Osteochondritis Dissecans

Indexing Metadata/Description

Title/condition: Osteochondritis Dissecans

Synonyms: Osteochondrosis dissecans; dissecans, osteochondritis; dissecans, osteochondrosis

Anatomical location/body part affected: Curved articular surfaces of most joints in the upper and lower extremities/glennoid fossa of shoulder, capitellum of elbow, femoral condyle of knee, talar dome of ankle, metatarsal head in foot

Area(s) of specialty: Orthopedic Rehabilitation, Pediatric Rehabilitation, Sports Rehabilitation

Description

• Osteochondritis dissecans (OCD) is an idiopathic disorder of subchondral bone and articular cartilage in which a segment of the subchondral bone separates from the surrounding bone. Progression of the defect can result in varying degrees of fragmentation from the articular surface and surrounding cartilage. The osteochondral defects are associated with joint pain, inflammation, catching/locking, and impaired functional mobility.

• If the growth plate has fused, OCD is defined as adult. If the growth plate has not fused, OCD is defined as juvenile.

• The joints most commonly affected are the following:
  – Roughly 75% of OCD cases involve the knee, especially the medial femoral condyle, and 75–80% of cases are unilateral
  – Elbow (6%) (humeral capitellum)
  – Ankle (4%) (talus)
  – Combination of other joints (15%)

• Despite the suffix “itis,” inflammation has not been shown to be of significance in OCD. Osteochondrosis or osteochondral lesion may be a more appropriate term to describe this disorder.

• Prevalence is about 2 per 10,000 persons

ICD-9 codes

• 732.7 osteochondritis dissecans
• 718.1 loose body in joint
• 718.10 loose body in joint, site unspecified
• 718.11 loose body in joint of shoulder region
• 718.12 loose body in upper arm joint
• 718.13 loose body in forearm joint
• 718.14 loose body in hand joint
• 718.15 loose body in joint of pelvic region + thigh
• 718.17 loose body in ankle + foot joint
• 718.18 loose body in joint of other specified sites
• 718.19 loose body in joint of multiple sites

ICD codes are provided for the reader’s reference, not for billing purposes

ICD-10 codes

• M93.2 osteochondritis dissecans
• M23.4 loose body in knee
• M24.0 loose body in joint
  – use optional subclassification code to indicate site of involvement
    - 0 multiple sites
    - 1 shoulder region
    - 2 upper arm
    - 3 forearm
    - 4 hand
    - 5 pelvic region and thigh
    - 6 lower leg
    - 7 ankle and foot
    - 8 other
    - 9 site unspecified
• (ICD codes are provided for the reader’s reference, not for billing purposes)

– G-Codes
  - Mobility G-code set
    - G8978, Mobility: walking & moving around functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8979, Mobility: walking & moving around functional limitation; projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8980, Mobility: walking & moving around functional limitation, discharge status, at discharge from therapy or to end reporting
  - Changing & Maintaining Body Position G-code set
    - G8981, Changing & maintaining body position functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8982, Changing & maintaining body position functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8983, Changing & maintaining body position functional limitation, discharge status, at discharge from therapy or to end reporting
  - Carrying, Moving & Handling Objects G-code set
    - G8984, Carrying, moving & handling objects functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8985, Carrying, moving & handling objects functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8986, Carrying, moving & handling objects functional limitation, discharge status, at discharge from therapy or to end reporting
  - Self Care G-code set
    - G8987, Self care functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8988, Self care functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8989, Self care functional limitation, discharge status, at discharge from therapy or to end reporting
  - Other PT/OT Primary G-code set
    - G8990, Other physical or occupational primary functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8991, Other physical or occupational primary functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
    - G8992, Other physical or occupational primary functional limitation, discharge status, at discharge from therapy or to end reporting
  - Other PT/OT Subsequent G-code set
    - G8993, Other physical or occupational subsequent functional limitation, current status, at therapy episode outset and at reporting intervals
    - G8994, Other physical or occupational subsequent functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
- G8995, Other physical or occupational subsequent functional limitation, discharge status, at discharge from therapy or to end reporting

<table>
<thead>
<tr>
<th>G-code Modifier</th>
<th>Impairment Limitation Restriction</th>
</tr>
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<tbody>
<tr>
<td>CH</td>
<td>0 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CI</td>
<td>At least 1 percent but less than 20 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CJ</td>
<td>At least 20 percent but less than 40 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CK</td>
<td>At least 40 percent but less than 60 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CL</td>
<td>At least 60 percent but less than 80 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CM</td>
<td>At least 80 percent but less than 100 percent impaired, limited or restricted</td>
</tr>
<tr>
<td>CN</td>
<td>100 percent impaired, limited or restricted</td>
</tr>
</tbody>
</table>

Source: [https://www.cms.gov/](https://www.cms.gov/).

• **Reimbursement**: Reimbursement for therapy will depend on insurance contract coverage; no specific special agencies are applicable for this condition. No specific issues or information regarding reimbursement have been identified.

• **Presentation/signs and symptoms** (1,3)
  – Most often seen in children and adolescents but can occur in adults
  – Joint involvement is most often on the dominant side; in a minority of cases, OCD affects bilateral joints (24)
    - Knee (21)
    - Ankle (22)
    - Elbow
      - The capitellum is most commonly affected, but the radial head, olecranon, and trochlea can also be involved (24)
    - OCD of the capitellum typically involves the central or lateral portion (24)
  – Early lesions cause nonspecific joint pain that increases with activity and decreases with rest (3)
  – As OCD progresses, increased joint pain, stiffness, and intermittent swelling interferes with daily activities and/or restricts sports
  – Decreased range of motion (ROM) (24)
  – Antalgic gait when the knee or ankle is involved
  – Favoring or protecting the involved extremity
  – Tenderness over joint (3)
  – Intermittent catching or locking due to a loose fragment becoming detached (3)
    - OCD is the primary origin of loose bodies in the joints of adolescents, and these produce the sensation of joint locking or catching (1)
  – Increased dull ache and stiffness usually follow aggravating activity
  – Joint crepitus, occasionally with a palpable loose body (3)

**Causes, Pathogenesis, & Risk Factors**

• **Causes**
  – OCD is idiopathic but may be associated with underlying osteochondral pathology (1)
    – Sudden, direct contusion/shearing force or repetitive microtrauma (e.g., overuse, overweight condition)
    – Underlying incongruence of involved joint (e.g., due to abnormal ossification or ligamentous laxity)
–Ischemia resulting from abnormal anatomy of blood vessels
–Examples of juvenile cases
  - OCD may occur in the throwing athlete when the epiphyseal growth plate is open and repetitive valgus strain causes damage to the poorly vascularized capitellum\(^{(23)}\)
  - Awkward jump/landing might initiate OCD of the knee or ankle in a volleyball player
  - Fall on knee could bruise the articular cartilage of the medial femoral condyle which may years later develop into OCD
• Genetic predisposition: juvenile cases may also involve immature bone formation or ossification disorder\(^{(1)}\)

\[\text{Pathogenesis}\] \(^{(1)}\)

• Slow progressive degeneration of bone after osteochondral injury (e.g., subchondral fracture)
• The initial change following injury appears to be subchondral swelling
• A new theory proposes that a type of storage disease in the endoplasmic reticulum disrupts the synthesis of chondrocyte matrix and subsequent endochondral ossification\(^{(4)}\)
• Bone necrosis occurs in the early stage. The necrotic bone may then be absorbed and replaced by either viable subchondral trabeculae or cartilage without bone trabeculae\(^{(1,5)}\)
• Advanced stage is characterized by osteochondral sclerotic lesions and fragmentation, with secondary cartilage flaps and loose bodies, and persistent or intermittent effusion\(^{(1)}\)
• Fragmentation may be precipitated by vascular insufficiency (ischemia) to growth cartilage and/or following focal disturbance of endochondral ossification\(^{(1,5)}\)
• In juvenile OCD, lesions are often intact and the articular surface has potential to heal, whereas in adults they more often detach\(^{(1)}\)

\[\text{Risk factors}\] \(^{(2)}\)

• Sex: male sex (incidence ratio of 3:1 male to female)
  – Authors of a 2014 United States epidemiological study involving 192 children and adolescents (ages 6 to 19 years) with 206 cases of OCD of the knee reported that the incidence of OCD of the knee in males is 15.4 per 100,000 compared to 3.3 per 100,000 in females. Males had ~4 times greater risk of OCD affecting the knee compared to females\(^{(21)}\)
  – Authors of a 2014 United States study reported that female children and adolescents (ages 6 to 19 years) had a 1.5 times greater risk of developing OCD of the ankle compared to males\(^{(22)}\)
• Age: more common in adolescents 12 to 19 years of age than in children 6 to 11 years of age\(^{(20)}\)
  – Authors of a 2014 United States epidemiological study of 192 children and adolescents with 206 cases of OCD of the knee reported a 3.3-fold increased risk of OCD of the knee in adolescents aged 12 to 19 years compared with children aged 6 to 11 years. There were no children with OCD between the ages of 2 and 5 years\(^{(21)}\)
  – The same study reported a 7-fold increased risk of OCD of the ankle in adolescents aged 12 to 19 years compared with children aged 6 to 11 years\(^{(21)}\)
  – Asymptomatic cases of OCD may present during young adulthood as a result of misdiagnosis or failure to diagnose
• Race and ethnicity
  – Authors of a 2014 United States epidemiological study report that Blacks have the highest relative risk for OCD of the knee\(^{(21)}\)
  – Non-Hispanic Whites have the highest relative risk for OCD of the ankle\(^{(22)}\)
• Sports
  – OCD is associated with repetitive trauma and sports\(^{(3)}\)
  – OCD of the capitellum typically affects pitchers over 10 years of age and gymnasts at an earlier age\(^{(27)}\)
• Family history\(^{(1)}\)
• Joint malalignment\(^{(1)}\)
  – In 103 knees (23 adolescents [open growth plate] and 70 adults), varus alignment on standing was associated with medial condyle OCD and valgus alignment with lateral condyle OCD\(^{(2)}\)
• Authors of a 2016 prospective study relate development of OCD lesions as a result of vitamin D3 deficiency\(^{(30)}\)
  – Among the 23 patients with a stage 3 or 4 OCD lesion, 18 were found to be deficient in vitamin D3, 2 were found to be insufficient in Vitamin D3, and 3 were found to have the lowest normal value for Vitamin D3
**Overall Contraindications/Precautions**

- In juvenile cases, obtain written informed consent from parent or legal caretaker
- Obtain weight-bearing (WB) and exercise instructions from physician
- If postoperative, confirm guidelines provided by the surgeon
- Notify referring physician immediately on discovery of absent sensation or impaired motor function of the involved limb (significant neurological deficits are not usually associated with OCD)
- Patients with limited functional capacity (e.g., severe degenerative joint disease) may require special medical clearance and precautions for exercise
- Closely monitor patients at risk for falls
- No direct evidence contraindicates prescription of therapeutic exercise for muscle strengthening in stable OCD or for postoperative management of OCD. However, heavy load-bearing on the affected joint (e.g., in weightlifting) is contraindicated in cases of articular cartilage instability or a diagnosed loose body, or immediately postoperative
- Restrict or modify exercises that cause joint pain/swelling
- See specific **Contraindications/precautions** under **Assessment/Plan of Care**

**Examination**

**History**

- **History of present illness/injury**
  - **Mechanism of injury**: When did symptoms begin? Document the physical activities associated with increased symptoms. Identify probable causes and modifiable risk factors. How have symptoms progressed since their onset?
  - **Course of treatment**
    - **Medical management**: What conservative interventions (e.g., exercise modification, bracing, non-WB) have been taken to treat OCD in this patient? For example, has the patient’s physical activity or WB status been modified/restricted? If so, how?
      - Stable focal lesions with an intact articular surface may heal with early nonoperative treatment\(^1\)
    - **Surgical management**: Was a surgical procedure performed? If so, document when and the type of arthroscopic/open surgery used to repair (e.g., debridement, bone marrow stimulation, drilling) or reconstruct (e.g., fixation with bioabsorbable screws, chondrocyte transplantation) the affected joint surface
      - Surgical management generally is indicated after failed conservative treatment. Large, unstable fragments and loose bodies typically require arthroscopic fixation or removal\(^6\)
      - The generally accepted standard surgical approach for capitellar OCD is arthroscopic fragment removal. Reconstruction of the articular surface should be considered if the osteochondral defect is > 50% of the capitellar width. Autologous osteochondral plug grafts from the knee are used to reconstruct articular defects of the capitellum with good clinical outcomes\(^23\)
        - Fixation of knee OCD defects with bioabsorbable nails has been associated with a low rate of clinical healing and high complication rate\(^6\)
        - However, researchers in Japan reported improved clinical outcomes and high radiographic healing rates at a mean of 3.3 years follow-up after fixation of unstable OCD lesions with bioabsorbable pins and advocate this procedure to enable fixation, which will preserve the normal contour of the distal femur\(^28\)
        - Newer techniques such as biomimetic nanostructured osteochondral scaffold implantation and bone-marrow-derived cell transplantation are minimally invasive and have the advantage of requiring a single operation.\(^15\) Autologous osteochondral transplantation and mosaicplasty are surgical techniques for resurfacing focal articular lesions with hyaline cartilage\(^6\)
        - Researchers are conducting studies on the use of osteochondral autologous transplantation or allografts for the surgical management of osteochondral defects
          - German researchers utilized osteochondral autologous transplantation from the ipsilateral femoral lateral condyle in OCD of the talus for 32 patients. Age over 40 years was the only factor associated with a significantly lower Hospital for Special Surgery patella score. Obesity, preexisting arthritis, size of defect, need for malleolar osteotomy, location of defect, or the number of previous surgeries did not negatively influence clinical outcomes\(^17\)
- Israeli researchers investigated the use of osteochondral allograft transplantation for the surgical management of OCD and avascular necrosis of the femoral head in 8 patients. Five patients had good-to-excellent clinical outcomes at an average follow-up of 41 months.\(^{(18)}\)

- **Medications for current illness/injury:** Determine what medications clinician has prescribed, if any; are they effective? Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used to control pain and swelling.

- **Diagnostic tests completed**
  - Radiographs with “tunnel views” are the test of choice. Early, small lesions can look normal or show only increased subchondral bone density. A classic OCD lesion is viewed on a radiograph as a subchondral bone fragment surrounded by a radiolucent, crescent-shaped line.\(^{(3)}\)
  - Magnetic resonance imaging (MRI) is the most sensitive and is used to identify symptomatic patients with normal radiographs.\(^{(2)}\) MRI or computerized tomography (CT) scans may be used to identify subendochondral changes, any fractured cartilage, or the stability/instability of the OCD lesion.\(^{(8)}\)
  - MRI can be used to measure the size of the lesion, which can be used to determine the time frame for nonoperative management (6 months vs. 12 months). A timeframe of 6 months may be appropriate if the healing potential is > 48%. If the lesion at the knee is < 1.3mm in length, a nonoperative period of 12 months may be successful at symptom management and the reduction of OCD.\(^{(19)}\)
  - An expert panel on musculoskeletal imaging recommends MRI without contrast to rule out child and adolescent osteochondral injuries of the knee. MR arthropathy and CT arthropathy may also be appropriate.\(^{(20)}\)
  - In some cases, imaging to rule out another condition may reveal nonsymptomatic OCD.\(^{(2)}\)

- **Home remedies/alternative therapies:** Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help.

- **Previous therapy:** Document whether patient has had occupational or physical therapy for this or other orthopedic conditions and what specific treatments were helpful or not helpful.

- **Diagnosis of OCD should be considered if a patient being treated for sprained ankle does not improve with the usual course of treatment.**\(^{(3)}\)

  - **Aggravating/easing factors** (and length of time each item is performed before symptoms come on or are eased): Has patient discontinued or reduced activities that aggravate symptoms?

  - **Body chart:** Use body chart to document location and nature of symptoms. Pain and tenderness are located over the affected joint.

  - **Nature of symptoms:** Document nature of symptoms (e.g., constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling). Symptoms include reduced mobility of involved joint, tenderness over joint, and possible catching or locking if fragment has dislodged. Vague, dull ache and stiffness usually follow aggravating activity. Any episodes of joint locking, catching, or clicking?

  - **Rating of symptoms:** Use a visual analog scale (VAS) or 0–10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much). Is there stiffness after rest? Use the Wong-Baker FACES Pain Rating Scale or Oucher pain scale for younger children.

  - **Pattern of symptoms:** Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms due to weather or other external variables.

  - **Sleep disturbance:** Document number of wakings/night, if any.

  - **Other symptoms:** Document other symptoms patient may be experiencing that could be indicative of a need to refer to physician (e.g., dizziness, bowel/bladder dysfunction, neurological symptoms).

  - **Respiratory status:** Is there any known respiratory compromise?

  - **Barriers to learning**
    - **Are there any barriers to learning?** Yes__ No__
    - If Yes, describe ________________________

- **Medical history**
  - **Past medical history**
    - **Previous history of same/similar diagnosis:** Any previous skeletal problems or injury to the affected joint? History of OCD in contralateral or other joint?
    - **Comorbid diagnoses:** Ask patient/caregiver about other problems, including diabetes, cancer, heart disease, complications of pregnancy, psychiatric disorders, orthopedic disorders, etc.
- **Medications previously prescribed**: Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs)
- **Other symptoms**: Ask patient about other symptoms he or she may be experiencing

• **Social/occupational history**
  – **Patient’s goals**: Document what the patient hopes to accomplish with therapy and in general
  – **Vocation/avocation and associated repetitive behaviors, if any**: Inquire about recreational activity, sports, and occupation. Are the symptoms of OCD preventing the patient from participating in his or her desired activities? Competitive sports participation before skeletal maturity in susceptible individuals increases the risk of OCD
  – **Functional limitations/assistance with ADLs/adaptive equipment**: Document use
  – **Living environment**: Stairs, number of floors in home, with whom patient lives, caregivers, etc.

› **Relevant tests and measures**: (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting.) The main objective is to assess the extent of functional loss in the joint and the acting muscles

• **Anthropometric characteristics**: Determine height, weight, and body mass index (BMI) and compare to age and gender norms
• **Assistive and adaptive devices**: Evaluate need for, proper fit, and use of brace, immobilizer, or ambulatory assistive device
• **Balance**: If OCD involves the lower extremity, assess static and dynamic balance using the Berg Balance Scale (BBS) or Pediatric Balance Scale (PBS). Single limb stance can be used to compare quality and time to the unaffected side
• **Edema**: Compare circumference measurements of involved joint and limb to opposite side
• **Functional tests**: (including transfers, etc.): Assess general mobility with affected limb. If patient is an athlete, assess sports-related motion, such as throwing a baseball for pitcher with elbow OCD. If lower-extremity OCD, assess patient’s ability to negotiate stairs. Use the FIM to assess level of independence with functional mobility skills
• **Gait/locomotion**: Assess gait for patients with OCD of the lower extremity. Note any antalgic gait patterns, asymmetry in WB, stance or swing phase changes.
• **Joint integrity and mobility**: Assess joint mobility using Paris-Stoddard Scale, noting any hypomobility or hypermobility. Assess bilateral joints for ligamentous integrity. Note any complaints of pain or tenderness (e.g., varus and valgus stability). Note any crepitus
• **Muscle strength**: Perform manual muscle testing for the extremity involved. Compare to the unaffected extremity. Isokinetic strength testing can also be performed at the involved joint
• **Observation/inspection**: Thigh atrophy is common in knee OCD. Assess for atrophy of the vastus medialisobliquus (VMO). Inspect skin for wound healing following surgical repair. Note any signs of infection. Note bruising
• **Palpation**: Assess for joint and soft tissue tenderness, warmth, and soft tissue edema
• **Posture**: Assess alignment at involved joint. Measure for leg length discrepancy
• **Range of motion**: Assess for loss of active ROM due to pain, joint locking, or muscle shortening or stiffness. Passive ROM is usually normal unless locking occurs; assess flexibility of lower extremity as appropriate
• **Sensory testing**: Assess sensation and proprioception at involved joint and compare to contralateral side
• **Special tests**
  – Wilson’s sign to assess for provocative knee pain in knee OCD
  - Patient is in the supine position and tester holds foot on involved side in internal tibial rotation at 90° knee flexion.
  - Patient is asked to extend the knee against manual resistance. Test is positive for medial femoral condyle OCD if pain is elicited at ~30° flexion and pain is relieved by externally rotating tibia
  – Active radiocapitellar compression test
  - Examiner places the patient’s elbow in full extension and then asks the patient to actively pronate and supinate the forearms. A positive test occurs if the patient complains of lateral elbow pain

  – The International Knee Documentation Committee (IKDC) Subjective Knee Form score: a patient-centered knee questionnaire

  – Lysholm Knee Scale for patients with OCD of the knee
  – Lower Extremity Functional Scale (LEFS) for patients with OCD of the hip or knee
  – Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Measure for patients with OCD of the upper extremity
  – Quality of life measurement: SF-12
Contraindications and precautions

- Only those contraindications/precautions applicable to this diagnosis are mentioned below, including with regard to modalities. Rehabilitation professionals should always use their professional judgment in their assessment and treatment decisions.
- Patients with lower-extremity OCD may be at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Ensure that patient and family/caregivers are aware of the potential for falls and educated about fall-prevention strategies.
- Use a sterile field and sterile techniques when treating postoperative open lesions; dressings that retain moisture are contraindicated in the presence of infection.
- Allow for wound healing prior to functional rehabilitation.

Cryotherapy contraindications

- Cold intolerance
- Raynaud’s syndrome
- Medical instability
- Cryoglobulinemia
- Cold urticaria
- Over a regenerating peripheral nerve
- Over a circulatory compromise
- Over an area of peripheral vascular disease
- Paroxysmal cold hemoglobinuria

Cryotherapy precautions

- Hypertension
- Thermoregulatory disorders
- Over a superficial peripheral nerve
- Over an open wound
- Over an area of poor sensation
- Individuals with poor cognition
- In the very young or very old
- Persons with aversion to cold

Superficial heat contraindications

- Over areas with a lack of intact thermal sensation
- Over areas of vascular insufficiency or vascular disease
- Over areas of recent hemorrhage or potential hemorrhage
- Over areas of known malignancy
- Over areas of acute inflammation
- Over infected areas where infection may spread
- Over areas where liniments or heat rubs have recently been applied
- In any situation deemed unreliable by the practitioner

Whirlpool contraindications

- Incontinent bladder or bowel
- Alcohol or drug ingestion
- Uncontrolled epilepsy
- Danger of hemorrhaging
- Post-op surgical incision with dehiscence (i.e., bleeding surgical wound), sutures, or staples
- Skin ulcers caused by venous insufficiency, edema, or lymphedema
- Skin conditions such as atopic eczema, ichthyosis, and senile pruritus (i.e., itching)
- Tissue flaps or recent skin grafts
- Skin infection
- Thrombophlebitic areas
• **Whirlpool precautions** (8)
  - Malignancies
  - Sensory impairments
  - Hypersensitivity to cold
  - Pulmonary disease
  - Cardiac insufficiency
  - Unstable blood pressure
  - Impaired circulation
  - Edema
  - Acute febrile episode
  - Acute inflammation

• **Electrotherapy** contraindications (in some cases, when approved by the treating physician, electrotherapy may be used under some of the circumstances listed below when benefits outweigh the perceived risk) (9)
  - Over the trunk or heart region in patients with demand-type pacemakers and implantable cardioverter defibrillators (ICDs)
  - Over the pelvic, abdominal, lumbar, or hip region of a pregnant woman
  - Over the carotid bodies
  - Over the phrenic nerve, eyes, or gonads
  - Over areas of known peripheral vascular disease
  - Over areas of active osteomyelitis
  - Over areas of hemorrhage

• **Electrotherapy** precautions
  - With patients without intact sensation
  - With patients who cannot communicate
  - With patients with compromised mental ability
  - With cardiac dysfunction (uncontrolled hypertension or hypotension, irregular heartbeat)
  - Over active or previous neoplasms
  - With electrodes
    - Over compromised skin, unless treating wound specifically
    - Over tissues that are vulnerable to hemorrhage
    - Over areas of active osteomyelitis
  - Do not use within 5 years of diathermy units or other source of electromagnetic radiation

• **Therapeutic ultrasound, continuous** contraindications (9)
  - During pregnancy, over the abdomen and low back
  - Over active bone growth at the epiphysis
  - Over a known or suspected area for cancer
  - Over the infected tissue in a tuberculosis infection
  - Over an area of active bleeding – can be used in area of hematoma
  - Over skin with impaired circulation – recommend use pulsed
  - Following are considered contraindications but have no evidence to support
    - Myositis ossificans
    - Deep vein thrombosis or thrombophlebitis
    - Acute injury
    - Recently irradiated tissue
    - Impaired sensation due to nerve damage
    - Skin disease
    - Implanted cardiac pacemaker or other implanted electronics
    - Reproductive organs
    - Eyes
    - Anterior neck
  - Metal implants, head, and heart often listed but consensus is there should not be contraindications

• **Therapeutic ultrasound, continuous** precautions
  - Over plastic or cemented implants
Over spinal cord and superficial or regenerating nerves (poor evidence)

- Over low back and abdomen during pregnancy
- Over known or suspected area of malignancy
- Over area of active bleeding
- Following are considered contraindications but have no evidence to support
  - Myositis ossificans
  - Deep vein thrombosis or thrombophlebitis
  - Recently irradiated tissue
  - Implanted cardiac pacemaker or other implanted electronics
  - Reproductive organs
  - Eyes
  - Anterior neck

- Over epiphysis with active bone growth
- Over infected area
- Over acute injury
- Over area of impaired sensation due to nerve damage
- With patients with impaired cognition or communication
- Over areas of impaired circulation
- In the presence of skin disease
- Over plastic and cemented implants
- Over spinal cord and superficial or regenerating nerves (poor evidence)

**Therapeutic ultrasound, pulsed**

- Over known or suspected area of malignancy
- Over area of active bleeding
- Following are considered contraindications but have no evidence to support
  - Myositis ossificans
  - Deep vein thrombosis or thrombophlebitis
  - Recently irradiated tissue
  - Implanted cardiac pacemaker or other implanted electronics
  - Reproductive organs
  - Eyes
  - Anterior neck

**Diagnosis/need for treatment:** OCD/mechanical joint pain that interferes with daily activities and/or restricts sports.
Physical therapy is indicated for patients undergoing conservative treatment as well as postoperative management. Physical therapy typically emphasizes joint protection, pain management, gait training, swelling/joint effusion management, strengthening, and ROM, as well as patient education for safe load-bearing, activity modification, and restoring functional mobility. The American Academy of Orthopaedic Surgeons (AAOS) clinical practice guideline strongly recommends that patients be offered postoperative physical therapy after surgical treatment for OCD

**Rule out**

- Knee: acute fracture, arthritis, tendinitis, ligament sprain, meniscal injury, medial plica syndrome, stress fracture, neoplasm, referred pain from back or hip
- Elbow: Panner’s disease, Little League elbow, epicondyle fracture, epicondylitis, collateral ligament injury
- Ankle: ankle sprain, tarsal coalition, neoplasm

**Prognosis**

- The prognosis for juvenile OCD depends primarily on the distinction between stable and unstable defects. Juvenile OCD that presents with intact cartilage surface is likely to heal with conservative treatment (restricted activity and/or immobilization). Healing rates vary in the literature and are reported to be 100% after a follow-up of 1 to 10 years.
- It is recommended that patients with juvenile OCD receive 6 to 12 months of nonoperative, conservative treatment, including WB restrictions.
- Most young patients with early knee OCD improve with conservative management, return to their regular activities, and resume sport participation after symptoms resolve and optimal joint function is restored.
- With conservative treatment for early-stage OCD of the elbow, young patients can return to their regular activities and resume sports participation after symptoms resolve and optimal joint function is restored.
- Researchers who conducted a retrospective study in Japan on the outcomes of 39 young baseball players (mean age 12.8 years) with elbow OCD reported favorable outcomes with nonoperative treatment for those with early-stage lesions. Significant differences in healing due to the stage and growth plate development were reported. Healing occurred in 25 of the 30 early-stage lesions; however, healing occurred in only 1 of 9 advanced-stage lesions. For those with open capitellar growth plates, healing occurred in 16 of 17 cases compared to 11 of 22 cases with closed growth plates.
- Once complete healing occurs, joint function typically returns to normal. Healing is overwhelmingly achieved (95%) in skeletally immature children with small lesions, but in adults with larger lesions the complete healing rate is ~50%.

In
general, nonoperative treatment of juvenile OCD is successful in approximately 50% to 67% of stable lesions. For unstable lesions and lesions that fail to heal with nonoperative treatment, a variety of surgical interventions are used, with healing success rates of 62% or greater for all treatments except fragment excision.

- In order to determine the predictors of whether nonoperative treatment can be successful for juvenile OCD, researchers in Germany conducted a retrospective cross-sectional study to determine the factors associated with the healing process.

  - Sixty-two patients with juvenile OCD of the knee were included.
  - Following 6 months of nonoperative treatment, 67% of the stable lesions showed no progression toward healing or showed signs of instability.
  - Younger age, cyst-like lesion size, and normalized lesion width best predicted healing after 6 months.
  - Following 12 months of nonoperative treatment, 49% of the OCD lesions progressed toward healing, and a cyst-like lesion size had the highest predictive validity. Twelve months of nonoperative treatment can be successful in symptom management if the lesion is cyst-like and is < 1.3 mm in length.

- Positive predictors of successful nonoperative management of OCD involving the capitellum are open capitellarphysis, good elbow ROM (< 20° of lost motion), and localized flattening or lucency on radiographs without evidence of defect fragmentation or instability.

- Conservative management often fails in advanced cases of OCD, especially in adult patients with a large, unstable fragment or loose body. Unstable defects progressively detach and become loose bodies in the joint space, which may require surgical intervention. However, years may pass between injury, osteochondral fragmentation, and onset of severe symptoms. Consequently, the risk of degenerative joint disease developing increases over time.

  - On follow-up 10 to 19 years (mean, 14 years) after arthroscopic excision of unstable OCD defects of the lateral femoral condyle (N = 28 knees), 68% were rated (Hughston’s scale) good, 14% fair, and 18% poor.
  - IKDC scores after autologous chondrocyte implantation were better than after 5 other surgical procedures for OCD at 5.3 years follow-up.

- In juvenile cases with grade III OCD of the talus, there was a 61% failure rate when treated conservatively. Authors of this study suggest that increased age and the stage of the lesion are useful predictive values for determining failure rate when treated conservatively.

- Referral to other disciplines:
  - Nutritionist for dietary intervention as needed
  - Orthopedist as indicated

- Other considerations:
  - Current opinion is that nonoperative management (activity modification and immobilization) should be tried for 3–6 months in juvenile cases with stable OCD and in adults who have a small, stable fragment.
  - Patients who continue to experience mechanical symptoms are at risk for developing degenerative joint disease and should receive a surgical consultation. Surgical intervention is indicated for juveniles and adults with OCD with a loose body and in cases that fail to improve after 4 to 6 months of conservative management.
  - Calcitonin supplementation was found to be effective in nonoperative management of OCD of the elbow based on a case study of a 15-year-old female. Results from follow-up X-ray/MRI revealed fusion of her capitellum, which improved the overall outcome of OCD.

- Treatment summary: There are few evidence-based recommendations in the literature for conservative and postoperative rehabilitation for the management of OCD.

  - Lower extremity:
    - The effectiveness of bracing and activity modifications for juvenile OCD of the knee has not been established. Long-term immobilization can have negative effects on articular cartilage that may not be reversible.
    - Conservative management typically includes 4-6 weeks of non-WB for joint protection and to optimize healing, followed by WB as tolerated, activity modifications or restrictions, and pain and joint effusion management. Physical therapy intervention can begin once the bone healing begins. Treatment goals are pain-free ROM and normal strength and flexibility. Sports and activities can resume when symptoms are resolved (up to 12 weeks).
    - General stretching of the hip and ankle postoperatively with WB as tolerated on the affected knee joint. Gradual active knee ROM over the first 3 weeks, avoiding any vigorous knee flexion during this time. Running can begin 1 month
postoperatively as long as the donor knee was asymptomatic. Donor knee is defined as harvesting bone from areas of decreased weight bearing and transplanting it into chondral defects. In postoperative cases, the surgeon’s rehabilitation guidelines should be followed on an individualized basis. High compressive loads should be avoided to the affected joint until radiographic evidence of healing and sufficient neuromuscular control suggest that the patient’s joint is able to sustain more rigorous activity and strain.

- The goals of the initial phase of postoperative rehabilitation for OCD of the knee are to restore full ROM, maintain quadriceps function, and reduce joint swelling with the use of passive ROM exercises, straight leg raises, cryotherapy, stationary bike, and deep water therapy. Continuous passive ROM machines may be ordered per physician preference.

- Once the patient achieves full ROM and WB after about 2 months, the goal is to restore muscle function through WB: double leg-exercises with flexion up to 30°, stationary biking, deep water running, and elliptical and treadmill walking.

- Four to 6 months after surgery, the patient transitions to a staged running program and gradually to sport-specific activities such as pivoting, cutting, and jumping.

• Upper extremity
  – Japanese researchers recommend the following postoperative treatment intervention after autologous osteochondral plug graft for the management of OCD of the capitellum:
    - Elbow joint immobilized in 90° of flexion with the forearm in neutral for the first 2 weeks postoperatively
    - General stretching of the shoulder, especially the posterior shoulder. Start gentle resistance exercises at 2 months and progress into full resistance after 3 months
    - Throwing activity can be initiated at 3 months with full return to sports at 6 months
  – A hinged brace can be used to protect the elbow during the healing phase and to help correct natural elbow valgus and offload the capitellum. Depending on symptoms and the healing progress, athletes can usually return to unrestricted sports activities following 3 to 6 months of conservative treatment.

• Using low-intensity pulsed ultrasound (LIPUS) (0.5–50mW/cm²) for 20 minutes daily may reduce the average repair period in patients with OCD of the capitellum. However, further studies are warranted.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Goal</th>
<th>Intervention</th>
<th>Expected Progression</th>
<th>Home Program</th>
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</thead>
<tbody>
<tr>
<td>Pain, effusion</td>
<td>Decreased pain/ tenderness, reduced edema</td>
<td><strong>Joint protection</strong> Restrict high-impact activities such as jumping and high-velocity, resisted limb movements or heavy load-bearing that may stress the injured joint</td>
<td>Reduced pain and effusion and decreased need for modalities over time</td>
<td>Recommend strategies for the home to assist in relieving pain/effusion as appropriate and indicated for each patient</td>
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<tr>
<td>Reduced ROM/flexibility</td>
<td>Increase/maintain pain-free ROM/flexibility</td>
<td><strong>Manual therapy</strong></td>
<td>Progress as indicated</td>
<td>Recommend strategies for the home to assist in restoring ROM as appropriate and indicated for each patient</td>
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<td>Apply as indicated. Soft tissue mobilization, pain-free ROM, and stretching shortened</td>
<td></td>
<td>Apply as indicated. Soft tissue mobilization, pain-free ROM, and stretching shortened muscles should be tolerated well. However, joint mobilization is contraindicated in cases of articular cartilage instability or a diagnosed loose body, or immediately postoperative</td>
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<td>Recommend strategies for the home to assist in restoring ROM as appropriate and indicated for each patient</td>
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<td>Recommend strategies for the home to assist in restoring ROM as appropriate and indicated for each patient</td>
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<td>cases of articular cartilage instability or a diagnosed loose body, or immediately</td>
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<td>Recommend strategies for the home to assist in restoring ROM as appropriate and indicated for each patient</td>
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<td>postoperative</td>
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<td>Recommend strategies for the home to assist in restoring ROM as appropriate and indicated for each patient</td>
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<tr>
<td>In knee OCD, quadriceps atrophy and reduced strength</td>
<td>Increase/maintain sufficient strength to promote articular stability and alignment, with less reliance on biomechanical devices</td>
<td><strong>Therapeutic exercises</strong></td>
<td>Progress as indicated</td>
<td>Recommend strategies for the home to assist in restoring strength as appropriate and indicated for each patient</td>
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<tr>
<td>Reduced function in daily activities</td>
<td>Improve function</td>
<td>Clinical trials on the effectiveness of exercise therapy in OCD are lacking. Low-intensity, low-impact exercises for conditioning muscles that support the affected joint should be tolerated well. Consider aquatic therapy for knee or ankle OCD</td>
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<td>Recommend strategies for the home to assist in restoring strength as appropriate and indicated for each patient</td>
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<td></td>
<td></td>
<td><strong>Electrotherapeutic modalities</strong></td>
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<td>Recommend strategies for the home to assist in restoring strength as appropriate and indicated for each patient</td>
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<td>Evidence is lacking as to whether ultrasound or electrostimulation provides direct therapeutic benefits in OCD. However, muscle stimulation may help in activation of the weak quadriceps, especially if the VMO is atrophied. Ultrasound should not be applied directly over bony growth plates in pediatric cases</td>
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<td>Recommend strategies for the home to assist in restoring strength as appropriate and indicated for each patient</td>
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<td>Recommend strategies for the home to assist in restoring strength as appropriate and indicated for each patient</td>
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<td>Proprioceptive deficit in affected joint with impaired balance</td>
<td>Age-appropriate proprioception and balance reactions</td>
<td>Prescription, application of devices and equipment</td>
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<td>Knee taping or neoprene sleeve for joint protection and to compensate for proprioceptive deficits initially, then begin balance and proprioceptive training as appropriate</td>
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<td>Progress as indicated, wean off taping or sleeve</td>
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<td>Recommend strategies for the home to assist in proprioceptive/balance input as appropriate and indicated for each patient</td>
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<td>Antalgic gait in knee OCD with reduced walking speed</td>
<td>Improve gait mechanics and walking speed</td>
<td>Functional training</td>
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<td>To improve limb function in daily activities or to correct faulty gait pattern</td>
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<td>Progress as indicated</td>
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<td>Recommend strategies for the home to assist in gait restoration as appropriate and indicated for each patient</td>
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<td>No independent home exercise program (HEP)</td>
<td>Patient will be independent with HEP</td>
<td>Home exercise program</td>
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<td>Involve parent(s) in HEP for pediatric cases</td>
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<td>Progress as indicated</td>
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<td>Design and implement a home program as indicated</td>
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<td>Decreased ability to perform sport-related activities</td>
<td>Return to sport</td>
<td>Sport-specific training</td>
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<td>(e.g., agility training, running, cuts)</td>
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<td>Progress as indicated</td>
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<td>Design and implement a home program as indicated</td>
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**Desired Outcomes/Outcome Measures**

- Resolved pain (with negative Wilson’s sign)
  - VAS for pain and Wilson’s sign
- Increased flexibility and ROM
  - Goniometry for ROM measurements
- Increased functional strength
  - Manual muscle testing of involved body part
- Increased static and dynamic balance
  - Balance: BBS, PBS
- Full WB status for gait and functional mobility
  - FIM
  - Lysholm Knee Scale
  - LEFS
  - DASH Outcome Measure
  - IKDC score
  - ICRS classification
- Restored and normalized gait biomechanics without complaints of pain
- Improved self-reported quality of life
  - SF-12
- Return to prior regular physical activities/sport
  - Patient satisfaction with return to physical activities
**References**


