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MAKOplasty®
Walk Away From Knee Pain With
Surgeon-Interactive Robotic Arm Surgery
MAKOplasty

- Robotic Computerized Navigation Systems
  - Assists with Partial Knee and Total Hip Replacements
- Utilizes a Pre-operative CT Scan
  - 3D computerized model built
- Intra-operative robotic arm assists in placement of implants
MAKOplasty

• Results in more ACCURATE, PRECISE and RELIABLE placement of implants

• OPTIMIZES RESULTS
  – Increased longevity of joint replacement
  – Minimizes complications
What is a Robot?

- According to Wikipedia:
  - A mechanical or virtual agent, usually an electro-mechanical machine
  - Guided by a computer program or electronic circuitry
• Used extensively in industry and construction
Medicine and Robots

• da Vinci Medical Robot
Mako Robot

- More of an additional tool for the procedure than a new way of doing the procedure
- Surgeon in control at all times- not at an independent work station
MAKOplasty®
Walk Away From Hip Pain With Surgeon-Interactive Robotic Arm Surgery
Degenerative Joint Disease (DJD) of the Hip

- Hip Anatomy
Degenerative Joint Disease (DJD) of the Hip

Osteoarthritis (OA)

- A degenerative bone disease that causes cartilage found on healthy joints to break down, removing the buffer between bones.
- Osteoarthritis (OA) is the most common cause of hip replacement surgery.\(^1\)
- 14.3% of older adults report significant hip pain\(^2\)
- 50% growth in hip OA expected by 2035, from the 3 million currently suffer with hip OA

1. AAOS website, retrieved September 2011
Degenerative Joint Disease (DJD) of the Hip

Rheumatoid Arthritis (RA)
- An inflammatory arthritis of the joints.
Degenerative Joint Disease (DJD) of the Hip

- Post-Traumatic Injury (severe fracture or dislocation)
Degenerative Joint Disease (DJD) of the Hip

- **Avascular Necrosis (AVN)**
  - Condition where the “ball” of the femoral head has lost a healthy supply of blood flow, causing the bone to die and the femoral head to become misshapen.
Degenerative Joint Disease (DJD) of the Hip

- **Hip Dysplasia**
  - Condition in which bones around the hip did not form properly, which may cause misalignment of the hip joint.

![Diagram of normal and dislocated hip joint](image)
Degenerative Joint Disease (DJD) of the Hip

- Who Experiences the following Signs & Symptoms?
  - Pain while putting weight on the affected hip
  - Limping to lessen the weight-bearing pressure on the affected hip
  - Pain that may radiate to the groin, lower back, or down the thigh to the knee
  - Hip pain or stiffness during walking or other impact activities
  - Failure to respond to non-surgical treatments or non-steroidal anti-inflammatory medication
Osteoarthritis

- Reduced Joint Space (Bone-on-bone)
RIO® Enables Consistently Reproducible Precision

Post-operative X-ray
Complications in Total Hip Arthroplasty

• Short Term
  • **Dislocation** is the leading short term complication for total hip Replacements\(^2\) — National average is around 4\(\%\)\(^2\)
  • **Leg Length Discrepancy**

• Long Term
  • **Implant loosening** caused by vertical cups and polyethylene wear\(^4\)
  • **Accelerated Wear**

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### THA Implant Alignment Options

- **Conventional Techniques**
  - Manual Alignment Guides

- **Advanced Alignment Tools**
  - Navigation Systems

- **Precision Surgical Assistance**
  - MAKOplasty® Robotic Arm Assisted THA
Robotic Arm Assisted MAKOplasty® Hip

• Consistently Reproducible Precision
• Patient-specific 3-D pre-op and intra-op planning
• Guided femoral neck resection
• Robotic arm assisted and controlled acetabular reaming
• Robotic arm assisted and controlled cup placement
• Leg length and offset measurement intra-op
RIO® Enables Consistently Reproducible Precision

Pre-operative Planning

![Pre-operative Planning Image]
RIO® Enables Consistently Reproducible Precision

Intra-operative Reaming
RIO® Enables Consistently Reproducible Precision

Intra-operative Impaction
Am I a Candidate?

• Typical process
  • Office Visit
  • Physical Exam
  • X-rays Taken
• If Yes
  • CT Scan performed
  • Joint Arthroplasty Education Seminar
  • Pre-admission Testing
  • Admission to Hospital
  • Home and/or Outpatient Physical Therapy
  • In-office Follow-up Exam
Osteoarthritis

• Knee Anatomy

Diagram showing knee anatomy with labels:
- Patella (kneecap)
- Femur (thighbone)
- Anterior cruciate ligament
- Patella ligament
- Articular cartilage
- Lateral meniscus
- Medial meniscus
- Blood vessels
- Tibia (shinbone)
- Fibula
Osteoarthritis (OA)

- A degenerative bone disease that causes cartilage found on healthy joints to break down, removing the buffer between bones.
- 15 million Americans suffer with OA of the knee.¹
- 46% of people will develop knee OA over their lifetime. ²
- The 55+ age group, peak knee pain candidates, will grow 3 times the average rate of the U.S. Population, reaching 96 million by 2020.³

¹ AAOS
² Arthritis Care & Research, September 2008. Thurston Arthritis Research Center, University of North Carolina-based Johnston County Osteoarthritis Project.
³ U.S. Census Bureau
Osteoarthritis Disease Progression

**Progression of knee joint disease**

- **Early-stage: Mild disease**
  - Sports related injuries
  - Minor defects/ loss of cartilage

- **Mid-stage: Moderate disease**
  - Increased pain
  - Reduced mobility
  - Changes to lifestyle/sports activities
  - Partial knee disease: one or two compartments

- **Late-stage: Severe disease**
  - Leading cause of disability
  - Severe pain
  - Walking, stair climbing challenging
  - Total knee disease
Osteoarthritis of the Knee

- Who Experiences the following Signs & Symptoms?
  - **Pain**
    - Standing or walking short distances
    - Climbing up and down stairs
    - Getting in and out of chairs
  - **Stiffness**
    - Initiating activities from a sitting position
    - After getting out of bed
  - **Swelling**
  - A Grating Sensation or Crunching Feeling
  - Decreased Range of Motion (Ability to bend knee fully)
  - **Instability**
  - **Reduced Activity**
Osteoarthritis

- Reduced Joint Space (Bone-on-bone)

- Normal
- Bowleggedness (Varus)
- Knock Knees (Valgus)
Osteoarthritis

- Reduced Joint Space (Bone-on-bone)
Osteoarthritis causes of bone-on-bone knee pain?

- Old Sports Injury (tears or fractures)
Osteoarthritis causes of bone-on-bone knee pain?

- Long-term Impact Activities (work or sports)
Osteoarthritis causes of bone-on-bone knee pain?

- Obesity

Normal joint force  Joint force due to obesity
Non-Surgical Treatment Options

- Change in activities to include low-impact exercising (i.e. biking, swimming etc)
- Nonsteroidal anti-inflammatory drugs
- Injections (Cortisone & Viscosupplements)
- Weight loss
Surgical Treatment Options

Arthroscopic Surgery

- Cleans or trims damaged cartilage (debridement)
- Variable benefits - may be just for diagnostic purposes
Surgical Treatment Options

**Unicondylar Knee Arthroplasty (UKA)**
(also known as Partial Knee Arthroplasty)

- Less than 50,000 partial knee procedures in the United States in 2007
- ACL and PCL remain intact
- Traditionally performed with manual instruments
Total Knee Arthroplasty (TKA) is considered the Gold Standard

- 600,000 performed annually in U.S.
- Proven long term survivorship 90% out 15 years
- Can correct large deformities
What do we consider when selecting implants?

• **Substrate strength (polyethylene)**
  – How long will the plastic last?
  – Lab testing is positive.

• **Alignment of the implants**
  – If aligned properly, we believe the plastic and components will last longer
RIO® Enables Consistently Reproducible Precision

Pre-operative Planning

TRANSVERSE

External

0.9°

CORONAL

Varus

1.3°

SAGITTAL

Posterior Slope

1.4°
RIO® Enables Consistently Reproducible Precision

Intra-operative Registration
RIO® Enables Consistently Reproducible Precision

Intra-operative Adjustments – Knee Balancing
RIO® Enables Consistently Reproducible Precision

Intra-operative Resurfacing
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Partial Knee Replacement
RIO® Enables Consistently Reproducible Precision

Total Knee
RIO® Enables Consistently Reproducible Precision

Post-operative X-rays - Unicondylar
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Post-operative X-rays - Patellofemoral
RIO® Enables Consistently Reproducible Precision

Post-operative X-rays - Bicompartmental
Potential Benefits of MAKOplasty®

- Performed through a smaller incision than that required for traditional total knee replacement surgery.
- Only the arthritic portion of the knee is removed, preserving healthy bone and tissue.
- Implants are optimally positioned in the knee joint to allow the knee to move smoothly again.
  - Improved surgical outcomes
  - Less implant wear and loosening
  - Bone sparing
  - Smaller incision, Less invasive
  - Less scarring
  - Reduced blood loss
  - Minimal hospitalization
  - Rapid recovery
  - Ligaments remain intact for a more natural feeling knee

* Individual results may vary. There are risks associated with any knee surgical procedure, including MAKOplasty®. Your physician can explain these risks and help determine if MAKOplasty® is right for you.
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MAKOplasty = Future of Joint Replacements

Thank You

Restoring Quality of Life Through Innovation®