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Sprains and Strains

A closer look at musculoskeletal and repetitive use injuries

November 9, 2022

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Presenters

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Discussion topics

1. Scope
2. Definitions and injury grades
3. Soft tissue injury diagnosis and treatment
4. Treatment
5. Medication treatment options
6. Common injury types
7. On the horizon

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Sprains and strains are the most common workplace injury

25,000 people sprain an ankle every day.

55% do not seek medical attention

Back strain accounts for approximately 40% of days away from work

Approximately 630,000 sprains and strains are reported annually in the U.S.

Half of these are in the workplace

Resources:
Zippia.com
Bureau of Labor statistics
GSKhealthpartner.com

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Most common occupations for sprains and strains (U.S., private sector, 2018)

Occupation	Total number of days away from work	Median days away from work	% of total injuries involving musculoskeletal disorders
Laborers and freight, stock, and material movers	25,110	13	38%
Nursing assistants	15,360	7	52%
Heavy and tractor-trailer truck drivers	14,810	21	31%
Stock clerks and order fillers	10,150	15	40%
Registered nurses	8,390	8	42%
Light truck or delivery services drivers	8,380	16	38%
Retail salespersons	7,900	8	30%
First-line supervisors of retail sales workers	6,020	12	36%
Maintenance and repair workers- general	6,010	14	28%
Maids and housekeeping cleaners	5,740	12	35%

https://www.bls.gov/iif/factsheets/msds.htm

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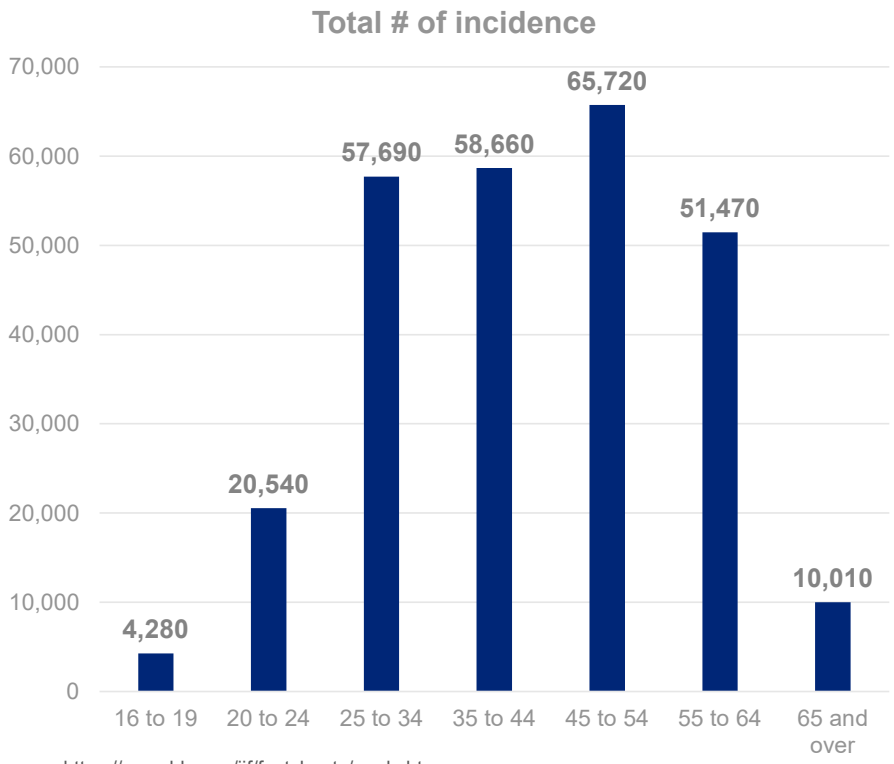
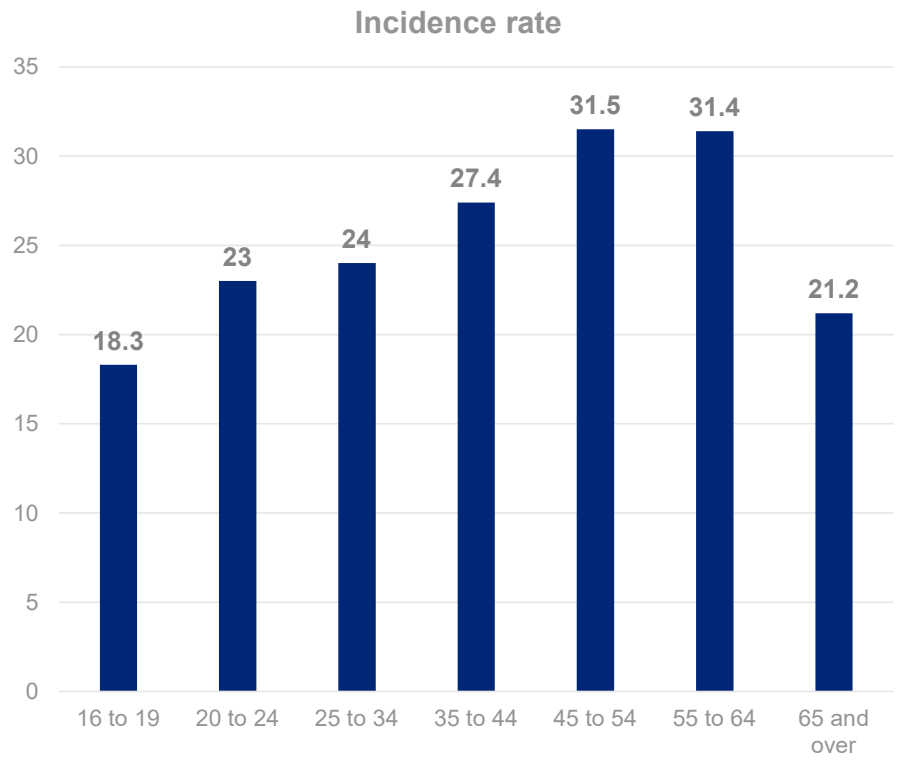
Incidence by age group (U.S., private sector, 2018)





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Definitions and injury grades

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What is a soft tissue injury?

- Sprains/Strains, contusions (bruises), tendonitis, bursitis
- Symptoms may include Pain, swelling, bruising, limited range, weakness, spasms, instability
- Classification
  - Acute
  - Overuse

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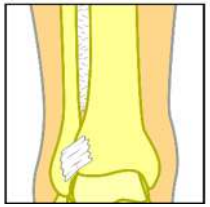
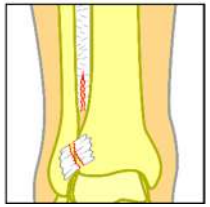
Definitions and injury grades

Sprain: Bone to bone ligament

Grade			
Normal	1st overstretched, fibers	2nd partial tear of structure	3rd complete rupture
			

Sprain: Muscle to bone - Tendon

Grade			
Normal	1st overstretched, fibers	2nd partial tear of structure	3rd complete rupture
			

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Diagnosis and treatments

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Diagnosis

- Mechanism of Injury
- Pain, swelling, bruising
- Point tenderness
- Pain on range of motion
- Tests
  - X-rays
  - Ultrasound
  - MRI

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Treatment

Stage	Acute or inflammatory	Subacute	Chronic
Goal	• Remove from injury • Prevent further harm	• Promote healing • Restore mobility and function	• Educate • Increase mobility, endurance, strength and function

RICE (Not the long-grain variation)

R	**Rest** Take a break from the activity that caused the injury. For example, if the injury is to the leg, crutches may be indicated to avoid bearing weight.
I	**Ice** Use cold packs for 10-15 minutes at a time, several times a day. Do not apply ice directly to the skin
C	**Compression** Prevent additional swelling and blood loss, wear an elastic compression bandage
E	**Elevation** Reduce swelling, elevate the injury higher than your heart while resting

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Healing cascade

Hemostasis

Inflammation

Cellular and Matrix Proliferation

Most important phase

Remodeling

Longest phase

Healing cascade

Hemostasis

- Coagulation
- Platelet aggregation
- Clot formation
- Extracellular matrix (Platelet binding to matrix releases bioactive substances)

Inflammation

Cellular and Matrix Proliferation

Most important phase

Remodeling

Longest phase

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Healing cascade

Hemostasis

- Coagulation
- Platelet aggregation
- Clot formation
- Extracellular matrix (Platelet binding to matrix releases bioactive substances)

Inflammation

- Neutrophils summoned – 1-2 hours
- Macrophages appear- 2-3 days (Debridement and regulation of inflammation)
- Fibroblast recruited
- Lymphocytes - enter late inflammatory phase

Cellular and Matrix Proliferation

Most important phase

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Healing cascade

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Cellular and Matrix Proliferation

Most important phase

- Growth factors
- Pluripotent progenitor cells (i.e., stem cells)
- Fibroblasts make collagen – Type III
- Angiogenesis and formation of granulation tissue

Remodeling

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Cellular and Matrix Proliferation

Most important phase

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- Fibroblasts make collagen – Type III
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Remodeling

Longest phase

- Additional growth factors – PDGF, TGF-beta
- Fibroblast proliferation and migration
- Type I collagen
  - Replaces Type III collage, proteoglycan, fibronectin
  - Improved strength
- Challenges:
  - Ischemia, tissue hypoxia, infection, growth factor imbalance
  - Systemic causes such as metabolic disease and nutritional status

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Medication treatment options

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NSAIDs

- Classes, Subdivisions
- Individual responses to NSAIDs can vary

Six Major Classes

1. Salicylates – aspirin
2. Propionic Acid derivatives – ibuprofen
3. Acetic Acid derivatives – diclofenac
4. Enolic Acid derivatives – meloxicam
5. Anthranilic Acid derivatives – mefenamic acid
6. Selective COX-2 inhibitors – celecoxib

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Mainstay of treatment

- Guidelines consider NSAID first line (Generally, a cost-effective option)
- Even though first line, it is not without risks
  - Major risks: cardiovascular events, renal insufficiency, prolonged bleeding times, and gastrointestinal issues including bleeding, ulcers, and pain.
  - Can consider H2 blockers and/or PPI if needed
- Consider lowest dose, shortest duration, and OTC formulations if appropriate

Are NSAIDs helpful?

An NIH study showed:

Compared with paracetamol (Acetaminophen)

- NSAIDs make no difference to pain at one to two hours and at two to three days and may make no difference at day seven or beyond.
- NSAIDs may result in a small increase in gastrointestinal adverse events and may make no difference in neurological adverse events compared with paracetamol.

Compared with opioids

- NSAIDs probably make no difference to pain at one hour and may make no difference at days four or seven.
- NSAIDs probably result in fewer gastrointestinal and neurological adverse effects compared with opioids.

Oral non-steroidal anti-inflammatory drugs versus other oral analgesic agents for acute soft tissue injury - PubMed (nih.gov)

Meta-analysis Cochrane Database 2020

NSAID Alternatives

- Acetaminophen
- Steroids
  - Effective but limit use due to side effects
  - Prolonged use with adrenal insufficiency
- Antispasmodics
  - Common examples
  - Side effects drowsiness
  - Caution with other medications

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NSAID Alternatives

- Adjuncts
  - Gabapentinoids – gabapentin, pregabalin
  - Generally not used for musculoskeletal pain
- Opioids
  - Short term, limited, as needed use
  - Opioid in WC claims, use with caution
  - No indication for LAO in sprain/strain

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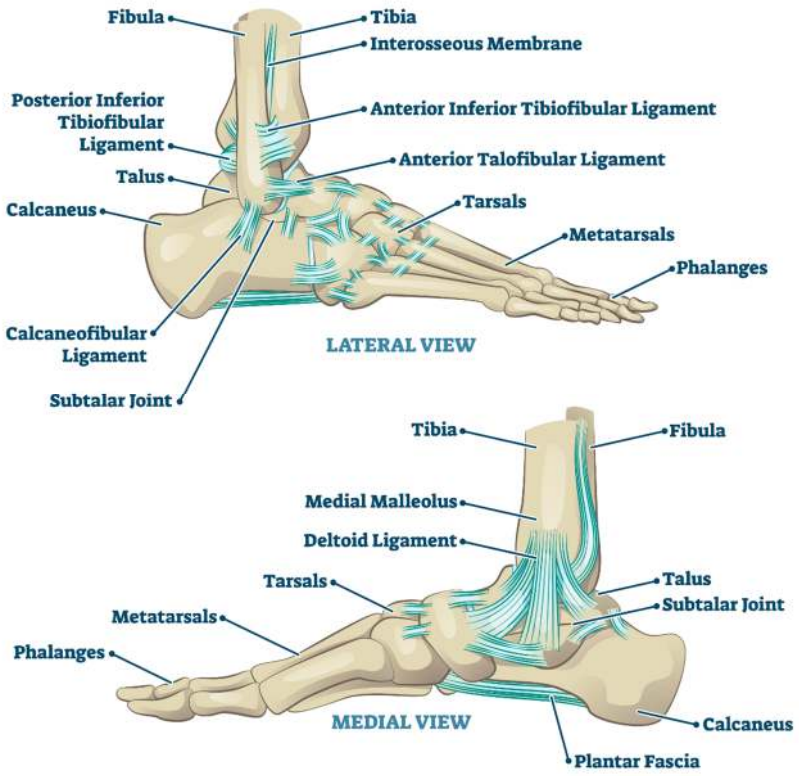
Common injuries

Exam, Diagnosis, Treatments

Ankle sprain

Ligaments	Anterior talofibular, calcaneofibular, posterior talofibular • Lateral ankle most common >>> medial or deltoid ligaments • Ligaments ATFL (66%) and +CFL (86%) • Studies support ankle bracing to reduce risks
Exam	• Anterior drawer, Talar tilt • External rotation and squeeze tests
Diagnosis	• Clinical • MRI



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Ankle sprain

Treatments	Medications
	Bracing: Evidence to support more stringent initial immobilization
	Air-Stirrup with elastic wrap for Gr I and II, possible below knee cast for Gr III
	Balance training to support ankle – SLS postural control
	Joint mobilizations – Systematic review in 2011 supported reduced pain, improved weight bearing distribution
	Other considerations – Stochastic resonance, Attention focus

Reinjury can turn to CAI (chronic ankle instability) 70-75%

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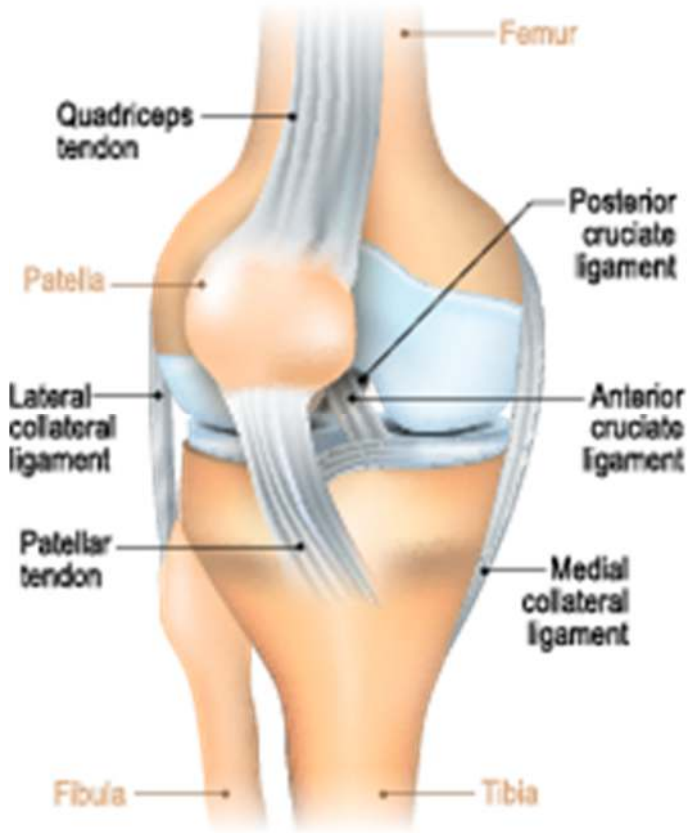
Knee sprain

Ligaments	Collateral (medial/lateral w or wo meniscus), cruciates
	ACL: • Up to 200,000 injuries to ACL/year w 100,000 reconstructions/year • 60% of all injuries; 70% ACLs non contact deceleration or sudden change • Risks – hamstring weakness
	PCL: • Ranges from 1 to 40% of all ligamentous injuries to knee • MVA most common cause followed by fall on bent knee
	Lateral: Least common 4% - torque with contact “clipping”



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Knee sprain

Diagnosis	Exam – Ant/Post Drawer & Lachman's, Pivot Shift, Varus/Valgus stress, McMurray's MRI – most sensitive and specific test
Treatment (ACL example)	Medications
Diagnosis	Immobilization • Flexed bracing for healing of ligament in partial tear, total time 8-10 weeks • Post reconstruction – Variable: from no bracing to braces that allow ROM up to 8 weeks
	Therapy • Conservative Treatment Only - quad/hamstring most important • Post surgical – est. 6-12 months post op for return to full activity
	Surgery • Complete tears will need surgery • Overall, 90% return to near-normal functioning

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Wrist sprains

Ligaments	20 ligaments of the wrist connecting eight carpal bones
Mechanisms	Acute: Sudden force, excessive load-bearing, or twisting injury; fall
	Chronic: Repetitive tasks
	Most common structures – • Triangular fibrocartilage complex (TFCC) – associated with radioulnar ligaments (RUL) and ulnocarpal ligaments (UCL); usually diagnosed with US or MRI • Scapholunate ligament complex; usually diagnosed with Xray – closed fist • Neurovascular implications with instability
Treatments	• Medications • Bracing up to six weeks • Therapy • Surgery may be needed

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Back strain

- Lumbar strain is most common
- $200 billion spent annually on the management of back pain
- Likely both strain and sprain
  - Complex connection of vertebra
  - Sacroiliac Joint sprains
  - Quadratus lumborum strains
- Bracing not usually effective unless there is instability

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Back strain

Exam	• Range, strength, neuro, provocative maneuvers • Must rule out other etiologies “Red Flags”
Diagnostic tests	• X-rays including Flex/Ext • CT for acute trauma but MRI gold standard
Treatment	• Medications • Therapy • Injections

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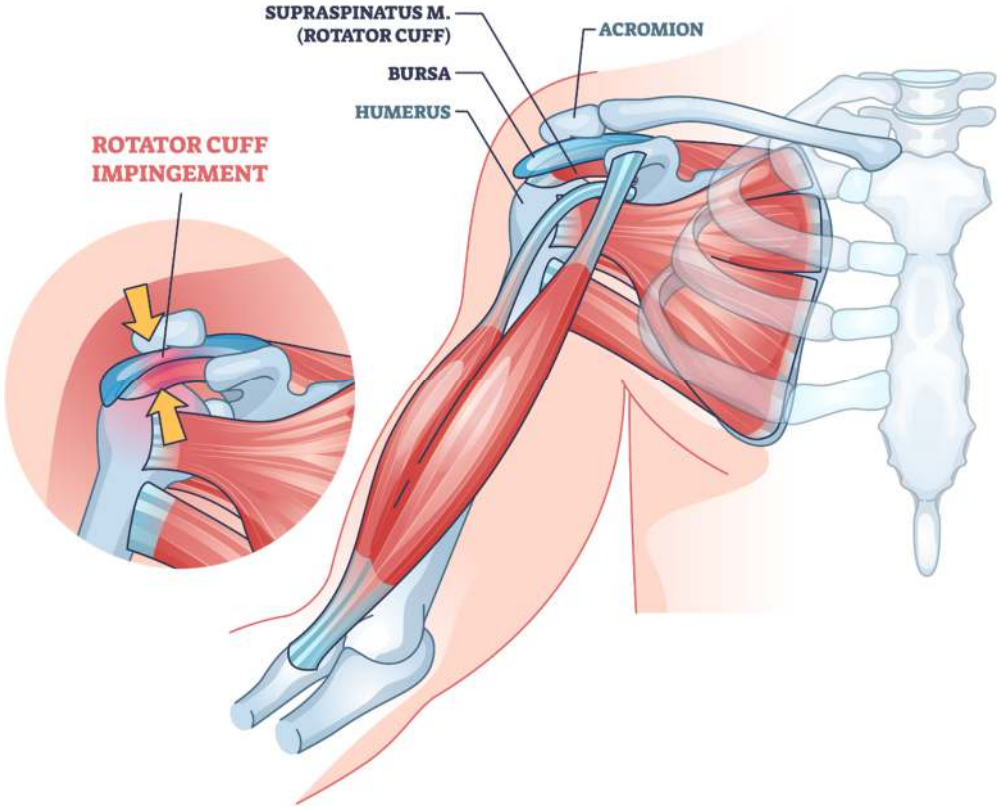
Shoulder strain

- Rotator Cuff – Supra/Infraspinatus, Teres minor, subscapularis
- Incidence
  - 8% of all work injuries are shoulder
  - 65-70% of shoulder is related to rotator cuff



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Shoulder strain

Exam	Hawkins, Neer, Drop Arm, Empty Can
Tests	Ultrasound becoming more utilized; MRI Gold standard
Treatments	Relative rest
	Ergonomic Evaluation
	Physical Therapy • Focus on scapular positioning • Progress to rotator cuff strength
	Injections • Trigger Point Injections • Steroid
	Surgery: Usually needed for a complete tear

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Repetitive Strain UE

- Repetitive Stress Injuries (RSI) or Repetitive Motion Disorders (RMD)
- Risks: Uninterrupted repetitions, awkward motions, excessive force, overexertion, static and/or incorrect postures, vibration, extreme temperatures or muscle fatigue.
- RMDs occur most commonly in the hands, wrists, elbows
- Occupational Risks: assembly line work, meatpacking, sewing, musicians, and computer work

Diagnosis	Objective tests sometimes unable to provide answers
Treatments	• Medications • Rest/Support • Ergonomics • Therapy

Bureau labor statistics reported that RSI resulted in the greatest average number of days away from work (average > 20).

On the Horizon

Regenerative Medicine

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Prolotherapy injections

- Concentrated dextrose solution injected to promote collagen formation
- Superior to controls in Osgood-Schlatter disease, lateral epicondylitis of the elbow, traumatic rotator cuff injury, knee OA, finger OA. (Hauser 2016)
- Cochrane Study (Dagenais 2007) – Mixed results

  Some studies, no more effective than control for chronic low-back pain and disability.

  Two studies, when given with spinal manipulation, exercise, and other therapies, are more effective than control injections for chronic low-back pain and disability. Initial reduction in pain and disability but only one study showed sustained benefit at 6 months.

Summary

Prolotherapy alone is not an effective treatment for CLBP. However, when combined with spinal manipulation, exercise, and other co-interventions, prolotherapy might have a subtle effect.

Platelet Rich Plasma (PRP)

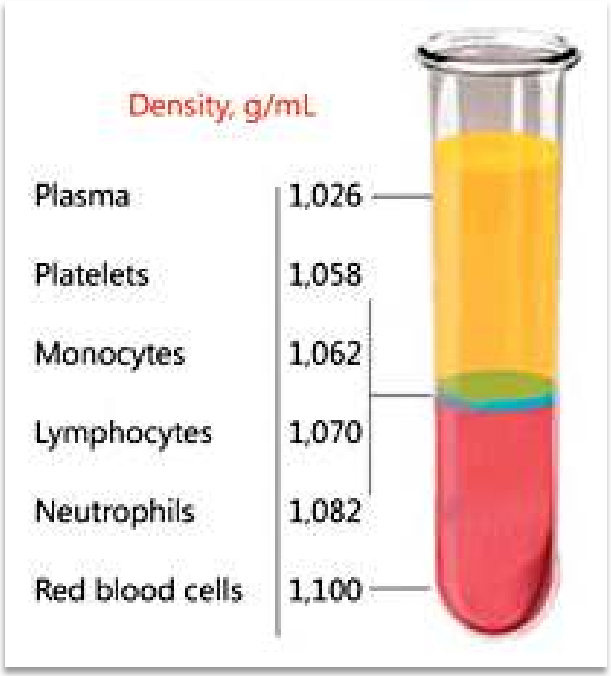
Separation of blood components

- PRP platelet rich plasma
- PPP platelet-poor plasma
- RBCs at bottom

Growth factors and cytokines

- Increase vascularization
- Promote stem cell migration
- Promote cell proliferation

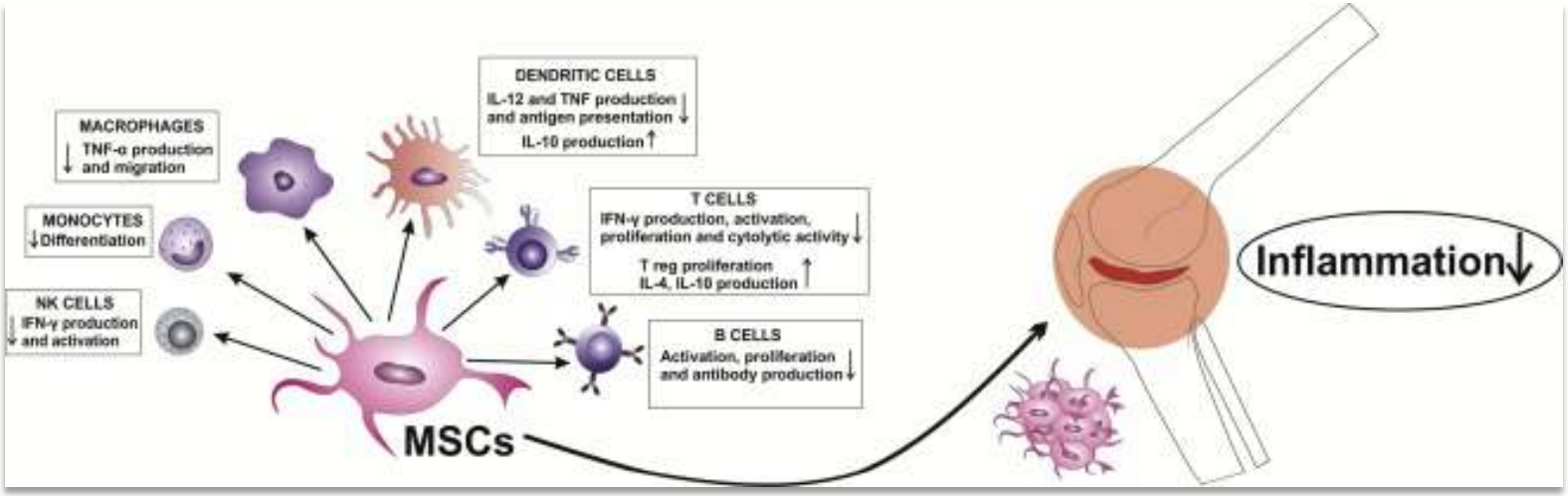
Studies support use for knee OA and lateral epicondylitis. More research needed on other diagnoses, including use in the spine.



Alves R, Grimalt R: A Review of Platelet-Rich Plasma: History, Biology, Mechanism of Action, and Classification. Skin Appendage Disord 2018;4:18-24.

Stem Cells | Mesenchymal Stem Cells (MSC)

- Multipotent cells with high capacity for self renewal
- Being explored as an alternative to Autologous chondrocyte implantation in OA
- Effects seem to include cell differentiation and overall suppression of cells that are pathogenic in OA
- NIH small study currently for DDD Lumbar spine projected to be completed by 2022
- More research needed



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Summary

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Take Aways

- A lot happening under the surface
- PRICE or RICE
- Focus on restoring function
- Medications – As needed to allow progress
- Job fit and/or Fit for duty
- Ergonomics
- Future treatment
- Research needed

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