Lecture materials 9/25/02
Acetabular Cup Fixation
Hip Load Discretization
Serial FE Contact Stress Solutions ( # = 16 )
Effect of Metal Backing
Alteration of Pelvic Stresses
Design Assessment & Development
Questions in the Design Process

- What clinical problem motivates the change?
- How does the problem relate to design?
- What innovation would improve the design?
- Does the change solve the clinical problem?
- Does it cause other/worse problems?
FDA-approved designs: 709
Failure Scenarios

• Pre-Clinical Testing
  – Trial & error culture
  – $ Scramble, Champion charisma
• Gold Standard: LTFU
• Laboratory tests & FEA
• Early clinical measures(RSA, Dx-ray, DEXA, gait analysis)
• Validity of lab tests?
THA Failure Scenarios

- Accumulated damage
- Particulate reaction
- Failure to bond
- Stress shielding
- Stress bypass
- Destructive wear
- Recurrent Dislocation
Accumulated Damage Scenario

- Repetitive dynamic loading
- Microdamage
- Crack nucleation, propagation
- Interface disruption
- Micromotion
- Bone resorption, fibrous interposition
- Gross loosening
Particulate Reaction Scenario

- Most common nowadays
- Particles activate macrophages
  - Bearing surface wear
  - Modular interface fretting
  - Small particles are worse (sub-μm)
  - Transport to remote locations
- Inflammatory cytokines
- Osteolysis
- Relative motion, loosening
The Cause: Polyethylene Wear

The Mechanism: Osteolytic Aseptic Loosening
Failure-to-Bond Scenario

• Non-cemented interfaces
  – Due to excessive gaps
  – Due to excessive relative motions