**INTRODUCTION**

Given the number of knife fatalities in the UK (>200 a year), and the unfortunate reality that many cases are never solved, any advancements in forensic analysis through scientific research is crucial to ensuring perpetrators are brought to justice. However, current literature regarding the analysis of toolmarks left by knife attacks appears to lack standardisation, ecological validity and quantitative analysis. New imaging and analysis techniques such as micro-CT have been proposed as a potential tool for micro-morphological analysis of knife marks, but very little research on this has actually been conducted. Given the forensic utility of this technology, there is a need to explore, consider and test various possible solutions using current engineering technology.

**SUMMARY**

In forensic anthropology the analysis of microscopic tool marks found in skeletal sharp force trauma is a challenging area. Many different imaging methods have been employed to measure cut mark characteristics in aid of developing diagnostic tools for estimating knife type used for these marks. Furthermore, numerous experimental methods for creating tool marks for analysis have been used. A novel method for creating, analysing and presenting tool marks using reverse engineering and metrology was investigated. Pig tonopores were produced in mimicked human anatomy and were then stabbed by volunteers in an upright anatomical position. Over 650 stab marks were performed with each stab recorded using high-speed camera. As a result of the issues noted above, this study will aim to explore, consider and test various possible solutions using current engineering technology.

**METHODOLOGY**

Seven different ‘used’ knives confiscated by the Met Police were used for this study.

- Five cadaveric pig torsos were ethically acquired and prepared to mimic human anatomy. They were then stabbed by two volunteers in an upright anatomical position. Over 650 stab marks were performed with each stab recorded using high-speed camera.

This resulted in 60+ defleshed ribs and 150+ marks ready for scanning and analysis.

- Samples were defleshed with a chemical solution.

**RESULTS**

- Statistical Analysis of Cut Mark Measurements
  - > 90% accuracy in determining knife type (serrated or non-serrated) from cut marks left on bone!

**CONCLUSIONS**

- An ecologically valid process was developed for creating realistic knife marks
- Micro-CT was found to be a superior technology for tool mark analysis
- Knife Type can be determined from cut mark micro-morphology with a 90% accuracy
- Knife impact trajectory is strongly correlated with cut mark trajectory
- High Resolution 3D models for visualisation and 3D printing can be developed

**FURTHER WORK**

- Whether analysis of marks left in a controlled stabbing of a ‘standard’ material could be used to statistically determine knife type used on an unknown stabbing
- The procedure and effects of using 3D printed models in court could be investigated
- The analysis of over 600 more high-speed videos considering impact velocity prediction
- 174 cut marks were collected but only around 80 were analysed in this study

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**REFERENCES**