Arthritis Research UK
Biomechanics & Bioengineering Centre

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Biomechanically informed rehabilitation

&

Liposomal bone cement

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Tackling the challenge of managing long-term musculo-skeletal conditions

1. Knee Pain & Back Pain
2. Biomechanical analysis comparing healthy subjects with MSK patients:
3. Identify movement adaptations/compensations used by MSK patients
4. Create a virtual rehabilitation environment with feedback tools focusing on these adaptations/compensations
5. Identify how people learn to correct their movement based on feedback provided
Gait Real-time Analysis Interactive Lab

- Comprehensive movement analysis
- Real-time movement feedback

- 10 motion capture cameras
- Dual belt instrumented treadmill
- 180° projection screen
- 4 projectors
- 3 DV cameras
- Sound system
- 6 computers in an integrated network
Biomechanically informed rehabilitation

Exercise for self-management
- GRAIL
- Home-based device

Information/education for self-management
- TRAK
- Exercise app

[Images and text related to rehabilitation programs]
Anterior Cruciate Ligament reconstruction

Clinic-based evaluation of movement strategy

Stiff landing

Compliant landing

Backward Lean  |  Forward Lean

Stiff landing  |  Normal landing  |  Compliant landing

TIP Length (% leg length)

TIP Angle (degrees)
Personalised Therapies for Back Pain based on biomechanics

- Feedback Validation
- Personalised therapies for back pain
  - Feasibility Acceptability
  - Intervention Development
Personalised feedback

- Laboratory: Specific Classified movement based intervention
  - ThetaMATRIX
  - Cardiff Classifier
  - See How You Move

- Clinic: CB CFT

CB-CFT = REDUCED Pain, Disability, Distress, IMPROVED Function & Activity level
Personalised treatment

• Software for personalised feedback
  - Clinically informed performance classification networks for personalized feedback

• Hardware for personalised monitoring
  - Validation of different sensors (ThetaMATRIX and Xsense) against 3D Vicon Kinematics to pick up the most important aspects of movement for home- and clinic-based feedback

• Sensors --- patient & clinician friendly for real time feedback
Preventing Infection in Joint replacements

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• Increasing ageing population- Joint replacements
• Infection = requiring complex and expensive revisions.
• Powdered antibiotic within the bone cement can reduce infection rates, the powder frequently agglomerates, resulting in poor antibiotic release characteristics
• **Solution:** a novel delivery system antibiotic-loaded nano-sized liposomes was developed for inclusion into polymethyl methacrylate (PMMA) bone cement.
Liposomal bone cement

- More prolonged and greater release over 60 days
- Can release multiple antimicrobial combinations
Liposomal bone cement

- Consistently inhibits bacterial growth
- Reduced infections
- Increases fracture toughness and fatigue properties
Thank You