



Cartilage in the shoulder

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Introduction

- **Common mechanisms (rugby tackles, fall, overhead trauma, instability)**
- **What will be covered-**
- **How it fails**
- **Healing**
- **Tissue biomechanics**
- **Rehabilitation**

Anatomy of intra articular cartilage

Intra- articular cartilage- hyaline articular cartilage

**Lines inside the glenohumeral joint- humeral head and glenoid fossa
(Sophia Fox et al.)**

Four zones- superficial, middle, deep and calcified (Eschweiler et al.)

How intra- articular cartilage fails

Intra-articular fails because -

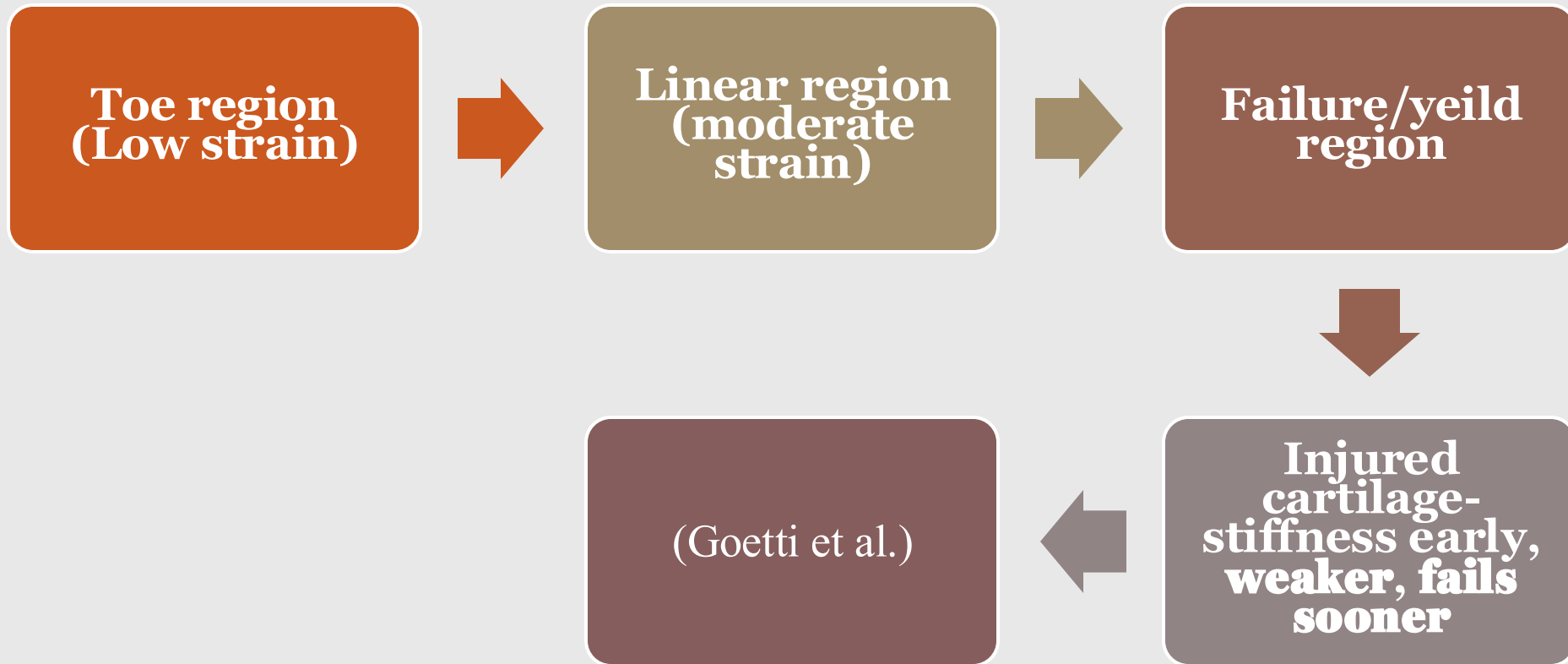
Avascular- no direct bloody supply, slow healing time

A neural- no nerve supply, meaning the damage is not painful- surrounding area is

A lymphatic- no lymphatic drainage, slower everything

Sophia Fox et al. (2020)

Stress strain



Mechanisms of failure

Excessive shear forces- overhead loading, instability

Compressive overload- contact injuries, heavy overhead lifting

Rotator cuff failure- labral stress, anterior shear

Instability episodes- dislocations or subluxations

Repetitive overhead loading-

Types of intra-articular cartilage

Chondral contusions- swelling and softening of the cartilage

Focal chondral defect- localised area of cartilage loss

Chondromalacia- early degenerative change

Slap lesions- superior labrum

Bankart lesions- anterior shoulder dislocations

Healing time frame of intra-articular cartilage

Labral tears=
fibrocartilage-
moderate
healing

Articular
cartilage-
hyaline= poor
healing

Forces that help

Compressive forces
(low load)

Controlled ROM,
isometrics, closed
chain

Tensile forces of
rotator cuff

Creates joint
centration- spreads
even load. Reduce
focal stress/shear

Joint retraction
forces

Muscular
compression meets
cartilage resistance

Scapular upward
rotation

Controlled shear

Fluid pressure

(Landínez-Parra
et al,2012).

Yang, Z. et al.
(2023)

Load tolerance

**The humerus elevates to
120 before **acromion** lifts
further**

**60 of overhead elevation
comes from scapular
upwards **rotation****

Rotator cuff **acts as force
couple to **stabilise humeral
head****

**Prevents increase of shear
stress**

Joint arthrokinematics

Shoulder is a ball and socket- concave glenoid fossa, convex humeral head



Humeral head rolls in same directions as limb



Intra articular cartilage depends on even load



Rotator cuff provides dynamic stability



Rehab stages overview chondral contusions

- **Early phase 0-6 weeks**
 - **Improve pain, swelling, stiffness**
- **Intermediate 6-12 weeks**
- **Late healing phase 3-6 months**
 - **Collagen fibers partially realign**
- (Yang et al.2023)

Surgical vs conservative

Conservative
management-

Chondral
contusions

Small, stable focal
defects

No locking or
catching

Surgical

Large or unstable
focal chondral
defects

3-6 months of
rehab –
persistent
symptoms

Locking/catching

Bankart lesions-
anterior inferior
glenoid labrum,
dislocates
forwards

Exercise 1 – isometric

- **Isometric external rotation-**
- **Targets infraspinatus, teres minor, stabilise humeral head**
- **5-10 second hold, 8-10 reps, 2-3 sets**



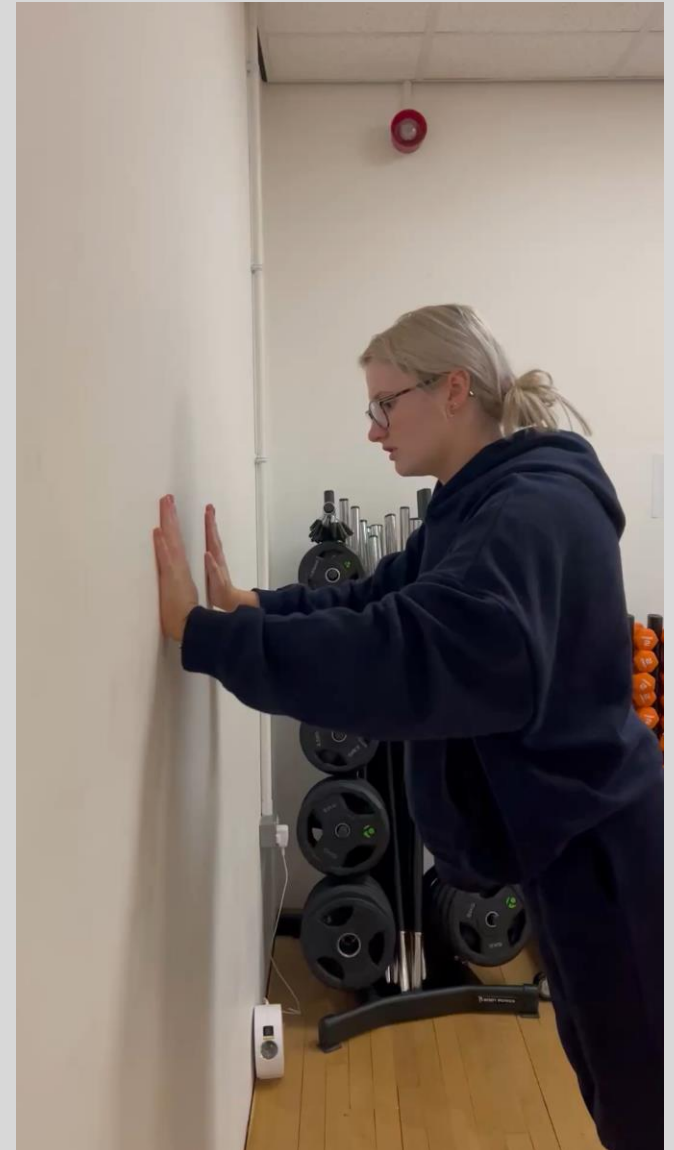
Exercise 2 –isotonic

- **Banded internal rotation external rotation**
- **Targets rotator cuff strengthen**
- **12 reps x 3 sets**



Exercise 4 – concentric

- **Wall shoulder taps**
- **Progression- plank shoulder taps**
- **Regression- wider hands and feet to distribute weight**



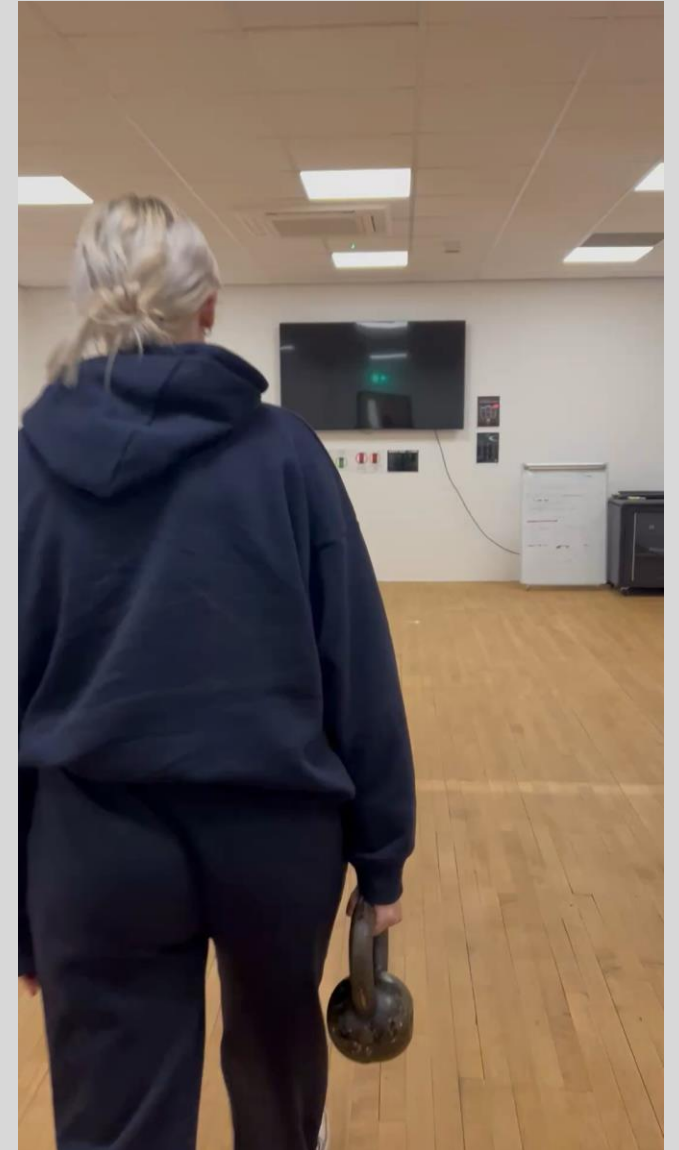
Exercise 5 – eccentric

- **Dumb bell row**
- **4 seconds on the way down**
- **10 reps x 3 sets**
- **Progression- heavier weights with barbell**
- **Regression- chest supported rows**



Exercise 6 – eccentric

- **Farmers carry**
- **Progression- increase the distance and load**
- **Regression farmers hold- not walking with lighter weight**





Exercise 3 –open chain

- **Increase load tolerance**

Weighted front raises

Progression- yoga ball or smaller ball rolling up and down the wall

Regression- no weight or wall slides

Conclussion

- **The cartilage is organised into 4 zones- superficial, middle, deep, calcified**
- **Its avascular, aneural ,alymphathatic**
- **Can manage compression, shear and tensile force during sport**
- **Sporting movement such as overhead, high veleocity impacts, instability and high forces exceed the force it can take**

References

- Chang, Lou-Ren, et al. "Anatomy, Shoulder and Upper Limb, Glenohumeral Joint." *Nih.gov*, StatPearls Publishing, 8 Aug. 2023, www.ncbi.nlm.nih.gov/sites/books/NBK537018/.
- Eschweiler, Joerg, et al. "The Biomechanics of Cartilage—an Overview." *Life*, vol. 11, no. 4, 1 Apr. 2021, p. 302, <https://doi.org/10.3390/life11040302>.
- Elser, Florian, et al. "Glenohumeral Joint Preservation: Current Options for Managing Articular Cartilage Lesions in Young, Active Patients." *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, vol. 26, no. 5, May 2010, pp. 685–696, <https://doi.org/10.1016/j.arthro.2009.10.017>. Accessed 27 Dec. 2021.
- Fiegen, Anthony, et al. "Articular Cartilage Defects of the Glenohumeral Joint: A Systematic Review of Treatment Options and Outcomes." *CARTILAGE*, vol. 13, no. 1_suppl, 23 Aug. 2019, pp. 401S413S, <https://doi.org/10.1177/1947603519870858>.
- Goetti, Patrick, et al. "Shoulder Biomechanics in Normal and Selected Pathological Conditions." *EFORT Open Reviews*, vol. 5, no. 8, 10 Sept. 2020, pp. 508–518, www.ncbi.nlm.nih.gov/pmc/articles/PMC7484714/, <https://doi.org/10.1302/2058-5241.5.200006>.
- Krych, Aaron J, et al. "The Effect of Cartilage Injury after Arthroscopic Stabilization for Shoulder Instability." *Orthopedics*, vol. 38, no. 11, 1 Nov. 2015, <https://doi.org/10.3928/01477447-20151020-03>. Accessed 11 Mar. 2025.
- Lansdown, D.A. et al. (2020) "Risk Factors for Intra-articular Bone and Cartilage Lesions in Patients Undergoing Surgical Treatment for Posterior Instability," *The American journal of sports medicine*, 48(5), pp. 1207–1212. Available at: <https://doi.org/10.1177/0363546520907916>.
- McCready, Erin, et al. "Biomechanical, Morphological, and Biochemical Characteristics of Articular Cartilage of the Ovine Humeral Head." *CARTILAGE*, vol. 13, no. 1, Jan. 2022, <https://doi.org/10.1177/19476035221081465>. Accessed Jan. 13 2026.
- Rosenberg, Nahum. *Shoulder Injuries and Treatment*. BoD – Books on Demand, 3 Dec. 2025.
- Ricardo, Alfonso. "Anatomy and Kinematics of the Shoulder Joint." *Springer EBooks*, 1 Jan. 2021, pp. 111–133, https://doi.org/10.1007/978-3-030-81549-3_10.
- Sophia Fox, Alice J., et al. "The Basic Science of Articular Cartilage: Structure, Composition, and Function." *Sports Health: A Multidisciplinary Approach*, vol. 1, no. 6, Nov. 2009, pp. 461–468, <https://doi.org/10.1177/1941738109350438>.
- Yang, Zhengzhong, et al. "Effect of Different Loads on the Shoulder in Abduction Postures: A Finite Element Analysis." *Scientific Reports*, vol. 13, no. 1, 11 June 2023, p. 9490, www.nature.com/articles/s41598-023-36049-9, <https://doi.org/10.1038/s41598-023-36049-9>.
- Zhang, Min, and Chih-Hwa Chen. "Biomechanics of the Shoulder." *Frontiers in Orthopaedic Biomechanics*, 2020, pp. 131–145, https://doi.org/10.1007/978-981-15-3159-0_6. Accessed 19 Jan. 2026.