F33 Bite Mark Comparison and Analysis Using Image Perception Technology

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A new approach to bite mark analysis will show how a more detailed and thus less error prone image can be achieved using image perception technology and showing a method of visualising more detail in bite mark photographs, making a more accurate comparison of a bite mark and a suspect's dentition possible.

Method: A photograph of a bite mark is opened with the image perception software, and a region of interest (ROI) is then selected. After such selection, one can add colour to different greyscale areas of the image. The assigning of selected colours to levels of grey values enables the forensic odontologist to select regions with similar grey values or to enhance subtle differences of grey values in the picture. The human eye can only distinguish about 30 shades of grey in a monochrome image, but it can distinguish hundreds of different colours. This will make it easier to establish which regions of pixel intensity are part of the bite mark and which are not. By omitting certain areas of pixel intensity, it is possible to isolate the region of the image which shows the bite mark. A satisfactory detailed image of the bite mark is produced. The resolution of the image is then altered to be compatible with the resolution of the original photograph. Most bite mark images are scanned at 300dpi. Part of the ABFO No.2 scale has to be visible to accommodate the placement of the image over the original photograph with 100% exactitude. The coloured image of the bite mark is now layered over the original bite mark photograph using Photoshop® of Adobe Systems®.

The opacity of individual layers can be increased or decreased according to the requirements of the forensic odontologist. The enhanced image can now be used to accommodate an overlay of the suspected biter's dentition. Both hollow and compound overlays can be used, depending on the amount of incisal detail. With this improved degree of information, it is not uncommon to distinguish aspects previously invisible. With image perception software (Forensic IQ, LumenIQ Inc., Bellingham, WA, USA) it is also possible to turn a 2D picture into a 3D surface object. Different pixel intensities are turned into different surface heights, yielding additional information contained in 256 intensity values. These 3D images can be freely moved, rotated, or zoomed to any specific region of interest.

The forensic odontologist is now able to combine the information of the 2D and pseudo-3D images to investigate the bite mark and establish its origin with a higher degree of certainty.

Conclusion: Human bite mark analysis is by far the most demanding and complicated part of forensic dentistry. There is no dependable way of stating that one or more tooth marks seen in a wound are irrefutably unique to just one person in the population. Bite mark distortion through skin elasticity, anatomical location, and body positioning is a recurring problem. However, with the help of image perception technology it is possible to visualise more details in a bite mark photograph. The availability of additional colouring of selected areas with similar intensity values as well as rendering 2D photographs as pseudo 3-D images will enable the researcher to analyse the image more extensively and come to a more accurate conclusion regarding the source of the bite. However, bite mark analysis alone should not be allowed to lead to a guilty verdict, but it will offer the opportunity to exclude a suspect from a crime when the data do not correspond.

Bite Marks, Image Perception Technology, Overlay Comparison

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