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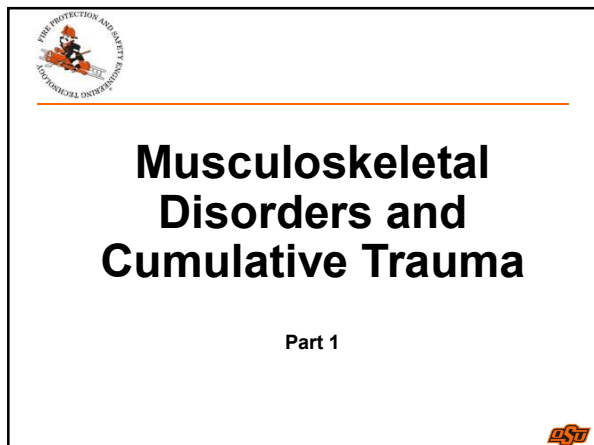
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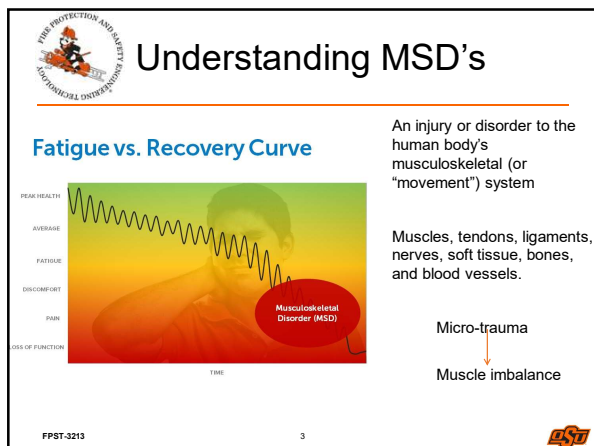
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## Factors

- Force
- Posture
- Compression
- Repetition
- Duration
- Vibration
- Temperature

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## Mountain peaking through the fog

Stage 3	Disability Disorders, injuries, & diseases	Not reversible
Stage 2	Pronounced Symptoms Soreness and pain Movement & posture problems, fatigue, aches	Can be reversed
Stage 1	Fatigue, tiredness, discomfort	Can be reversed

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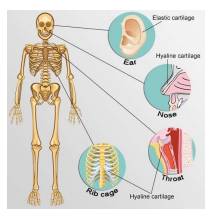
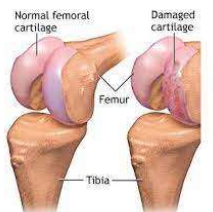
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## Cartilage

- Absorb shock to protect the bone



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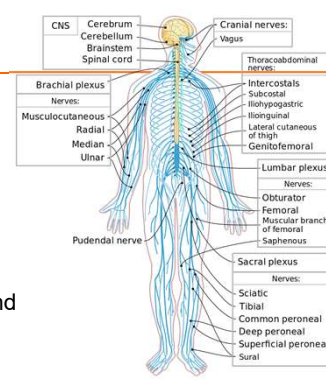
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**CNS**  
Cerebrum  
Cerebellum  
Brainstem  
Spinal cord

**Cranial nerves:**  
Vagus

**Thoracoabdominal nerves:**  
Intercostals  
Subcostal  
Iliohypogastric  
Ilioinguinal  
Lateral cutaneous of thigh  
Genitofemoral

**Brachial plexus**  
Nerves:  
Musculocutaneous  
Radial  
Median  
Ulnar


**Lumbar plexus**  
Nerves:  
Obturator  
Femoral  
Muscular branches of femoral  
Saphenous

**Sacral plexus**  
Nerves:  
Sciatic  
Tibial  
Common peroneal  
Deep peroneal  
Superficial peroneal  
Sural

Pudendal nerve

## Nerves

- Control voluntary and involuntary movement

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## Muscle Pain

- Cramp
- Delayed Onset Muscle Soreness (DOMS)
- Chronic exposure to static loads prevents proper recovery and can lead to permanent damage



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## Tendon - Strains

- A strain is an injury to a tendon
  - Repetitive movements
  - Awkward posture



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## Ligament - Sprains

- A sprain is stretching or tearing of a ligament



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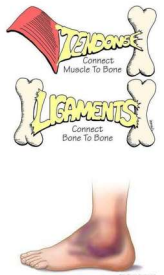
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## Strains and sprains

- Inflammation is a natural protective response
  - Tenosynovitis
  - Tendonitis
  - Bursitis
  - Planter fasciitis
  - Achilles' tendonitis



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## MSDs by profession



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## Lower limb

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## Planter Fasciitis

- Highly repetitive movements




Plantar fascia

Plantar fasciitis

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## Planter Fasciitis

- Sometimes mistaken for or the result of heel spurs
- Heel spur
  - Hook of bone that can form on the heel bone, or calcaneus, of the foot



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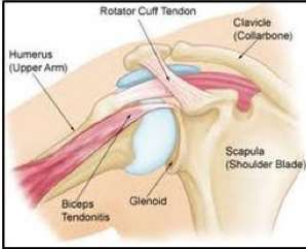
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## Tendonitis


- Caused by repeated tension, motion, bending, or being contact with a hard surface



<https://www.youtube.com/watch?v=T8SWKH18FIQ>

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## Tendonitis

- Repetitive motions
  - Awkward positions
  - Frequent overhead reaching
  - Vibration
  - Forceful exertion

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## Achilles' Tendonitis



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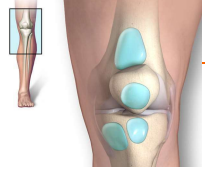
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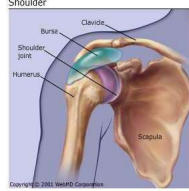
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## Bursitis




- Bursa - Fluid filled Sack
  - Prevents friction in joints
  - Acts like a cushion
- Bursitis – toughening from friction



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## Bursitis



- Bunions are a form of bursitis

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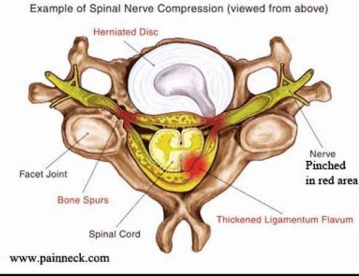
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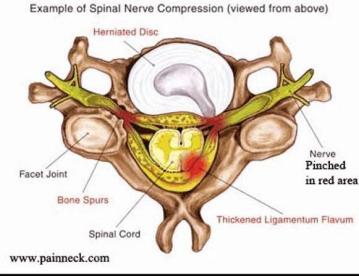
## Nerve Compression



Example of Spinal Nerve Compression (viewed from above)


• Motor nerve

• Sensory nerve



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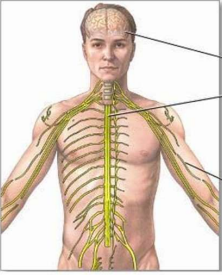
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## Neuritis


General inflammation of the peripheral nervous system



Central nervous system  
Brain  
Spinal cord  
Peripheral nervous system  
Peripheral nerve

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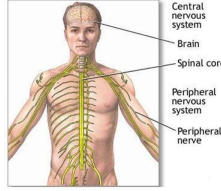
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## Neuritis


- Usually, a secondary problem from another type of injury/illness
  - Poisoning
    - lead, arsenic, mercury
  - Nerve compression
  - Acute Injury
  - Stroke



Central nervous system  
Brain  
Spinal cord  
Peripheral nervous system  
Peripheral nerve

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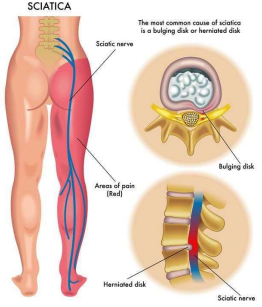
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## Nerve Compression

- Inflammation of or injury to the sciatic nerve
- Most common cause is a herniated disk



SCIATICA

Sciatic nerve

The most common cause of sciatica is a bulging disk or herniated disk.

Bulging disk


Herniated disk

Areas of pain (Red)

Sciatic nerve

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# Blood Vessel Compression



wiseGEEK

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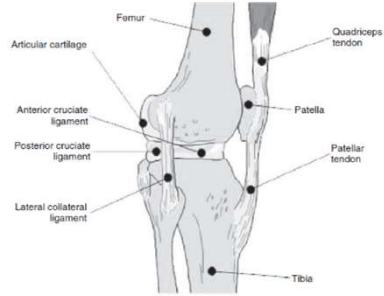
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# Knee


Janitors,  
road  
construction  
workers,  
carpet  
layers.



Articular cartilage  
Anterior cruciate ligament  
Posterior cruciate ligament  
Lateral collateral ligament  
Femur  
Tibia  
Patella  
Quadriceps tendon  
Patellar tendon

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# Knee

TABLE 13.2 Risk Factors for Knee Disorders					
Risk	Extrinsic Risk	Intrinsic Risk	OA	Meniscal Disorders	Knee Bursitis
Knocking	X		X	X	X
Squatting	X		X	X	
Crawling	X		X	X	
Stair/laddering climbing	X		X	X	
Lifting/carrying/moving	X		X	X	
Walking	X		X		
Standing up from a knee/squat/crawl	X		X	X	
Chair sitting (while driving)	X			X	
BMI		X	X		
Past knee injury/surgery		X	X		
Age		X	X		
Using the knee as a hammer	X				X
Prolonged contact stress against the patella other than when kneeling	X				X
Physical intensive habits/hobbies that could affect the knee		X	X	X	

Source: Adapted from Reid (2010).

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Upper limb

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Carpal Tunnel Syndrome

- Compression of the median nerve in the wrist
- Common Work Tasks
  - Buffing, grinding, sanding, polishing, assembly work, typing, keying, cashiering, playing musical instruments, surgery, packing, housekeeping, cooking, butchering, hammering, scissor work

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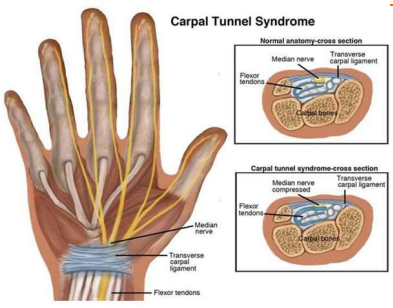
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Carpal Tunnel Syndrome




<https://www.youtube.com/watch?v=cz-SaH5-nQo>

<https://www.youtube.com/watch?v=QJNrkq7Ils>

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## Carpal Tunnel Syndrome

- There are six occupational risk factors for CTS:
  - Exertion of force over 1 kg (2.2lbs)
  - Duration of the shortest wrist operation greater than 10 seconds
  - Lack of a change in tasks
  - Lack of breaks for at least 15% of the day
  - Manual supply of parts and equipment to workstations
  - Lack of job rotation

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## Cubital Tunnel Syndrome

- Compression of the ulnar nerve below the notch of the elbow
- Common causes
  - Resting elbow on a hard surface
  - Reaching over obstructions
  - Keeping the elbow bent for a long time can stretch the nerve behind the elbow
    - Common during sleep

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## Cubital Tunnel Syndrome

### Cubital Tunnel Syndrome or Ulnar Nerve Compression



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## Guyon Canal Syndrome

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- Entrapment of the ulnar nerve as it passes through the wrist
- Common causes
  - Prolonged extension and flexion of the wrist
  - Repeated pressure on the palm
- Common Tasks
  - Playing musical instruments
  - Bricklaying
  - Use of pliers
  - Hammering
  - Soldiering

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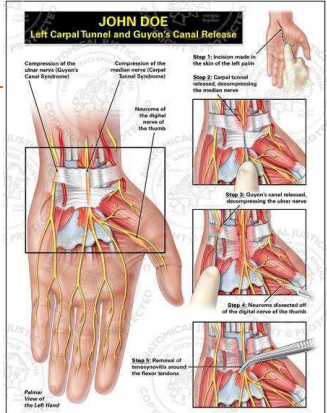
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## Guyon Canal Syndrome


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**JOHN DOE**  
Left Carpal Tunnel and Guyon's Canal Release



Palmar View of the Left Hand

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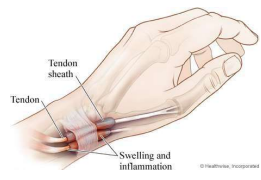
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## De Quervain's Syndrome

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- Symptoms:
  - Pain and swelling near the base of your thumb
  - Difficulty moving thumb and wrist when grasping or pinching
  - A "sticking" or "stop-and-go" sensation in your thumb
- Causes
  - Forceful gripping
  - Hand twisting or wringing



© Healthline, Incorporated

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## De Quervain's Syndrome

- Common Tasks
  - Buffing, grinding, polishing, sanding, pushing, pressing, sawing, tool use, turning controls



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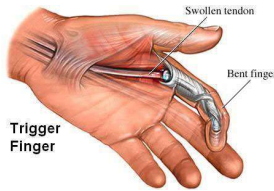
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## Trigger Finger

- Symptoms:
  - Finger stiffness, particularly in the morning
  - A popping or clicking sensation as you move your finger
  - Tenderness or a bump (nodule) in the palm at the base of the affected finger
  - Finger catching or locking in a bent position, which suddenly pops straight
- Common Tasks
  - Trigger operated tools
  - Hand tools with sharp edges
  - Handles too far apart



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## White Finger (Raynaud's Disease)

- Results from closure of digit arteries caused by vasospasms by vibration
- Common Tasks
  - Chain Saws, jackhammering, vibrating tools, too small tools, working in the cold.



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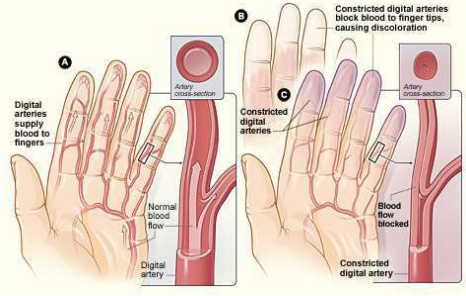
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## White Finger (dead finger)

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**A** Digital arteries supply blood to fingers. Normal blood flow. Digital artery.

**B** Constricted digital arteries block blood to finger tips, causing discoloration. Artery cross-section. Constricted digital artery. Blood flow blocked.

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## Ganglion Cyst

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- Cystic Tumor
- Common Tasks
  - Buffing, grinding, polishing, sanding, pushing, pressing, use of pliers, turning controls such as on a motorcycle, inserting screws and holes, **or forceful handwringing**



Fluid-filled sac (cyst)

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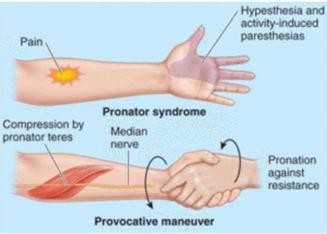
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## Pronator Teres Syndrome

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- Compression of the median nerve in the top third of the forearm.
- Common Tasks
  - Soldering, buffing, grinding, polishing or sanding



Pain, Hypesthesia and activity-induced paresthesias, Compression by pronator teres, Median nerve, Pronator syndrome, Pronation against resistance, Provocative maneuver

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## Epicondylitis – Tennis Elbow

- Symptoms
  - Pain or burning on the outer part of your elbow
  - Weak grip strength that
- Common Tasks
  - Turning screws
  - Small parts assembly
  - Hammering
  - Meat cutting
  - Playing musical instruments
  - Playing tennis, pitching, bowling

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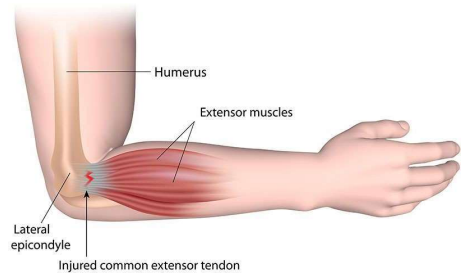
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## Epicondylitis – Tennis Elbow



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## Neck Tension Syndrome



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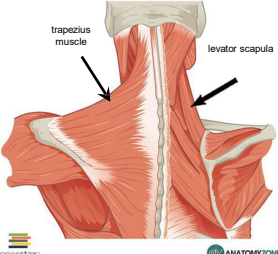
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## Neck Tension Syndrome

An irritation of the levator scapulae and trapezius muscle of the neck



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## Neck Tension Syndrome

- Symptoms
  - Headache
  - Fatigue
  - Aching discomfort at the back of the neck and the upper back.
  - Spasms in the neck and dull pain in the upper arm, elbow, forearm and hands

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## Neck Tension Syndrome

- Causes
  - Computer mouse more than 25 hours per week
  - Localized muscle fatigue due to repetitive motion or static, sustained contraction
    - Lack of oxygen supply
- Common Tasks
  - Conveyor belt assembly, computer use, small part assembly, packing, load carrying in hands or on shoulder, overhead work, cashiers.

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Neck Tension Syndrome



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Neck Tension Syndrome



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Thoracic Outlet Syndrome



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## Thoracic Outlet Syndrome



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## Thoracic Outlet Syndrome | Mark's Story



[https://www.youtube.com/watch?v=ILXn\\_j3NZIE](https://www.youtube.com/watch?v=ILXn_j3NZIE)

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## Thoracic Outlet Syndrome

- Symptoms vary on the compressed structures
  - Neurological
    - Compression of the brachial plexus
    - Numbness or tingling in your arm or fingers
    - Pain or aches in your neck, shoulder or hand
    - Weakening grip
    - Arm fatigue with activity

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## Thoracic Outlet Syndrome

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- **Vascular**
  - Veins or arteries are compressed
  - Bluish discoloration of your hand
  - Arm pain and swelling, possibly due to blood clots
  - Weak or no pulse in the affected arm
  - Cold fingers, hands or arms
  - Throbbing lump near your collarbone

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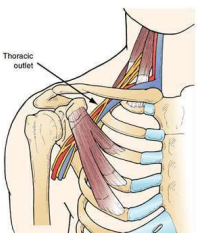




## Thoracic Outlet Syndrome


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- Blood vessels or nerves (Brachial plexus) in the space between your collarbone and your first rib (thoracic outlet) are compressed



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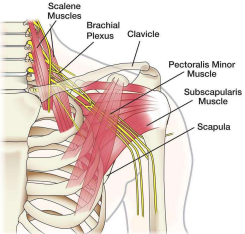
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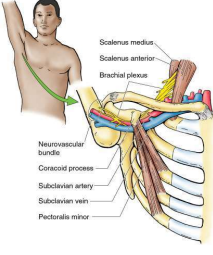


## Thoracic Outlet Syndrome

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5.86 Compression of the neurovascular bundle by the axilla.




© Leonard Williams & Wilkins


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## Thoracic Outlet Syndrome



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## Thoracic Outlet Syndrome



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## Introduction to musculoskeletal disorders



Dental Hygiene and Ergonomics Video Series  
Video 1 of 5  
Introduction to musculoskeletal disorders

<https://www.youtube.com/watch?v=RTNmYcUjGgI>

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## To do list

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- HW 01 is posted due by Friday

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## Questions?

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