INTRODUCTION

UK Home Office Statistics 2012 reported 636 homicides between April 2010 – March 2011. 37% of these homicides used a sharp instrument such as a knife with 14% of investigations not resulting in prosecution.1 Sharp force trauma in forensic anthropology concerns the analysis of the marks (kerfs) caused by sharp weapons like knives, ice-picks etc.2 Tool mark analysis and weapon matching is a developing area and currently, the forensic anthropologist establishes either weapon class or exact weapon used to commit the homicide.1 This is traditionally done macroscopically but is rarely sufficient to determine weapon class3 and help in current research trends investigating the use of imaging techniques for post-mortem examination.2 Newer techniques such as micro-CT, could allow much more detailed investigation into weapons indicating greater potential for research into weapon-wound matching.4 Our study aims to use micro-CT and 3D/CDAD programs to analyse sharp force trauma which, to our knowledge, will be the first attempt at investigating 3D weapon-wound matching. The applications of this study can potentially lead to new techniques in forensic anthropology for weapon-wound matching and aid in criminal investigations.

SUMMARY

Nearly 40% of murders in the UK result from sharp force trauma caused by knives (Home Office 2012). Weapon-wound matching in forensic anthropology attempts to estimate weapon class from the wound characteristics but few studies have investigated quantitative methods for performing this analysis on the microscopic scale.2 In this study five cadaveric pig torsos, prepared to mimic human anatomy, will be stabbed in the upright position with 12 different knives by two volunteers. Knife dynamics will be recorded using a Casio high-speed camera (1000fps), with wound tracts being recorded using photogrammetry. Samples will be defleshed exposing the regions on the ribs where the knives have made contact, thus marking the bone, so micro-CT can be performed. All samples will undergo a pre and post stab CT. The analysis will be performed using various quantitative and qualitative methods to establish the feasibility of weapon-wound matching. Results are pending, however it’s hypothesized that, on the macroscopic scale, and individual bladed weapons have their own unique edge profiles which should leave unique striations on the bone for weapon-wound matching. If this is the case, and we can quantify this, then applications in forensic investigation for weapon-wound matching is a natural progression.

METHODOLOGY

To be undertaken on 14th November 2012

PILOT STUDY

The pilot study conducted to investigate the scale of the marks being studied, the velocities of the stab and the effectiveness of the antiformalin solution

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Student’s T-Test

KRF WIDTH:
Serrated vs Non-Serrated Blade
(t12) = 2.751, p = 0.018
Small vs large Non-Serrated Blade
(t12) = 5.990, p = 0.004

KRF DEPTH:
Serrated vs Non-Serrated Blade
(t12) = 3.522, p = 0.004
Small vs large Non-Serrated Blade
(t12) = 4.902, p = 0.000

Both a graph and Student’s T-test was used to display and analyse the significance of the data recorded for both kerf depth and width for each knife

FURTHER WORK AND APPLICATIONS

The pilot study hints at the potential of micro-CT in providing detailed information on the dimensions of the cuts left behind on bone by various knives. Whether striations are visible on the kerf wall has yet to be compared with photographic evidence. The impact of velocity on both damage will also be investigated. Also the use of mesh and CAD software for weapon-wound matching will be explored along with possible 3D printing of marks left. Furthermore, having compared two ‘same knives’ it appears that there are microscopic differences between them that may results in unique cut mark features that could be used to determine the individual knife used. Following the results of this experiment (commencing November 14th) further work potentially using human cadavers will be conducted to control for the differences between pig tissue and bone and human. If the research indicated that micro-CT is a powerful tool in aiding in weapon-wound matching for sharp force trauma then methods for application in forensic cases will be investigated.

REFERENCES


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*Corresponding Author: Danielle Norman

Email: D.Norman3@warwick.ac.uk

D.G. Norman1 B. Bennett2, J. Barnes-Warden3 & M.A. Williams4

1School of Engineering, University of Warwick, 2University Hospital Coventry and Warwickshire, 3Operational Technology, Metropolitan Police Service, 4WMG, University of Warwick

Wound matching is a natural progression.