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Fleming, Leigh and Power, Jess

The future of wound measurements - 3D printing and scanning

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Overview

- Technologies
  - Textiles
  - Multi-disciplinary Innovation
  - 3D printing product
- Innovation – prototypes, innovation, projects/research
  - Wiggle bag
  - Paxman cooling cap
  - 21st Century Medical Bag
- TSB project (Orthox, 3T, Cardiff University)
- The challenge of measurement

Technologies

3D Printing and knitting ADA

10gg Shima Seiki FIRST (wholegarment knitting machine)

ZCorp 650
ZBuilder Ultra
Stratasys Fortus FDM 360
Projet 5500 – prints flexible materials

3D visualisation software

Computerised Tomography Scan (CT), Infinite focus Microscopy (IFM) 3D Microscopy,
X-Ray Fluorescence (XRF) – chemical composition (Calvet, Power, Ryall, Bills - 2014)

Test sculpture for pattern making experiment by MA Postgraduate students (Taylor and Univer, 2013)

“Wigglebag”

Harness to improve well-being of children with cancer

- Ergonomically designed
- Comfort / functionality / dignity
- Stylish
- Antibacterial

Paxman cap

Dr Unver worked with Product Design team on externally funded Paxman cap design and manufacturing. This project currently being patented.

Paxman required new innovative, low cost and mass manufacturable of new caps. To challenge this, Paxman engaged the expertise of researchers at two of the University of Huddersfield’s academic schools. Initially funded by an Innovation Voucher from Kirklees Council, Paxman started working with the School of Applied Sciences, using its cutting-edge cell biology techniques to help identify the mechanisms that govern patients’ variable responses to scalp cooling. Following additional funding from Knowledge Transfer Partnership (KTP) and Technology Strategy Board (TSB) grants and from the Collaborative Ventures Fund at the University, the School of Art, Design and Architecture then joined the team to investigate the design of the scalp cooling cap

Cartilage repair

TSB project (Orthox, 3T, Cardiff University)

“Development of single protein fibre matrix composites for high performance cartilage repair devices”

Silkworm silk technologies for cartilage repair

The knitted structure lays in the device to enable sutures to be anchored through the textile structure to the bone.
Why is measurement important?

- Assessing functionality and performance
  - Wound healing
  - Integrity
  - Risk
  - Device development

- Barrier
- Contact
- Support
- Delivery

Measurement of Skin Integrity

- Contact – Pressure, area
- Condition – Texture, moisture, temperature, integrity
- Performance – Hydration, absorption, elasticity, strength
- Interaction – Pressure, shear, friction, temperature

Measurement of skin texture

- Adult female
  - Average roughness $Sq = 52\mu m$
  - Functional pore volume $V_{vc} = 42mL/m^2$
- Female child
  - Average roughness $Sq = 92\mu m$
  - Functional pore volume $V_{vc} = 25mL/m^2$

Assessing Pressure Care

- Stiletto vs Elephant
  - 160kg/$21 = 0.0015m^2$
  - $3,000,000 \text{ N/m}^2$
  - 3,000kg/$40 = 0.011m^2$
  - $125,000 \text{ N/m}^2$
Challenges of measurement for Skin Integrity

- Integrity of the system
- Scale of the accuracy
- Repeatability
- Reliability
- Non-standard geometry (free form surfaces)
- Varying textures
- Hydrated surfaces
- Infection prevention
- Standardisation
- ...........etc