Activity: Can You Identify Activity Patterns?

Summary

Some occupations and habits modify skeletons because bones change size and shape in response to forces exerted on them. The bones of body builders show well-developed ridges where muscles are attached. The hips and knees of runners may develop joint deterioration. The right arm bones of someone who is right-handed may be larger than the left. Generally, pinpointing a task that caused a particular bone formation is not possible. However, the basic movement and degree of labor of a task can be determined. Repetitive, heavy use of certain muscles can affect the bones to which they are attached. The bone may thicken, modify in shape, or become roughened where the muscles connect. Similarly, inactivity can cause bone loss, or atrophy.

Manifestations of Heavy Labor

Normal vs. Damaged

Bony Ridges & Crests

Figure 1 shows upper arm bones of two adults. The humerus on the left is from a young female. The humerus on the right is from an older male. The male humerus is larger and has greater evidence of heavy physical labor involving the upper arms.

Both the right and left humeri of the same male show defined bony ridges (i.e., roughened bone) and crests where the muscles of the upper arm were attached.

Figure 1. Female (left) and male (right) humeri. (Source: Smithsonian Institution)

Figure 2. Male right and left humeri. (Source: Smithsonian Institution)

Cortical Excavations, Schmorl's Nodes

Rather than causing bony ridges where muscles attach, heavy labor in young people can result in cortical excavations (pits in the outer surface of bone). The humerus on the right in Figure 3 has a cortical bone excavation. The bone on the left is normal with a smooth outer surface.

Bony changes in the spinal column also reflect excessive physical strain and activity. Traumatic and heavy lifting can compress the spine, producing hollowed depressions (known as Schmorl's nodes) in the vertebrae, as the tissue cushioning the disks bulges into the bone. The vertebra on the right in Figure 4 shows an endplate cavity caused by compression of the spine. The vertebra on the left is normal without evidence of disk compression.

Figure 3. Two juvenile humeri, normal (left), cortical excavation from heavy labor (right). (Source: Smithsonian Institution)

Figure 4. Two vertebrae, normal (left) and with Schmorl's nodes (right). (Source: Smithsonian Institution)

More Examples from the Boy in the Cellar

Collar Bone (Clavicle)

Figures 5 and 6. Right and left clavicles (collarbone) of the skeleton in the cellar. (Source: Smithsonian Institution)

Notes from the forensic report of the skeleton in the cellar: *The inferior surfaces of the clavicles have deep cortical excavations at the attachment sites for the subclavius muscles and costoclavicular ligaments. These excavations extend from the medial ends of the bones onto the shafts for approximately 30 mm with widths of approximately 9 mm and depths that range from 2 to 4 mm.*

Upper Arm (Humerus)

Figures 7 and 8. Humerus and proximal humerus of the skeleton in the cellar. (Source: Smithsonian Institution)

The proximal humeri exhibit roughened attachment sites for teres major, latissimus dorsi, and pectoralis major. Cortical excavations are present at the attachments for teres major with the left side being more pronounced. This excavation measures approximately 25 mm superior-inferior by 8 mm across, and 1.5 mm in depth.

Lower Arm (Ulna & Radius)

The ulnae and radii have roughened and thickened crests (the radii are not shown here). The anterior and medial surfaces of the right ulna shaft are especially roughened.

Figures 9 and 10. Right and left and right proximal ulnae and right ulnar shaft. (Source: Smithsonian Institution)

Spine (Vertebrae)

Eight thoracic vertebrae and three lumbar vertebrae have Schmorl's depressions in their proximal and/or inferior endplates. (See comparison of normal and affected vertebrae in Figure 4 above. A subset is shown below.)

Figure 11. Vertebrae series from the spine of the skeleton in the cellar (three thoracic vertebrae [upper row] and two lumbar vertebrae [lower row]). (Source: Smithsonian Institution)

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