

### Osteochondritis Dissecans of the Knee

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*Abbreviations, Definitions for terms marked with \*, and How to Cite this Guideline may be found in the Appendices.*

#### INTRODUCTION / BACKGROUND

Osteochondritis Dissecans (OCD) refers to a lesion or injury of the subchondral bone, which is the area of bone just beneath the articular cartilage surface (Kocher 2006 [5], Glancy 1999 [5], Cahill 1995 [5], Detterline 2008 [5a]). OCD of the knee is a common cause of knee pain and dysfunction among children, adolescents, and young adults (Kocher 2006 [5]) with higher incidences reported for males than in females (Yang 2014 [5b], Kessler 2014 [4a]). OCD lesions may or may not compromise the integrity of the articular cartilage. A lesion is classified as being stable or unstable depending on the presence of an associated cartilage defect. In cases where the articular cartilage is damaged, the lesion is classified as unstable and frequently entails the presence of loose bodies (Schmitt 2009 [5], Cahill 1995 [5]). Evidence is lacking relative to the exact cause or causes of OCD lesions. However, emerging evidence is promising and supports several proposed causes of OCD lesion formation. These include: an acute traumatic event, (Shea 2013 [4a], Freemont 2010 [4a], Shea 2013 [4b], König 2013 [5b], Sum 2011 [5b]) repetitive microtrauma, (Freemont 2010 [4a], Kao 2011 [5a], Polousky 2011 [5b]) aberrant mechanical pressures, (Edmonds 2013 [5a]) and/or genetic predispositions (Gans 2013 [4b]).

Diagnosis and early management of an OCD lesions before it becomes unstable are key to ensuring successful outcomes with non-operative interventions (Jurgensen 2002 [2a], De Smet 1997 [3a], Hughes 2003 [4a], Edge 2011 [5b], Eriksson 2008 [5b]). Once a lesion progresses to an unstable state, more aggressive measures to promote healing of the articular surface (e.g. surgical fixations) may be necessary (Wall 2003 [5], Glancy 1999 [5], Kao 2011 [5a]). OCD that occurs in younger individuals with open physes is known as juvenile OCD or JOCD and can lead to further joint damage and premature development of osteoarthritis (Kocher 2006 [5], Wall 2003 [5], Twyman 1991 [5], Detterline 2008 [5a]). Non-operative management of juvenile OCD lesions is often successful because younger patients are more likely to have stable lesions and greater healing potential (Krause 2013 ], De Smet 1996 ], Wall 2008 [4a], Eismann 2014 [5a], Ganley 2006 [5b]). A nomogram is now available to help determine the likelihood of healing with conservative treatment of an OCD lesion (Wall 2008 [4a]). However, once a conservative management route is selected, there is large variation in the intervention strategies that are used to help rehabilitate these patients (Wall 2008 [4a]).

The purpose of this guideline is to provide a description of evidence-supported evaluation and intervention strategies for physical therapists involved in the non-operative management of juvenile OCD in the knee. This guideline was developed using current evidence for the management and treatment of OCD injuries. When evidence from the literature was insufficient, a panel of physical therapists, an orthopaedic surgeon, and a sports medicine physician was utilized to generate recommendation statements through a consensus-based process with special consideration given to joint biomechanics and tissue properties that contribute to the healing of the lesion and surrounding tissues. The organization of the guideline is structured to provide general recommendations to govern the rehabilitation process followed by specific criterion-based goals and intervention strategies for the initial, intermediate, and advanced stages of the rehabilitation process.

#### TARGET POPULATION

##### Criteria for Inclusion: Children or young adults

- With stable Osteochondritis Dissecans (OCD)\* of the patellofemoral or tibiofemoral joints
- Ages 5 to 18 years
- Who are skeletally immature and mature

##### Criteria for Exclusion: Children or young adults

- Following surgical management of OCD lesion
- With an unstable OCD lesion with articular cartilage injury
- With OCD of the capitulum
- With OCD of the talus

### TARGET USERS FOR THE RECOMMENDATIONS

Target users include, but are not limited to:

- Athletic Trainers
- Coaches
- Patients and families
- Physical Therapists and Physical Therapy Assistants
- Physicians

### GUIDELINE RECOMMENDATIONS

Click on the [{Evidence Discussion and Dimensions for Recommendation #}](#) hyperlink for the Discussion/Synthesis of the Evidence, the Table of Dimensions for Judging Recommendation Strength, and the Evidence Table of Included Studies related to individual recommendation statements.

#### General Recommendations

##### Recommendation 1

It is recommended that patients with stable OCD lesions enter into physical therapy early in the recovery process to safely address impairments while protecting the healing tissue and to promote long term joint integrity (*Jurgensen 2002 [2a], Hughes 2003 [4a], Local Consensus 2017 [5], Glancy 1999 [5], Eismann 2014 [5a], Paterno 2014 [5a], Edge 2011 [5b]*).

[{Evidence Discussion & Dimensions for Recommendation 1}](#)

##### Recommendation 2

It is recommended that the specific location and size of the lesion and the integrity of the surrounding tissues is considered, within the context of the biomechanics of the tibiofemoral or patellofemoral joints, throughout the initial exam and the entire rehabilitation process (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Paterno 2014 [5a]*).

**Note 1:** Rehabilitation for an individual with a lesion on a weight-bearing articular surface will necessitate a modified approach avoiding compressive forces and a slower progression whereas shear forces should be avoided for lesions located within the trochlea or on the undersurface of the patella (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5]*).

**Note 2:** All progressions in therapy activities should individualized to patient with a specific consideration of how the magnitude, direction, and duration of forces will affect the joint loads on the lesion and surrounding tissue (*Local Consensus 2017 [5]*).

[{Evidence Discussion & Dimensions for Recommendation 2}](#)

##### Recommendation 3

It is recommended that advancement through the phases of rehabilitation rely on a criterion-based rather than a time based progression (*Local Consensus 2017 [5], Paterno 2014 [5a]*).

**Note:** For the purposes of this guideline, three criterion-based phases will be described: Initial, Intermediate, and Advanced.

[{Evidence Discussion & Dimensions for Recommendation 3}](#)

##### Recommendation 4

It is recommended that the following precautions and red flags prompt communication with the referring physician and medical team throughout each phase of rehabilitation (*AmericanPhysicalTherapyAssociation ], Local Consensus 2017 [5]*):

- Increased or unchanging irritability
- Persistent or recurring effusion
- Mechanical block or joint locking
- Unexpected loss of range of motion (ROM)
- Persistent pathological end feel with passive motion.

[{Evidence Discussion and Dimensions for Recommendation 4}](#)

### Recommendation 5

It is recommended that the early phases of the rehabilitation process begin with a period of protected activity to minimize stress and mitigate risk of further articular cartilage breakdown (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Glancy 1999 [5], Buckwalter 1998 [5], Eismann 2014 [5a], Paterno 2014 [5a]*).

**Note 1:** Joint immobilization such as casting or bracing may be utilized to avoid the potentially deleterious forces at the lesion site. The method to immobilize may vary depending on patient factors (*Local Consensus 2017 [5], Bruns 2017 [5a], Cruz 2016 [5a], Eismann 2014 [5a], Ganley 2006 [5b]*).

**Note 2:** It is important to keep in mind that prolonged immobilization can have detrimental effects to the healing tissues, including: flattening of articular surface, non-contact area degeneration and inhibition of chondrogenesis, intra-articular adhesions, muscle atrophy and a reduced incidence of reattachment of the fragment (*Freemont 2010 [4a], Behrens 1989 [4a], Bray 2015 [5], Harada 2005 [5], Vanwanseele 2002 [5], Sood 1971 [5], Pascual-Garrido 2013 [5b], Mestriner 2012 [5b]*).

[\[Evidence Discussion and Dimensions for Recommendation 5\]](#)

### Recommendation 6

It is recommended that throughout the rehabilitation process a balance is struck between exposing the healing tissues to sufficient levels of joint compression while protecting the injured site from potentially damaging forces (*Local Consensus 2017 [5], Buckwalter 1998 [5], Paterno 2014 [5a]*).

**Note 1:** In animals, repetitive stress has been shown to cause osteochondral damage (*Stone 2016 [5a]*).

**Note 2:** Joint compression and decompression facilitates the nourishment of articular cartilage matrix production and stimulates bone and tissue remodeling to accommodate environmental demands (*Behrens 1989 [4a], Vanwanseele 2002 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 6\]](#)

### Recommendation 7

It is recommended that control of joint pain and effusion is a point of emphasis throughout the rehabilitation process because persistent pain and effusion contributes to elevated intra-articular joint temperature which may negatively affect articular cartilage healing (*Local Consensus 2017 [5], Reinold 2006 [5]*).

**Note:** The presence of pain and effusion at the knee may elicit an arthrogenic reflex that inhibits volitional quadriceps motor activity (*Rice 2009 [3a], Spencer 1984 [4a]*), which may delay progression for completion of the initial phase of rehabilitation (*Local Consensus 2017 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 7\]](#)

## Initial Phase

This phase is designed to help patients begin to restore normal knee range of motion, initiate proper quadriceps neuromuscular control, and gain strength to begin to normalize gait mechanics with at least a partial weight-bearing status. Table 1 highlights the expected goals and outcomes for the Initial Phase. Some patients may skip this phase all together if, upon presentation, the goals/criteria for progression to the next phase have already been met (*Local Consensus 2017 [5]*). A critical aspect of this phase is to slowly progress joint loading using proper gait mechanics and good joint alignment to prevent excessive shear forces, proteoglycan loss and weakening of the cartilage structure (*Behrens 1989 [4a], Vanwanseele 2002 [5], Haapala 2000 [5]*). Controlled progression of weight-bearing and joint loading can facilitate nourishment of the articular cartilage and will appropriately stimulate involved tissues to accommodate to environmental and activity demands (*Behrens 1989 [4a], Vanwanseele 2002 [5]*). Weight-bearing modifications will likely differ for each individual and the use of assistive devices, such as axillary crutches, may be used to limit joint loading (*Local Consensus 2017 [5]*).

**Table 1: Goals and Expected Outcomes for Initial Phase**

Impairment	Goals
Pain and effusion	<ul style="list-style-type: none"> <li>Minimal</li> </ul>
Gait (with or without assistive device)	<ul style="list-style-type: none"> <li>Maintain at least partial weight bearing status without adverse effects</li> <li>Demonstrate normalized gait mechanics (<i>Perry 1992 [5]</i>)</li> </ul>
ROM	<ul style="list-style-type: none"> <li>0 degrees to 120 degrees</li> <li>Joint mobility symmetrical with the uninvolved limb</li> </ul>
Strength and muscle performance	<ul style="list-style-type: none"> <li>Sufficient volitional quadriceps femoris muscle activation to maintain straight leg raise with negative lag sign (for at least 10 seconds)</li> <li>Manual Muscle Test grades of 4-/5 for trunk, hip, knee, and ankle strength</li> </ul>
Neuromuscular control	<ul style="list-style-type: none"> <li>Demonstrates appropriate lower extremity volitional muscle activation, particularly the quadriceps femoris neuromuscular control, with therapeutic activities</li> </ul>

### Recommendation 8

It is recommended that if a period of reduced weight-bearing is implemented, joint loading is progressed slowly using weight-shifting and gait training activities because exposure of articular cartilage to excessive compressive or shear forces may result in additional tissue damage (*Setton 1995 [4a], Radin 1971 [4a], Reinold 2006 [5]*).

**Note 1:** Optimal joint compression and decompression forces are achieved via joint motion, muscle activation, and controlled progression of weight-bearing and joint loading (*Behrens 1989 [4a], Local Consensus 2017 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 8\]](#)

### Recommendation 9

It is recommended that muscle strengthening activities include open and closed kinetic chain activities inclusive of quadriceps femoris lower extremity and core musculature with consideration for the lesion size/location, joint mechanics, and activity demands (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Eismann 2014 [5a], Paterno 2014 [5a]*).

[\[Evidence Discussion and Dimensions for Recommendation 9\]](#)

### Recommendation 10

It is recommended that neuromuscular control exercises that focus on facilitation of normal lower extremity muscle activation with minimal movement pattern deviations are integrated into the initial phase (*Local Consensus 2017 [5], Paterno 2014 [5a]*).

[\[Evidence Discussion and Dimensions for Recommendation 10\]](#)

## Intermediate Phase

The intermediate phase is designed to help patients achieve full knee range of motion, ambulate without the use of an assistive device, gain lower extremity strength so the transition from double leg to single leg activities can occur, and improve the patient's abilities to perform all lower extremity activities using good alignment and biomechanical form. Table 2 highlights the specific goals, expected outcomes for the Intermediate Phase (*Local Consensus 2017 [5]*).

**Table 2: Goals and Expected Outcomes for Intermediate Phase**

Impairment	Goals
Pain and effusion	<ul style="list-style-type: none"> <li>Minimal to none</li> </ul>
Gait (with or without assistive device)	<ul style="list-style-type: none"> <li>Maintain full weight bearing status and independent ambulation without adverse effects</li> <li>Demonstrate normalized gait mechanics (<i>Perry 1992 [5]</i>) with independent ambulation</li> </ul>
ROM	<ul style="list-style-type: none"> <li>Full active range of motion, symmetrical with contralateral knee.</li> </ul>
Strength and muscle performance	<ul style="list-style-type: none"> <li>Manual Muscle Test grades of 4+/5 for trunk, hip, knee, and ankle strength</li> </ul>
Neuromuscular control	<ul style="list-style-type: none"> <li>Demonstrate appropriate mechanics during all open kinetic chain and closed kinetic chain activities</li> <li>Maintains single leg balance on unstable surface, symmetrical with uninvolved</li> </ul>

### Recommendation 11

It is suggested that increased joint loading and strength/neuromuscular control activities continue to be addressed concurrently in the intermediate phase (*Local Consensus 2017 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 11\]](#)

### Recommendation 12

It is suggested that neuromuscular control exercises that focus on minimizing compensation patterns and utilization of appropriate technique during open kinetic chain and closed kinetic chain activities are a continued point of emphasis during the intermediate phase (*Local Consensus 2017 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 12\]](#)

## Advanced Phase

The Advanced Phase is designed to help the patient progress towards dynamic strengthening activities and to initiate plyometric, sport-specific activities. For all strengthening and plyometric interventions, there is a heavy focus on proper movement technique. Table 3 highlights the specific goals and expected outcomes for the Advanced Phase. With achievement of these goals at the level of  $\geq 85\%$ , the patient has met the necessary criteria for entry into the return to activity phase of rehabilitation and can progress back to full unrestricted activity once performance based functional tests and subjective questionnaires are met at a limb symmetry index (LSI) of  $\geq 90\%$  (*Local Consensus 2017 [5]*).

**Table 3: Goals and Expected Outcomes for Advanced Phase**

Impairment	Goals
Pain and effusion	<ul style="list-style-type: none"> <li>Resolved during all activities</li> </ul>
Gait	<ul style="list-style-type: none"> <li>Demonstrate normalized gait and jogging mechanics</li> </ul>
ROM	<ul style="list-style-type: none"> <li>Full active range of motion, symmetrical with contralateral knee.</li> </ul>
Strength and muscle performance	<ul style="list-style-type: none"> <li>Manual Muscle Test grades of 5/5 for trunk, hip, knee, and ankle strength</li> <li>Quadriceps Index (QI) <math>\geq 85\%</math> to <math>90\%</math></li> <li><math>QI = (\text{involved force output} / \text{uninvolved force output}) * 100\%</math></li> <li>Measured with dynamometer</li> </ul>
Neuromuscular control	<ul style="list-style-type: none"> <li>Demonstrate appropriate mechanics and force attenuation strategies with high impact and plyometric activities</li> </ul>
Subjective Questionnaire	<ul style="list-style-type: none"> <li>Report International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form score <math>\geq 85\%</math> to <math>90\%</math></li> </ul>
Performance Based Functional Tests	<ul style="list-style-type: none"> <li>Demonstrate Limb Symmetry Index of <math>\geq 85\%</math> to <math>90\%</math> on all Single Leghop tests</li> <li>Demonstrate appropriate mechanics during additional screens per clinical judgement</li> </ul>

### Recommendation 13

It is recommended that the initiation of impact, plyometric and sport-specific activities with focus on movement technique occur during this phase (*Local Consensus 2017 [5]*, *Eismann 2014 [5a]*).

**Note:** Activities should be initiated with double leg activities using sub-maximal effort and low repetitions. There needs to be proper emphasis on proper force attenuation strategies with landing mechanics. In addition, focus on performance and power generation during the take-off phase of a jump task (*Local Consensus 2017 [5]*, *Paterno 2014 [5a]*).

[\[Evidence Discussion and Dimensions for Recommendation 13\]](#)

### Recommendation 14

It is recommended that the initiation of jogging and a return to running program be introduced with an emphasis on proper gait mechanics (*Local Consensus 2017 [5]*, *Paterno 2014 [5a]*).

[\[Evidence Discussion and Dimensions for Recommendation 14\]](#)

### Recommendation 15

It is recommended that the physical therapist guide the patient through a progressive re-integration into their desired activity with a focus on improving cardiovascular activity/endurance and when applicable progressions into non-contact drills, contact drills, and eventually full re-integration into scrimmage and game play, all with a focus on maintain appropriate form and good technique (*Local Consensus 2017 [5], Eismann 2014 [5a]*).

**Note 1:** For re-integration into sports activities, consider modifications for speed/demand, time, and intensity of participation (*Local Consensus 2017 [5]*).

**Note 2:** For unrestricted sports participation, performance based functional tests need to be passed with a LSI  $\geq 90\%$  in addition to one or more additional performance based tests being passed (sport specific to the patient). The patient must be able to demonstrate appropriate mechanics during anticipated and unanticipated activity-specific maneuvers and drills with symmetrical and adequate power generation and power absorption (*Local Consensus 2017 [5]*).

[\[Evidence Discussion and Dimensions for Recommendation 15\]](#)

## REFERENCES

Evidence Level in [ ], Table of Evidence Levels in [Appendix 7](#)

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### APPENDIX 1 ABBREVIATIONS AND DEFINITIONS

#### Abbreviations

- OCD-Osteochondritis Dissecans
- LSI-Limb Symmetry Index
- JOCD-Juvenile Osteochondritis Dissecans
- IKDC-International Knee Documentation Committee
- QI-Quadriceps Index
- Others in recommendations and tables

### APPENDIX 2 IMPLEMENTATION

#### Applicability & Feasibility Issues

**Facilitators to implementation of recommendations include:** (1) Having leadership support which may include strategic objectives to increase utilization of physical therapy services for management and treatment of patients who have osteochondritis dissecans. (2) Focused training on the principles of physical therapy related to osteochondritis dissecans and equipment associated with this intervention. (3) Physicians understanding and support for the management and treatment of osteochondritis dissecans rehabilitation. (4) Research to contribute to the evidence and improve insurance funding.

**Barriers to implementation include:** (1) Support from physical therapist secondary to change in his or her practice and knowledge base. (2) Access to physical therapy services and an adequate number of staff trained to properly manage this condition, and/or. (3) Decreased coverage by insurance companies. (4) Lack of evidence in pediatrics.

**Resource needs include but not limited to:** Specialized training, access to equipment, and referral sources.

**Tools or processes that need to be developed:** Flow chart for determining eligibility for intervention, scheduling processes, referral processes, Electronic Medical Record (EMR) documentation tools and outcome data collection processes.

#### Relevant Cincinnati Children's Tools

- Health Topics – Osteochondritis Dissecans of the Knee
  - <https://www.cincinnatichildrens.org/health/o/osteochondritis-dissecans-knee>

#### Outcome Measures and Process Measures

The percent of children and young adults with OCD that receive PT services who are determined to be appropriate to progress to re-integration of desired activities.

The percent of children and young adults with OCD whose medical record indicates the initiation of ongoing physical therapy services within 1 week of the evaluation to safely address impairments while protecting the healing tissue and to promote long term joint integrity.

The percent of patients who complete patient reported outcome measures at the time of initial evaluation and discharge.

The percent of patients who demonstrate improvement on a region specific and quality of life outcome measure over the course of the episode of care.

The percent of patients who demonstrate resolution of impairments (can specify X, Y, Z) through episode of care without need for surgical intervention.

### APPENDIX 3

#### DISCUSSION / SYNTHESIS OF THE EVIDENCE, TABLES OF DIMENSIONS FOR JUDGING RECOMMENDATIONS STRENGTH, AND EVIDENCE TABLE OF INCLUDED ARTICLES (i.e., articles meeting inclusion criteria) BY RECOMMENDATION

#### Recommendation 1

It is recommended that patients with stable OCD lesions enter into physical therapy early in the recovery process to safely address impairments while protecting the healing tissue and to promote long term joint integrity (*Jurgensen 2002 [2a], Hughes 2003 [4a], Local Consensus 2017 [5], Glancy 1999 [5], Eismann 2014 [5a], Paterno 2014 [5a], Edge 2011 [5b]*).

#### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based primarily on imaging studies that demonstrate that children with OCD lesions have a much better prognosis (50% cure rate) when treated conservatively compared to adults, who rarely heal without surgical intervention (*Edge 2011 [5b]*). Imaging studies have also confirmed that despite extensive subchondral bone changes, as long as the lesion was stable, the lesion improved over time with conservative treatment, (*Jurgensen 2002 [2a], Hughes 2003 [4a]*) indicating low safety/harm concerns. This recommendation is also supported by expert opinion review papers and local consensus of the guideline development team that earlier initiation of physical therapy allows for skilled movement interventions and personalized progressions for patients that can optimally protect the healing tissue and promote long term joint integrity while considering the patients impairments, functional limitations, and activity level (which could range from basic activities of daily living through high level sport participation) (*Local Consensus 2017 [5], Glancy 1999 [5], Paterno 2014 [5a]*). Further research may be needed to strengthen the body of evidence relative to the optimal timing of initiation of physical therapy. Despite the lack of strong levels of evidence directly relating to this recommendation, the guideline development team determined that the safety/harm benefits of adhering to this recommendation would be minimal while the health benefits would be significant. This led to the rating of the strength of this recommendation as moderate.

#### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm (Side Effects and Risks)	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input checked="" type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input checked="" type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong		<input checked="" type="checkbox"/> Moderate		<input type="checkbox"/> Weak

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#### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Edge, A. (2011)	Review of the literature regarding the relationship between the juvenile and adult forms, and describe the current and future treatment methods for OCD.	Review, expert opinion	The authors recommend early non-operative treatment because once the disease progresses, there is greater risk of fragmentation and further damage to the articular surface.	5b
Eismann, E. (2014)	Review the etiology, diagnosis, and operative and non-operative treatments of JOCD.	Review, expert opinion	Recommended by multiple authors that early treatment of OCD lesions leads to the best long-term outcomes.	5b
Glancy, G.L. (1999)	Classification, pathophysiology, diagnosis, and treatment of OCD of the distal femoral condyle and the patella.	Review, expert opinion	The author suggests that exercises guided by a physical therapist can be helpful to promote healing and minimizing risk for engagement in high-impact and potentially damaging joint loading activities.	5b
Hughes, J.A. (2003)	Using serial MRI to document the natural history of JOCD. Correlate the natural history of JOCD with arthroscopy and clinical outcomes over 5 years.	Twenty-one knees that had lesions (in 19 patients) were classified as stable or unstable on MRI and correlated with clinical and arthroscopic data.	On 5-year follow-up, 17/19 patients were asymptomatic and the other two had minimal pain. Of this patient population, 14 arthroscopic surgeries were performed on 11/21 knees.	4a
Jurgensen, I. (2002)	Two groups of patients with knee OCD were examined using MRI pre- and post-conservative or surgical treatment intervention.	The decision to proceed with conservative or surgical intervention for the OCD lesion was based on the interface between the main bone and bone fragment on T1 and T2-weighted images. 27 patients were managed conservatively and 46 patients had surgery. Approximately 2 years later, the patient had a repeat MRI to assess the healing of their OCD lesion.	30% of the patients managed conservatively showed partial or complete remission. 63% of patients managed conservatively had no change. Those that underwent surgery had 37% remission and 57% had no change. In 33.3% of those initially treated conservatively, it was decided at the time of 2 year follow up to treat them surgically because of ongoing clinical symptoms that were affecting their quality of life.	2a
Local Consensus (2017)	To generate consensus on the content of recommendation 1.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V. (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest that early initiation of physical therapy can help patients address impairments while protecting the healing structure and safely progress the patient toward previous functional activities.	5a

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### Recommendation 2

It is recommended that the specific location and size of the lesion and the integrity of the surrounding tissues is considered, within the context of the biomechanics of the tibiofemoral or patellofemoral joints, throughout the initial exam and the entire rehabilitation process (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Paterno 2014 [5a]*).

**Note 1:** Rehabilitation for an individual with a lesion on a weight-bearing articular surface will necessitate a modified approach avoiding compressive forces and a slower progression whereas shear forces should be avoided for lesions located within the trochlea or on the undersurface of the patella (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5]*).

**Note 2:** All progressions in therapy activities should individualized to patient with a specific consideration of how the magnitude, direction, and duration of forces will affect the joint loads on the lesion and surrounding tissue (*Local Consensus 2017 [5]*).

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation was derived from local consensus of the review team combined with expert opinion from three clinical commentary evidence review articles (*Reinold 2006 [5], Wilk 2006 [5], Paterno 2014 [5a]*). These sources were in agreement that there is a critical need for physical therapists to be aware of the specific location and size of each patient's osteochondral lesion and how the location of the lesion can be affected by different joint loading patterns (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5]*). In addition, an understanding of the integrity of the surrounding tissues is also necessary to make decisions about which therapeutic interventions are appropriate at the various stages of the healing and rehabilitation processes (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5]*). Despite the lack of evidence directly relating to this recommendation, the guideline development team determined that the safety/harm benefits of adhering to this recommendation would be minimal while the health benefits would be significant. In contrast, the consequences of not adhering to this recommendation could put the patient at high risk for poor healing outcomes. This led to the rating of the strength of this recommendation as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm (Side Effects and Risks)	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input checked="" type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong		<input checked="" type="checkbox"/> Moderate		<input type="checkbox"/> Weak

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 2.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Reinold, M.M. (2006)	Provide overview of the rehabilitation strategies following surgery involving knee cartilage repair.	Clinical commentary	Rehabilitation will progress differently based on the location of the lesion. For lesions on the weight bearing surface, compressive forces should be avoided. For lesions located within the trochlea or undersurface of the patella, excessive shear forces should be minimized. Larger lesions may require a slower rehabilitation compared to a lesion that is small.	5
Wilk, K.E. (2006)	A clinical commentary to discuss different types of articular cartilage lesions in the knee, risk factors for full-thickness and articular cartilage lesions and development of osteoarthritis, and evaluation and treatment strategies for the athlete with articular cartilage lesions is given.	Clinical commentary	Location, size, and type of lesion along with any concomitant injuries need to be considered to know how to safely progress the patient through the rehabilitation process. The rehabilitation will progress at a modified rate if the lesion is on a weight-bearing surface.	5
Paterno, M.V (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest that therapy should progress based on properties of the lesion (size, location, etc.) with consideration for principles of joint biomechanics and tissue healing.	5a

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### Recommendation 3

It is recommended that advancement through the phases of rehabilitation rely on a criterion-based rather than a time based progression (*Local Consensus 2017 [5], Paterno 2014 [5a]*).

**Note:** For the purposes of this guideline, three criterion-based phases will be described: Initial, Intermediate, and Advanced.

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### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is founded on a comprehensive clinical commentary review paper and the local consensus of the guideline development team. A criterion-based progression is recommended to make sure that the patient's impairments are minimized or improved prior to advancement in the rehabilitation process to protect the healing tissue while facilitating improvements in strength, range of motion, and neuromuscular control (*Local Consensus 2017 [5]*). Paterno et al. provides specific criterion-based progressions in relation to pain, effusion, range of motion, weight bearing and strength and couched within a general timeline to help the therapist gain an understanding of how long each stage is likely to take for most patients (*Paterno 2014 [5a]*).

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input checked="" type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 3.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V. (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors give general timelines associated with each phase of rehabilitation to ensure sufficient healing time. The authors emphasize the importance of the patient meeting specific goals prior to progressing to the next phase in the rehabilitation process.	5a

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### Recommendation 4

It is recommended that the following precautions and red flags prompt communication with the referring physician and medical team throughout each phase of rehabilitation (*AmericanPhysicalTherapyAssociation* ], *Local Consensus 2017 [5]*):

- Increased or unchanging irritability
- Persistent or recurring effusion
- Mechanical block or joint locking
- Unexpected loss of range of motion (ROM)
- Persistent pathological end feel with passive motion.

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

The list of precaution and red flags were established through Local Consensus to help the clinician identify signs and symptoms associated with an abnormal knee presentation that would necessitate prompt communication with the referral source. Although there is no direct evidence to directly describe these as common red flags with OCD, these are generally accepted red flags associated with any kind of orthopedic-related pain or injury. The expert opinion of the guideline development team believe that these signs and symptoms may be indicative of an unstable lesion or other pathological condition that may warrant further investigation by an orthopedic specialist prior to progressing physical therapy interventions (*Local Consensus 2017 [5]*). If these signs and symptoms are correctly identified and addressed immediately, risk of harm to the patient is minimized. However, if these signs and symptoms are missed or left unaddressed, there may be a higher likelihood for deleterious effects resulting in poor outcomes. The guideline development team determined that the lack of direct evidence is offset by the need to mitigate safety concerns of not immediately addressing these potential red flags, leading to a rating of the overall strength of this recommendation statement as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence ( <i>See Evidence Table below; *GNA – Grade Not Assignable</i> )	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input checked="" type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 4.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

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### Recommendation 5

It is recommended that the early phases of the rehabilitation process begin with a period of protected activity to minimize stress and mitigate risk of further articular cartilage breakdown (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Glancy 1999 [5], Buckwalter 1998 [5], Eismann 2014 [5a], Paterno 2014 [5a]*).

**Note 1:** Joint immobilization such as casting or bracing may be utilized to avoid the potentially deleterious forces at the lesion site. The method to immobilize may vary depending on patient factors (*Local Consensus 2017 [5], Bruns 2017 [5a], Cruz 2016 [5a], Eismann 2014 [5a], Ganley 2006 [5b]*).

**Note 2:** It is important to keep in mind that prolonged immobilization can have detrimental effects to the healing tissues, including: flattening of articular surface, non-contact area degeneration and inhibition of chondrogenesis, intra-articular adhesions, muscle atrophy and a reduced incidence of reattachment of the fragment (*Freemont 2010 [4a], Behrens 1989 [4a], Bray 2015 [5], Harada 2005 [5], Vanwanseele 2002 [5], Sood 1971 [5], Pascual-Garrido 2013 [5b], Mestriner 2012 [5b]*).

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on a low level of evidence consisting of animal studies, literature reviews, and local consensus of the guideline development team. The intent of this recommendation is to establish the need for activity modification to decrease stress on the articular cartilage to prevent further articular cartilage breakdown (*Local Consensus 2017 [5]*). Activity restrictions are necessary to promote a period void of trauma or excessive micro stresses to the bone to promote healing. With this patient population, adherence to activity modification recommendations can vary greatly. In some instances, joint immobilization such as casting or bracing may be used as a method to assist in joint protection when adherence to activity restrictions is questionable. However, this must be carefully balanced and occur over a short period of time as animal studies have shown that prolonged immobilization can have detrimental effects on healing tissues, including: flattening of articular surface, non-contact area degeneration and inhibition of chondrogenesis, intra-articular adhesions, muscle atrophy and a reduced incidence of reattachment of the fragment (*Freemont 2010 [4a], Behrens 1989 [4a], Vanwanseele 2002 [5], Sood 1971 [5]*). Despite the lack of strong levels of evidence directly relating to this recommendation, the guideline development team determined that the safety/harm benefits of adhering to this recommendation would be minimal while the health benefits would be significant. This led to the rating of the strength of this recommendation as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input checked="" type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input type="checkbox"/> Positive	<input checked="" type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence ( <i>See Evidence Table below; *GNA – Grade Not Assignable</i> )	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate		<input type="checkbox"/> Weak	

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### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Eismann, E. (2014)	Review the etiology, diagnosis, and operative and non-operative treatments of JOCD.	Review, expert opinion	The authors recommend that patients may be immobilized to allow the knee to rest from repetitive stress. The authors recognize that there is no consensus on ideal duration for immobilization and list many ways that the patient could be immobilized (cast, brace, etc.).	5b
Buckwalter, J. (1998)	To review the mechanisms of articular cartilage injuries and healing processes.	Review, expert opinion	The author states that controlled early movement may facilitate healing by preventing further cartilage degeneration.	5b
Ganley, TJ (2006)	A review of the management of OCD lesions, both non-operative and operative.	Review, expert opinion	The authors recommend immobilization via cast, brace, knee immobilizer, or knee unloader brace based on convenience and compliance of the patient.	5b
Local Consensus (2017)	To generate consensus on the content of recommendation 5.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Reinold, M.M. (2006)	Provide overview of the rehabilitation strategies following surgery involving knee cartilage repair.	Clinical commentary	The authors suggest that the amount of stress applied to the injured knee should be done gradually to provide a healthy stimulus for cartilage, but not done so quickly that it results in damage. Controlled weight-bearing is necessary to facilitate healing and prevent degeneration.	5
Wilk, K.E. (2006)	A clinical commentary to discuss different types of articular cartilage lesions in the knee, risk factors for full-thickness and articular cartilage lesions and development of osteoarthritis, and evaluation and treatment strategies for the athlete with articular cartilage lesions is given.	Clinical commentary	The authors suggest developing a progressive weight bearing program based on the location and size of the lesion.	5
Paterno, M.V (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest a period of restricted weight-bearing during the initial phase of rehabilitation.	5a

[\[Back to Guideline Recommendation 5\]](#)

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Recommendation 6

It is recommended that throughout the rehabilitation process a balance is struck between exposing the healing tissues to sufficient levels of joint compression while protecting the injured site from potentially damaging forces (*Local Consensus 2017 [5], Buckwalter 1998 [5], Paterno 2014 [5a]*).

**Note 1:** In animals, repetitive stress has been shown to cause osteochondral damage (*Stone 2016 [5a]*).

**Note 2:** Joint compression and decompression facilitates the nourishment of articular cartilage matrix production and stimulates bone and tissue remodeling to accommodate environmental demands (*Behrens 1989 [4a], Vanwanseele 2002 [5]*).

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation originates from animal research (*Stone 2016 [5a]*) and expert opinion review papers (*Local Consensus 2017 [5], Buckwalter 1998 [5], Paterno 2014 [5a]*). The knowledge of how articular cartilage responds in animal models along with basic biomechanical joint force and ground reaction force knowledge resulted in a local consensus from the guideline development team that exposing the healing tissues to sufficient levels of joint compression while protecting the injured site from potentially damaging forces can facilitate healing (*Local Consensus 2017 [5]*). Despite the lack of evidence directly relating to this recommendation, the guideline development team determined that the safety/harm benefits of adhering to this recommendation would be minimal while the health benefits would be significant. This led to the rating of the strength of this recommendation as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence ( <i>See Evidence Table below; *GNA – Grade Not Assignable</i> )	<input checked="" type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Buckwalter, J. (1998)	To review the mechanisms of articular cartilage injuries and healing processes.	Review, expert opinion	The author states that controlled loading and motion is beneficial for articular cartilage. Premature or excessive loading and motion may disrupt articular cartilage.	5b
Local Consensus (2017)	To generate consensus on the content of recommendation 6.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest that based on the location of the lesion, weight-bearing and mobilization may occur at different rates.	5a

[\[Back to Guideline Recommendation 6\]](#)

### Recommendation 7

It is recommended that control of joint pain and effusion is a point of emphasis throughout the rehabilitation process because persistent pain and effusion contributes to elevated intra-articular joint temperature which may negatively affect articular cartilage healing (*Local Consensus 2017 [5], Reinold 2006 [5]*).

**Note:** The presence of pain and effusion at the knee may elicit an arthrogenic reflex that inhibits volitional quadriceps motor activity (*Rice 2009 [3a], Spencer 1984 [4a]*), which may delay progression for completion of the initial phase of rehabilitation (*Local Consensus 2017 [5]*).

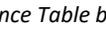
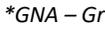
### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on a low level of evidence consisting of human subject research, basic expert physiology knowledge of joint temperature elevation, and the local consensus of the guideline development team. The intent of this recommendation is to emphasize the importance of pain and effusion control around the knee joint to protect both the articular cartilage and quadriceps musculature from any side effects related to the arthrogenic reflex in response to the presence of either pain and or effusion in the knee joint. If pain and effusion are not addressed, this may delay progress through the initial phase of rehabilitation (*Local Consensus 2017 [5]*). The effects of an arthrogenic reflex on volitional quadriceps motor activity is based off research done on healthy adult subjects in which knee swelling was simulated by using a saline solution while monitoring the effects of quadriceps motor activity via electromyography (EMG). Both of these studies demonstrated that volitional quadriceps motor activity is inhibited in the presence of knee effusion (*Rice 2009 [3a], Spencer 1984 [4a]*). The guideline development team determined that the lack of direct evidence is offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence <i>(See Evidence Table below; *GNA – Grade Not Assignable)</i>	<input type="checkbox"/> High 	<input type="checkbox"/> Moderate 	<input type="checkbox"/> Low 	<input checked="" type="checkbox"/> Very Low 	<input type="checkbox"/> GNA* 
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong		<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak	

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 7.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Reinold, M.M. (2006)	Provide overview of the rehabilitation strategies following surgery involving knee cartilage repair.	Clinical commentary	The authors are in favor of minimizing pain and effusion throughout rehabilitation to keep the quadriceps muscle strong. In the presence of pain and effusion, reflex inhibition is present which results in decreased quadriceps muscle activation. The authors note that when there is an increase in intra-articular joint temperature, proteoglytic enzyme activity is stimulated, which negatively affects articular cartilage.	5

[{Back to Guideline Recommendation 7}](#)

### Recommendation 8

It is recommended that if a period of reduced weight-bearing is implemented, joint loading is progressed slowly using weight-shifting and gait training activities because exposure of articular cartilage to excessive compressive or shear forces may result in additional tissue damage (*Setton 1995 [4a], Radin 1971 [4a], Reinold 2006 [5]*).

**Note 1:** Optimal joint compression and decompression forces are achieved via joint motion, muscle activation, and controlled progression of weight-bearing and joint loading (*Behrens 1989 [4a], Local Consensus 2017 [5]*).

# Evidence-Based Clinical Practice Guideline 47 Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

## Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on a low level of evidence consisting of basic science of articular cartilage, animal research, and local consensus from the guideline development team. Weight shifting and gait training activities are necessary to facilitate a controlled progression of weight-bearing and joint loading to facilitate nourishment of the articular cartilage. This will appropriately stimulate involved tissues to accommodate to environmental and activity demands (*Behrens 1989 [4a], Vanwanseele 2002 [5]*). The use of axillary crutches is recommended as a way to make weight bearing modifications to limit the patient's load on the involved joint (*Local Consensus 2017 [5]*). Joint loading should be progressed slowly with the patient using proper gait mechanics and good joint alignment to prevent excessive shear forces (which can result in additional tissue damage), proteoglycan loss and weakening of the cartilage structure (*Setton 1995 [4a], Radin 1991 [4a], Behrens 1989 [4a], Radin 1971 [4a], Vanwanseele 2002 [5], Haapala 2000 [5]*). The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

## Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence ( <i>See Evidence Table below; *GNA – Grade Not Assignable</i> )	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input checked="" type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input type="checkbox"/> Moderate	<input checked="" type="checkbox"/> Weak		

## Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 9.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

[\[Back to Guideline Recommendation 8\]](#)

## Recommendation 9

It is recommended that muscle strengthening activities include open and closed kinetic chain activities inclusive of quadriceps femoris lower extremity and core musculature with consideration for the lesion size/location, joint mechanics, and activity demands (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Eismann 2014 [5a], Paterno 2014 [5a]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on a few clinical commentaries and local consensus (*Local Consensus 2017 [5], Reinold 2006 [5], Wilk 2006 [5], Paterno 2014 [5a]*). The intent of this recommendation is to highlight the importance of including both open and closed kinetic chain exercises that target all muscle groups starting proximally at the core and working distally through the rest of the limb. It is important to emphasize the importance of quadriceps femoris muscle strengthening because the quadriceps femoris largely contribute to force production and force dissipation at the knee (*Mikesky 2000 [4a], Local Consensus 2017 [5]*). In addition, quadriceps femoris muscle disuse atrophy and inhibition are common in this patient population (*Local Consensus 2017 [5]*). Although the quadriceps muscle group is important, other core and hip musculature along with the hamstrings and calf musculature is important to have strong and balanced for proper force attenuation in preparation for impact activities. It is important for the therapist to consider the location and size of the lesion when choosing exercises to work the musculature in a variety of joint ranges and consider the effects of open kinetic chain versus closed kinetic chain to limit excess joint stress over the affected lesion site to protect against any further articular cartilage degradation (*Local Consensus 2017 [5], Wilk 2006 [5], Paterno 2014 [5a]*). The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input checked="" type="checkbox"/> Directly relates	<input type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence ( <i>See Evidence Table below; *GNA – Grade Not Assignable</i> )	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong		<input checked="" type="checkbox"/> Moderate		<input type="checkbox"/> Weak

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Eismann, E. (2014)	Review the etiology, diagnosis, and operative and non-operative treatments of JOCD.	Review, expert opinion	The authors recommend focusing on lower extremity and core muscle strength to be a stabilizing force to protect the joint and dampen forces around the joint.	5b
Local Consensus (2017)	To generate consensus on the content of recommendation 10.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V. (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest trying to improve muscle activation with an incorporation of both open and closed kinetic chain strengthening interventions.	5a
Reinold, M.M. (2006)	Provide overview of the rehabilitation strategies following surgery involving knee cartilage repair.	Clinical commentary	The authors suggest focusing on exercises that strengthen the entire lower extremity, including the core, to assist in controlling the production and dissipation of forces around the knee joint.	5
Wilk, K.E. (2006)	A clinical commentary to discuss different types of articular cartilage lesions in the knee, risk factors for full-thickness and articular cartilage lesions and development of osteoarthritis, and evaluation and treatment strategies for the athlete with articular cartilage lesions is given.	Clinical commentary	The authors recommend strengthening exercises that target the trunk, hip and quadriceps muscle groups while considering loads and location and size of the lesion.	5

[\[Back to Guideline Recommendation 9\]](#)

### Recommendation 10

It is recommended that neuromuscular control exercises that focus on facilitation of normal lower extremity muscle activation with minimal movement pattern deviations are integrated into the initial phase (*Local Consensus 2017 [5], Paterno 2014 [5a]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on the local consensus, expert opinion, and clinical review (*Local Consensus 2017 [5], Paterno 2014 [5a]*) and is intended to highlight the importance of proper movement patterns. This can be done through emphasizing proper neuromuscular control exercises to facilitate normal lower extremity muscle activation throughout the patient's exercise progression. Multiple factors which contribute to neuromuscular control include strength, proprioception, balance, coordination, postural stability, hip and trunk stabilization, dynamic stabilization, and power generation and absorption. The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input checked="" type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 11.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V. (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The authors suggest utilizing interventions that focus on improving muscle activation and enhancing lower extremity neuromuscular control.	5a

[{Back to Guideline Recommendation 10}](#)

### Recommendation 11

It is suggested that increased joint loading and strength/neuromuscular control activities continue to be addressed concurrently in the intermediate phase (*Local Consensus 2017 [5]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on the local consensus of the guideline development team (*Local Consensus 2017 [5]*). The intent of this recommendation is to highlight the need to progress joint loading, strength, and neuromuscular control simultaneously. For example, if a patient was asked to do a heel tap, the therapist would simultaneously address knee mechanics (avoidance of genu valgus, anterior knee translation, and neutral pelvic alignment) as joint loads were increased from a double limb to single limb activity. These concepts are recommended to occur concurrently to protect the healing lesion and promote joint protection strategies as rehabilitation progresses. The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input type="checkbox"/> Positive	<input checked="" type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 12.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

[{Back to Guideline Recommendation 11}](#)

### Recommendation 12

It is suggested that neuromuscular control exercises that focus on minimizing compensation patterns and utilization of appropriate technique during open kinetic chain and closed kinetic chain activities are a continued point of emphasis during the intermediate phase (*Local Consensus 2017 [5]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on the local consensus with the intention to highlight the need to ensure the patient is able to properly perform progressions of open kinetic chain and closed kinetic chain exercises given to them with minimal compensation along the kinetic chain (*Local Consensus 2017 [5]*). If a patient does not have sufficient strength or neuromuscular control to perform the exercise, unnecessary joint stress may be placed on the healing lesion (*Local Consensus 2017 [5]*). The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input checked="" type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input checked="" type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 13.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

[\[Back to Guideline Recommendation 12\]](#)

### Recommendation 13

It is recommended that the initiation of impact, plyometric and sport-specific activities with focus on movement technique occur during this phase (*Local Consensus 2017 [5]*, *Eismann 2014 [5a]*).

**Note:** Activities should be initiated with double leg activities using sub-maximal effort and low repetitions. There needs to be proper emphasis on proper force attenuation strategies with landing mechanics. In addition, focus on performance and power generation during the take-off phase of a jump task (*Local Consensus 2017 [5]*, *Paterno 2014 [5a]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on a clinical commentary and the local consensus. The intent of this recommendation is to discuss a proper plyometric progression when impact is first being initiated. The volume needs to be low with a focus on proper biomechanical form both during the take-off and landing of the jump. Biomechanical faults to address include knee genu valgus, hip internal rotation and increased ground reaction forces related to shallow knee flexion angles. Impact activities should not be progressed prior to the demonstration of proper biomechanical form to avoid any deleterious effects of abnormal stresses on the knee joint. The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○	<input type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Eismann, E. (2014)	Review the etiology, diagnosis, and operative and non-operative treatments of JOCD.	Review, expert opinion	The authors recommend during the advanced phase the patient should gradually proceed to impact and sport specific activities as tolerated.	5a
Local Consensus (2017)	To generate consensus on the content of recommendation 2.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

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### Recommendation 14

It is recommended that the initiation of jogging and a return to running program be introduced with an emphasis on proper gait mechanics (*Local Consensus 2017 [5], Paterno 2014 [5a]*).

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

This recommendation is based on local consensus on a review paper (*Local Consensus 2017 [5]*). The intent of this recommendation is to highlight the appropriate stage of rehabilitation to initiate jogging and a return to running program (*Paterno 2014 [5a]*). It is important to note that even if the patient is not formally returning to a running based activity, it is likely he or she may be expected to participate in at least low level running activities for physical education classes or for participation at recess with classmates. It is important to ensure the patient can run at least a short distance safely using proper form. The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

### Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious		
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal		
3. Burden on population to adhere to recommendation	<input type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High		
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective		
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates		
6. Impact on quality of life, morbidity, or mortality	<input checked="" type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative		
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input type="checkbox"/> Very Low ⊕○○○	<input checked="" type="checkbox"/> GNA* ○○○○
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak		

### Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Local Consensus (2017)	To generate consensus on the content of recommendation 2.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5
Paterno, M.V. (2014)	Overview of non-operative PT management of the elbow, ankle, and knee in patients with an OCD lesion.	Review, expert opinion	The author suggests that once normal movement patterns are established, a gradual reintegration into plyometric activity can begin. Plyometric activity is indicated for those who plan to return to impact sport if there is no risk to healing tissue. This must be done gradually, with restricted volume to start, with regular feedback to promote normal movement patterns.	5a

[\[Back to Guideline Recommendation 14\]](#)

### Recommendation 15

It is recommended that the physical therapist guide the patient through a progressive re-integration into their desired activity with a focus on improving cardiovascular activity/endurance--and when applicable--progressions into non-contact drills, contact drills, and eventually full re-integration into scrimmage and game play, all with a focus on maintain appropriate form and good technique (*Local Consensus 2017 [5], Eismann 2014 [5a]*).

**Note 1:** For re-integration into sports activities, consider modifications for speed/demand, time, and intensity of participation (*Local Consensus 2017 [5]*).

**Note 2:** For unrestricted sports participation, performance based functional tests need to be passed with a LSI  $\geq$  90% in addition to one or more additional performance based tests being passed (sport specific to the patient). The patient must be able to demonstrate appropriate mechanics during anticipated and unanticipated activity-specific maneuvers and drills with symmetrical and adequate power generation and power absorption (*Local Consensus 2017 [5]*).

### Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

The intent of this recommendation is based on a clinical commentary and the local consensus of the guideline development team. It is important that the physical therapist emphasize the progression and personalization of end stage exercises in alignment the patient's specific higher level sport and physical activity goals (*Local Consensus 2017 [5]*). The guideline development team determined that the lack of evidence was offset by the need to mitigate safety concerns and optimize the health benefits for the patient led to an overall strength of the recommendation being rated as moderate.

# Evidence-Based Clinical Practice Guideline 47 Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

Dimensions of Judging the Recommendation Strength for *successful healing of OCD lesion*.

1. Safety / Harm ( <i>Side Effects and Risks</i> )	<input checked="" type="checkbox"/> Minimal	<input type="checkbox"/> Moderate	<input type="checkbox"/> Serious	
2. Health benefit to patient	<input checked="" type="checkbox"/> Significant	<input type="checkbox"/> Moderate	<input type="checkbox"/> Minimal	
3. Burden on population to adhere to recommendation	<input checked="" type="checkbox"/> Low	<input checked="" type="checkbox"/> Unable to determine	<input type="checkbox"/> High	
4. Cost-effectiveness to healthcare system	<input type="checkbox"/> Cost-effective	<input checked="" type="checkbox"/> Inconclusive	<input type="checkbox"/> Not cost-effective	
5. Directness of the evidence for this target population	<input type="checkbox"/> Directly relates	<input checked="" type="checkbox"/> Some concern of directness	<input type="checkbox"/> Indirectly relates	
6. Impact on quality of life, morbidity, or mortality	<input type="checkbox"/> Positive	<input type="checkbox"/> Moderate/Neutral	<input type="checkbox"/> Negative	
7. Grade of the Body of Evidence (See Evidence Table below; *GNA – Grade Not Assignable)	<input type="checkbox"/> High ⊕⊕⊕⊕	<input type="checkbox"/> Moderate ⊕⊕⊕○	<input type="checkbox"/> Low ⊕⊕○○	<input checked="" type="checkbox"/> Very Low ⊕○○○
			<input type="checkbox"/> GNA* ○○○○	
<b>Overall Strength of the Recommendation:</b>	<input type="checkbox"/> Strong	<input checked="" type="checkbox"/> Moderate	<input type="checkbox"/> Weak	

## Evidence Table of Included Studies

First Author & Year	Purpose	Methods	Results	Evidence Level
Wilk, K.E. (2006)	A clinical commentary to discuss different types of articular cartilage lesions in the knee, risk factors for full-thickness and articular cartilage lesions and development of osteoarthritis, and evaluation and treatment strategies for the athlete with articular cartilage lesions is given.	Clinical commentary	The authors recommend initiating sport-specific drills such as running and jumping and to gradually increase load. As rehabilitation progresses, the authors recommend performing running and sport specific drills every other day with strengthening on alternate days. As function returns without symptoms, gradual return to the desired sport may be approved by the medical team.	5
Local Consensus (2017)	To generate consensus on the content of recommendation 16.	A consensus generation process was used through online polling and face to face voting to obtain agreement of a group of 23 physical therapists specializing in sports and orthopedic physical therapy.	After a single round of discussion and voting, a consensus of 23/23 sports and orthopedic physical therapists was obtained for this recommendation statement.	5

[{Back to Guideline Recommendation 15}](#)

## APPENDIX 4

### CLINICAL QUESTIONS, CRITERIA FOR INCLUSION, EVIDENCE SEARCH STRATEGIES, AND SEARCH RESULTS

#### Clinical Question 1:

In children aged 5-18 years who are skeletally immature or mature and have a stable OCD of the patellofemoral joint and/or tibiofemoral joint, what physical therapy evaluation/intervention strategies (Pain and effusion, gait, range of motion, strength and muscle performance, neuromuscular control) are best for maximizing optimal function for return to activity?

# Evidence-Based Clinical Practice Guideline 47

## Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

### Clinical Questions

P	<i>(Population)</i>	In children aged 5 – 18 years who are skeletally immature or mature and have a stable OCD of the patellofemoral and/or tibiofemoral joint
I	<i>(Intervention)</i>	What physical therapy evaluation/intervention strategies (pain and effusion, gait, range of motion, strength and muscle performance, neuromuscular control)
C	<i>(Comparison)</i>	None
O	<i>(Outcome)</i>	Are best for maximizing optimal function for return to activity

### Criteria for considering studies for this review

<b>Types of Studies</b>	All levels of study design in humans or in animal models focused on osteochondritis dissecans
<b>Types of Participants</b>	Participants of all ages with osteochondritis of the knee joint, animal model studies, and histological studies that provide foundational, relevant evidence to bolster decision-making processes
<b>Types of Interventions</b>	Interventions that fall under the scope of practice for a physical therapist
<b>Types of Outcomes</b>	Pain, effusion, gait, range of motion, strength and muscle performance, neuromuscular control, self-report of function, and self-report of quality of life measures
<b>Exclusion Criteria, if any</b>	Post-operative studies

### Search Strategy

#### Search Methods

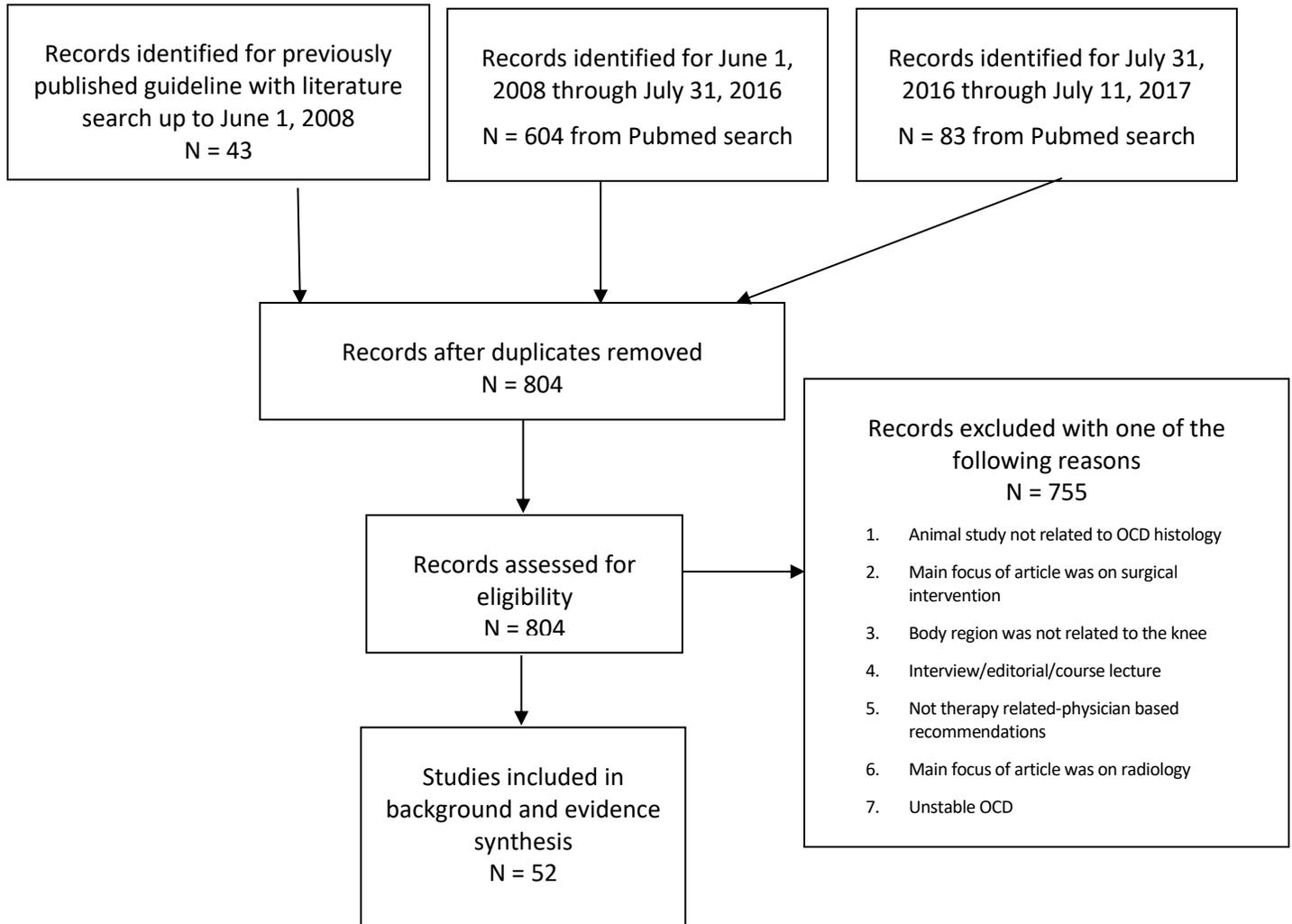
All references from the original guideline we imported into an EndNote Library File representing evidence published prior to June 1, 2008. These articles were supplemented with an additional key word search designed to capture evidence from June 1, 2008 – July 11th, 2017 (search terms by database and dates listed below). The articles identified through this search were also imported into EndNote. Duplicates were removed and articles from the selected pool of citations were evaluated for inclusion by two reviewers. Study selection was focused on published articles that addressed conservative management of osteochondritis dissecans or osteochondritis dissecans and employing a combination of Boolean searching and “natural language” searching on human-indexed thesaurus terms as well as “natural language” searching on words in the title, abstract, and indexing terms. During the guideline development, additional articles were identified from other known references evidence and hand searching of reference lists.

## Evidence-Based Clinical Practice Guideline 47

### Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

Search Databases	Search Terms	Limits, Filters, & Search Date Parameters	Date of Most Recent Search
<b>X</b> Pubmed	• ((osteochondritis) AND (dissicans OR dissecans))	Publication Dates or Search Dates: 6/1/2008 – 07/31/2016 <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: not limited <input type="checkbox"/> Other Limits or Filters: Not limited	7/11/2017
<b>X</b> MedLine via PubMed or Ovid	• “osteochondritis dissicans” OR “osteochondritis dissecans”	Publication Dates or Search Dates: 6/1/2008 – 07/31/2016 <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: not limited <input type="checkbox"/> Other Limits or Filters: Not limited	7/11/2017
<b>X</b> CINAHL	• Osteochondritis dissecans or osteochondritis dissicans	Publication Dates or Search Dates: • 6/1/2008 – 07/31/2016 <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • Not limited <input type="checkbox"/> Other: • Not limited <input checked="" type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • Not limited <input type="checkbox"/> Other: • Not limited	7/11/2017
<b>X</b> SPORT Discus with Full Text	• Other: osteochondritis dissecans or osteochondritis dissicans	Publication Dates or Search Dates: • 1/1/08 – 7/29/14 <input type="checkbox"/> English Language <input type="checkbox"/> Pediatric Evidence Only: • X <input checked="" type="checkbox"/> Other: • Not animal	7/11/2017

## Evidence-Based Clinical Practice Guideline 47 Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee



### APPENDIX 5 FUTURE RESEARCH AGENDA

1. Determine the prevalence and incidence of OCD lesions in children and adolescents
2. Determine the etiology and risk factors associated with OCD lesions in children and adolescents
3. Determine the harmful and beneficial effects of stress and loading on healing bone and articular cartilage tissues
4. Determine the forces and loads borne by bony and articular cartilage tissues imposed during various therapeutic activities/exercises and activities of daily living/recreational activities
5. Determine the effectiveness of current and new rehabilitation approaches to maximize outcomes and minimize risk of secondary injury for children and adolescents with OCD lesions
6. Determine appropriate objective criteria for safe rehabilitation progression and readiness for return to high-level activities for children and adolescents with OCD lesions
7. Determine the long-term outcomes and risk of secondary injuries for children and adolescents with OCD lesions

## APPENDIX 6

### TEAM MEMBERS & CONFLICTS OF INTEREST

#### Multidisciplinary Team Members

##### Team Leader/Author/Chair:

Alyson Filipa, PT, DPT, SCS, CSCS, Division of Occupational Therapy and Physical Therapy, Cincinnati Children's Hospital Medical Center

##### Team Members/Co-Authors:

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Carmen Quatman, MD, PhD Division of Orthopaedic Surgery, The Ohio State University

Catherine Quatman-Yates, PT, DPT, PhD, Divisions of Occupational Therapy and Physical Therapy and Sports Medicine Cincinnati Children's Hospital

##### Patient/Family/Parent or Other Parent Organization:

A patient and family reviewed the guideline and provided feedback. However, consent to release the name of the patient and family was not obtained.

##### Other Development Support

###### Content Reviewers:

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###### Support/Consultants:

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Karen Vonderhaar, MS, RN, Guidelines Program Administrator, James M. Anderson Center for Health Systems Excellence

###### Methodologist:

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# Evidence-Based Clinical Practice Guideline 47 Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

Conflicts of Interest were declared for each team member and:

- No financial or intellectual conflicts of interest were found.
- The following conflicts of interest were disclosed:

The guideline was developed without external funding.

Conflict of interest declaration forms are filed with the Cincinnati Children's EBDM group of the James M. Anderson Center for Health Systems Excellence.

## APPENDIX 7

### LEGEND EVIDENCE EVALUATION SYSTEM *(LET EVIDENCE GUIDE EVERY NEW DECISION)*

Full tables of the [LEGEND evidence evaluation system](#) are available in separate documents:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (*abbreviated table below*)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) ([Appendix 3 – Evidence Discussion and Dimensions for Recommendations](#))

**Table of Evidence Levels** (*see link above for full table*):

Quality level	Definition
1a <sup>+</sup> or 1b <sup>+</sup>	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

**Table of Grade for the Body of Evidence** (*see link above for full table*):

Grade	Definition
High	Sufficient number of high quality studies with consistent results
Moderate	A single well-done trial, Multiple lesser quality trials, or Multiple large, high-quality observational studies
Low	A single well-done study or Multiple studies of lesser quality or with some uncertainty
Very Low	Studies with insufficient quality including case reports, case studies, general reviews, and commentaries.
Grade Not Assignable	There was insufficient evidence.

**Table of Language and Definitions for Recommendation Strength** (see link above for full table):

Language for Strength	Definition
It is strongly recommended that... It is strongly recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is high support that benefits clearly outweigh risks and burdens. (or visa-versa for negative recommendations)
It is recommended that... It is recommended that... not...	When the dimensions for judging the strength of the evidence are applied, there is moderate support that benefits are closely balanced with risks and burdens.
It is suggested that... It is suggested that... not...	When the dimensions for judging the strength of the evidence are applied, there is weak support that benefits are closely balanced with risks and burdens.
There is insufficient evidence to make a recommendation...	

### APPENDIX 8

#### EVIDENCE-BASED CLINICAL CARE RECOMMENDATION DEVELOPMENT PROCESS

The process by which this guideline was developed is documented in the [Guideline Development Process Manual](#); relevant development materials are kept electronically. The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic search and critical appraisal of the literature, using the [Table of Evidence Levels](#) described with the references and in Appendix 4, and examined current local clinical practices. The guideline has been reviewed and approved by clinical experts not involved in the development process. The guideline has also been distributed to leadership and other parties as appropriate.

Recommendations have been formulated based upon best available evidence and when evidence was not available or was limited by a consensus process directed by best evidence, patient and family preference, and clinical expertise. See Appendix 3 for description of consensus process. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

#### Review Process

This guideline has been reviewed against quality criteria by two independent reviewers from the Cincinnati Children's Evidence Collaboration.

The guideline was also externally appraised by two independent reviewers using the [AGREE II instrument](#) (*Appraisal of Guidelines for Research and Evaluation II*) and the results by domain are:

- Scope and Purpose 94%
- Stakeholder Involvement 94%
- Rigor of Development 95%
- Clarity and Presentation 100%
- Applicability 94%
- Editorial Independence 100%

# Evidence-Based Clinical Practice Guideline 47 Management of Non-Operative Courses of Care for Stable Juvenile Osteochondritis Dissecans in the Knee

## Revision Process

The guideline will be removed from the Cincinnati Children's website, if content has not been revised within five years from the most recent publication date. A revision of the guideline may be initiated at any point within the five-year period that evidence indicates a critical change is needed. Team members reconvene to explore the continued validity and need of the guideline.

## Review History

Date	Event	Outcome
12/10/17	Original Publication	Osteochondritis Dissecans of the Knee

## Permission to Use the Guideline

This Evidence-Based Care Guideline (EBCG) and any related implementation tools (*if applicable, e.g., screening tools, algorithms, etc.*) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: <http://www.cincinnatichildrens.org/service/j/anderson-center/evidence-based-care/recommendations/default/>

Examples of approved uses of the EBCG include the following:

- copies may be provided to anyone involved in the organization's (*outside of Cincinnati Children's*) process for developing and implementing evidence-based care guidelines;
- hyperlinks to the Cincinnati Children's website may be placed on the organization's website;
- the EBCG may be adopted or adapted for use within the organization, provided that Cincinnati Children's receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care.

Notification to Cincinnati Children's ([EBDMInfo@cchmc.org](mailto:EBDMInfo@cchmc.org)) is appreciated for all uses of any EBCG or its companion documents which are adopted, adapted, implemented, or hyperlinked.

## Please cite as:

Cincinnati Children's Osteochondritis Dissecans Community of Practice Group, Filipa, A.; McHugh, R.; Paterno, M.; Cherny, C.; Quatman-Yates, C. (2017). Cincinnati Children's Hospital Medical Center: Evidence-based clinical care guideline for Physical Therapy Non-Operative Care Management for Stable Juvenile Osteochondritis Dissecans in the Knee. <http://www.cincinnatichildrens.org/service/j/anderson-center/evidence-based-care/recommendations/default/>, Guideline 47, pages 1-37.

## For more information:

About this guideline, its companion documents, or the Cincinnati Children's Evidence-Based Care Recommendation Development process, contact the CINCINNATI CHILDREN'S Evidence Collaboration at [EBDMInfo@cchmc.org](mailto:EBDMInfo@cchmc.org).

## Note/Disclaimer

These recommendations result from review of literature and practices current at the time of their formulations. This guideline does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this guideline is voluntary. The clinician considering the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.