Prosthetics and Orthotics

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Prosthetics and Orthotics: National and international landscape

- Over 1 million hip and knee replacements per annum worldwide
- Most very successful (<5% revision at 10 years)
- Success informs popularity/confidence in procedure
- “Operation of the Century” Lancet, 2007 on hip replacement
- Fitted in younger patients, who are living longer (ageing population) and are more obese
- Therefore current joint replacements are challenged
- Revision operations are expensive/less successful than primary
- Other joint replacements lack success/numbers of hips/knees
- Two main challenges – wear and infection
- Established global market in both Prosthetics and Orthotics, with established international research societies
Prosthetics and Orthotics: Current strengths, Newcastle groups

• Orthopaedics: Northern Retrieval Registry, based at Freeman Hospital
• Collaboration between hospitals in NE and MSE, Newcastle University
• Understand why replacement joints fail
• Mainly hips and knees
• Also spinal implants (MAGnetic Expansion Control) rods for children
• MSE - work on bioceramic implants for bone and osteochondral defects
• Orthotics – 3D printing, based at MSE, with Peacocks Medical Group
• SLS Foot and Ankle lab based at Freeman
• Dr Kia Nazapour “restore function to individuals with sensorimotor deficit”, artificial limbs
• Infection, biofilms, Dr Vicky Chen, MSE
• Strong links – engineering, medical school, regional hospitals
Prosthetics and Orthotics: Future Research Opportunities

• For joint replacements: reduce wear and infection, therefore reduce overall health costs
• Analysis of failed implants – hence Northern Retrieval Registry
• For all implants – cost reduction
• Innovations more likely in finger, toe, ankle, wrist, elbow etc implants
• Devices which address unmet clinical need
• Seamless integration between medical imaging sources from MRI/CTs/Ultrasound and CAD design software via smart segmentation algorithms
• Design tools for adding tailored porosity to specific implant areas
• EPSRC Healthcare Technologies
NEWCASTLE SURGICAL TRAINING CENTRE

Healthcare at its very best - with a personal touch
ATOS Triple Scan System

• Optical measuring system

• Custom made Ti shells

• Thin TiO$_2$ coating applied to shell

• Shell internal surface measured prior to and post implantation

• Accuracy of the order of 5-10 µm
Immunobiology of cobalt

Helen Lawrence, David Deehan, John Kirby, Alison Tyson-Capper
Freeman Hospital & Newcastle University, UK

6th Advanced Hip Resurfacing Course
Ghent, Belgium
30th May 2014
What does scar tissue look like?

<table>
<thead>
<tr>
<th>Synovial membrane</th>
<th>ROM &gt;90° Arc</th>
<th>ROM &lt;90° Arc</th>
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<td>Primary TKA</td>
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<td>Infrapectellar fat pad</td>
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<td>Primary TKA</td>
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Picrosirius red
Data collection and analysis

- **Dynamic data collection**: from an optical tracking system used for computer navigated surgery.

- **Laxity was quantified**: as the range of motion of the tibia in relation to the fixed femur – for varus/valgus, anterior drawer, internal/external rotation.

- **Statistics**: Mixed effect modelling was used to quantify the effects of each “intervention” (PS-TKA implantation and popliteus resection) and flexion as well as inter knee variation on laxity.

- **Data representation**: mean ± SD for 8 knees (n=8).

(Stryker eNdtrac ASM Knee Navigation System, Michigan USA)