How Stiff Should the Construct Be?
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1. Introduction
   a. Mechanical engineering background
   b. Industry and academic jobs in orthopaedics

2. Current Standards of ORIF
   a. Plates and screws
   b. Nails

3. Problems that are encountered
   a. Poor bone quality
   b. Nonunion
   c. Cut-out

4. Techniques we use to “tune” implants
   a. Materials and geometry
      i. Stainless Steel
      ii. Titanium
      iii. Others?
   b. Surgical Augmentation
      i. Locked and non-locked plates
      ii. Cortical and cancellous screw selection
      iii. Bone substitute materials
      iv. Overdrilling the near cortex
      v. Bridging and number of screws used

5. Our lab’s experiences- a brief review of recent projects
   a. Variations in plate and screw designs
      i. 2.7mm vs. 3.5mm plates in clavicle ORIF
      ii. Hollow vs. solid screws in Lisfranc injuries
      iii. Locking caps vs cross-threading in polyaxial locking plates
   b. Screw use and implant placement
      i. Screw use in olecranon repairs
      ii. ‘Missing’ the calcar in proximal humerus repairs
   c. Too stiff or not stiff enough in proximal humerus repairs?
      i. Cement augmentation
      ii. Far cortical locking
      iii. Both?

6. Ongoing and future research directions
   a. Assessing implant failure with serial fluoroscopy during fatigue tests
   b. Rethinking test standards to better reflect clinical experience
      i. More complex rigs in simple test frames
      ii. 3-D robot manipulation
      iii. Sawbones vs. cadaver vs. 3-D printed bones
   c. Lightweight and accessible computational models
      i. Dynamic activities of daily living
      ii. Trauma is under-studied in this area

7. Conclusions
   a. A really ‘simple’ engineering problem is actually very difficult to solve
   b. Clinic-lab-industry partnerships are imperative