



Articular cartilage lesions of the knee: Considerations for management

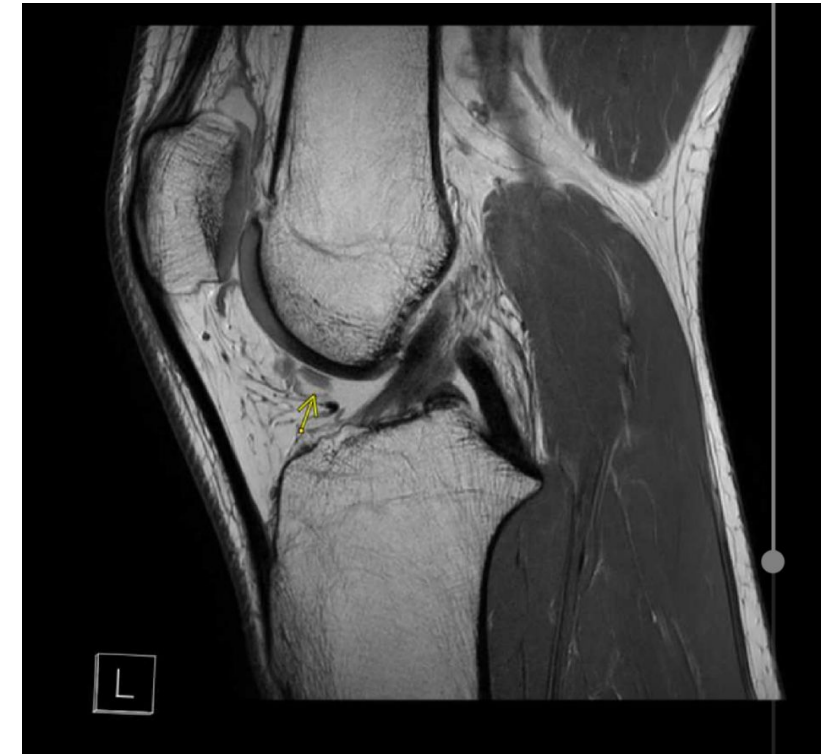
Alex Downie - Post Graduate Masters Sports Physiotherapy Student



Case Study - With Consent

- 30yo right footed goalkeeper
- 2 months I/M lateral joint awareness
- Sunday felt knee “lock out” after a kick
- Played again Wednesday. Woke with pain on weightbearing and a large effusion

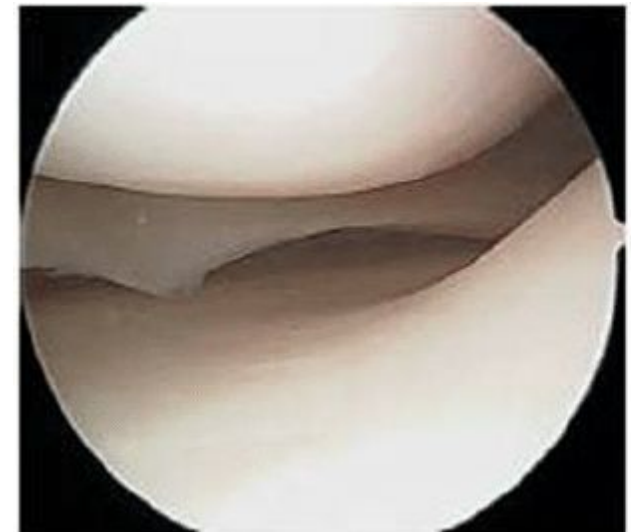
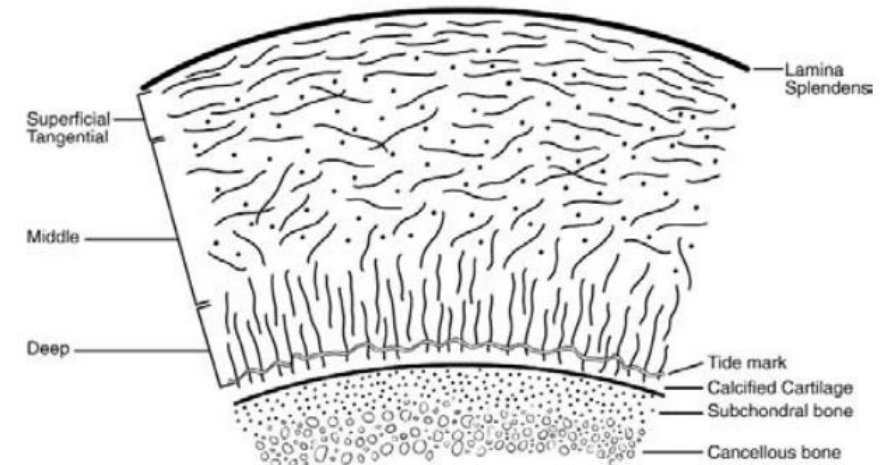




No lateral meniscus tear. An area of full thickness chondral loss with adjacent basal delamination is present at the posterior weight bearing part of the lateral femoral condyle, this extends into the non-weight bearing part of the lateral femoral condyle. Collectively, the area measures 17 x 8mm/AP x TV. A chondral flap has opened posteriorly and medially which leads to an area of basal delamination which measures up to 9mm. The articular cartilage on the lateral tibial plateau side of the joint is better maintained.

Articular Cartilage Structure and Function

- Extremely low coefficient of friction
- Protects subchondral bone
- Lacks neural innervation
- Lacks blood supply
- Poor intrinsic healing ability
- (Alford & Cole, 2005)



Grading of lesion

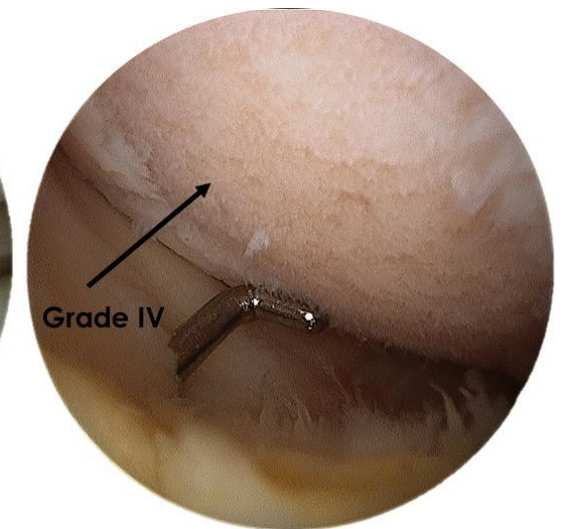
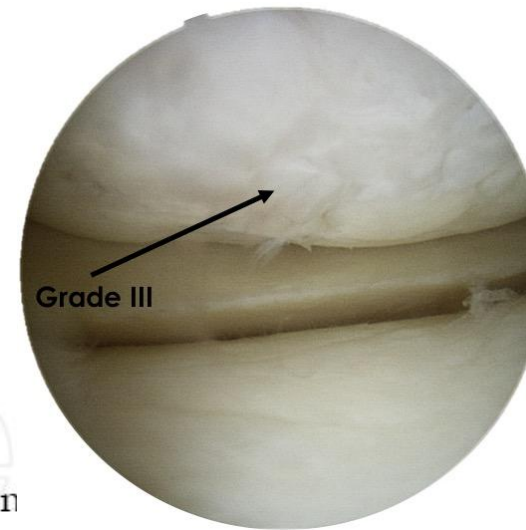
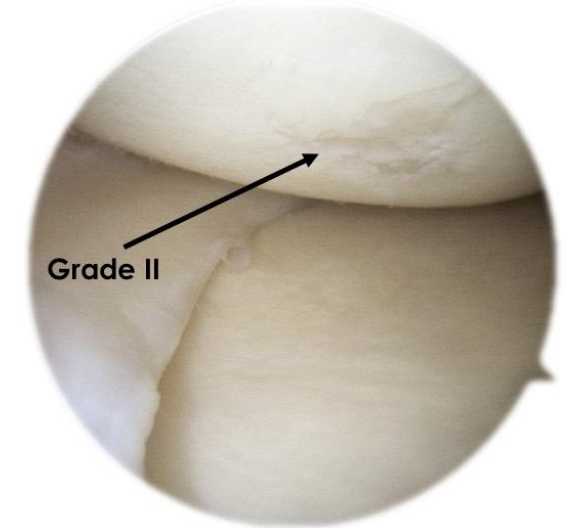
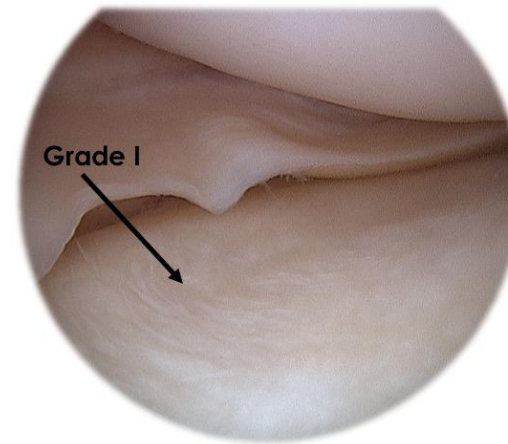
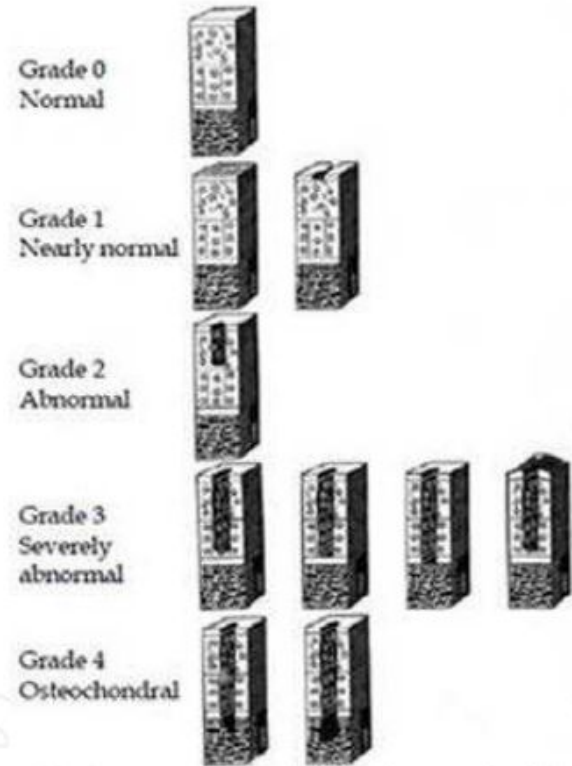
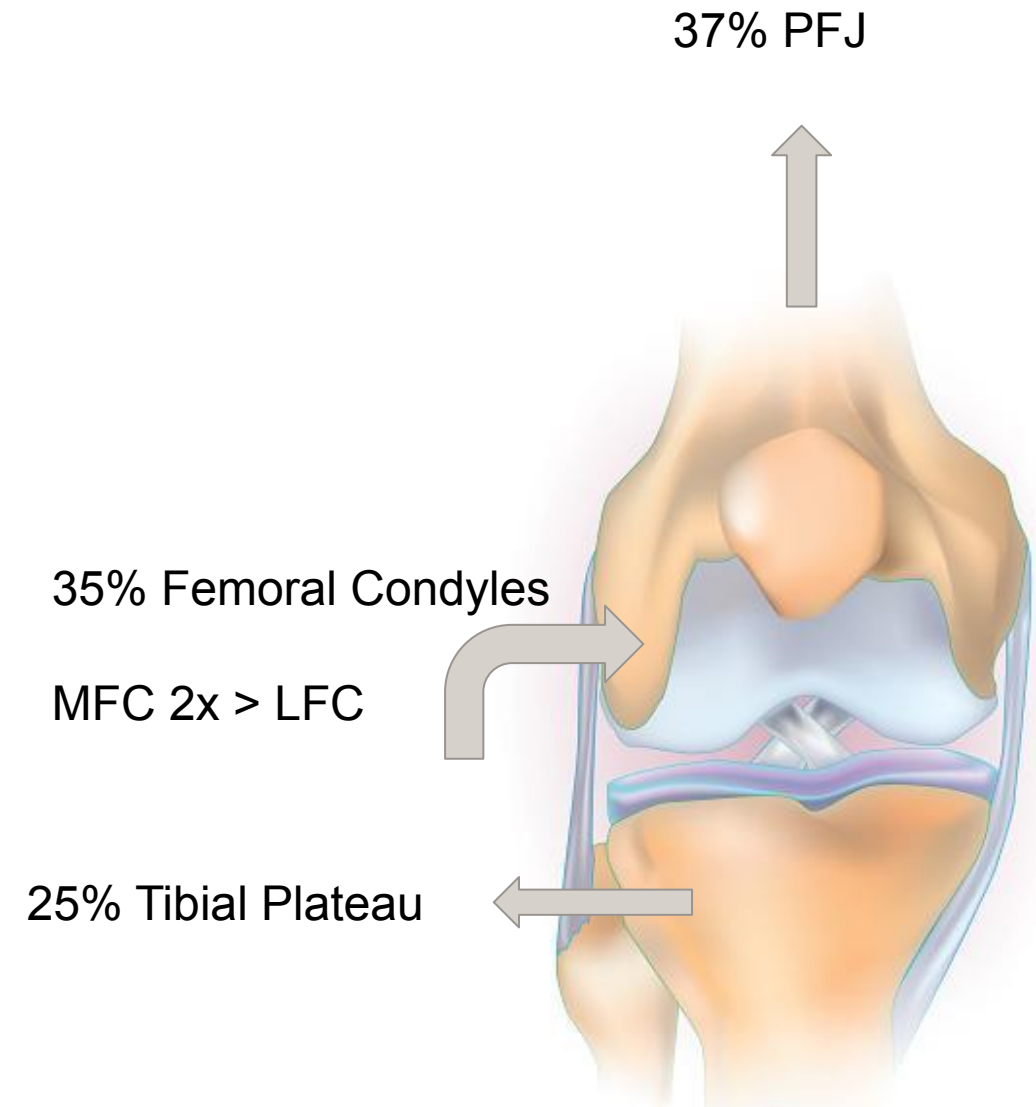


Fig. 7. International Cartilage Repair Society (ICRS) cartilage injury classification (reproduced from the ICRS Cartilage Injury Evaluation Package [www.cartilage.org], with permission from the ICRS).

<http://www.wahlmd.com/dr-wahl-blog/cartilage-grading-outerbridge-scale>

Epidemiology

- Systematic review 931 athletes. 36% with full thickness focal chondral defects.
14% asymptomatic
- “Natural history not well established....
Optimal approach to asymptomatic athlete is unknown” (Flanigan et al., 2010)

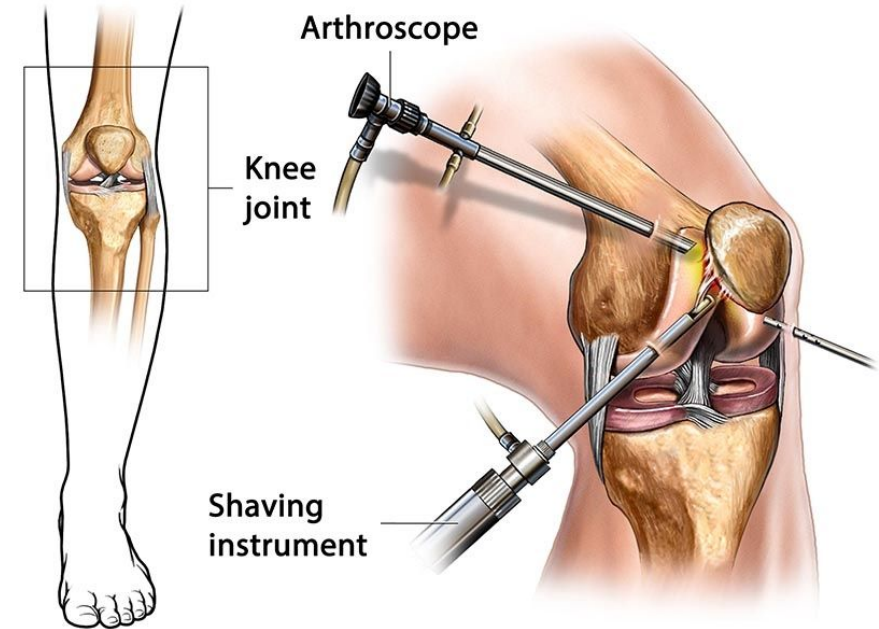


The long-term prognosis for severe damage to weight-bearing cartilage in the knee

A 14-year clinical and radiographic follow-up in 28 young athletes

Karola Messner and Wolfgang Maletius

- 28 Athletes
- All had arthroscopy
- Remainder - shaving and removal of loose bodies
- At follow up 22 patients excellent or good knee function



Conservative Management

Indications for conservative management (Cain & Clancy, 2001)

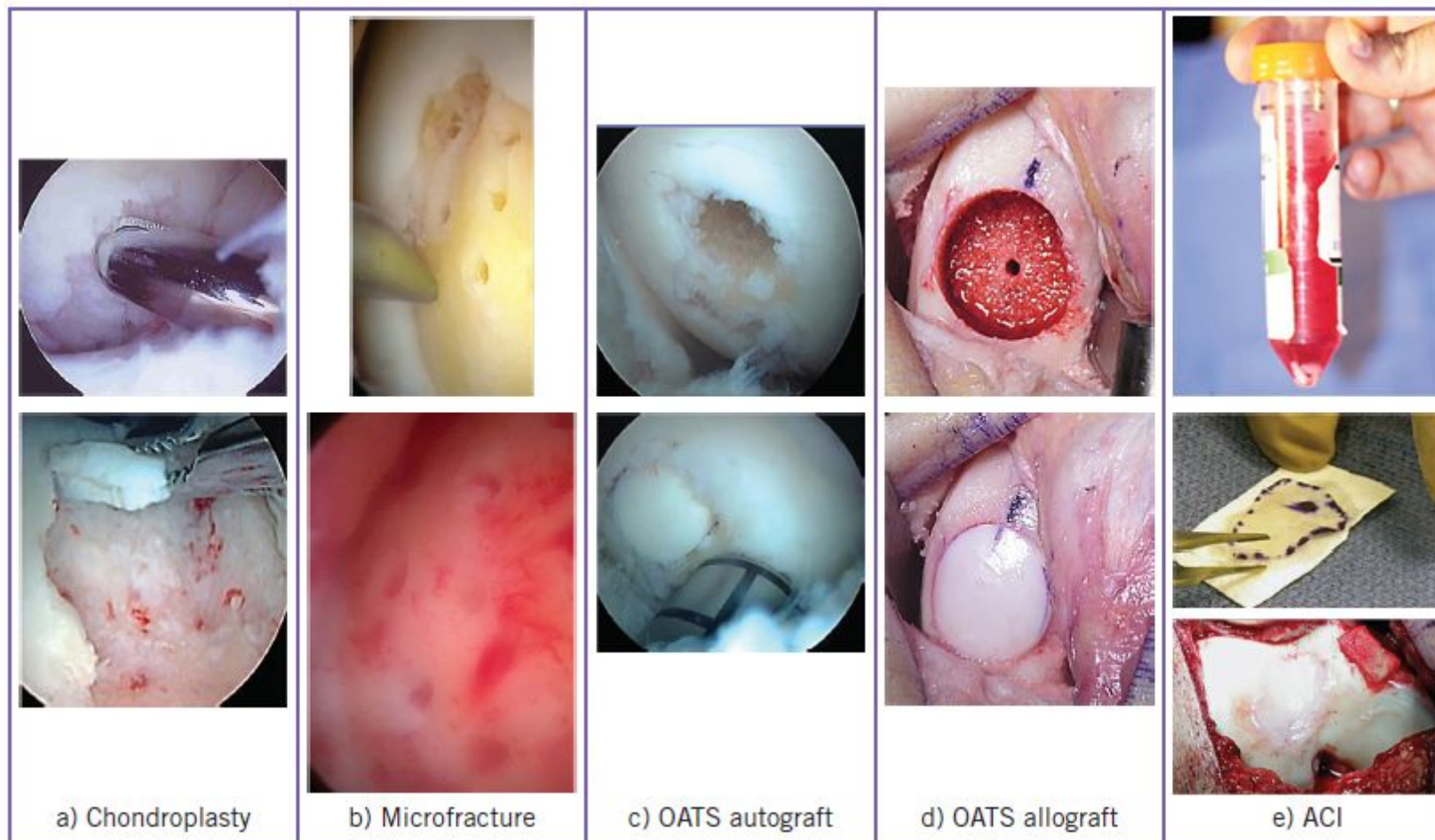
- Pure chondral lesions
- No exposed subchondral bone
- Not in a weight bearing location

Mildly symptomatic cases (Falah et al., 2010)

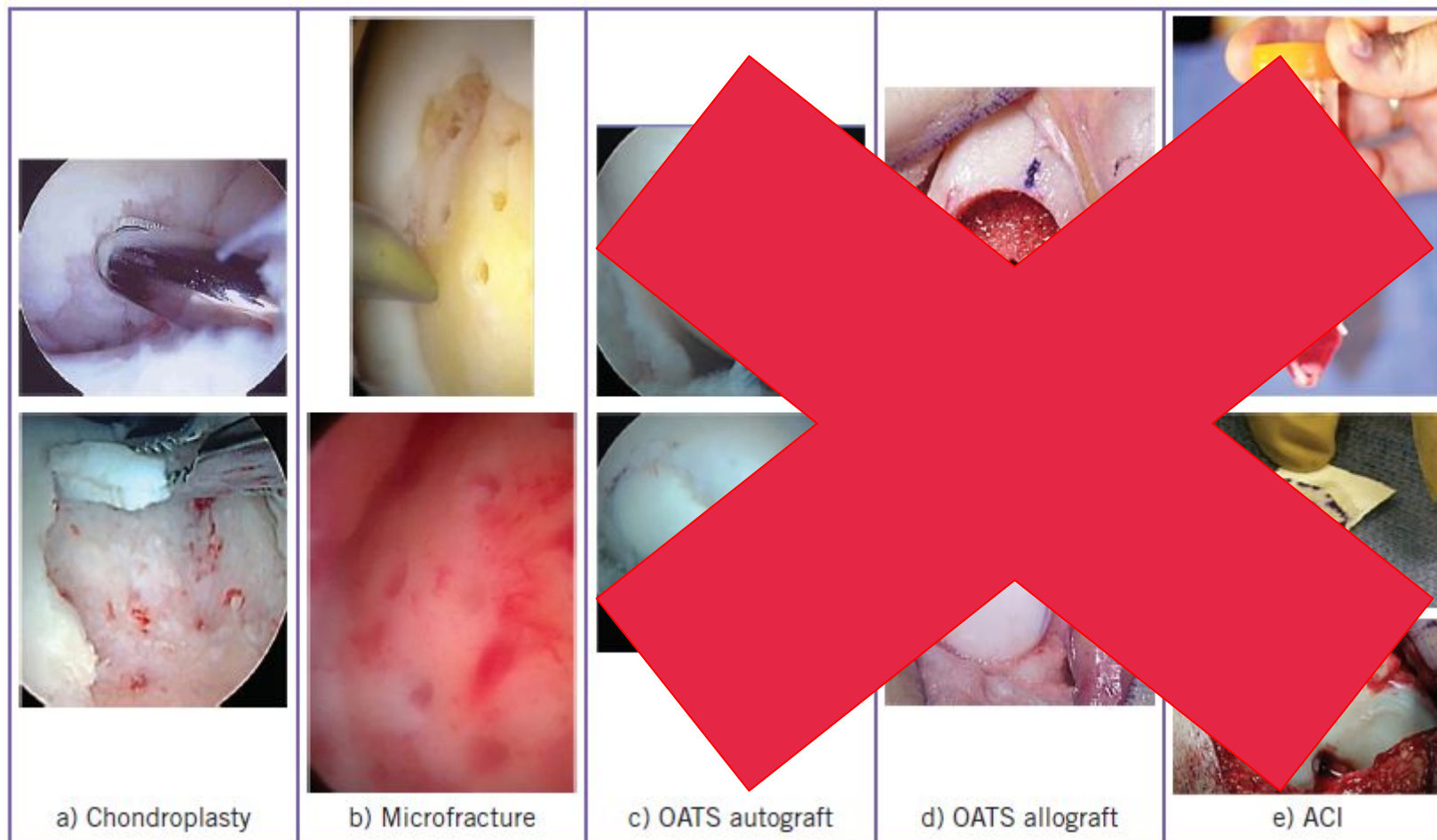
Surgery for mechanical symptoms (Howell et al., 2021)

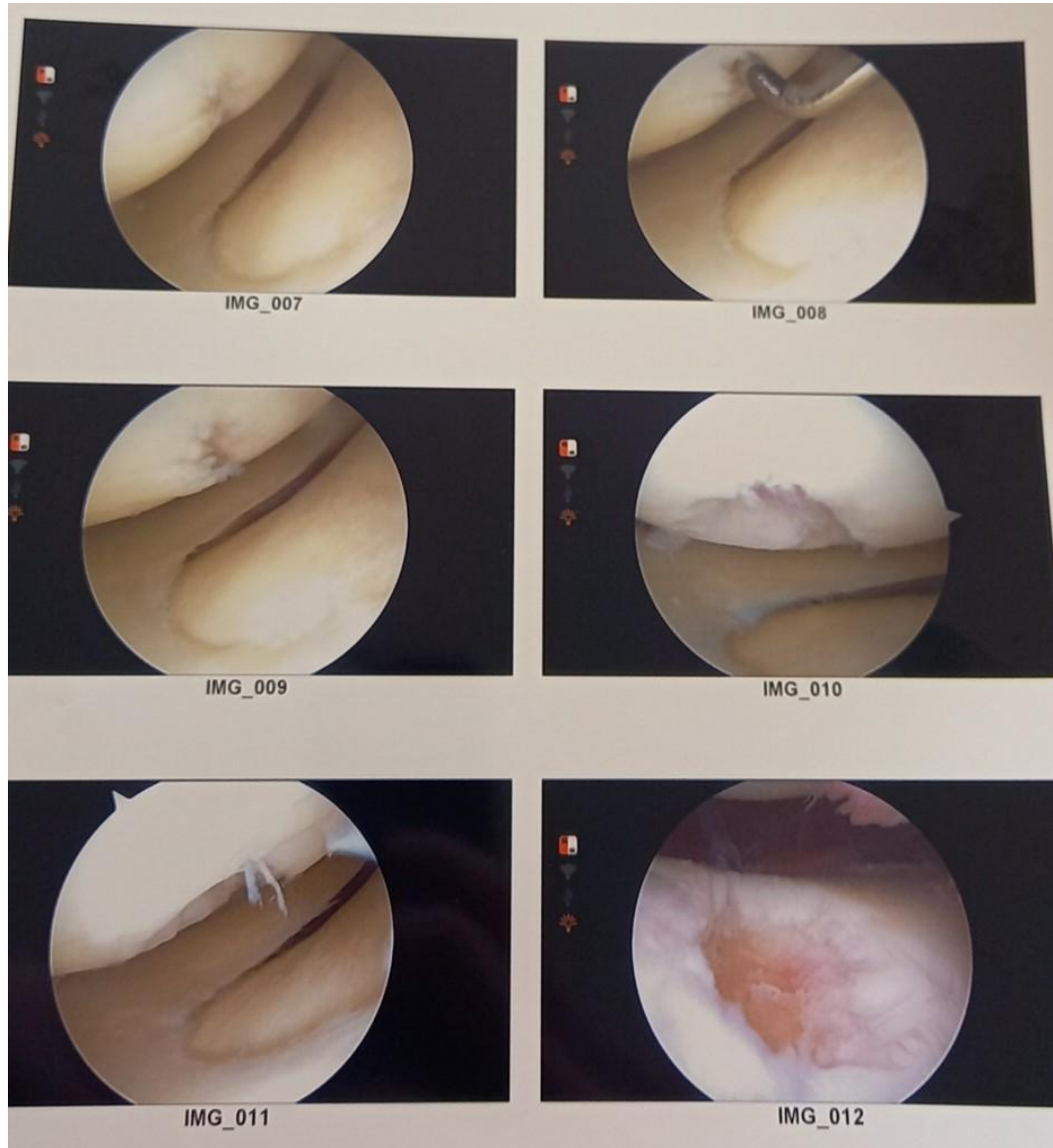
“Conservative management has a limited role in many patients with symptomatic osteochondral injuries” (Alleyne & Galloway, 2001)

Surgical Options



Surgical Options





Prognosis

Positive	Negative
Younger age (Campbell et al., 2016) <25yo in athletes	High BMI (Mithoefer 2015)
Shorter pre-op duration of symptoms (<12 months) (Campbell et al., 2016)	Poor fill rates on MRI (Mithoefer 2015)
Smaller defects (Campbell et al., 2016) Generally <2cm ²	Previous surgical interventions (Campbell et al., 2016)
Good rehabilitation participation (Campbell et al., 2016)	Higher activity level*
Better repair tissue quality (Mithoefer et al., 2009)	

CARTILAGE INJURIES IN SPORTS

THE DILEMMA IS IN THE DETAIL

– Written by Emmanuel Papakostas and Pieter D’Hooghe, Qatar

FACTORS AFFECTING TREATMENT METHOD

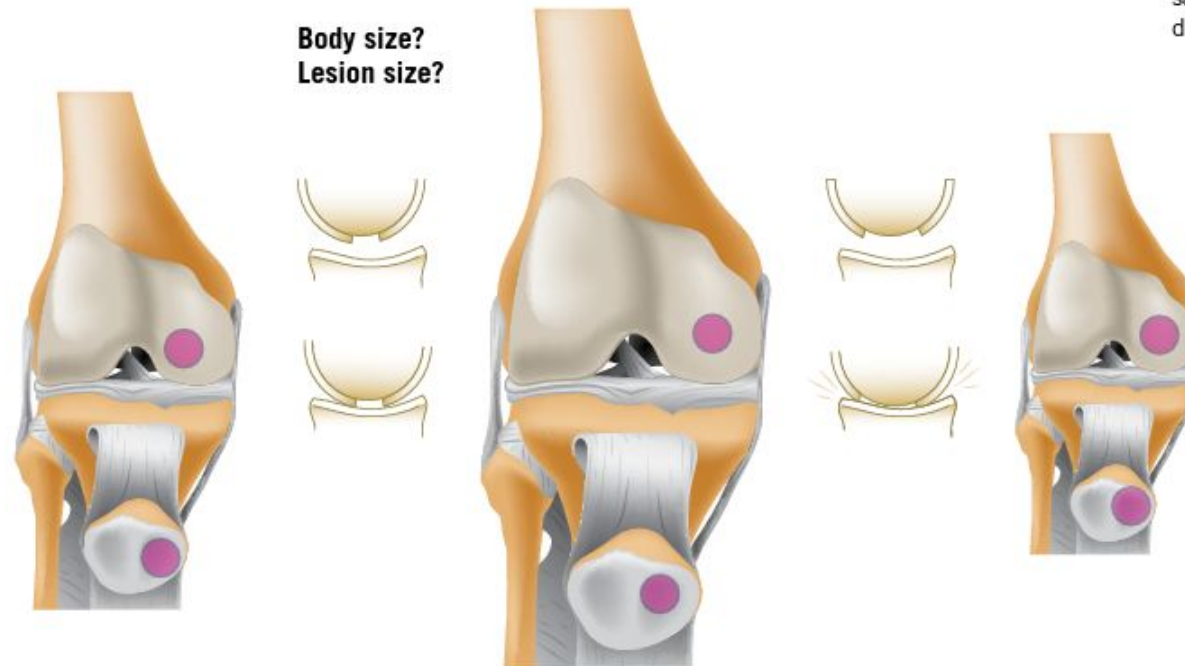
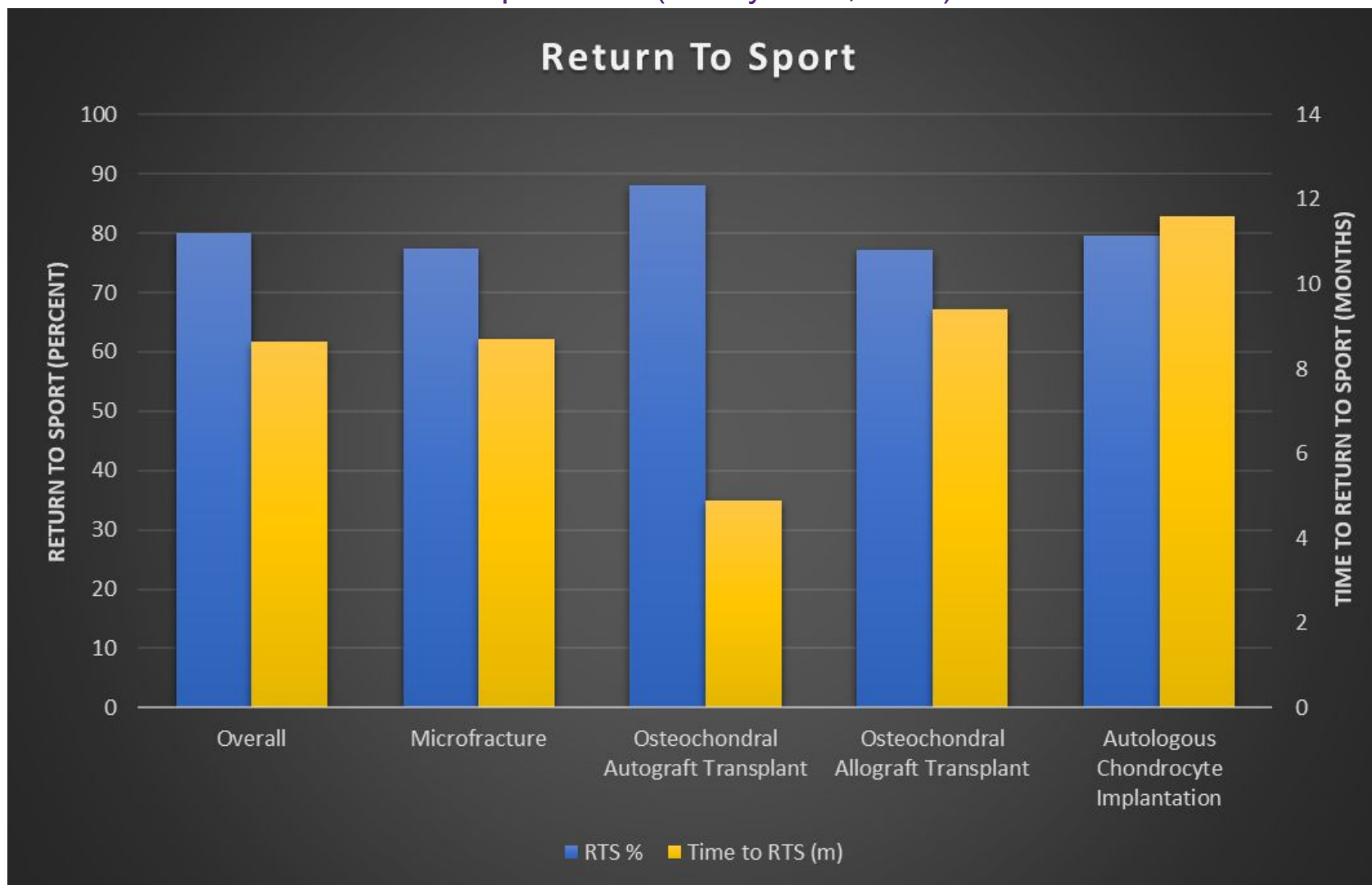


Figure 2: Size matters – same lesion dimensions in different sized knee joints.

Comparison RTS

adapted from (Hurley et al., 2021)



Survival Rates



- Longer term failure rate greater in MFX vs Transplant (66% v 51%)
- Mean time to failure MFX 4 years vs Transplant 8.4 years (Solheim et al., 2020)
- Beyond 5 years postoperatively, treatment failure after microfracture could be expected regardless of lesion size. (Goyal et al., 2013)

Weight Bearing Restrictions

“There is a wide variety in the rehabilitation protocols” (Hurley et al., 2021)

KAI MITHOEFER, MD¹ • KAREN HAMBLY, PT, PhD, MCSP² • DAVID LOGERSTEDT, PT, PhD, MPT, SCS³
MARGHERITA RICCI, MD⁴ • HOLLY SILVERS, MPT⁵ • STEFANO DELLA VILLA, MD⁴

Current Concepts for Rehabilitation and
Return to Sport After Knee Articular
Cartilage Repair in the Athlete

Are Weightbearing Restrictions Required
After Microfracture for Isolated Chondral
Lesions of the Knee? A Review of the
Basic Science and Clinical Literature

Deeptee Jain, MD,[†] Elshaday S. Belay, MD,^{*‡} John A. Anderson, MD,[§]
William E. Garrett, MD, PhD,[‡] and Brian C. Lau, MD[‡]

Restrictions

KAI MITHOEFER, MD¹ • KAREN HAMBLY, PT, PhD, MCSP² • DAVID LOGERSTEDT, PT, PhD, MPT, SCS³
MARGHERITA RICCI, MD⁴ • HOLLY SILVERS, MPT⁵ • STEFANO DELLA VILLA, MD⁴

Current Concepts for Rehabilitation and Return to Sport After Knee Articular Cartilage Repair in the Athlete

TABLE 4

WEIGHT-BEARING GUIDELINES AND CRITERIA FOR PROGRESSION AFTER ARTICULAR CARTILAGE REPAIR

Phase 1. Weight-Bearing Guidelines

- Femoral defects
 - Restorative techniques (OATS/allograft): touch-down loading for 2 wk, then progress to full weight bearing by 4 to 6 wk
 - Reparative techniques (microfracture/ACI): touch-down loading for 2 wk, then progress by 25% body weight per wk
- Patellar/trochlear defects
 - Immediate weight bearing with brace locked in 0° to 10° of knee flexion

Early Rehabilitation - Weeks 0-6

- Protection of repair
- Swelling control
- Regain extension
- Unloaded Knee ROM (Bike from week 2)
- Adequate patella mobility
- NWBing quads
- E-stim and BFR (options)

Blood Flow Restriction (Jakobsen et al., 2022)

- 9 weeks of BFR
- 5 x per week
- Weeks 4 to 13 post op
- 4 sets
- Reps - 30, 15, 15, 15-30
- Tempo 2-1-2
- Rom max 90 degrees
- 30 rep max, failure on 4th set
- 80% Limb occlusion pressure
- ~10 minute duration
- Add external load from week 6

ORIGINAL PAPER

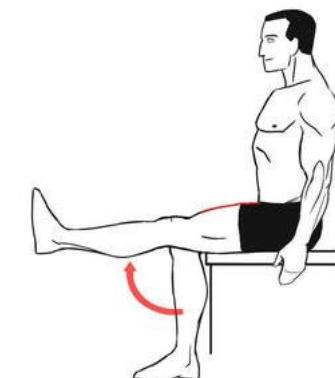
Open Access

Blood flow restriction added to usual care exercise in patients with early weight bearing restrictions after cartilage or meniscus repair in the knee joint: a feasibility study

Thomas Linding Jakobsen^{1*}, Kristian Thorborg^{2,3}, Jakob Fisker¹, Thomas Kallemose⁴ and Thomas Bandholm^{2,3,4,5}

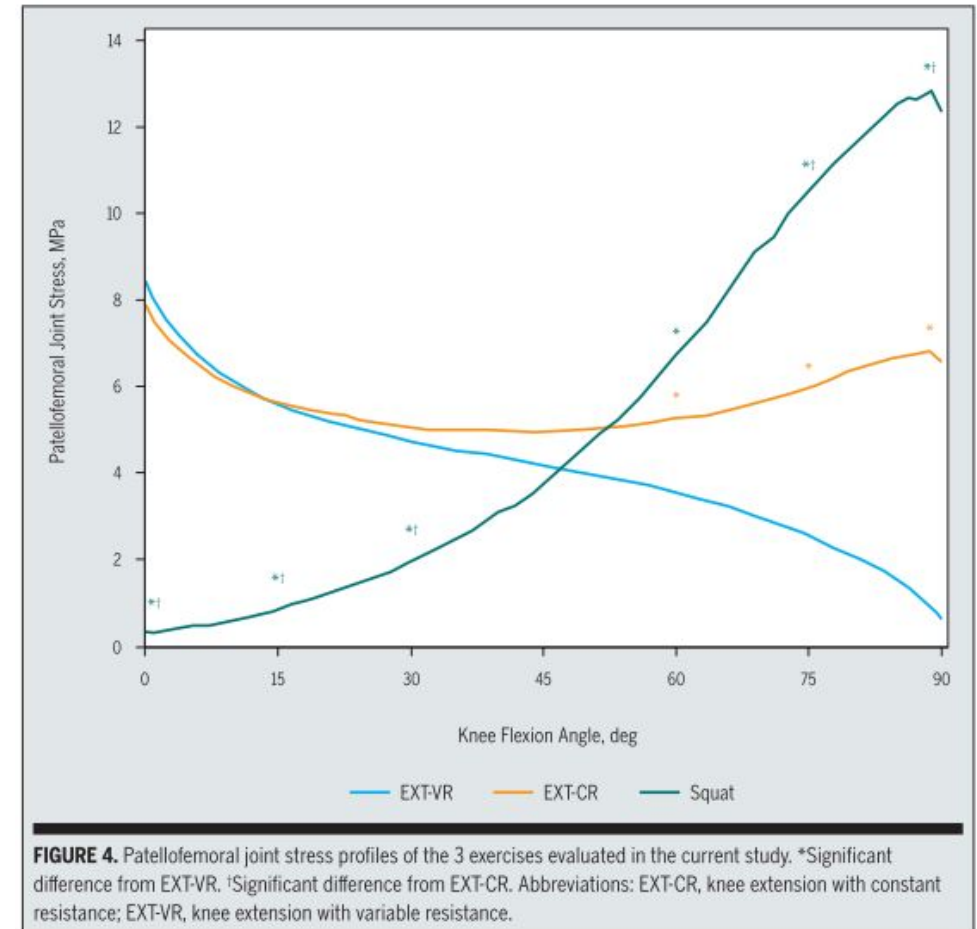


If you are using an elastic band, put the entire band around your thigh. It is placed in the same place as the cuff without space between the folds. You should experience the same pressure in your thigh as when using the cuff.



Weeks 6-12 - Introduction to Progressive Strengthening

- Restore normal gait off crutches
- Weight bearing exercise (squatting, step up, leg press) initially 0-30° reduce PFJ and TFJ forces (Wilk et al., 2010)
- Bike fitness 8-10 week mark (Patel et al., 2021)
- OKC quads 90-40° due to PFJ forces (Powers et al., 2014)



Months 3-6 - Heavier Strengthening

- Defect filled at 12 weeks. Remodeling up to 1yr (Jain et al., 2021)
- Heavier single leg strengthening
- Aiming to restore all lower limb muscle deficits
- Hold off on jogging as long as able, and if no need then don't perform in this phase
- Higher intensity running not warranted until 6-8 months (Patel et al., 2021)
- Static sports specific exercises such as basketball free throws



Months 6-9 - Graded return to Running

- Minimum 80% Quad symmetry prior to RTR
- Surgeon may want to image healing prior to high intensity running and commencing plyometrics
- Graded reintroduction to sports specific activities



Return to Sport - 9 months+



Take Home



- Articular cartilage is vitally important
- Lots of individual variances depending on size, location, procedure, age, goals, sport etc
- Respect tissue healing
- Realistic expectations for RTS time and previous level of sport
- Good rehabilitation improves chances of success

References

- Alford, J. W., & Cole, B. J. (2005). Cartilage restoration, part 1: basic science, historical perspective, patient evaluation, and treatment options. *Am J Sports Med*, 33(2), 295-306. <https://doi.org/10.1177/0363546504273510>
- Alleyne, K. R., & Galloway, M. T. (2001). Management of osteochondral injuries of the knee. *Clin Sports Med*, 20(2), 343-364. [https://doi.org/10.1016/s0278-5919\(05\)70310-0](https://doi.org/10.1016/s0278-5919(05)70310-0)
- Cain, E. L., & Clancy, W. G. (2001). TREATMENT ALGORITHM FOR OSTEOCHONDRAL INJURIES OF THE KNEE. *Clinics in Sports Medicine*, 20(2), 321-342. [https://doi.org/https://doi.org/10.1016/S0278-5919\(05\)70309-4](https://doi.org/https://doi.org/10.1016/S0278-5919(05)70309-4)
- Campbell, A. B., Pineda, M., Harris, J. D., & Flanigan, D. C. (2016). Return to Sport After Articular Cartilage Repair in Athletes' Knees: A Systematic Review. *Arthroscopy*, 32(4), 651-668 e651. <https://doi.org/10.1016/j.arthro.2015.08.028>
- Falah, M., Nierenberg, G., Soudry, M., Hayden, M., & Volpin, G. (2010). Treatment of articular cartilage lesions of the knee. *International Orthopaedics*, 34(5), 621-630. <https://doi.org/10.1007/s00264-010-0959-y>
- Flanigan, D. C., Harris, J. D., Trinh, T. Q., Siston, R. A., & Brophy, R. H. (2010). Prevalence of chondral defects in athletes' knees: a systematic review. *Med Sci Sports Exerc*, 42(10), 1795-1801. <https://doi.org/10.1249/MSS.0b013e3181d9eea0>
- Gillogly SD., & Burnett A. (2016). Return To Play After Articular Cartilage Repair of The Knee. *Aspetar Sports Medicine Journal*. <https://www.aspetar.com/journal/viewarticle.aspx?id=308#.Y1tlk3ZBy3B>
- Goyal, D., Keyhani, S., Lee, E. H., & Hui, J. H. (2013). Evidence-based status of microfracture technique: a systematic review of level I and II studies. *Arthroscopy*, 29(9), 1579-1588. <https://doi.org/10.1016/j.arthro.2013.05.027>
- Howell, M., Liao, Q., & Gee, C. W. (2021). Surgical Management of Osteochondral Defects of the Knee: An Educational Review. *Curr Rev Musculoskelet Med*, 14(1), 60-66. <https://doi.org/10.1007/s12178-020-09685-1>
- Hurley, E. T., Davey, M. S., Jamal, M. S., Manjunath, A. K., Alaia, M. J., & Strauss, E. J. (2021). Return-to-Play and Rehabilitation Protocols following Cartilage Restoration Procedures of the Knee: A Systematic Review. *Cartilage*, 13(1_suppl), 907S-914S. <https://doi.org/10.1177/1947603519894733>
- Jain, D., Belay, E. S., Anderson, J. A., Garrett, W. E., & Lau, B. C. (2021). Are Weightbearing Restrictions Required After Microfracture for Isolated Chondral Lesions of the Knee? A Review of the Basic Science and Clinical Literature. *Sports Health*, 13(2), 111-115. <https://doi.org/10.1177/1941738120938662>

References

- Jakobsen, T. L., Thorborg, K., Fisker, J., Kallemoose, T., & Bandholm, T. (2022). Blood flow restriction added to usual care exercise in patients with early weight bearing restrictions after cartilage or meniscus repair in the knee joint: a feasibility study. *J Exp Orthop*, 9(1), 101. <https://doi.org/10.1186/s40634-022-00533-4>
- Marom, N., Warner, T., & Williams, R. J., 3rd. (2021). Differences in the Demographics and Preferred Management of Knee Cartilage Injuries in Soccer Players Across FIFA Centers of Excellence. *Cartilage*, 13(1_suppl), 873S-885S. <https://doi.org/10.1177/19476035211018857>
- Messner, K., & Maletius, W. (2009). The long-term prognosis for severe damage to weight-bearing cartilage in the knee: A 14-year clinical and radiographic follow-up in 28 young athletes. *Acta Orthopaedica Scandinavica*, 67(2), 165-168. <https://doi.org/10.3109/17453679608994664>
- Mithoefer, K., Hambly, K., Della Villa, S., Silvers, H., & Mandelbaum, B. R. (2009). Return to sports participation after articular cartilage repair in the knee: scientific evidence. *Am J Sports Med*, 37 Suppl 1, 167S-176S. <https://doi.org/10.1177/0363546509351650>
- Mithoefer, K., Hambly, K., Logerstedt, D., Ricci, M., Silvers, H., & Della Villa, S. (2012). Current concepts for rehabilitation and return to sport after knee articular cartilage repair in the athlete. *J Orthop Sports Phys Ther*, 42(3), 254-273. <https://doi.org/10.2519/jospt.2012.3665>
- Mithoefer, K., Peterson, L., Zenobi-Wong, M., & Mandelbaum, B. R. (2015). Cartilage issues in football-today's problems and tomorrow's solutions. *Br J Sports Med*, 49(9), 590-596. <https://doi.org/10.1136/bjsports-2015-094772>
- Papakostus, E., & D'Hooge, P. (2021). Cartilage Injuries in Sports. The Dilemma is in The Details. *Aspetar Sports Medicine Journal*. <https://www.aspetar.com/journal/viewarticle.aspx?id=532#.Y1toPHZBy3A>

References

- Patel, S., Amirhekmat, A., Le, R., Williams Iii, R. J., & Wang, D. (2021). Osteochondral Allograft Transplantation in Professional Athletes: Rehabilitation and Return to Play. *Int J Sports Phys Ther*, 16(3), 941-958. <https://doi.org/10.26603/001c.22085>
- Powers, C. M., Ho, K. Y., Chen, Y. J., Souza, R. B., & Farrokhi, S. (2014). Patellofemoral joint stress during weight-bearing and non-weight-bearing quadriceps exercises. *J Orthop Sports Phys Ther*, 44(5), 320-327. <https://doi.org/10.2519/jospt.2014.4936>
- Solheim, E., Hegna, J., & Inderhaug, E. (2020). Long-Term Survival after Microfracture and Mosaicplasty for Knee Articular Cartilage Repair: A Comparative Study Between Two Treatments Cohorts. *Cartilage*, 11(1), 71-76. <https://doi.org/10.1177/1947603518783482>
- Wilk, K. E., Macrina, L. C., & Reinold, M. M. (2010). Rehabilitation following Microfracture of the Knee. *Cartilage*, 1(2), 96-107. <https://doi.org/10.1177/1947603510366029>



THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

CREATE CHANGE

Thank you - Questions?

Alexander Downie | Post Graduate
Physiotherapy Sports Masters Student
alexander.downie@uq.net.au



@AlexanderDowni1

CRICOS code 00025B