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

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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

Rowe SP, Fritz J, Fishman EK Emerg Radiol (2018) 25:93–101

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)

MIP < 1995 VR 1995 CR 2015 CR 2015 CR 2015 CR 2015

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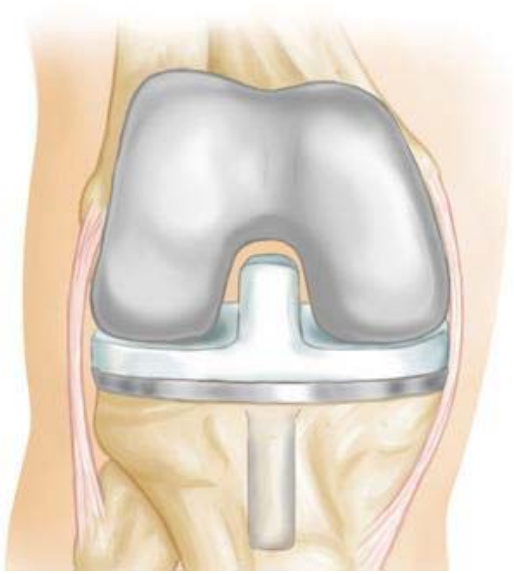
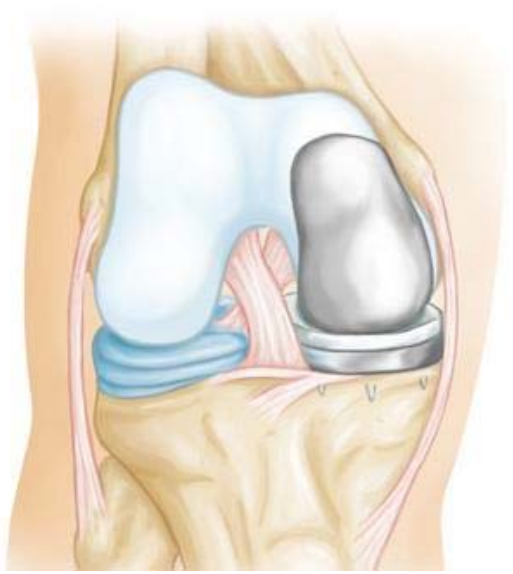
Background: Arthritis and Arthroplasties

Arthritis



TKA



UKA

https://orthoinfo.aaos.org/en/treatment/unicompartmental-knee-replacement/

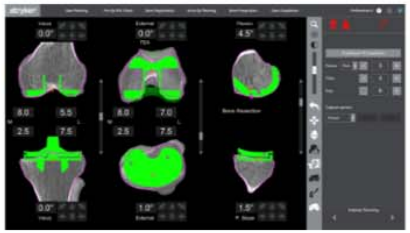
https://orthoinfo.aaos.org/en/treatment/total-knee-replacement/

Stryker Mako™ Robotic-Arm Assisted Total Knee Replacement System

Mako Robotic-Arm

Mako Camera Stand

Mako Guidance Cart & Software



Advanced 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

Delanois RE, Mistry JB, Gwam CU, et. al. The Journal of Arthroplasty 32 (2017) 2663-2668

Gwam CU, Mistry JB, Mohamed NS, et. al. The Journal of Arthroplasty 32 (2017) 2088-2092.

Aibinder WR, Schoch B, Schleck C. J Shoulder Elbow Surg 2017 Mar;26(3):443-449

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!

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- Maura
- Future OHDSI Collaborators