

Microanalysis of Chainsaw Tool Marks on Bone Using SEM-EDS¹

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Chainsaw tool marks on bone may include class and individual identification characteristics. The purpose of this study is twofold; first to evaluate kerf marks in cortical bone to determine the quality of individual characteristics with the Scanning Electron Microscope (SEM) and second to use the Energy Dispersive X-Ray Spectroscopy (EDS) to analyze any trace element transfer to the bone from the metal in the chainsaw teeth.

A Quanta model 400 environmental scanning electron microscope (ESEM) was operated in low vacuum mode with a chamber pressure of 0.2 mbar water vapor to examine the bone samples. The acceleration voltage was 20 kV with a working distance of approximately 10 mm. EDS spectra were acquired with a Si(Li) detector for 30 live seconds per measured area.

The SEM micrographs were evaluated using a scale of +1 to +3 depending on the quality of striations. A +1 evaluation indicated poor quality or no striations present, +2 indicated some striations but not enough for a positive identification and +3 evaluation indicated there were sufficient striations for a match. Of 21 bone micrographs examined for tool marks, 3 (14%) yielded no useful comparison data, 1 (5%) had +1 tool marks, 14 (67%) had +2 tool marks and 3 (14%) had +3 tool marks. Microanalysis of trace elements using EDS yielded 4 (19%) chainsaw tool marks with no useful data. The presence of iron was not detected in 2 (10%) chainsaw tool marks; however, the presence of iron was detected in 15 (71%) of the tool marks.

In conclusion, analyzing chainsaw cut marks with SEM-EDS can be an effective procedure for visualizing striations in bone for comparisons. Even though every chainsaw cut did not have sufficient striations for comparisons, 3 (14%) micrographs could be used for comparison purposes. EDS spectra are also useful in identifying trace elements transferred from the chainsaw to bone. In 15 (71%) of the chainsaw tool marks in this study, iron was identified in the tool marks.

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