**ABSTRACT**

Micro Computed Tomography was used to image seven cadaveric human knees with the aim of investigating the existence, or otherwise, of osseous landmarks – used as a navigation tool during Anterior Cruciate Ligament Reconstruction Surgery. The presence of these landmarks is a hotly debated issue among clinicians. Application of Micro-CT to orthopaedics is a burgeoning field, however post-processing of CT data is a significant problem due to the large file sizes resulting from fine detail in bone trabeculae. A method for isolating the surface topology of the knees was developed, facilitating various analyses including: Relief Mapping, 3D visualisation and 3D printing. This new method, employing a range of post-processing software, permits reduction of Micro-CT volumes from ~40Gb to 15Mb without compromising surface detail – a necessary step to performing meaningful analysis. Quantitative analysis of surface topology allowed objective representation of osseous landmarks which were compared to qualitative, subjective observations made by clinicians in previous research. The relief maps disfavour the current consensus among clinicians, that osseous landmarks are present in 80%+ of samples. Further work is being conducted to confirm these findings using a larger representative sample. The method developed has been used as a navigation tool during Anterior Cruciate Ligament Reconstruction Surgery.

**METHODOLOGY**

- The 2D CT images were reconstructed using CT Pro
- The ACL footprint and Femur were exported separately with the footprint being kept at its highest resolution while the whole femur was exported at a lower resolution to reduce the data size.
- Both the ACL footprint and femur were imported into Geomagic where they were ‘lid’ and merged back together.
- Relief maps of the ACL footprint were produced by smoothing a baseline knee and applying a coloured deviation analysis.
- Knees were imported in Autodesk Showcase for bone material rendering and visual optimisation. They were then viewed in a 3D interactive virtual environment by surgeons during a survey looking at ridge visibility.
- The 2D CT images were reconstructed using CT Pro
- The ACL footprint and Femur were exported separately with the footprint being kept at its highest resolution while the whole femur was exported at a lower resolution to reduce the data size.
- Both the ACL footprint and femur were imported into Geomagic where they were ‘lid’ and merged back together.
- Relief maps of the ACL footprint were produced by smoothing a baseline knee and applying a coloured deviation analysis.
- Knees were imported in Autodesk Showcase for bone material rendering and visual optimisation. They were then viewed in a 3D interactive virtual environment by surgeons during a survey looking at ridge visibility.

**RESULTS**

- A photo-rendered 3D object that can be viewed in a 3D virtual environment
- Relief maps of the ACL footprint allowing for further analysis
- Relief maps of the ACL footprint were produced by smoothing a baseline knee and applying a coloured deviation analysis.
- Knees were imported in Autodesk Showcase for bone material rendering and visual optimisation. They were then viewed in a 3D interactive virtual environment by surgeons during a survey looking at ridge visibility.
- Relief maps of the ACL footprint were produced by smoothing a baseline knee and applying a coloured deviation analysis.
- Knees were imported in Autodesk Showcase for bone material rendering and visual optimisation. They were then viewed in a 3D interactive virtual environment by surgeons during a survey looking at ridge visibility.

**CONCLUSIONS**

- Micro-CT, coupled with this method for extracting surface topology, can be an effective way for investigating anatomical features at a very high resolution (60µm).
- Surface extraction from CT can create versatile files allowing for further analysis.
- Relief maps of osseous landmarks can be created therefore allowing for a more objective approach to identifying controversial osseous landmarks.
- The quantitative observations from the relief maps about the presents of the ridges disfavours the general consensus as seen in the results graph.
- We note that our sample size was small and aged (60-80 years old) and hence further work is needed.

**REFERENCES**