The Association Between Preoperative 3D Rendering Prior to an Elective Total Knee, Shoulder or Hip Arthroplasty and Postoperative Outcomes: Real World Evidence from the OHDSI Network

3D Ankle Fracture

Fig. 6 A 13-year-old male patient who tripped and fell down several stairs and subsequently presented with right ankle pain. a Sagittal 2D MDCT image indicates the presence of an acute triplane fracture, which may be considered a Salter IV-type fracture (black arrowheads). b, c CR reconstructions in the same patient allow a 3D evaluation of the fracture parts, including oblique fracture through the metaphysis, horizontal fracture through the non-ossified physis, and vertical-oblique fracture through the epiphysis.

Background: 3D Rendering

• 3D renderings are reconstructed from cross sectional images (CT, MRI, etc.)
• Widely used for visualizing complex anatomy and pathology
• CPT codes 76376 and 76377 introduced in 2006
• Without or with an independent workstation (i.e. CT scan vs. 3D Lab)
• Reimbursement policies for 3D renderings vary by insurance providers
• We are interested in large scale, observational data about preoperative use of 3D rendering before a total knee arthroplasty (TKA), total shoulder arthroplasty (TSA) and total hip arthroplasty (THA)
Background: Arthritis and Arthroplasties

Arthritis

TKA

UKA

Stryker Mako™ Robotic-Arm Assisted Total Knee Replacement System

Mako Robotic-Arm

Mako Camera Stand

Advanced Software

Mako Guidance Cart & Software

ROBOTIC JOINT CENTER BUECHEL
Public Health Impact: Revision Arthroplasties

• Revision arthroplasties cost more than $3.5 Billion to the United States Healthcare System
• Aseptic mechanical loosening is a leading cause of TKA, TSA, and THA revision
• 3D rendering use may reduce incidences of mechanical loosening and revision arthroplasties

Preop 3D Rendering: Hypothetical Advantages

• Create Intuitive Visualization of Anatomy and Pathology
• Provide Quantitative Measurements
• Improve Decisions about Surgical Access
• Improve Choice of Prosthetic
• Improve Communication among Patients, Healthcare Providers and Trainees
Study Design

• A set of retrospective, observational, cohort studies
• Study Period: 01/01/2006 – Present
• Comparison 1: 3D prior to TKA vs. No 3D prior to TKA
• Comparison 2: 3D prior to TSA vs. No 3D prior to TSA
• Comparison 3: 3D prior to THA vs. No 3D prior to THA
• Outcomes Cohorts: TKA, TSA, THA Revision
• Time-At-Risk: POD#1 – End of Study Period
• Propensity Score, Negative Controls, Positive Controls
3D TKA Cohort

- TKA is the index event, first procedure occurrence, on or after 1/1/2006, 365 days of medical records prior
- At least 1 3D Rendering within 90 days prior to index event
- Not a robotic or computer-assisted procedure
- Age 40+
- No prior knee revision procedure
- No prior knee arthroplasty procedure, observation or condition
- No fracture of bone of knee joint within 90 days prior to index event
Preliminary Results and Analysis Plan

• Preliminary results suggest that 3D rendering cohorts consist of patients who are more complex and are use medical imaging more often than the patients in the comparator cohort
• Consistent with another analysis of an NYC based central data repository, the proportions of 3D renderings done without and with an independent workstation are similar
• Time to Revision
• Proportion of Revisions
• Cost Effectiveness
• Variance by Site and Insurance Provider
Discussion Outline

• Changes to preoperative arthroplasty imaging workup
• Insurance Coverage
• Imaging Nuances
• Evolution of 3D Rendering Technology
• 3D Printing/Patient Specific Instrumentation
• Preop planning vs. Computer-Assisted or Robotic Guidance
• Limitations of Codes and Phenotypes
• Uncontrolled Confounding
Thanks!

- Study Authors (Columbia and Oxford)
- Dr. Patrick Ryan
- Maura
- Future OHDSI Collaborators