DOWNLOAD PDF HEAT-INDUCED ALTERATIONS OF BONE HISTOLOGY

Chapter 1 : [Full text] Forensic investigation of burnt human remains | RRFMS

Heat-induced alterations to the bone color,weight, volume, and density were monitored using gross morphology and micro-focus X-ray computed www.nxgvision.com found that the increase in temperature caused the color of the compact bones to change in order of yellow, brown, gray,and white.

Metscher Find articles by Brian D. This article has been cited by other articles in PMC. Only a few methods have been published dealing with the visualization of heat-induced cracks inside bones and teeth. As a novel approach this study used nondestructive X-ray microtomography micro-CT for volume analysis of heat-induced cracks to observe the reaction of human molars to various levels of thermal stress. The subsequent high-resolution scans voxel-size In total, 14 scans were automatically segmented with Definiens XD Developer 1. In addition, the distributions and shape of the heat-induced changes could be classified using the computed 3D models. The macroscopic heat-induced changes observed in this preliminary study correspond with previous observations of unrestored human teeth, yet the current observations also take into account the entire microscopic 3D expansions of heat-induced cracks within the dental hard tissues. Using the same experimental conditions proposed in the literature, this study confirms previous results, adds new observations, and offers new perspectives in the investigation of forensic evidence. Fire victims, forensic odontology, forensic science, heat-induced changes, X-ray microtomography Introduction Burned human remains are frequently found after natural disasters or house fires,[1 , 2] as a result of either direct contact with open flames or the exposure to high temperatures. The results provided in this study are of current importance for the field of forensic odontology, providing a more detailed understanding of thermal stress induced three-dimensional 3D alterations in human teeth. Recently, the focus of analysis has shifted from macroscopic heat-induced changes to the microscopic changes. In general, macroscopic changes can be influenced by a large number of external factors such as time and temperature of heat exposure, availability of oxygen, as well as material properties; and therefore do not seem to be the ideal tool for temperature estimation. However, the destruction of the material is sometimes not acceptable for evidence from forensic cases. Therefore, noninvasive and nondestructive methods had to be found in order to analyze heat-induced changes of bones and teeth. Visualization of heat-induced changes Savio et al. A visible increase of heat-induced cracks was found. The first use of 3D imaging methods on burned bones was by Thompson and Chudek,[18] who used magnetic resonance imaging MRI to visualize heat-induced changes. The authors used 1. Due to the reduced resolution, the scans could not show the detailed 3D alterations of skeletal tissue. Aim of micro-CT study For a better understanding of the heat-induced 3D changes inside teeth, the noninvasive imaging technology of micro-CT was used for the first time in this application. This experimental study provides image data for a qualitative 3D reconstruction as well as quantitative results. This novel approach to evaluating burned human teeth produced results for a more detailed understanding of thermal stress-induced 3D alterations in human teeth as well as useful statistical data for interpretation and estimation of burning temperatures. A declaration of consent was filled out by every donor involved in this study. Teeth were excluded from the study because of unknown patient age, damages e. The 18 intact third molars nine female and nine male, mean age: Thermal treatment The 18 teeth were randomly divided into three groups before subjecting them to the thermal stress. The time of thermal stress exposure for each group was on average As soon as the desired temperature was reached the specimens were removed from the furnace, cooled to room temperature in air and then stored in conical tubes padded with cotton. The macroscopic changes of the teeth were described and documented by direct vision of the samples and photographs using a compact digital camera. The general settings for the scans were a voxel size of The automated segmentation was done with Definiens XD Developer 1. To control the results of the automated segmentation, additional manual segmentation was carried out in five cases using Visage Imaging Amira 5. The final 3D reconstruction was also performed with Visage Imaging Amira 5. Results Heat-induced changes Three teeth completely broke apart during the heating process and one tooth during the subsequent handling. In two cases the root acquired a brown color. A partial or full debonding of the crown alongside the dentin-enamel junction was

observed in none of the specimens. In the micro-CT images only small cracks were visible in the crown region, whereas multiple small cracks were in the root region [Figure 1]. These cracks were frequently located in the root and usually did not reach the dentin-enamel junction. The mean volume of cracks was 2.

Chapter 2 : Bone marrow - Wikipedia

Heat-induced alterations to the bone color, weight, volume, and density were monitored using gross morphology and micro-focus X-ray computed tomography. We found that the increase in temperature caused the color of the compact bones to change in order of yellow, brown, gray, and white.

Disease[edit] The normal bone marrow architecture can be damaged or displaced by aplastic anemia , malignancies such as multiple myeloma , or infections such as tuberculosis , leading to a decrease in the production of blood cells and blood platelets. The bone marrow can also be affected by various forms of leukemia , which attacks its hematologic progenitor cells. Many of the symptoms of radiation poisoning are due to damage sustained by the bone marrow cells. To diagnose diseases involving the bone marrow, a bone marrow aspiration is sometimes performed. This typically involves using a hollow needle to acquire a sample of red bone marrow from the crest of the ilium under general or local anesthesia. Plain film x-rays pass through soft tissues such as marrow and do not provide visualization, although any changes in the structure of the associated bone may be detected. For example, normal fatty "yellow" marrow in adult long bones is of low density to Hounsfield units , between subcutaneous fat and soft tissue. Tissue with increased cellular composition, such as normal "red" marrow or cancer cells within the medullary cavity will measure variably higher in density. MRI enables assessment of the average molecular composition of soft tissues, and thus provides information regarding the relative fat content of marrow. In adult humans, "yellow" fatty marrow is the dominant tissue in bones, particularly in the peripheral appendicular skeleton. Because fat molecules have a high T1-relaxivity , T1-weighted imaging sequences show "yellow" fatty marrow as bright hyperintense. Furthermore, normal fatty marrow loses signal on fat-saturation sequences, in a similar pattern to subcutaneous fat. When "yellow" fatty marrow becomes replaced by tissue with more cellular composition, this change is apparent as decreased brightness on T1-weighted sequences. Both normal "red" marrow and pathologic marrow lesions such as cancer are darker than "yellow" marrow on T1-weight sequences, although can often be distinguished by comparison with the MR signal intensity of adjacent soft tissues. Normal "red" marrow is typically equivalent or brighter than skeletal muscle or intervertebral disc on T1-weighted sequences. Diffuse marrow T1 hypointensity without contrast enhancement or cortical discontinuity suggests red marrow conversion or myelofibrosis. Falsely normal marrow on T1 can be seen with diffuse multiple myeloma or leukemic infiltration when the water to fat ratio is not sufficiently altered, as may be seen with lower grade tumors or earlier in the disease process. Bone marrow examination is the pathologic analysis of samples of bone marrow obtained via biopsy and bone marrow aspiration. Bone marrow examination is used in the diagnosis of a number of conditions, including leukemia, multiple myeloma, anemia , and pancytopenia. The bone marrow produces the cellular elements of the blood, including platelets , red blood cells and white blood cells. While much information can be gleaned by testing the blood itself drawn from a vein by phlebotomy , it is sometimes necessary to examine the source of the blood cells in the bone marrow to obtain more information on hematopoiesis; this is the role of bone marrow aspiration and biopsy. The ratio between myeloid series and erythroid cells is relevant to bone marrow function, and also to diseases of the bone marrow and peripheral blood , such as leukemia and anemia. The normal myeloid-to-erythroid ratio is around 3: The preferred sites for the procedure In a bone marrow transplant , hematopoietic stem cells are removed from a person and infused into another person allogenic or into the same person at a later time autologous. If the donor and recipient are compatible, these infused cells will then travel to the bone marrow and initiate blood cell production. Transplantation from one person to another is conducted for the treatment of severe bone marrow diseases, such as congenital defects, autoimmune diseases or malignancies. The procedure is minimally invasive and does not require stitches afterwards. This procedure is similar to that used in blood or platelet donation. In adults, bone marrow may also be taken from the sternum , while the tibia is often used when taking samples from infants. The earliest fossilised evidence of bone marrow was discovered in in Eusthenopteron , a lobe-finned fish which lived during the Devonian period approximately million years ago. Pathology of bone marrow and blood cells 2nd ed. North-Western Journal of Zoology. Tissue Engineering

Part B:

Chapter 3 : Histology - Wikipedia

Light microscopic histological observations of burnt bone revealed heat-induced alterations such as cracking and separation of the osteons at higher temperatures.

Fixation histology Chemical fixatives are used to preserve tissue from degradation, and to maintain the structure of the cell and of sub-cellular components such as cell organelles e. For electron microscopy, the most commonly used fixative is glutaraldehyde , usually as a 2. These fixatives preserve tissues or cells mainly by irreversibly cross-linking proteins. The main action of these aldehyde fixatives is to cross-link amino groups in proteins through the formation of methylene bridges -CH2- , in the case of formaldehyde, or by C5H10 cross-links in the case of glutaraldehyde. This process, while preserving the structural integrity of the cells and tissue can damage the biological functionality of proteins, particularly enzymes , and can also denature them to a certain extent. This can be detrimental to certain histological techniques. Further fixatives are often used for electron microscopy such as osmium tetroxide or uranyl acetate. However, extraction and analysis of nucleic acids and proteins from formalin-fixed, paraffin-embedded tissues is possible using appropriate protocols. It is often used after surgical removal of tumors to allow rapid determination of margin that the tumor has been completely removed. Processing - dehydration, clearing, and infiltration[edit] The aim of tissue processing is to remove water from tissues and replace with a medium that solidifies to allow thin sections to be cut. For light microscopy, paraffin wax is most frequently used. Since it is immiscible with water, the main constituent of biological tissue, water must first be removed in the process of dehydration. Samples are transferred through baths of progressively more concentrated ethanol to remove the water. This is followed by a hydrophobic clearing agent such as xylene to remove the alcohol, and finally molten paraffin wax , the infiltration agent, which replaces the xylene. Paraffin wax does not provide a sufficiently hard matrix for cutting very thin sections for electron microscopy. Instead, resins are used. Epoxy resins are the most commonly employed embedding media, but acrylic resins are also used, particularly where immunohistochemistry is required. Again, the immiscibility of most epoxy and acrylic resins with water necessitates the use of dehydration, usually with ethanol. Embedding[edit] OCT embedding [13] optimal cutting temperature compound After the tissues have been dehydrated, cleared, and infiltrated with the embedding material, they are ready for external embedding. During this process the tissue samples are placed into molds along with liquid embedding material such as agar, gelatine, or wax which is then hardened. This is achieved by cooling in the case of paraffin wax and heating curing in the case of the epoxy resins. The acrylic resins are polymerised by heat, ultraviolet light, or chemical catalysts. The hardened blocks containing the tissue samples are then ready to be sectioned. Because formalin-fixed, paraffin-embedded FFPE tissues may be stored indefinitely at room temperature, and nucleic acids both DNA and RNA may be recovered from them decades after fixation, FFPE tissues are an important resource for historical studies in medicine. Embedding can also be accomplished using frozen, non-fixed tissue in a water-based medium. Pre-frozen tissues are placed into molds with the liquid embedding material, usually a water-based glycol, OCT, TBS, Cryogel, or resin, which is then frozen to form hardened blocks. Microtome For light microscopy, a steel knife mounted in a microtome is used to cut 4- micrometer -thick tissue sections which are mounted on a glass microscope slide. For transmission electron microscopy, a diamond knife mounted in an ultramicrotome is used to cut nanometer -thick tissue sections which are mounted on a 3-millimeter-diameter copper grid. Then the mounted sections are treated with the appropriate stain. Sections can be cut through the tissue in a number of directions. For pathological evaluation of tissues, vertical sectioning, cut perpendicular to the surface of the tissue to produce a cross section is the usual method. Horizontal also known as transverse or longitudinal sectioning, cut along the long axis of the tissue, is often used in the evaluation of the hair follicles and pilosebaceous units. Frozen section procedure Fixed or unfixed tissue may be frozen and sliced using a microtome mounted in a refrigeration device known as a cryostat. The frozen sections are mounted on a glass slide and may be stained to enhance the contrast between different tissues. Unfixed frozen sections can also be used for studies requiring enzyme localization in tissues and cells. It is necessary to fix tissue for certain

procedures such as antibody linked immunofluorescence staining. Frozen sectioning can also be used to determine if a tumour is malignant when it is found incidentally during surgery on a patient. Sample of a trachea coloured with hematoxylin and eosin Main article: Staining Example of staining [14] in light microscopy: Staining is employed to give both contrast to the tissue as well as highlighting particular features of interest. Where the underlying mechanistic chemistry of staining is understood, the term histochemistry is used. Hematoxylin, a basic dye, stains nuclei blue due to an affinity to nucleic acids in the cell nucleus; eosin, an acidic dye, stains the cytoplasm pink. Uranyl acetate and lead citrate are commonly used to impart contrast to tissue in the electron microscope. There are many other staining techniques that have been used to selectively stain cells and cellular components. One of these techniques involves marking peripheral tumors or surgical margins, in which a certain color of dye is applied to the posterior border of a sample, another to the anterior, etc. Other compounds used to color tissue sections include safranin , Oil Red O , Congo red , Fast green FCF , silver salts, and numerous natural and artificial dyes that usually originated from the development of dyes for the textile industry. Histochemistry refers to the science of using chemical reactions between laboratory chemicals and components within tissue. A commonly performed histochemical technique is the Perls Prussian blue reaction, used to demonstrate iron deposits in diseases like hemochromatosis. Histology samples have often been examined by radioactive techniques. In historadiography , a slide sometimes stained histochemically is X-rayed. More commonly, autoradiography is used to visualize the locations to which a radioactive substance has been transported within the body, such as cells in S phase undergoing DNA replication which incorporate tritiated thymidine , or sites to which radiolabeled nucleic acid probes bind in in situ hybridization. For autoradiography on a microscopic level, the slide is typically dipped into liquid nuclear tract emulsion, which dries to form the exposure film. Individual silver grains in the film are visualized with dark field microscopy. Recently, antibodies have been used to specifically visualize proteins, carbohydrates, and lipids. This process is called immunohistochemistry , or when the stain is a fluorescent molecule, immunofluorescence. This technique has greatly increased the ability to identify categories of cells under a microscope. Other advanced techniques, such as nonradioactive in situ hybridization, can be combined with immunochemistry to identify specific DNA or RNA molecules with fluorescent probes or tags that can be used for immunofluorescence and enzyme-linked fluorescence amplification especially alkaline phosphatase and tyramide signal amplification. Fluorescence microscopy and confocal microscopy are used to detect fluorescent signals with good intracellular detail. Digital cameras are increasingly used to capture histological and histopathological image Common laboratory stains[edit].

Chapter 4 : Atlas of Bone Marrow pathology: Erythroid hyperplasia

In the present investigation a comparison was made between conventional histology, histochemistry and vital microscopy for assessment of heat-induced bone tissue injury. The extent of the bone damage around a burr hole or after heating fibular bone samples in saline solutions of various temperatures.

In forensic casework, it is vital to be able to obtain valuable information from burnt bone fragments to ascertain the identity of the victim. Burnt bones show significant alterations both in physical and in chemical properties, and these could be obstacles to anthropological tests and DNA profiling. Heat increases the difficulties of bone identification, depending on the exposure temperature. We therefore need to collate detailed information on bone alterations during burning and the influence on appropriate interpretation of observations and test results. This review summarizes the alterations that occur in bone during the burning process, particularly focusing on coloration, weight reduction, shrinkage, deformation, fragmentation, and DNA survival. In addition, the application of micro-computed tomography imaging to burnt bone identification is introduced as one of the most advanced technologies for anthropological analysis. Properties of bone, both physical and chemical, change drastically during burning and these changes cause difficulties in forensic identification tests. Physical changes occurring in burnt bone, such as deformation and fragmentation due to heat-induced shrinkage, alter the morphological indicators that are critical for anthropometric analysis of species, sex, age, and stature estimation. In addition to the physical alterations, heat in the burning process also induces chemical modification of bones due to combustion and pyrolysis of chemical substances. The degree of modification increases with rising temperatures, and includes degradation of DNA, which compromises forensic identification techniques. We therefore need to know details of these problematic influences, as well as consider the degree of heat to which the specimen had been exposed. Such information will help forensic scientists to interpret test results obtained from burnt bones more accurately. Many studies regarding burnt bone identification have been published, and their results are summarized in book chapters and reviews. These alterations will be summarized and a newly applied method for burnt bone identification, micro-computed tomography micro-CT imaging, will also be introduced. Burnt bones in forensic cases There is a wide range of case types for which burnt bones are submitted to the forensic laboratory, 14 â€” 16 , 19 â€” 25 including fire victims in vehicle accidents, 14 , 15 from mass disasters, 14 and in house fires. Additionally, DNA analysis of severely burnt bones can be extremely difficult. Coloration of burnt bones Bone changes color drastically when it is burnt. Since the color of the bone surface varies with exposure temperature, many researchers have attempted to find a correlation between bone color and burning temperature in order to establish an index for estimating the exposure temperature of questioned bone samples. The unevenness of soft tissue thickness in the body and an unequal distribution of heat during the burning itself often result in varying degrees of burnt bones even in the same individual. These alterations were shown in photographs and colored charts in previous reports. Weight reduction of burnt bones During burning, bone weight is reduced because of water vaporization and combustion of organic materials which releases the carbon mainly in the form of carbon dioxide. Fredericks et al performed Fourier transform infrared spectroscopy FTIR on burnt bone powder to monitor the decrease of collagen by measuring the amide-to-phosphate ratio. This supports the aforementioned description of the decrease of the organic matrix in burnt bones. We should consider this early decrease of the organic matrix when applying DNA tests to burnt bones since DNA is an organic component of the bone. Shrinkage and deformation of burnt bones Bone also reduces in volume through the burning process. Though this is one of the major alterations occurring in burnt bones, a quantitative analysis of volume reduction has not been established because of the difficulty of precise volume measurement in its cracked and fragmented form. Recent X-ray computed tomography CT technology enabled the digital volume measurement of complex shapes and has been applied to volume analysis of burnt bones. This shrinkage occurs through a combination of losing collagen, 36 , 45 recrystallization of the hydroxyapatite thus increased crystallinity , 6 , 45 chemical alteration of the hydroxyapatite to beta-tricalcium phosphate, 6 , 9 , 38 , 42 and the fusion of these crystals. The influence it has on morphology ranges from the gross to the microscopic

level. However, those anthropometric standards established for sex estimation of non-burnt normal bones did not produce an effective estimation in male specimens because shrinkage caused a reduction of measurements. An anthropometric study on experimentally burnt sheep bones revealed significant changes of the measurements, not only a reduction but also an expansion, resulting from complicated shape alteration during the shrinkage process. Some investigators have applied the use of frontal sinus morphology, and dentition to burnt bone identification and successfully established identities of the victims. The former study by Nelson revealed significant shrinkage of microstructural elements after burning, while the latter tentatively concluded that the shrinkage does not appear to have a significant effect on age estimation. The other use for histological observation of burnt fragmented bones is species identification. Mean sizes of the osteon and the Haversian canal significantly differ among species, 52 , 60 â€" 63 and animal bones tend to have a lamellar pattern formed by primary osteons that is absent in adult human bones. The hardness of the burnt bone has been measured by Fredericks et al using the Vickers hardness method. The formation of these unique shapes depends not only on the temperature exposure but also on the age of the individual. It is possible to apply these protocols in estimating the exposure temperature of the bone specimens. The shrinkage mechanism produces cracks in the burnt bone. Burnt bones exhibit fragmented forms in different degrees and this creates difficulties in the identification attempts. One of the techniques often applied to bone fragments in the identification process is reconstruction. Waterhouse examined the course of post-burning fragmentation using pig limbs and found that a short-term recovery delay of 24 hours increased the degree of fragmentation. In murder cases, it is important to identify the evidence of trauma on the burnt bone, and attempt to describe the weapon used. Poppa et al examined survival of simulated trauma to pig heads after burning. A detailed examination of saw marks was completed by Robbins et al. These saw marks survived well even in calcined bones. In relation to gunshot trauma, the soot staining that appears around a gunshot wound has also been studied. However, casework we have encountered and studies published on burnt bone DNA typing show the harsh reality of this application. As mentioned earlier, the organic matrix disappears at a comparatively early phase in the burning process, and DNA is no exception. Several studies have reported the applicability of DNA typing to the investigation of burnt bones. From the knowledge about the properties of burnt bone already discussed in this review, the bones they burnt are thought to have been severally shrunk and colored white. Follow-on studies conducted more detailed experiments on burning temperature and time, as well as assessing amplification product size. The shorter PCR target region tended to be more resistant to the high temperatures from burning. Tsuchimochi et al have performed a similar experiment using teeth. In this study, the threshold temperature for amplification success was higher than those shown in the three previously mentioned studies. However, considering that the dental pulp is somewhat protected from heat by the surrounding enamel and dentine, this severe DNA degradation after such a short period of heating also suggests the poor heat resistance of DNA. In contrast to these studies, Schwark et al achieved better results from DNA amplifications of burnt bones obtained from actual cases. However, there is a plausible explanation for this contradiction. The portion chosen for DNA extraction might have been exposed to a lesser degree than the dominant area used for classification of burn coloration. Further experimental study of burning bone under strict temperature control would be required to clarify this matter. Advanced technology for observing burnt bones As already explained in this review, burnt bones present many problems for forensic identification. These extend into both anthropological and DNA analysis and we should not expect to consistently obtain sufficient DNA profiles from severely burnt bones. In such situations, anthropological results become more important as the means for forensic identification. We therefore need to obtain as much morphological information as possible from fragmented and fragile burnt bones. The micro-CT imaging technique is one of the most advanced technologies available for observing the detailed morphology of small materials. The micro-CT scanning system employs two main units: The micro-focal X-ray spread from the source projects enlarged image of the object onto the detector, and the manipulator precisely rotates the object during a scanning Figure 2. The object size available for scanning varies by the type of the scanner. Our system shown in Figure 1 scans objects sized between approximately 2 and mm in diameter. Many applications of the micro-CT system to research uses have been reported in a wide range of areas not only in bone and dental

anatomy 81 â€” 83 but also in archaeology to observe bodies of arthropods in fossil remains, 80 in neuroanatomy to observe nervous system of arthropods, 84 in cardiology to obtain cardiovascular images of mice, 79 , 85 and so on. Highly advanced technology, synchrotron radiation micro-CT has also been applied to observing detailed histological structures of the compact bone. Figure 2 Interior view of the micro-CT system: A a micro-focal X-ray source, B a high-resolution X-ray detector, and C a precise manipulator. Two examples where the micro-CT imaging has been applied to bones are shown in Figures 3 and 4. Figure 3 shows the reconstructed 3D image of the proximal end of a humerus that had been completely cremated. The 3D shape was virtually cut longitudinally, and the detailed structure of spongy bone was revealed. The age estimation can be done from this image based on the metamorphosis of cancellous and trabecular structures of the spongy bone, comparing the changes in overall morphology through various stages of life. Figure 4 shows enlarged images of the human and bovine compact bones obtained using intensely focused CT slicing. Histological structures such as osteons and Haversian canals can be clearly seen and the lamellar pattern is clear in the bovine specimen. Though these images are of non-burnt specimens, it is thought that an equivalent histological observation would be possible with burnt specimens. As this has shown, micro-CT imaging has huge potential for forensic burnt bone identification because of its high resolution both in reconstructed 3D shapes and in single CT slices. Figure 3 Three-dimensional 3D images of cremated proximal end of humerus, obtained by micro-CT imaging. Detailed structure of sponge bone can be observed by virtually slicing the 3D image. A 3D image before virtual slicing and B interior view of the humerus after virtual slicing. Figure 4 Enlarged images of the compact bones obtained by intensely focused CT slicing. Histological structures can be seen clearly and the lamellar pattern is found in bovine specimen. A Human tibia and B bovine metacarpal bone. Conclusion A number of investigative studies on burnt bone identification were discussed in this review. This research issue has been studied over a long period of time from a wide range of perspectives in various areas of expertise. Although important findings continue to accumulate, identification methods for burnt bone are still at an early stage of development. Although burnt bone poses many difficulties for forensic identification, current advancements in chemical and physical analyses, X-ray imaging, and DNA analysis have the potential to provide higher scientific certainty for the results of identification attempts. Continued application of more advanced technology is expected to provide more opportunities to increase our knowledge in this field. Acknowledgment The author wishes to thank the anonymous reviewers for their helpful comments. Disclosure The author reports no conflicts of interest in this work.

Chapter 5 : Volume analysis of heat-induced cracks in human molars: A preliminary study

New parameters for the characterization of diagenetic alterations and heat-induced changes of fossil bone mineral using Fourier transform infrared spectrometry Author links open overlay panel M. Lebon a b I. Reiche b J.-J. Bahain a C. Chadefaux b A.-M. Moigne a F. FrÃ¶hlich a F. SÃ©mah a H.P. Schwarcz c C. FalguÃ¨res a.

Chapter 6 : Atlas of Bone Marrow pathology: Bone Marrow Pathology

Much of the microscopic analysis of the internal structure of burned bone to date has been conducted by forensic anthropologists, who have identified important heat-induced changes to human bone histology (Bradtmiller and Buikstra, , Cattaneo et al., , Forbes, , Harsanyi, , Herrmann, , Hummel and Schutkowski, , Nelson.

Chapter 7 : DNA survival and physical and histological properties of heat-induced alterations in burnt bones

Androgen deficiency is associated with low bone mass in humans and animals, but the remodeling alterations that lead to bone loss are unclear. Our objective was to define early responses in both cancellous and cortical bone to orchiectomy (ORX) using histomorphometry in sexually mature (4- month-old) rats.