

The Use of Diagnostic Medical Imaging in Osgood-Schlatter Disease

Abstract

Osgood-Schlatter disease (OSD) is a common cause of anterior knee pain in adolescents, especially those involved in running and jumping sports. It is caused by repetitive traction of the patellar tendon on the tibial tuberosity during growth spurts, leading to inflammation and possible fragmentation at the growth plate. Symptoms include localized pain, swelling, tenderness, and sometimes a bony prominence that worsens with activity and improves with rest. Diagnosis is primarily clinical, with imaging such as X-ray, ultrasound, MRI, or CT used to assess severity and rule out similar conditions. Management is conservative, including rest, activity modification, NSAIDs, and stretching and strengthening exercises. Most cases resolve with skeletal maturity, and surgery is rarely required.

Introduction

- First described in 1903 by Robert B Osgood (U.S.) and Carl Schlatzer (Switzerland) independently of each other¹
- Identified as a painful condition of the tibial tuberosity caused by partial avulsion at the patellar tendon insertion²
- Most commonly affects active adolescents, especially those involved in sports
 - 21% of active adolescents
 - 30% of cases are bilateral
 - Occurs during growth spurts:
 - Boys ages 10-15
 - Girls ages 8-12
 - Historically more common in males, but recent studies show similar prevalence between boys and girls
- Currently considered a multifactorial condition involving:
 - Mechanical factors, functional factors, morphological factors, and psychosocial factors^{3,4,5,10}

Symptoms and Presentation

- Pain, swelling, and tenderness at the tibial tuberosity
 - Worsens with physical activity; improves with rest
- Becomes more persistent over time
- Common in sports involving running, jumping, kneeling⁵
 - Basketball, volleyball, soccer, football
- Physical exam findings
 - Tenderness at tibial tuberosity
 - Enlargement of tibial tuberosity
 - Possible firm mass below the kneecap⁵

Knee Anatomy

The knee joint consists of three bones

- Femur – thigh bone (superior portion of the knee)
- Tibia – lower leg bone (inferior portion of the knee)
- Patella – kneecap (anterior portion of the knee)

Long bones (femur and tibia) contain an apophysis (growth plate)

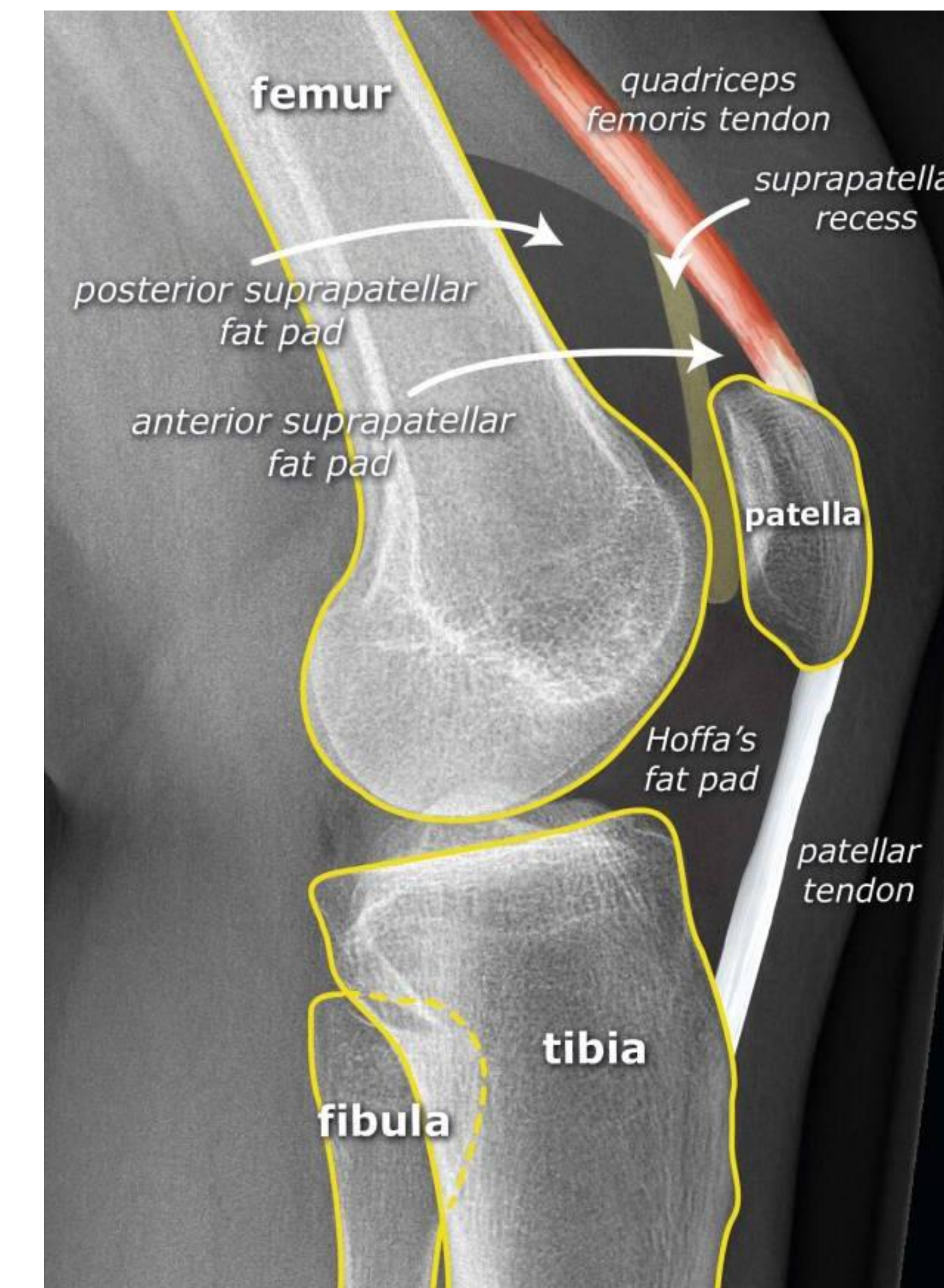
- Cartilaginous area between the shaft and the epiphysis
- Allows for bone growth during adolescence⁷

Major muscles around the knee

- Anterior thigh: quadriceps
- Posterior thigh: hamstrings
- Behind the knee: popliteus
- Lower leg (calf): gastrocnemius and soleus
- Additional muscles: sartorius, gracilis⁸

Tendons and Ligaments

- Tendons: muscle to bone
- Ligaments: bone to bone
- The primary structure involved in OSD is the patellar tendon
 - Continuation of the quadriceps muscle
 - Extends from the patella to the tibial tuberosity
 - Often referred to as the patellar ligament^{1,9}



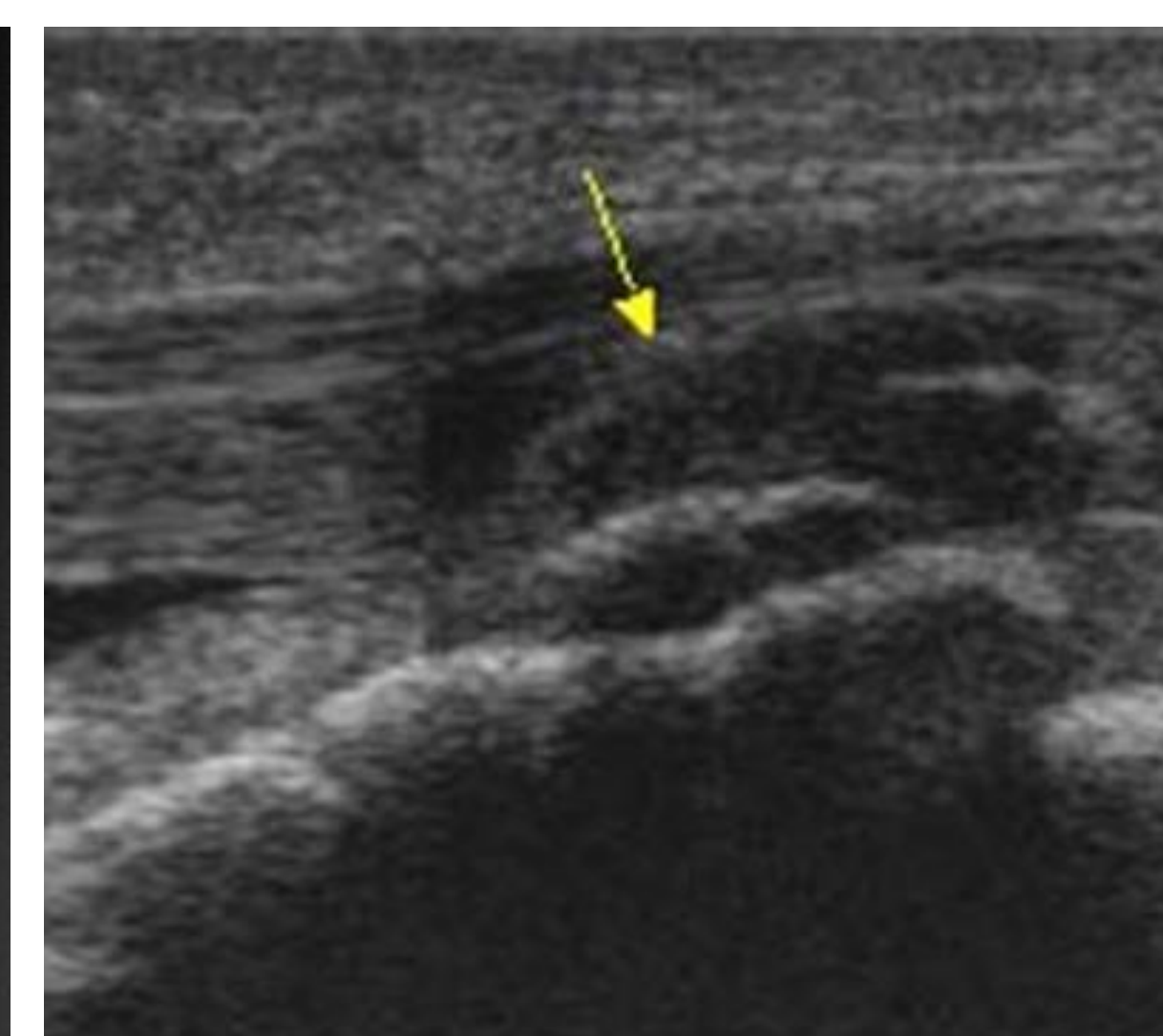
Lateral X-Ray Knee Anatomy⁸

Radiologic Involvement

X-RAY	ULTRASOUND	MAGNETIC RESONANCE IMAGING (MRI)	COMPUTED TOMOGRAPHY (CT)
<ul style="list-style-type: none"> • First-choice modality • Widely available and cost-effective • Good for identifying bony abnormalities • Findings (best seen on lateral view): <ul style="list-style-type: none"> • Irregularity or separation of the apophysis • Fragmentation of the tibial tuberosity • Soft tissue swelling • Patellar tendon thickening • Calcification or ossicle formation • Grading (1-3) <ul style="list-style-type: none"> • 1: slight tibial tuberosity elevation • 2: radiolucency and swelling • 3: fragmented ossicles • Limitations: <ul style="list-style-type: none"> • Limited soft tissue detail • Uses ionizing radiation¹ 	<ul style="list-style-type: none"> • Non-invasive, no ionizing radiation, cost-effective • Useful for tendon evaluation & monitoring progression • Findings: <ul style="list-style-type: none"> • Fragmentation of ossification center • Patellar tendon injury • Edema and/or infrapatellar bursitis • Increased doppler flow (neovascularization) • Types/Grading (1-3) <ul style="list-style-type: none"> • 1: Delamination of ossification center • 2: delamination tear/fracture of epiphyseal portion • 3: separation with irregular tuberosity deformity • Limitations: <ul style="list-style-type: none"> • Operator dependent • Affected by patient body habitus^{1,3,4,11-13} 	<ul style="list-style-type: none"> • More sensitive and specific • Excellent soft tissue detail • Not routinely used • Helpful in complicated or unclear cases • No ionizing radiation • Findings: <ul style="list-style-type: none"> • Soft tissue swelling • Thickened distal patellar tendon • Infrapatellar bursitis • Bone marrow edema • Displaced or nondisplaced osseous/cartilaginous fragments • Staging (0-3) <ul style="list-style-type: none"> • 0: normal scan • 1: early stage (no visible inflammation) • 2: torn secondary ossification center • 3: complete ossicle separation and tendon thickening • Limitations: <ul style="list-style-type: none"> • Expensive • Longer scan time (30+ minutes)^{3,13} 	<ul style="list-style-type: none"> • Not routinely used • Considered when complications or additional pathology is suspected • Findings: <ul style="list-style-type: none"> • Ossicles at tibial tuberosity • Tissue enlargement • Decreased attenuation at tendon attachment • Infrapatellar bursae visualization • Physeal fusion bar (possible complication) • Limitations: <ul style="list-style-type: none"> • Higher radiation exposure • Benefits often do not outweigh the risks¹⁴



Lateral Knee X-ray Demonstrating Osgood-Schlatter Disease³



OSD Knee Ultrasound With Fragmentation and Swelling at Apophysis⁴



Knee MRI Demonstrating Osgood-Schlatter Disease³



CT Scan of the Knee¹⁴

Differential Diagnoses

- Sinding-Larsen-Johansson Disease (SLJD)
 - Affects the inferior pole of the patella
 - Common in adolescents ages 10-14
 - Symptoms include tenderness at the bottom of the patella, swelling, and limited range of motion¹¹
- Jumpers Knee (Patellar Tendinopathy)
 - Overuse injury of the patellar tendon
 - Common in athletes of all ages^{11,15}
- Infrapatellar Bursitis
 - Inflammation of the infrapatellar bursa
 - Symptoms include swelling below patella, and localized tenderness
 - Swelling is diffuse, not a firm bony prominence
 - Can occur with or without OSD¹⁶
- Osteochondritis Dissecans (OCD)
 - Form of osteonecrosis
 - Affects adolescents and adults ages 10-20
 - Involves detachment of subchondral bone and cartilage
 - Pain location: medial femoral condyle^{11,17}
- Patellofemoral Pain Syndrome (Runners Knee)
 - Pain due to abnormal patella-femur mechanics
 - Common in runners and jumping athletes
 - Pain located higher at the patella¹⁸
- Chondromalacia Patellae
 - Softening/damage of cartilage behind patella
 - Affects adolescents and adults
 - Associated with repetitive stress or instability¹⁹
- Tibial Tubercle Avulsion Fracture (Most like OSD)
 - Affects same anatomical area
 - Common in adolescents nearing skeletal maturity
 - Caused by forceful quadriceps contraction²⁰

Management & Treatment

- Conservative Treatment (first-line)
 - Non-surgical and self-limiting. Initial treatment focuses on reducing symptoms and decreasing stress on the knee
 - Activity modification, ice therapy, NSAIDs, protective padding, stretching/strengthening exercises
 - Approximately 80% recover by skeletal maturity
 - Recovery varies based on severity. Most recover within 12 weeks, some up to 6 months, and occasionally up to 1 year
- Surgical Treatment (rare cases)
 - About 10% may have persistent symptoms into adulthood
 - Indications for surgery: significant ongoing pain, and/or loose bone fragments or cartilaginous material after ossification
 - Performed only after skeletal maturity
 - Surgery shows no significant benefit over conservative treatment^{1,3,11}

References

- Gregory J, Young C. Osgood-Schlatter disease. *Medscape*. January 25, 2024. Accessed October 21, 2025. <https://emedicine.medscape.com/article/1923268>
- Hanada M, Koyama H, Takahashi M, Matsuyama Y. Relationship between the clinical findings and radiographic severity in Osgood-Schlatter disease. *Open Access Journal of Sports Medicine*. 2012;3:17-20. March 9, 2012. Accessed October 9, 2025. [doi:10.2147/OAJSM.S29115](https://doi.org/10.2147/OAJSM.S29115)
- Corbi F, Matas S, Alvarez-Herns J, et al. Osgood-Schlatter disease: Appearance, diagnosis and treatment: A narrative review. *Healthcare (Basel)*. 2022;10(6):1011. May 20, 2022. Accessed October 9, 2025. [doi:10.3390/healthcare10061011](https://doi.org/10.3390/healthcare10061011)
- Svensen L, Rathleff M, Dean B, Oei E, Magnusson S, Olesen J, et al. A systematic review of imaging findings in patients with Osgood-Schlatter disease. *Translational Sports Medicine*. 2021;00:1-16. September 2021. Accessed October 9, 2025. [doi:10.1002/tsm2.281](https://doi.org/10.1002/tsm2.281)
- Ciri F, Aklak Y, Beyroluoglu T. Treatment of Osgood-Schlatter disease: review of the literature. *Musculoskeletal Surgery*. 2017;101(3):195-200. June 7, 2017. Accessed October 9, 2025. [doi:10.1007/s12306-017-0479-7](https://doi.org/10.1007/s12306-017-0479-7)
- Vaishya R, Tariq Aziz A, Kumar Agarwa A, Vijay V. Apophysitis of the tibial tuberosity (Osgood-Schlatter Disease): a review. *Cureus*. 2016;8(9). September 13, 2016. Accessed October 9, 2025. [doi:10.7755/cureus.200](https://doi.org/10.7755/cureus.200)
- Cluett J. Osgood-Schlatter disease and knee growing pains. *Very Well Health*. May 28, 2024. Accessed October 24, 2025. <https://www.verywellhealth.com/osgood-schlatter-disease-248247>
- Sentis G. Knee joint. *Kenhub*. October 20, 2023. Accessed October 24, 2025. <https://www.kenhub.com/en/library/anatomy/the-knee-joint>
- Tosovic D. Patellar tendon. *Kenhub*. March 31, 2025. Accessed October 30, 2025. <https://www.kenhub.com/en/library/anatomy/patellar-tendon>
- Wilson K. Osgood-Schlatter disease (knee pain). *American Academy of Orthopedic Surgeons*. September 2024. Accessed October 25, 2025. <https://orthoinfo.aaos.org/en/diseases-conditions/osgood-schlatter-disease-knee-pain/>
- Cailliet J, Kearns C, Gonzalez Herrera G, et al. Osgood-Schlatter disease. *Radiopaedia*. Updated September 12, 2025. Accessed October 2, 2025. <https://doi.org/10.5334/rp.17286>
- Siddiq A. Osgood-Schlatter disease unveiled under high-frequency ultrasonogram. *Cureus*. 10(10):e3411. October 4, 2018. Accessed November 5, 2025. [doi:10.7755/cureus.3411](https://doi.org/10.7755/cureus.3411)
- Kjellin I. Subacute and chronic avulsion injuries of the extensor mechanism of the knee. *MBJ Web Clinics*. March 2014. Accessed October 9, 2025. <https://doi.org/10.5334/rp.17286>
- Josh A. Osgood-Schlatter disease imaging. *Medscape*. August 12, 2022. Accessed November 6, 2025. <https://emedicine.medscape.com/article/411842-overview#a1>
- Theodorou A, Kosmos G, Hanties M. Patellar tendinopathy: an overview of prevalence, risk factors, screening, diagnosis, treatment, and prevention. *Archives of Orthopaedic and Trauma Surgery*. 2023;143(11):6695-6705. August 4, 2023. Accessed November 10, 2025. [doi:10.1007/s00402-023-04992-5](https://doi.org/10.1007/s00402-023-04992-5)
- Morgan M, Fenger J, Knipe H. Superficial infrapatellar bursitis. *Radiopaedia*. November 19, 2018. Accessed November 11, 2025. <https://doi.org/10.5334/rp.32225>
- Mohr B, Malyouk A, Baldea J. Osteochondritis Dissecans of the knee. *StatPearls Publishing*. January 25, 2025. Accessed November 10, 2025. <https://www.ncbi.nlm.nih.gov/books/NBK531824/>
- Bodaj C. Patellofemoral syndrome. *Medscape*. June 17, 2024. Accessed November 11, 2025. <https://emedicine.medscape.com/article/308471-overview#a1>
- Farooq S, Eifeky M. Chondromalacia patellae. *Radiopaedia*. March 25, 2025. Accessed November 11, 2025. <https://doi.org/10.5334/rp.17286>
- Radoski T, Eifeky M, Fortin F, et al. Tibial tuberosity avulsion fracture. *Radiopaedia*. October 29, 2011. Accessed on 11 Nov 2025. <https://doi.org/10.5334/rp.17286>