

# Hip and Knee Arthroplasty

## Goals and Objectives

### Course Description

"Hip and Knee Arthroplasty" is an online recorded video of a previously presented live CE webinar for physical therapists and physical therapist assistants that examines surgical management of osteoarthritis through total joint arthroplasty. This course includes a review of current literature relating to pathophysiology of osteoarthritis, specific arthroplasty procedures, post-surgical medical management, and anticipated outcomes.

### Course Rationale

The purpose of this course is to provide participants with a comparative analysis of surgical techniques and post-surgical management to minimize complications, and maximize outcomes based on current research.

### Course Goals and Objectives

Upon completion of this course, participants will be able to:

1. Identify the current trends in osteoarthritis conservative and surgical techniques.
2. Define prolotherapy and its indications for medical management of osteoarthritis.
3. Compare prosthetic knee components which substitute or salvage cruciate ligaments.
4. Identify total hip arthroplasty surgical procedures.
5. Compare outcomes for various total hip arthroplasty surgical techniques.
6. Identify factors contributing to increased risk of post-surgical complications.
7. Identify surgical anesthetic and pharmacologic strategies to manage post-surgical pain after total joint replacement.
8. Recognize factors associated with improved outcomes following total joint replacement.

**Course Provider** – Innovative Educational Services

**Provider Contact Information** – [information@cheapceus.com](mailto:information@cheapceus.com)

**Course Instructor** – Jodi Gootkin, PT, Med, CEAS

**Financial/Non-financial Disclosure** - Neither the Provider nor the instructor have any financial or non-financial conflict of interest related to the presentation of this CE program.

**Target Audience** – Physical Therapists, Physical Therapist Assistants

**Course Educational Level** – This course is applicable for introductory learners.

**Course Prerequisites** – None

**Instructional Method** – Distance Learning – Independent; Asynchronous online video-based home study

**Location** - Cheapceus.com

**Date** – Continuously available on-demand

**PD Activity Completion Requirements / Criteria for Issuance of CE Credits** – Completion of viewing of 1 hour recorded video, and a score of 70% correct or greater on the course post-test.

**Continuing Education Credits** – Three (3) contact hours

**Course Fee** - \$34.95

**Registration Information** – No pre-registration required; available on-demand at Cheapceus.com

**Special Needs Requests** – Email: [information@cheapceus.com](mailto:information@cheapceus.com) or phone: 954-663-4101

**Cancellation by the Learner** – Learners may cancel their participation at any time and receive a full refund of all paid fees.

**Cancellation by the Provider** – Registrants for the cancelled activity will be contacted by an IES staff member via phone call or email within 12 hours of the cancellation decision. If the decision to cancel is made less than 14 hours prior to the event, each participant will be contacted no later than 2 hours prior to the scheduled start time of the activity. Registrants will receive a full refund if an activity is cancelled by the Provider. The refund will be processed back to the Registrant within 12 hours of the cancellation.

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**Refund Policy** - Unrestricted 100% refund upon request. The request for a refund by the learner shall be honored in full without penalty or other consideration of any kind. The request for a refund may be made by the learner at any time without limitations before, during, or after course participation.

# Hip and Knee Arthroplasty

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Jodi Gootkin, PT, MEd, CEAS  
jodiemail@comcast.net

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## Course Overview

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- “Hip and Knee Arthroplasty” examines surgical management of osteoarthritis through total joint arthroplasty. This course includes a review of current literature relating to pathophysiology of osteoarthritis, specific arthroplasty procedures, post-surgical medical management, and anticipated rehabilitation outcomes.

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## Course Rationale

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- The purpose of this course is to provide a comparative analysis of surgical techniques and post-surgical management to minimize complications, assess rehabilitation potential, and maximize outcomes based on current research.

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## Goals and Objectives

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1. Describe the current trends in osteoarthritis conservative and surgical management techniques.
2. Define prolotherapy and its indications for management of osteoarthritis.
3. Compare prosthetic knee components which substitute or salvage cruciate ligaments.
4. Describe total hip arthroplasty surgical procedures.
5. Compare outcomes for various total hip arthroplasty surgical techniques.
6. Identify factors contributing to increased risk of post-surgical complications.
7. Differentiate surgical anesthetic and pharmacologic strategies to manage post-surgical pain after total joint replacement.
8. Detail factors associated with improved outcomes following total joint replacement.
9. Identify components of pre-operative patient education programs.
10. Recognize the benefits of early post-surgical mobilization.

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## Course Outline and Schedule

| Topic   | Time      |
|---|-----------|
| Pathophysiology of Osteoarthritis               | 0:00-0:10 |
| Conservative Management                         | 0:11-0:15 |
| Rehabilitation                                  | 0:16-0:20 |
| Prolotherapy                                    | 0:21-0:30 |
| Surgical Management                             | 0:31-0:35 |
| Total Knee Arthroplasty Surgery                 | 0:36-0:40 |
| Posterior Cruciate Stabilizing Prosthetic       | 0:41-0:45 |
| Cruciate Retaining Prosthetic                   | 0:46-0:50 |
| Interactive Discussion of Clinical Applications | 0:51-0:60 |
| Total Hip Arthroplasty Surgery                  | 1:00-1:05 |
| Surgical Techniques                             | 1:06-1:15 |
| Outcome Comparison                              | 1:16-1:25 |
| Total Hip Dislocation                           | 1:26-1:30 |
| Post-Operative Complications                    | 1:31-1:35 |
| Infection                                       | 1:36-1:40 |
| Venous Thromboembolism                          | 1:41-1:45 |
| Regional vs. General Anesthesia                 | 1:46-1:50 |
| Interactive Discussion of Clinical Applications | 1:51-2:00 |
| Acute Post-Surgical Pain                        | 2:01-2:05 |
| Pre-Operative Considerations                    | 2:06-2:10 |
| Surgical Anesthetic Techniques                  | 2:11-2:15 |
| Clinical Outcomes                               | 2:16-2:20 |
| Predictive Factors                              | 2:21-2:25 |
| Rehabilitation Measures                         | 2:26-2:30 |
| Chronic Post-Surgical Pain                      | 2:31-2:35 |
| Pre-operative Patient Education Programs        | 2:36-2:40 |
| Early Post-Operative Mobilization               | 2:41-2:50 |
| Interactive Discussion of Clinical Applications | 2:51-3:00 |

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- After watching the video go to [www.cheapceus.com](http://www.cheapceus.com)
- Complete the post test with score of at least 70%
  - May be retaken multiple times
- Submit online payment for course
- Print certificate
- Course review and summary for post test at the end of the webinar.



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## National Arthritis Prevalence

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23%

Adults over 18  
diagnosed with  
arthritis as of 2016

44%

Adults with Arthritis  
Attributable Limitation  
(AAL)

Grasping small objects  
Reaching overhead  
Sitting > 2 hours  
Climbing flight of stairs  
Walking ¼ mile  
Standing > 2 hours

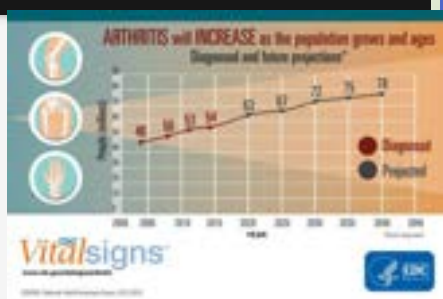
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[https://www.cdc.gov/arthritis/data\\_statistics/disabilities-limitations.htm](https://www.cdc.gov/arthritis/data_statistics/disabilities-limitations.htm)

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## Future Burden: 78 Million

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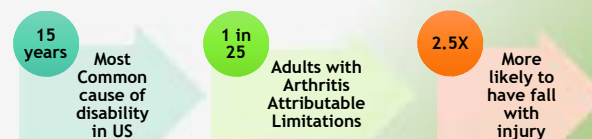
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[https://www.cdc.gov/arthritis/data\\_statistics/national-statistics.html](https://www.cdc.gov/arthritis/data_statistics/national-statistics.html)

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## Impact of Arthritis

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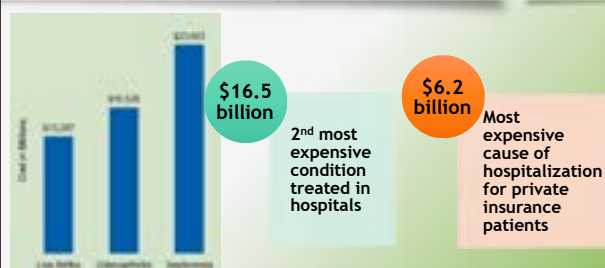
[https://www.cdc.gov/arthritis/data\\_statistics/arthritis-related-stats.htm](https://www.cdc.gov/arthritis/data_statistics/arthritis-related-stats.htm)

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## Osteoarthritis Cost

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<https://www.cdc.gov/chronicdisease/resources/publications/aag/arthritis.htm>

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## Pathophysiology of Osteoarthritis - OA

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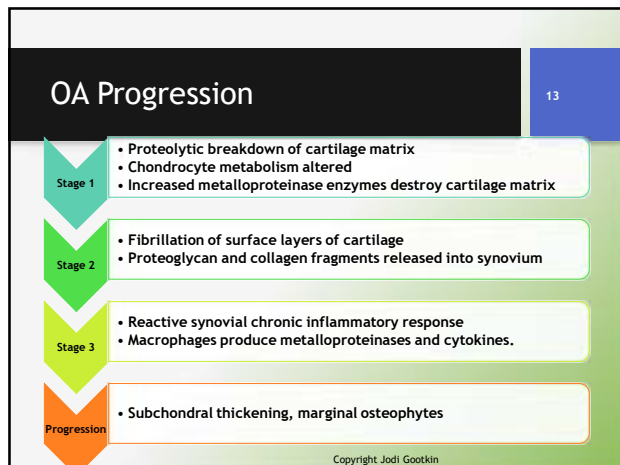
- Progressive cartilage damage in response to mechanical loading during weight bearing.

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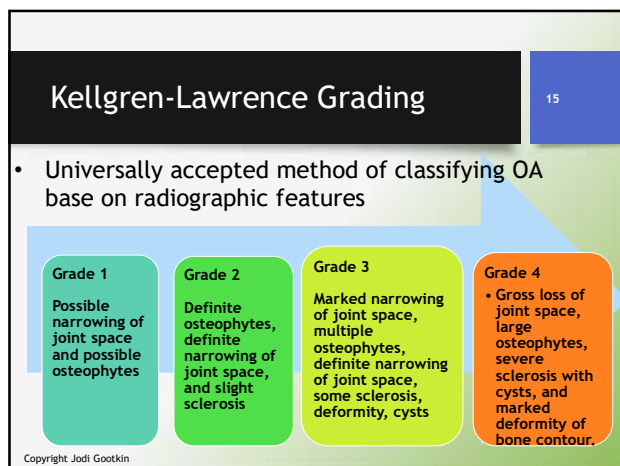
## Radiologic Examination

Radiographic features confirming OA include:

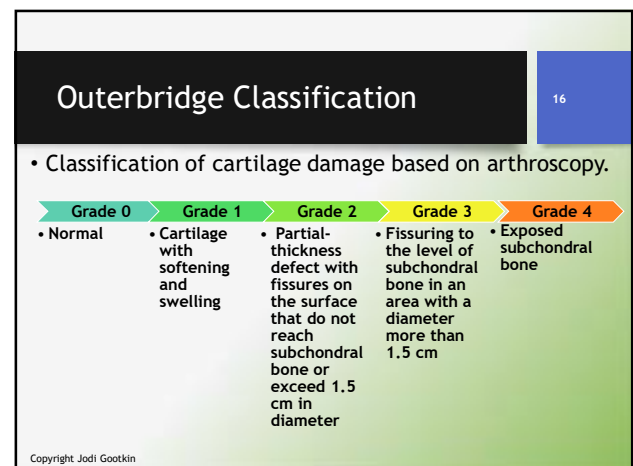
- Bony sclerosis
- Marginal osteophytes
- Joint space narrowing
- Subchondral cysts
- malalignment

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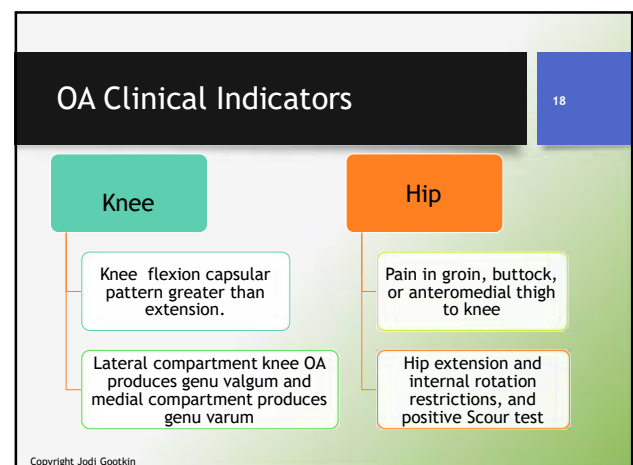
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## OA Clinical Presentation

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- Joint pain, swelling, and decreased range of motion.
- Morning stiffness  $\geq 30$  min
- Inactivity stiffness
- Crepitus with motion

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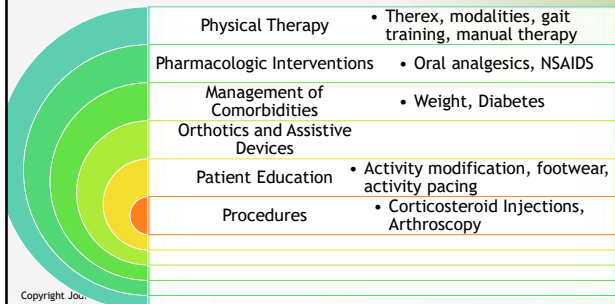
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## Conservative Management

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## OA Rehabilitation

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- Goals:
  - Decrease pain
  - Increase ROM and strength
  - Maximize gait quality and quantity
  - Improve balance and proprioception
  - Maximize functional task performance
  - Independent in home exercise program

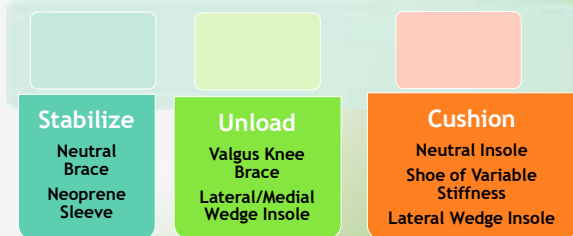
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## Knee OA Orthotics

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*"The optimal choice for an orthosis remains unclear"*



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Duivenvoorden, T., Brouwer, R. W., van Raaij, T. M., Verhagen, A. P., Verhaar, J. A., & Bierma-Zeinstra, S. (2015). Braces and orthoses for treating osteoarthritis of the knee. *The Cochrane Library*.

21

## OA Clinical Guidelines

22

- Based on current evidence from AAOS, NICE, and ESCO, the following management strategies are NOT recommend:
  - Neutraceuticals -Glucosamine and Chondroitin
  - Acupuncture
  - Intra-articular hyaluronan

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## Prolotherapy

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- Injection of an irritating dextrose solution to stimulate body's natural repair and healing mechanisms potentially reducing degenerative changes in ligament, tendon, and cartilage.
- Intra and extra articular injections into multiple points at site of pain/pathology occur every 3-6 weeks.
- Typically results evident after 3 treatments.

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## Prolotherapy Intervention

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- Mechanism of action theorized to include:
  - Stimulation of intra- and extra- articular tissue healing
  - Stimulation of collagen cell proliferation
- During the course of treatment AVOID:
  - Anti-inflammatory medication
  - Cryotherapy
  - Aggressive exercise and stretching
  - Inactivity
  - Smoking

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## Prolotherapy Evidence

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- Evidence is evolving indicating progressively improved pain and function.

| Interventions                  | Outcome   |
|--------------------------------|---|
| Prolotherapy vs. Home Exercise | WOMAC composite, pain, and function scores improved |

- Additional research needed to determine optimal strategy for prolotherapy.
  - Dextrose concentration and volume
  - Treatment frequency and duration
  - Specificity of injection sites

Copyright Jodi Gootkin Sit, Regina WS, et al. "Hypertonic dextrose injections (prolotherapy) in the treatment of symptomatic knee osteoarthritis: a systematic review and meta-analysis." *Scientific reports* 6 (2016).

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## Anatomy Review

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- Hip Joint
  - Triaxial ball and socket articulation of femoral head and acetabulum.
- Knee Joint
  - Hinge articulation of femoral condyles and tibial plateau.

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## Role of Knee Ligaments

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- Anterior cruciate ACL resists anterior tibial translation from 0-30 degrees of flexion when peak quad force creates anterior translation of tibia on femur.
- Posterior cruciate PCL resists hamstring force generating posterior translation of tibia on femur during knee flexion.

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## Total Knee Arthroplasty - TKA

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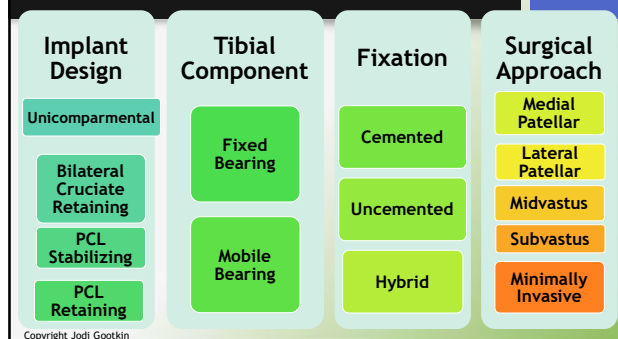
- Distal end of the femur and proximal end of the tibia are excised.
- Tibial and femoral guides are inserted to determine appropriate fit to restore mechanical alignment and a level joint line.
- Prosthetic implants are placed on femur, tibia, and patella.
- ROM, ligamentous stability, and patellar tracking are assessed.

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## Total Knee Arthroplasty Surgery

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## Implant Materials

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- Metal components are cobalt chrome or titanium.
- Plastic is high molecular weight polyethylene.
- Implant selection considers patient size, weight, and gender.

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## Implant Design Unicompartmental

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- Also referred to as partial knee replacement.
- Only one femoral condyle and articulating tibial surface are replaced.
- All ligaments are preserved allowing greater stability and proprioception.

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## Implant Design Bilateral Cruciate Retaining

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- Both anterior and posterior cruciate ligaments are left intact maintaining anatomical kinematics.
- Femoral bone box component allows preservation of natural tibial bone island.
- Early loosening and failure contribute to limited use, but newer designs emerging.

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## Implant Design Posterior Cruciate Stabilizing

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- Also referred to as:
  - Posterior Cruciate Sacrificing
  - Posterior Cruciate Substituting
- Both anterior and posterior cruciate ligaments removed during surgery.
- This is a total condylar prosthesis that closely replicates anatomy and function of natural knee.

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## PCL Stabilizing Prosthesis

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- Easier balancing when contractures and deformity are present
- Greater ROM
- Cam jump
- Tibial post polyethylene wear
- Patellar Clunk Syndrome
- Less reliable Femoral Rollback

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## Patellar Clunk Syndrome

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- Following TKA patient may develop scar tissue in the quad tendon at the superior pole of the patella.
- The fibrous nodule causes mechanical catching of the patella during active knee extension.
- A painful, palpable “clunk” occurs.

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## Femoral Roll Back

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- Normal kinematics of anterior to posterior translation of the femur on the tibia must be recreated by the prosthesis to achieve full knee flexion ROM.

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## Implant Design Posterior Cruciate Retaining

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- Also referred to as:
  - Posterior Cruciate Retention
  - Posterior Cruciate Sparing
  - Cruciate Retaining
- Only the anterior cruciate ligament is removed during surgery.
- The natural posterior cruciate ligament provides stability to the joint.

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## PCL Retaining

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- Resembles normal knee kinematics
- Enhanced stability
- Improved proprioception and kinesthesia
- Knee pain, restricted ROM, and instability if ligament balancing is insufficient

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## PCL Retention vs. Stabilizing Outcomes

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- Clinical and functional outcome measures demonstrated no clinically relevant difference.
  - WOMAC, KSS Pain, HSS, SF-12
  - Radiographic evaluation
  - Complication rate
- Slightly more favorable results in favor of PCL stabilizing where PCL is removed.
  - 2 degree increase in post-operative knee flexion**
  - 2.4 point higher KSS functional score.**

Verra, Wiebe C., et al. "Similar outcome after retention or sacrifice of the posterior cruciate ligament in total knee arthroplasty: A systematic review and meta-analysis." *Acta orthopaedica* 86.2 (2015): 195-201.  
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## Tibial Components

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- Fixed bearing implant incorporates metal tibial component with a polyethylene tray locked on top.
- Mobile bearing implant utilizes a rotating polyethylene insert on a metal tibial platform.

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## Fixed Bearing Design

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- Reduced polyethylene wear
- Single point of contact may increase wear

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## Mobile Bearing Design

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- Reduced polyethylene wear
- Requires PCL removal
- Improved kinematics

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## Mobile vs. Fixed Bearing Outcomes

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- No statistical differences on multiple outcome measures.

| Outcome                        | Assessment Tool                                     |
|--------------------------------|---|
| Pain                           | KSS Knee Society Score<br>VAS Visual Analogue Scale |
| Function                       | KSS<br>HSS Hospital for Special Surgery<br>WOMAC    |
| Health Related Quality of Life | SF12 Short Form Health Summary                      |
| Revision Rate                  | 3 more knees per 1000 in mobile bearing             |

Hofstede, Stefanie N., et al. "Mobile bearing vs fixed bearing prostheses for posterior cruciate retaining total knee arthroplasty for postoperative functional status in patients with osteoarthritis and rheumatoid arthritis." *The Cochrane Library* (2015).

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## Fixation

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- A hybrid design is typically utilized.
- The femoral stem is a trabecular metal surface for new bone growth.
- The tibial component is secured using a fast curing bone cement for strong fixation to bone.

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## Patellar Prosthesis

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- Evidence demonstrates no difference in pain or function with or without patellar resurfacing.
- Resurfacing may decrease the need for revision after 5 years when compared to no patellar resurfacing.

American Academy of Orthopedic Surgeons (2017). Surgical Management of Osteoarthritis of the Knee Evidence Based Clinical Practice Guideline. <http://www.orthoguidelines.org/topic?id=101>

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## Surgical Approach

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- Medial Parapatellar**
  - Midline incision with patella flipped
  - Potential lateral patellar subluxation
- Lateral Parapatellar**
  - Used for valgus deformity and lateral contractures
- Midvastus**
  - Incision mid-muscle belly
  - Sparing VMO insertion for accelerated rehab and improved patellar tracking
- Subvastus**
  - VMO is lifted without flipping the patella
- Minimally Invasive**
  - Small incision site for robotic assisted surgery
  - Potentially more rapid recovery

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## Infrapatellar Fat Pad Resection

47

- Beyond 6 months post-op, patients with resection demonstrate increased incidence of knee pain.

White, L., Holyoak, R., Sant, J., Hartnell, N., & Mullan, J. (2016). The effect of infrapatellar fat pad resection on outcomes post-total knee arthroplasty: a systematic review. *Archives of Orthopaedic and Trauma Surgery*, 136(5), 701-708.

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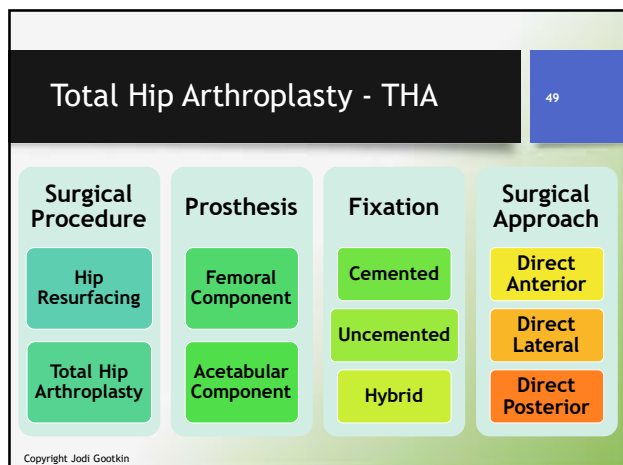
## Longevity

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- Long term wear and loosening lead to late implant failure.
- Typical survivorship of TKA is between 20-30 years

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## Hip Resurfacing

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- The procedure involves sculpting of the deteriorated femoral head for placement of a metal cap with a short stem.
- It then articulates with a shallow cup inserted into acetabulum.
- This technique preserves biomechanics for greater stability in younger active patients.

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## Hip Resurfacing Outcomes

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- According to the Food and Drug Administration (FDA):  
*"Metal ions from a metal-on-metal implant will enter the bloodstream."*
- The long term safety of metal on metal components requires further analysis.
- An increased incidence of revisions compared to total hip arthroplasty has been demonstrated.

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## FDA Recommendations for Patients with Metal on Metal Implants

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- Patients must be monitored for adverse tissue reactions of increased pain, swelling, numbness, noise, and gait alterations.
- Potential systemic adverse reactions:
  - General hypersensitivity reaction
  - Cardiomyopathy
  - Neurological changes including sensory changes
  - Psychological status change
  - Renal function impairment
  - Thyroid dysfunction
- Greater risk for patients with renal insufficiency, immunocompromise, obesity, receiving high doses of steroids, females, and bilateral implants.

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## Total Hip Arthroplasty Prosthesis

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- A titanium or ceramic stemmed device with a prosthetic head replaces the femoral head and neck.
- A hemispherical shaped cup with a polyethylene or ceramic liner replaces acetabulum.
- Leg length must be assessed to avoid discrepancy.
- Newer components account for anatomical gender differences.

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## FDA Recalls

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|             |  |
|-------------|--|
| July 2016   | <ul style="list-style-type: none"> <li>Standard Offset Cup Impactor by Greatbatch</li> <li>Class I Recall - Inadequate Sterilization</li> </ul> <a href="https://www.fda.gov/safety/medwatch/safetyinformation/safetyalertsforhumanmedicalproducts/ucm333967.htm">https://www.fda.gov/safety/medwatch/safetyinformation/safetyalertsforhumanmedicalproducts/ucm333967.htm</a>                                      |
| August 2015 | <ul style="list-style-type: none"> <li>PROFEMUR Neck Varus/Valgus by MicroPort Orthopedics</li> <li>Class I Recall - Unexpected Rate of Post-op Fractures</li> </ul> <a href="https://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm465529.htm">https://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm465529.htm</a>                 |
| June 2015   | <ul style="list-style-type: none"> <li>M/L Taper Kinectiv Technology Prosthesis by Zimmer</li> <li>Class I Recall - Higher than Expected Levels of Manufacturing Residues</li> </ul> <a href="https://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm452012.htm">https://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm452012.htm</a> |

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## Fixation

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- Acetabular component
  - Porous coated press fit and stabilized with screws
  - Cemented
- Femoral component
  - Cemented
  - Uncemented has porous trabecular surface for bone growth

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## Fixation Outcomes

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*"Although cementless femoral fixation for THA has evolved to the "new standard", it has not been proven to be the "gold standard" for all patients."*

Moskal, Joseph T., Susan G. Capps, and John A. Scanelli. "Still no single gold standard for using cementless femoral stems routinely in total hip arthroplasty." *Arthroplasty Today* 2.4 (2016): 211-218.

- Cemented femoral stems beneficial for patients with poor bone integrity and demonstrate good long term survivorship.
- Loosening failure risk is lower in younger patients under 55 years old.

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## Posterior Approach

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- Incision is along and posterior to the greater trochanter.
- Glut max split with tendon intact.
- Piriformis and Gemelli muscles are detached.



Better visualization of entire hip

Potentially more expensive due to pharmacy needs of patient, operating room time, and longer length of stay.  
Disruption of hip abductor muscles.

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## Anterior Approach

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- Incision from ASIS distal toward ipsilateral knee
- Entering in between Sartorius and Tensor Fascia Lata requires no muscle detachment.



Less disruptive to hip musculature  
Less post-operative pain  
Improved function in early post-operative phase  
ADLs less disrupted by dislocation precautions

Custom operating table and fluoroscopy required  
Increased risk associated with surgeon learning curve  
Potential damage to lateral femoral cutaneous nerve

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## Anterior vs. Posterior Approach Outcomes

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- AAOS guidelines find no clinically significant differences in outcomes.
- Potential benefit of shorter length of stay and improved function for anterior approach.
  - Earlier mobilization is permitted due to less muscular trauma.

Improved function on HHS at 12 months noted for anterior approach

Balasubramaniam, Umatheepan, et al. "Functional and clinical outcomes following anterior hip replacement: a 5-year comparative study versus posterior approach." *ANZ Journal of surgery* 86.7-8 (2016): 589-593.

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## Current Trends

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- Minimally Invasive
  - Surgeons use this term to reference incision length, speed of recovery, or level of surgical dissection of tissues.
- Robotic Assisted
  - Surgeon uses robotic arms to plan procedure and control tools during surgical operation.

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## Robot Assisted Arthroplasty

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- Two primary systems are MAKO Robot (Stryker®) and the NAVIO Robot (Smith & Nephew®)

Improved alignment and stability

Prolonged surgical time  
Possible higher hip dislocation rate

Copyright Jodi Gootkin      Robot 217 Shenoy, R., & Nathwani, D. (2017). Evidence for robots. SICOT-J, 3, 38.

61

## THA Dislocation

62

**Anterior Avoid**

- Hip Extension
- Hip External Rotation
- Hip ADDuction past neutral

**Posterior Avoid**

- Hip Flexion >90
- Hip Internal Rotation past neutral
- Hip ADDuction past neutral

- Risk factors include greater age, prior surgery, cognitive and neuromuscular comorbidities.
- There appears to be no difference in the rate of dislocation between anterior and posterior approach.

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## Observing Anterior Precautions

63

| Precaution   | Patient Instruction   |
|--|---|
| Avoid closed chain external rotation.                        | Do not turn away from your operative side when turning or performing ADLs.          |
| Limit operative limb hip extension at toe off.               | Take a short step with your NON-operative limb.                                     |
| Avoid hip extension beyond neutral in supine and hook lying. | Be cautious when using bed pan and avoid bridging up your bottom with feet planted. |

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## Observing Posterior Precautions

64

| Precaution                                 | Patient Instruction  |
|--|--|
| Avoid closed chain internal rotation.      | Do not turn toward your operative side when turning or performing ADLs.        |
| Avoid hip flexion greater than 90 degrees. | Do not bend forward to pick up objects.<br>Do not sit in a low chair or couch. |
| Avoid hip ADDuction past neutral.          | Do not cross legs in sitting or when lying down.                               |

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## Total Joint Arthroplasty Post-Operative Complications

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- Preventing hospital re-admissions and reducing complications contributes to improved patient outcomes and manages the cost of care.
- Centers for Medicare and Medicaid Services implemented the Comprehensive Care for Joint Replacement Model in April 2016 to provide more coordinated patient care from surgery through recovery.

<https://innovation.cms.gov/initiatives/cjr>

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## Comprehensive Care for Joint Replacement Model - CJR

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- The hospital where the surgery was performed is responsible for the full cost of the episode of care which is defined from time of surgery through 90 days post hospital discharge.
- Bundling payments is intended to foster coordination among hospitals, physicians, and other providers for effective and efficient care.

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## Hospital-Level Risk-Standardized Complication Rate - RSCR

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This THA/TKA complications measure tracks:

During the admission or within 7 days  
acute myocardial infarction, pneumonia, and sepsis/septicemia/shock

During admission or within 30 days  
death, surgical site bleeding, and pulmonary embolism

During the admission or within 90 days  
mechanical complications and periprosthetic joint infection/wound infection

<https://www.qualitymeasures.ahrq.gov/summaries/summary/49201/total-hip-arthroplasty-tha-andor-total-knee-arthroplasty-tka-hospital-level-risk-standardized-complication-rate-rscr-following-elective-primary-tha-andor-tka>

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## Infection

68

- Wound site and periprosthetic joint infections can occur.
- According to the Centers for Disease Control, infection is the most common indication for revision in total knee arthroplasty and the third most common indication in total hip arthroplasty.
- Lifelong antibiotic prophylaxis prior to dental care or other surgical procedures can help reduce transient bacteremia.

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## Minimizing Risk

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- Implementation of a pre-operative staphylococcal decolonization protocol decreases incidence of surgical site infections.

30 days pre-op nasal swab

Pre-op course of nasal ointment

Night before surgery single shower with antiseptic or antimicrobial agent

Hadley, Scott, et al. "Staphylococcus aureus decolonization protocol decreases surgical site infections for total joint replacement." *Arthritis* 2010 (2010).

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## Surgical Site Infection

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- Infection risk is greater with BMI >30, active smoking, and staphylococcus aureus colonization.
- Several factors related to obesity increase infection risk:
  - Longer surgical time
  - Difficult surgical exposure
  - Decreased vascularization of adipose tissue
  - Weakened immune responses

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## Venous Thromboembolism - VTE

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- Deep vein thrombosis (DVT) is the formation of a clot within the lumen of a deep vein in the lower extremity.
- Pulmonary embolism (PE) occurs when the clot dislodges traveling through the circulatory system into the heart and lodging in the lungs obstructing blood flow.

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## VTE Prevalence

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- Despite prophylaxis, patients are still at risk for DVT and PE.

| Diagnosed before discharge     | TKA   | THA   |
|--------------------------------|-------|-------|
| VTE - Pooled DVT and PE        | 1.09% | 0.53% |
| DVT                            | 0.63  | 0.26  |
| PE                             | 0.27  | 0.14  |
| Within 3 months post discharge | 2-3%  | 2-5%  |

- There is limited evidence that the complication rate increases with age, but comorbidities have been shown to increase risk.

Januel J, Chen G, Ruffieux C, Quan H, Douketis JD, Crowther MA, Colin C, Ghali WA, Burnand B, IMECCHI Group PT. Symptomatic In-Hospital Deep Vein Thrombosis and Pulmonary Embolism Following Hip and Knee Arthroplasty Among Patients Receiving Recommended Prophylaxis: A Systematic Review. *JAMA*. 2012;307(3):294-303. doi:10.1001/jama.2011.2072

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## DVT Differential Diagnosis

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- Signs and symptoms of DVT include localized calf pain, tenderness, swelling, warmth, but are not conclusive of diagnosis.
- Other possible etiologies include:
  - Sciatica
  - Gastroc spasm or tendonitis
  - Intermittent claudication
  - Baker's cyst
  - Cellulitis

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## Homan's Sign

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*"The clinical signs cannot be trusted"*

Positive in only 33% cases and false positive in 21%

*"Unreliable, insensitive, and nonspecific"*

Positive in 8-56% cases and false positive in 50% cases

*"Essentially no diagnostic value"*

Low sensitivity of 50.0% and specificity of 51.875%

Haeger K. Problems of acute deep venous thrombosis. The interpretation of signs and symptoms. Angiology 1969;20:219-23.  
Urbano, FL. Homans' sign in the diagnosis of deep vein thrombosis. Hospital Physician. March 2001, pp. 22-24  
Patnaik, Pritam Pritish, et al. "A Study Of Deep Vein Thrombosis In Surgical Practice." Age 8-648X100 (2016): 1-23.

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## Wells Rule for DVT

75

- Predicts DVT presence of prior to imaging studies.
- Scoring
 

|     |                      |
|-----|----------------------|
| 3   | High Probability     |
| 1-2 | Moderate Probability |
| 0   | Low Probability      |

| Assessment Criteria   | Points |
|---|--------|
| Active Cancer (treatment ongoing or within previous 6 months)   | + 1    |
| Paralysis, paresis or recent plaster immobilization of the LE   | + 1    |
| Recently bedridden for 3 days or more, or major surgery within the previous 12 weeks requiring anesthesia | + 1    |
| Localized tenderness along the distribution of the deep venous system                                     | + 1    |
| Entire leg swelling   | + 1    |
| Calf Swelling at least 3cm larger than asymptomatic leg (measured 10cm below tibial tub)                  | + 1    |
| Pitting Edema confined in symptomatic leg   | + 1    |
| Collateral superficial veins (nonvaricose)  | + 1    |
| Previous DVT  | + 1    |
| Alternative diagnosis at least as likely as a DVT   | - 2    |

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## DVT Management

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- General recommendation is to refer symptomatic patients for diagnostic testing.
- Continuous Passive Motion (CPM) device does NOT prevent VTE.
- Enhanced peri-operative management and prophylaxis can decrease risk.
  - Anticoagulant medications
  - Compression stockings
  - Mechanical compression devices

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## Mechanical Compression Devices

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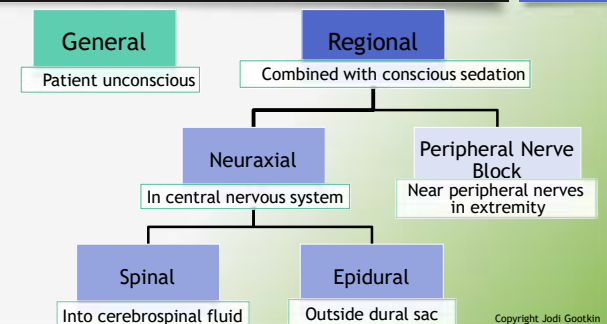
- Above-Knee Sequential Compression Devices: Not recommended over other devices for THA
- Below-Knee Sequential Compression Device: Good efficacy for THA and TKA
- Rapid Asymmetrical Inflation Device: Promising but future research needed
- Foot Pump: Potential benefit when combined with pharmacoprophylaxis

Pierce, Todd P., et al. "A current review of mechanical compression and its role in venous thromboembolic prophylaxis in total knee and total hip arthroplasty." The Journal of arthroplasty 30.12 (2015): 2279-2284.

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## Surgical Anesthesia

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## Anesthesia Complications

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|                     | Benefits  | Complications   |
|---------------------|---|---|
| Regional Anesthesia | <ul style="list-style-type: none"> <li>Decreased one month mortality</li> <li>Decreased post-op confusion</li> <li>Potential decreased risk of DVT</li> </ul> | <ul style="list-style-type: none"> <li>Increased minor complications of wound dehiscence and superficial infection</li> </ul> |

Whiting, Paul S., et al. "Regional anaesthesia for hip fracture surgery is associated with significantly more peri-operative complications compared with general anaesthesia." *International orthopaedics* 39.7 (2015): 1321-1327.

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## Anesthesia Functional Outcomes

80

- Regional anesthesia appears to decrease length of stay, improve joint ROM, strength, gait, and stair negotiation post-operatively but long-term functional impact beyond 3 months cannot be confirmed.

Atchabahian, A., Schwartz, G., Hall, C. B., Lajam, C. M., & Andrae, M. H. (2015). Regional analgesia for improvement of long-term functional outcome after elective large joint replacement. *The Cochrane Library*. Johnson, R. L., Kopp, S. L., Burkle, C. M., Duncan, C. M., Jacob, A. K., Erwin, P. J., ... & Mantilla, C. B. (2016). Neuraxial vs general anaesthesia for total hip and total knee arthroplasty: a systematic review of comparative-effectiveness research. *British journal of anaesthesia*, 116(2), 163-176.

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## Acute Post-Surgical Pain

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- Effective preemptive multimodal management of post-operative pain supplies several benefits.
  - Facilitates earlier mobilization
  - Diminishes opioid related side effects
  - Improves patient satisfaction
  - Contributes to shorter hospital length of stay

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## Acute Post Surgical Pain Pre-operative Considerations

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### No Pre-operative Education

- Poorer functional outcomes at 6 months

### Effective Pre-operative Education

- Decreased pain levels at 2 weeks
- Greater use of non-medication interventions
- Less pain interference with ADLs

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## Surgical Anesthetic Techniques

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- During joint replacement surgery, the physician may combine general anesthesia with a regional method including epidural or peripheral nerve block.

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## Patient Controlled Epidural Analgesia - PCEA

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- Self administered IV pain medication through epidural catheter placed during surgery.
- Close medication delivery to opioid receptors in dorsal horn increases potency.
- Pump design prevents overdosing by blocking self administration if too early based on medication prescription parameters.

*Only the patient should push the button!!*

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## Peripheral Nerve Block

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- Reliability and duration of the pain relief can be problematic.
- While pain analgesia is achieved, the side effect of muscle weakness can contribute to decrease motor control increasing risk of falls.
  - Femoral Nerve Block common
- Assess patients sensory and motor status to ensure adequate quad strength for out of bed activities.

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## Local Infiltration Analgesia

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- Also referred to as periarticular local anesthetic infusion or high volume local infiltration analgesia.
- The surgeon injects anesthetic into the joint region throughout the surgery and prior to wound closure.
- Medication combinations may vary, but the most common is:
  - Ropivacaine
  - Adrenaline
  - Ketorolac

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## Local Infiltration Analgesia Outcomes

87

- Lower VAS pain ratings, decreased narcotic medication use, and improved motor function contribute to enhanced early therapy participation.



Gibbins, M. L., Kane, C., Smit, R. W., & Rodseth, R. N. (2016). Periarticular local anaesthetic in knee arthroplasty: A systematic review and meta-analysis of randomised trials. *SA Orthopaedic Journal*, 15(3), 49-56.  
 Horn, B. J., Cien, A., Reeves, N. P., Pathak, P., & Taunt Jr, C. J. (2015). Femoral Nerve Block vs Periarticular Bupivacaine Liposome Injection After Primary Total Knee Arthroplasty: Effect on Patient Outcomes. *The Journal of the American Osteopathic Association*, 115(12), 714-719.

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## Cryotherapy

88

- Research reflects only small improvements in pain and ROM when cryotherapy is utilized during the immediate post-operative phase.

| Potential Benefit TKA | Research Outcome  |
|-----------------------|---|
| Decreased blood loss  | 225 ml less blood loss  |
| Decreased pain        | Post-op day 2 less reported pain<br>POD 1 and 3 equivalent    |
| Increased ROM         | 11 degrees greater knee flexion at time of hospital discharge |

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Adie S, Kwan A, Naylor JM, Harris IA, Mittal R. Cryotherapy following total knee replacement. *Cochrane Database of Systematic Reviews* 2012, Issue 9

88

## Continuous Passive Motion - CPM

89

- A CPM machine is applied after TKA to passively move joint through specified ROM.
- Evidence does NOT support the widely accepted rationales for the use of the CPM.
  - Improving knee flexion ROM
  - Pain management
  - Enhanced functional mobility
  - Improved quality of life
  - Decreased risk of DVT
- Use may reduce future risk of manipulation under anesthesia

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Harvey, L. A. (2014). Continuous passive motion following total knee arthroplasty in people with arthritis. *Cochrane Database Of Systematic Reviews*, (3).

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## Arthroplasty Clinical Outcomes

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- Function and Outcomes Research for Comparative Effectiveness in Orthopedics - FORCE Ortho
- This is a current registry gathering data to guide practice, reimbursement, and improve patient outcomes.

<https://forceortho.org/>

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## Factors Associated with Improved Outcomes from TKA

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- Geriatric population does NOT demonstrate reduced functional outcomes or pain management compared to the younger population undergoing TKA.

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## Factors Associated with Improved Outcomes from THA

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- Stronger pre-operative strength of knee extensors on involved side
- Greater walking distance pre-operatively.
- Lower post-operative HHS can be predictor of revision risk.

| HHS                 |  |
|---------------------|--|
| <55 at 2 or 5 years | Predictive of revision                   |
| 16-18 point change  | Minimal clinically important improvement |
| 40 point change     | Moderate clinical improvement            |

Singh, Jasvinder A., et al. "Clinically important improvement thresholds for Harris Hip Score and its ability to predict revision risk after primary total hip arthroplasty." *BMC musculoskeletal disorders* 17.1 (2016): 256.

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## Factors Associated with Poor Outcomes from THA and TKA

93

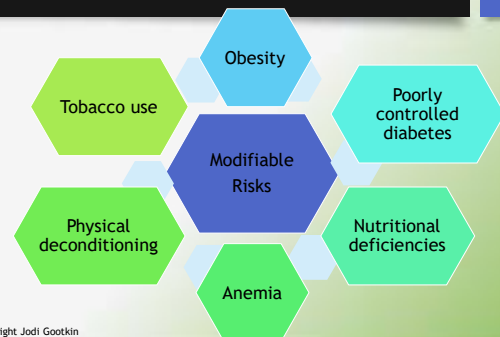
- Research appears to be consistent that having poorer psychological health, more compromised function, and greater pain levels prior to surgery diminish long-term outcomes.

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## Pre-operative Modifiable Risk Factors

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## Obesity

95

- Increased Body Mass Index (BMI) >30-40 contributes to greater risk of post-surgical complications.
  - Aseptic loosening
  - Superficial and deep infections
- Obese patients following total joint replacement report higher pain scores, experience slower recovery from pain, and have greater difficulty restoring functional mobility.

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## Musculoskeletal Comorbidities

96

- Pre-operative arthritic pain elsewhere in the body is associated with poorer physical function.
- TKA patients present with additional arthritic pain in the contralateral knee and low back.
- THA patients present with additional arthritic pain in the ipsilateral knee and low back.

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## Rehabilitation Measures

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- Clinicians use a combination of patient reported outcome measures and performance measures to assess progress.

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## Western Ontario and McMaster Universities Arthritis Index - WOMAC

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- Patient self-assessment tool using 0-5 Likert scale.
- Originally designed specific for OA disability.
- Higher scores indicate greater pain, stiffness, and functional limitation.



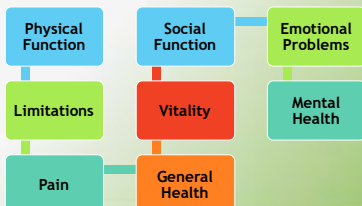
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## Short Form Health Summary - SF-12

99

- Patient self-assessment of physical and mental well being.
- Scores >50 reflect better physical or mental health than the mean normative data.



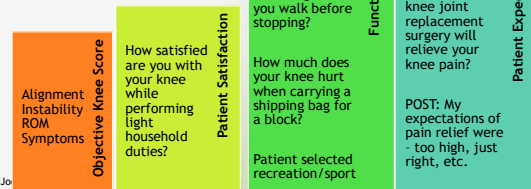
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## Knee Society Score - KSS

100

- Physician and patient pre/post-operative information.
- Assesses expectation, satisfaction, and physical function
- New version expands to sport and recreation activities.



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## Knee Injury and Osteoarthritis Outcome Score - KOOS

101

- Patient self-assessment questionnaire regarding their knee and associated problems in the past week.
- Specifically considers stiffness, pain, function in sport/recreation, activities of daily living, and quality of life.
- Score of 100 indicates no symptoms and score of 0 reflects extreme symptoms.
- Minimal Important Change is suggested to be 8-10.

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## Hip Dysfunction and Osteoarthritis Outcome Score - HOOS

102

- Patient self-assessment questionnaire regarding their hip and associated problems in the past week.
- Specifically considers stiffness, pain, function in sport/recreation, activities of daily living, and quality of life.
- Score of 100 indicates no symptoms and score of 0 reflects extreme symptoms for each subscale.

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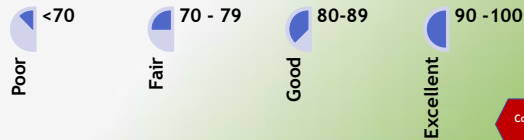
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## Harris Hip Score - HHS

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- Clinician based tool considered Gold Standard for assessing hip surgical outcomes.
- Rates patient's pain, function, and joint mobility.
- Scores range from 0-100 with a higher score indicating less dysfunction.



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## Patient Satisfaction

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- The majority of patients appear to be satisfied with their post-operative achievements.
- Dissatisfaction tends to be related to pain and limited ability to kneel and descend stairs.

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## Chronic Post-Surgical Pain

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- Multifactorial symptom with anatomical and psychological components to address.
- Greater post surgical pain, poor mental health, and presence of musculoskeletal comorbidities may contribute to the risk of developing chronic postsurgical pain.
- Consider central-sensitization of pain and fear avoidance during the early post-operative phase.

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## Iliopsoas Impingement

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- Prominence of the anteroinferior rim of the THA acetabular cup causes mechanical irritation to the iliopsoas tendon.
- Symptoms are consistent with tendonitis.
- Imaging studies confirm the diagnosis.
- Management options include physical therapy, corticosteroid injections, arthroscopic tenotomy, or acetabular revision.

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## Pre-operative Patient Education

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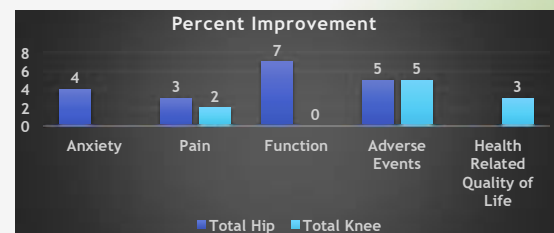
- Traditional "Prehab" content is function based with patient education emphasizing:
  - Exercise programs
  - Mobility training
  - Adaptive equipment
  - Home environment safety
  - post-operative precautions

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## Pre-operative Education Outcomes

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*"unsure if it offers benefits over usual care"*



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McDonald, S., Page, M. J., Beringer, K., Wasiake, J., & Sprowson, A. (2014). Preoperative education for hip or knee replacement. *The Cochrane Library*.

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## Pre-Operative Education Outcomes continued

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*"Invite the patient to be an active participant"*

- Primary benefit is to improve patient awareness and expectations.

Decreased anxiety

Possible minimal decrease in hospital length of stay

No difference in:

- Pain level
- Pain interference
- Recovery rate
- Function

Consider This

Hass, S., Jaekel, C., & Nesbitt, B. (2015). Nursing strategies to reduce length of stay for persons undergoing total knee replacement: integrative review of key variables. *Journal of nursing care quality*, 30(3), 283-288.  
Wilson, R. A., Watt-Watson, J., Hodnett, E., & Tramer, J. (2016). A Randomized Controlled Trial of an Individualized Preoperative Education Intervention for Symptom Management After Total Knee Arthroplasty. *Orthopaedic Nursing*, 35(1), 20-29.

109

## Symptom Management Education

110

- To maximize benefits, inform the patient of the peri-operative pathway focusing on symptom management strategies.

- Importance pain relief for activity
- Communicating pain level
- Requesting analgesics and antiemetics
- Preventing dehydration

Pain

Mobility

Nausea

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## Pre-operative Patient Empowerment

111

Learn Relaxation Techniques

Build Self Confidence

Manage Emotions

Align Beliefs

Self-efficacy training may yield physical and psychological benefits to enhance outcomes.

Consider This

Cooke, M., Walker, R., Aitken, L. M., Freeman, A., Pavay, S., & Cantrill, R. (2016). Pre-operative self-efficacy education vs. usual care for patients undergoing joint replacement surgery: a pilot randomised controlled trial. *Scandinavian Journal of caring sciences*, 30(1), 74-82.

111

## Early Post-Operative Mobilization

112

Improved pain

Improved ROM and strength

Improved functional mobility

Reduced hospital length of stay

More efficient and cost effective care

Enhanced health-related quality of life

Benefits of early post-surgical mobilization.

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## Physical Therapy Day of Surgery

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- At minimum within 24 hours of surgery, sitting upright and an attempt at ambulation should occur.

Pre-operative Education

Early Mobilization

Improved Outcomes

Consider This

Hass, S., Jaekel, C., & Nesbitt, B. (2015). Nursing strategies to reduce length of stay for persons undergoing total knee replacement: integrative review of key variables. *Journal of nursing care quality*, 30(3), 283-288.  
Guerra, M. L., Singh, P. J., & Taylor, N. F. (2015). Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: a systematic review. *Clinical rehabilitation*, 29(9), 844-854.

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## Physical Therapy Day of Surgery

114

- As early as 4 to 6 hours post surgery has been shown to help achieve functional recovery and reduce hospital stays.

Day of Surgery: 67% discharged in 3 days or less

Post-op day 1: 57% discharged in 3 days or less

Consider This

Hass, S., Jaekel, C., & Nesbitt, B. (2015). Nursing strategies to reduce length of stay for persons undergoing total knee replacement: integrative review of key variables. *Journal of nursing care quality*, 30(3), 283-288.  
Guerra, M. L., Singh, P. J., & Taylor, N. F. (2015). Early mobilization of patients who have had a hip or knee joint replacement reduces length of stay in hospital: a systematic review. *Clinical rehabilitation*, 29(9), 844-854.

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## Early Mobilization Considerations

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- Weight bearing status varies among physicians.
  - Cemented tends to permit earlier weight bearing as tolerated.
- Coordinate therapy with pain medication administration to allow easier participation in rehabilitation interventions.
- Femoral nerve block decreases quad strength potentially increasing risk of falls.

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## TKA Acute Care Phase

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- Rehab goals directed at decreasing swelling, increasing range of motion, enhancing lower extremity strength, and maximizing mobility.
- Encourage knee extension with trochanter roll and towel roll at ankle.

| Knee Flexion ROM | Post-op Week Achieved At |
|------------------|--------------------------|
| 90 degrees       | 1-2                      |
| 100 degrees      | 3-4                      |
| 120 degrees      | 5-8 weeks                |

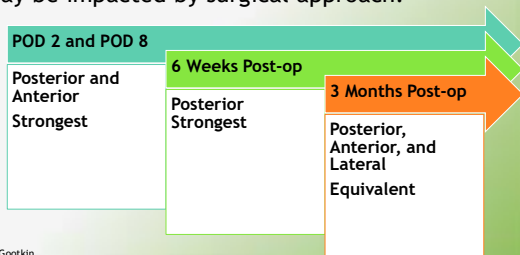
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## Surgical Approach Impact on THA Strength

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- Hip Abduction and Extension muscle strength may be impacted by surgical approach.



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## Aquatic Therapy

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- Buoyancy reduces the relative body weight and diminishes compressive forces on the lower extremities allowing earlier ambulation and progressive resistance exercise.

| Outcome                      | Compared to land based therapy            |
|------------------------------|---|
| Wound Infection              | No increased risk                         |
| ADL's                        | Improved function                         |
| Muscle Strength              | Increase knee extension and hip abduction |
| ROM                          | Increased knee flexion                    |
| Pain, Edema, Quality of Life | No statistical difference                 |

Villalta, E. M., & Peiris, C. L. (2013). Early aquatic physical therapy improves function and does not increase risk of wound-related adverse events for adults after orthopedic surgery: a systematic review and meta-analysis. *Archives of physical medicine and rehabilitation*, 94(1), 138-148.

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## Effectiveness of Therapy

119

- Physical therapy improves function at 3-4 months post-op TKA compared to no therapy.
- Outpatient and home care therapy demonstrate equivalent improvement in pain and function.
- Supervised use of THA adaptive equipment by occupational therapist can reduce disability.

Artz, N., Elvers, K. T., Lowe, C. M., Sackley, C., Jepson, P., & Beswick, A. D. (2015). Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. *BMC musculoskeletal disorders*, 16(1), 15.

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## Conclusion

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- The continued evolution of surgical techniques and components combined with a broader perspective on the role of rehabilitation professionals throughout the continuum of care will foster enhanced patient outcomes from total joint arthroplasty.

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1. What is the term for the technique involving injection of hyperosmolar dextrose solution into the joint to stimulate the body's natural healing mechanisms?
- a. Prolotherapy
  - b. Corticosteroid Injection
  - c. Stem Cell Infusion
  - d. Glucosamine Supplementation

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2. The posterior stabilized total knee arthroplasty sacrifices which ligament(s)?
- a. No ligaments
  - b. Anterior Cruciate only
  - c. Posterior Cruciate only
  - d. Both Anterior and Posterior Cruciate

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3. Which of the following is NOT a potential benefit of anterior approach total hip arthroplasty?
- a. Reduced muscular trauma
  - b. Accelerated weight bearing status
  - c. Improved function during early rehab
  - d. Shorter hospital length of stay

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4. Which of the following is TRUE of cementless total hip replacement?
- a. Future revisions are more complicated
  - b. Greater weight bearing can occur immediately after surgery
  - c. Good stability can be achieved in patients with osteoporosis
  - d. Failure due to loosening occurs less often in younger patients

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5. Which of the following increases the risk of post-operative deep vein thrombosis after total joint replacement?
- a. Patient being over 65 years old
  - b. Type of anesthetic utilized during surgery
  - c. Immobility without the use of mechanical compression
  - d. History of joint tumor

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6. Patients who receive \_\_\_\_\_ may demonstrate decreased pain scores and narcotic consumption following total knee replacement.
- a. General anesthesia
  - b. Oral pain medication
  - c. Local infiltration analgesia
  - d. Systemic anesthetic

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7. The \_\_\_\_\_ is a clinician based tool considered the “gold standard” to assess hip surgical outcomes.
- a.HHS
  - b.KOOS
  - c.HOOS
  - d.WOMAC

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8. The \_\_\_\_\_ is a five part patient self-assessment questionnaire to assess their opinion of their knee and associated problems.
- a.HHS
  - b.KOOS
  - c.KHS
  - d.WOMAC

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9. Based on current research, what is the primary benefit of pre-operative patient education programs prior to total joint replacement?
- a.Decreased pain interference
  - b.Reduced length of stay
  - c.Less post-operative complications
  - d.Improved patient awareness and expectations

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10. Which of the following is NOT a benefit of early post-surgical mobilization?
- a.Decreased risk of incision site infection
  - b.Reduced hospital length of stay
  - c.Improved range of motion
  - d.Enhanced health-related quality of life

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