

Conservative Management of the Patient with Osteoarthritis

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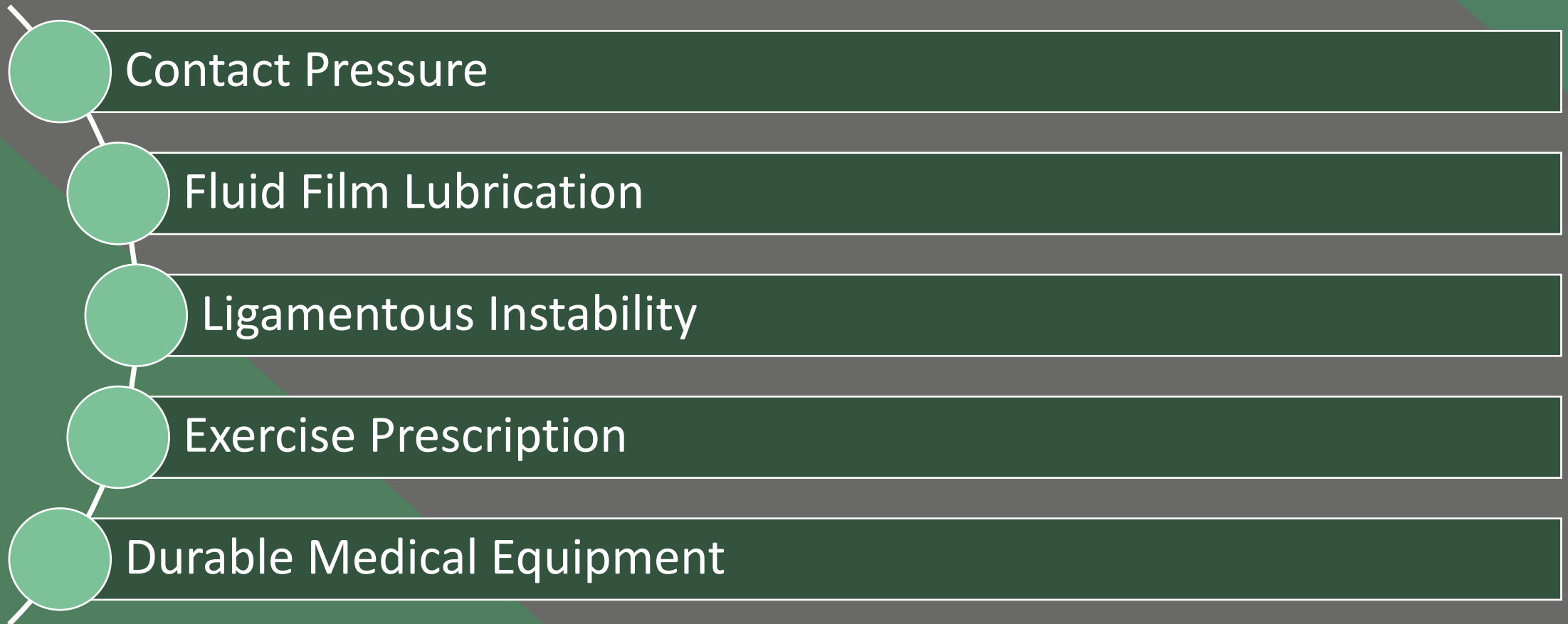
Acknowledgements

- Thank you to my committee: Dr. Gross, CDR Hall, and Dr. Chelminski
- Classmates and colleagues
- Provider survey responses

Objectives

- Describe factors influencing symptom severity of osteoarthritis (OA)
- Identify which factors are modifiable and non-modifiable
- Outline treatment principles guiding the conservative management of OA
- Demonstrate ability to teach patients about OA and how to effectively self-manage

General Principles



Contact Pressure

- Ground reaction forces (GRF)
- How strength plays a role
- Joint malalignment

$$CP = \frac{CF}{CA}$$

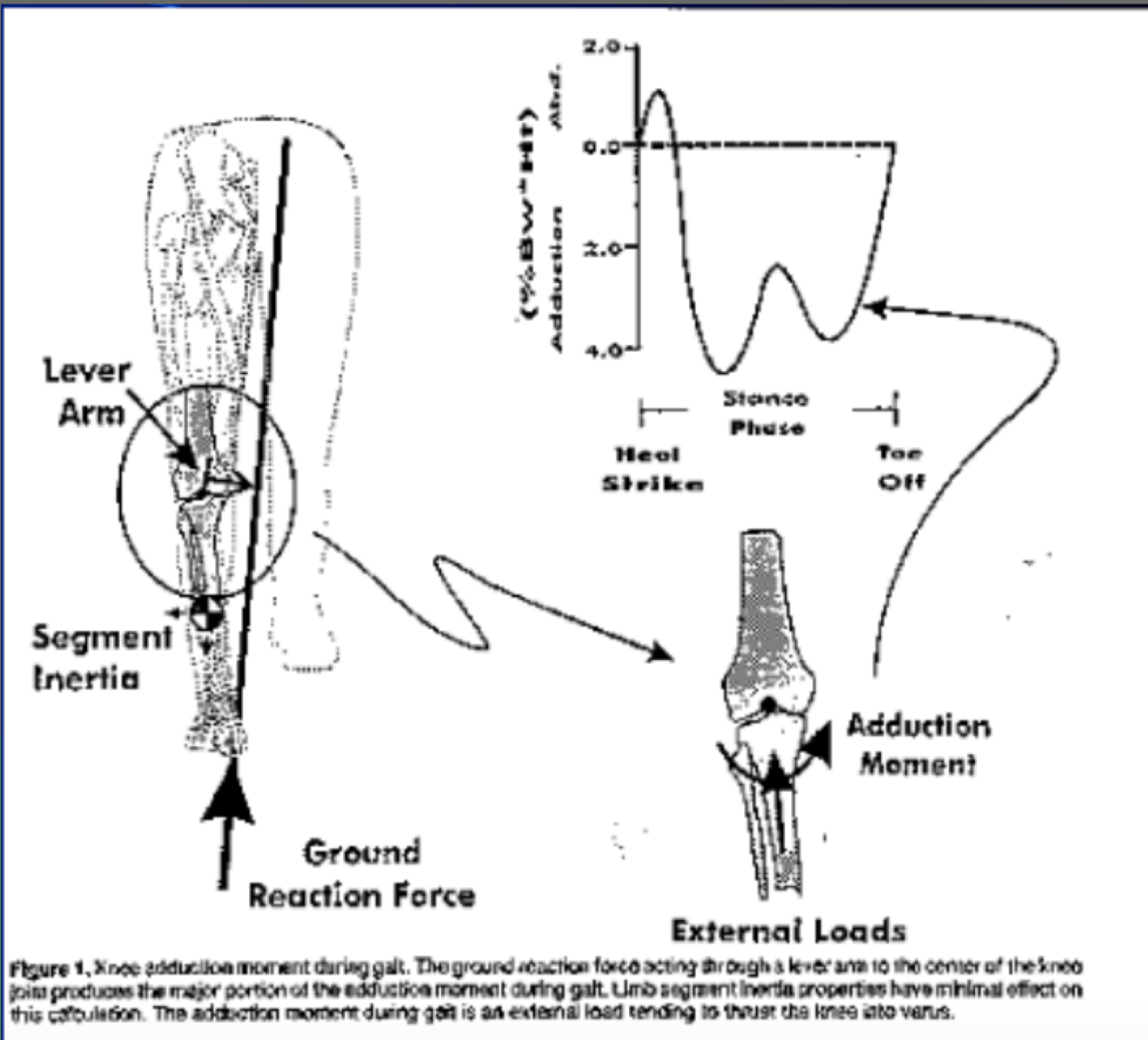


Figure 1. Knee adduction moment during gait. The ground reaction force acting through a lever arm to the center of the knee joint produces the major portion of the adduction moment during gait. Limb segment inertia properties have minimal effect on this calculation. The adduction moment during gait is an external load tending to thrust the knee into varus.

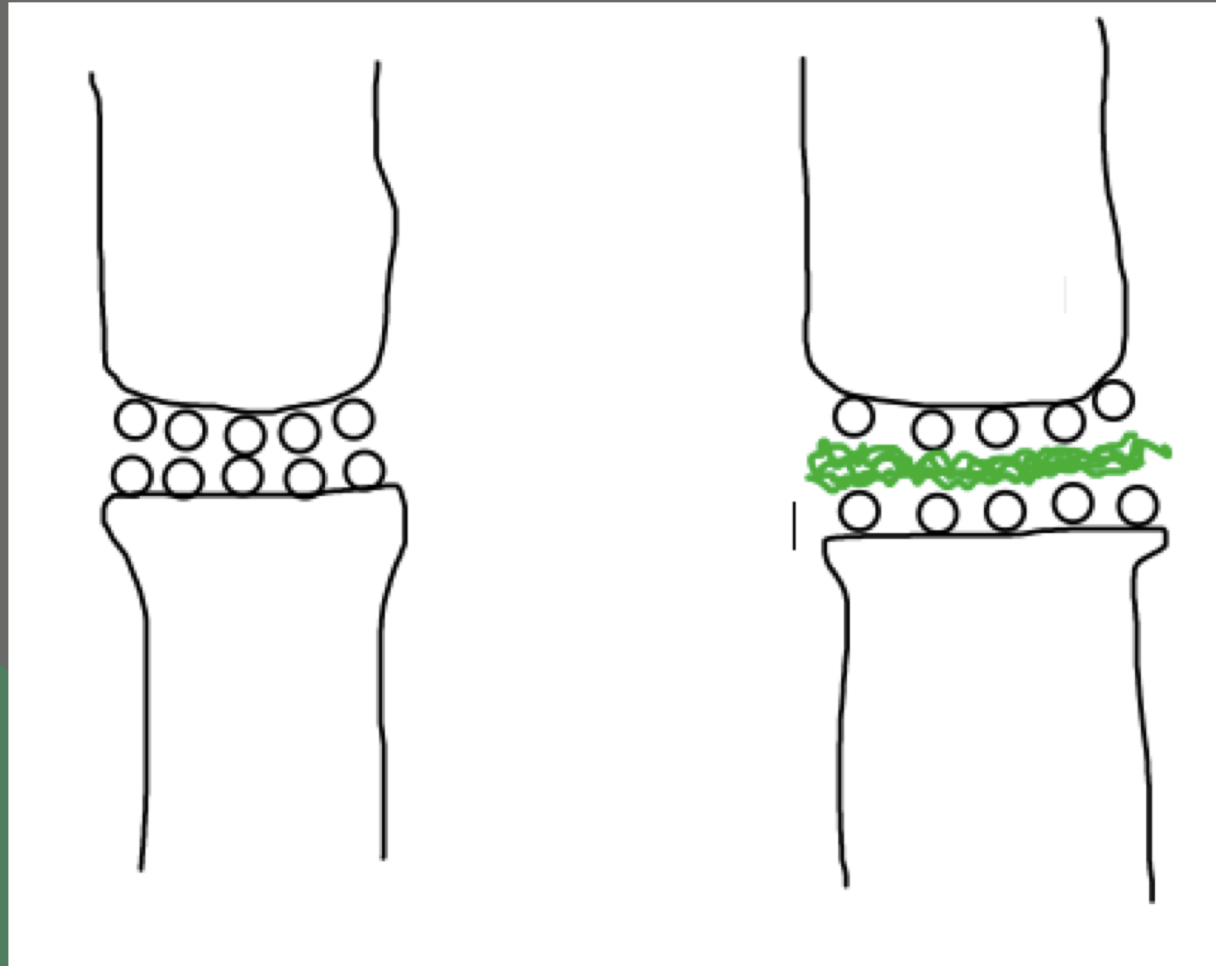
Borrowed from Gross M. Articular Cartilage. 2019.

Fluid Film Lubrication

Boundary Layer Lubrication

High load
Low velocity

Lubricin



Fluid Film Lubrication

Low load
High velocity

Synovial fluid

Ligamentous Instability

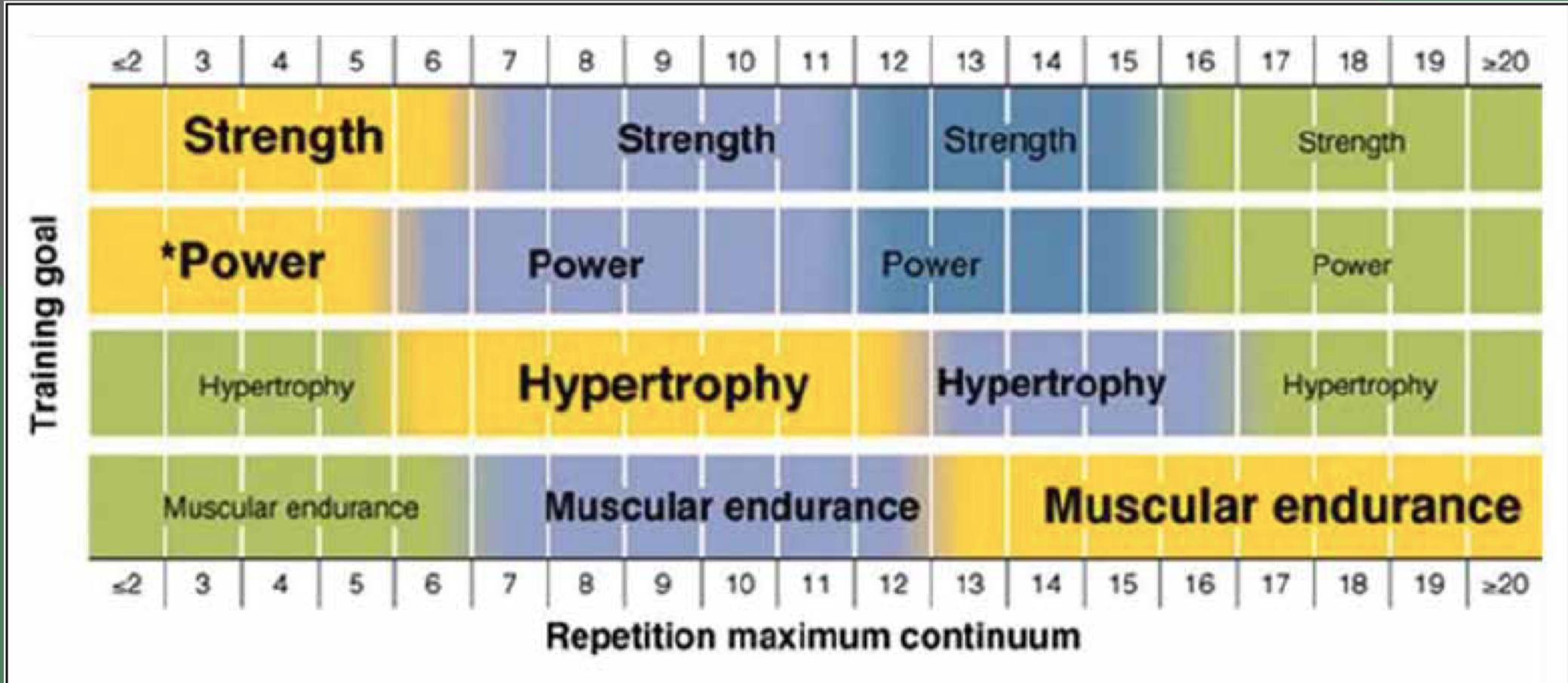
- Decreased lubricin levels post-ligamentous injury (Elsaid, 2008)
- Increased shear and abrasive wear to articular cartilage
- High rates of degeneration occur even following surgery (Patterson, 2018)
- Meniscectomy with ACL reconstruction is risk factor (Lee et al, 2018; Neuman, 2008)

Basic Exercise Principles

Closed-chain vs.
Open-chain

Repetitions/sets
based on training
goals (Sands, Wurth, Hewit,
2012)

Regularity of
exercise (Fransen et al,
2015; Skelly et al, 2018)



Borrowed from Sands, Wurth, Hewit, 2012

Durable Medical Equipment (AAOS)

Walkers



Canes

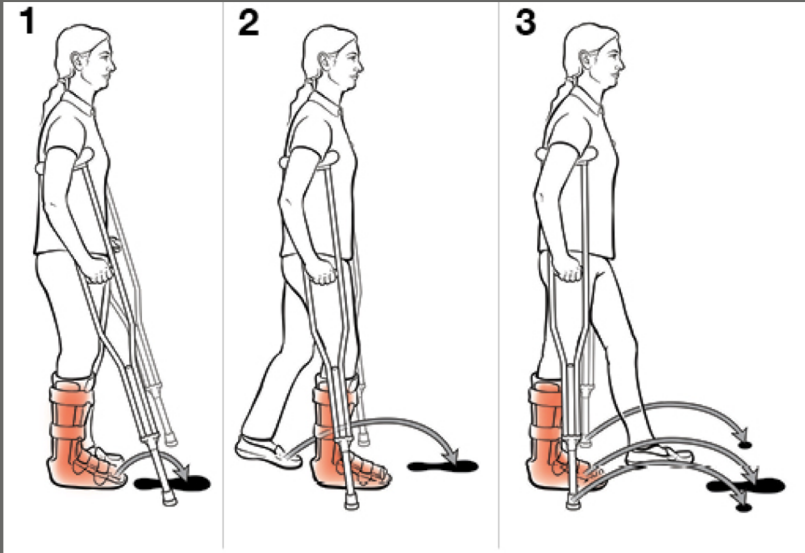
Crutches



Durable Medical Equipment

- Canes and walkers
 - Handle(s) at wrist crease while standing
 - Elbow should be bent 10-20 degrees when holding handle(s)
- Crutches
 - Elbows bent 10-20 degrees when holding handles
 - Two-finger space between top pad and axilla
 - Tips should be placed 2 inches outside and 6 inches in front of feet when checking the fit

Durable Medical Equipment

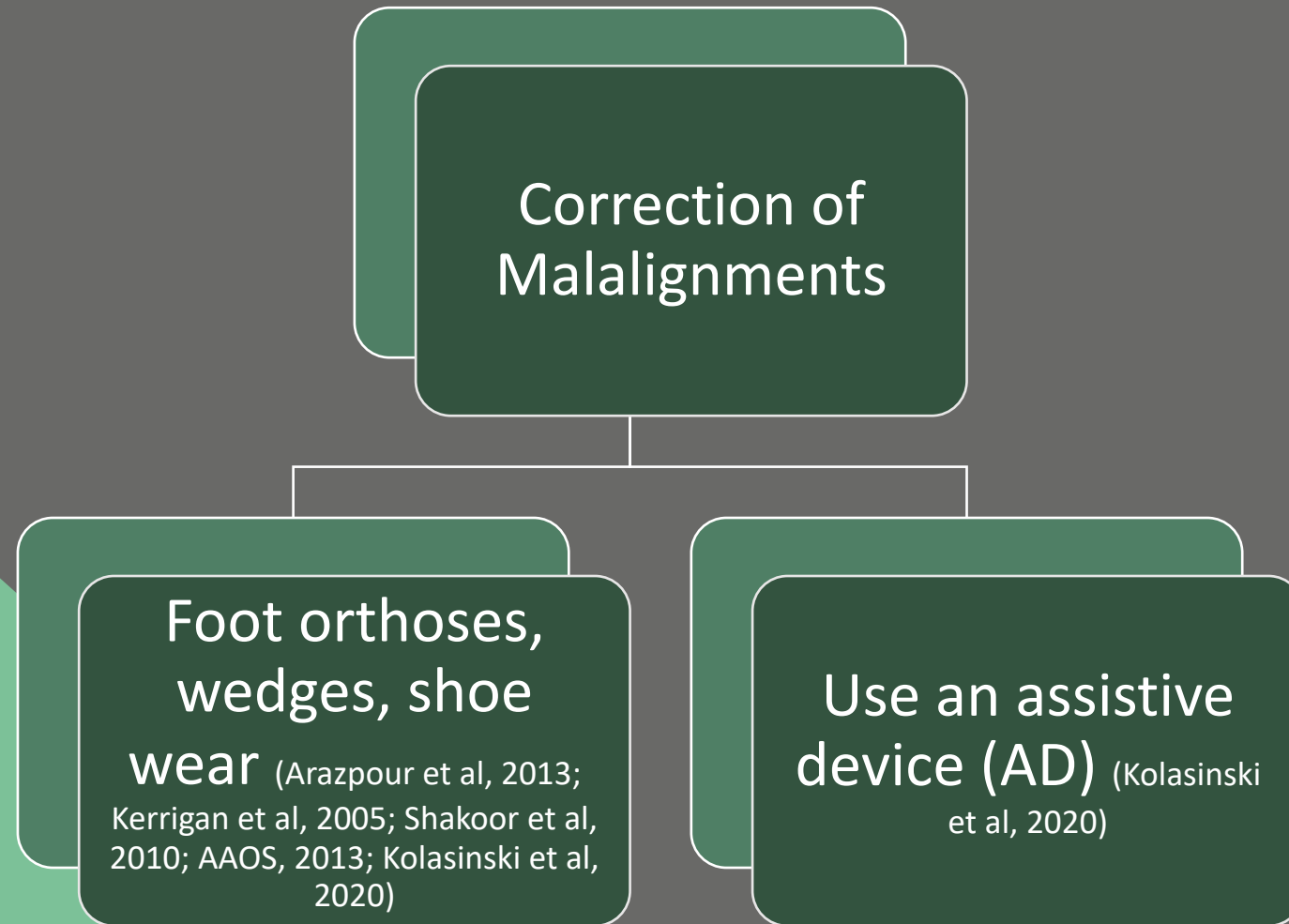


Sources 16, 18-19, 21 in reference list (images)

Interventions

$$CP = \frac{CF}{CA}$$

Increasing Contact Area



Decrease Contact Forces

Mass

- Decrease body weight (Messier et al, 2013; Allen et al, 2016)

Change in Velocity

- Decrease running velocity
- Avoid running downhill

Change in Time

- Shock absorption via ground surface, shoe wear, stronger muscles, AD use

Decrease Contact Forces

Stretch Tight Soft Tissues

- Creep (iit.edu)
- Stress-relaxation (Molded Dimensions)

Positioning for Immobile Patients

- Prone
- Standing programs (Paleg, Livingstone, 2015)



Joint Specific Concepts



Hip and Knee

Spine

Post-traumatic OA (PTOA)

Hip and Knee OA

- **Quadriceps and proximal hip girdle strengthening** (Fernandes et al, 2013; Kolasinski et al, 2020; AAOS, 2013; AAOS, 2017)
- **Aerobic exercise** (AAOS, 2013; Kolasinski et al, 2020)
- **Balance and motor control activities** (Kolasinski et al, 2020)
- **Modified shoes, wedged inserts (-)** (AAOS, 2013; Kolasinski et al, 2020)
- **Cognitive behavioral therapy (CBT) or mindfulness training for chronic pain** (Kolasinski et al, 2020)

Spine OA

- Abdominal strength (*caution*) (Vieira et al, 2015)
- Frequency of 4 days per week or more (Chen & Onishi, 2012)
- If spinal fusion candidate, pre-surgical strengthening/exercise is recommended (Lindbäck et al, 2018; Fors et al, 2019)
- Opioid use caution, high risk populations (Power et al, 2019)
- Shock absorbing shoes, softer surfaces
- Avoid high-impact loading (step aerobics, running downhill)

Post-traumatic OA (PTOA)

- Quadriceps weakness, meniscectomy, high BMI, and age are risk factors (Patterson et al, 2018; Lee et al, 2018)
 - Quadriceps weakness, meniscectomy, BMI are modifiable
- Extensive effusion synovitis associated with cartilage degeneration, which can be induced by intra-articular injury (e.g., meniscal tear) (MacFarlane et al, 2019)

Communication

- ~~Bone on bone~~
- Normalize OA
 - “Wrinkles on the inside”
 - Not a disease like cancer or Parkinson’s
- Our words have impact (Stewart and Loftus, 2018)
 - Reduce fear avoidance behaviors

Take Home Messages

- $CP = \frac{CF}{CA}$
 - Alignment (CA), muscle strength (CF), activity (CF)
 - Lose weight
- Fluid film lubrication → open-chain, aerobic exercises
- ADs can help, but weigh the costs and benefits
- Regular activity is beneficial, regardless of what it is
- Communication

Thank you!

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References

1. Thompson D. Ground Reaction Force. *Ground Reaction Force* 2002. Available at: <https://ouhsc.edu/bserdac/dthompso/web/gait/kinetics/GRFBKGND.HTM>. Accessed March 17, 2020.
2. Allen K, Choong P, Davis A, et al. Osteoarthritis: Models for appropriate care across the disease continuum. *Best Pract Res Clin Rheumatol* 2016;(30):503-535.
3. Fernandes L, Hagen KB, Bijlsma JWJ, et al. EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Ann. Rheum. Dis.* 2013;72(7):1125-1135. doi:10.1136/annrheumdis-2012-202745.
4. American Academy of Orthopaedic Surgeons. MANAGEMENT OF OSTEOARTHRITIS OF THE HIP EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE. 2017.
5. American Academy of Orthopaedic Surgeons. TREATMENT OF OSTEOARTHRITIS OF THE KNEE: EVIDENCE-BASED GUIDELINE, 2ND EDITION. 2013.
6. Gross M. Articular Cartilage. 2019.
7. Flowers SA, Zieba A, Örnros J, et al. Lubricin binds cartilage proteins, cartilage oligomeric matrix protein, fibronectin and collagen II at the cartilage surface. *Sci. Rep.* 2017;7(1):13149. doi:10.1038/s41598-017-13558-y.
8. Elsaid KA, Fleming BC, Oksendahl HL, et al. Decreased lubricin concentrations and markers of joint inflammation in the synovial fluid of patients with anterior cruciate ligament injury. *Arthritis Rheum.* 2008;58(6):1707-1715. doi:10.1002/art.23495.
9. Patterson BE, Culvenor AG, Barton CJ, et al. Worsening knee osteoarthritis features on magnetic resonance imaging 1 to 5 years after anterior cruciate ligament reconstruction. *Am. J. Sports Med.* 2018;46(12):2873-2883. doi:10.1177/0363546518789685.
10. Lee DW, Yeom CH, Kim DH, Kim TM, Kim JG. Prevalence and Predictors of Patellofemoral Osteoarthritis after Anterior Cruciate Ligament Reconstruction with Hamstring Tendon Autograft. *Clin Orthop Surg* 2018;10(2):181-190. doi:10.4055/cios.2018.10.2.181.
11. Neuman P, Englund M, Kostogiannis I, Fridén T, Roos H, Dahlberg LE. Prevalence of tibiofemoral osteoarthritis 15 years after nonoperative treatment of anterior cruciate ligament injury: a prospective cohort study. *Am. J. Sports Med.* 2008;36(9):1717-1725. doi:10.1177/0363546508316770.
12. Sands W, Wurth J, Hewit J. BASICS OF STRENGTH AND CONDITIONING MANUAL. NSCA 2012.
13. Skelly AC, Chou R, Dettori JR, et al. *Noninvasive Nonpharmacological Treatment for Chronic Pain: A Systematic Review*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2018. doi:10.23970/AHRQEPCCER209.
14. Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. Exercise for osteoarthritis of the knee: a Cochrane systematic review. *Br. J. Sports Med.* 2015;49(24):1554-1557. doi:10.1136/bjsports-2015-095424.

References continued

15. How to Use Crutches, Canes, and Walkers - OrthoInfo - AAOS. Available at: <https://orthoinfo.aaos.org/en/recovery/how-to-use-crutches-canes-and-walkers/>. Accessed March 12, 2020.
16. Using a Cane | Articles | Mount Nittany Health System. Available at: <https://www.mountnittany.org/articles/healthsheets/6975>. Accessed March 29, 2020.
17. Moller F, Ortiz-Muñoz L, Irrarázaval S. Contralateral canes for knee osteoarthritis. *Medwave* 2020;20(1):e7759. doi:10.5867/medwave.2020.01.7759.
18. Slide show: Tips for choosing and using walkers - Mayo Clinic. Available at: <https://www.mayoclinic.org/healthy-lifestyle/healthy-aging/multimedia/walker/sls-20076469?s=7>. Accessed March 29, 2020.
19. Walker, Using a. Available at: <https://mychart.geisinger.org/Staywel/html/Inpatient/3,82335.html>. Accessed March 29, 2020.
20. UNH Health Services. Use of Crutches. 2007.
21. Using Crutches with Step Through (Weight Bearing). Available at: <https://www.fairview.org/patient-education/90356>. Accessed March 29, 2020.
22. Arazpour M, Bani MA, Maleki M, Ghomshe FT, Kashani RV, Hutchins SW. Comparison of the efficacy of laterally wedged insoles and bespoke unloader knee orthoses in treating medial compartment knee osteoarthritis. *Prosthet. Orthot. Int.* 2013;37(1):50-57. doi:10.1177/0309364612447094.
23. Kerrigan DC, Johansson JL, Bryant MG, Boxer JA, Della Croce U, Riley PO. Moderate-heeled shoes and knee joint torques relevant to the development and progression of knee osteoarthritis. *Arch. Phys. Med. Rehabil.* 2005;86(5):871-875. doi:10.1016/j.apmr.2004.09.018.
24. Shakoor N, Sengupta M, Foucher KC, Wimmer MA, Fogg LF, Block JA. Effects of common footwear on joint loading in osteoarthritis of the knee. *Arthritis Care Res. (Hoboken)* 2010;62(7):917-923. doi:10.1002/acr.20165.
25. Running Shoes: How to Choose the Best Running Shoes | REI Co-op. Available at: <https://www.rei.com/learn/expert-advice/running-shoes.html>. Accessed March 22, 2020.
26. Kolasinski SL, Neogi T, Hochberg MC, et al. 2019 american college of rheumatology/arthritis foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Rheumatol.* 2020;72(2):220-233. doi:10.1002/art.41142.
27. Messier SP, Mihalko SL, Legault C, et al. Effects of intensive diet and exercise on knee joint loads, inflammation, and clinical outcomes among overweight and obese adults with knee osteoarthritis: the IDEA randomized clinical trial. *JAMA* 2013;310(12):1263-1273. doi:10.1001/jama.2013.277669.
28. Academic Resource Center. Creep Deformation in Materials.
29. Creep and Stress Relaxation. Available at: <https://moldeddimensions.com/creep-and-stress-relaxation.php>. Accessed March 21, 2020.

References continued

30. Paleg G, Livingstone R. Systematic review and clinical recommendations for dosage of supported home-based standing programs for adults with stroke, spinal cord injury and other neurological conditions. *BMC Musculoskelet. Disord.* 2015;16:358. doi:10.1186/s12891-015-0813-x.
31. Vieira S, Dibai-Filho AV, Brandino HE, Ferreira VTK, Scheicher ME. Abdominal muscle strength is related to the quality of life among older adults with lumbar osteoarthritis. *J Bodyw Mov Ther* 2015;19(2):273-277. doi:10.1016/j.jbmt.2014.05.002.
32. Chen H, Onishi K. Effect of home exercise program performance in patients with osteoarthritis of the knee or the spine on the visual analog scale after discharge from physical therapy. *Int. J. Rehabil. Res.* 2012;35(3):275-277. doi:10.1097/MRR.0b013e328355a1bd.
33. Fors M, Enthoven P, Abbott A, Öberg B. Effects of pre-surgery physiotherapy on walking ability and lower extremity strength in patients with degenerative lumbar spine disorder: Secondary outcomes of the PREPARE randomised controlled trial. *BMC Musculoskelet. Disord.* 2019;20(1):468. doi:10.1186/s12891-019-2850-3.
34. Lindbäck Y, Tropp H, Enthoven P, Abbott A, Öberg B. PREPARE: presurgery physiotherapy for patients with degenerative lumbar spine disorder: a randomized controlled trial. *Spine J.* 2018;18(8):1347-1355. doi:10.1016/j.spinee.2017.12.009.
35. Power JD, Perruccio AV, Gandhi R, et al. Factors associated with opioid use in presurgical knee, hip, and spine osteoarthritis patients. *Arthritis Care Res. (Hoboken)* 2019;71(9):1178-1185. doi:10.1002/acr.23831.
36. MacFarlane LA, Yang H, Collins JE, et al. Association of Changes in Effusion-Synovitis With Progression of Cartilage Damage Over Eighteen Months in Patients With Osteoarthritis and Meniscal Tear. *Arthritis Rheumatol.* 2019;71(1):73-81. doi:10.1002/art.40660.
37. Stewart M, Loftus S. Sticks and stones: the impact of language in musculoskeletal rehabilitation. *J. Orthop. Sports Phys. Ther.* 2018;48(7):519-522. doi:10.2519/jospt.2018.0610.