How Stiff Should the Construct Be?

Michael Hast, PhD
hast@pennmedicine.upenn.edu

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

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