ABSTRACT: Palpation can help distinguish “tennis elbow” from radial tunnel syndrome. In lateral tennis elbow, the point of maximum tenderness is over the origin of the extensor carpi radialis brevis, within 1 to 2 cm of the lateral epicondyle. In radial tunnel syndrome, maximal tenderness is present at the proximal edge of the supinator, which is under the posterior edge of the lateral forearm muscles, distal to the radial head, and about 4 to 5 cm distal to the lateral epicondyle. If posterior pain results when the elbow is quickly hyperextended, the cause is most likely impingement between osteophytes on the olecranon and the walls of the olecranon fossa. The valgus stress test evaluates the stability of the lateral and medial collateral ligaments. True valgus laxity during both pronation and supination of the forearm suggests insufficiency of the anterior or posterior collateral ligament; apparent valgus instability in supination that resolves in pronation represents posterolateral rotatory instability resulting from attenuation of the lateral collateral ligament.

Palpating the elbow to elicit point tenderness is a key part of the office examination. Once you determine the exact location of the tenderness, you can formulate a differential diagnosis of the possible structures injured (Table). Palpate nonpainful regions first, then proceed to the symptomatic area.

In a previous article (CONSULTANT, April 1, 2001, page 509), we discussed how to garner key diagnostic points from the history and initial observation. Here, we describe how to make best use of palpation to arrive at a differential diagnosis; we also discuss range of motion evaluation and tests for instability. In a future article, we will describe provocative tests (tests that place specific structures under stress) that can confirm a diagnosis.

LATERAL PALPATION

“Anconeus soft spot.” Palpate the anconeus soft spot (infracondylar recess) to determine the consistency of any fullness that may be present. Hemarthrosis is usually tenser to palpation than is a synovial effusion, and synovitis often feels lumpy and rubbery. Deformation or dislocation of the radial head may also lead to fullness here, which will be noticeably harder than fluid or synovitis.

Lateral elbow. The most common cause of lateral elbow pain is “tennis elbow,” or degenerative tendinosis of the extensor carpi radialis brevis (ECRB). Tendinosis has previously been referred to as tendinitis or lateral epicondylitis. However, histologic examination of excised symptomatic tendons has consistently failed to reveal acute inflammatory cells. The term “tendinosis” is therefore used rather than “tendinitis” because it more accurately reflects the histopathology of the degenerative process.

Tenderness over the origin of the ECRB, just anterior and distal to the tip of the lateral epicondyle, is a sign of tennis elbow. The point of maximum tenderness is invariably within 1 to 2 cm of the lateral epicondyle. If the extensor digitorum communis is also
volved, it will be tender just posterior and distal to the tip of the lateral epicondyle. In 20% of patients, associated exostosis of the lateral epicondyle results in tenderness over the lateral epicondyle itself.

The main entity included in the differential diagnosis of tennis elbow is radial tunnel syndrome, which is caused by compression of the posterior or intersosseus nerve (PIN). PIN compression leads to diffuse pain and tenderness along the track of the radial nerve in the extensor mass of the proximal forearm.²

In radial tunnel syndrome, the point of maximum tenderness is at the proximal edge of the supinator, under

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Office Examination of the Elbow:
Palpation and Instability Tests

Humerus

Ulnar nerve

Figure 1 – Percussion of the ulnar nerve proximal to, over, and distal to the cubital tunnel, may elicit a positive Tinel sign at the site of nerve compression. This consists of pain or paresthesias that radiate distally from the elbow to the ulnar digits.

the posterior edge of the lateral forearm muscles, just distal to the radial head and approximately 4 to 5 cm distal to the lateral epicondyle. This tenderness should be compared with that of the contralateral forearm, because this region is often slightly tender to deep pressure. In a future article, we will describe provocative tests that can help further distinguish lateral tennis elbow from radial tunnel syndrome.

Capitellum. The capitellum is most easily palpated in flexion; it is located under the most anterior aspect of the lateral soft spot, distal and anterior to the lateral epicondyle. The capitellum may become tender in the presence of osteochondral fractures or osteochondritis dissecans.

Radial head. Just distal to the capitellum, the radial head can be palpated. You can find it most easily by passively rotating the forearm with the elbow flexed 90 degrees. It is located approximately 2 cm distal to the lateral epicondyle, in a visible depression just posterior to the lateral forearm muscles. With forearm rotation, approximately three quarters of the radial head is palpable. Tenderness of the radial head in conjunction with an effusion may represent a radial head fracture, even if standard radiographs are negative.

Rotate the forearm at varying degrees of elbow flexion. Rotation of the radial head should be smooth; any asymmetry suggests subluxation or fracture of the proximal radius. Crepitus, popping, or pain during rotation may represent radiocapitellar arthritis, chondromalacia, osteochondritis dissecans, or a loose body.

MEDIAL PALPATION

Medial collateral ligament. The medial epicondyge serves as origin for the medial collateral ligament (MCL) and the flexor-pronator muscle mass. With the elbow gently flexed to 30 to 60 degrees, palpate the anterior band of the medial ulnar collateral ligament along its entire length—from its origin at the anteroinferior medial epicondyle to its insertion on the ulna, by the base of the coronoid process. Tenderness of the MCL in conjunction with pain on valgus stress is consistent with injury to this ligament.

Flexor-pronator muscles. Palpate the flexor-pronator muscle mass. Medial tennis elbow (also called golfer’s elbow) is a tendinopathy of the pronator teres and/or the flexor carpi radialis. The point of maximum tenderness usually lies within these tendons.
hich are distal and anterior to the medial epicondyle. In addition, the proximal origin of the pronator teres, proximal to the medial epicondyle, may also be tender. In medial tennis elbow, the point of maximum tenderness is within 1 or 2 cm of the medial epicondyle.

Ulnar nerve. The ulnar nerve may be palpated in the cubital tunnel, just posterior to the medial epicondyle. The cubital tunnel begins where the ulnar nerve passes beneath the cubital retinaculum, a fascial covering that extends from the medial epicondyle to the olecranon. If the retinaculum is pathologically thick or shortened, it may cause ulnar nerve compression. If incomplete, it may allow ulnar nerve subluxation.

By performing percussion of the ulnar nerve proximal to, over, and distal to the cubital tunnel, you can often localize the site of nerve compression. A positive Tinel sign consists of pain or aesthesias that radiate distally from the elbow along the length of the ulnar nerve (i.e., to the “ulnar one and one-half digits”) (Figure 1). Palpate the nerve as you flex and extend the elbow to detect subluxation, which may predispose patient to ulnar neuritis.

OSTERIOR PALPATION

Triceps tendon. The triceps tendon is occasionally a source of pain that results from repetitive overload and tendinosis. Tenderness of the triceps tendon often represents triceps tendinosis or “posterior tennis elbow.” A gap in the substance of the tendon suggests frank rupture.

Olecranon. To palpate the tip of the olecranon, flex the elbow approximately 30 degrees to deliver the olecranon from its fossa and relax the triceps muscle. This allows easy palpation of the tip of the olecranon, which is then covered only by the insertion of the triceps aponeurosis, its bursa, and skin. An exostosis may be palpable at the olecranon tip in patients with chronic hyperextension overload resulting from repetitive impaction of the olecranon into its fossa. This is found most often in high-level throwing athletes, and these osteophytes are a common cause of loose body formation. An osteophyte at the tip of the olecranon may be tender and may limit full elbow extension. The pain of posterior impingement may be reproduced by quick, passive hyperextension of the patient's elbow. Tenderness directly over the olecranon or the proximal ulna itself may suggest olecranon osteophytes or a stress fracture, especially in athletes who throw.

The olecranon bursa, located superficial to the olecranon tip, may be inflamed, tender, or distended with fluid. Rheumatoid nodules may occur on the extensor surface of the elbow and the subcutaneous border of the ulna. Such nodules are firmer to palpation than a fluid-filled bursa.

In some patients, you will also be able—with gentle flexion—to palpate the olecranon fossa, on the posterior aspect of the distal humerus. Tenderness over the olecranon fossa may reflect synovitis or loose bodies.

ANTERIOR PALPATION

The antecubital fossa is bordered laterally by the brachioradialis, and medially by the pronator teres. It contains—from lateral to medial—the lateral antebrachial cutaneous nerve, the biceps tendon, the brachial artery, and the median nerve.

The lateral antebrachial cutaneous nerve (the terminal branch of the musculocutaneous nerve) emerges laterally between the biceps and the brachialis; this nerve is not palpable. It pierces the brachial fascia lateral to the biceps tendon and runs distally down the lateral forearm, medial to the brachioradialis.

Biceps tendon. The biceps tendon is easily palpable where it attaches to the bicipital tuberosity of the proximal radius. Its tension is increased with resisted elbow flexion and forearm supination. Tenderness at this point is a sign of strain or tendinosis of the distal biceps tendon.

Brachial artery. The brachial artery is just medial to the biceps tendon, and its pulse can be palpated here.

Median nerve. The median nerve runs under the lacertus fibrosus (bicipital aponeurosis), just medial to the brachial artery. It is unusual for the lacertus fibrosus to cause median nerve entrapment. When this does occur, a Tinel sign may be elicited here.

Anterior capsule and brachialis. If the anterior capsule has been strained in a hyperextension injury, it may be tender in the area of its origin on the anterior wall of the distal humerus. Strain of the overlying brachialis muscle can also produce anterior elbow symptoms. A strained brachialis will be tender in the same area as the anterior joint capsule, but in the case of such a strain, pain may also be reproduced by resisted elbow flexion with the forearm pronated. Forearm pronation lessens the biceps' input, making elbow flexion more dependent upon the brachialis.

RANGE OF MOTION

The normal range of elbow motion is from a few degrees of hyperextension—depending on the patient's degree of ligamentous laxity—to approximately 145 to 150 degrees of flexion. The normal range of forearm rotation is from approximately 85 to 90 degrees of supination to 70 to 80 degrees of pronation. The functional range of motion needed for most activities of daily living is much less; however, from 30 to 130 degrees of flexion-extension, and from 50 degrees of pronation to 50 degrees of supination.

Flexion-extension. Full extension is usually the first parameter lost with pathology of the elbow joint or its surrounding soft tissue structures. Be-
cause terminal extension is not required for most activities, a sizable flexion contracture may occur without loss of significant function. Many professional baseball pitchers perform quite well with moderate degrees of elbow flexion contracture. In fact, more than half of professional pitchers have some degree of flexion contracture.

To test for flexion-extension problems, passively hyperextend the elbow. Patients who are subjected to repetitive hyperextension overload may have posterior pain with hyperextension. This may be due to impingement between osteophytes on the olecranon and the walls of the olecranon fossa. If valgus (MCL) instability is also present, this posterior pain will be accentuated if you apply a valgus load while hyperextending the joint, since in this case the osteophytes are usually on the posteromedial olecranon.

If you note any blockage to motion, determine whether it is abrupt or rubbery. The former suggests an osseous blockage, while the latter may be caused by capsular contraction or soft tissue interposition. Any crepitation with elbow motion is abnormal.

**Rotation.** Measure forearm rotation with the arm at the side so that the patient cannot use shoulder motion to compensate for deficiencies of forearm rotation. Deficiencies of forearm pronation can be compensated for by shoulder abduction. Deficiencies of supination are more difficult to compensate for. Restricted forearm rotation, especially loss of supination, most commonly occurs following trauma to the wrist, forearm, or elbow.

**INSTABILITY TESTS**

**Valgus stress test.** The anterior band of the MCL is the primary stabilizer during valgus stress in flexion. In full extension, the osseous architecture of the elbow—as well as the anterior joint capsule—provide a great degree of the elbow’s valgus stability. Therefore, to isolate the MCL for stress testing, flex the elbow approximately 25 to 30 degrees to remove the olecranon from its fossa and to relax the anterior joint capsule. To prevent shoulder rotation from interfering with the examination, conduct the valgus test with the humerus in maximum external rotation (Figure 2).

How to apply the valgus load is a matter of personal preference. The patient may be standing, sitting, or supine. Stabilizing the humerus in max-
Office Examination of the Elbow: Palpation and Instability Tests

During ligament stress testing, evaluate 3 criteria: laxity, end point quality, and pain or apprehension elicited. Valgus stress to the elbow that reproduces the patient’s pain along the course of the MCL is diagnostic of an MCL injury.11
• A minor sprain (grade 1) causes pain on valgus stress that localizes to the MCL, but does not lead to laxity.
• A partial tear (grade 2) allows some laxity, but still maintains a solid end point to valgus stress.
• A complete tear (grade 3) leads to gross valgus laxity without a firm end point.

Note that even in cases of complete tears, valgus laxity may be subtle.

Valgus instability testing may be easier to perform with the forearm supinated. If instability is noted, repeat the test with the forearm pronated. True valgus laxity due to insufficiency of the anterior MCL is present during both pronation and supination. Apparent valgus instability in supination that resolves in pronation represents posterolateral rotatory instability (PLRI) caused by attenuation of the lateral ligament complex. Valgus instability and PLRI are clinically indistinguishable with the forearm supinated.15,16

Varus stress test. The varus stress test is similar to the valgus stress test, except that the humerus is internally rotated and the forearm supinated (Figure 3). True varus laxity is caused by deficiency of the entire lateral collateral ligament complex and is much less common than either straight valgus laxity or PLRI.

Test for posterolateral rotatory instability. PLRI is caused by insufficiency of the lateral ulnar collateral ligament (LUCL). PLRI refers to a rotatory subluxation of the ulnohumeral joint, in which the lateral margin of the ulna’s semilunar notch rotates (supinates) away from the trochlea of the humerus.15 Because the proximal radius and ulna are coupled by the an-
ular ligament, the 2 forearm bones move together as a unit. Therefore, rotatory subluxation of the proximal ulna from the trochea causes the radius to sublux posteriorly off the capitellum. This instability occurs only with the forearm in supination and the elbow near full extension. It is prevented or reduced by forearm pronation or elbow flexion.

The reason injury to the LUCL results in PLRI rather than straight varus laxity is most likely that the osseous architecture of the ulnohumeral articulation, not the collateral complex, is the primary contributor to varus stability. Moreover, the radial collateral ligament provides a degree of protection against varus stress.

PLRI is often overlooked. Probably the easiest way to diagnose PLRI on physical examination is to test valgus instability in both pronation and supination. If incompetence of the LUCL has led to PLRI, the elbow will appear to be unstable under valgus stress when supinated because the radial head will "roll off" the capitellum posteriorly. However, with the forearm pronated, the elbow will feel stable under valgus stress. Thus, apparent valgus laxity that occurs with the forearm in supination and resolves with the forearm in pronation is indicative of PLRI.

We have found the "pivot-shift" test for PLRI difficult to administer in the office setting. The patient is often apprehensive and guards against this examination. Even under anesthesia, a positive result is very subtle. In our opinion, applying a valgus load to the elbow in both pronation and supination is an easier and more reliable method of diagnosing PLRI.

REFERENCES: