The Atlatl

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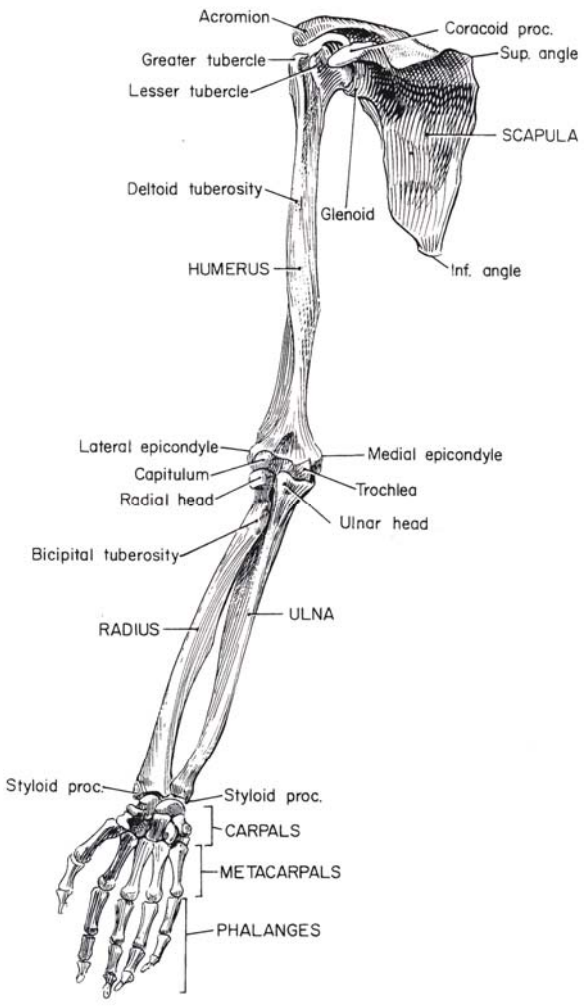
Atlatl Elbow: Anatomy and Archaeology

By John Whittaker 9/02

At the end of last atlatl season I went to my doctor J.R. Paulson with stomach problems, but thought I might as well tell him about my elbow while I was there. I described the symptoms: "the outside of the elbow and the tendons on the outside and back of the lower right arm are really sore" and he poked it a bit and said "oh yes, tennis elbow." "Actually," I said, "it's from throwing spears," and I explained. That caught his interest, and he flexed my arm enthusiastically. I winced, but he was pleased: "OK, we can name a new medical syndrome: 'spear thrower elbow'." With regret, I told him it was too late, for "atlatl elbow" had already been diagnosed in prehistoric skeletons. J.R. didn't think I would have any damage that would show on an x-ray, so he dashed my dream of being the first archaeologist to experimentally replicate and document injuries to his own skeleton. But when J.R. asked for more archaeological details and wanted me to get precise about the anatomy, I realized I needed to do some research, so here it is.

Caption



Bones of the right arm and shoulder, seen from in front. The hand is supinated (palm up) and the clavicle has been left out for clarity. It attaches to the coracoid process.

Where does it Hurt?: Anatomy of "Atlatl Elbow"

Human anatomy, in books by both doctors and physical anthropologists, is a lost world where fragments of ancient Greek and Latin still wander, apparently used as a code to keep common folk from intruding on the authority of science. Actually, the scientists are trying for unambiguously precise location and description of body parts, but the jargon requires some translation – those who don't need it can skip the bracketed comments. Chuck Hilton, a physical anthropologist, helped lead me through the maze and otherwise improved this discussion.

The elbow, shoulder, and wrist joints are all involved in throwing. Most atlatl complaints I hear are about elbows, and osteologists have focused on elbows in prehistoric populations, so I will focus on "atlatl elbow," but discuss shoulders as well. The wrist is even more complex, and seems to cause less grief, so I won't consider it here, but we should not forget that it is part of the throwing equipment.

The Elbow

The elbow unites the three main

bones of the arm, the humerus [upper arm] and the radius and ulna in the lower arm. The elbow joint allows a wide range of motion. Flexion and extension [bending and straightening] are allowed by the hinging joint of the "semi-lunar" notch in the upper ulna and the smooth rounded end of the lower humerus. The lower arm also rotates, turning palm up [supination] and palm down [pronation]. When you straighten your arm and turn your palm down, the head of the radius rotates in the radial notch on the side of the ulna head and on the rounded capitulum on the lower end of the humerus, and the lower end of the radius crosses over the ulna.

Atlatlists seem most likely to suffer lateral epicondylitis, or what my doctor recognized as "tennis elbow," where the soreness is mostly on the back side of the arm and the outer part of the elbow. Baseball pitchers seem to suffer more from "little league elbow," which affects the inner elbow. The muscles along the back of the arm, running between the lateral epicondyle of the humerus [the bony lump on the outside of the elbow] and the wrist and fingers, are mostly "extensors" which serve to extend [straighten] the wrist and fingers. On the inner, palm side of the arm, the muscles are mostly "flexors" which flex wrist and fingers, and attach to the radius and ulna and the inside of the humerus head. The elbow itself is mostly flexed by the biceps, and extended [straightened] by the triceps. These are big strong muscles and rarely feel the strain.

Tennis elbow usually affects the extensor muscles on the back of the arm and the outside of the elbow. The gripping muscles on the other side of the arm and elbow must also be in use, as they are in pitching, but the real stress is on the extensors which are resisting the force of backhands in tennis (Miller 1983), and involved in the serve (Norkin and Levangie 1992). In our sport, a hard throw followed by breaking the swing of the atlatl should produce similar stresses. If you used atlatls vigorously all your life, we might expect osteoarthritis to result. This could lead to bone spurs and enlargement of the lateral epicondyle on the humerus, and wear on the elbow joint, especially on the capitulum of the humerus and head of the radius, which are the outside part of the hinging and rotating joint. These areas are often damaged in pitching, especially in young athletes (Lipscomb 1975).

Because tennis involves gripping the racket as well as the flexing/extending and rotating motions of throwing, tennis elbow in more extreme forms involves most of the elbow. In fact, although doctors often talk about "tennis elbow" when the outside (lateral) part of the elbow hurts, tennis players show more damage to the medial [inside] parts also damaged by pitching (Priest, Jones and Nagel 1974). This more general damage is also what might be expected from atlatl use. Accordingly, damage might also extend to the olecranon [funny bone, back of elbow] and the olecranon fossa [groove on back of humerus head], because the elbow is forcibly extended in a hard throw (Merbs 1983: 150), and perhaps the wrist as well.

The Shoulder

Throwing involves rotating the shoulder, lifting the arm above the horizontal and swinging it around the ball-and-socket joint in the shoulder where the head of the humerus fits into the glenoid cavity of the scapula [shoulder blade] with additional support from the clavicle [collar bone].

On the back, the trapezius muscle is a large triangular sheet originating along the vertebrae and attached to the spine of the scapula [in the middle of your shoulder in back]. It pulls the scapula both up and down, and in throwing rotates it so the glenoid [socket] moves up, allowing the arm to be raised above the shoulder. The deltoid is the large muscle on the top of the arm that abducts [raises] the arm. It attaches to the acromion [on the top] and lower edge of the spine of the scapula, and to the lateral third of the clavicle, and runs to the deltoid tuberosity [a rough spot midway down the shaft of the humerus]. The pectoralis major, originating on the ribs, clavicle, and sternum [breast bone] and running to the crest of the greater tubercle on top of the humerus, is the major muscle flexing the arm at the shoulder. The latissimus dorsi originates on the lower back and attaches to both the scapula and the upper humerus. It helps to stabilize the scapula and is the major extensor of the arm at the shoulder [pulling it away from the chest]. Serratus anterior, another stabilizer of the scapula, is between the scapula and the side of the rib cage. Four other muscles (subscapularis, supraspinatus, infraspinatus, and teres minor) form the "rotator cuff." They all originate from the scapula and attach to the upper part of the humerus, and function both to move the shoulder joint and keep it together. Humans have this complicated shoulder and arm anatomy that allows us to throw things because distant primate ancestors were forest apes who climbed and swung.

When I over-exercise with my atlatl, I have a hard time telling what is hurting, other than my whole shoulder. When I throw, the pain seems to be mostly around the acromion, and might involve the joint between acromion and clavicle, and muscles such as the ventral [front] part of the deltoid and perhaps the top of the pectoralis major, and maybe rotator cuff muscles. It feels like more joint than muscle however, and last season I hurt partly from overuse of the shoulder in lifting.

Although I know a few atlatlists who use little motion in the shoulder, the majority uses a rotating shoulder motion where the arm lifts at least slightly above the shoulder. We should expect rotational wear on the head of the humerus and the glenoid cavity [socket] of the shoulder blade, and stress on the joint between the clavicle and scapula at the top of the shoulder from raising the arm. The soft parts that hurt after a hard day at the ISAC should be muscles of the rotator cuff and the joint (acromioclavicular) between clavicle and scapula and the muscles that attach there, probably the top of the pectoralis major and the front of the deltoid.

Sore Bones: "Atlatl Elbow" in Prehistory

J. Lawrence Angel, an influential physical anthropologist, coined the term "atlatl elbow" in a 1966 study of Early Horizon (Archaic) burial remains from Tranquility, California. At the time, the fields of archaeology and physical anthropology were moving toward more interpretive studies, attempting to examine the behavior of individuals and groups as sources of information on subsistence, adaptation to the environment, and social interaction. Angel was one of the pioneers in paleopathology who were beginning to look at patterns of disease and trauma on skeletons as evidence of repeated activities that stressed the living body. Arthritic changes in joints are one form of evidence often interpreted in terms of past activities. Much of the damage we do to our joints is in the soft tissue structures of muscles, tendons, and ligaments, painful but usually leaving no trace on the skeleton. However, severe damage, or even long term stress, may increase the likelihood that the joint in question will become arthritic. What you see on the bone (osteoarthritis) is first the development of small spicules or lips of bony growth around the edges of joints, resulting from damage to ligaments. When damaged, both tendons and ligaments may become calcified [more bone-like] at the spots where they attach to bone. In advanced cases, the cartilage, which separates and cushions bones and allows for smooth motion at joints may become damaged or even worn away. At this point, the articular surfaces (where bones come together) begin a repair process. But it is already too late. Once the cartilage begins to erode, it will wear away at a faster rate until there is bone on bone contact. New, dense bone is laid down, and the surface develops a polished appearance, called eburnation. The surface may also develop grooves or pitting, and continued use of the joint causes further breakdown. Joints with this type of cartilage damage will not repair, even after reducing use.

On the Tranquility remains, Angel noted that six out of 13 elbows had arthritic conditions. Usually including eburnation after friction removal of cartilage over the capitulum, the "ball" [on the elbow part of the humerus, the upper arm bone] against which the concave upper surface of the head of the radius [lower arm bone] rubs during flexion and extension [bending and straightening] of the elbow and pronation and supination [rotation down and up] of the hand. What repeated and stressful action combines those movements? One thinks at once of baseball pitcher or javelin thrower, except that this equally strains shoulder and clavicular joints." Angel interpreted the signs of elbow stress in the ancient population as resulting from long use of atlatls, but apparently assumed that atlatlists would not use shoulders much, a mistake that a little practical experience could have avoided.

According to Jurmain (1999:122) this study was influential in the development of paleopathology as a whole, and especially interest in osteoarthritis as evidence of activity patterns, because Angel had apparently identified a clear link between activity and pathology, and given it a catchy name. Others followed this path, and prehistoric elbows turned out to be especially interesting. Elbows and knees tend to have more frequent osteoarthritis than other major joints, and elbow lesions in prehistoric populations are more common than in modern clinical studies (Bridges 1992). Ortner (1968), Jurmain (1978), and Merbs (1983) all worked with Inuit skeletal evidence, and found high rates of elbow arthritis in these arctic populations. Harpoons, and in some areas, throwing boards, are well-documented ethnographically among Inuit groups, and the paleopathologists used ethnographic information to explain the pathological lesions in their skeletal samples.

Jurmain (1999) and others are now more cautious about interpreting activity patterns from osteoarthritis. Angel and others usually relied on small samples of skeletons, so small that they could not subdivide them to look at differences between age groups for instance. Age of course is important – by middle age, most of us have at least some beginning arthritic changes visible in vertebrae and some limb bones, even if they don't trouble us. Genetic differences among populations may also influence rates and positions of arthritis in unknown ways. Meanwhile, there is argument about how arthritis develops, and whether stress and damage to joints really produces arthritic changes in a predictable way. We also do not know as much as we think about activity patterns in prehistoric populations. Even if we know that a group used atlatls, we do not necessarily know what kind of motion was favored, who used them, or how often and hard they practiced, just as styles and skills among modern atlatlists are highly variable. Although

some motions stress fairly specific parts of joints, most are much more general, and everyone participates in many activities. Merbs (1983) and Jurmain (1978) expect that dog sledding, hide scraping, bow and arrow use, and kayak paddling would be other activities likely to affect Inuit elbows as well as various kinds of throwing. Miller (1985) found evidence of lateral epicondylitis (outside of the elbow, the soreness in tennis elbow) in skeletons from a 13th century southwestern pueblo. They did not use atlatls, and he attributed the elbow lesions to grinding corn with a heavy mano in a trough metate.

Other attempts to suggest atlatl use from skeletal evidence usually use the following arguments:

1. Good evidence that atlatl use was important.
2. Skeletal evidence compatible with atlatl use AND more specifically:

a: favoring one side in individuals – very few people throw ambidexterously.

b. probably more common in one sex – in recent cultures atlatl use and hunting is more likely to be a male activity, although there is no reason to assume that will necessarily be true.

c. Comparison between two local populations whose weaponry changed through time.

Ortner (1968) described in detail arthritic changes in the capitulum of the humerus, where the head of the radius rubs against it during both flexing and rotation of the elbow joint. He compared Eskimo and Peruvian skeletal specimens, and found higher rates of arthritic changes in the Eskimo. Although he refers to this condition throughout as "atlatl elbow", he did not actually interpret it as resulting from atlatl use in his study. He argues that atlatl elbow does probably result from the stress of use, but notes that genetics, age, and different activities complicate the issue.

Bridges (1990) was specifically interested in connecting atlatl use to pathology. She compared Archaic (atlatl using) and Mississipian (later bow and arrow using) skeletal populations from northwestern Alabama. She expected to see more arthritis of elbow and shoulder, and greater difference between left and right arms in both arthritic conditions and dimensions in the Archaic population, and also expected that males would be more affected in both populations than females. In fact, there were no clear patterns, and she was forced to conclude: "in this region, changes in hunting technology appear to have had a minimal impact on the physique." While "atlatl elbow" occurred in 15 to 26% of her male specimens, it was slightly more common in females, and equally common in both periods, so "it is impossible to attribute atlatl elbow to any specific activity." Pickering (1984), comparing Illinois Woodland to Mississipian populations, was also unable to interpret their arthritis patterns in terms of weaponry.

The term "atlatl elbow" came to us from skeletal studies, but it actually turns out to be based on rather weak and inconclusive evidence. That doesn't mean that we don't hurt after throwing too hard or often, but what modern atlatlists recognize, as atlatl elbow is pain in the tendons and muscles, rather than damage to the bone joints. At least I hope so…

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The art of life is the art of avoiding pain. -- Thomas Jefferson