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Original Research Article

Assessment of speed of post mortem alteration to skeletal microstructure

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Abstract: The assessment of microstructural influence on post mortem changes usually depends over human skeletal system. Various works stated that post mortem alteration to skeletal material can be extensive, and can occur shortly after death. This study conducted to assess the potential speed of post mortem alteration to skeletal microstructure by examining a small group of forensic specimens from various time intervals. The method of assessment was microscopical analysis, microstructural morphologies of post mortem alteration investigated in buried material for both normal and pathological. A total 15 samples were included between fourth months to seventy-five years. Microstructural changes at fourth month shows normal density as compact bone, at 15 months exhibited intraorganisation of demineralized and remineralized foci and at 7 years in a tooth shows a slight change in cementum of a tooth. The microstructural changes to bone could occur within days of death because of endogenous bacterial migration to the skeleton.
Keywords: Microstructural change, skeletal system, Post mortem changes

INTRODUCTION

The structural degradation of skeletal remains needs a lengthy degradation process, which progress from crack appearance, proceeds with loss of shape, architecture and microstructural integrity; it may take minimum 6 years to maximum 30 years [1]. The speed of post mortem change to human skeletal remains has become an increasingly important question with regard to the efficacy of forensic techniques [2-4].

That skeletal microstructure can change post mortem has been known from as early as 1864 [5]. The changes caused by either the separate or the combined actions of bacteria, fungi and other microflora [6, 7]. Most authors who have examined archaeological human material consider time the least important contributory factor in the process of post mortem change, generally agreeing that post mortem alteration begins at the point of skeletonization [8-10].

The present study conducted to assess the potential speed of post mortem alteration to skeletal microstructure by examining a small group of forensic specimens from various time intervals.

MATERIALS AND METHODS

A sample of 11 human skeletal specimens from different environmental contexts examined. The post mortem interval calculated from the period of death to recovery. The sample extended over a range of 3 months to 83 years post mortem. The age and **sex** of each individual known. Thick sections removed from bones and teeth by saw. All bones sectioned transversely and teeth sectioned bucco-lingually. All sections cleaned with water, allowed to air dry. Sections were placed in 95% distilled methyl methacrylate with 5% styrene and 0.2% methyl propionitrile and the transferred in to an oven at 32^0C. Embedded specimens sectioned and sent for examination.

RESULTS

The microstructural post-mortem changes in tibial fragment at fourth month shows normal density as

of compact bone and at two sites focal demineralisation were detected, one at periosteal with demineralised foci around lacunae of osteocyte and other at intracortical.

The microstructural changes in fifth rib at 15 months show an alteration and exhibited intraorganisation of demineralized and remineralized foci. The post-mortem foci did not cross cement line, localized around post-mortem voids, and enlarged osteocyte lacunae. The next microstructural change of tooth observed for 2 years post mortem. Eccentric cavities over the neck of the tooth, which invades in to the cementum and dentine. Enamel was unaffected for short distance. No demineralisation and remineralisation associated with the cavities appeared by post-mortem alteration.

Post mortem, microstructural changes at 7 years in a tooth shows a slight change in cementum of a tooth observed. Small post-mortem foci found nearly half way down to the root. The foci characterises a slight demineralisation of cementum with a clear remineralized leading band of increased density. In another case, changes at 70 years in twelfth rib showed demineralisation around the whole periphery of the rib.

DISCUSSION

The results from this study confirm that post mortem alteration to skeletal tissues can occur very soon after death, change being identified in the earliest specimen examined at fourth months post mortem. The other findings, occurring within 7 and 70 years post mortem, concur with those of Yoshino *et al.;* findings with regard to time. The taphonomic relationship between environment and post mortem change in bones and teeth gains support from this new data. The localised change to the fourth month specimen is similar to the exposure change noted by Yoshino *et al.;* [11].

The results from this study, although bringing forward the time-frame for post mortem change to the skeleton, do not refute the notion that this process begins at the point of, or after, skeletonization [12]. It is a curious fact that although it is known that endogenous gut microflora promote early stages of body decomposition, it is exogenous microflora (usually soil related) which are solely implicated in skeletal post mortem change [11]. This idea has been adopted and utilised in archaeological and geochemical research which has tended to consider skeletal remains as depositional artifacts, subjects to diagenetic alteration via the biologically porous network of empty vascular and cellular spaces [13, 14]. This notion has been accepted and utilised as idea has not been tested and the evidence f or post mortem change potentially beginning earlier and being possibly of endogenous origin is strong.

In life, the intestinal mucosa acts as a barrier preventing the invasion of endogenous microflora of the gut lumen transmigrating into the body [15]. Only under certain circumstances can gut microflora transmigrate, and when this occurs it is primarily into the portal vein and to a lesser extent via the mesenteric lymph system. After death the intestinal mucosa, no longer functions as an effective barrier and it has been experimentally demonstrated that bacteria can cross the intestinal mucosa within 15 hours post mortem [16].

Bacteriological studies of post mortem blood have confirmed the rapid motility of this invasion, via the vascular network, reaching all the major organs of the body within 24 hours [17]. The endogenous bacteria can transmigrate via capillary network, bone, in to medullary cavity through vessels supplying the bone and then expands intracortically in to Haversian level. This is the early sign of alteration in microstructure of bone after death and before skeletonization.

CONCLUSION

This study has brought forward the period for post mortem change to skeletal microstructure. The contribution of the depositing environment was also shown to influence significantly the microstructural/ morphological type of post mortem alteration. It is hypothesized that microstructural changes to bone could occur within days of death as a result of endogenous bacterial migration to the skeleton. However, further studies are needed to establish still earliest moment, such as change occur prior to skeletonization.

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