



Physical Anthropology Section – 2005

H15 Microscopic and Cross Section Analysis of Occult Intraosseous Fracture (Bone Bruise) of the Skull

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The goal of this presentation is to present a case report in which crosssection analysis of a so-called "bone bruise" of the skull revealed extensive microfracture of the bone.

This presentation will impact the forensic community and/or humanity by raising awareness of the forensic importance of bone crosssection analysis for occult intraosseous fracture, and show the possibility of using this pattern of microfracture in comparative tool mark analysis.

Occult intraosseous fracture of bone, otherwise known as a "bone bruise," is usually the result of compressive and/or impaction forces - including falls, car accidents, sports injuries, and other injuries including deliberate blows received at the hands of others. In the clinical setting, a bone bruise is often considered an area of trabecular bone microfracture with bony alterations similar to those seen in stress fractures, and there is little or no limitation of motion or function. In these clinical settings, bone bruises are poorly defined, and are not visible on plain film radiographs. Magnetic Resonance Imaging (MRI) often reveals subtle variations in signal intensity of the medullary bone, but this MRI modality is not readily available in most forensic autopsy settings. Gross examination of the bone at autopsy often demonstrates discoloration of the bone due to hemorrhage, but with a bone bruise there are no visible cracks in the bone, nor variation in the contour of the bone's surface. However, gross and microscopic *cross-section* examination of these areas can reveal evidence of impaction or compression forces sufficient to break the bone. This cross-section analysis of the bone can also be valuable for determining the precise area of bone which sustained the blow. Measuring the extent of discrete areas of microfracture has the potential to prove useful for tool mark comparison studies.

In this case study, the decomposing body of an adult female was found outdoors partially covered by forest debris. The skull was essentially skeletonized, although there was a considerable amount of soft tissue remaining on the lower trunk and extremities. The cause of death was determined to be sharp force trauma. The only area of apparent injury to the skull was a 1 X 3 inch teardrop - shaped area of discoloration in the frontal bone at the midline.

Gross examination of both the ectocranial and endocranial surfaces of the bone revealed no break in the contour of the bone. Plain film radiographs of the bone did not reveal the presence of any fractures. Within the darkened hemorrhagic area, however, there was a small semicircular line of darker discoloration on the ectocranial surface. A wedge-shaped section of frontal bone, including this line, was harvested with an oscillating bone saw. On cross-section, the gross appearance of the entire wedge of bone revealed the hemorrhagic discoloration had seeped through the outer cortex to the diploë, and portions of the diploë were filled with blood. The bone exhibited fractures parallel to the ectocranial surface. Cross section examination also revealed other numerous tiny fractures, which extended into the diploë. These fractures could be seen by the naked eye. The fractures were essentially parallel, with separation of their margins being wider at the ectocranial surface of the bone, and becoming progressively narrower as they approached the diploë. None of the fractures crossed the diploë. The microfractures stopped abruptly at the outline of the semicircular line on the ectocranial surface of the bone.

Analysis of the semicircular line was done by the side-by-side comparative microscope technique usually reserved for ballistic comparative analysis.

Bone Bruise, Trauma, Tool Marks