Peritendinous Injections:
Update of Tecniques and Evidences

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Istanbul University, Faculty of Medicine
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Orginizer of

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Creative approach is important!

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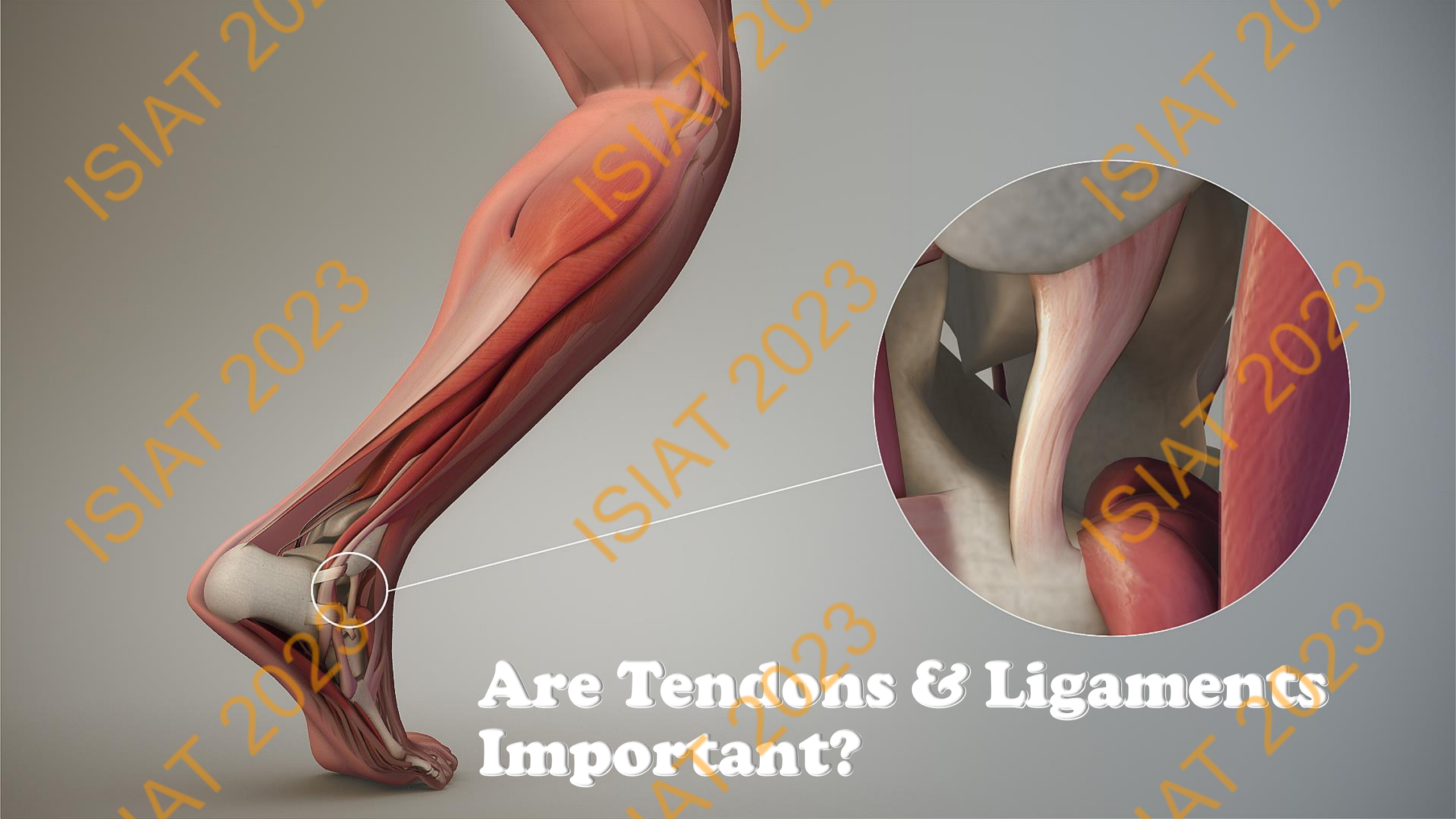

Are Tendons & Ligaments Important?


Bosphorus Bridge
Istanbul
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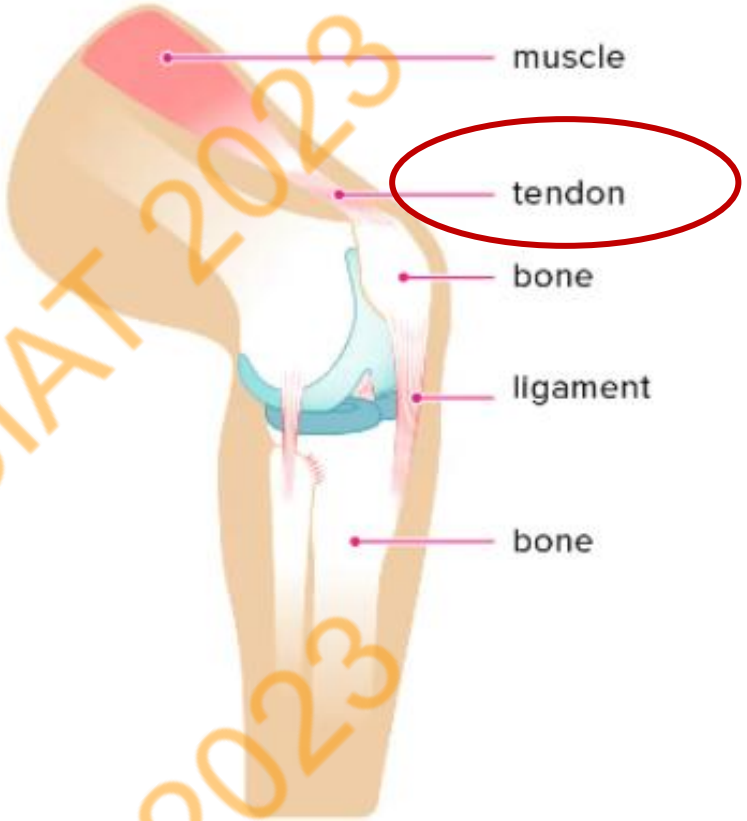
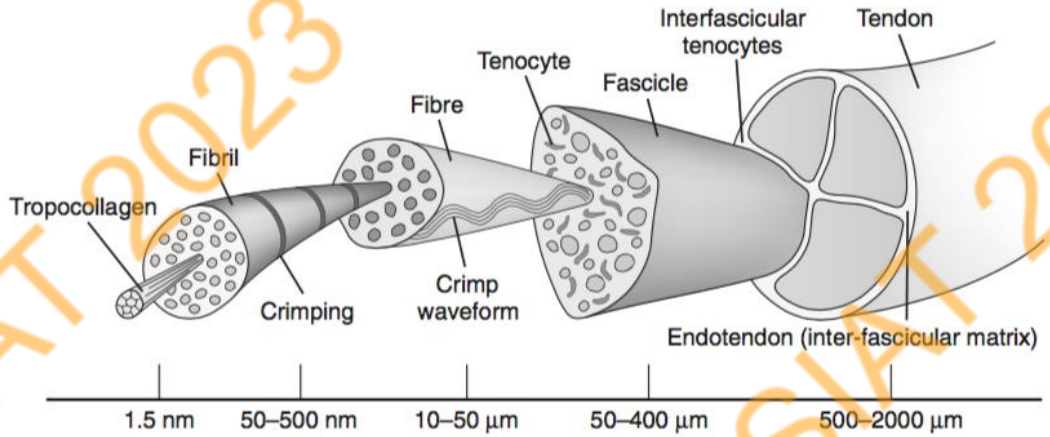
Tendon «A Mechanical Bridge»





A tendon is a tough band of fibrous connective tissue that connects muscle to bone and is built to withstand tension.

Bordoni B, Varacallo M. Anatomy, Tendons. [Updated 2021 Jul 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021

Packages

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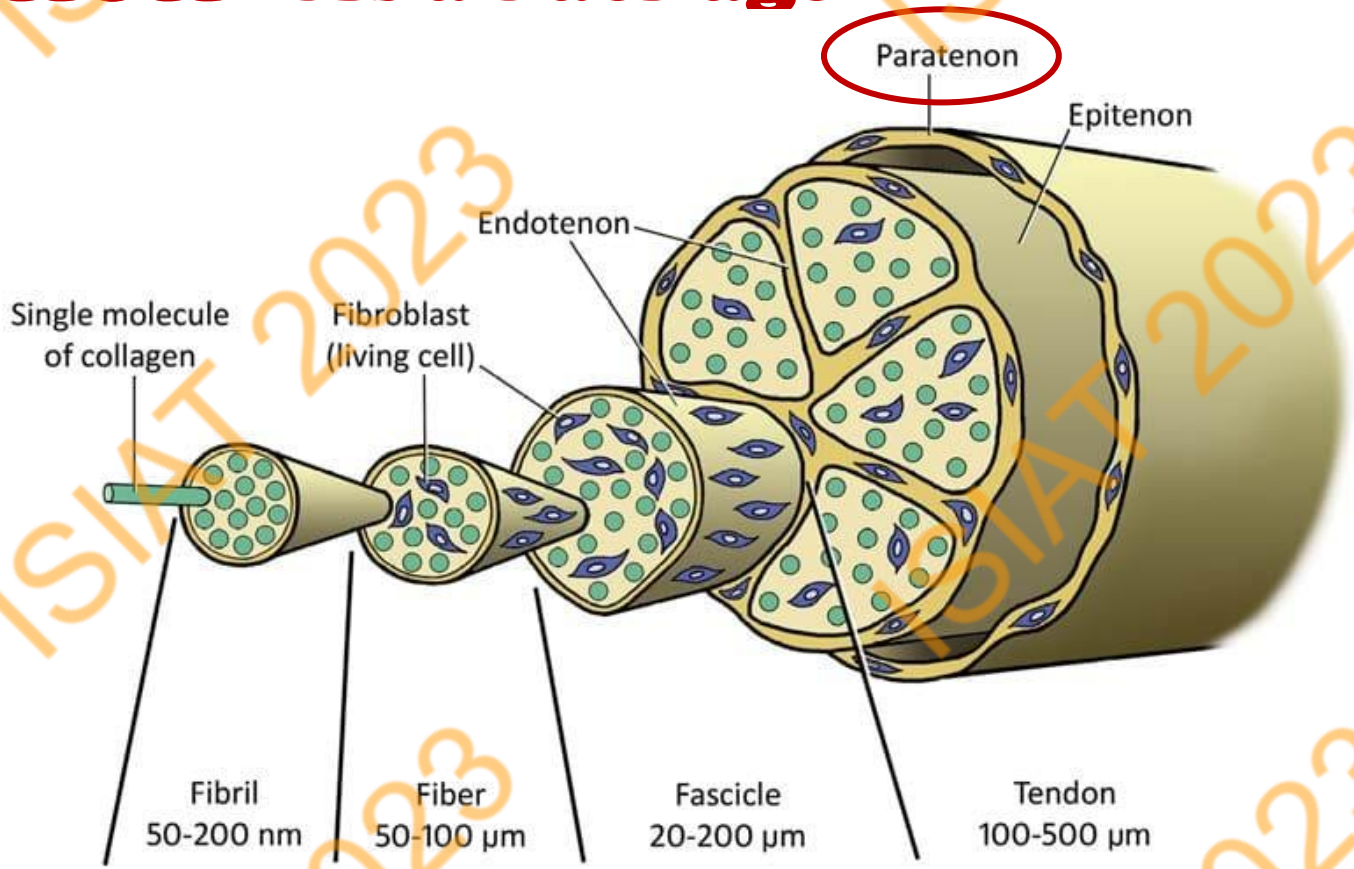
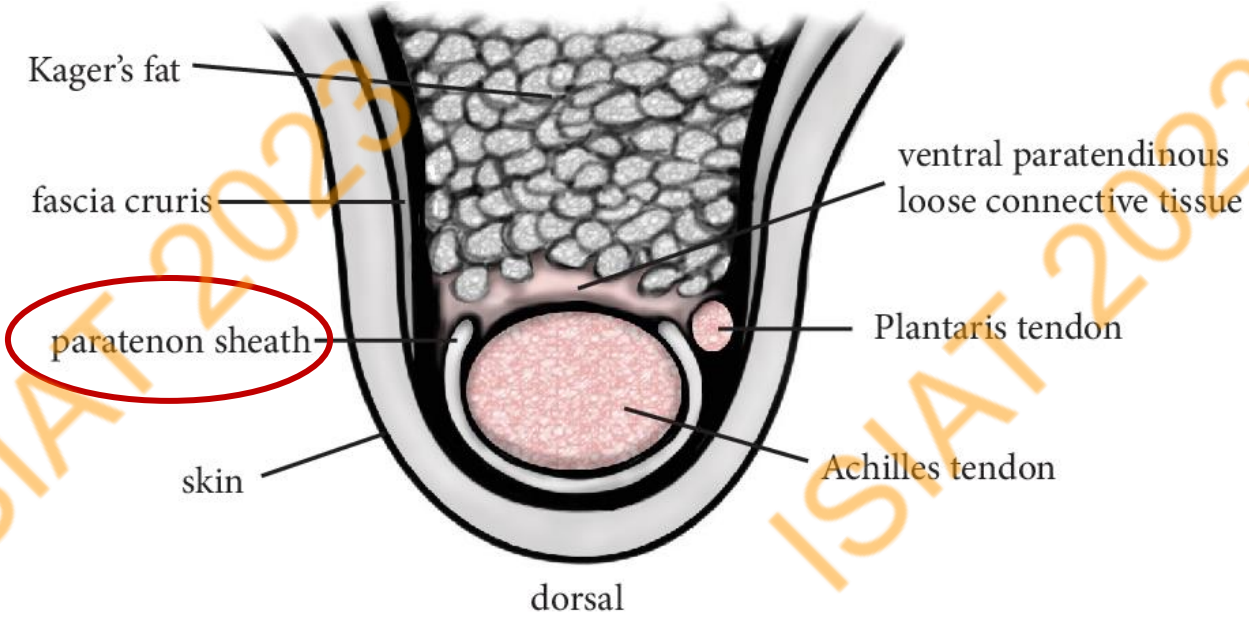
Paratenon «As a Package»

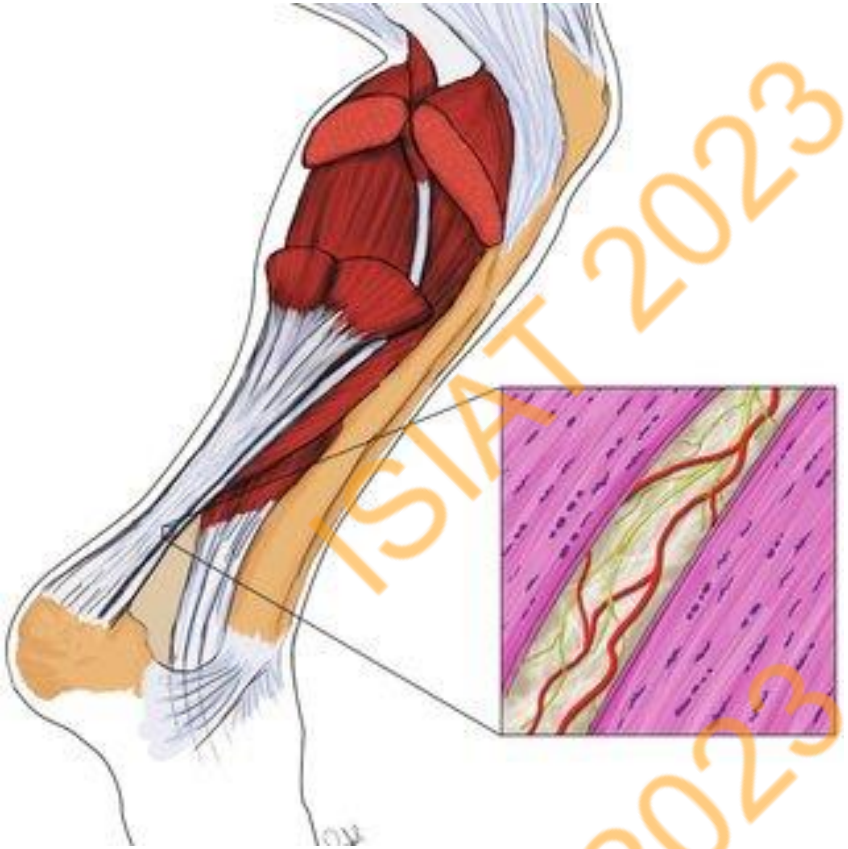
- Paratenon is made up of collagen fibrils of type I and III and of thin elastic fibers.
- It helps to reduce friction and works as a sort of elastic sleeve that allows the free movement of the tendon with respect to the surrounding structures.



Stecco C, Cappellari A, Macchi V, Porzionato A, Morra A, Berizzi A, De Caro R. The paratendineous tissues: an anatomical study of their role in the pathogenesis of tendinopathy. Surg Radiol Anat. 2014 Aug;36(6):561-72. doi: 10.1007/s00276-013-1244-8. Epub 2013 Dec 8.

Paratenon





The paratenon is more vascularized and innervated than the tendon, supporting the hypothesis that it is the origin of pain in tendinopathy.

Stecco C, Cappellari A, Macchi V, Porzionato A, Morra A, Berizzi A, De Caro R. The paratendineous tissues: an anatomical study of their role in the pathogenesis of tendinopathy. Surg Radiol Anat. 2014 Aug;36(6):561-72. doi: 10.1007/s00276-013-1244-8. Epub 2013 Dec 8.


What is Tendinopathy?
Inflammation?
Degeneration?
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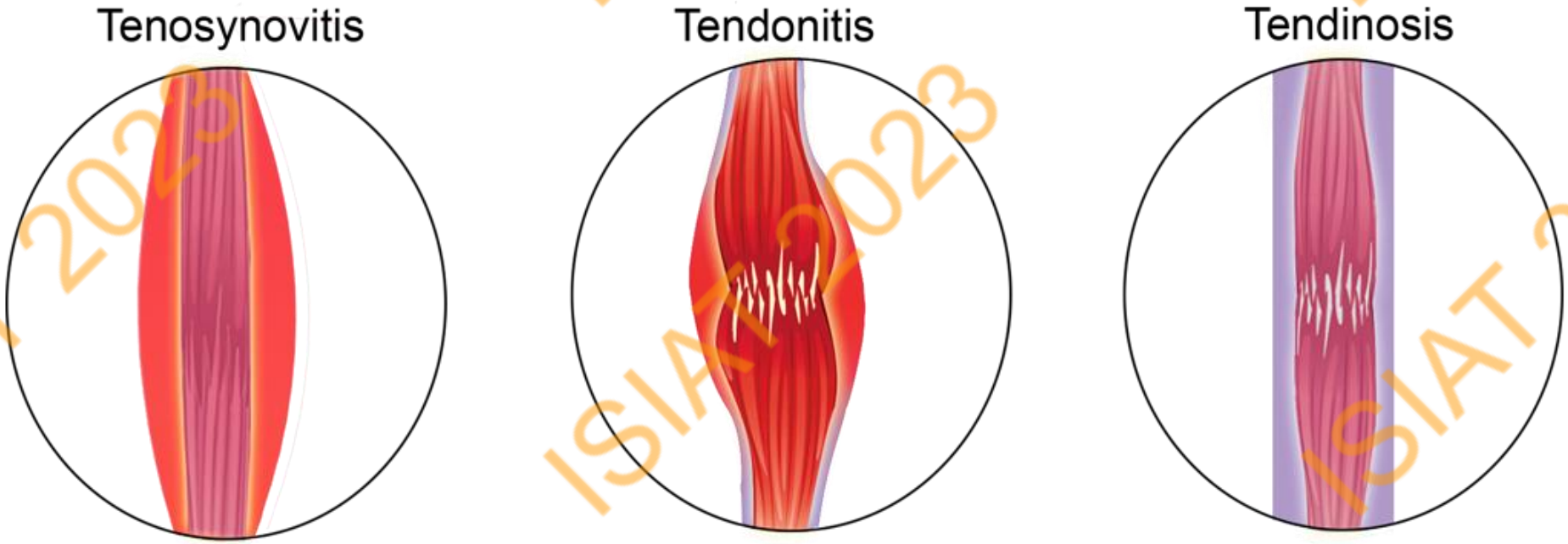
Tendinopathy



- Neovascularization (Angiofibroblastic hyperplasia)
- Matrix disorganization
- Increased protein synthesis

Gervasi M, Barbieri E, Capparucci I, Annibalini G, Sisti D, Amatori S, Carrabs V, Valli G, Donati Zeppa S, Rocchi MBL, Stocchi V, Sestili P. Treatment of Achilles Tendinopathy in Recreational Runners with Peritendinous Hyaluronic Acid Injections: A Viscoelastometric, Functional, and Biochemical Pilot Study. J Clin Med. 2021 Mar 31;10(7):1397. doi: 10.3390/jcm10071397. PMID: 33807327; PMCID: PMC8037202.
Surena Namdari, Jason E. Hsu. Shoulder and Elbow. In Namdari, Surena, MD, editor. Orthopedic Secrets, Fourth Edition; 2015. Chapter 8, P. 244-280.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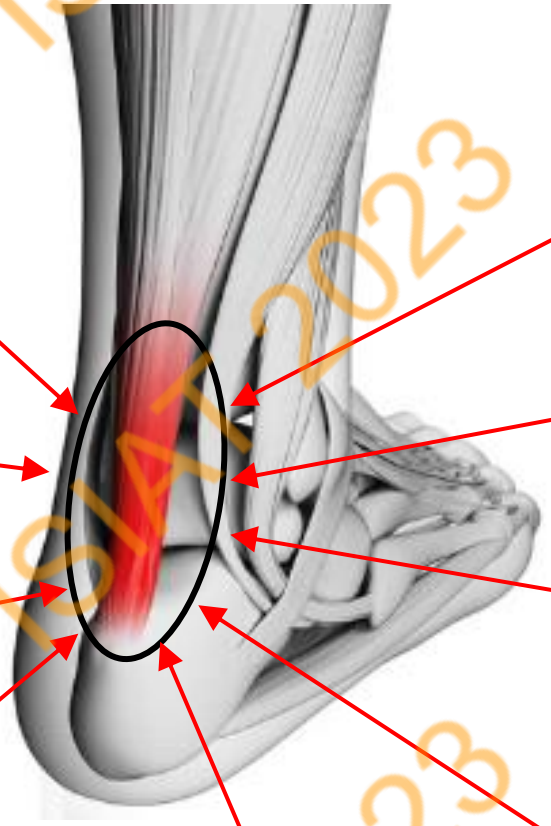
Peritendinous Injection Agents



Hyaluronic Acids

Hypertonic Dextrose

MMP Inhibitors

Sclerosing Agents

Autologous Blood

PRP

Corticosteroids

Protease Inhibitors (Aprotinin)

Dry Needling

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Treatment	Mode of Action
Corticosteroid injection	Reduction of inflammation and other unknown effects (generally inhibitory of protein synthesis)
Hyaluronic acid	Lubricant and regulation of angiogenesis
Sclerosant injection	Blocks tendon blood flow (targets neovascularization and associated nerve in growth)
Autologous blood	Contains growth factors (e.g. transforming growth factor b and platelet-derived growth factor) that promote matrix synthesis and tissue repair
PRP	Contains concentrated growth factors (e.g. transforming growth factor b and platelet-derived growth factor) that promote matrix synthesis and tissue repair
Hyperosmolar dextrose (prolotherapy)	Healing by local inflammatory response
Extracorporeal shockwave treatment	Mechanical stimulation. Anti-inflammatory by effect on nitric oxide production.
Dry needling	Microtrauma and bleeding bringing inflammatory response

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What About the Coctails?

- HA + PRP ?
- PRP + Stem Cells ?
- HA + Corticosteroids ?
- HA + Dextrose ?

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Primum Non Nocere!

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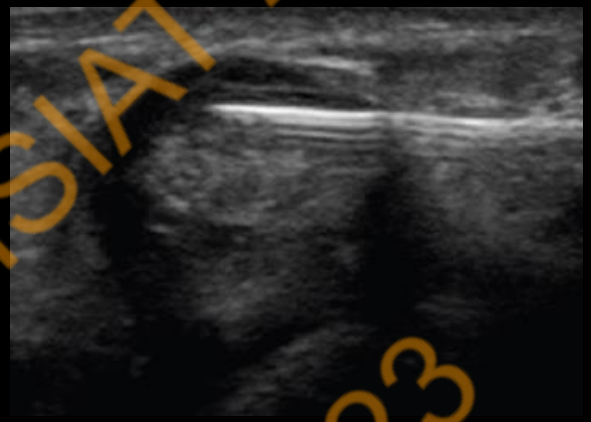

Ultrasound Guidence

- ✓ Ultrasound is an indispensable guide for the periarticular injections
- ✓ In ultrasound-guided peritendinous injection, the "**donut sign**" can be seen, indicating a successful intrasheath injection
- ✓ A gradual distension in which the tendon is surrounded by the injected substance

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Most Common Peritendinous Injections

- Achilles tendinopathy
- Patellar tendinopathy
- Lateral epicondylitis
- Biceps long head tendinopathy
- Iliopsoas tendinopathy
- Gluteus medius tendinopathy
- Distal biceps tendinopathy
- ……

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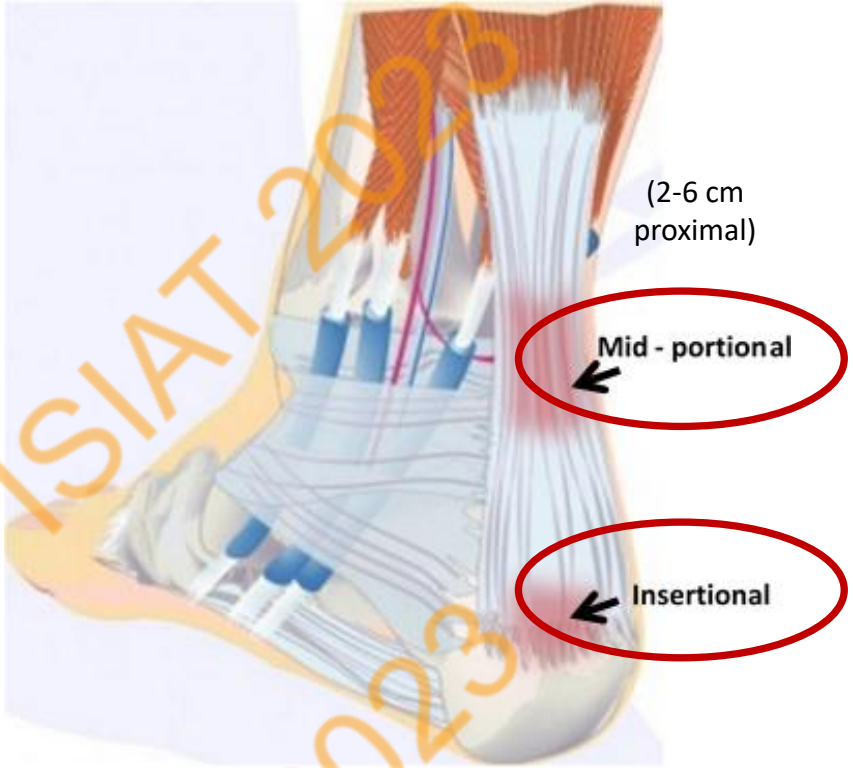
Achilles Tendinopathy



- Sensibility
- Pain after exercise
- Morning stiffness
- Swelling

Nicola Maffulli, Umile Giuseppe Longo, Anish Kadakia, Filippo Spiezia, Achilles tendinopathy, Foot and Ankle Surgery, Volume 26, Issue 3, 2020, Pages 240-249

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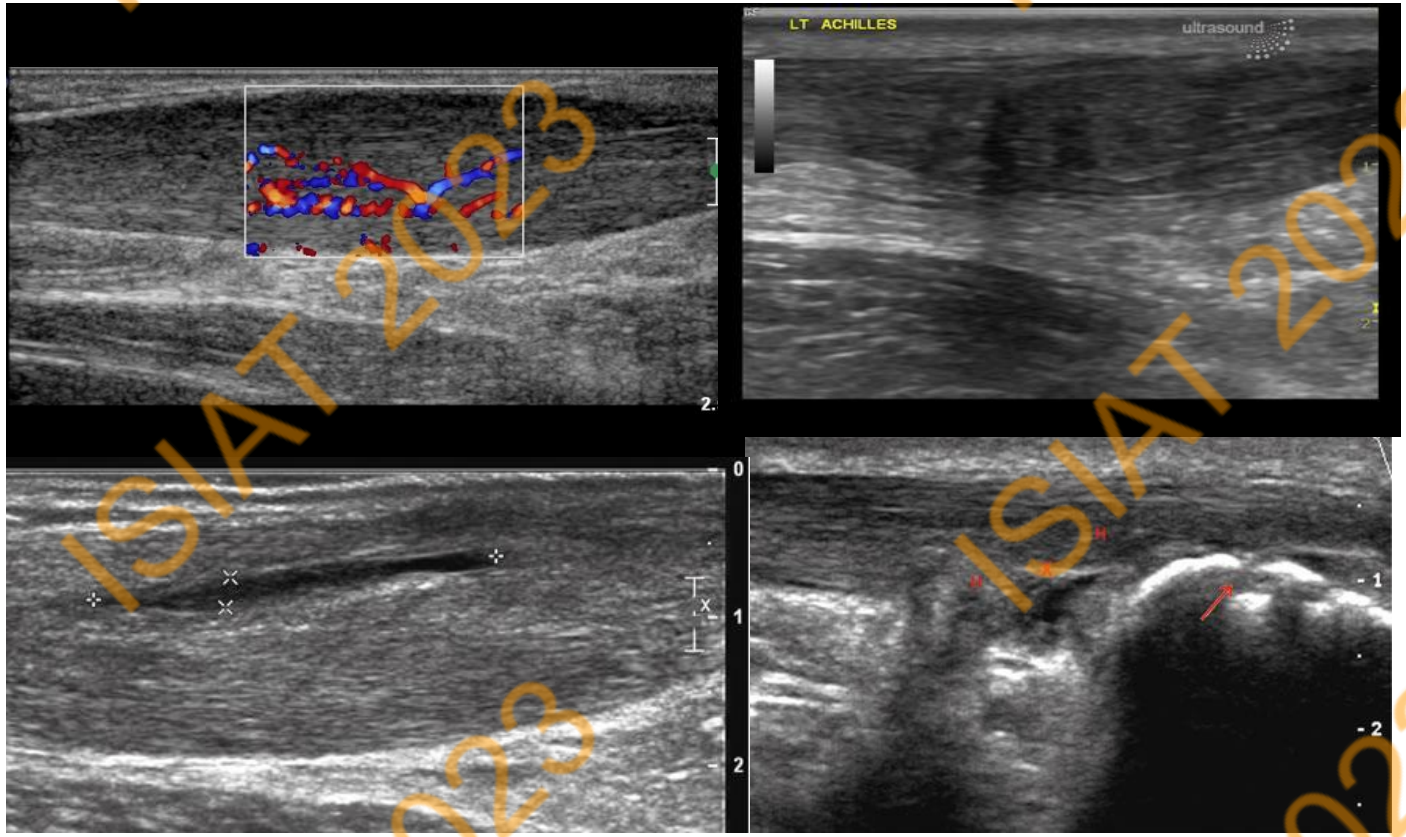
Achilles Tendinopathy

Ultrasound View



- Thickening of the tendon
- Irregularities in the tendon structure
- Neovascularization (Doppler Us)

Nicola Maffulli, Umile Giuseppe Longo, Anish Kadakia, Filippo Spiezia, Achilles tendinopathy, Foot and Ankle Surgery, Volume 26, Issue 3, 2020, Pages 240-249,

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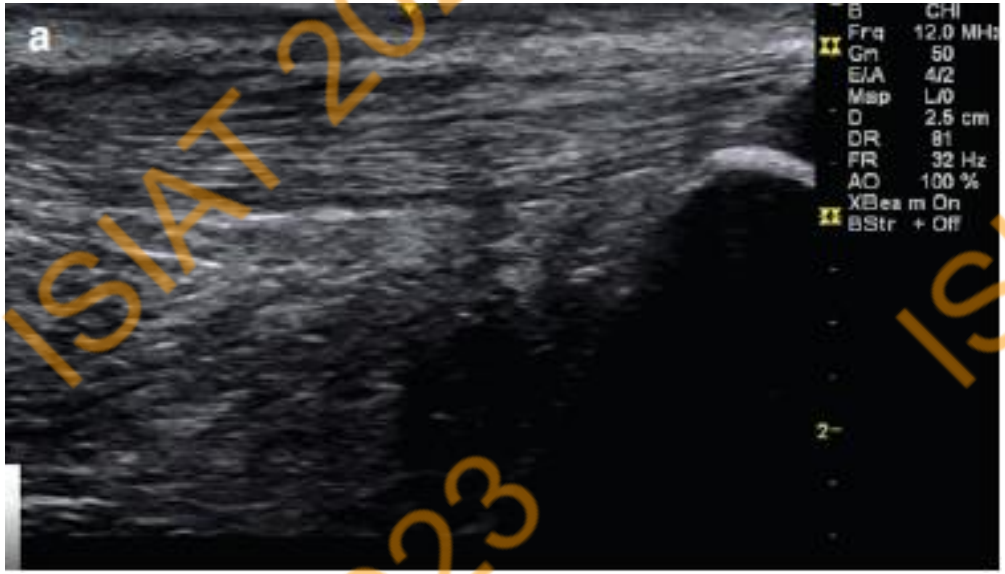
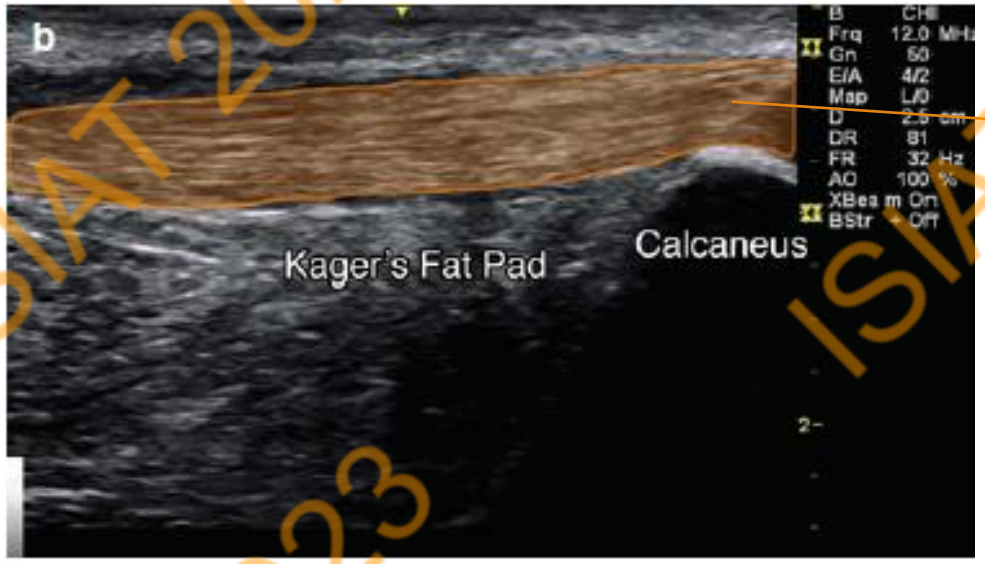




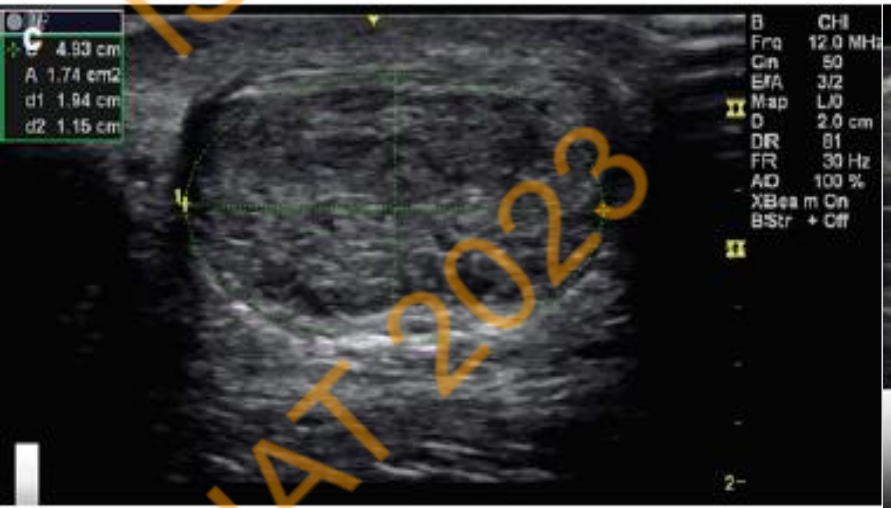
Achilles tendon

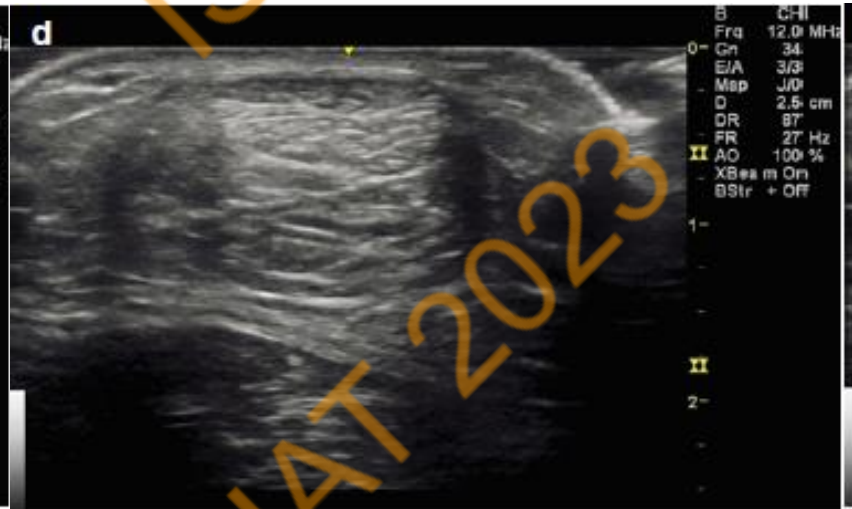
Sagittal view

Axial view

Tendinosis

Achilles tendon





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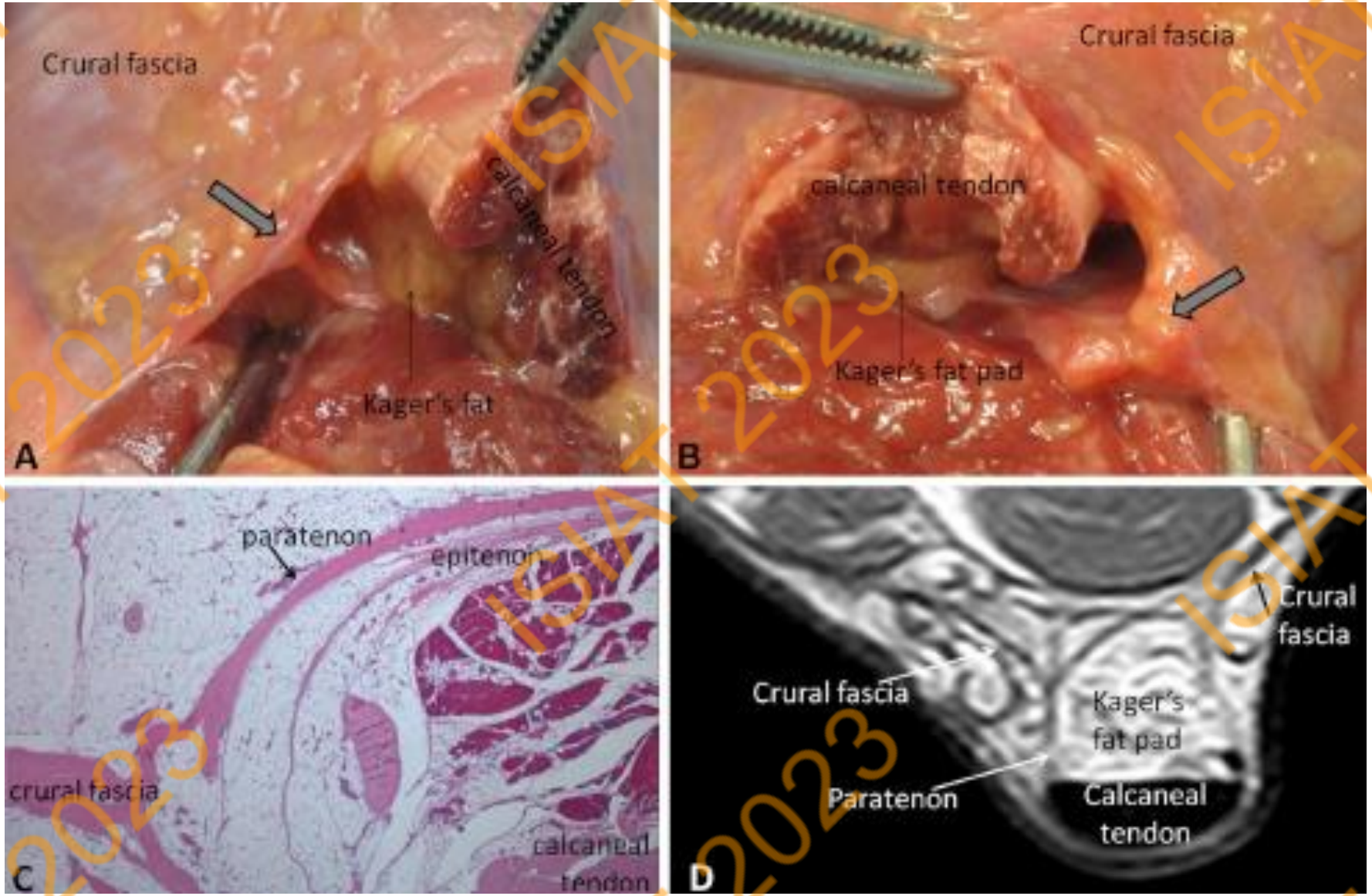

Stecco, Carla, et al. "The paratendineous tissues: an anatomical study of their role in the pathogenesis of tendinopathy." *Surgical and Radiologic Anatomy* 36.6 (2014): 561-572.

US-guided Peritendinous Injection Technique in Achilles Tendinopathy

Sagital, In-plane Approach

- **Position:** Pron, feet away from the end of the table (Ankle dorsiflexion stretches the Achilles tendon and can reduce anisotropy.)
- **The probe** is inserted longitudinally to obtain images in the sagittal plane and scanned proximally and distally to look for focal thickening and/or fluid.
- **Needle tip:** 25G 1.5 inch
- **Needle position:** It is entered in-plane from proximal to distal or distal to proximal and advanced superficially.

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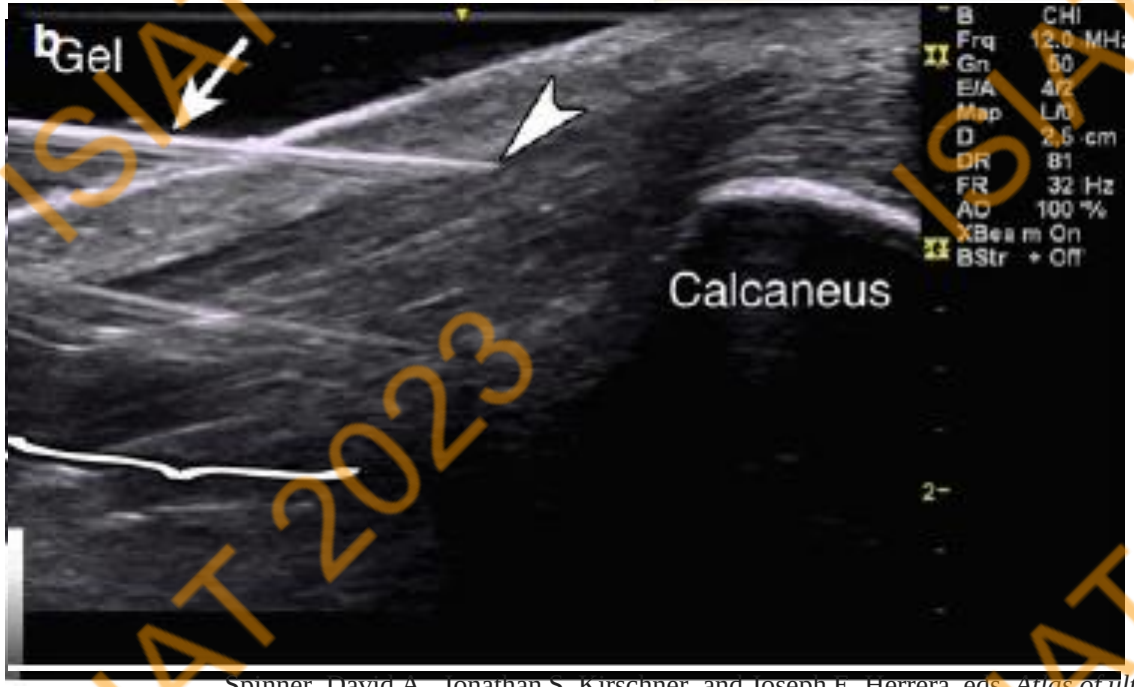
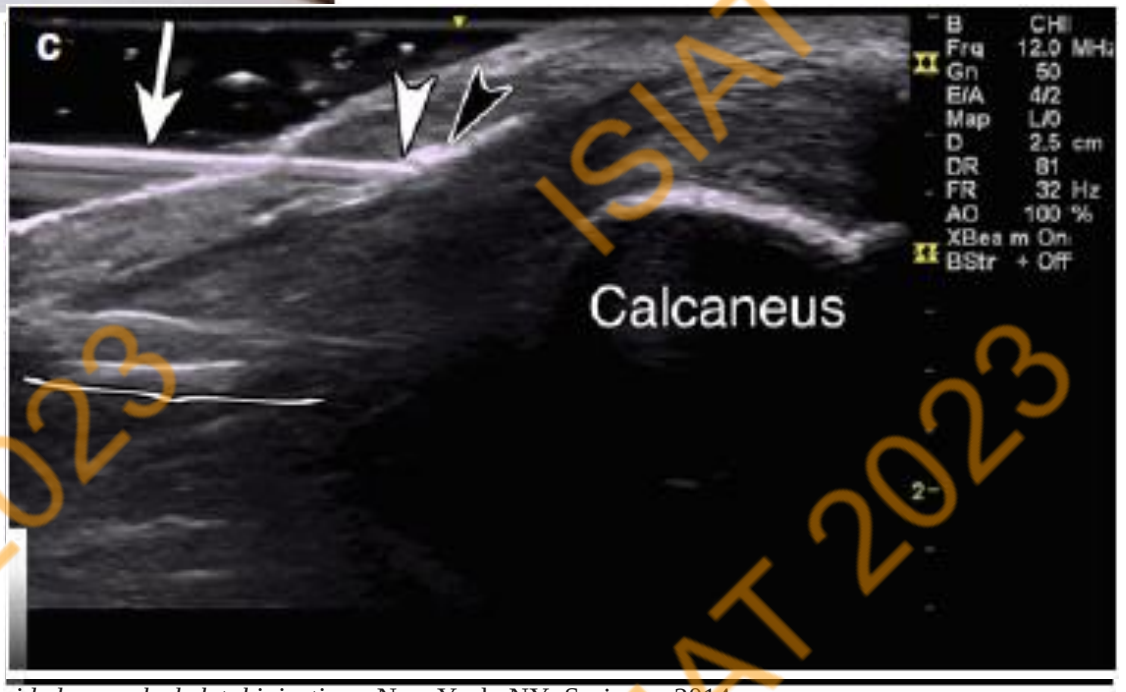
- **Sagittal**
- **In-plane**





Spinner, David A., Jonathan S. Kirschner, and Joseph E. Herrera, eds. *Atlas of ultrasound guided musculoskeletal injections*. New York, NY: Springer, 2014.

US-guided Peritendinous Injection Technique in Achilles Tendinopathy

Axial, In-plane Approach

- **Position:** Prone, feet hanging off the end of the table
- **Probe:** In the sagittal plane, the Achilles tendon is placed in the midline on the calcaneal attachment line and rotated 90° to obtain an image in the axial plane. Doppler is used to determine the surrounding vascular structures.
- **Needle tip:** 25G 1.5 inch
- **Needle position:** It is entered in-plane, medial or lateral.
- *In the lateral approach, it is necessary to avoid the sural nerve and prominent vessels.*

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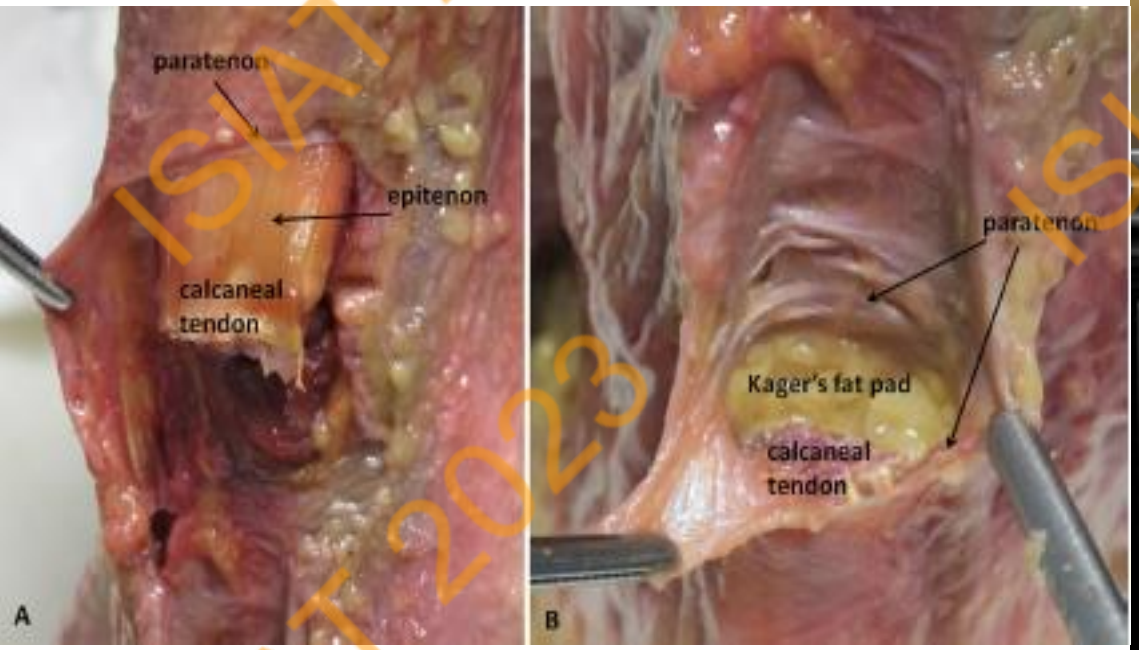
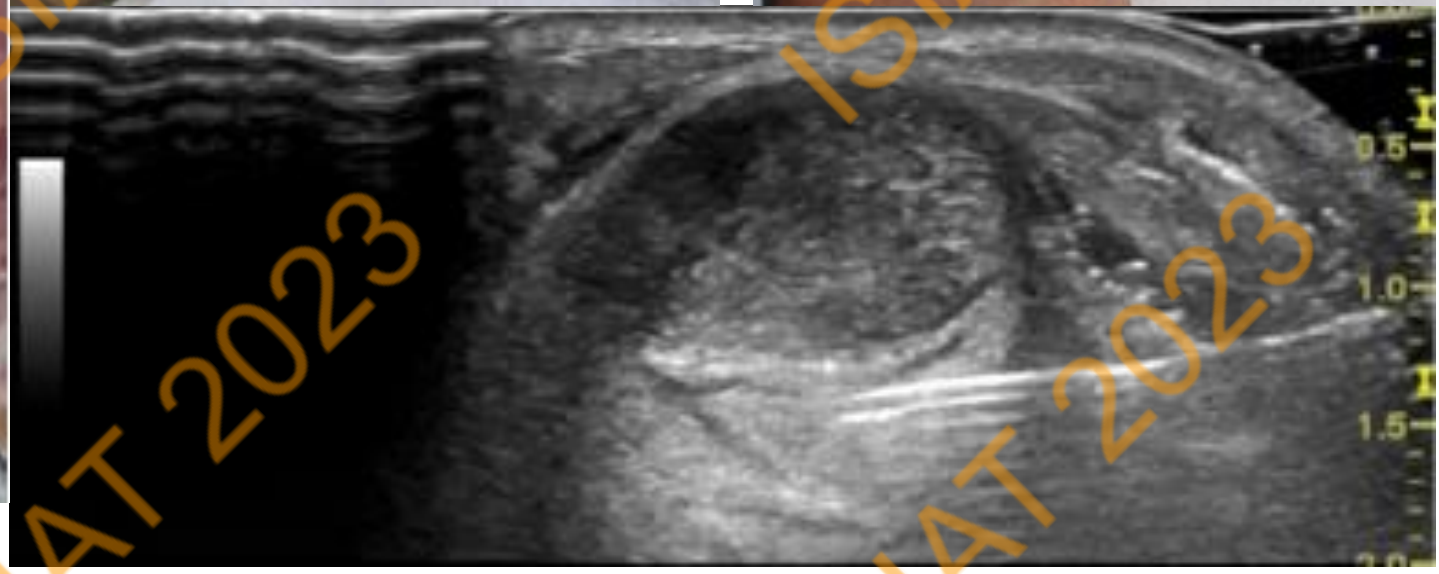
- **Axial**
- **In-plane**
- **Medial**

It is injected between Kager's fat pad and the anterior surface of the Achilles tendon.





Spinner, David A., Jonathan S. Kirschner, and Joseph E. Herrera, eds. *Atlas of ultrasound guided musculoskeletal injections*. New York, NY: Springer, 2014.

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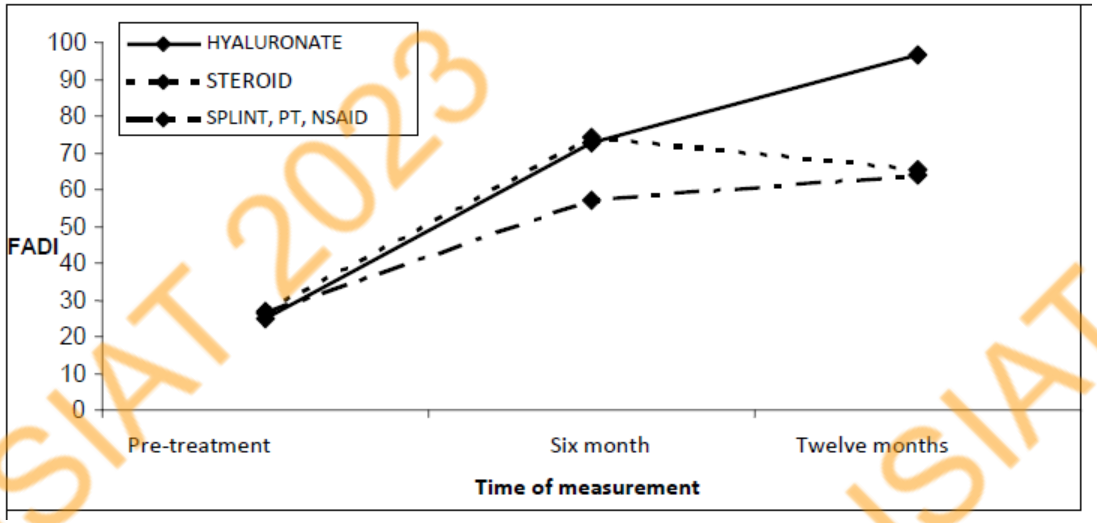
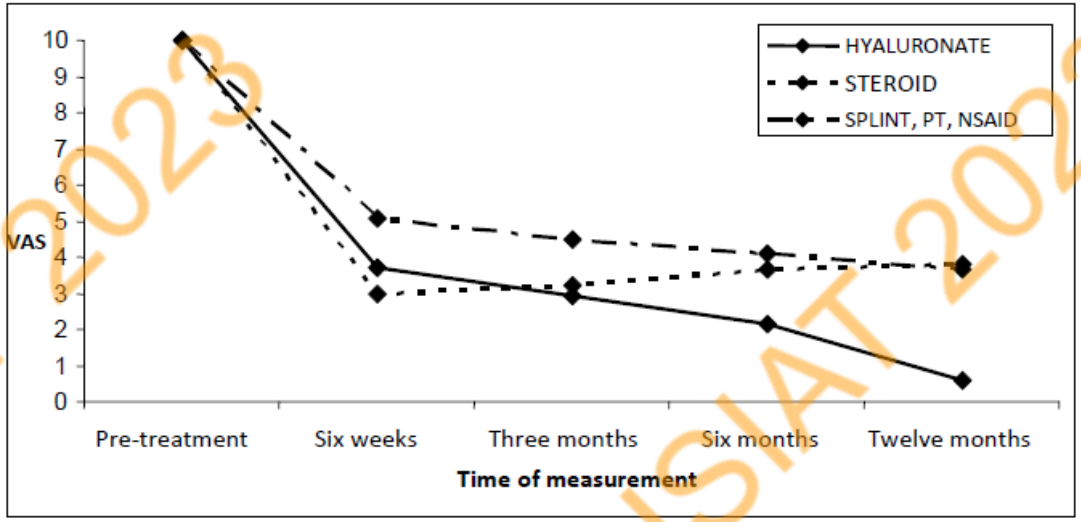
Single Hyaluronate Injection in the Management of Insertional Achilles Tendinopathy in Comparison to Corticosteroid Injections and Non-invasive Conservative Treatments

Lauren Gorelick[1], Ayala Rozano-Gorelick[2], Anwar Saab[2], Edward Ram[3]

Gorelick L et al.; Scholars. Bull.; Vol-1, Iss-1(Jul, 2015):16-20





Insertional Achilles tendinopathy: 3 Groups

1- Single dose of peritendinous HA (40 mg/2mL + 10 mg mannitol)

2- Corticosteroid

3- Rest, splint, NSAID and physiotherapy

Hyaluronic acid treatment seems to be superior to corticosteroid treatment and non-invasive conservative treatments.

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HA vs ESWT

Comparison of Peritendinous Hyaluronan Injections Versus Extracorporeal Shock Wave Therapy in the Treatment of Painful Achilles' Tendinopathy: A Randomized Clinical Efficacy and Safety Study

Nils Lynen, MD,[a] Thierry De Vroey, MD,[b] Imke Spiegel, MD,[a] Frederik Van Ongeval, MD,[b] Niels-Jan Hendrickx, MD,[b] Gaëtane Stassijns, MD, PhD[b,c]

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In midportional Achilles tendinopathy;

Group 1: Peritendinous HA (2 sessions)
(40 mg/2mL + 10 mg mannitol)

Group 2: Standard ESWT treatment (3 session)

HA appears superior to ESWT.

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Journal of *Clinical Medicine*

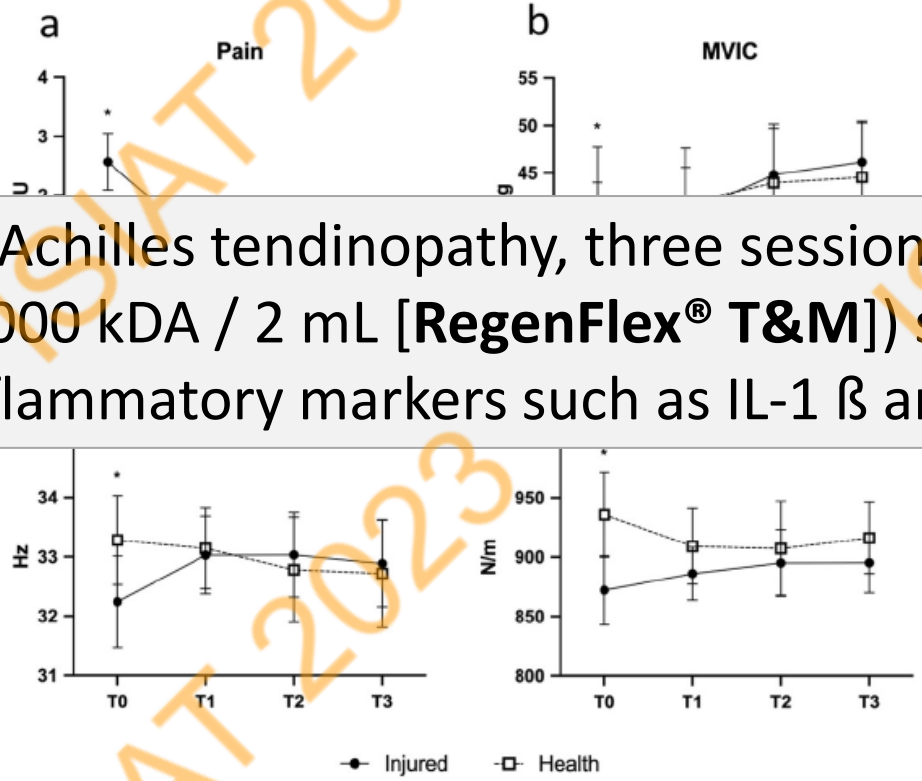
MDPI

Article

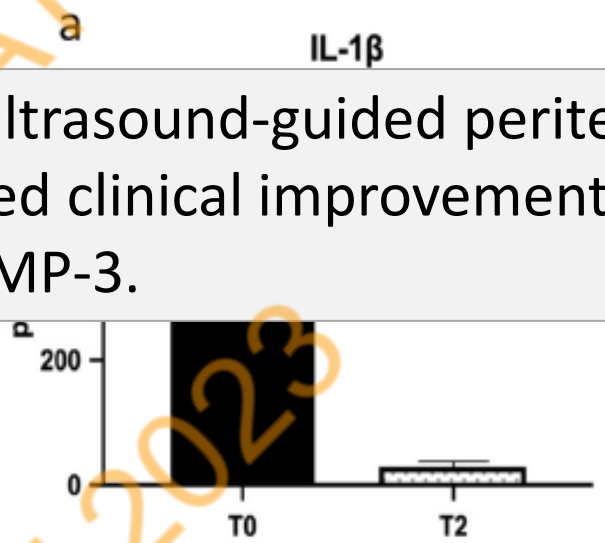
J. Clin. Med. **2021**, *10*, 1397. https://doi.org/10.3390/jcm10071397

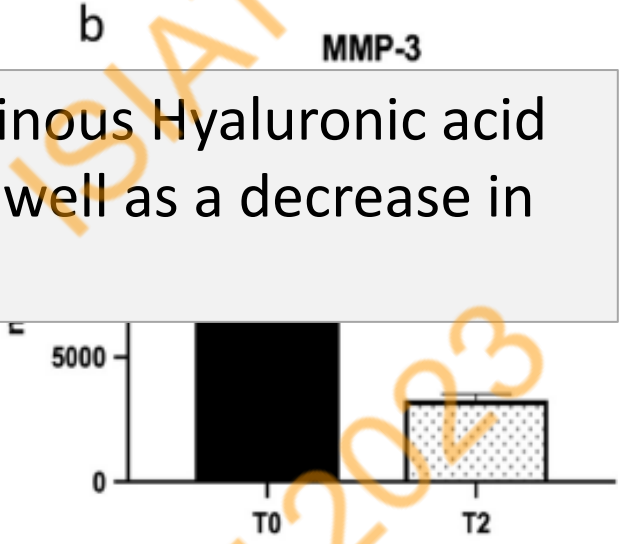
Treatment of Achilles Tendinopathy in Recreational Runners with Peritendinous Hyaluronic Acid Injections: A Viscoelastometric, Functional, and Biochemical Pilot Study

Marco Gervasi [1,*], Elena Barbieri [1,2], Italo Capparucci [1], Giosuè Annibalini [1], Davide Sisti [1], Stefano Amatori [1], Vittoria Carrabs [1], Giacomo Valli [1], Sabrina Donati Zeppa [1], Marco Bruno Luigi Rocchi [1], Vilberto Stocchi [1] and Piero Sestili [1]



In Achilles tendinopathy, three sessions of ultrasound-guided peritendinous Hyaluronic acid (1000 kDA / 2 mL [**RegenFlex® T&M**]) showed clinical improvement as well as a decrease in inflammatory markers such as IL-1 ß and MMP-3.





Journal of
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Article

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Hyaluronic acid could be a good option in the treatment of tendinopathies.

- Lubrication
- Up-regulation of VEGF and Type IV collagen
- Anti-inflammatory
- Anti-adhesion
- Analgesia

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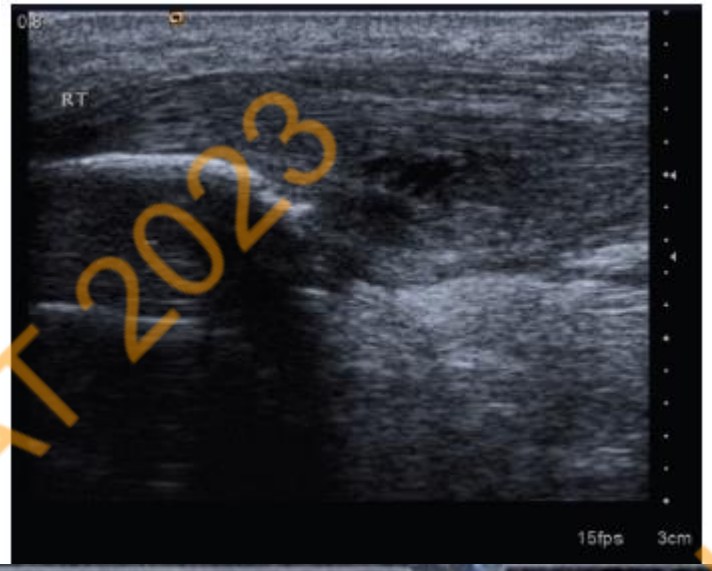
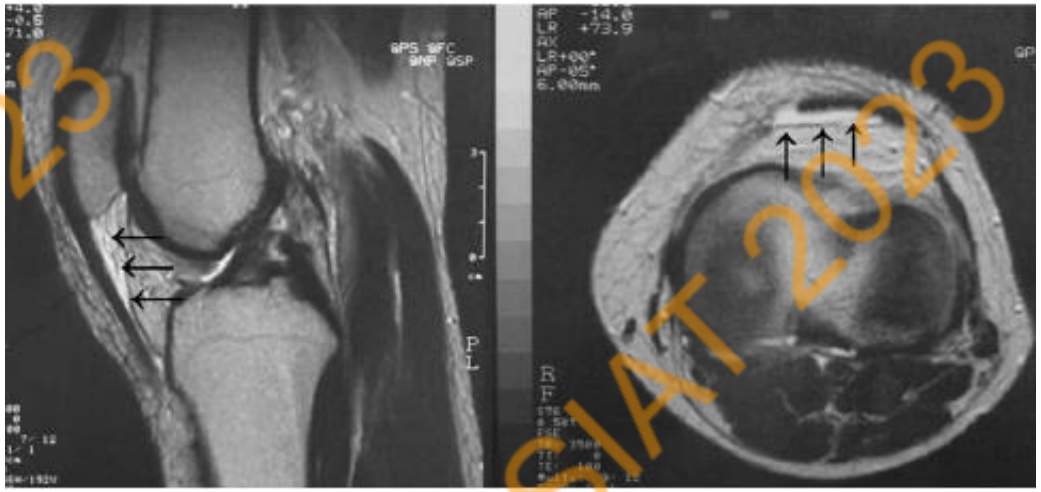
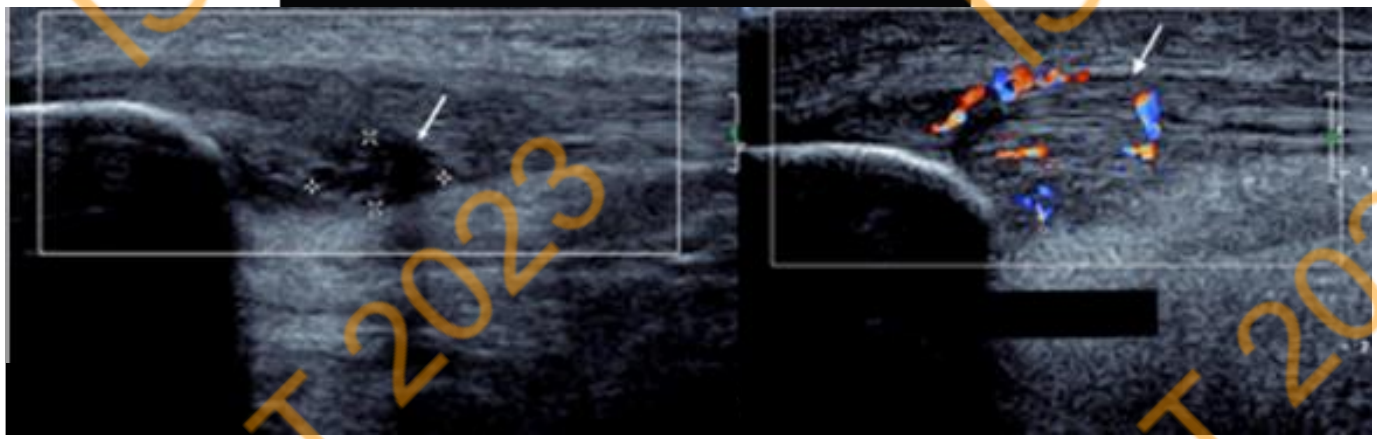
Patellar Tendinopathy (Jumper's knee)

- Pain with jumping, running, walking
- Tenderness/swelling in the lower part of the patella
- Athlete?







- Thickening of the tendon
- Irregularities in the tendon structure
- Neovascularization (Doppler Us)

Schwartz, Aaron, Jonathan N. Watson, and Mark R. Hutchinson. "Patellar tendinopathy." *Sports health* 7.5 (2015): 415-420.

Tan, Suan Cheng, and Otto Chan. "Achilles and patellar tendinopathy: current understanding of pathophysiology and management." *Disability and rehabilitation* 30.20-22 (2008): 1608-1615.

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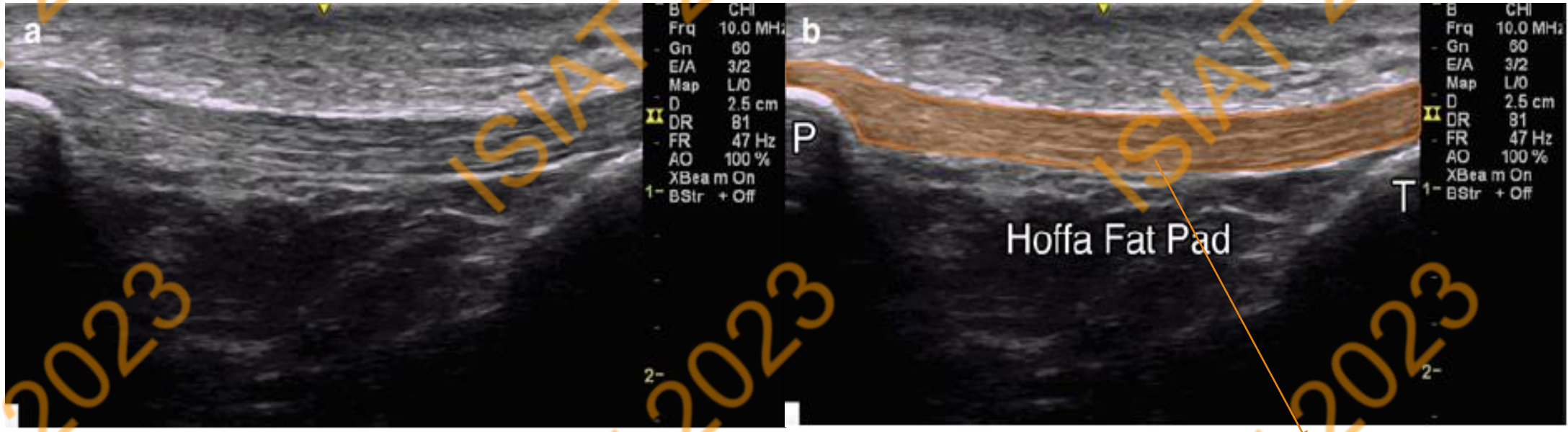
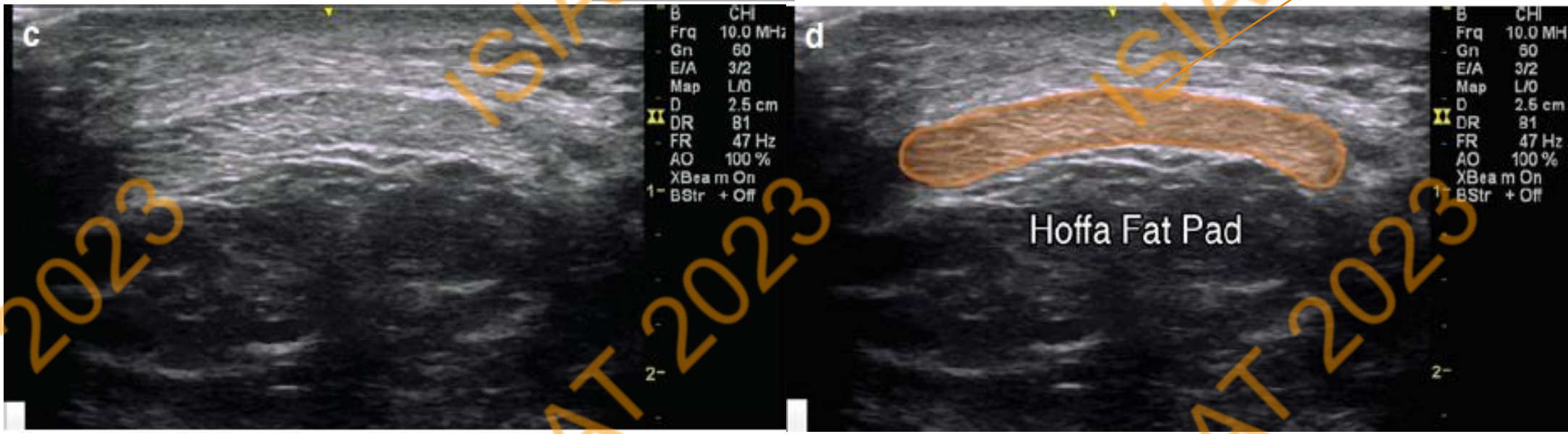
Sagittal view



* knee flexed at 30°

Axial view



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US-guided Peritendinous Injection Technique in Patellar Tendinopathy

Sagittal, In-plane Approach

- **Position:** Supine, knee at approximately 30° of flexion (pillow or rolled towel under the knee)
- **Probe:** It is placed on the lower pole of the patella to obtain images in the sagittal plane.
- **Needle tip:** 25G 1.5 inch
- **Needle position:** In-plane, oriented cranio-caudally at 45° to Hoffa's body

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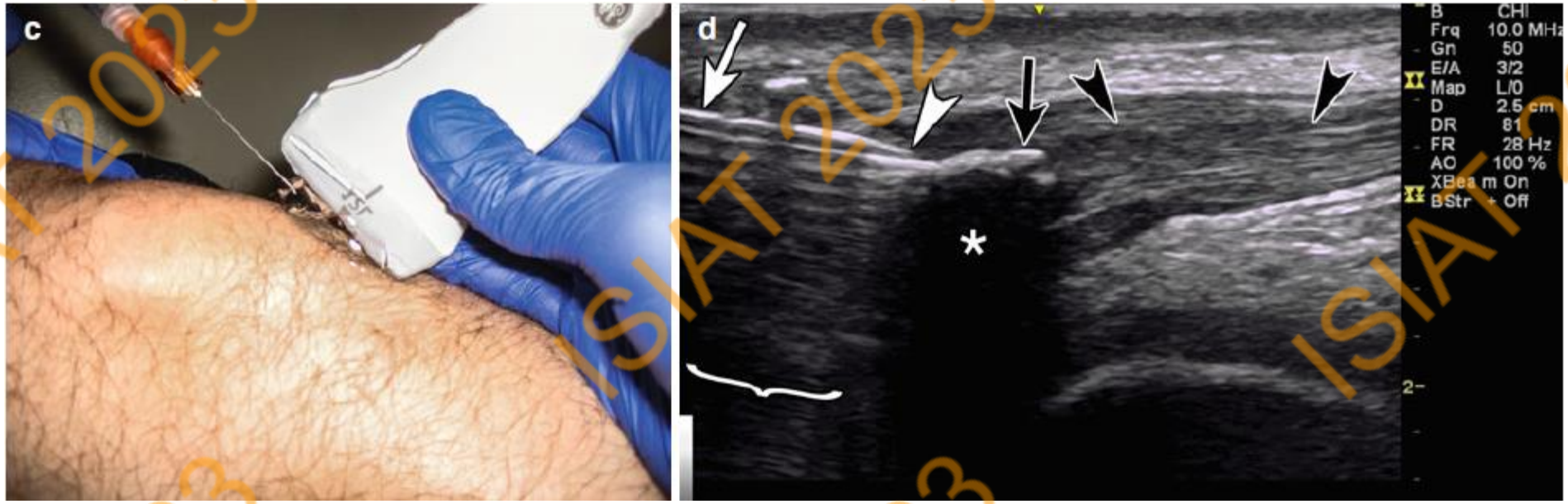
- **Sagittal**
- **In-plane**
- **Cranio-Caudal**



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Us-guided Peritendinous Injection Technique in Patellar Tendinopathy

Axial, In-plane Approach

- **Position:** Supine, knee at approximately 30° of flexion (pillow or rolled towel under the knee)
- **Probe:** In the middle of the patella to obtain images in the axial plane
- **Needle tip:** 25G 1.5 inch
- **Needle position:** In-plane, it is directed from medial to lateral or lateral to medial, targeting the tendinosis area.

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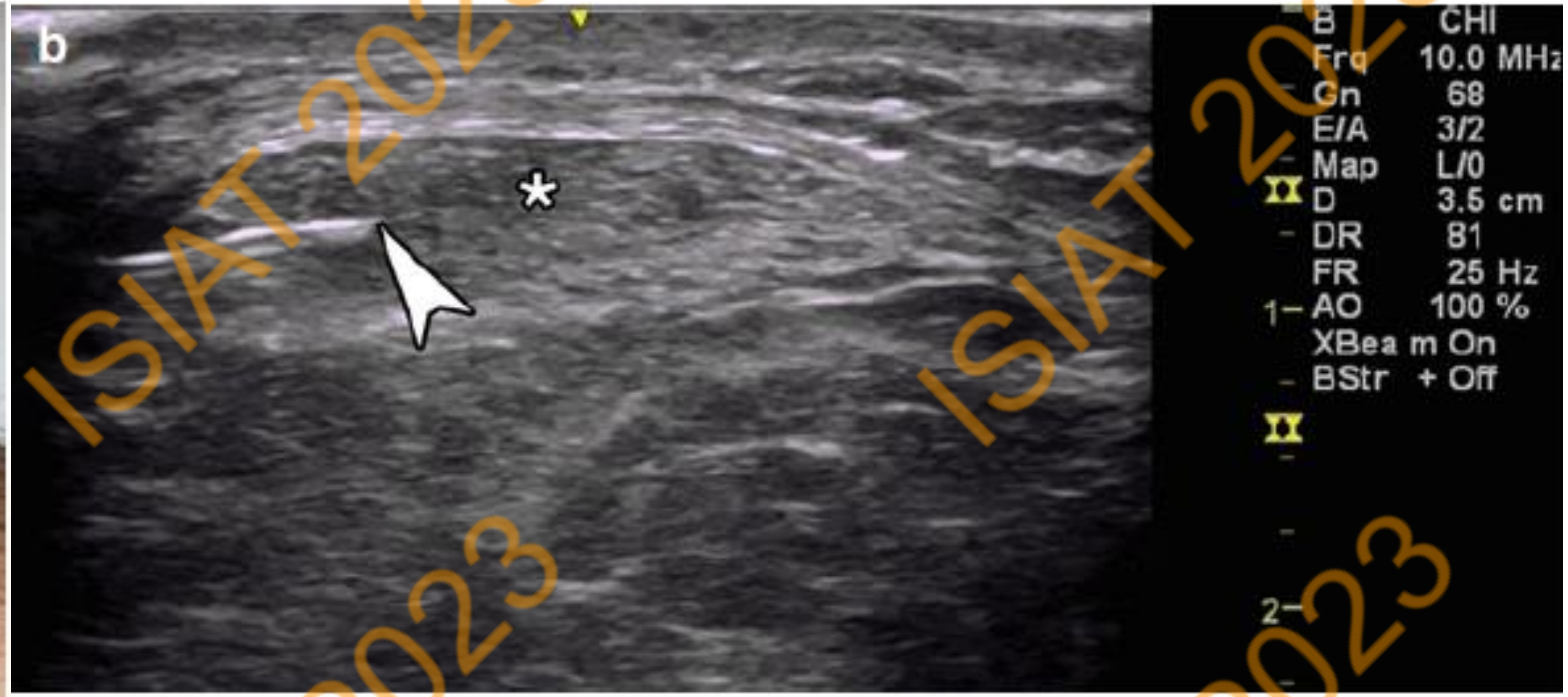
- **Axial**
- **In-plane**
- **Lateral**



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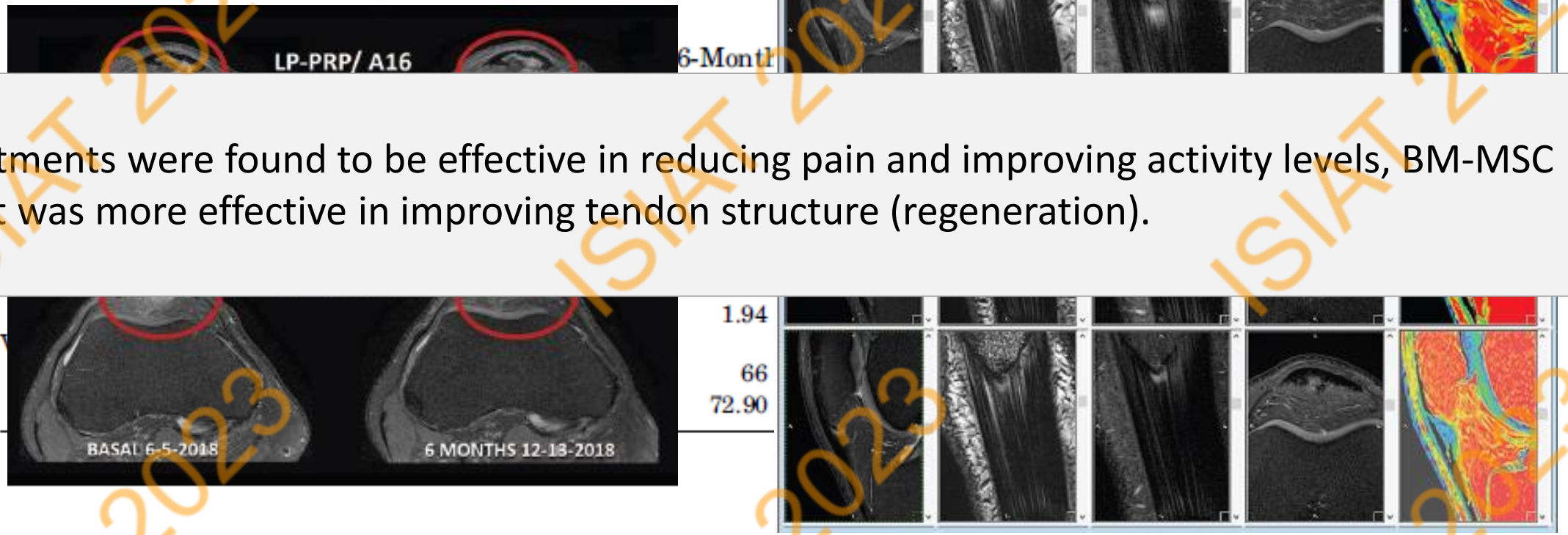
Effect of Autologous Expanded Bone Marrow Mesenchymal Stem Cells or Leukocyte-Poor Platelet-Rich Plasma in Chronic Patellar Tendinopathy (With Gap >3 mm)

Preliminary Outcomes After 6 Months of a Double-Blind, Randomized, Prospective Study

Gil Rodas,*† MD, MS, PhD, Robert Soler-Rich,‡§ MD, MS, Joan Rius-Tarruella,‡ MD, MBA, Xavier Alomar,‖ MD, MS, Ramon Balius,¶ MD, MS, PhD, Lluís Orozco,‡ MD, MS, PhD, Lorenzo Masci,# MD, MS, PhD, and Nicola Maffulli,**††‡‡ MD, MS, PhD
Investigation performed at Institut de Teràpia Regenerativa Tissular, Centro Médico Teknon, Barcelona, Spain



Both treatments were found to be effective in reducing pain and improving activity levels, BM-MSC treatment was more effective in improving tendon structure (regeneration).

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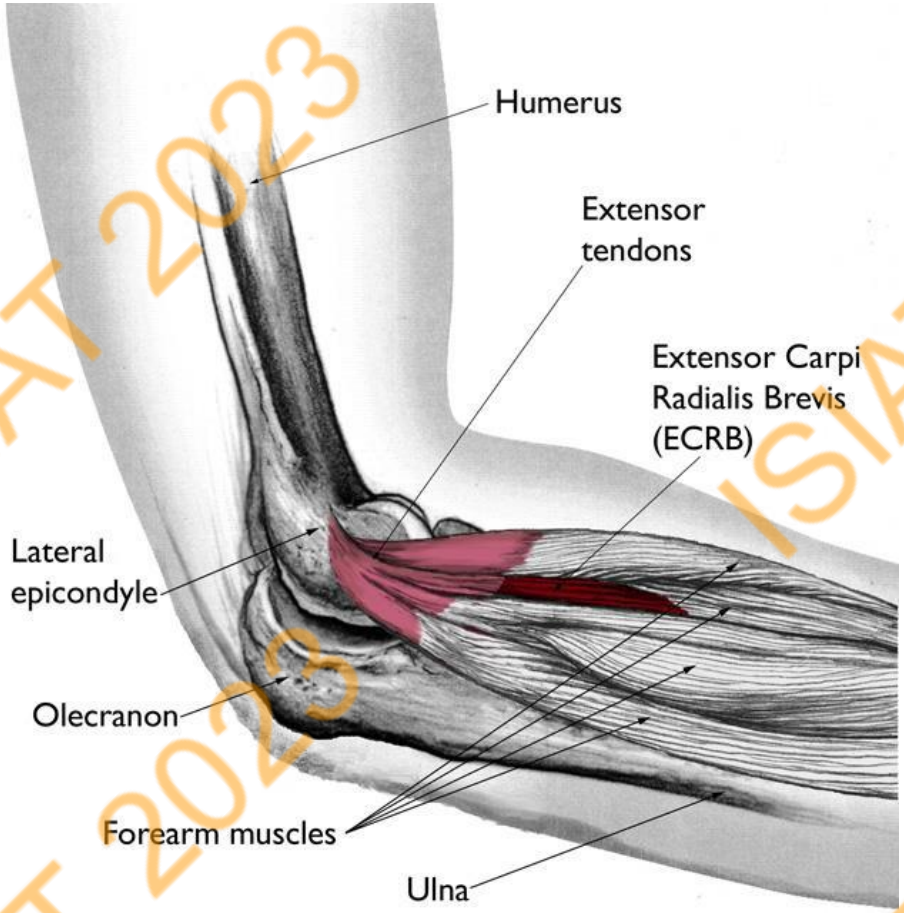
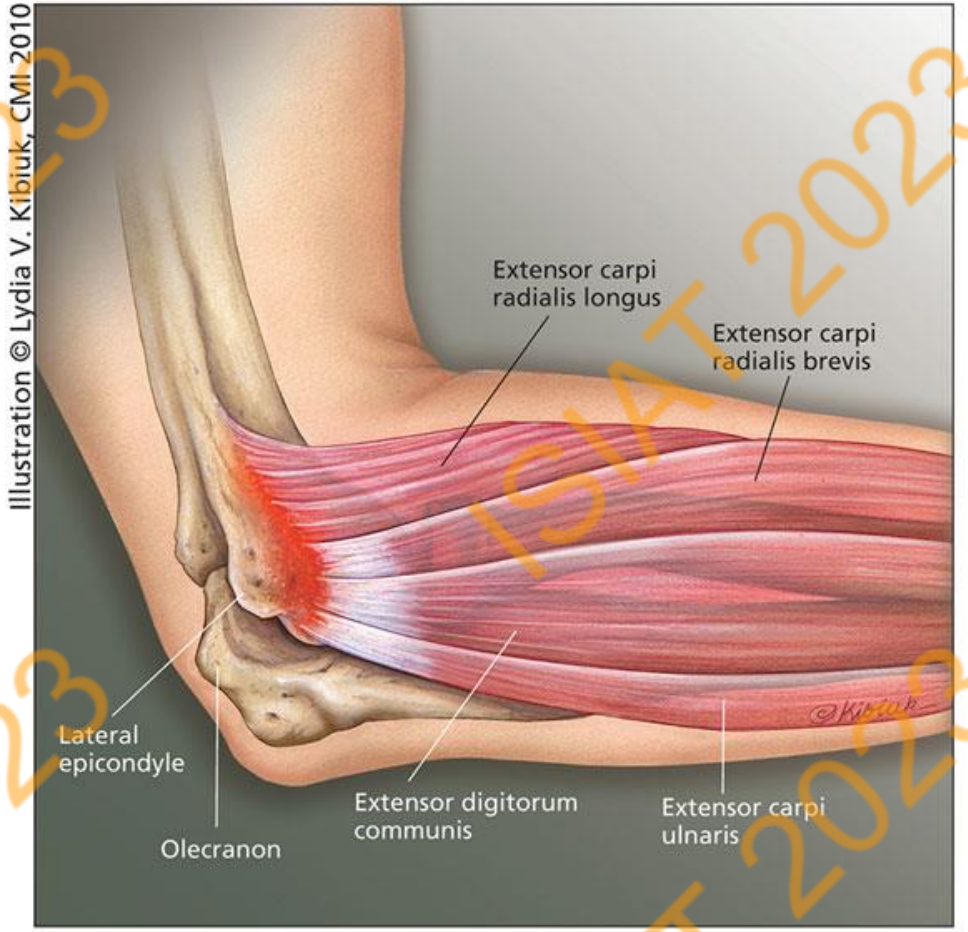
Lateral Epicondylitis (Tennis Elbow)





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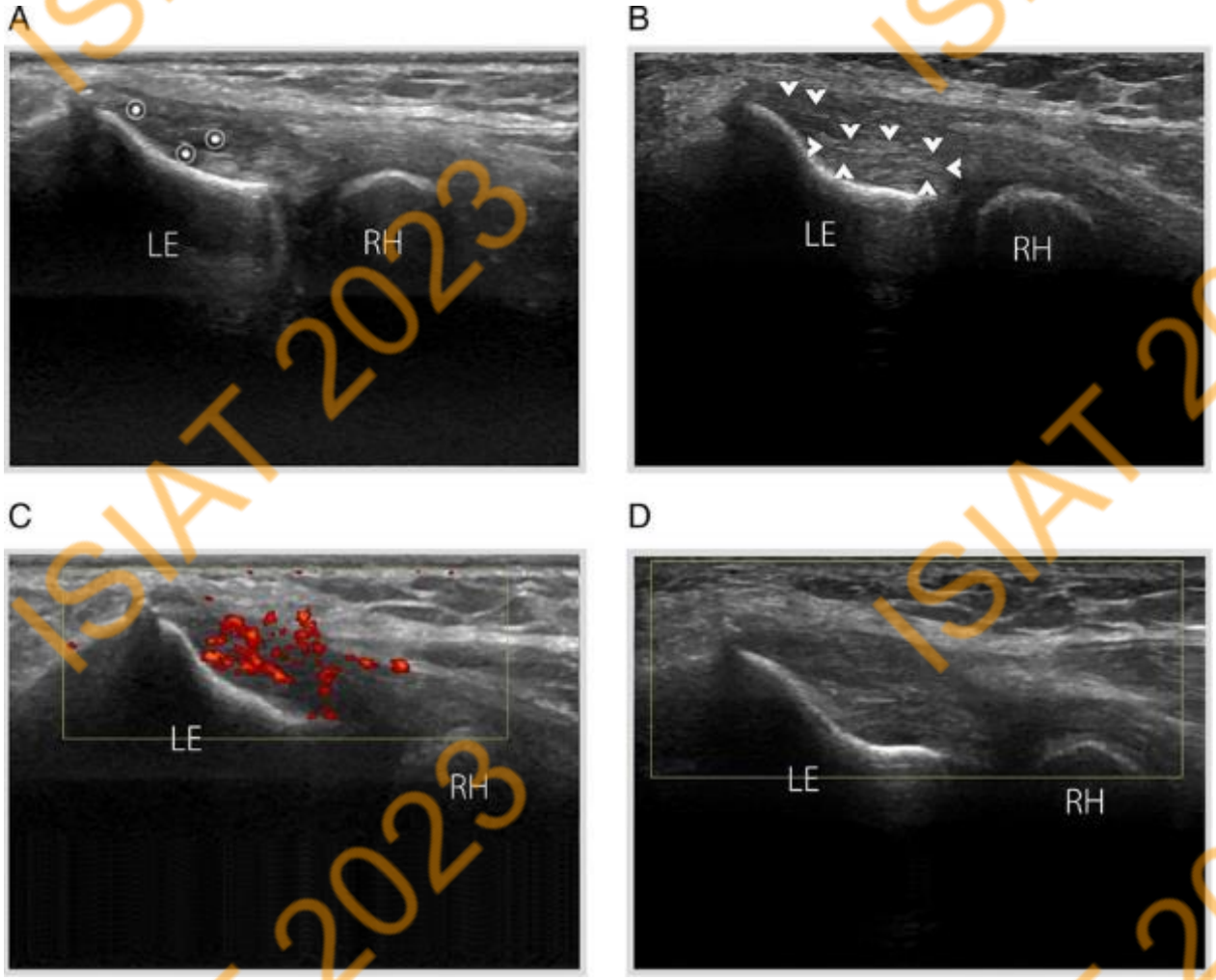
Lateral Epicondylitis (Tennis Elbow)



- Repeated use and microtrauma
- Pain on resisted wrist extension and grip,
- Tenderness over the lateral epicondyle
- Decreased grip, supination, and wrist extension muscle strength

Valera-Garrido, Fermín & Minaya-Muñoz, Francisco & Medina-Mirapeix, Francesc. (2014). Ultrasound-Guided Percutaneous Needle Electrolysis in Chronic Lateral Epicondylitis: Short-Term and Long-Term Results. Acupuncture in medicine : journal of the British Medical Acupuncture Society. 32. 10.1136/acupmed-2014-010619.

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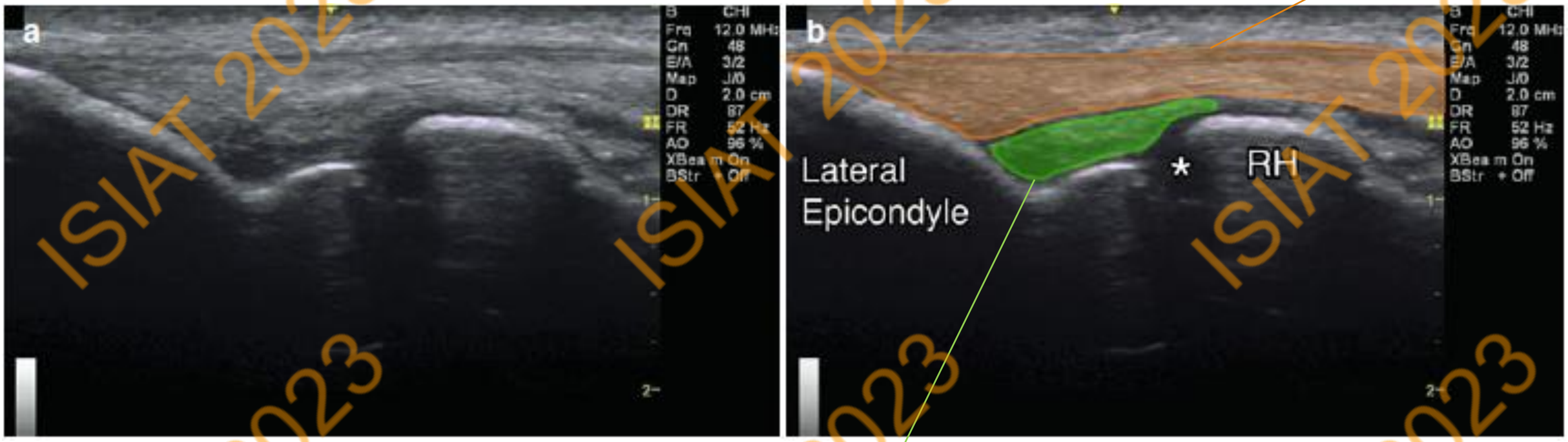
Coronal view



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Spinner, David A., Jonathan S. Kirschner, and Joseph E. Herrera, eds. *Atlas of ultrasound guided musculoskeletal injections*. New York, NY: Springer, 2014.

Us-guided Peritendinous Injection Technique in Lateral Epicondylitis

Long Axis, In-plane Approach

- **Position:** Supine, arm in internal rotation and elbow flexed (or sitting position with arm placed on table with elbow at 20-40° flexion)
- **Probe:** Longitudinal (coronal) on lateral epicondyle
- **Needle tip:** 25G 1.5 inch
- **Needle position:** Placed proximal to distal or distal to proximal parallel (in-plane) to the transducer. For peritendinous injection, the needle is held above or below the tendon
- *Note the radial and posterior interosseous nerves and the lateral collateral ligament complex!*

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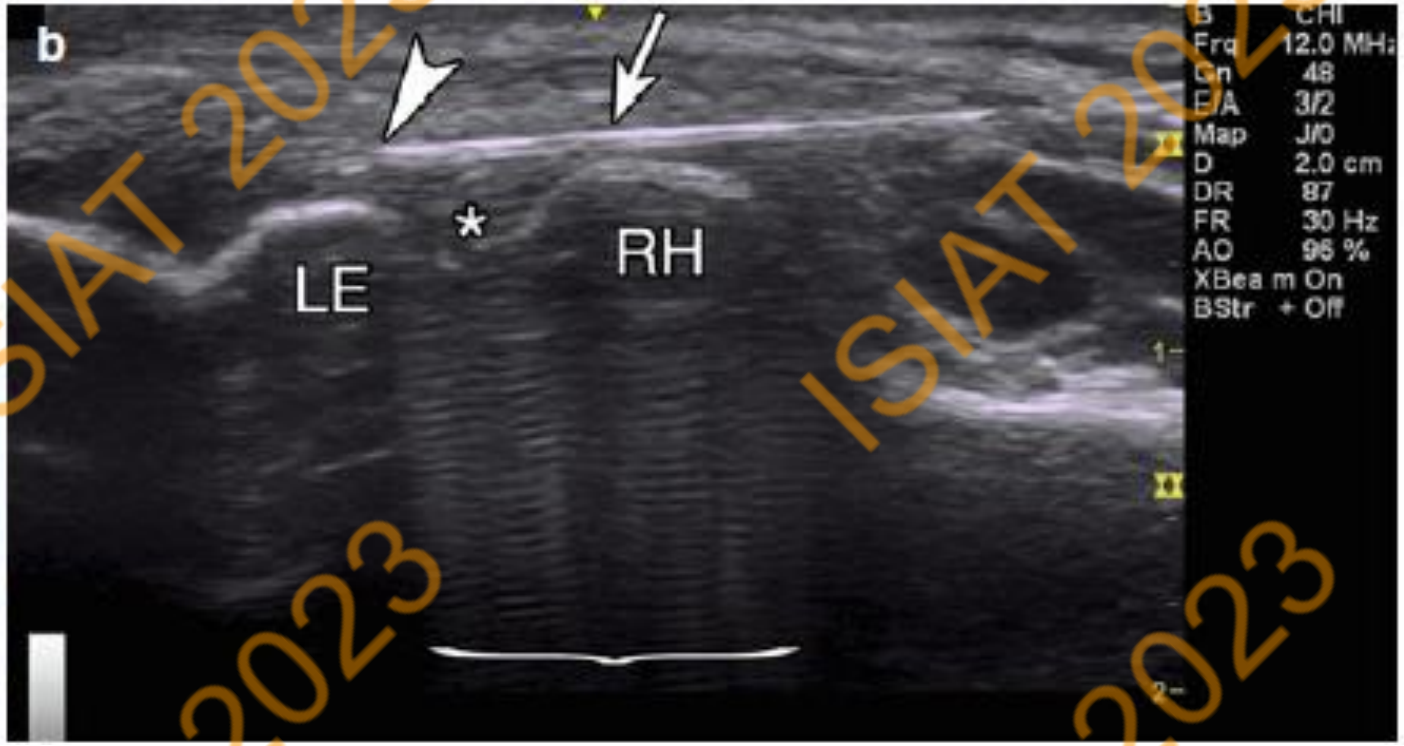
- **Long axis**
- **In-plane**
- **Distal to proximal**



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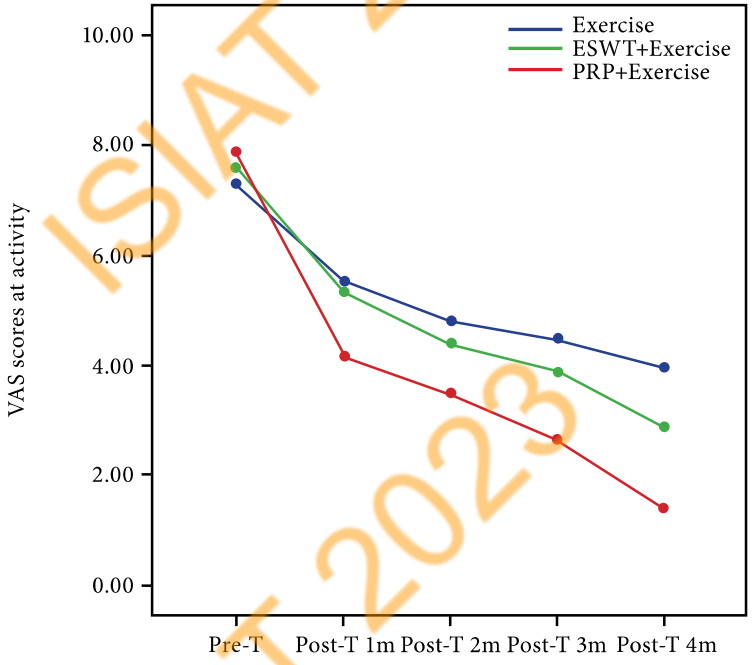
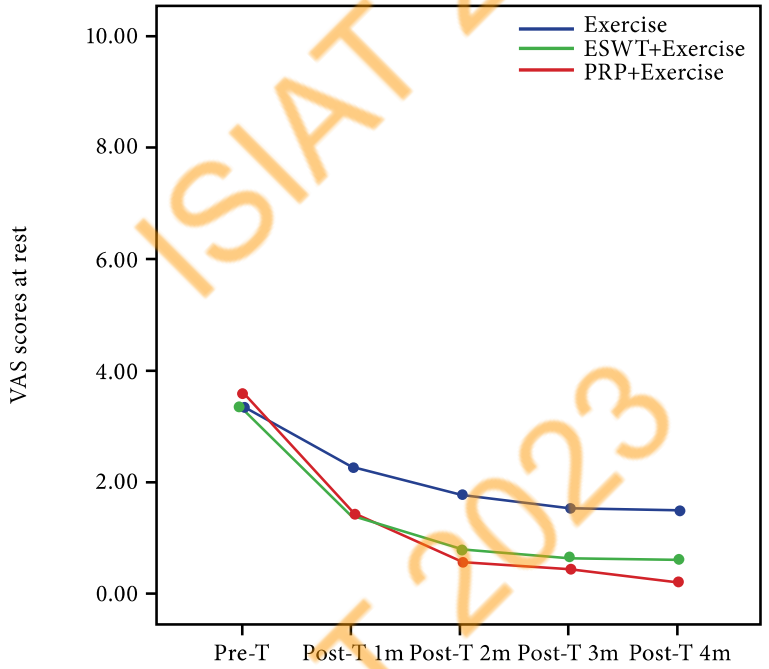
Turk J Phys Med Rehab 2021;67(4):490-501
DOI: 10.5606/tftrd.2021.6377
Available online at www.turkishjournalpmr.com

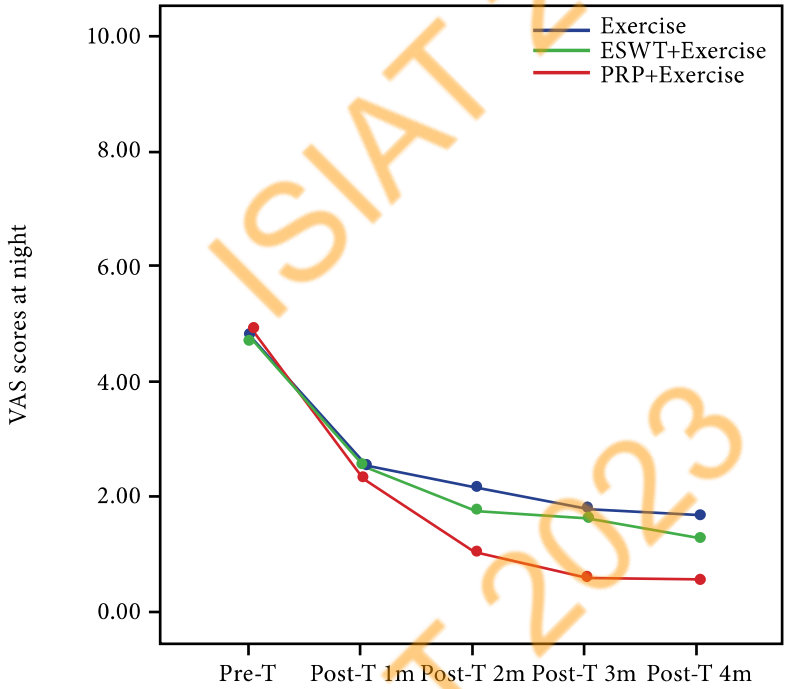
Original Article

Comparison of platelet-rich plasma and extracorporeal shock wave therapy in patients with chronic lateral epicondylitis: A prospective, randomized-controlled study

Tuğba Şahbaz[1], Cansın Medin Ceylan[2], Başak Çiğdem Karacay[3], Merve Damla Korkmaz[1], Demirhan Dıracoğlu[4]







Original article

Efficacy and safety of hyaluronic acid (500-730kDa) Ultrasound-guided injections on painful tendinopathies: a prospective, open label, clinical study

Muscles, Ligaments and Tendons Journal 2017;7 (2):389-395

Marco Fogli[1]
Nicola Giordan[2]
Gianni Mazzoni[1]

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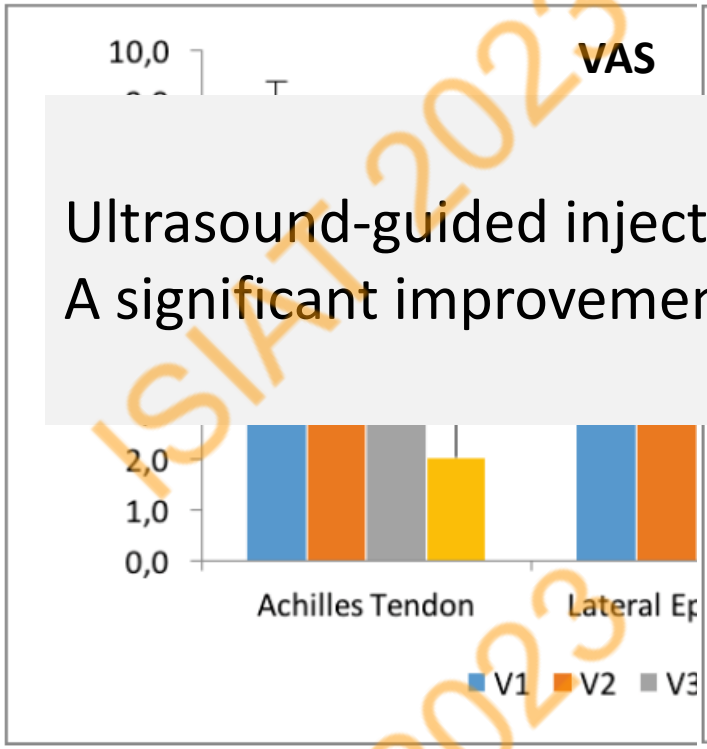
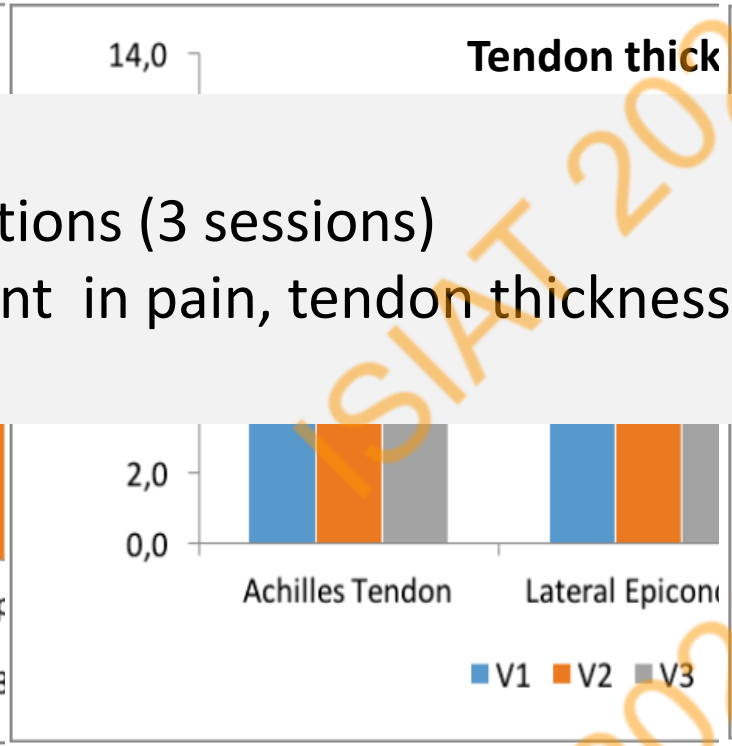
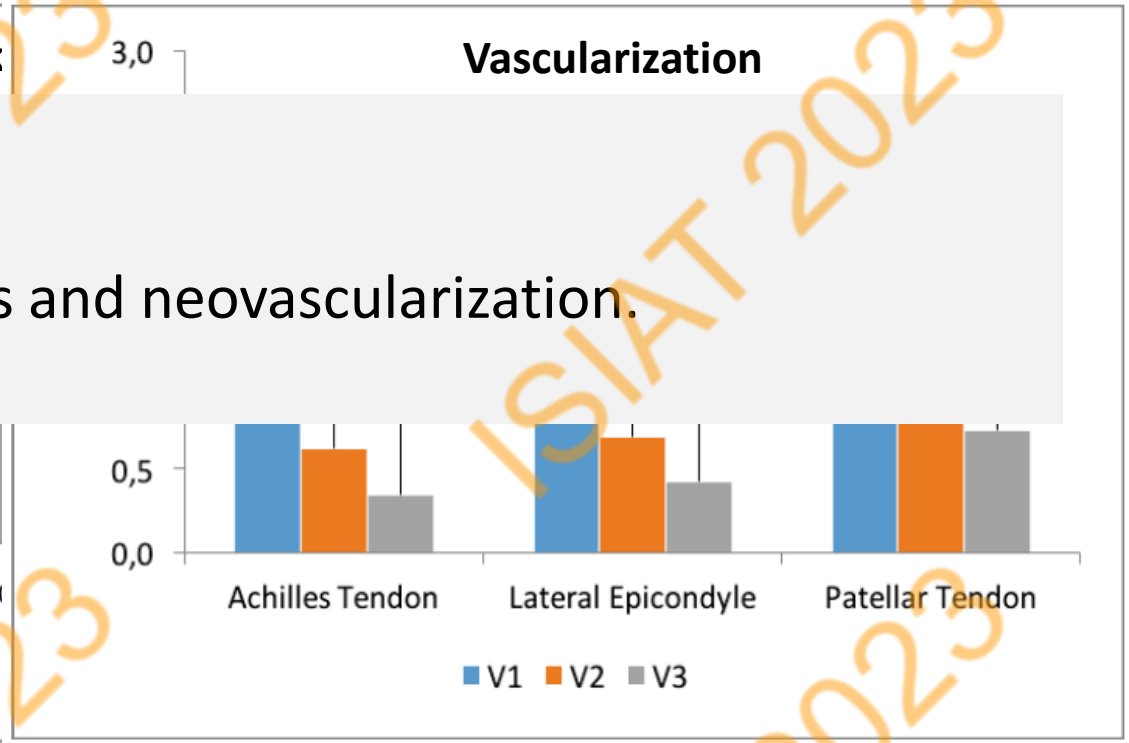




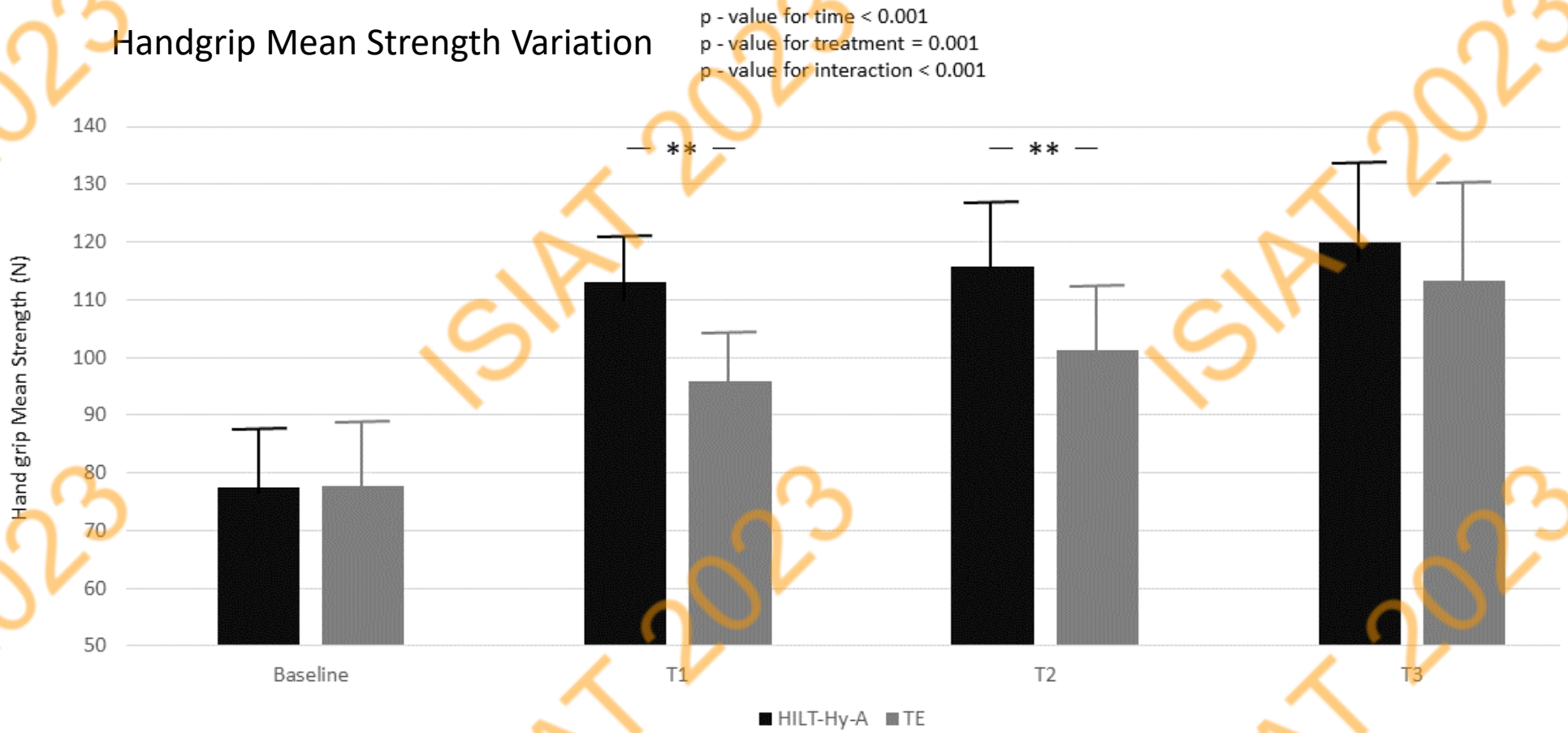


Ultrasound-guided injections (3 sessions)
A significant improvement in pain, tendon thickness and neovascularization.

Article

Effectiveness of High-Intensity Laser Therapy Plus Ultrasound-Guided Peritendinous Hyaluronic Acid Compared to Therapeutic Exercise for Patients with Lateral Elbow Tendinopathy

Raffaello Pellegrino [1], Teresa Paolucci [2], Fabrizio Brindisino [3], Paolo Mondardini [4], Angelo Di Iorio [5,*], Antimo Moretti [6] and Giovanni Iolascon [6]



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Creative approach is important!

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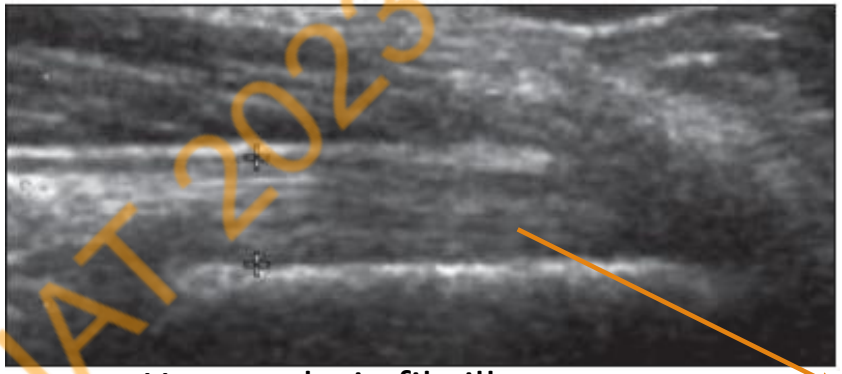
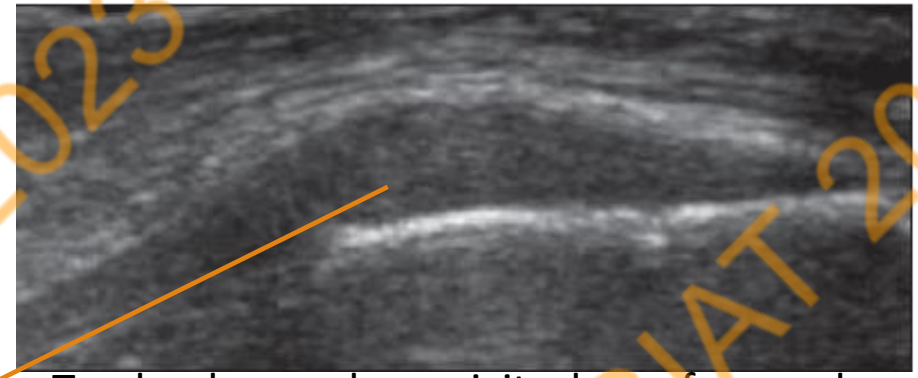
Gluteus Medius Tendinopathy "Greater Trochanteric Pain Syndrome"

- Lateral hip pain
- Pain with resistant hip abduction
- Often with trochanteric bursopathy
- Associated with obesity

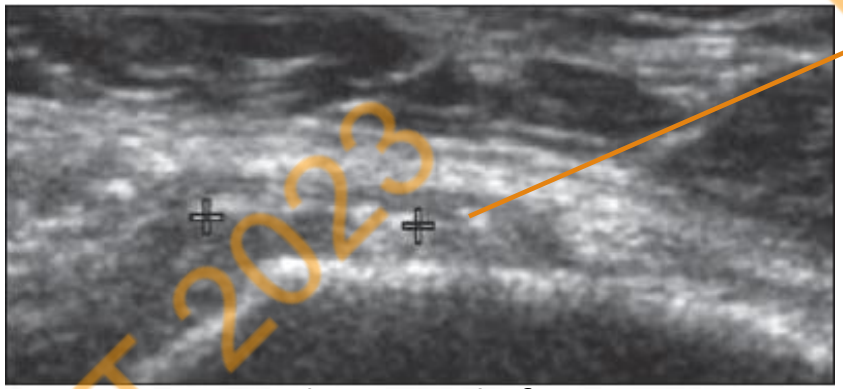


Hyperechoic fibrillar pattern, normal tendon

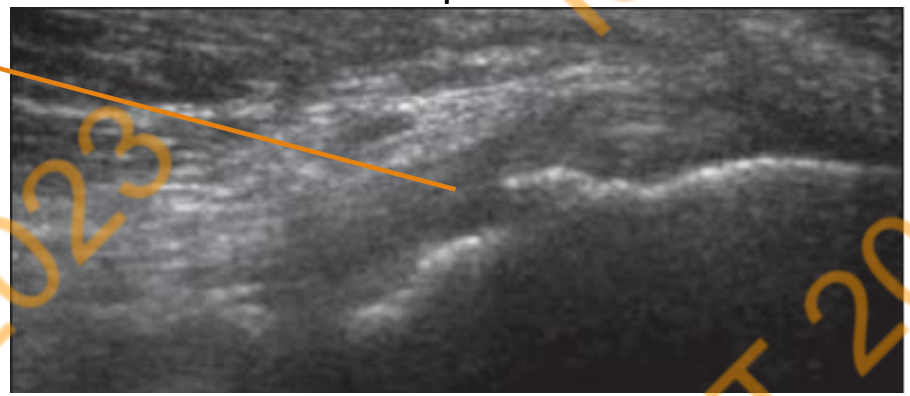


Tendon hypoechogenicity, loss of normal fibrillar pattern

Gluteus medius tendon



Intratendinous calcifications



Enthesophytes, cortical irregularities

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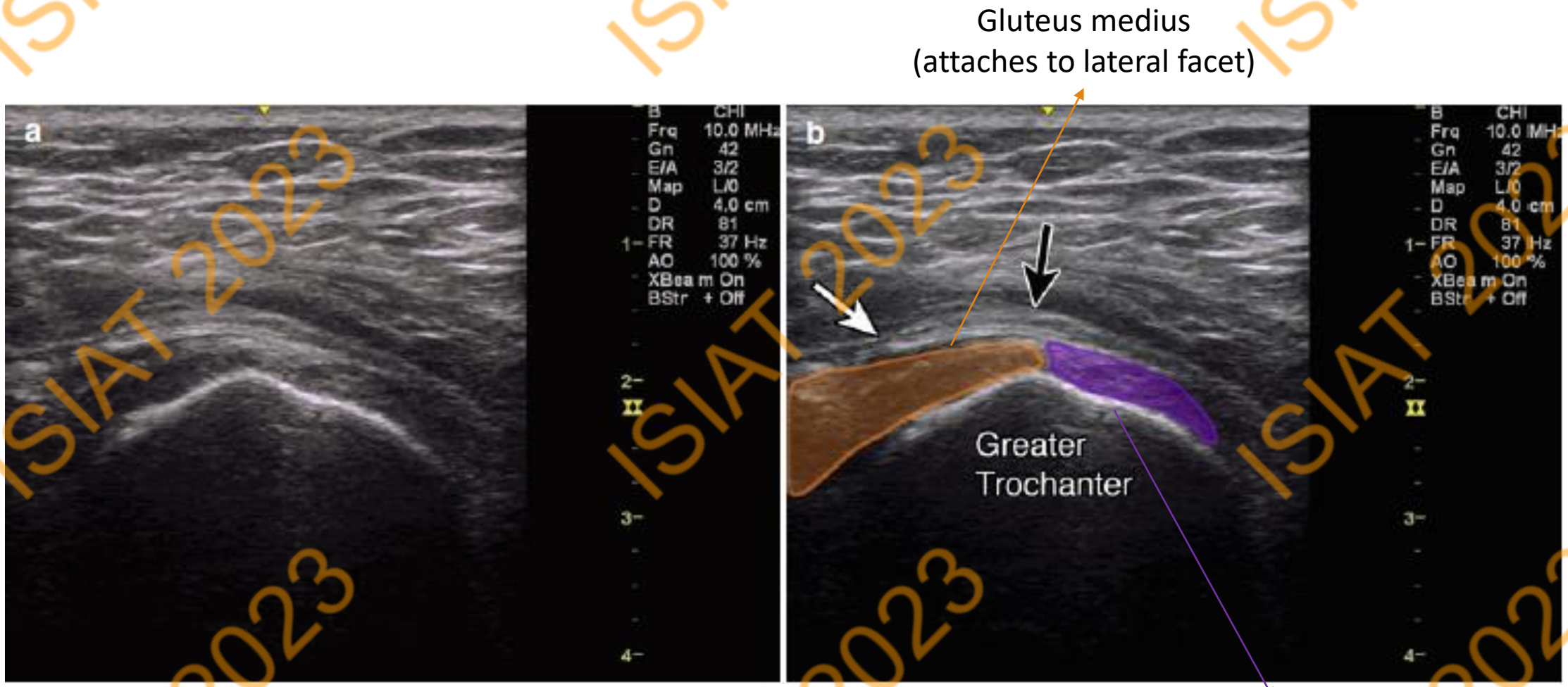
Labrosse JM, Cardinal E, Leduc BE, Duranceau J, Rémillard J, Bureau NJ, Belblidia A, Brassard P. Effectiveness of ultrasound-guided corticosteroid injection for the treatment of gluteus medius tendinopathy. AJR Am J Roentgenol. 2010 Jan;194(1):202-6. doi: 10.2214/AJR.08.1215. PMID: 20028924.

Transvers view



Spinner, David A., Jonathan S. Kirschner, and Joseph E. Herrera, eds. *Atlas of ultrasound guided musculoskeletal injections*. New York, NY: Springer, 2014.

Us-guided Peritendinous Injection Technique in Gluteus Medius Tendinopathy

Axial, In-plane Approach

- **Position:** Lateral decubitus, both hips slightly flexed
- **Probe:** Transverse (axial) on the greater trochanter
- **Needle tip:** 22G 90 mm (3.5 inch) (spinal needle)
- **Needle position:** directed in-plane anterior to posterior or posterior to anterior, towards the surface of the lateral portion of the gluteus medius tendon
- There is no vascular and nerve structure to be considered, since trochanteric bursitis may also occur, pain should not be increased by applying excessive pressure to the transducer.

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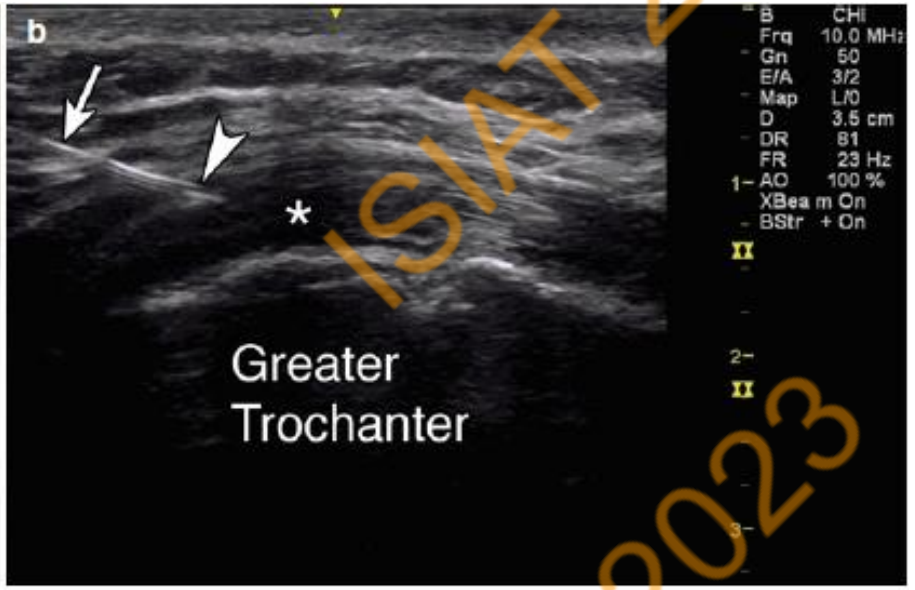
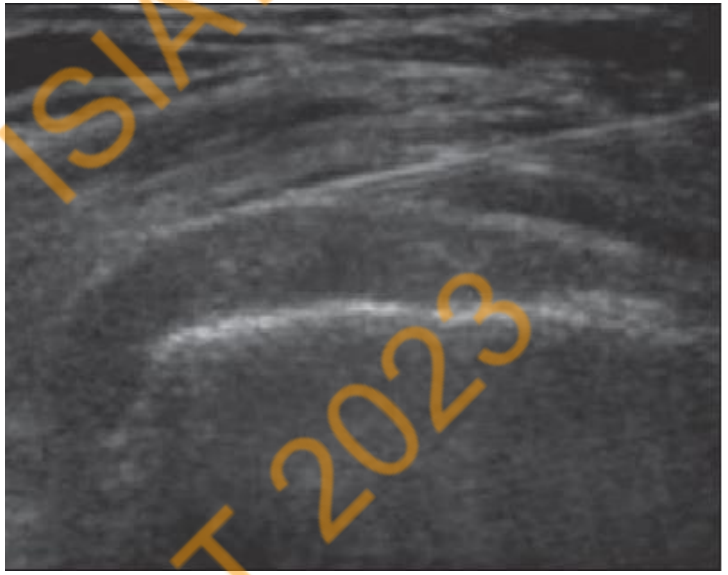
- **Axial**
- **In-plane**
- **Posterior to anterior**





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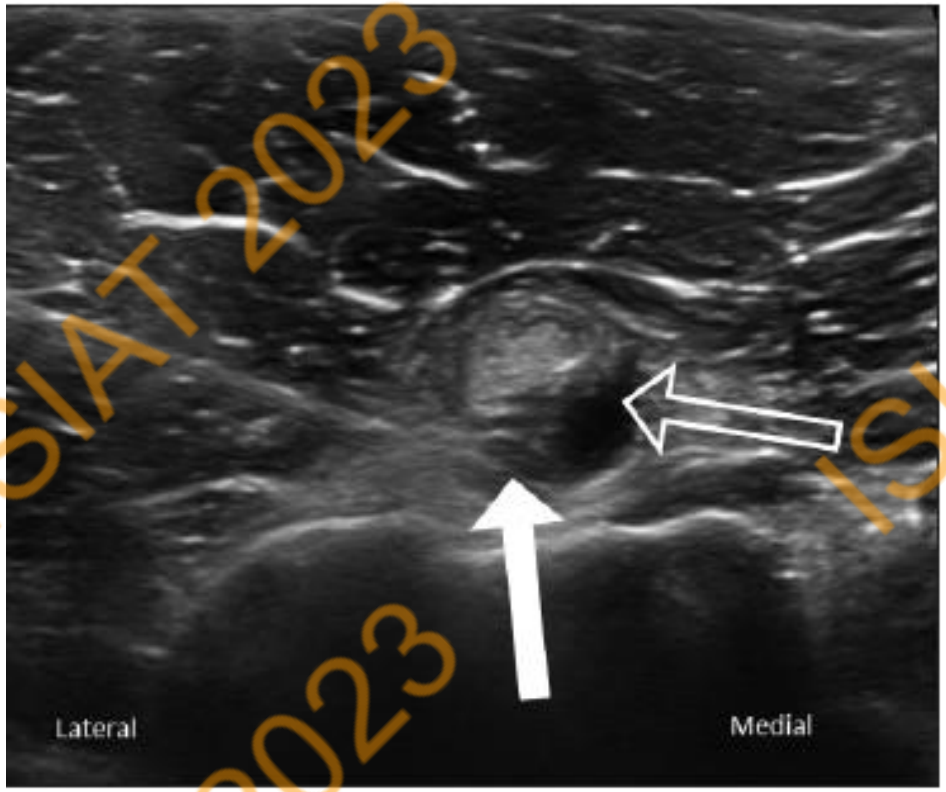
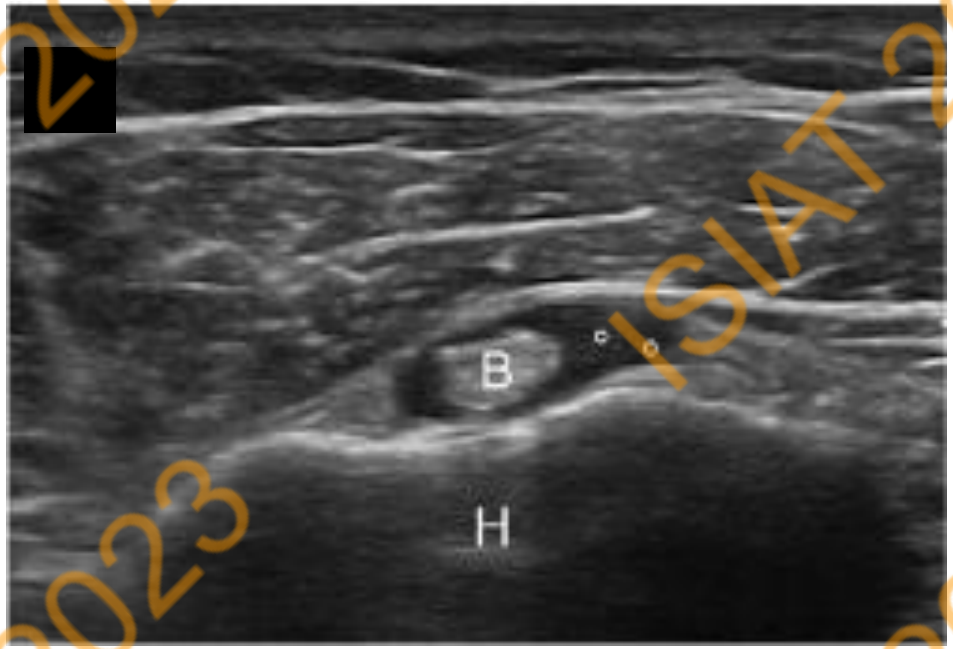
Tendinopathy Long Head of Biceps

- Anterior shoulder pain radiates throughout the humerus
- Tendon sheath associated with the glenohumeral joint
- Isolated or with rotator cuff tears





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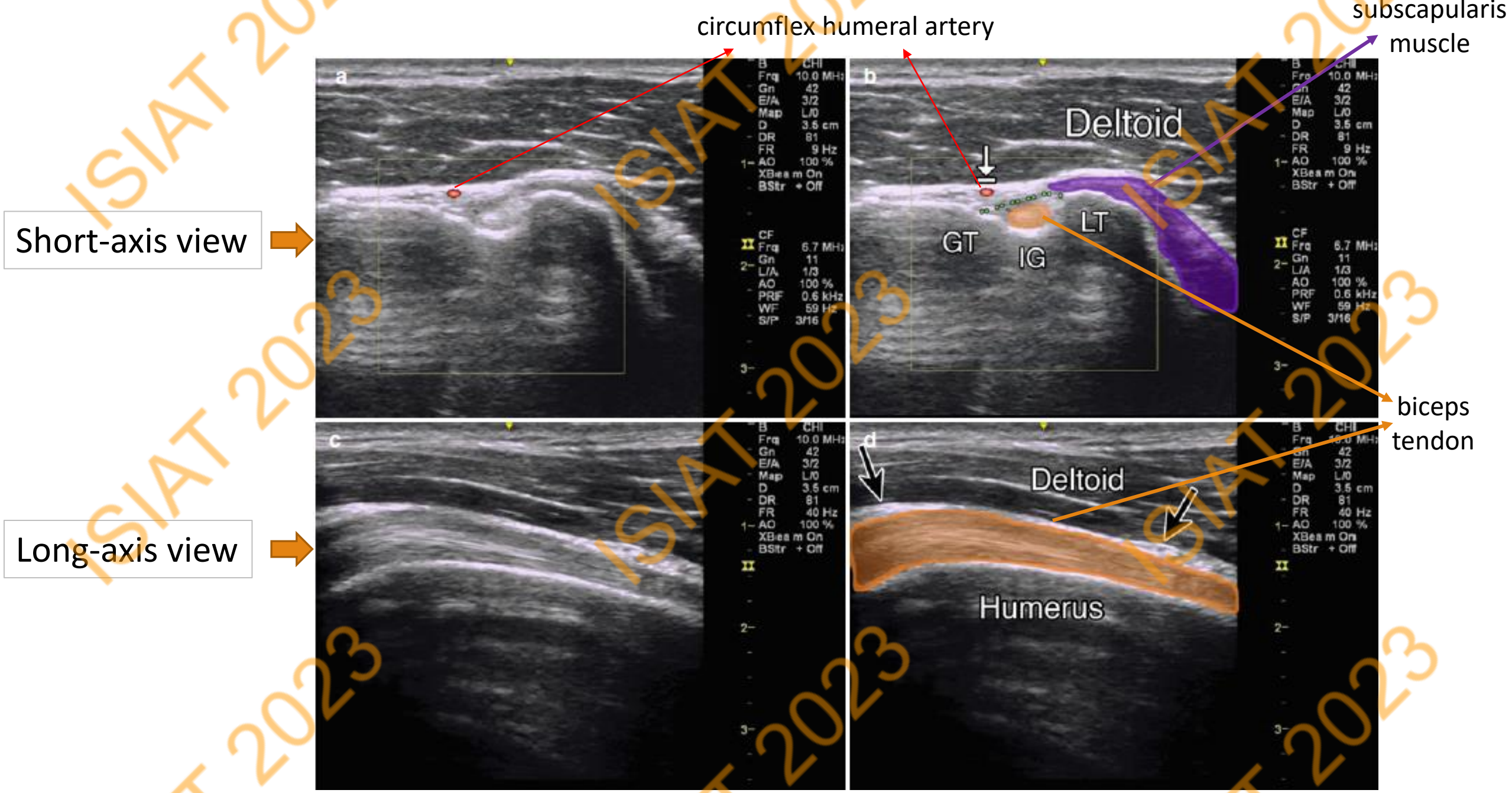
Stone TJ, Adler RS. Ultrasound-Guided Biceps Peritendinous Injections in the Absence of a Distended Tendon Sheath: A Novel Rotator Interval Approach. J Ultrasound Med. 2015 Dec;34(12):2287-92. doi: 10.7863/ultra.15.02017. Epub 2015 Oct 30. PMID: 26518277.
Sconfienza LM, Chianca V, Messina C, Albano D, Pozzi G, Bazzocchi A. Upper Limb Interventions. Radiol Clin North Am. 2019 Sep;57(5):1073-1082. doi: 10.1016/j.rcl.2019.05.002. Epub 2019 Jun 18. PMID: 31351537.



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Us-guided Peritendinous Injection Technique in Biceps Long Head Tendinopathy

Axial, In-plane Approach

- **Position:** Sitting, elbow flexed and forearm supinated
- **Probe:** It is placed on the proximal humerus in the axial plane. The circumflex humeral artery is determined by power Doppler imaging. (It extends up the side of the bicipital groove.)
- **Needle tip:** 25G 1.5 inch
- **Needle position:** Using a lateral to medial in-plane approach, it is guided into the tendon sheath located between the biceps tendon and the transverse humeral ligament.
- *The circumflex humeral artery should be visualized and avoided !*
- *«Donut sign» – indicates that the injection was made around the tendon.*

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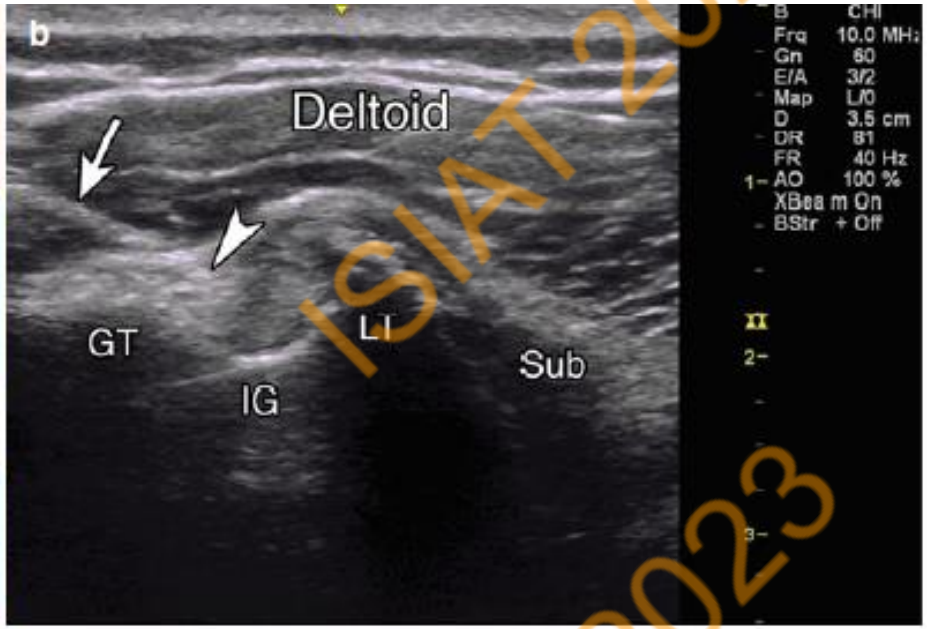
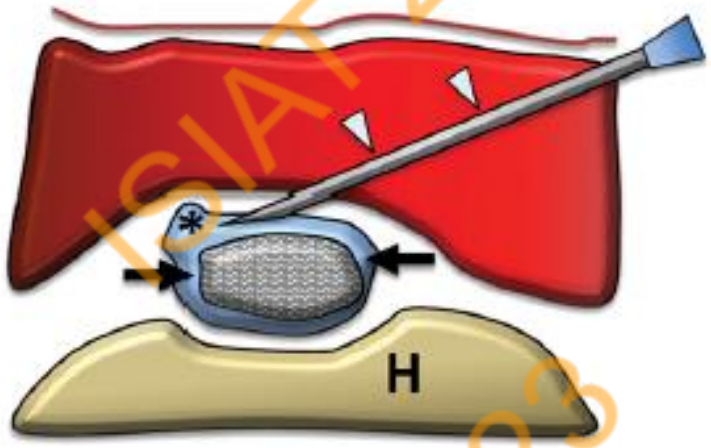
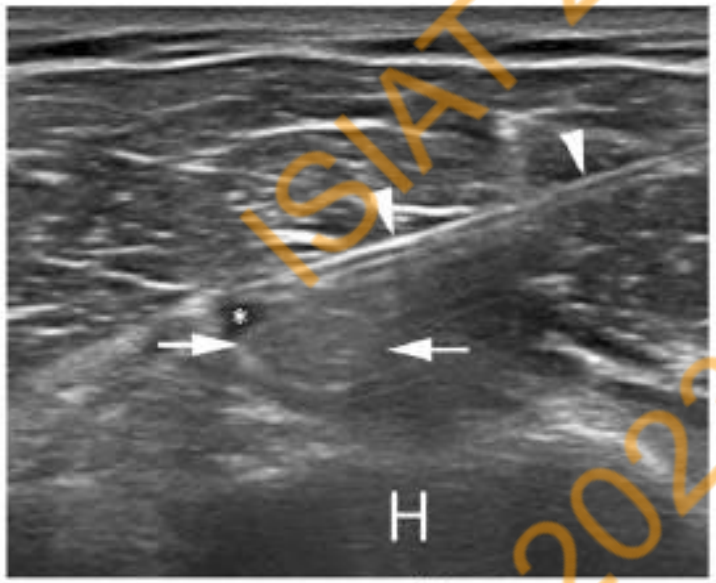
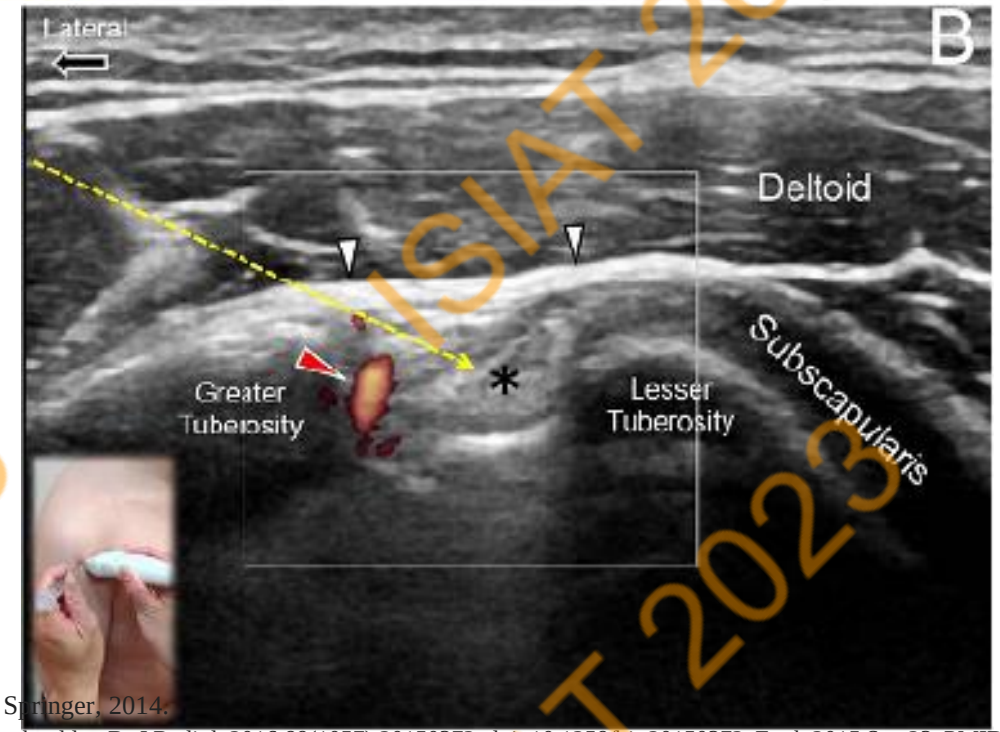
- **Aksiyal**
- **In-plane**
- **Lateral to medial**









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Messina C, Banfi G, Orlandi D, Lacelli F, Serafini G, Mauri G, Secchi F, Silvestri E, Sconfienza LM. Ultrasound-guided interventional procedures around the shoulder. Br J Radiol. 2016;89(1057):20150372. doi: 10.1259/bjr.20150372. Epub 2015 Sep 23. PMID: 26313499; PMCID: PMC4985952.

Chang KV, Mezian K, Naňka O, Wu WT, Lin CP, Özçakar L. Ultrasound-guided interventions for painful shoulder: from anatomy to evidence. J Pain Res. 2018 Oct 11;11:2311-2322. doi: 10.2147/JPR.S169434. PMID: 30349357; PMCID: PMC6188188.

Us-guided Peritendinous Injection Technique in Biceps Long Head Tendinopathy

Sagital, In-plane Approach

- **Position:** Sitting, elbow flexed and forearm supinated
- **Probe:** inserted sagittally to view the length of the biceps tendon in the bicipital groove and the pyramidal shape of the lesser tubercle
- **Needle tip:** 25G 1.5 inch
- **Needle position:** Caudo-cranial entered using in-plane approach
- *The circumflex humeral artery should be visualized and avoided !*

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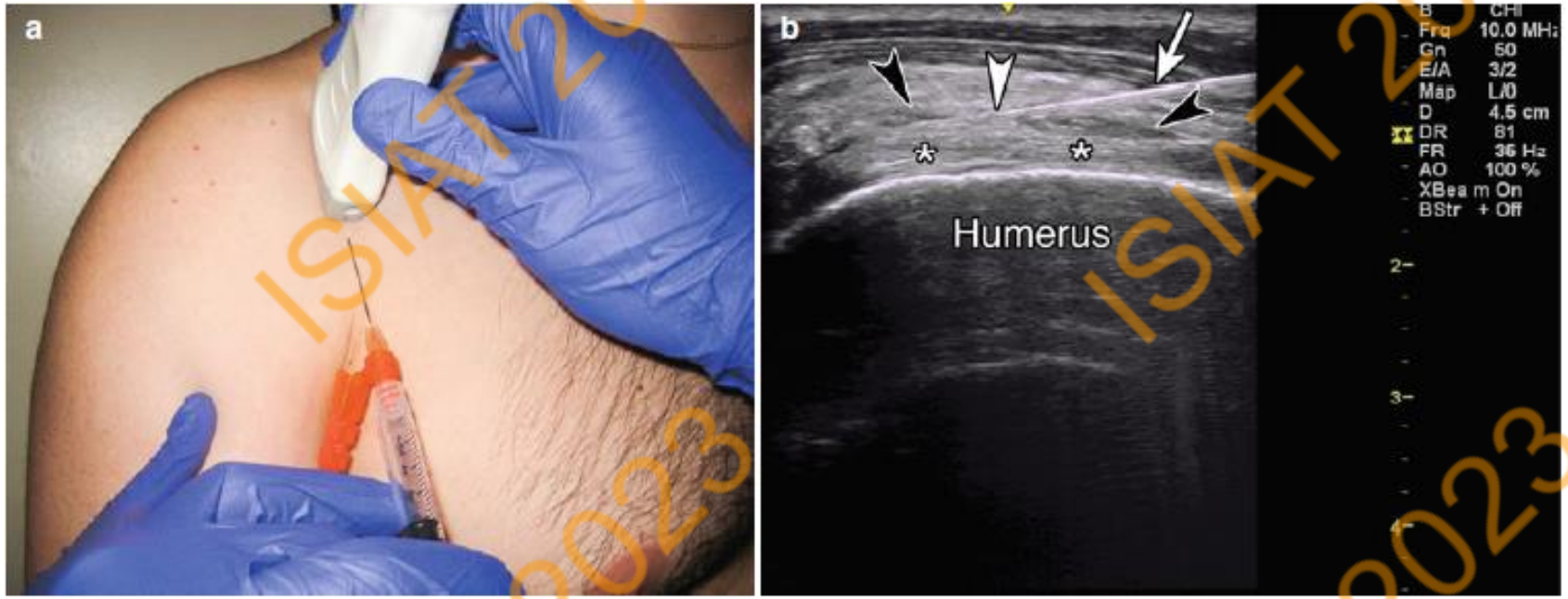
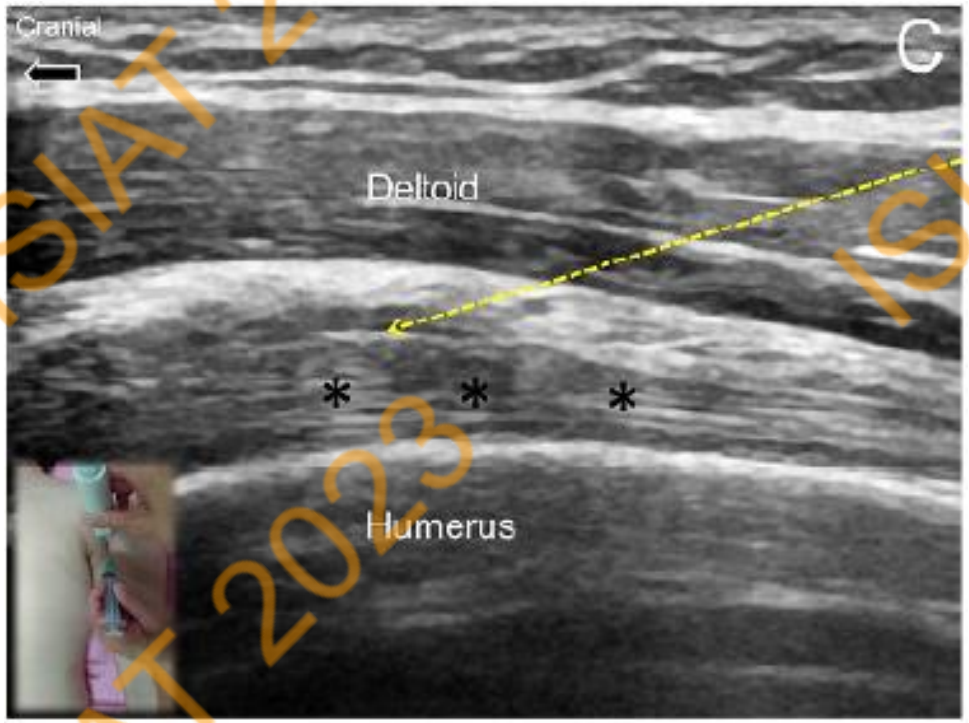
- **Sagittal**
- **In-plane**
- **Cranio-caudal**





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Antalya
THANK YOU!