The Biomechanics of Golfer's and Tennis Elbow

Golfer's elbow and tennis elbow are both musculoskeletal pathologies that are hallmarked by elbow pain, hence their names. However, even though these conditions cause elbow pain, they are not conditions of the actual elbow joint; rather, they are overuse syndromes of musculature of the hand and/or the fingers. Pain is experienced at the elbow because these muscles have their proximal tendinous attachments there.

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BIOMECHANICS

The biomechanics of golfer's and tennis elbow can be nicely compared and contrasted because they are extremely similar, although they are somewhat mirror opposites of each other. The muscles of golfer's elbow have their proximal attachments on the medial epicondyle of the humerus, so golfer's elbow causes medial elbow pain; the muscles of tennis elbow attach onto the lateral epicondyle of the humerus, so tennis elbow causes lateral elbow pain.

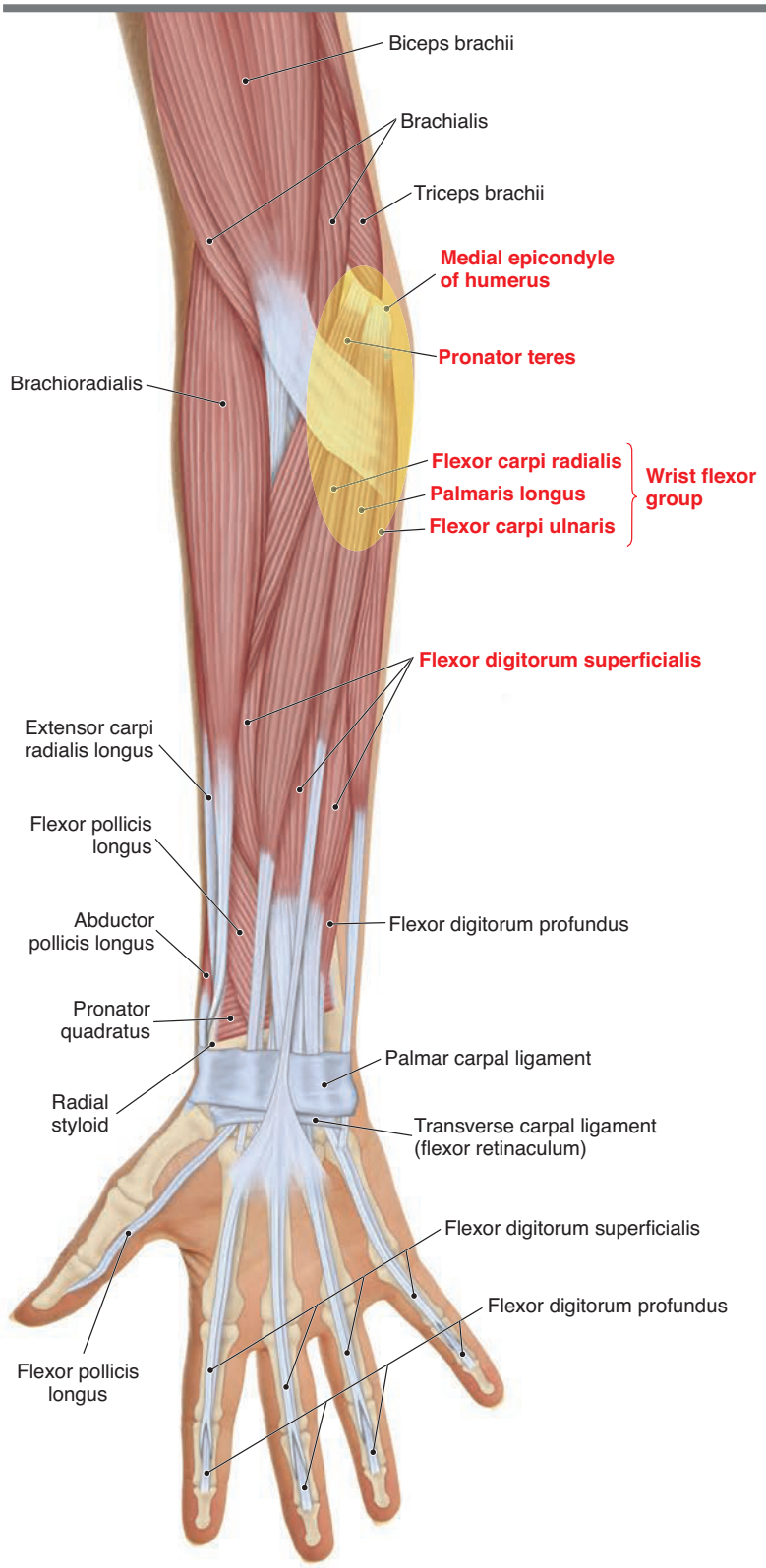
Golfer's elbow is an overuse condition of excessive flexion of the hand at the wrist joint and flexion of the fingers at the metacarpophalangeal (MCP) and interphalangeal (IP) joints, resulting in overuse of the anterior flexor compartment of the forearm musculature. In contrast, tennis elbow is primarily an overuse syndrome of excessive extension of the hand at the wrist joint and extension of the fingers at the MCP and IP joints, resulting in overuse of the posterior extensor compartment of the forearm musculature.

GOLFER'S ELBOW

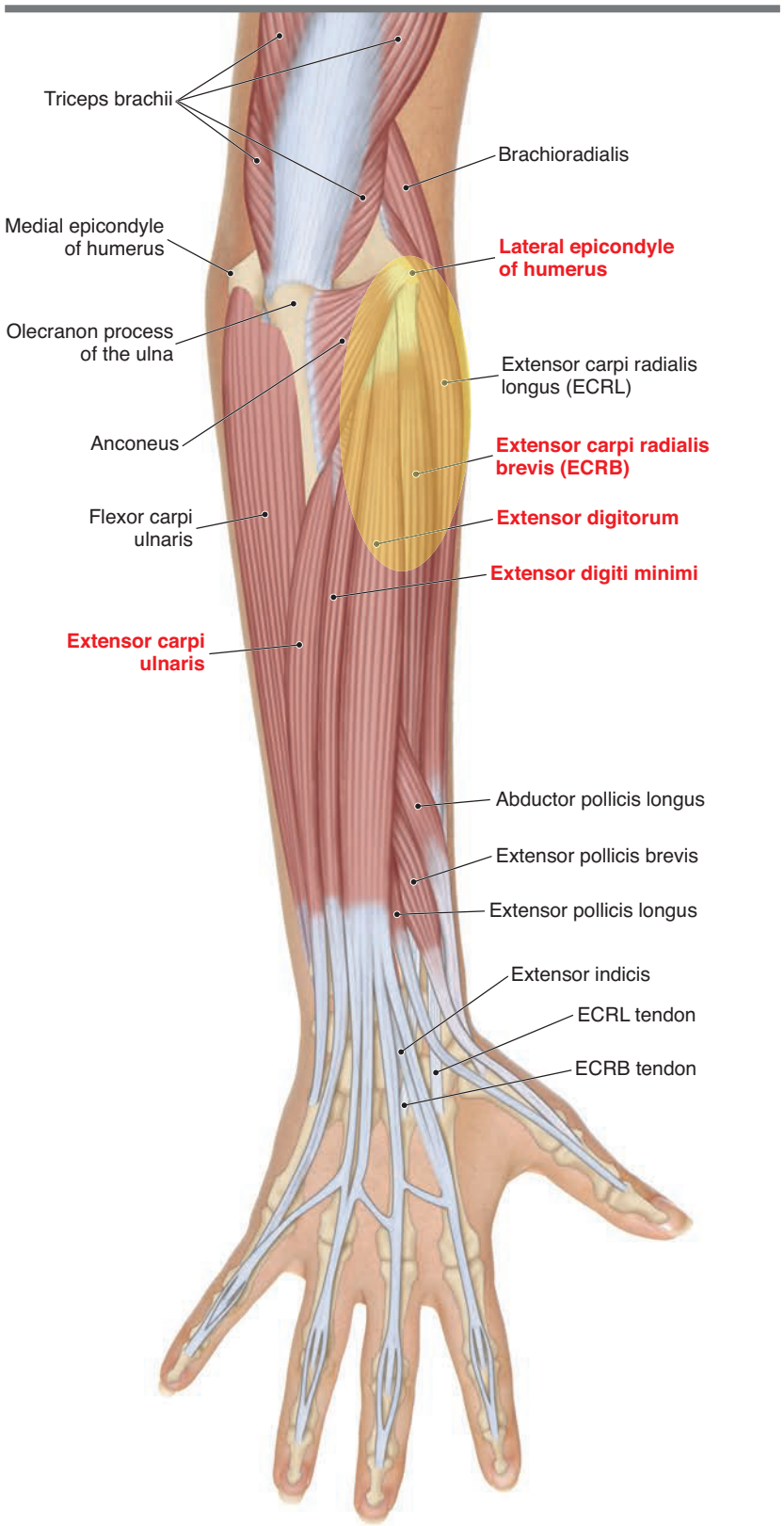
Golfer's elbow involves five muscles that all attach to the medial epicondyle of the humerus and along the medial supracondylar ridge of the humerus. These five muscles are the pronator teres, the three muscles of the wrist flexor group (the flexor carpi radialis, palmaris longus, and flexor carpi ulnaris), and the flexor digitorum superficialis (Image 1). These muscles attach to the medial epicondyle via what is known as the *common flexor tendon* because the proximal tendons of these muscles blend into each other. Perhaps a better name might be the *common flexor belly/tendon* because their bellies blend together before their tendons merge.

As the name *common flexor* implies, these muscles are involved with flexion. The three muscles of the wrist flexor group all cross the wrist joint anteriorly, so they flex the hand at the wrist joint. The flexor digitorum superficialis crosses the

1 Anterior view of the right upper extremity. Golfer's elbow causes pain at the medial elbow. The muscles of golfer's elbow common flexor belly/tendon group are noted in red. *Permission Joseph E. Muscolino,* The Muscular System Manual, *4th edition, Elsevier, 2015.*



2 Posterior view of the right upper extremity. Tennis elbow causes pain at the lateral elbow. The muscles of tennis elbow common extensor belly/tendon group are noted in red. *Permission Joseph E. Muscolino,* The Muscular System Manual*, 4th edition, Elsevier, 2015.*



Elbow Pains by Different Names

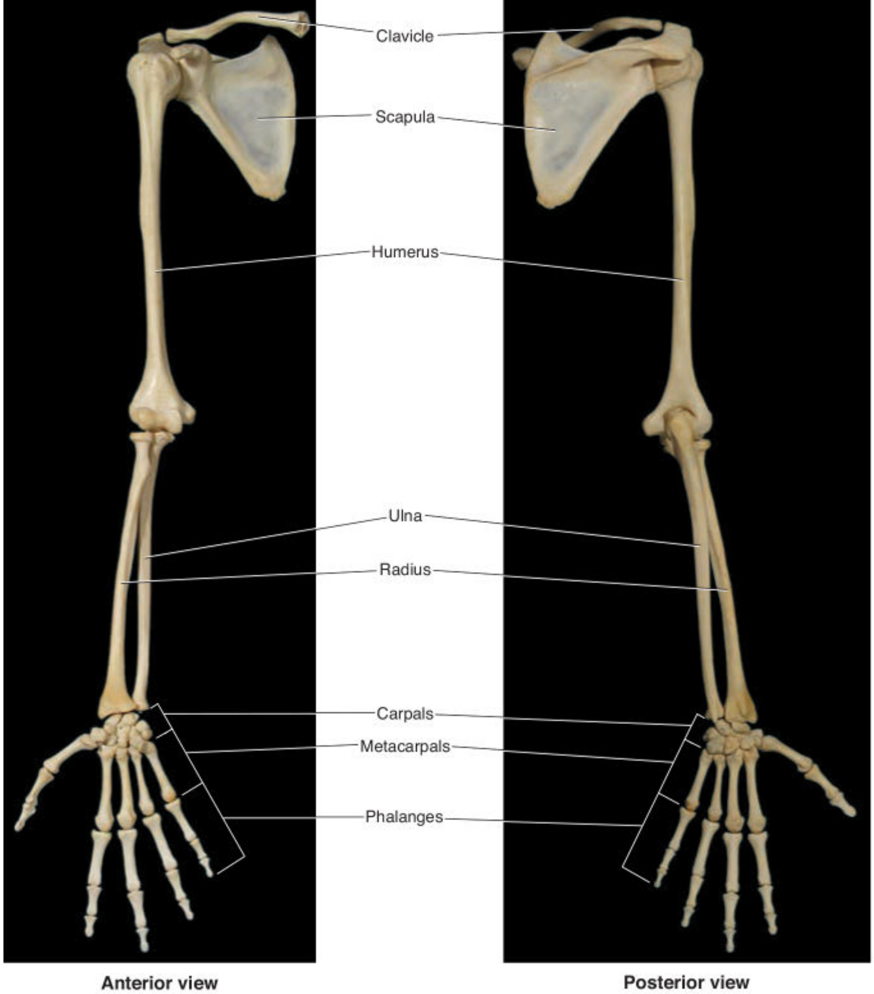
Golfer's and tennis elbow have classically been described as *medial epicondylitis* and *lateral epicondylitis*, respectively, because pain experienced with these conditions is usually situated at, or near, the medial or lateral epicondyle of the humerus.

Pain from tennis elbow occurs primarily at the lateral epicondyle because backhand strokes require wrist joint extension. This extension stresses the musculature of the common extensor belly/tendon that attaches at the lateral epicondyle of the elbow.

Pain from golfer's elbow occurs primarily at the medial epicondyle because gripping and swinging a golf club (and a forehand stroke in tennis) requires wrist and finger joint flexion. This flexion stresses the musculature of the common flexor belly/tendon that attaches at the medial epicondyle of the humerus.

Because inflammation often accompanies these conditions, the suffix *itis* is part of the names. However, in recent years, it has become understood that the inflammation is often only present when the condition is acute. When the condition becomes chronic, the inflammation recedes or disappears; therefore, the more general terms *medial epicondylosis* and *lateral epicondylosis* are applied instead. The suffix *osis* simply means *condition of* and does not imply inflammation.

New terms have recently gained favor, including *medial elbow tendinopathy* for golfer's elbow and *lateral elbow tendinopathy* for tennis elbow. These terms are likely better because they capture both the acute inflamed phase and the chronic noninflamed phase.



3 Bones and joints of the upper extremity, right side. *Permission Joseph E. Muscolino, Kinesiology: The Skeletal System and Muscle Function, 3rd edition, Elsevier, 2015.*

wrist joint anteriorly and the MCP and proximal IP joints of fingers 2–5 (index, middle, ring, and little) anteriorly, so it flexes the hand and fingers. The pronator teres pronates the forearm at the radioulnar joints. And all five golfer's elbow muscles cross the elbow joint anteriorly, so they all flex the elbow joint as well (Image 3).

Any of these joint actions of flexion of the wrist, fingers, and forearm—and pronation of the forearm—place a stress on the myofascial tissue of the musculature of this group, as well as its attachment onto the medial epicondyle of the humerus, where all their common tendinous attachment is located. Even though golfer's elbow was originally described for its periosteal inflammation of the humeral attachment, before the humeral inflammation occurred, golfer's elbow involved common flexor tendinopathy. And before the tendinopathy occurred, golfer's elbow began as an overuse and tightness of the muscular tissue of the muscles involved. So, what was originally named as a condition of the bone, was before that a condition of the tendon, and before that, an overuse condition of musculature. This factor is often missed in allopathic treatment of this condition.

TENNIS ELBOW

Tennis elbow is nearly a mirror opposite of golfer's elbow. Whereas golfer's elbow involves five muscles that all attach to the medial epicondyle of the humerus, tennis elbow involves four muscles that all attach to the lateral epicondyle of the humerus.

The four muscles of the tennis elbow group are the extensor carpi radialis brevis (ECRB), extensor digitorum, extensor digiti minimi, and the extensor carpi ulnaris (see Image 2). The extensor carpi radialis brevis and extensor carpi ulnaris are members of the wrist extensor group. These muscles

Common Tendons

The common flexor tendon is sometimes referred to as the *common flexor/pronator tendon* because the pronator teres is one of the involved muscles and is not involved in wrist or finger flexion, but does perform forearm pronation at the radioulnar joints. In fact, even the flexor carpi radialis crosses the radioulnar joints and can pronate the forearm, so including the word *pronator* in the name of this common tendon is even more justified.

Similarly, the common extensor tendon can be referred to as the *common extensor/supinator* tendon because the extensor carpi radialis brevis can assist