H27 Frozen Human Bone: A Histological Investigation

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The goal of this presentation is to determine the histological effects of freezing on human bone.

A plethora of research has been produced concerning the fate of human bone when it has been exposed to various external stressors. These include taphonomic processes such as natural weathering, decomposition, and burning studies. Each study attempts to aid an investigator by trying to determine, for example, what exactly a human skeleton would look like after it had been exposed to an accelerated fire for thirty minutes. The result of this type of research may afford an investigator the opportunity to analyze the evidence at the crime scene and compare it to the research in order to draw educated conclusions about the actual evidence. This is not to imply that all of the questions of investigators have been answered. Rather, each new case brings more questions and more variables that need to be taken into consideration.

One such question asks if there is a way to decipher whether a body or body parts have been previously frozen by looking at the skeletal elements. The circumstances that surround this question suggest that the victim would have been frozen for some time and was taken out of the freezing element and was allowed to thaw and decompose to the state of skeletonization. Would it be possible at this point to determine whether or not this body had indeed been frozen? Or, at a more basic level, does freezing damage the histological integrity of bone to prevent osteon aging ability.

Few studies incorporate both the variable of low temperatures and human remains. However, two such studies focus on the decomposition of the soft tissue after a freeze thaw event, but none have focused on the bone itself. While there is no evidence that freezing can change the gross morphology, there has been no research concerning whether or not the microscopic structure of the bone would be altered as a result of the freezing process. This research will attempt to determine whether bone that has been previously frozen would be histologically distinguishable by looking for a patterned anomaly, such as patterned cracking.

It is possible that the microscopic structure may indicate some changes due to the blood vessels, which run throughout the bone allowing for communication and nutrient flow between bone cells, undergoing the freezing process. Freezing allows for the expansion of fluids (including bodily fluids) and possibly for the forced increase in vessel diameter that may be evident, microscopically, in a section of frozen bone as small fractures in the bone microstructure.

In order to determine whether the freezing can be identified within the bone microstructure, it is necessary to freeze several human bone sections. After the sections have been frozen for twenty-one days, they are allowed to thaw in accordance with the circumstances surrounding the question. The samples are thin sectioned in order to view their microstructure. This analysis affords the opportunity to look for changes in the microstructure that may be indicative of the freezing process.

Statistically, the results of the microscopic analysis did not demonstrate significant differences in the histology of frozen and non-frozen human bone. The changes that were noted in the test samples (C samples) do indicate that some fracturing may occur due to the freezing process, although this fracturing may not be patterned nor may it occur systematically throughout the frozen bone. While this evidence of physical changes caused by liquid expansion is encouraging to note, the cracking was not consistently present throughout the sample set, nor, when found in a section of bone, was the cracking present around each of the haversian canals within the section.

Even though there is not a consistent pattern to the fractures noted in the sample set, this should not rule out some histologically identifiable changes associated with freezing. It is clear that it is quite possible that bone sections may undergo noticeable changes due to the freezing process, although this experiment was unable to ascertain such information using light microscopy. The second part of this experiment is to view the specimens under a scanning electron microscope to analyze the bone surface for evidence of freezing.

Bone Histology, Freezing Process, Microscopy

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