SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY

MARTHA KALISZ
TOTAL KNEE ARTHROPLASTY PROCEDURE

- Purpose: decrease pain, optimize movement
- Resurface femur, tibia, patella
- Position implants, spacer
  - Temporary implant for size
- Balance joint*
- Insert permanent implants
SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY

TKA STATS

- 14th most common inpatient procedure in 2009
- 719,000 TKAs each year, $15,000 per procedure
- 54,000 revisions performed each year, $73,000 per procedure

- 12-13% annual TKA revision rate
- Revision expected inc: 37,544 (2005) - 56,918 (2030)
REASONS FOR KNEE REVISION

- Polyethylene wear
- Loosening
- Instability
- Infection
- Arthrofibrosis
- Malalignment/Malpositioning
- Extensor mechanism deficiency
- Avascular Necrosis - patella
- Periprosthetic fracture
- Isolated patellar resurfacing
CAUSES FOR KNEE REVISION

- Coronal instability
- Coronal/sagittal instability (combined)
- Global instability
- Flexion instability

FREQUENCY OF REQUIRED SURGICAL CORRECTIONS

- Soft Tissue Releases: 49
- Bone Cuts: 29
- Liner Thickness: 15
- Tibial Rotation: 7
 SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY

STUDY BY KIM ET AL

- Population: 39 pts; TKA revision due to stiffness
  - "Stiffness" - ROM <90° or flex contracture >10° 3mo
- Purpose: review outcome of TKA revision due to stiffness to find predictors of failure to gain ROM post-revision
STUDY BY KIM ET AL RESULTS

- **Pre-revision Averages**
  - ROM: 67° (range 0-110°)
  - Flex contracture: 12° (0-40°)
  - Knee Society Score (KSS): 45.7 (19-86)
  - Functional score: 41.8 (5-90)

- **Post-operative Averages**
  - ROM: 85° (range 10-120°)
  - Flex contracture: 6° (0-30°)
  - Knee Society Score (KSS): 67.9 (10-100)
  - Functional score: 62.9 (0-100)

49% REVISION FAILURE

- Unpredictable
SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY

VERASENSE™ BY ORTHOSENSOR

- Ligament balance quantification system
- Sensor and intra-operative monitor
- Real time information
  - Soft tissue release
  - Implant position
- Soft tissue balance, tibio-femoral congruency and implant position
- Disposable
30 DAY OUTLOOK

RANGE OF MOTION - PHYSICAL THERAPY

- Manual TKA
  - Passive
  - Active

- Verasense
  - Passive
  - Active
**SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY**

<table>
<thead>
<tr>
<th>IMPROVEMENT RATE OF VERASENSE GROUP</th>
<th>TIMES FASTER THAN MANUAL TKA</th>
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<tbody>
<tr>
<td>KSS Pain</td>
<td>1.69</td>
</tr>
<tr>
<td>KSS Function</td>
<td>1.66</td>
</tr>
<tr>
<td>KSS Total</td>
<td>1.68</td>
</tr>
<tr>
<td>Oxford Knee Score</td>
<td>1.5</td>
</tr>
</tbody>
</table>

![Graphs showing improvement rates of Verasense Group vs Manual TKA](chart.png)
90 DAY OUTLOOK

POST-OPERATIVE COMPLICATIONS
- Manual TKA: 3% None, 21% Manual TKA, 25% None - VERASENSE
- VERASENSE: 2% None, 89% None - VERASENSE, 2% Manipulation, 1% Infection, 1% Other

POST-OPERATIVE JOINT STIFFNESS
- Manual TKA: 76% Yes, 24% No
- VERASENSE: 92% Yes, 8% No

<table>
<thead>
<tr>
<th></th>
<th>MANUAL TKA</th>
<th>VERASENSE</th>
<th>P-VALUE</th>
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<tbody>
<tr>
<td>Pre-Operative Range of Motion</td>
<td>105.7</td>
<td>102.4</td>
<td>0.214</td>
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<tr>
<td>Pre-Operative KSS Function</td>
<td>55.5</td>
<td>48.1</td>
<td>&lt;0.001</td>
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<tr>
<td>Post-Operative Stiffness</td>
<td>24</td>
<td>8</td>
<td>0.002</td>
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<tr>
<td>Post-Operative Complications</td>
<td>29</td>
<td>12</td>
<td>0.002</td>
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<tr>
<td>Surgical Interventions within 90 Days</td>
<td>25</td>
<td>10</td>
<td>0.004</td>
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</tbody>
</table>

RANGE OF MOTION (CLINIC VISITS)

ACTIVE RANGE OF MOTION (PHYSICAL THERAPY)

PASSIVE RANGE OF MOTION (PHYSICAL THERAPY)
SENSOR-ASSISTED TOTAL KNEE ARTHROPLASTY

PATIENT SATISFACTION

PRIMARY TKA PATIENTS REPORTING SATISFACTION

Average Patient Satisfaction Reported in Literature 81%
(Brown-Forsythe=3.048; homogeniety <0.001; df=11)

Sensor-Assisted Patients Exhibiting Balance 97%
P < 0.001

Satisfaction at annual post-op intervals balanced vs. unbalanced patients

PATIENT-REPORTED SATISFACTION: “SATISFIED” TO “VERY SATISFIED” COMPARISON TO LITERATURE

81% Average Patient Satisfaction

Balanced vs. Unbalanced Patients

Multicenter Study 2-Year Results (2013)
TOTAL KNEE ARTHROPLASTY ECONOMICS

- 12-13% annual TKA revision rate
  - 4.5% TKA result in early revisions (first 2 years)
- 3 year study, 278 pts sensor assisted TKA
  - 13 expected revisions ($73,000 per revision)
  - 1 actual revision ($876,000 saved)
- Annual revision cost: 2.7 billion
REFERENCES


