

Arthritis Research UK Biomechanics & Bioengineering Centre

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Biomechanically informed rehabilitation

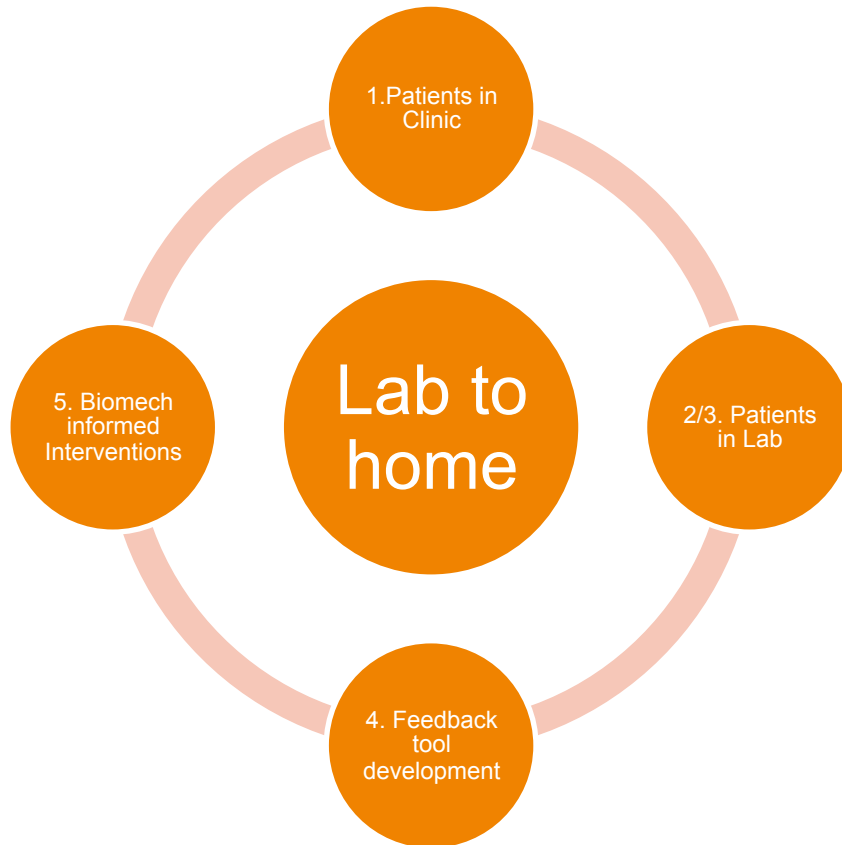
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Liposomal bone cement

Dr Wayne Nishio Ayre

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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 focussing on these adaptations/ compensations
5. Identify how people learn to correct their movement based on feedback provided

Gait Real-time Analysis Interactive Lab



- 10 motion capture cameras
- Dual belt instrumented treadmill
- 180° projection screen
- 4 projectors
- 3 DV cameras
- Sound system

Comprehensive
movement analysis

Real-time movement
feedback



Biomechanically informed rehabilitation

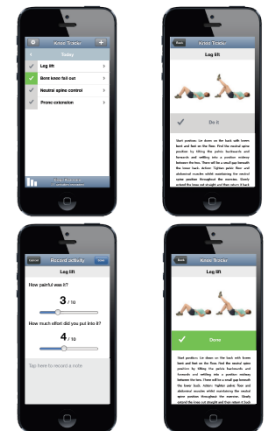
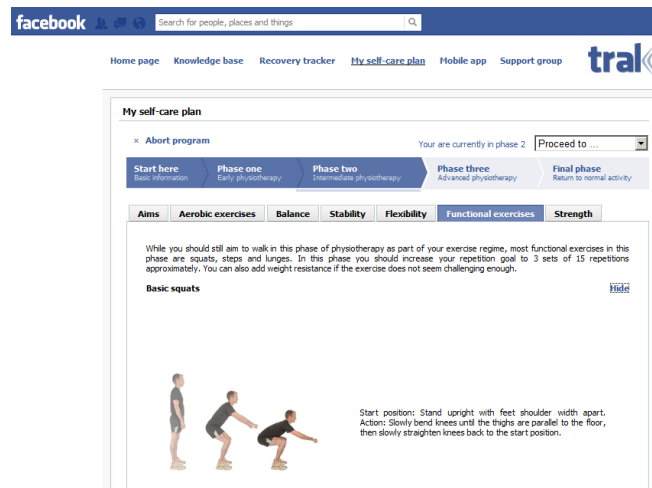
Exercise for self-management

- GRAIL
- Home-based device



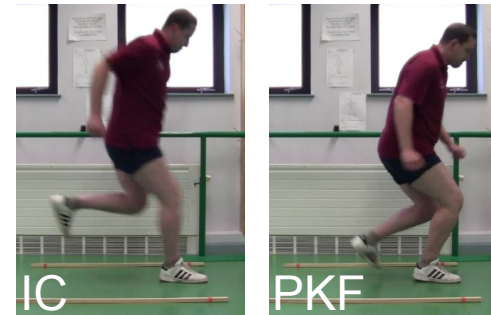
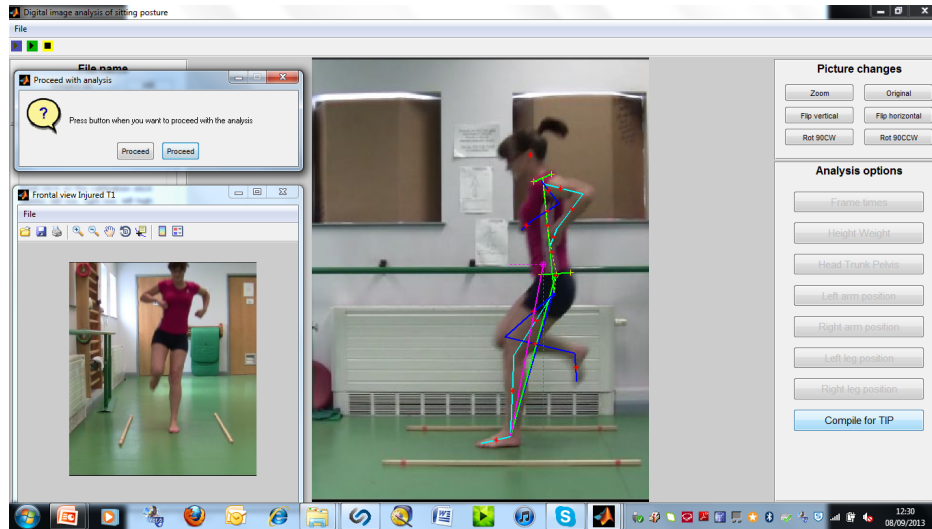
Information/education for self-management

- TRAK
- Exercise app

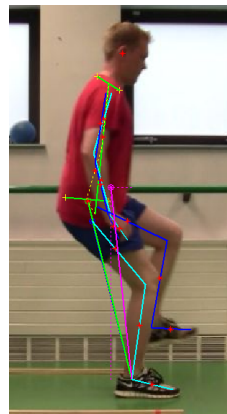


Anterior Cruciate Ligament reconstruction

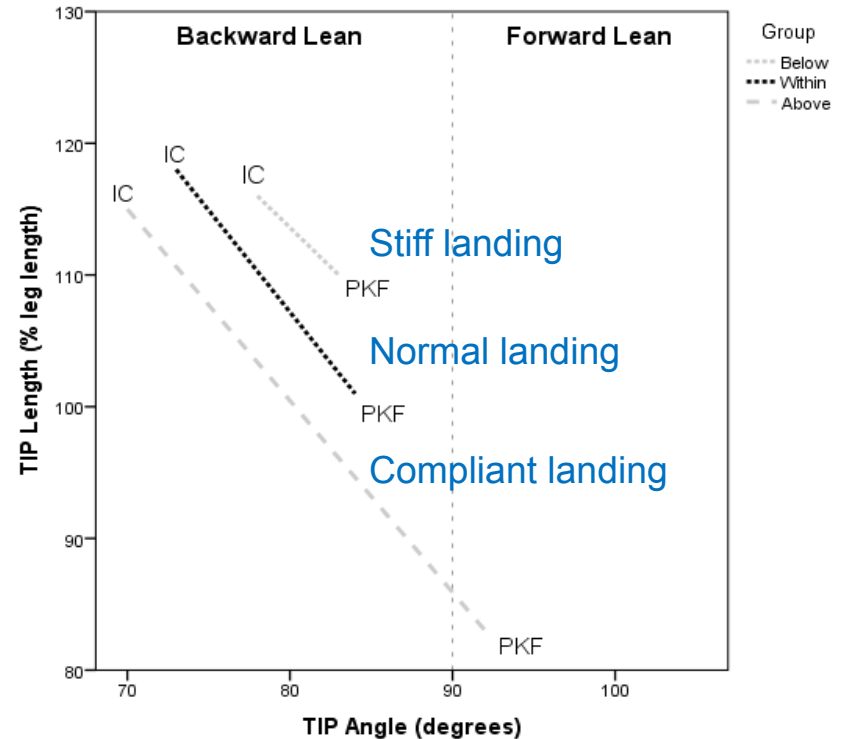
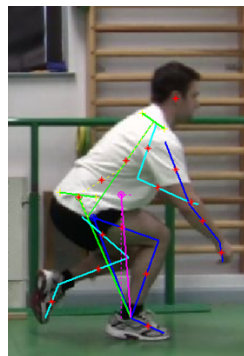
Clinic-based evaluation of movement strategy



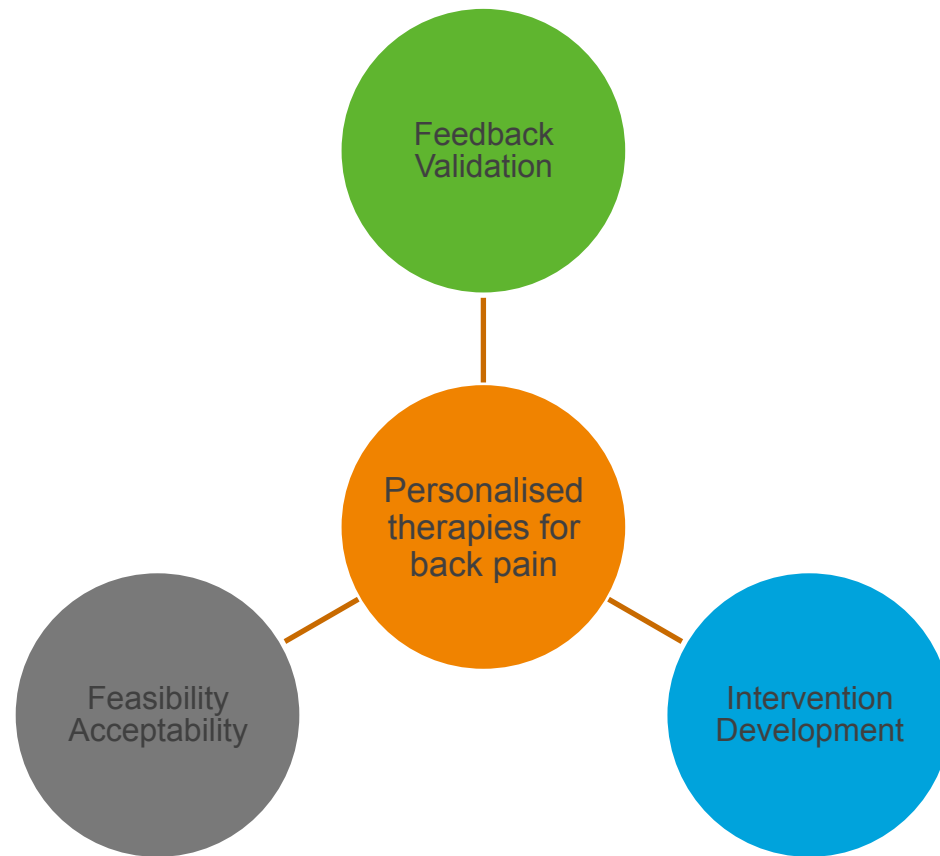
Stiff landing



Compliant landing



Personalised Therapies for Back Pain based on biomechanics

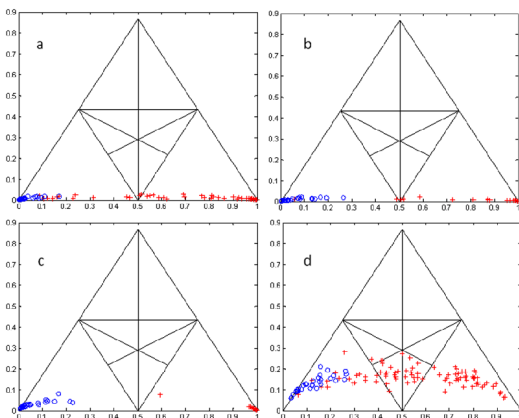


Personalised feedback

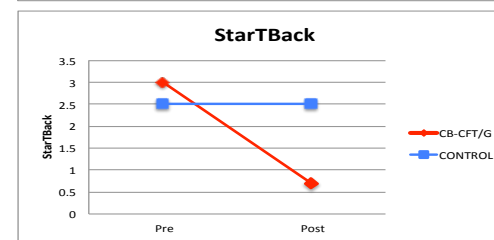
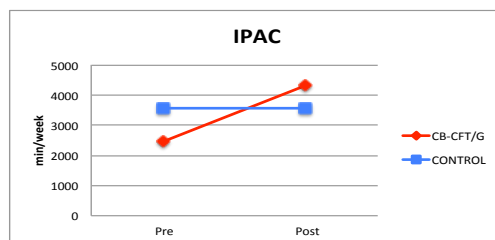
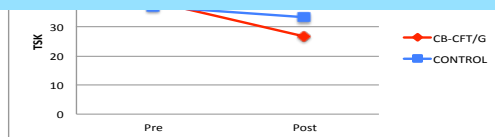
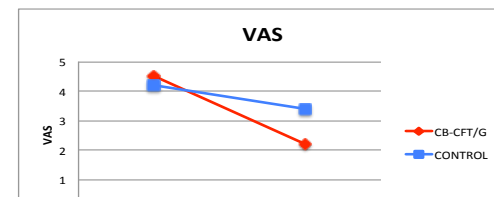
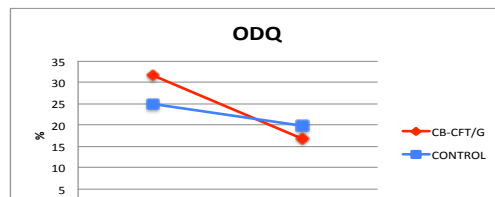
- **Laboratory: Specific Classified movement based intervention**

- 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

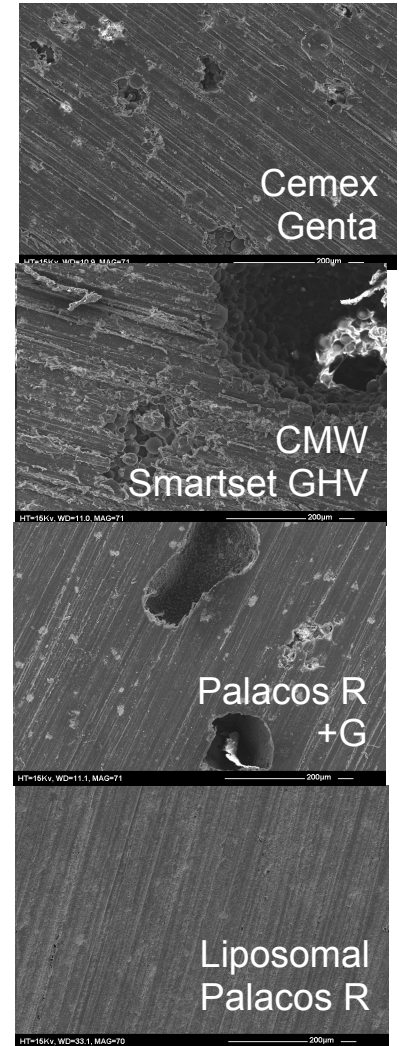
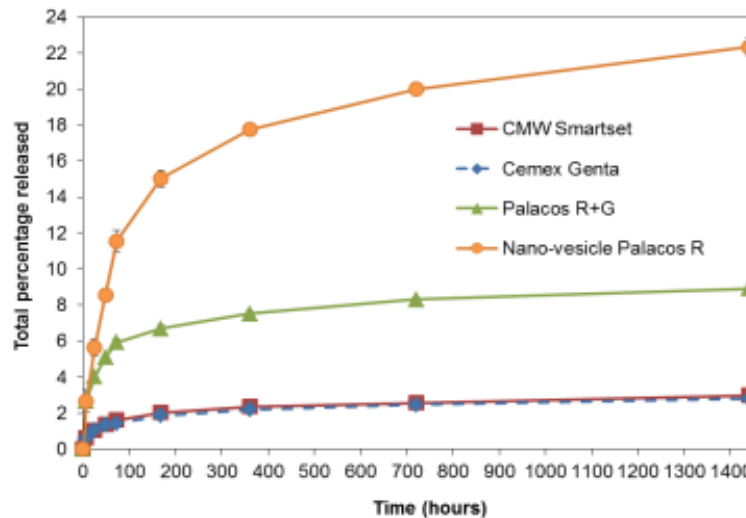
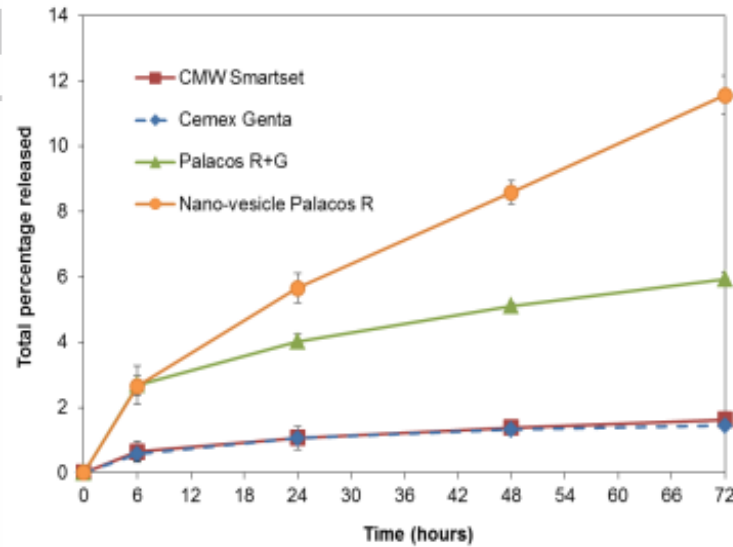
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- Increasing ageing population- Joint replacements
- Infection = requiring complex and expensive revisions.
- Powdered antibiotic within the bone cement can reduce infection rates, the powder frequently agglomerates, resulting in poor antibiotic release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

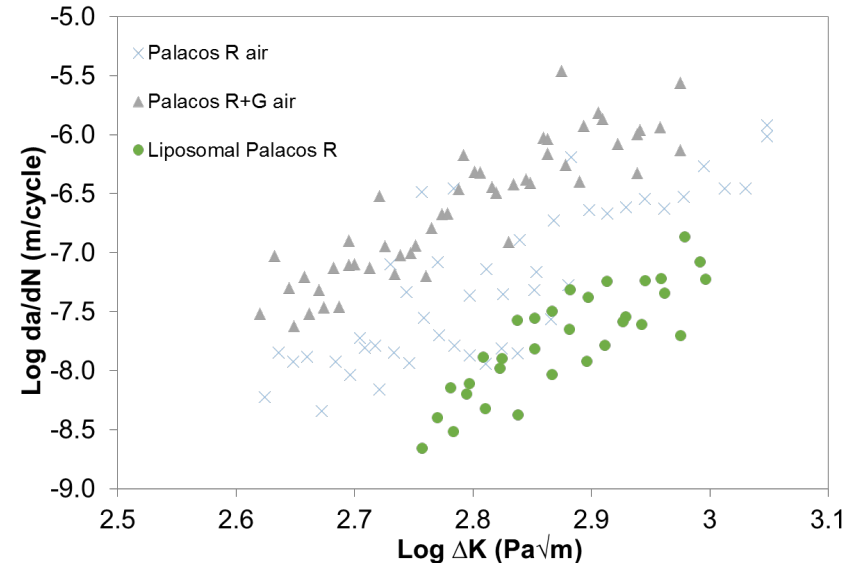
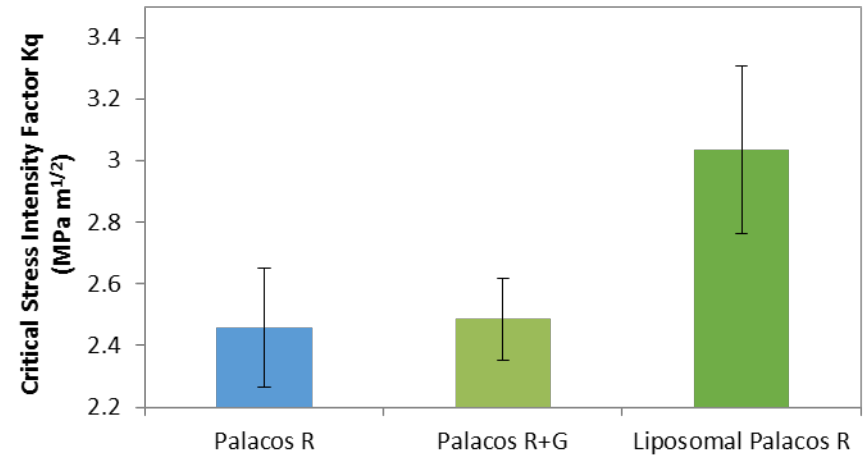
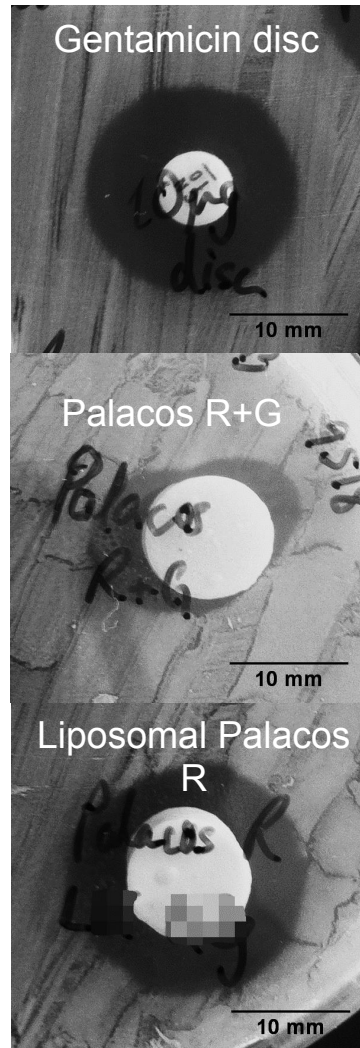
Liposomal bone cement

- 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

