Detection and Forensic Evidential Value of Tattoos Identified Using Alternative Light Sources

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Introduction

Tattoos have been used for over 5,000 years as a means of differentiating one person from another. However, different types of tattoos have increased in popularity over the last decade and are continuing to gain attention. A tattoo can be either temporary or permanent and can be on any area of a person's anatomy. Previously, tattoos have been ignored as a valuable biometric feature in human identification as they are not specific to one individual compared to favoured evidence such as DNA. Additionally, developments in technology are resulting in new ways to cover-up and remove traces of tattoos, causing intelligence gaps in the identification procedure. There has been limited research conducted on the use of tattoos in human identification processes.

This study investigated the influence of burning and decomposition upon temporary and permanent tattoos as a means of visualisation in a forensic identification context.
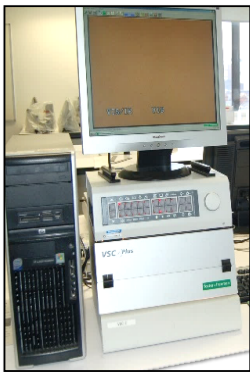
Video Spectral Comparator™ 400

Figure 1: Video Spectral Comparator™ 400 by Foster & Freeman

The Video Spectral Comparator™ 400 (VSC) is a photographic imaging instrument created by Foster & Freeman. The VSC was typically designed for the forensic examination of questioned documents and inks such as forged documents, security features and verification of official documents. However, more recently the VSC has been used to analyse other evidence types that are not apparent primarily or visible to the naked eye (Path-Tech, 2016).
The porcine samples were mostly analysed using Visible, Ultraviolet, Floodlighting and Infrared lighting ranging from 500nm-1500nm.

Materials & Method

- Four different types of tattoos: Temporary Metallic Transfer, Temporary UV Transfer, Permanent White Ink, and Permanent UV Blue Ink were subjected to different circumstances before being examined using different light sources.
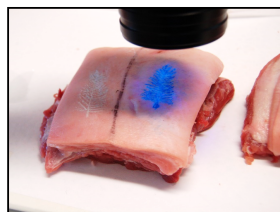

Figure 2: Permanent tattoos

- The four tattoo types were deposited on to several porcine samples, porcine being used as the closest alternative to human skin.
- The conditions included burning to second and third degree as well as decomposition for 21 days, examining any changes every 7 days.
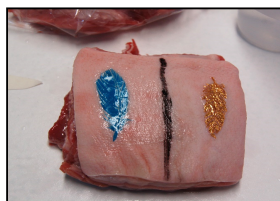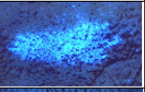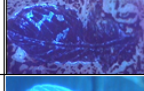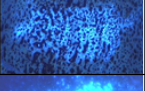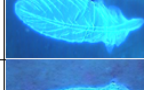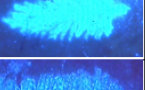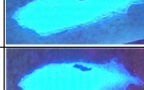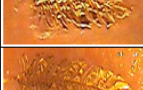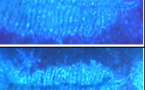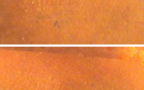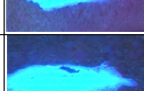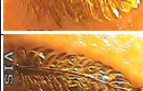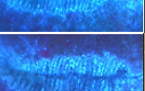

Figure 3: Temporary tattoos

- After the conditions, had been reached, examination of the tattoos was carried out using the Visual Spectral Comparator to enhance the distinguishability of the tattoos in their altered conditions.

Results

Table 1: Results of burning and decomposition conditions from day 0 to day 21

Condition	UV Temp	Metallic Temp	Blue UV Perm Ink	White Perm Ink
2nd Degree Burn				
3rd Degree Burn				
0 Day Decomp				
7 Day Decomp				
14 Day Decomp				
21 Day Decomp				

Figure 4: Graph to show means of tattoo visibility at day 0, in comparison to day 21 of decomposition.

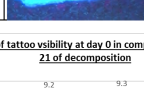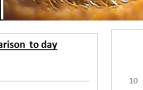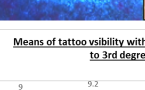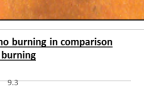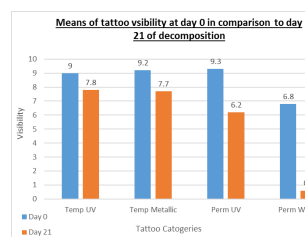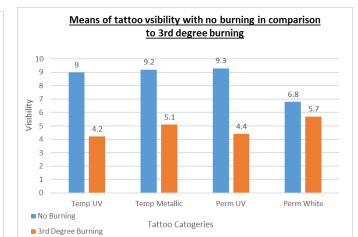*Figure 5: Graph to show means of tattoo visibility with no burning in comparison to 3rd degree burning*

Figure 4 and 5 shows difference in visibility of the tattoos in their original form (Blue) and their altered condition (Orange).

Conclusion

The White permanent ink faded under the skin after 7 days making identification problematic, whereas the Blue permanent ink did not fade during the 21 days of decomposition. Similarly, both styles of temporary tattoos did not fade or break during the decomposition process. Alternatively, when the permanent white ink was analysed on badly burnt skin, the tattoo could still be identified. The UV permanent and temporary tattoos provided the most significant finding, in which the fluorescent properties in the tattoo designs were still able to be identified after weeks of decomposing and after second and third degree burns. The ability to identify tattoos after the tattoos had endured specific conditions is a new and substantial finding. This study provides evidence that the tattoo features are of significant identification probity and can be used in human identification processes in combination with the correct wavelengths of lights from existing forensic LED light sources.

Further Work

- Determine the effects of further decomposition on temporary tattoos
- Determine the effects of tattoo visibility on different decomposed skin colours
- Further research on the composition of developing tattoo inks

References

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