



171 Ashley Avenue
Charleston, SC 29425
834-792-2300
www.musc.edu



**Joint Implant
Surgery and
Research
Foundation**

17321 Buckthorne Drive
Chagrin Falls, OH 44023
440-543-0347
www.jisrf.org

Modular Stems for Revision THA

By H. Del Schutte, Jr., M.D., Harry A. Demos, M.D., Neil C. Romero, M.D., Timothy McTighe, Dr. H.S. (hc)

Introduction

Revision hip arthroplasty has become an increasingly common surgical procedure. Approximately 100,000 joint revisions are done per year in the United States and reports indicate an increase of 11-13% in 2004¹⁰. Recently there has been an increase in the use of distally fixed proximal modular stems in an attempt to decrease the implant and joint instability and offset problems occurring during revision hip arthroplasty. The most common cause of proximal bone loss is due to osteolysis and aseptic loosening, resulting in a variety of femoral deficiencies that makes revision surgery more difficult^{3,15}. The following assessment system has proven to be helpful for selection of specific implant design features.

Area of Concern - Fatigue Strength

All devices are subject to fatigue failure especially with the increased patient activity we are seeing today. There are reports of device failure regardless of material, and regardless of design style (monoblock, modular). Recent reports of failures of total hip stems have led to more vigorous testing and the development of implants with improved material properties. In addition stems have been designed with greater ability for bony fixation at all levels of the stem. It is anticipated that all stem designs which allow for better fixation have the potential to be less susceptible to late failure. Recognizing design and material limits is part of the surgeon's responsibility in choosing the appropriate implant¹⁶.

The issues of fatigue, fretting and corrosion are areas that we are all

concerned with and need to know how our individual modular devices stack up. It is not possible for community based orthopaedic surgeons to know or be familiar with all the current standards for material testing but we do have a responsibility to demand and review from device manufactures appropriate material test

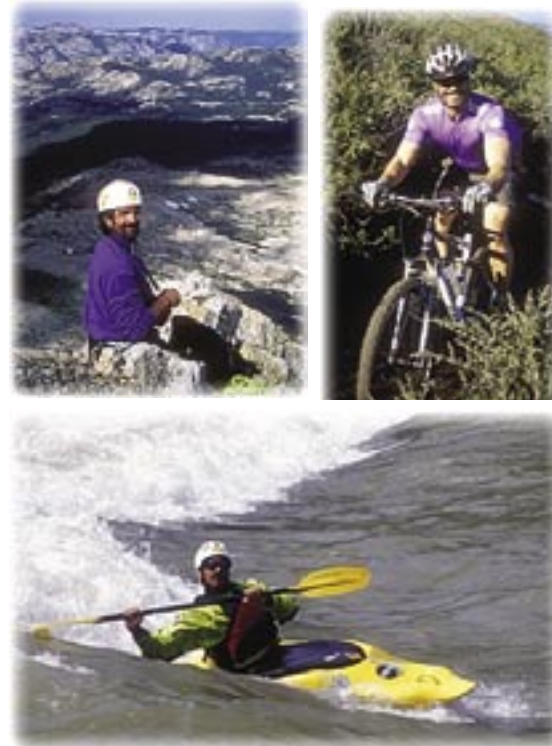
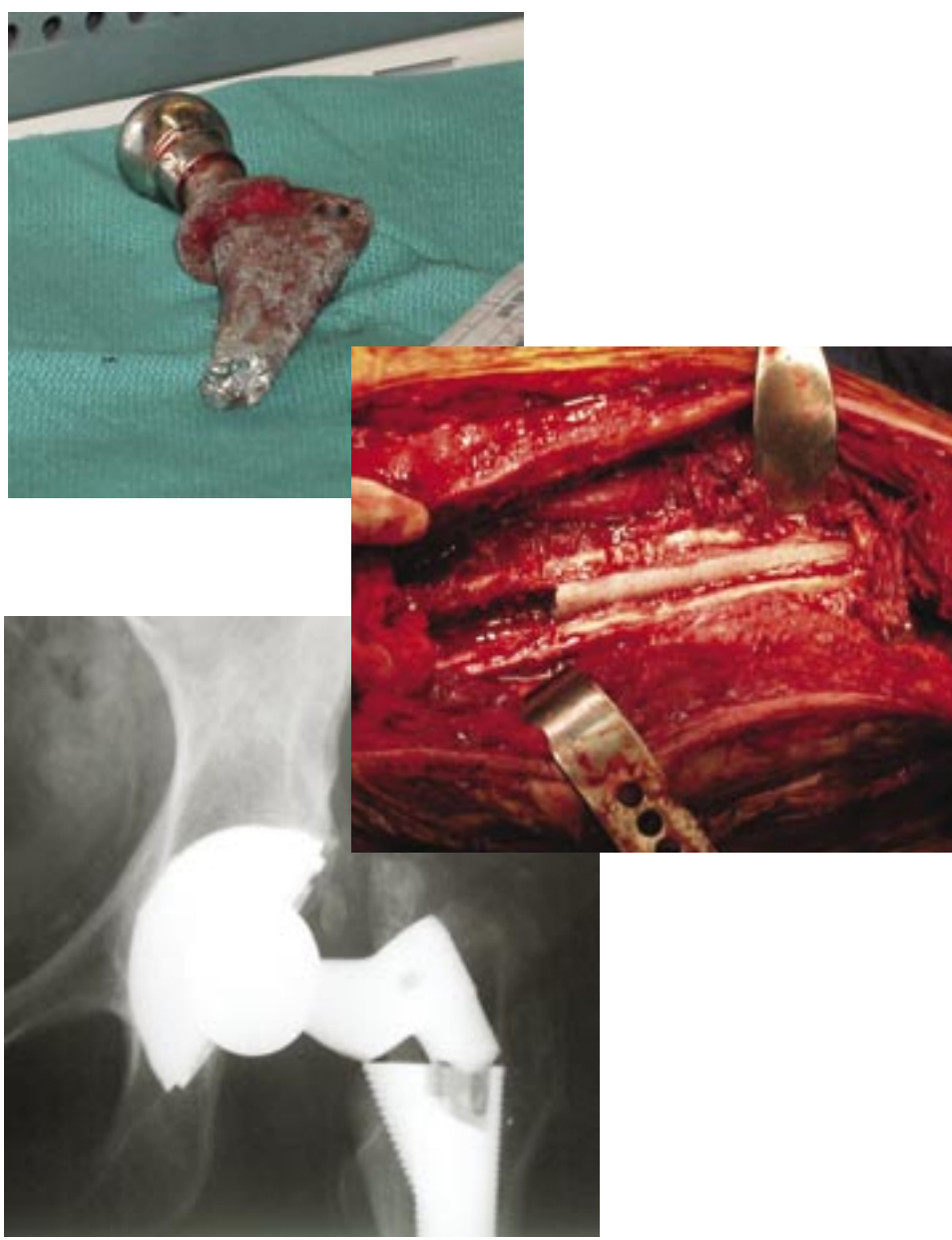
on the devices we are using especially new materials and designs.

Patient activity is placing higher demands than ever before on total joint reconstruction and revision surgery is often the reality especially when one does not understand or appreciate the limits of design and /or material of the device that is selected.

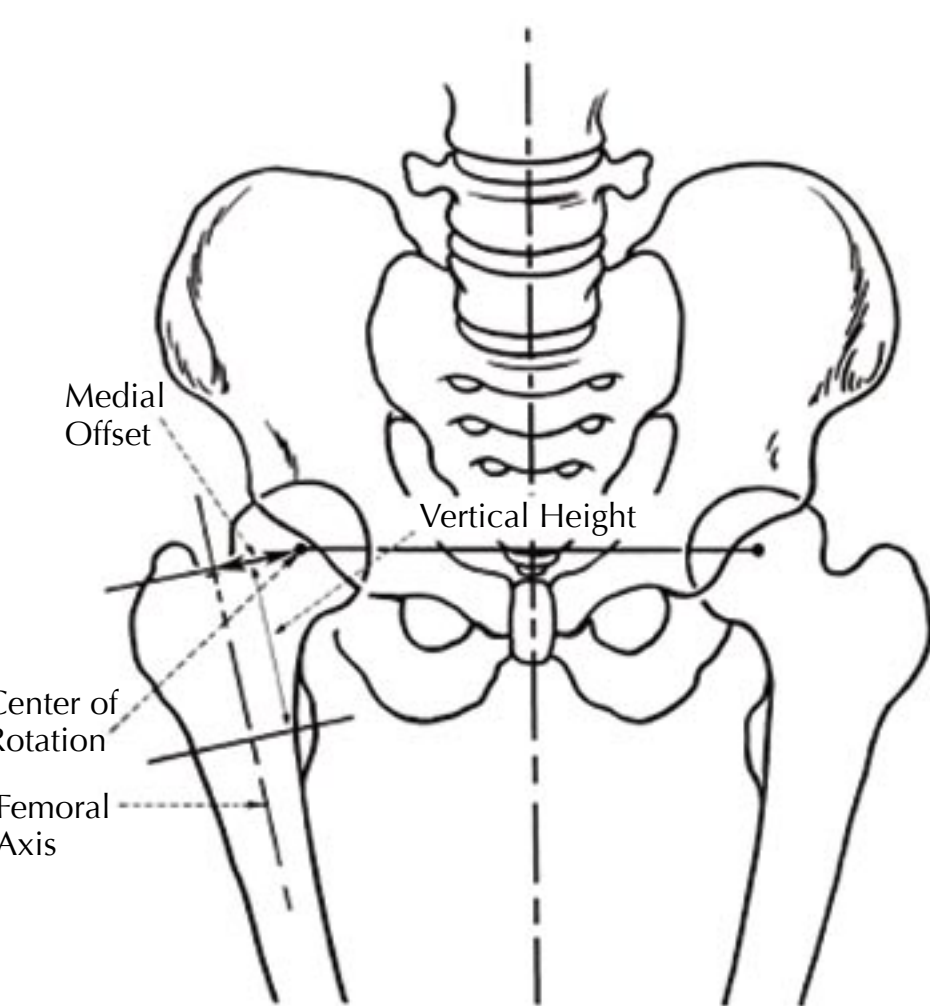
Restoring Hip Mechanics

Restoration of hip joint mechanics is critical to a successful outcome for all total hip reconstruction¹⁸. Correction of femoral head offset affects the joint reaction line and helps restore mechanical balance between adductor forces^{7,12}. If the offset is too short it will result in increased resultant forces across the hip joint, and possibly increase limp⁷. Offset too great will increase torsional and bending forces on the femoral implant.

Vertical height too short can jeopardize joint stability and if too long can result in nerve palsy and patient complaints. Incorrect version angles can impair range of motion resulting in implant impingement, joint dislocation, and increased generation of particulate debris.

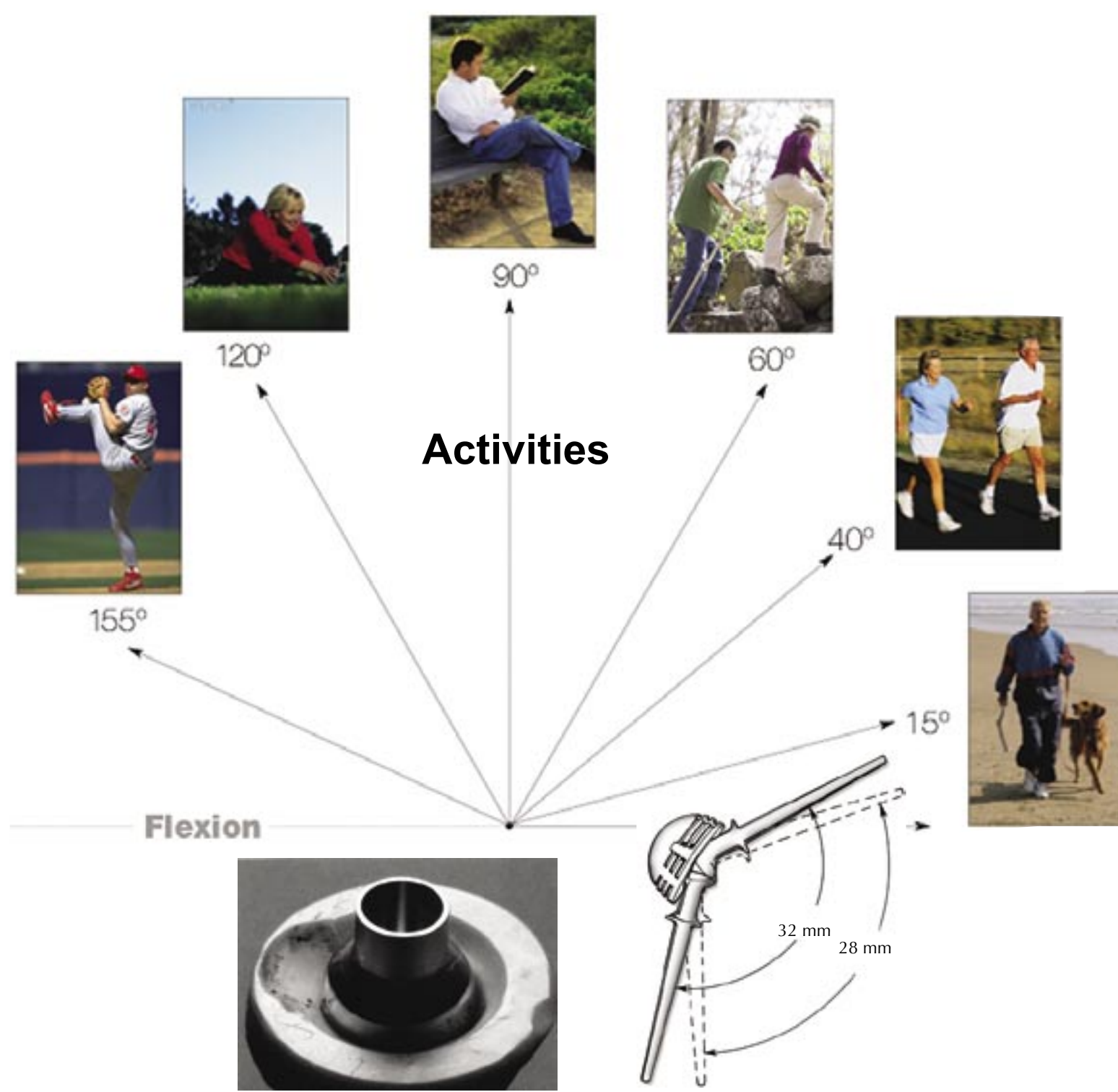


Examples of increased patient activity.



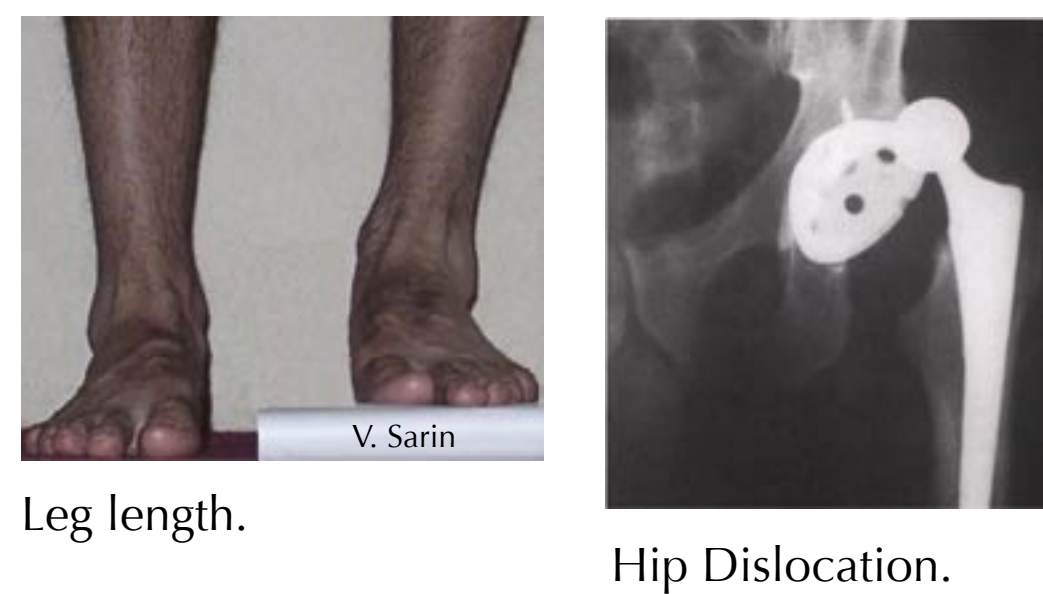
Range of Motion

Two factors that can affect range of motion are component positioning and component geometry^{8,13}. Head diameter, neck shape and skirts on femoral heads can all affect hip range of motion¹³. Although physiological range of motion varies for each patient an average of 114° of flexion is required for sitting. There is no question that certain activities require a greater degree of motion.



Major Problems

Two major problems in revision hip surgery are joint stability and correction of leg length. According to Dr. Hugh U. Cameron the most significant medical/legal concern in THA is leg length discrepancies. Estimating dislocation rates of both 2% and 10% there would be a corresponding 6 to 30 thousand dislocated hips each year. Subsequently total cost of dislocations in the U.S. would be \$64.522 to \$322.5 million respectively.



Leg length.

Hip Dislocation.

Implant Selection

The Restoration® Modular Stem system allows for independent selection of proximal bodies and distal stem styles and lengths. The mixing and matching of the modular components provide significant versatility in treating femoral deficiencies. The proximal body is attached by means of a taper lock that has received proprietary processing (shot peening) yielding higher fatigue, fretting and torsion results.

This poster will focus on our experience using the cone-shaped proximal bodies of the R/M Cone, RT3 and Link MP™.

Fifty Restoration® Stems were used for revision of indexed primary stems, secondary revision stems, and infections. A variety of bone deficiencies were encountered from minor bone loss (type 1) to extreme (type 4) requiring both impaction and strut grafts.

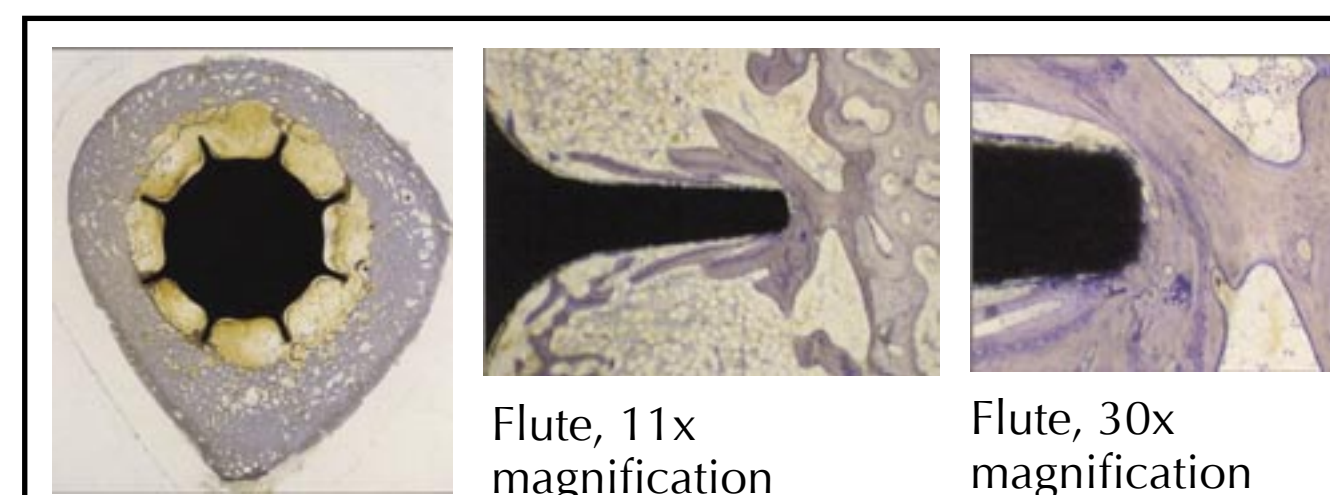
Of the fifty, thirty-five stems were the original T3 design, fifteen stems were the new Restoration® Modular cone, and twenty-three Link MP stems.



Distal Stems

Distal stems of the Restoration® Modular are available in three different styles including fluted, plasma coated, and conical straight taper stem. All stems are available in a variety of lengths and styles (straight and bowed). Our experience is with the conical stem.

The fluted distal stem of the Restoration Modular is designed from the successful stem geometry of the Wagner stem that has demonstrated excellent bone adaptation as shown to the right in this retrieved specimen.



Retrieval 5.5 months after implantation, 65 year old, 85kg patient.

R.K. Schenk, U. Weheli, On the reaction of the bone to a cementless SL femur revision prosthesis; Orthopaedics (1989) 18; 454-462

Results

- 99-02 23 Link MP
 - 1 stem fracture
 - 1 dislocation
 - 0 clinically observable subsidence or aseptic loosening
 - 01-Current 50 restorations
 - 01-03 35 RT3
 - 04-Current 15 Restoration Modular
 - 2 patients deceased
 - 3 patients lost to follow-up
 - 0 dislocation
 - 0 fractures
 - 0 revisions
 - No measurable subsidence
- Long-term data is necessary to clearly demonstrate the viability of modular revision systems. However, recent improvements to mechanical properties of the taper along with proven stem design features should aid the surgeon in restoring normal mechanics to the reconstructed hip.

Predictions and Concerns

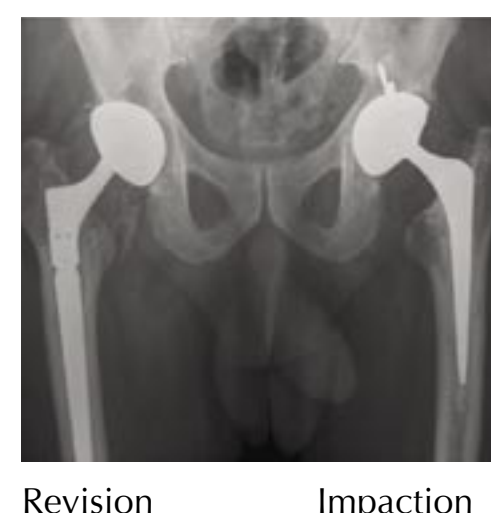
- Modularity is here to stay
- Increased Patient Activity & BMI Influences Outcomes & Device Failure
 1. High Impact Yield Failure
 2. Long Term Fatigue Failure
- Increased Device Malposition due to Limited Exposure
- Increased Medical/Legal Exposure

Final Comments

- All devices are subject to failure.
- Recognize design and material limits and do not over indicate,
- Warn your patients that device failure is directly linked to activity and BMI.
- Recognize required technique for specific modular designs and do not attempted to change surgical technique and device technique at the same time.
- Revisions are always with us – therefore select devices that take retrievability into account.



Loose cemented stem.



Revision restoration conical cone one year post-op.



Impaction graph three years post-op.



Infected cemented stem.



Antibiotic cement spacer.



Revision modular stem.



Infected hip revision. Antibiotic cement spacer.



Revision modular stem with strut grafts.



Initial post-op.



Two months post-op.



**New Zealand Orthopaedic
Association**
Annual Scientific Meeting
2-5 October 2005

**Poster Exhibit
2005**