A systematic review on the application of Fractography in Forensic Anthropology and Trauma Analysis: Assessing the gap between Academia and Practice

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Introduction

Bone fractography is a newly introduced method to the study of bone fractures and biomechanics to understand the cause and mechanism of material fractures.

Objective

This systematic review provides a comprehensive evaluation of the application of fractography in trauma analysis, the current state of research and level of experimental progress in the establishment of the technique.

Goal

Understand the current state of research and level of experimental process in the establishment of the technique. Further, to understand the barriers for the uptake of fractography.

Questions

1. What imaging methods and equipment are used?
2. What types of bones are used?
3. Fractographic applications?
4. Research networks and countries?

Materials and Methods

A structured literature review was undertaken according to a systematic method, focussing on a specific question with strict research parameters.

Literature search

- Data bases: Scopus, ProQuest, PubMed, and Web of Science
- Search terms 'Fractography,' 'Forensic', "Trauma" and 'Anthropology', and variations thereof

Selecting studies

- Established inclusion and exclusion criteria.
- Authors screened title and abstracts, followed by full articles.

Data analysis

- Synthesising and capturing main evidential points.
- Network analysis and visualisation (Gephi).

Material

22 peer-reviewed publications

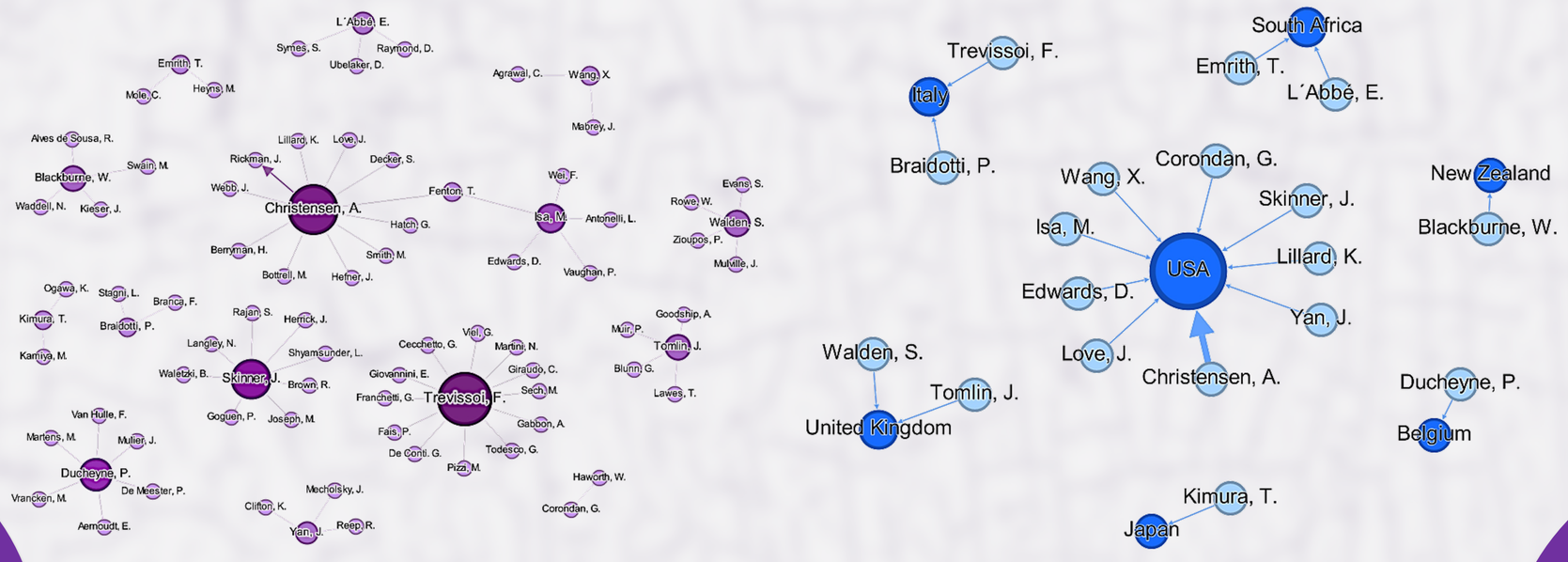

Figure 1: Network analysis based on authorship (left) and the country of first author (right).

Results

Experimental setups frequently apply three- and four-point bending to simulate trauma mechanics.

Bone fractography applications across various trauma types (blunt force, projectile and sharp force) using both human and animal remains.

Imaging methos used were micro-CT, SEM and microscopy.

No universal protocols or consistent experimental guidelines exists, restricting reproducibility and hindering cross-study comparisons.

The lack of accessible, standardised methods highlights a gap between academic advancements and routine forensic practice.

Technical demands of high-resolution imaging and the engineering origins of fractography present challenges in practical forensic contexts.

Conclusion

To address these limitations, future efforts should prioritise cost-effective imaging, expanded training, and standardised protocol to support the reliable integration of fractography in forensic anthropology.

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References: