supine, knees bent having the patient place one hand over their umbilicus, the other hand on their sternum. Initiation of a deep breath should start in the abdomen with minimal chest elevation. Normal breathing should cause a wave-like pattern of spinal flexion beginning at the diaphragm then moving cephalad (best observed in a prone patient).

299

Maigne Syndrome Management


- Localize the site of irritation
- Define hypermobility vs hypomobility
 - Mobility: manipulation, pelvic tilt, psoas, lats
 - Stability: core & hip, breathing

300

<p>Hypomobility</p> <ul style="list-style-type: none"> • Manipulation/ mobilization • Stretching • Foam Roller • (Flexion/ opening protocols) 	<p>Hypermobility</p> <ul style="list-style-type: none"> • Stability Exercise • Breathing Retraining
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301

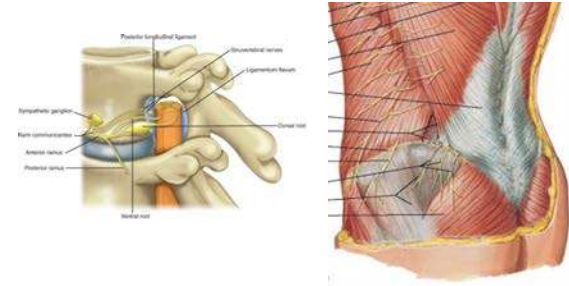
Cluneal Nerve Release



The patient should begin lying with their affected side up with their upper hip flexed approximately 60-90 degrees. The clinician straddles and grasps the patient's leg between their knees. With their upper hand, the clinician applies a stabilizing upward traction to the patient's shoulder. With their lower hand, the clinician contacts the site of adhesion and strips superior and lateral while simultaneously rolling the patient's pelvis forward, and repeats 4 to 5 times.


302

TL Fascia Release



303


Iliopsoas



Begin in a half-kneeling position with the side to be stretched on the floor and your opposite knee bent at 90 degrees, foot planted on the floor. Shift your pelvis forward slowly, keeping your hips and back straight. Against the resistance of the floor, contract your involved thigh in an attempt to flex it forward toward your chest for seven seconds. Relax and shift your pelvis further forward to increase the stretch. Keep your trailing leg rotated outward. "Lock in" to each new position and perform three contract/relax cycles twice per day or as directed.

304


Bretzel



Begin lying on your side with your affected knee bent to 90 degrees and crossed over the opposite leg. Grasp your crossed leg with your opposite arm. Next, bend the unaffected knee by grasping it with your other hand. Take in a deep breath and as you exhale, slowly rotate your body attempting to allow both shoulder blades to touch the floor. Each exhalation should relax your body further, allowing you to ultimately end with your back flat on the floor while still holding both hips in the start position. This make take several inhalation/exhalation attempts.

305

Seated Cluneal Nerve Floss



Begin seated with your affected leg crossed over the unaffected side. Slowly flex your neck by bringing your chin to your chest. Then, bend from the waist to approximate your head to your knee. Continue flexing forward until you reproduce symptoms in the lower back, hip, or leg. Upon eliciting symptoms, return to the starting position. Repeat for ten repetitions, each time attempting to achieve greater range of motion without increasing pain in your back or leg.

306

Posterior Pelvic Tilt - Supine



Begin lying on your back with your knees bent and feet flat on the floor. Maintain a slight gap between your lower back and the floor. Inhale, then as you breathe out, allow your abdomen to drop towards the floor. Pull in with your trunk to rotate your lower pelvis upward toward your ribs, as you press your lower back into the floor. Keep your hips and the rest of your body relaxed throughout this exercise. Relax and inhale as you return to the starting position. Repeat as directed.

307

Floor Plank



Begin lying face down with your upper body propped up on your elbows. Raise your hips up to a "plank" position while keeping your feet, hips, shoulders, and head aligned. Be sure not to allow your hips to sag or stick up. Tense all the muscles in your arms and legs for seven seconds, then release. Perform as directed. To advance, perform a "sawing" motion by rocking your body forward and backward, using your elbow as a fulcrum.

308

Posterior Pelvic Tilt Standing



Begin standing flat against a wall so that your heels, buttocks, shoulders, and head are touching the wall. Maintain a slight gap between your lower back and the wall. Inhale, then as you breathe out, pull in with your trunk to rotate your lower pelvis upward toward your ribs, as you press your lower back into the wall. Keep your hips and the rest of your body relaxed throughout this exercise. Relax and inhale as you return to the starting position. Repeat as directed.

309

Breathing Rehab Progression

- Educate the patient about the detrimental effect of abnormal breathing and how poor mechanics contribute to their symptoms.
- Briefly describe the patient's abnormal breathing pattern.
- Allow the patient to recognize their fault by manually palpating the areas of dysfunction while observing themselves breathe in a mirror.
- Demonstrate normal breathing mechanics, so that the patient may visualize proper abdominal and lower rib cage expansion while the chest remains still.

310

Training

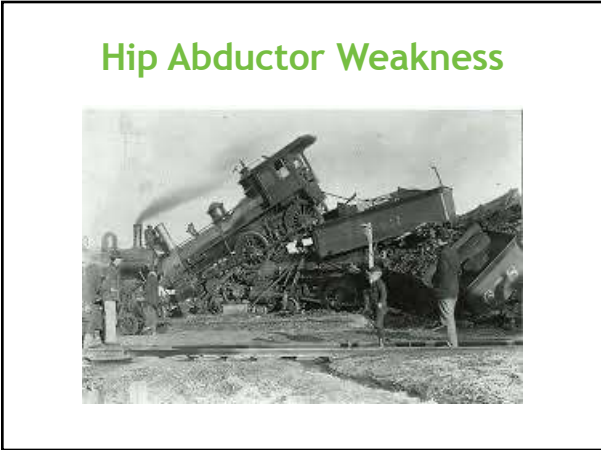


Training proper breathing techniques may begin with the patient in a supine hook-lying position, placing one hand on their abdomen and the other over their sternum. The patient should breathe in slowly and deeply through their nose. If they are breathing properly from their diaphragm, only the hand over their abdomen should rise, and the hand over their chest should remain still. Clinicians must stress the emphasis on abdominal expansion. Instruct the patient to lightly compress their abdomen while they breathe in, followed by relaxation of the pressure as they breathe out. The patient may apply light pressure to the lower lateral rib borders as they inhale and exhale. The patient should practice two to three breaths hourly and 10-20 breaths upon awakening and retiring. Patients should "groove" proper breathing mechanics by practicing in a progressive fashion- first in a supine position, then seated, then standing, and finally, while performing dynamic movements (i.e. overhead squat).

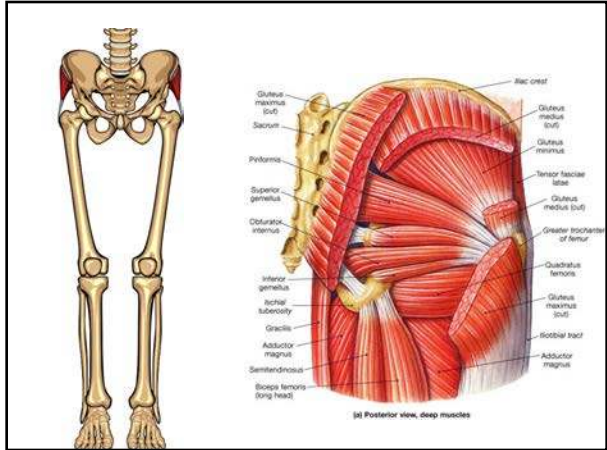
311

Hip Abductor Weakness

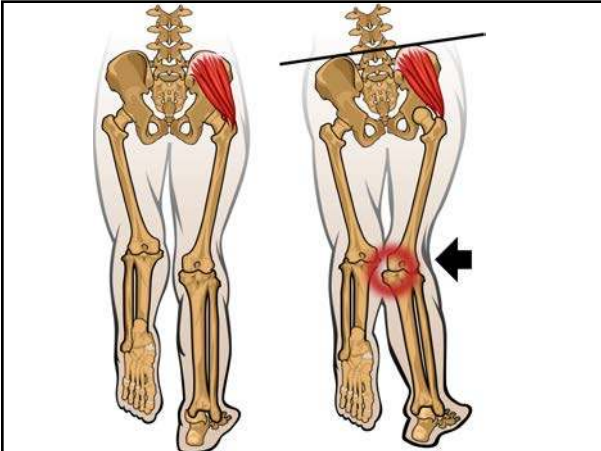
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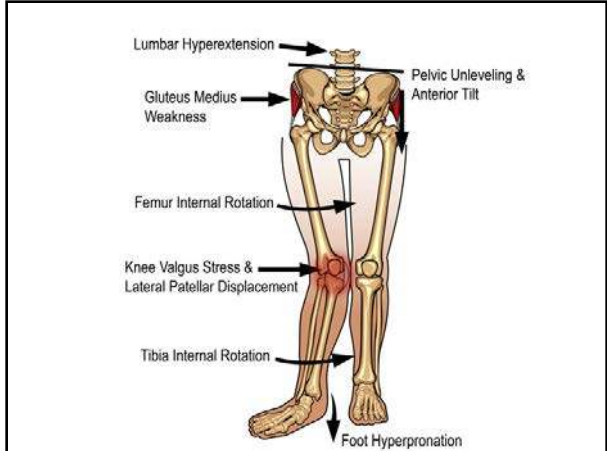
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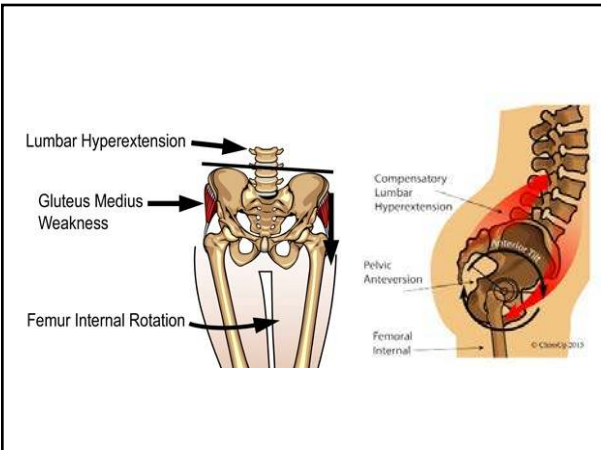
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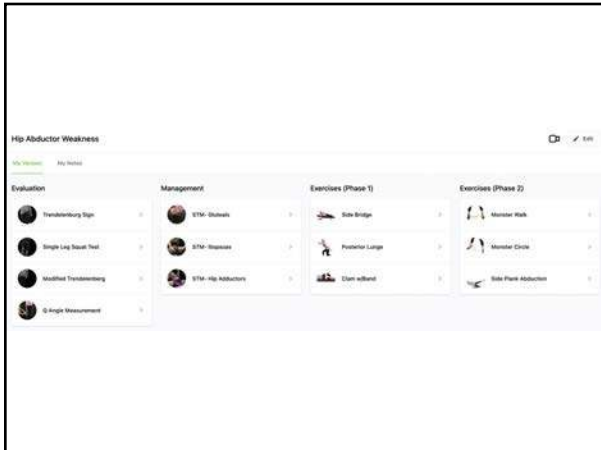


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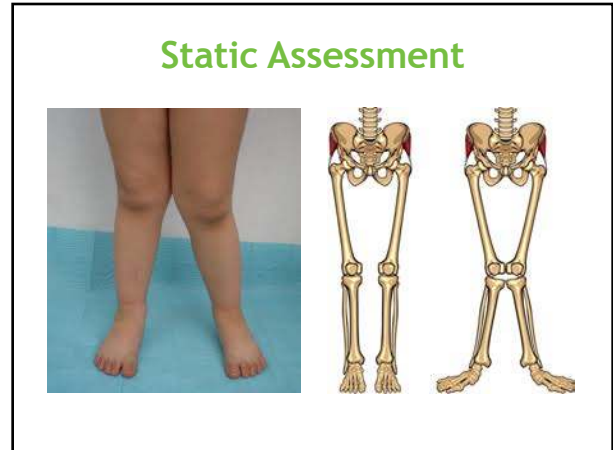
HAB Weakness Complaints

- Lumbar & Sacroiliac joint dysfunction
- Lumbar Facet Syndrome
- Lumbar Sprain/strain
- Discogenic pain
- Degeneration
- Greater Trochanteric Pain Syndrome
- ITB Syndrome
- Knee Sprain/ Strain
- Patellofemoral Pain Syndrome
- MTPP- Shin Splints
- Hyperpronation
- Achilles Tendinopathy
- Plantar Fasciitis

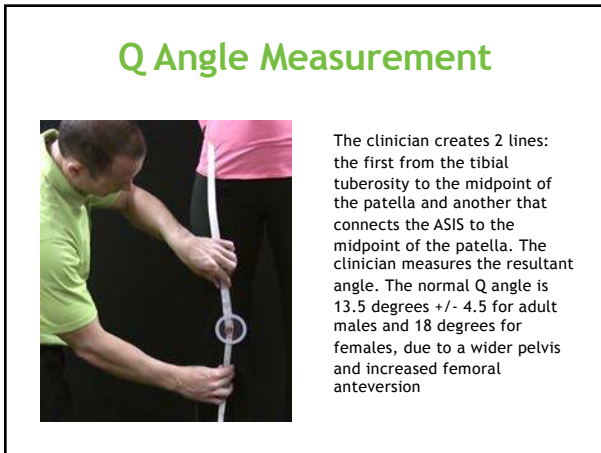
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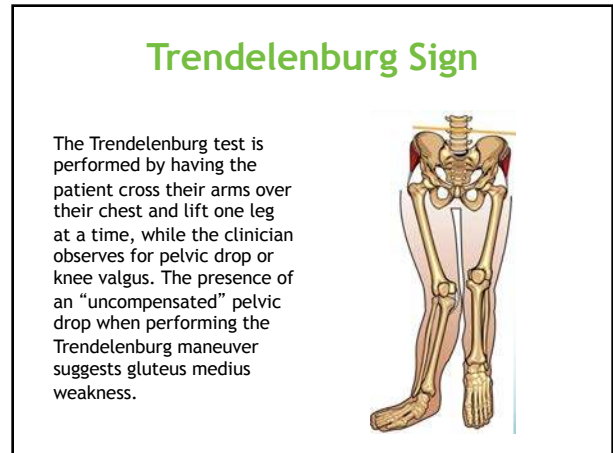
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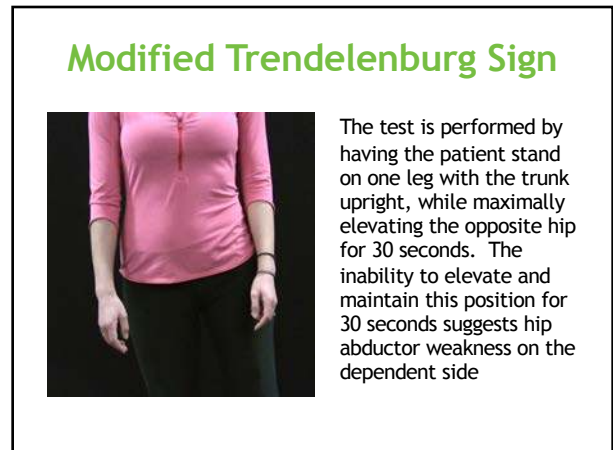
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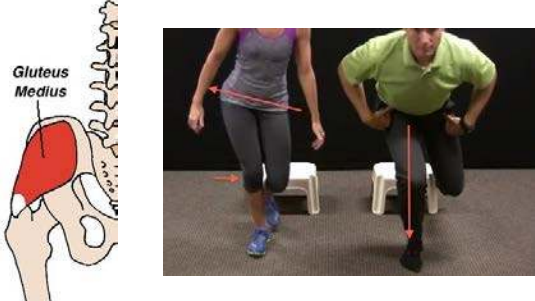
Single Leg Squat Test



Begin with the patient standing on the affected leg, without support. Have the patient squat three times, returning to a fully upright position between each repetition. The patient should squat as low as possible, stopping for any pain, weakness, or significant loss of balance. The clinician will assess for the presence of a Trendelenburg sign, knee varus/valgus movement, foot pronation, or poor balance. Repeat on the opposite leg.

325

Hip Abductor Weakness




326

Hip Abductor Weakness

- Pelvic drop
- Medial thigh rotation and adduction
- Knee buckling
- Instability
- Excessive foot pronation
- Lumbar hyperlordosis

327


Side Lying Hip Abduction



The Side Lying Active Hip Abduction test (S-AHAB) is an assessment of the patient's ability to maintain frontal plane stability of the lower limbs, pelvis, trunk, and shoulders in the while performing side lying hip abduction. The loss of frontal plane alignment while performing this test can reveal substitution strategies related to hip abductor weakness and/or core instability.

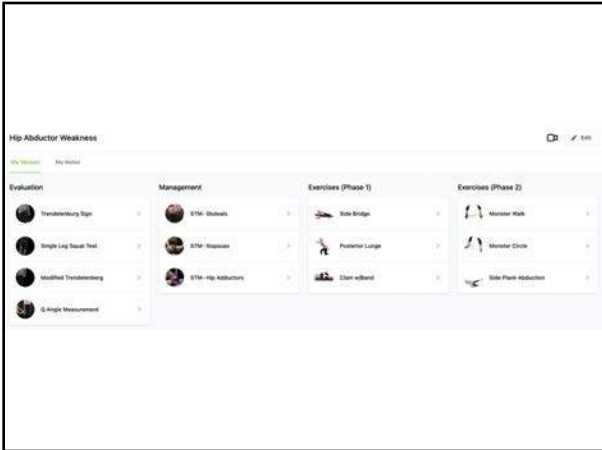
328

“Gluteus medius syndrome is related to lumbar degenerative disease, hip osteoarthritis, knee osteoarthritis, and failed back surgery syndrome. Accurate diagnosis and appropriate treatment could improve [outcomes].”



Kameda M, Tanimae H, Kihara A, Matsumoto F. Does low back pain or leg pain in gluteus medius syndrome contribute to lumbar degenerative disease and hip osteoarthritis and vice versa? A literature review. Journal of Physical Therapy Science. 2020;32(2):173-91.

329

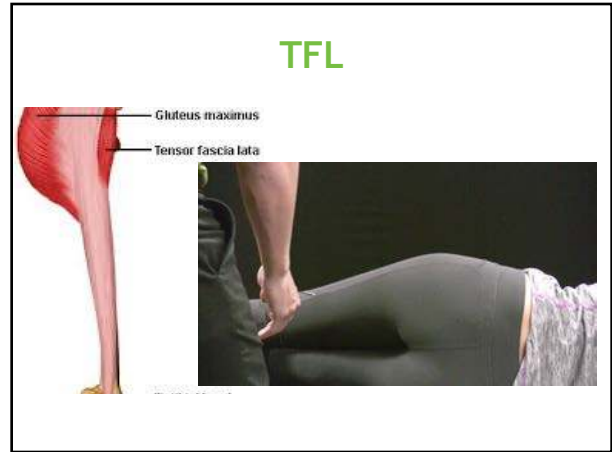


Evaluation	Management	Exercises (Phase 1)	Exercises (Phase 2)
Trendelenburg Sign	STM - Gluteals	Side Bridge	Monster Walk
Single Leg Squat Test	STM - Gluteals	Prone Hip Lift	Monster Circle
Modified Trendelenburg	STM - Hip Abductors	Clam shell	Side Plank Abduction
Q angle Measurement			

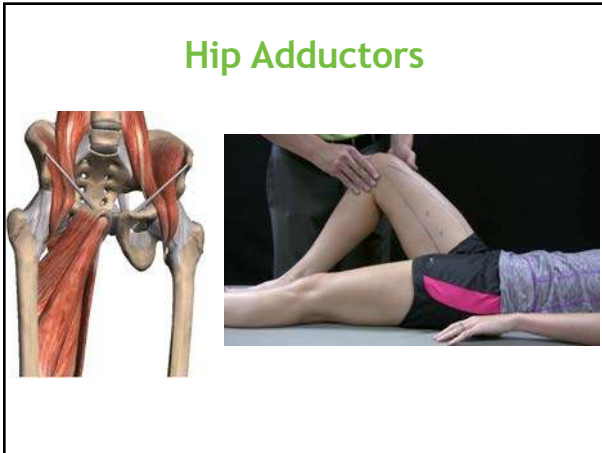
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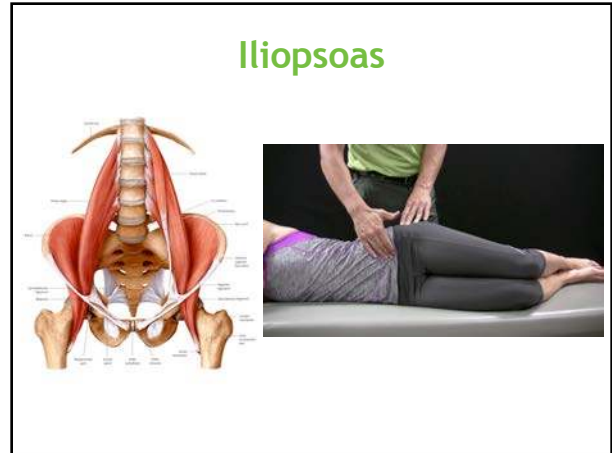
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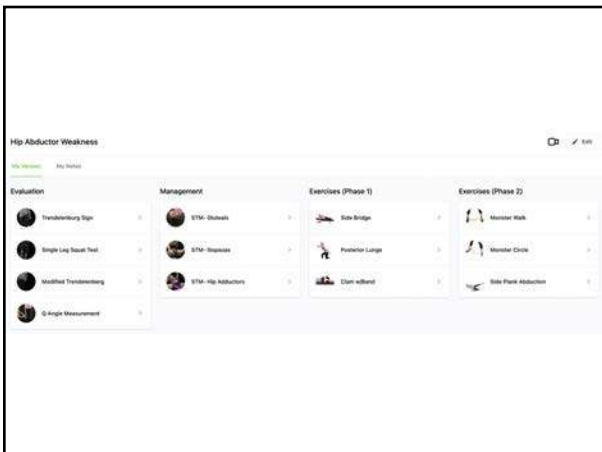
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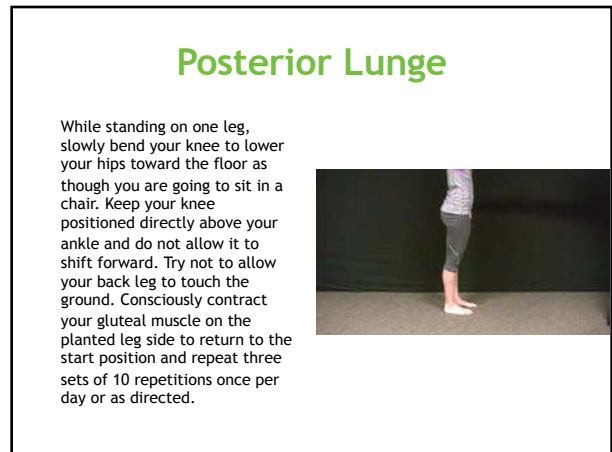
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Clam (#1)

Lie on your side with your affected hip pointing up. With your feet together, knees bent at 90 degrees and hips at 45 degrees, lift your knee upward without rolling your hips backward. Lower your legs so that your knees are touching and repeat on each side for three sets of 10 repetitions once per day or as directed.



337

Clam with Band

Lie on your side with your affected hip pointing up. Keep your feet together, knees bent at 90 degrees and hips at 45 degrees. Place an elastic band around the outside of both knees. Lift your knee upward without rolling your hips back. Maintain a pain-free range of motion. Slowly lower your legs so that your knees are touching and repeat on each side for three sets of 10 repetitions once per day or as directed.



338

Sidebridge



Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight "plank" position. Initially, you may need to use your knees for support. Slowly lower your hips back to the floor and repeat for three sets of 10 repetitions per day on each side, or as directed.

339

Side Plank with Abduction



Begin lying on your side. Rest your weight on your forearm and feet. Lift your hips forward and toward the ceiling until your body is in a straight "full plank" position. Slowly spread your legs by lifting your straightened upper leg toward the ceiling. Slowly lower your legs back together and repeat for three sets of 10 repetitions per day on each side, or as directed. If the "full plank" position is too difficult to maintain, begin from a modified position with your lower knee on the ground.

340

Advanced Clam (#4)



Lie on your side with your affected hip pointing up, knees bent at 90 degrees and hips at 45 degrees. Begin with your ankles together and knees spread about 6-8 inches, so that your top thigh is horizontal to the ground. Without elevating your thigh any further, rotate your leg to lift your top ankle toward the ceiling as high as possible. Lower your legs so that your ankles are touching and repeat on each side for three sets of 10 repetitions once per day or as directed. For a more challenging variant, perform this exercise with your top hip straight.

341

Piriformis Syndrome

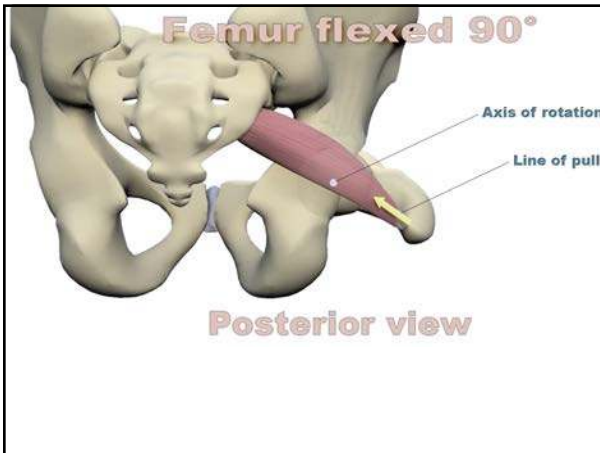
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Symptoms

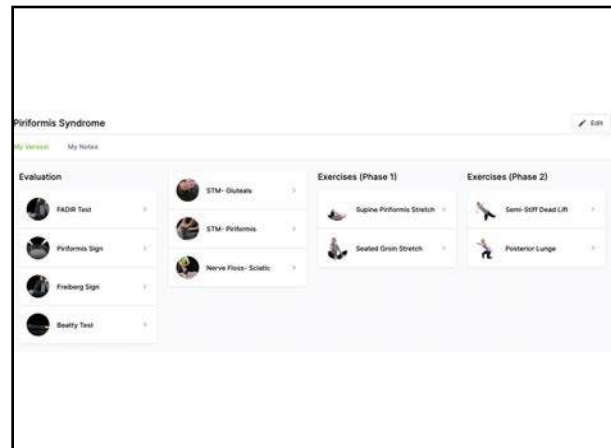
- Pain, paresthesia, or numbness beginning in the gluteal region and radiating along the course of the sciatic nerve.
- Provoked by holding any one position for longer than 15-20 minutes - particularly prolonged standing or sitting (cross legged).
- Positional changes may provide transient relief.

346

ADL Cautions

- Walking on uneven surfaces
- Hill and stair climbing
- Downhill running
- Twisting and throwing objects backward (i.e. firewood)
- Sitting on one foot
- Prolonged standing, sitting and car rides
- Sustained hip external rotation and abduction during gynecologic procedures or intercourse

347



348

FADIR Test

FADIR Test, or Anterior Hip Impingement Test, is performed with the patient lying supine. The clinician moves the thigh into 90 degrees of flexion, then adds adduction and internal rotation. This creates a shear force on the labrum and reproduction of hip pain during this maneuver could suggest "cam" type hip impingement or labral tear. The test is most useful to rule out FAI when negative. Reproduction of sciatic complaints may suggest piriformis syndrome. Sometimes called the "Pace sign" when positive.



349

Piriformis Sign

The piriformis sign is present when the patient displays a slightly externally rotated hip while at rest. Best observed from a prone position with the patients feet hanging off the end of the exam table. Suggests excessive tightness in the external rotators of the hip, particularly the piriformis.



350

Freiberg Sign

The Freiberg sign is present when hip range of motion testing reveals painfully limited passive internal rotation. May be associated with piriformis syndrome.



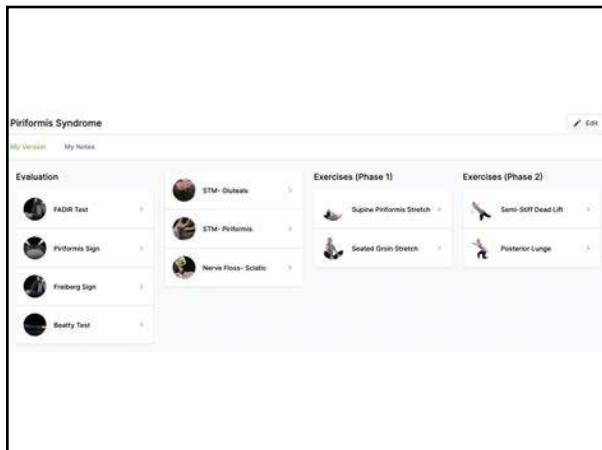
351

Beatty Test

The test is performed with the patient lying on the unaffected side and slightly abducting the affected leg a few inches off of the table. Reproduction of the chief complaint is suggestive of piriformis syndrome.



352



353

STM - Gluteals



354

STM - Piriformis

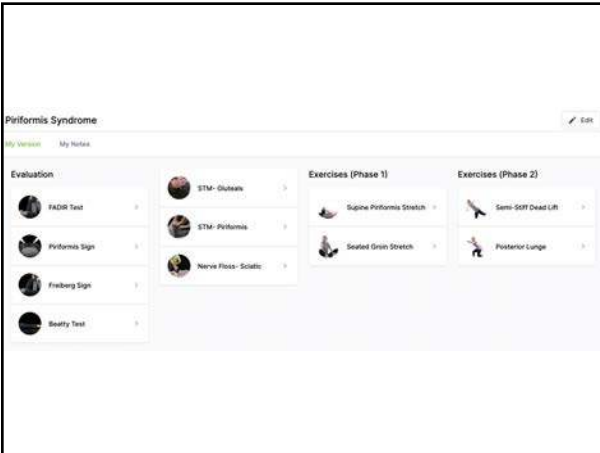


355

Nerve Floss - Sciatic



356



357

Supine Piriformis Stretch

Lie flat on your back with your affected knee bent and your ankle touching the outside of your opposite leg. Grasp your knee and pull your thigh across your chest toward your opposite shoulder. If you are unable to comfortably reach your knee, grasp a thin towel wrapped around your knee. Against the resistance of your hand, contract your affected hip in an attempt to push your knee outward for seven seconds. Relax and pull your knee further across your body towards your shoulder to increase the stretch. "Lock in" to this new position and perform three contract/relax cycles on each side twice per day or as directed.



358

Seated Groin Stretch

Sit with your knees bent and the soles of your feet together. Slowly allow your knees to drop away from each other, toward the floor. Grasp your ankles with your hands, allowing your elbows to rest on your knees. Keep your feet close to your groin. Lean forward until you feel a stretch in your groin. Against the resistance of your arms and elbows, push your knees upwards for seven seconds. Relax and slowly stretch your knees further into a butterfly position toward the floor. "Lock in" to each new position and repeat three contract/relax cycles twice per day or as directed.



359

Semi-Stiff Dead Lift


Begin standing with your thumbs on your rib cage and your fingers on the crests of your hip, making sure not to approximate your fingers throughout the exercise. Stand on one leg with your knee bent only slightly. Slowly flex forward from the hips moving your chest toward the floor, making certain not to flex your back. Return to an upright position. Perform as directed.



360

Posterior Lunge

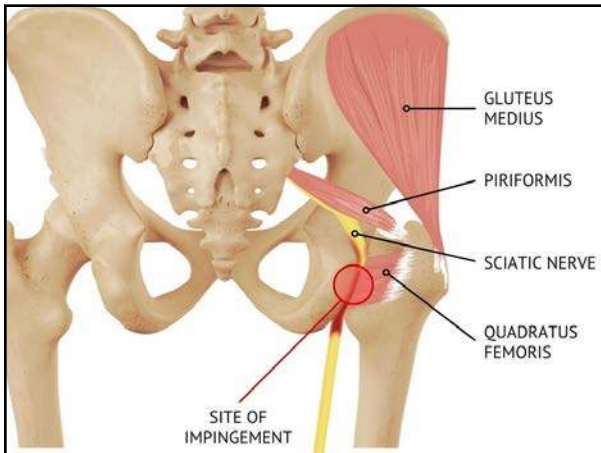
Begin standing on one leg and grasp the edge of a sink or a post for stability. Slowly bend your knee to lower your hips toward the floor as though you are going to sit in a chair. Keep your knee positioned directly above your ankle and do not allow it to shift forward. Try not to allow your back leg to touch the ground. Consciously contract your gluteal muscle on the planted leg side to return to the start position. Perform as directed.



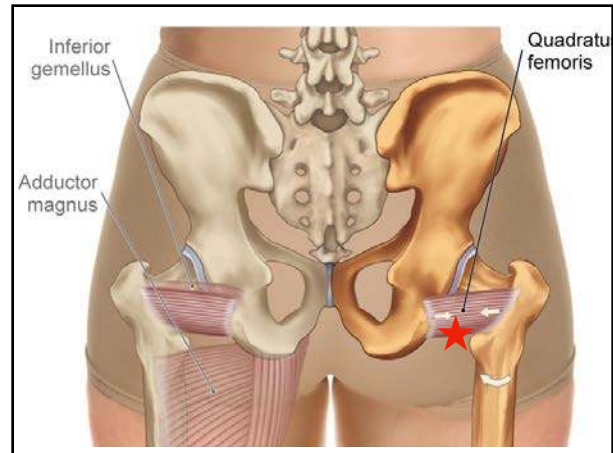
361

Ischiofemoral Impingement

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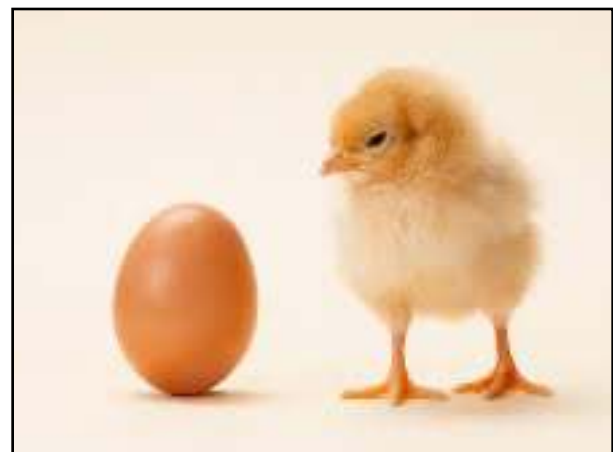


364

Predisposing Factors


<p>Congenital</p> <ul style="list-style-type: none"> • Prominence of the lesser trochanter • Posteromedial positioning of the femur • Low ischiopubic ramus <p>Functional</p> <ul style="list-style-type: none"> • Pelvic tilt- retroversion • Weak hip abductors 	<p>Acquired</p> <ul style="list-style-type: none"> • Hip osteoarthritis • Hip fracture/ replacement, • Legg-Calve-Perthes disease (AVN) • Expansile bony lesions • Proximal hamstring enthesopathy
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365



366

Quadratus Femoris Degeneration



Decreased Ischiofemoral Space

367



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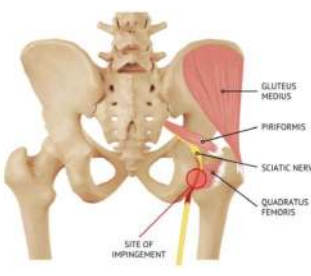
IFI affects both hips in 25 to 40% of cases; not surprising, since many of the contributing factors occur bilaterally.

-Aroen A, Helgo D, Granlund OG, Bahr R. Scand J Med Sci Sports. 2004 Feb;14(1):30-3.

370

IFI Complaints

- Buttock pain
- Symptoms may refer to the medial thigh, and anterior groin
- Will progress to sciatic leg pain if left unchecked



371

Key Findings

1. Limitation of hip extension may force walkers and runners to adopt a compensatory shorter gait cycle.
2. Patients often assume an antalgic sitting posture to unload the affected ischium.
3. Complaints of crepitus and snapping may accompany ischiofemoral impingement.

372

Orthopedic Evaluation

There is no single clinical exam finding specific to the diagnosis of ischiofemoral impingement.

A collection of findings may help confirm the diagnosis.

Palpation typically demonstrates tenderness over the quadratus femoris muscle and its attachment sites on the ischium and lesser trochanter.

373

Long Stride Walking Test

The patient is asked to walk with accentuated long strides. Reproduction of buttock pain during terminal extension on the trailing leg shows high sensitivity (92%) and specificity (82%) for ischiofemoral impingement.



374

IFI Test

With the patient in a side-lying position on the unaffected side, the clinician passively abducts and extends the patient's affected, straightened thigh. The clinician then lowers the patient's extended leg into adduction. Reproduction of pain upon adduction (but not abduction) shows high sensitivity (82%) and specificity (85%) for ischiofemoral impingement.



375

Passive Stretch

A hypertonic or irritable quadratus femoris muscle may be provoked via stretch through passive hip flexion with internal rotation.



376

Typically **negative** orthopedic tests



Valsalva Maneuver



"C" Sign



Related Muscles

- Piriformis
- Quadriceps femoris
- Gluteal muscles

377

In-Office Treatment



Manipulation-Lumbar and Sacral



Nerve Floss- Sciatic



Nerve Release- Sciatic Nerve at the Piriformis



STM- Quadratus Femoris



378

Sciatic Nerve Floss

Compression of the sciatic nerve may result in radiating pain or paresthesia into the anterolateral leg and foot. Nerve release may help resolve adhesions and restore normal mechanical function by "flossing" the affected nerves. The patient should be supine with their affected leg extended. The clinician begins by flexing the patient's hip (SLR) while the patient holds their neck in extension until symptoms are reproduced in the leg. The patient is instructed to flex their neck as the clinician lowers the patient's leg. Alternately, sciatic nerve floss may be performed with the patient seated. Flossing motions should not create or intensify any radicular complaints. The flossing pattern should be repeated 10 times, from the starting position to the end position. The patients may benefit by continuing self-flossing exercises at home.



379

STM- Quadratus Femoris

The quadratus femoris muscle originates on the lateral border of the ischial tuberosity and inserts on the intertrochanteric crest of the posterior femur. The primary action of the muscle is external rotation. Secondary actions include thigh adduction when the hip is neutral and thigh abduction when the hip is flexed. Trigger points commonly develop within the muscle belly. Soft tissue manipulation includes ischemic compression of trigger points and myofascial stripping parallel to the muscle fibers. Movement stripping may be performed with the patient lying prone and affected knee bent to 90 degrees. The clinician applies a thumb or elbow contact to the quadratus femoris while internally rotating the thigh. Contract/ relax stretching is performed by tensioning the muscle, then asking the patient to externally rotate the hip against resistance, followed by increased stretch. Clinicians should recognize the presence of the Sciatic nerve in this region and be judicious when performing STM.



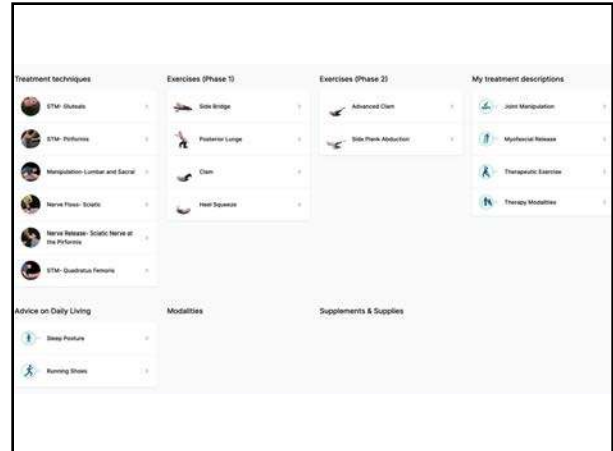
380

Nerve Release- Sciatic Nerve at the Piriformis

Entrapment of the sciatic nerve at the hip is called "piriformis syndrome". Compression may result in radiating pain or paresthesia into the posterolateral leg and dorsum of the foot. Weakness of ankle dorsiflexion and eversion is possible. Nerve release may help resolve adhesions and restore normal mechanical function. The patient should be side-lying with their legs bent slightly at the knees. Contact the site of adhesion and tension the nerve distally along the fibers of the piriformis at the sciatic notch. Slowly have the patient flex their hip while extending their knee. The ankle should be dorsiflexed and inverted for full nerve tension. Mobilization should be done 4-5 times consecutively without eliciting lasting symptoms in the distribution of the nerve.



381



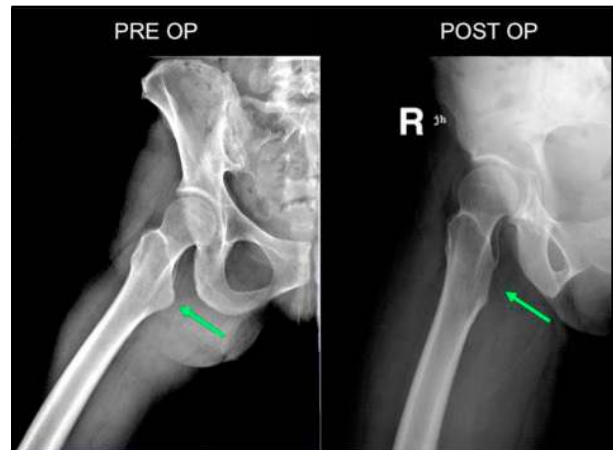
382

Hip abductor weakness is perhaps the most likely contributory comorbidity.

Incompetent hip abductors allow uncontrolled adduction of the knee with a corresponding reduction in ischiofemoral space.

Ahmad SS, Kerber V, Konrads C, Ateschrang A, Hirschmann MT, Stöckle U, Ahrend MD. The ischiofemoral space of the hip is influenced by the frontal knee alignment. Knee Surgery, Sports Traumatology, Arthroscopy. 2021 May 5:1-7.

383



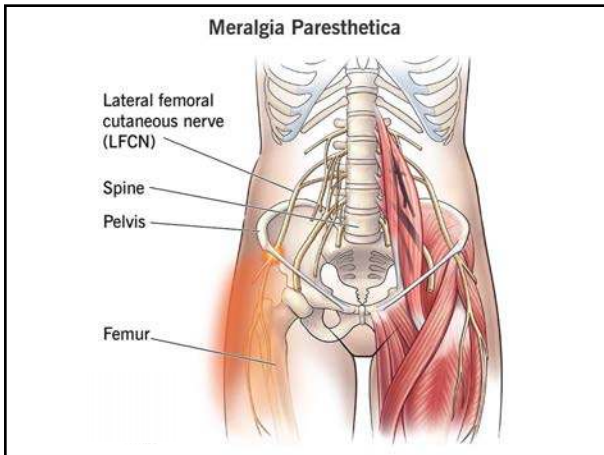
384

Meralgia Paresthetica

385



386



387

Presentation

- Most common in middle-aged adults
- Diabetics have a nearly six-fold increased risk
- Bilateral in 20-25% of cases
- Amen up to three times more frequently

388



389

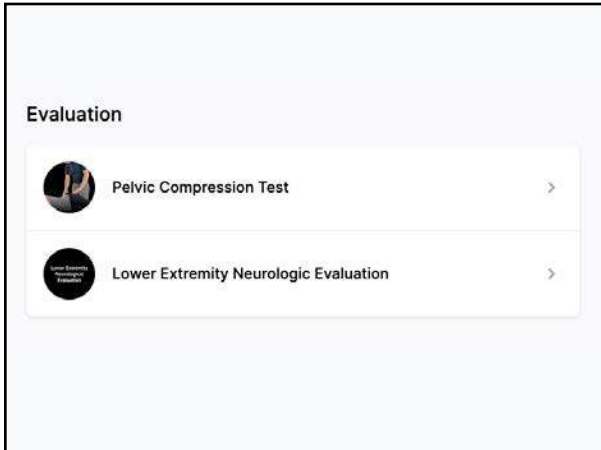
Clinical Symptoms

Isolated pain or paresthesia on the lateral thigh

Dull, aching, itching, buzzing or burning

Often **provoked by walking** and **alleviated when sitting**

390

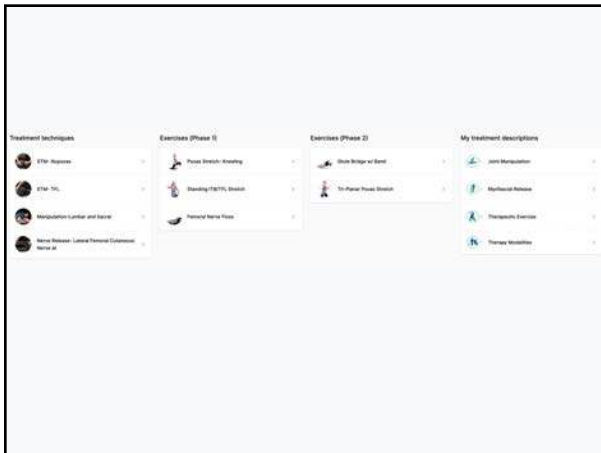


391

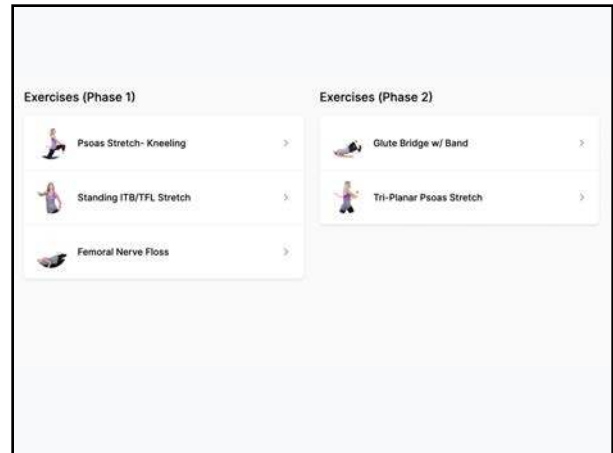
Pelvic Compression Test

This test is based on the premise the lateral femoral cutaneous nerve is compressed by the inguinal ligament and that relieving this compression will alleviate symptoms. The test is performed with the patient in a side posture position and focusing on their symptoms while the examiner applies a downward and lateral compressive force on the upper iliac crest. By compressing the pelvis in this manner, the two attachments of the inguinal ligament are approximated causing the ligament to become less taut. The pressure is held for 45 seconds is the test is positive for meralgia paresthetica when the patient reports an alleviation of their symptoms.

392



393



394

Femoral Nerve Floss

Begin in a side lying position with your affected side up. Flex your hip and knee as shown. Slowly move your affected leg and knee into extension. As you move your leg, extend your head, as to look back. Return to the start position by flexing your hip while simultaneously looking down with your head. This exercise should not create or intensify any buttock or leg pain. Perform as directed.

395

Psoas Stretch - Standing

To stretch the right side, stand with your right leg back and your left leg elevated onto a chair, hip and knee bent at 90 degrees. Keep your trunk upright and shift your weight forward until you feel a stretch in your right hip and thigh. Contract your right hip flexors as though you are attempting to kick forward for seven seconds. Relax and shift your pelvis further forward to increase the stretch. "Lock in" to each new position and do not ease tension. Repeat three contract/relax cycles twice per day or as directed.

396

Standing ITB Stretch

Stand approximately two feet from a wall with your affected hip facing the wall. Move your opposite leg forward so that your legs are in a scissors position. The outsides of your feet should be facing each other. Most of your weight should be on your straightened rear leg with your front knee slightly bent and relaxed. With your trunk upright, rotate your pelvis away from the wall and drop your buttock towards the wall until you feel a stretch. Be sure to keep your pelvis forward, not allowing it to drop backward. Keep your breastbone over your uninvolvement hip throughout this stretch. Against the resistance of the floor, attempt to contract your rear leg away from your body (toward the wall) for seven seconds. Relax and drop into this stretch to increase the pull. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.



397

Glute Bridge w/ Band

Lie on your back with your knees bent at 90 degrees. Place a loop of elastic band around the outside of both knees. Tighten your abdomen and tuck your pelvis toward your rib cage to perform a "pelvic tilt". Lift your hips up off of the ground into a "bridge" so that your shoulders, hips, and knees are all in the same plane. While holding this posture, push your knees apart against the resistance of the band. Do not allow your torso to drop towards the floor. Perform three sets of 10 repetitions once per day or as directed.



398

Tri-Planar Psoas Stretch

Begin standing in a "lunge" position with your involved leg back until a stretch is felt in your hip. Lunge forward to increase the stretch in your hip. Hold this position for two or three seconds and return to neutral. Slowly lunge forward 10 times, each time increasing the stretch. Perform 10 additional repetitions of increased stretch by rotating your body away from your involved leg. Perform a final set of 10 repetitions of increased stretch by raising your arm on the same side and rotating your body away while performing lunges. Perform a total of 30 repetitions twice per day or as directed.



399

1. Conservative management is the frontline treatment for meralgia paresthetica and is successful in up to 91% of cases.
2. The central goal of treatment is to remove any cause of excessive compression.

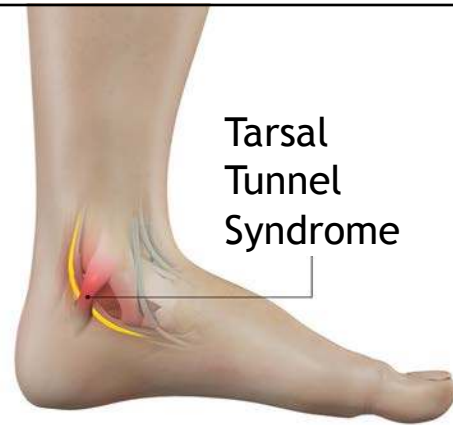
In some cases, simply wearing looser clothing may alleviate the complaint. Other considerations include selective rest from an aggravating activity (particularly repetitive hip flexion) losing weight, or carrying a toolbox instead of wearing a tool belt. Wearing high heels should be avoided as this causes excessive anterior pelvic tilt, which may be linked to the problem. (32)

400

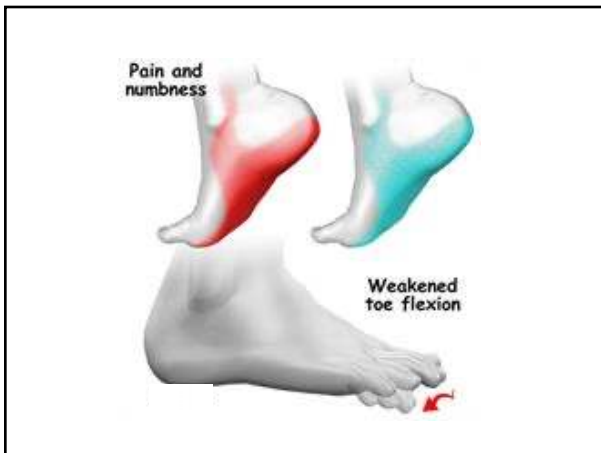
Tarsal Tunnel Syndrome

401

Tarsal Tunnel Syndrome



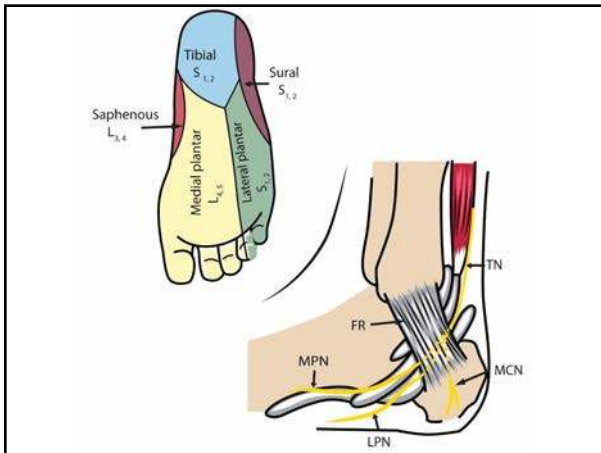
402



403



404



405

Symptoms

- Numbness, pain or paresthesia in the plantar arch and heel
- Described as “burning”
- Increases with prolonged standing, running or exercise
- Worse at night
- Possible weakness of the intrinsic foot muscles

406

Heel Pain Triad

- Plantar fasciitis
- Posterior tibial tendinopathy
- Tarsal tunnel syndrome

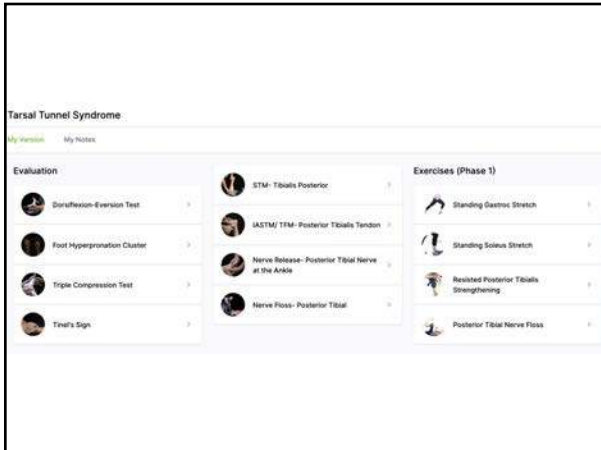
Posterior tibial nerve

Posterior tibialis tendon

407

DIAGNOSIS	CLINICAL CUES
Plantar Fasciitis	Medial calcaneal border pain with first steps
Heel Pad Syndrome	Central calcaneal pain with any pressure, possible fat atrophy
Calcaneal stress fracture	Progressively worsening pain with weight-bearing
Tarsal tunnel syndrome	Heel burning, numbness, or tingling
Tarsal Baxter's neuropathy syndrome	Heel pain with potential weakness of the abductor digiti minimi
Inflammatory arthropathies	Systemic involvement
Lumbosacral radiculopathy	Positive nerve tension tests

408



409

Dorsiflexion-Eversion Test

Performed by placing the patient's foot into dorsiflexion and eversion for 15 seconds while maintaining extension of the metatarsophalangeal joints. Reproduction of plantar parasthesia during this test, although not pathognomonic, is an overwhelming positive sign of tarsal tunnel. A modification of this test (aka Triple Compression Test) is performed by adding concurrent digital compression over the medial ankle.

410

Foot Hyperpronation Cluster

Evidence of foot hyperpronation includes: excessive forefoot abduction (too many toes sign), calcaneal eversion, loss of the medial longitudinal arch and navicular drop. Clinicians should also assess for weakness in the posterior tibialis by observing for calcaneal eversion during heel raises and the flexibility of the gastroc/ soleus in passive dorsiflexion.

411

Triple Compression Test

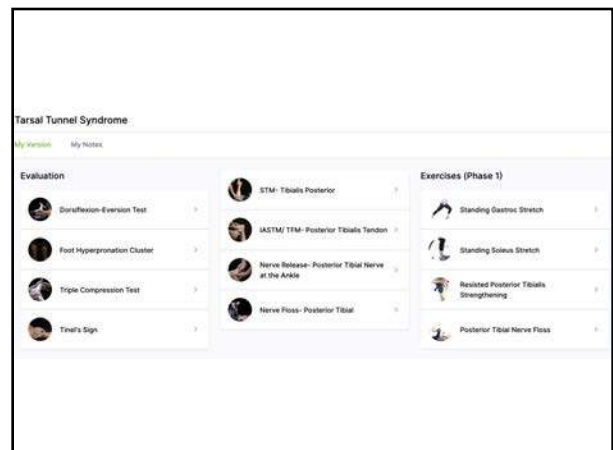
Performed by placing the patient's foot into dorsiflexion and eversion for 15 seconds while maintaining extension of the metatarsophalangeal joints. The clinician then adds digital compression over the medial ankle, specifically over the posterior tibial nerve. Reproduction of plantar parasthesia during this test, although not pathognomonic, is an overwhelming positive sign of tarsal tunnel.

412

Tinel's Sign

The clinician taps the skin over a peripheral nerve with a reflex hammer. Reproduction of neurologic complaints suggests irritation. Commonly used in the diagnosis of peripheral neuropathies.

413



414



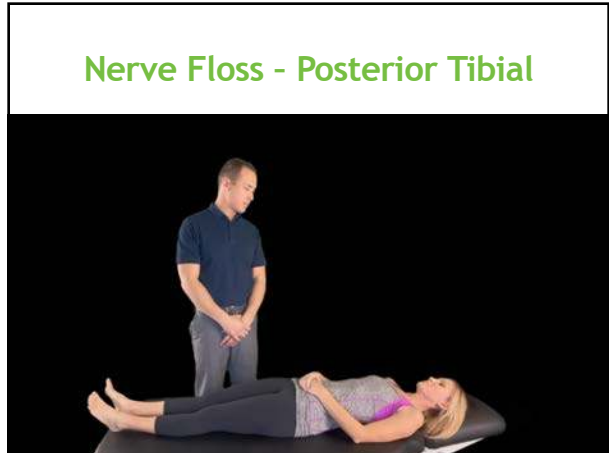
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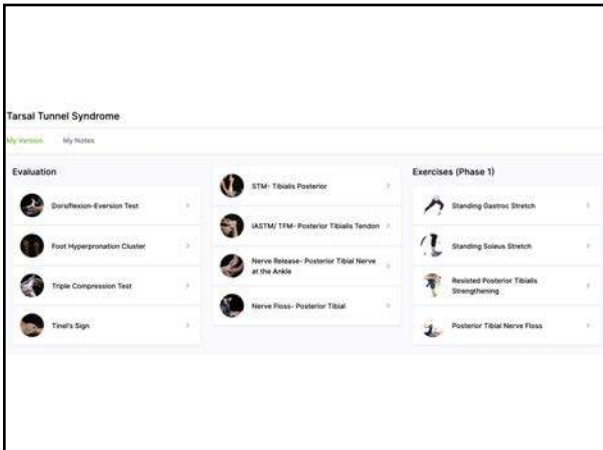
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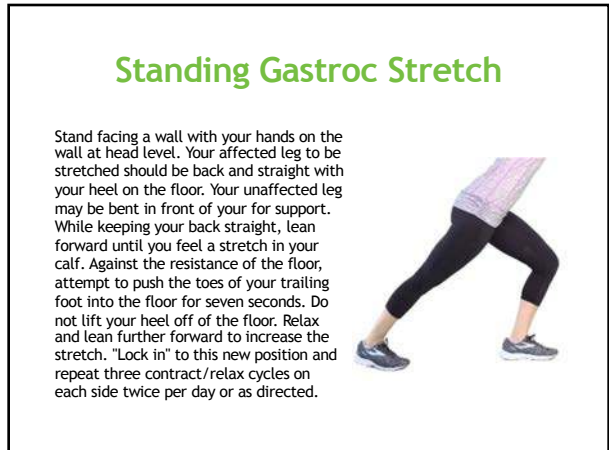
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420

Standing Soleus Stretch

Stand facing the wall with the ball of your affected foot on the wall, heels on the ground with your other leg behind you for stability. As an alternate to placing your foot on the wall, you may step on a 2-4 inch block or book on the floor in front of the wall. Place your hands on the wall for additional stability. Bend your forward knee while lowering your body toward the wall until you feel a strong stretch in your calf. Against the resistance of the wall/ block, attempt to flex the front of your foot toward the floor. Hold this contraction for seven seconds. Relax and stretch further. "Lock in" to this new position and repeat three contract/relax cycles on each side twice per day or as directed.



421

Resisted Posterior Tibialis Strengthening


Sit with your involved leg crossed over your uninvolved leg. Loop a piece of resistance tubing over your forefoot and secure it beneath your foot on the floor. Stabilize your lower leg with one hand. Against the resistance of the elastic, roll your involved foot upward, as though you are attempting to look at the bottom of your foot. Slowly return to the start position. Perform as directed.



422

Posterior Tibial Nerve Floss

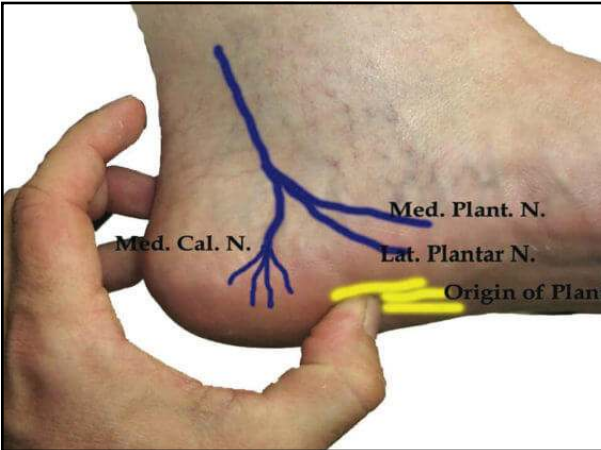
Begin lying on your back with your legs straight. Wrap a towel around your affected foot while keeping your toes pointed down. Slowly bend your knee while using the towel to pull your toes and ankle toward your head. Slowly return to the starting position. Perform as directed. Be careful not to reproduce any pain or numbness in your foot.



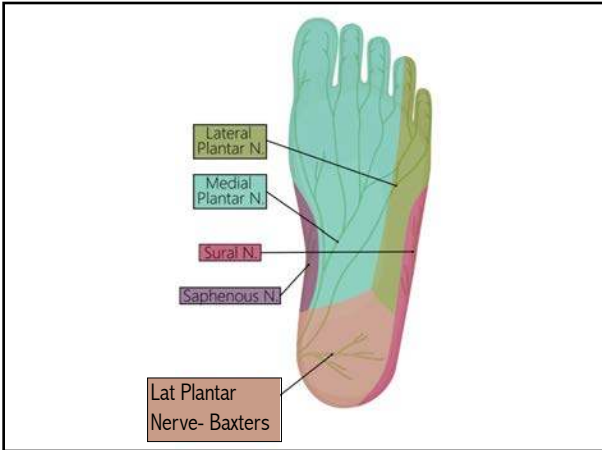
423

Baxters Neuropathy

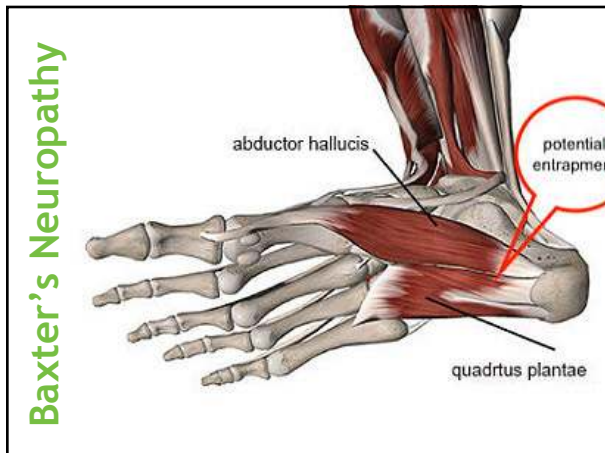
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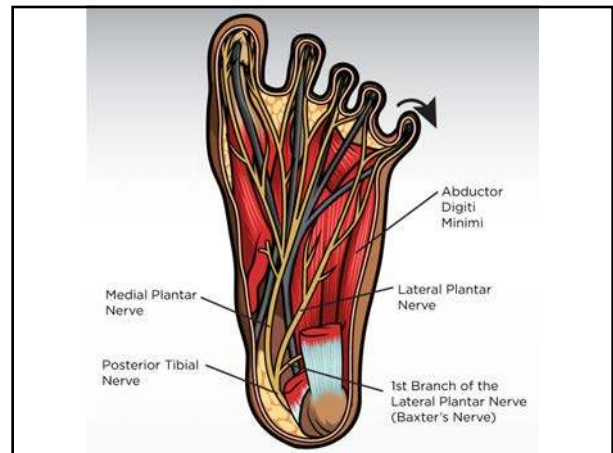
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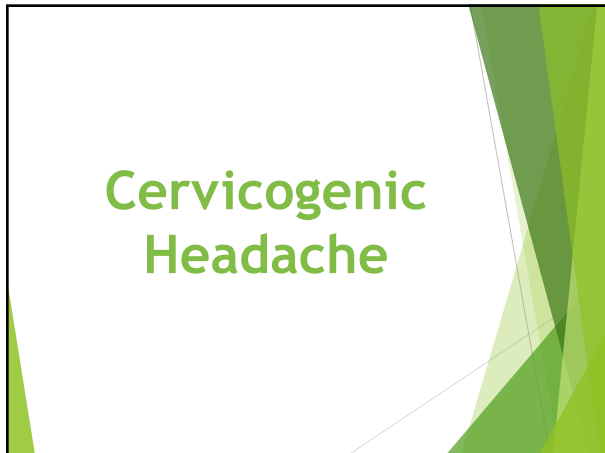
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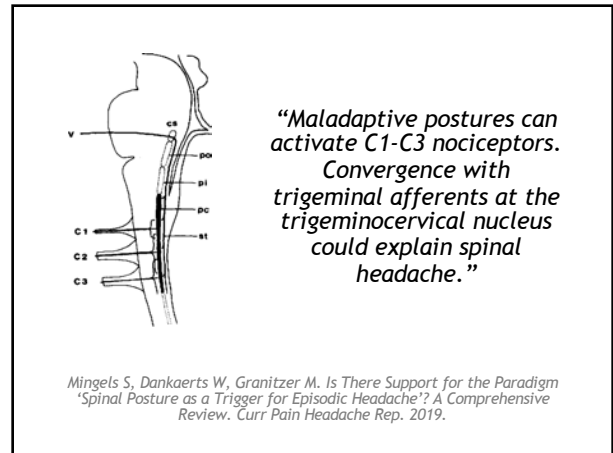
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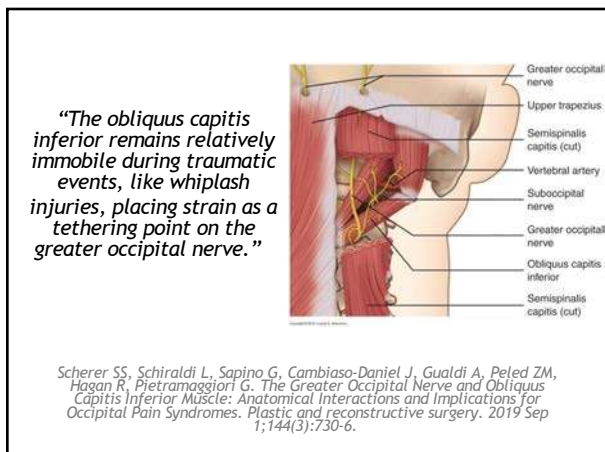
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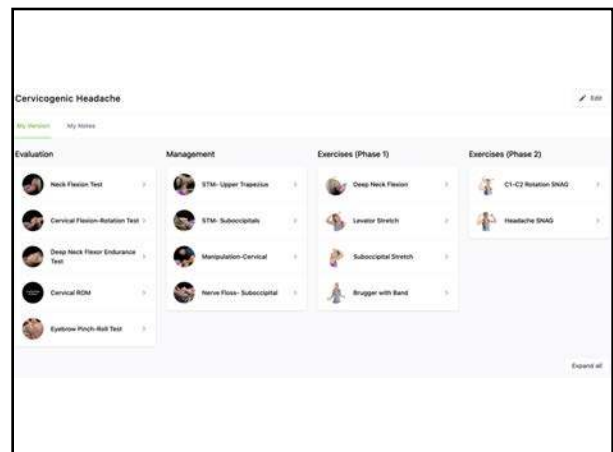
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432

Neck Flexion Test

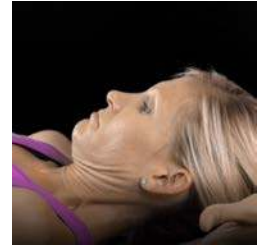
The supine patient is asked to lift their head several inches off of the table to look at their toes. The clinician observes for a "normal" movement pattern which would be initiated with a chin tuck and smooth reversal of the cervical lordosis. An "abnormal" screen would result in the chin moving forward into protraction from over compensation by the SCM. The normal firing pattern for this movement is: longus capitus, longus colli, SCM and finally anterior scalenes. Abnormal movement patterns suggest weakness of the deep neck flexors.



433

Deep Neck Flexor Endurance

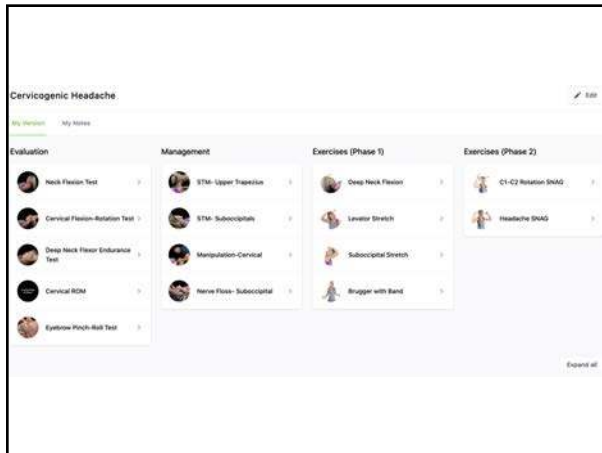
The clinician places their flat hand on the table below the patient's occiput. If the patient's head begins to lower or their anterior neck skin folds separate, they are reminded to "tuck your chin and hold your head up."
The test is timed until the patient's head touches the clinician's hand for more than one second.



The average endurance for men is about 40 seconds and 30 seconds for women. Those with neck pain average closer to 20 seconds. Low endurance suggests neck flexor weakness-resulting in an upper crossed posture and neck pain.

Domenech MA, Sizer PS, Dedrick GS, McGalliard MK, Brismee JM. "The Deep Neck Flexor Endurance Test: normative data scores in healthy adults." PM R. 2011 Feb. Web. 08/18/2012.
Harris KD, Heer DM, Ray TC, Santos DM, Whitman JM, Walster RS. "Reliability of a measurement of neck flexor muscle endurance." Physical Therapy 2005 Dec. Web. 08/18/2012.

434



435

"The manipulation group was statistically better than myofascial release group in terms of headache frequency, headache severity, and PPT scores."



Corum M, Aydin T, Ceylan Cm, Kesiktas Fn. The comparative effects of spinal manipulation, myofascial release and exercise in tension-type headache patients with neck pain: A randomized controlled trial. Complementary Therapies in Clinical Practice. 2021 Jan 24:101319.

436

"A linear dose-response was observed for all follow-ups, a reduction of approximately 1 CGH day/month for each additional 6 SMT visits. Cervicogenic headache days/month were reduced from about 16 to 8 for the highest and most effective dose of 18 SMT visits."

Haas M. et al. Dose-response and efficacy of spinal manipulation for care of cervicogenic headache: a dual-center randomized controlled trial. Spine J. 2018 Oct;18(10):1741-1754

437

Suboccipital Nerve Flossing

Begin with the patient lying supine, headpiece slightly extended. Have the patient bring their fingertips to their clavicles. Firmly grasp the patient's head and move their neck into full flexion, while maintaining a chin tuck. Ask the patient to fully extend their arms, wrists, and fingers while you simultaneously move their head and neck into full extension. Return to the start position and slowly repeat 10 flossing cycles. Stop if there is reproduction of pain or neurologic symptoms. To improve available ROM, this maneuver may be preceded contract-relax stretching of the suboccipitals.



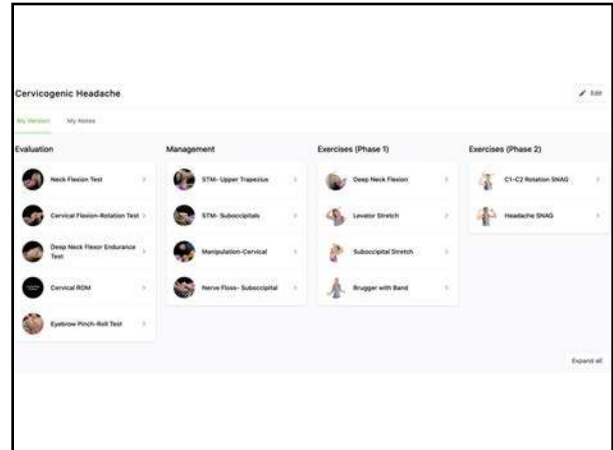
438



“Dry needling should be considered for the treatment of headache [cervicogenic, tension-type, and migraine], and may be applied either alone or in combination with pharmacological treatments.”

Vázquez-Justes D, Yarzabal-Rodríguez R, Doménech-García V, Herrero P, Bellosta-López P, Analysis of the effectiveness of the dry puncture technique in headaches: systematic review. Neurology. 2020 Jan 13.

439



Cervicogenic Headache

My Session My Notes


Evaluation	Management	Exercises (Phase 1)	Exercises (Phase 2)
Neck Flexion Test	STM- Upper Trapezius	Deep Neck Flexion	C1-C2 Rotation SMAG
Cervical Flexion-Rotation Test	STM- Suboccipitals	Levator Stretch	Headache SMAG
Deep Neck Flexion Endurance Test	Manipulation-Cervical	Suboccipital Stretch	
Cervical ROM	Nerve Floss- Suboccipital	Brugger with Band	
Eye/low Pitch-Roll Test			

Expand all

440

Cervical Retraction


Sit or stand looking forward with good posture. Tuck your chin to create a double chin. Hold this position for 3-5 seconds. Return to the starting position. Focus your vision on a spot on the wall to avoid neck flexion or extension. To progress, place a finger on your chin, and apply backwards pressure at end range. Imagine that your head is on drawer slides. Keep your mouth closed. Perform 1 set of 10 repetitions every hour. Alternately, this exercise may be performed standing with your back against a wall. Your buttocks and shoulder blades should be in contact with the wall. Tuck your chin to make a “double chin” until the base of your skull contacts the wall, relax and repeat as directed.



441

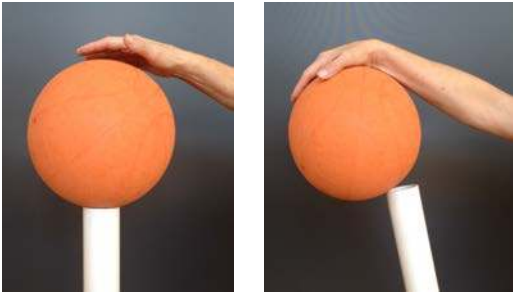
Deep Neck Flexion

Lie on your back, with your head supported. Perform a “chin tuck” by retracting your head to create a double chin. Lift your head, bringing chin toward your chest without lifting shoulders- as though you are looking at your toes. Hold this position for 3-4 seconds. Lower your head and relax. Keep your teeth apart during exercise to decrease straining at the jaw. Perform 1 set of 10 repetitions three times a day.



442

Forward Head/ Forward Shoulder Posture



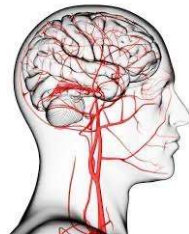
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VBAI & CAD

444

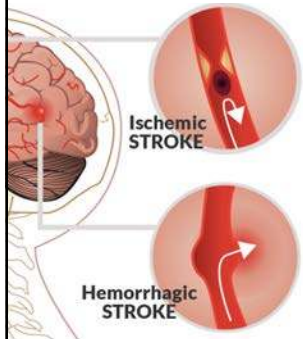
Stroke

The sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function.



445

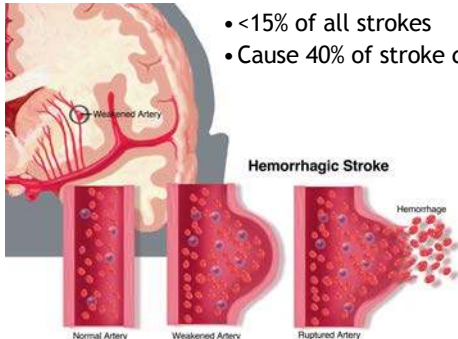
Etiology



- Ischemic (87%)
 - Thrombotic
 - Embolic
- Hemorrhagic (13%)

446

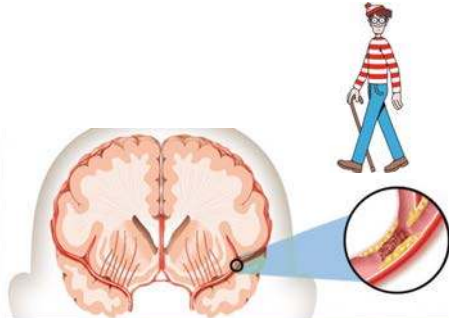
Hemorrhagic



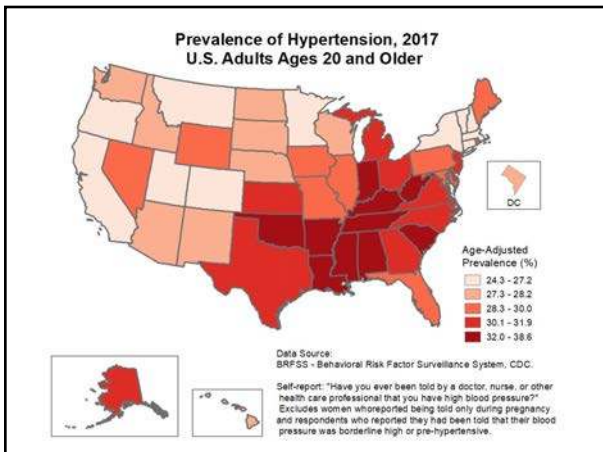
- <15% of all strokes
- Cause 40% of stroke deaths

447

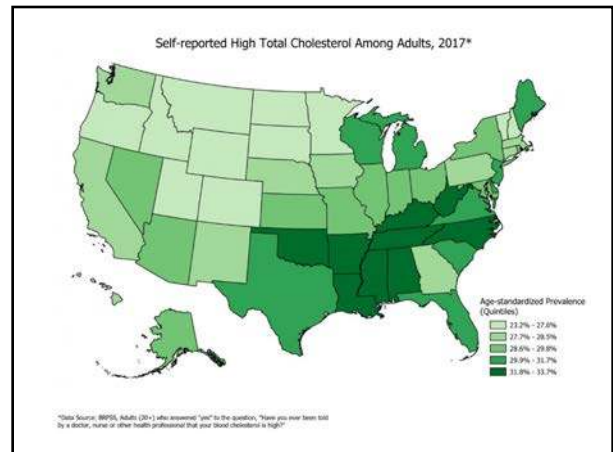
Ischemic



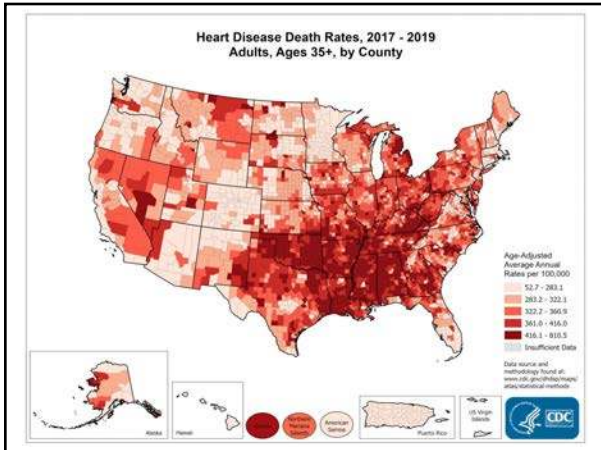
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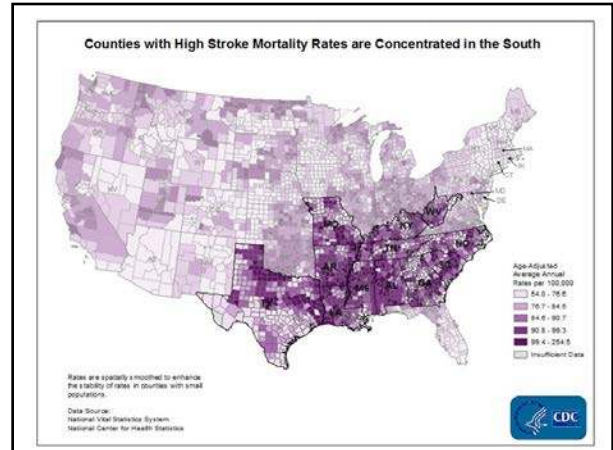
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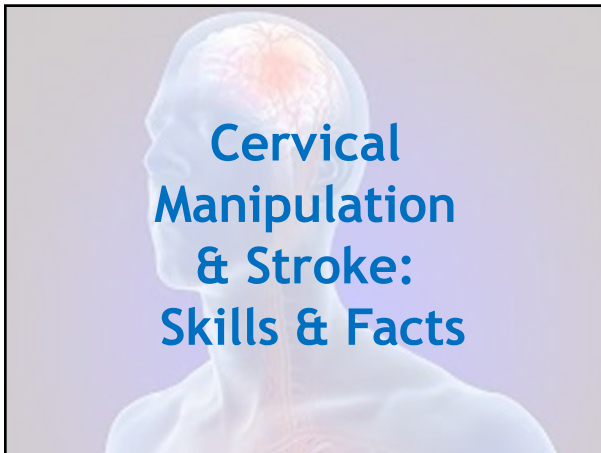
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451



452



453

DATA

ALL PUBLISHED DATA

CONCLUSION

"No excess risk of stroke for chiropractic manipulation compared to primary (MD) care"⁽¹⁾

Chaibi A et al. A risk-benefit assessment strategy to exclude cervical artery dissection in spinal manual-therapy: A comprehensive review. *Ann Med.* 2019 Mar 19;1-27

454

DATA

ALL PUBLISHED DATA

CONCLUSION

"No causal link between chiropractic manipulation and Cervical Artery Dissection (stroke)." ⁽³⁾

Church EW, Sieg EP, Zalatimo O, Hussain NS, Glantz M, Harbaugh RE. Systematic Review and Meta-analysis of Chiropractic Care and Cervical Artery Dissection: No Evidence for Causation. *Cureus.* 2016 Feb 16;8(2):e498.

455

DATA

100 MILLION PERSON YEARS

CONCLUSION

"No evidence of excess risk of stroke associated chiropractic care compared to primary care." ⁽¹⁾

Cassidy JD et al. Risk of vertebasilar stroke and chiropractic care: results of a population based case-control and case-crossover study. *Spine* 2008 Feb 15;33(4 Suppl):S176-83

456

39 MILLION PATIENTS

CONCLUSION | DATA

"No significant association between stroke and chiropractic visits. Manipulation is an unlikely cause of stroke." (2)

Kosloff TM, Elto D, Tao J, Bannister WM. Chiropractic care and the risk of vertebrabasil stroke: results of a case-control study in U.S. commercial and Medicare Advantage populations. *Chiropractic & Manual Therapies* (2015) 23:19

457

15, 523 CASES

CONCLUSION | DATA

"No excess risk of stroke after chiropractic care." (4)

Cassidy, J. David et al. Risk of Carotid Stroke after Chiropractic Care: A Population-Based Case-Crossover Study. *Journal of Stroke and Cerebrovascular Diseases*, Volume 26, Issue 4 , 842 - 850

458

53 Million Medicare Patients

CONCLUSION | DATA

"Among [patients] aged 65 and older who received cervical spinal manipulation, the risk of cervical artery dissection is no greater."

Whedon JM, Petersen CL, Li Z, Schoellkopf WJ, Haldeman S, MacKenzie TA, Lurie JD. Association between cervical artery dissection and spinal manipulative therapy-a medicare claims analysis. *BMC Geriatrics*. 2022 Dec;22(1):1-9.

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40 MILLION PATIENTS

CONCLUSION | DATA

"The association between cervical spinal manipulation and cervical artery dissection is NOT causal in nature." (6)

Whedon JM, Petersen CL, Schoellkopf WJ, Haldeman S, MacKenzie TA, Lurie JD. The association between cervical artery dissection and spinal manipulation among US adults. *European Spine Journal*. 2023 Jul 8:1-8.

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76% Lower

One recent study concluded: *"it is unlikely that chiropractic care is a significant cause of injury. In fact, risk of injury was 76% lower among subjects with a chiropractic office visit than those who saw a primary care physician."* (3)

Whedon JM, et al. Risk of Traumatic Injury Associated With Chiropractic Spinal Manipulation in Medicare Beneficiaries Aged 66 to 99 Years. *Spine* 2015;40:264-270

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Stroke Presenting Symptoms

- **Paresis (80%)**
 - Arms (76%)
 - Legs (69%)
 - Face (56%)
- **Sensory Deficit (45%)**
 - Arms (37%)
 - Legs (35%)
 - Face (21%)
- **Headache (25%)**
- **Speech Deficit (24%)**
- **Visual Field Deficit**
 - Hemianopia (15%)
 - Diplopia (6%)
- **Vertigo**
- **Convulsions**
- **Aphasia**

Saif S. Rathore, Albert R. Hinn, Lawton S. Cooper, Herman A. Tyroler, Wayne D. Rosamond Characterization of Incident Stroke Signs and Symptoms Findings From the Atherosclerosis Risk in Communities Study Stroke 2002;33:2718-2721

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Differentiating Migraine from Stroke

- Motor and sensory complaints, including paresthesia and numbness rarely occur in isolation.
- Aura symptoms develop slowly, over 5-20 minutes and can last up to an hour.

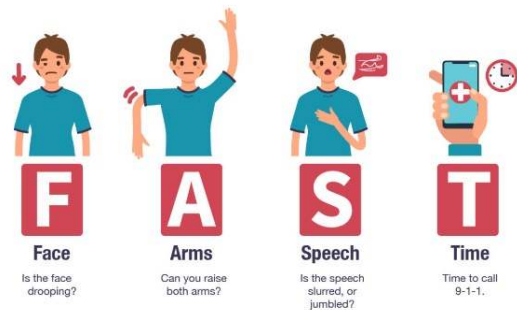
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Management Delays

- Too incapacitated to call for help
- Occurs during sleep (i.e., “wake-up” stroke)
- Unrecognized symptoms by patients or caregivers

Mandelzweig L, Goldbourt U, Boyko V, Tanne D. Perceptual, social, and behavioral factors associated with delays in seeking medical care in patients with symptoms of acute stroke. Stroke. 2006 May. 37(5):1248-53.

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Spotting a Stroke

BEFAST

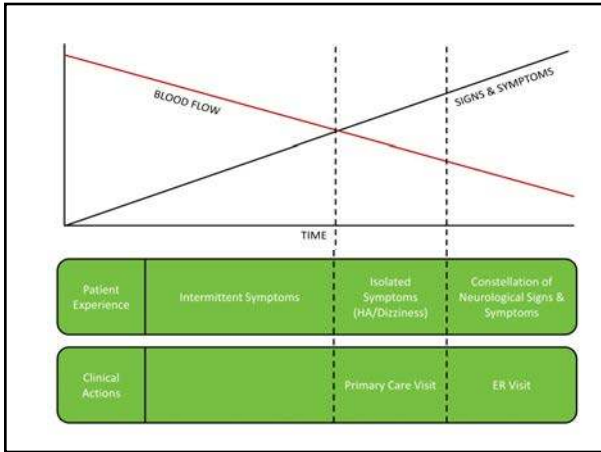


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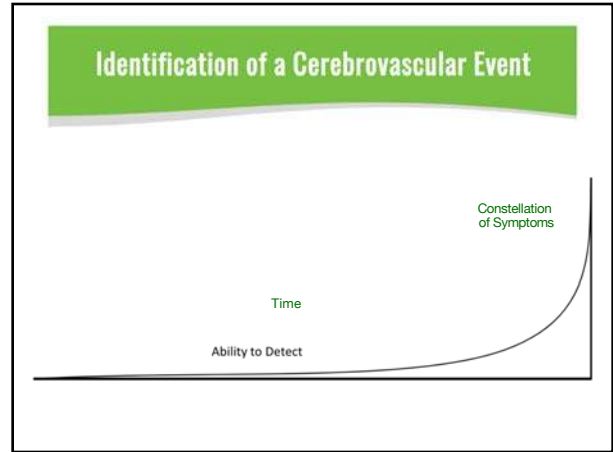
Neurologic Evaluation

- Mental Status & Language Assessment
- Motor, Sensory, Reflex
- Cranial Nerve Evaluation
- Cerebellar Testing
- Gait Testing

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CAD Webinar
ChiroUp.com/webinar

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Dizziness Differential						
	Cervicogenic	BPV	Meniere Disease	CAD	Central (Stroke, MS, etc.)	
Symptoms	Typical character	Unsteady or light-headed (1, 2)	Ang (1, 2)	Spinning/vertigo (1, 2)	Spinning/vertigo	
	Typical frequency	Episodic (1)	Episodic (1, 2, 3)	Infrequent, but lasting episodes (1, 2, 3, 4)	Likely constant	
	Typical duration	Seconds to minutes (1, 2)	Seconds (1, 2, 3)	Minutes to days (1, 2, 3)	Minutes to continuous (2)	
	Recurrent	Yes	Yes	No	Possible (2)	
	General symptoms: stiffness, discomfort	Very likely (2)(3) (1, 2)	Possible (2) (3)(4) (1, 2)	Possible (2) (3)(4) (1)	Likely (2) (3)(4) (1, 2)	Unlikely
	Headache	Possible, occipital	Unlikely	Possible, often migratory (2)	Likely (2)(3), "top of head" or "occipital" (1, 2, 3, 4)	Very possible, and "different"
	Ear symptoms: fullness, tinnitus, hearing loss	Unlikely	Unlikely (1)	Very likely (1, 2)(3, 4)	Unlikely (2)(3) (1)	Rare/none (1, 2)
	Constellation of other neuro symptoms: Parosmia, visual disturbances, ataxia, difficulty speaking or swallowing	No	No	No	Very likely (2)(3) (1, 2, 3, 4)	Very likely
	Clinical exam findings: nystagmus, hyperreflexia, Babinski, plantar reflexion	Very likely (1)(2)(3)(4)	Possible	Possible (1)	Likely	Unlikely
	Head/neck/body turned	Positive (1)	Unlikely	Negative	Possible	Negative
Old history	Likely	Very likely (2)(3) (1, 2)	Unlikely	Possible	Negative	
Signs	Osteopathic findings	Normal	Normal	Normal (1)	Normal	
	Fever	No	No	No	Possible	
	Nystagmus (if present)	Horizontal	Horizontal	Horizontal (2)	Vertical	Vertical, without latency or fatigue (1, 2)
	Postix	No	No	No	Possible (1)(2) (1, 2)	Possible
	Cerebral nerve dysfunction	No	No	No	Possible (2) (3) (4) (1, 2)	Likely
	UMMS signs: hyperreflexia, pathologic reflexes	No	No	No	Likely	Likely
ix	Manual therapy	Repositioning maneuvers	diet and PCP Co-management	Emergent referral	Emergent referral	

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