Tennis Elbow

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The term "tennis elbow" usually refers to lateral epicondylitis, but the same symptoms can be caused by pathologic processes in the elbow. In fact, most cases of this common condition are caused by occupational stress rather than racket sports. Patients complain of elbow pain when the wrist is extended against resistance or during repetitive actions with the wrist and elbow extended. The condition is thought to be caused by a lesion at the origin of the common wrist extensor mechanism, at or very near the lateral epicondyle of the humerus. Differential diagnosis includes inflammatory, arthritic and nerve entrapment syndromes. Prompt conservative treatment has a high success rate. Patient education, use of a tennis-elbow band and physical therapy play key roles in the management of acute symptoms and in the prevention of recurrence. Surgical intervention is required only when other treatment fails.

The extensor muscles of the wrist originate in the lateral epicondyle and supracondylar line of the humerus. The three wrist extensors that originate on the lateral side of the elbow are the brachioradialis, the carpi radialis longus and the carpi radialis brevis.[1] The term "tennis elbow" has been used since 1882 to describe pain at or near the origin of the extensor carpi radialis brevis.[2] The pain, however, is not related to tennis in at least 95 percent of patients.[3] Participation in sports accounts for most cases in younger patients, but in older patients, tennis elbow is more commonly related to occupation.[4] The incidence of work-related cases has been estimated at 59 per 10,000 workers per year.[5]

The etiology of the condition is unknown but probably comprises traction, repeated microtrauma and inflammation.[6] Direct trauma or systemic connective tissue disease is rarely implicated as a cause of tennis elbow.

Illustrative Case

A 42-year-old right-handed man, who worked as an accountant, complained of pain of two months' duration in his right elbow. The pain was noticeable when he typed on a computer but severe when he lifted heavy manuals from a bookshelf. He played no racket sport. During the previous six months he had been remodeling his home, hammering, sanding and using various hand tools.

The only abnormality on examination was vague tenderness directly over and one inch distal to the right lateral epicondyle. No swelling or crepitus of the elbow was noted, and the medial epicondyle was not painful. Tinel's sign was negative, and paresthesia was not elicited by resisted extension of the long finger of the right hand.

The patient was comfortable holding a book in his right hand while his elbow was flexed at his side and his forearm was supinated. When the patient held the book with his forearm actively pronated, he immediately felt pain in the right lateral epicondyle region and abducted the arm while allowing the book to dip. This maneuver reproduced the symptoms he experienced at work.

The clinical diagnosis was tennis elbow. After a splint was placed on the patient's forearm, he was able to grasp the book much more comfortably than before. He was instructed to wear the splint when

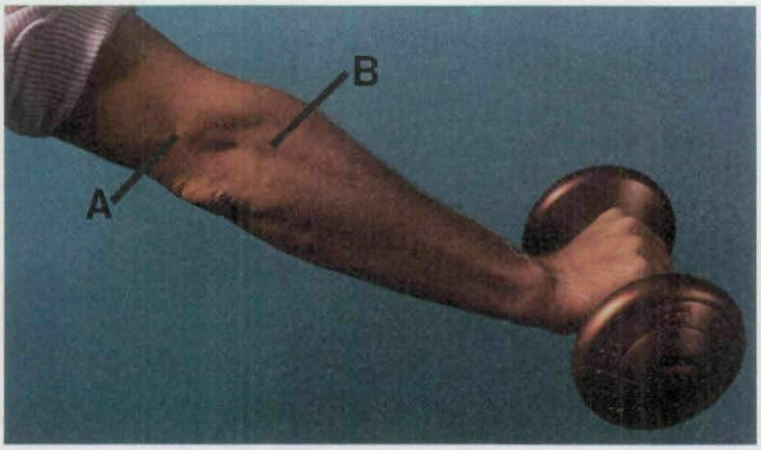

FIGURE 1. The wrist and elbow are extended against a load, showing the location of the lateral epicondyle of the humerus (*A*) and the location of the extensor carpi radialis brevis muscle (*B*).

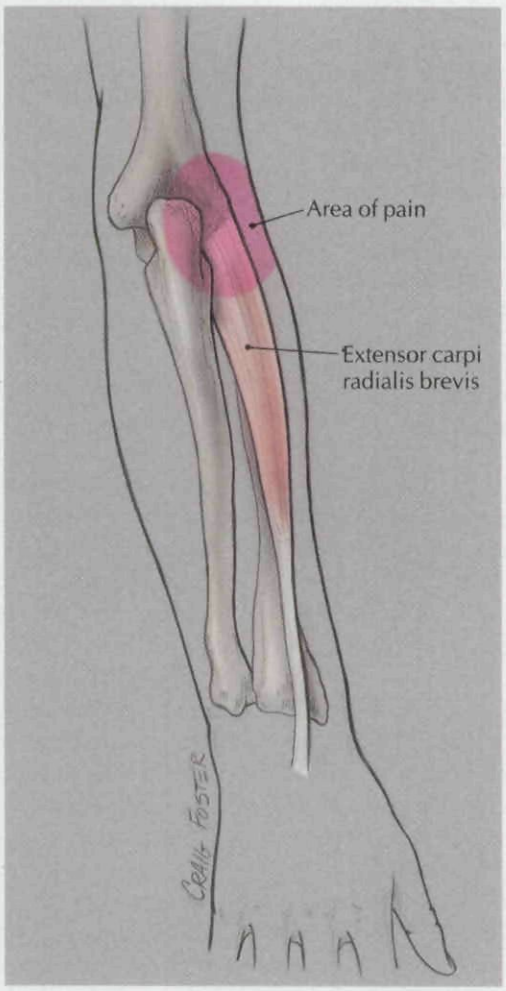

FIGURE 2. Posterior aspect of right forearm, showing extensor carpi radialis brevis and the area of pain associated with tennis elbow.

working in his office or home, to avoid lifting and grasping objects when his forearm was pronated and to lift objects with his elbow closer to his body. The patient decided to arrange for help in remodeling his house. Ibuprofen was prescribed at a dosage of 600 mg three times daily with meals. Six weeks later the patient was much improved.

Diagnosis

The illustrative case is typical in that the patient played no racket sport and acquired his symptoms occupationally. The site of pain in tennis elbow has been localized to the attachment of the extensor carpi radialis brevis mechanism to the distal aspect of the lateral epicondyle (*Figures 1 and 2*). Scarring and granulation are found at this site in patients treated surgically, but no single clinicopathologic process has been unequivocally identified as the cause of the pain.[7]

Tennis elbow occurs most often in white men between 30 and 60 years of age. The dominant side of the body is more frequently affected. Tennis elbow is reportedly rare in blacks.[8] The reported duration of symptoms ranges from three weeks to three and one-half years, with an average duration of six to 12 weeks. Tennis elbow is usually a chronic condition by the time the patient seeks medical treatment.

The diagnosis is clinical. No completely reliable or pathognomonic sign exists. Tenderness usually occurs over the lateral epicondyle or one to two inches distally, or at both sites. The pain decreases gripping power and can be provoked by resisting extension of the wrist.[9] A "coffee-cup" sign has been described, in which pain occurs at the lateral epicondyle when the patient picks up a full cup of coffee.[10]

A heavy book (about 6 lb) can be used both as an aid to diagnosis and for patient education on how to lift objects. The patient with tennis elbow can hold a book with little or no pain if the elbow is flexed

FIGURE 3. When a heavy book is held with the elbow flexed and adducted, the patient with tennis elbow does not experience pain.

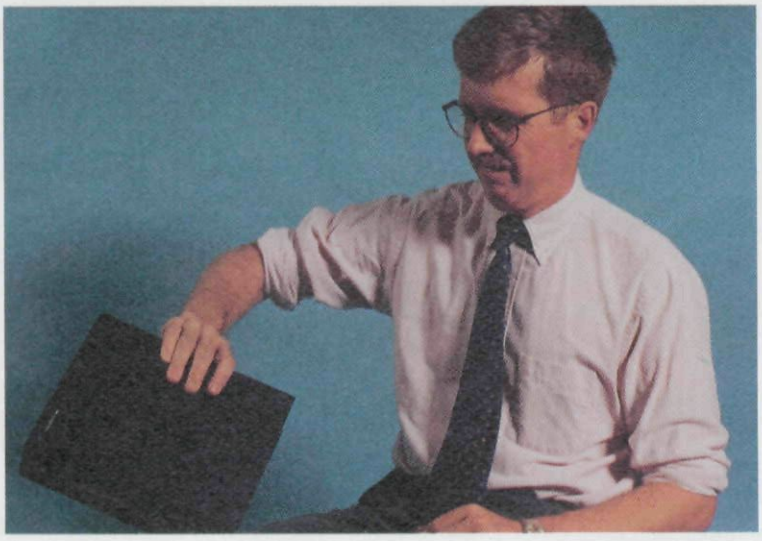

FIGURE 4. (*Top*) Grasping a heavy book while the forearm is pronated causes immediate pain in the elbow, followed quickly (*bottom*) by elbow abduction, allowing the book to dip below the level of the elbow.

TABLE 1

Differential Diagnosis of Tennis Elbow

Neuropathic
Radial tunnel syndrome
Entrapment of posterior interosseous nerve
Entrapment of musculocutaneous nerve
Entrapment of median nerve (pronator syndrome)
Ulnar entrapment syndromes
Inflammatory
Radiocapitellar arthritis
Synovitis
Gouty arthritis
Joint space infection
Trauma
Radial neck fracture
Distal humerus fracture
Referred pain
Cervical radiculopathy
Shoulder arthritis
Carpal tunnel syndrome
Angina pectoris
Other
Lateral epicondylitis (most common)
Medial epicondylitis
Tumor (primary or secondary)
Bone cyst

and adducted with the forearm supinated (*Figure 3*). However, when holding the book with the forearm pronated, the patient experiences immediate pain in the lateral epicondyle region, abducts the elbow and allows the book to dip below the level of the elbow (*Figure 4*).

The most common examination technique is palpation at and just distal to the affected lateral epicondyle while the examiner resists the patient's wrist extension. Because the extensor carpi radialis brevis inserts on the third metacarpal bone, some examiners prefer to use resistance against extension of the third, or long, finger rather than the entire wrist. This test (resisted wrist/finger extension), however, can produce variable temporary paresthesia in patients with radial tunnel syndrome. Passive pronation and supination of the forearm and extension and flexion of the elbow do not cause pain in patients with lateral epicondylitis.

Conditions that must be differentiated from tennis elbow are listed in *Table 1*. The five possible nerve entrapment syn-

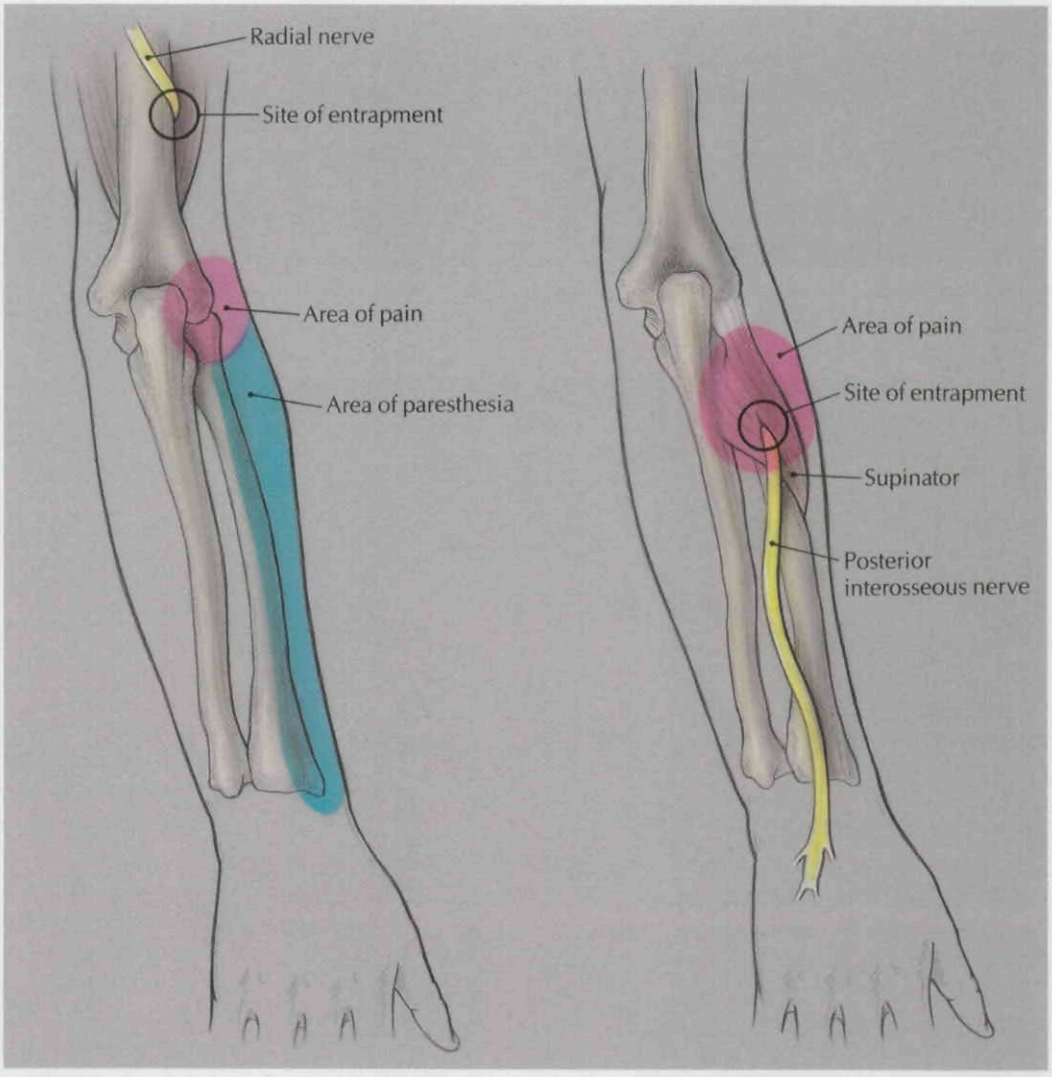

FIGURE 5. Entrapment sites of the radial nerve (*left*) and the posterior interosseous nerve (*right*) and areas of associated pain and paresthesia.

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dromes present the greatest diagnostic challenges.[11,12]

- The radial nerve can become compressed in the radial tunnel as it courses laterally around the posterior surface of the humerus and pierces the lateral muscular septum (*Figure 5*). Pain from radial nerve compression may be referred to the lateral epicondyle region, and paresthesias may occur in the distribution of the superficial radial nerve. With radial nerve compression, a Tinel's sign over the radial

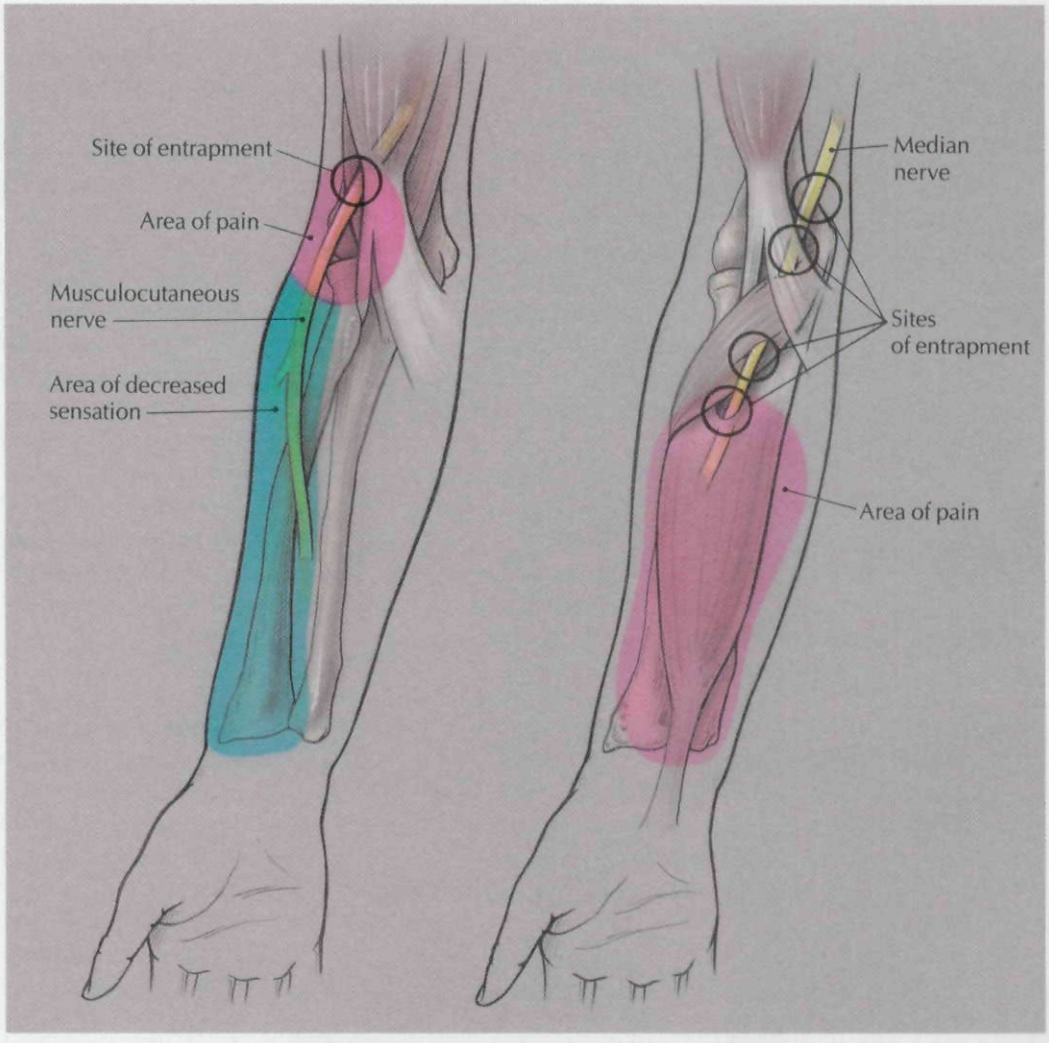

FIGURE 6. Entrapment sites of the musculocutaneous nerve (*left*) and the median nerve (*right*) and associated areas of pain and decreased sensation.

head is possible, as well as tenderness to muscle palpation approximately 4 cm distal to the lateral epicondyle. The most common finding is pain when the arm is supinated against resistance while the elbow is extended. Weakness of full-finger extension and limited extension of the elbow may be noted.

•The posterior interosseous nerve (deep branch of the radial nerve) can become trapped within the supinator muscle (*Figure 5*). Such entrapment produces weakness of fifth-finger extension and pain at the elbow, making the condition difficult to distinguish from radial tunnel syndrome.

•The musculocutaneous nerve can be compressed by the bicipital aponeurosis and tendon against the brachial fascia, resulting in pain in the anterolateral elbow and decreased sensation in the radial volar forearm (*Figure 6*).

•The median nerve can be compressed at four different sites in the forearm (pronator syndrome), producing pain in the volar forearm that worsens with repetitive use (*Figure 6*). Pain can be provoked

by resisting pronation or by resisting flexion at the proximal interphalangeal joint of the third finger.

•The ulnar nerve can be trapped in the elbow or forearm, although the pain occurs in the medial forearm or hand (*Figure 7*).

Tennis elbow usually causes no visible swelling. If swelling is present, arthritis, synovitis, infection, trauma and tumor should be diagnostic considerations. Inflammation can develop in the radiocapitellar bursa, as well as the synovial insertion at the elbow. Gout can produce swelling in the elbow.[13] Joint space infection and primary or metastatic tumors are differential possibilities but rarely are manifested by point tenderness at or near the lateral epicondyle.

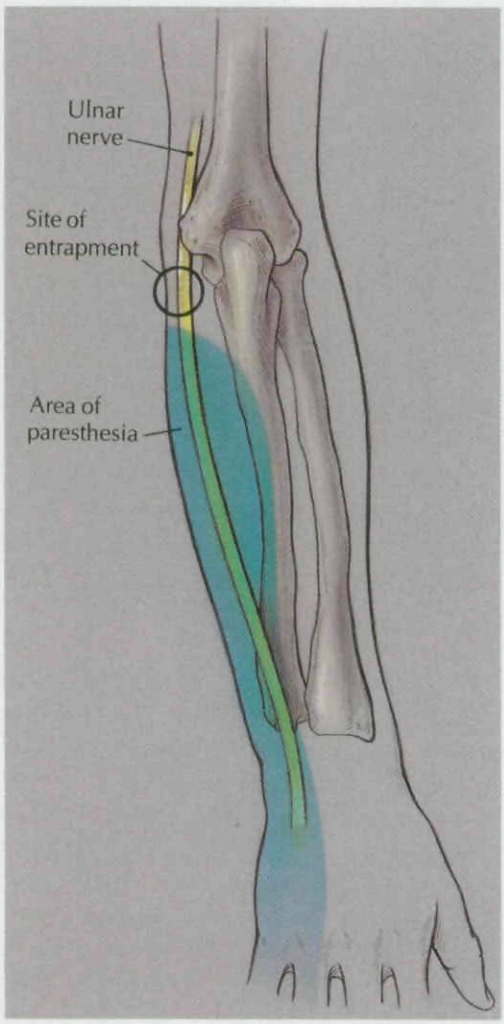

FIGURE 7. Entrapment site of the ulnar nerve and area of paresthesia.

Elbow pain can represent pain from cervical radiculopathy or carpal tunnel syndrome.[9] Rarely, the pain of angina pectoris is referred to the elbow. A history of falling or trauma should elicit a search for fracture, especially of the radial neck. Lastly, medial epicondylitis produces pain over the medial epicondyle of the humerus. The condition is known as golfer's elbow, although it also occurs in baseball pitchers and tennis players. This misnomer highlights the confusion caused by appending a sport's name to a medical condition.

Treatment

Patient education, protection of the painful elbow and avoidance or modification of aggravating actions are critical factors in the treatment of tennis elbow.[14] Treatment begins with teaching the patient lifting techniques that will protect the elbow. Lifting objects with the palm close to the body is comfortable to patients with tennis elbow; lifting with the elbow extended and forearm pronated is not.

A tennis-elbow band may be beneficial. To determine whether wearing a tennis-elbow band would be helpful in a particular patient, a blood pressure cuff can be placed on the affected forearm and inflated to midway between systolic and diastolic blood pressure, to simulate a tennis-elbow band. When the patient grasps a book (as previously discussed), a reduction in discomfort would demonstrate the utility of the band. A tennis-elbow band could then be prescribed, to be worn during daytime hours (*Figure 8*).

Two general types of bands are available: static and counterforce. The static band wraps around the forearm and applies equal pressure to all areas of the fore-

FIGURE 8. Placement of a tennis-elbow band, with the pad over the extensor surface of the forearm.

arm. The counterforce band applies most of the tightness directly over the extensor mechanism of the forearm.

In severe cases, instead of a forearm band, a cock-up splint can be placed at the wrist, to provide 20 degrees of extension.

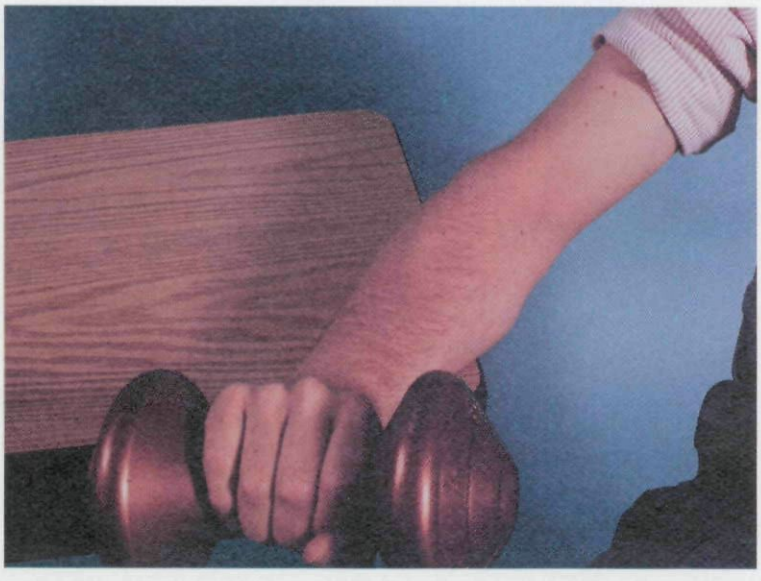

FIGURE 9. When free of pain, the patient begins strengthening the forearm, using a 1-lb weight.

Splinting shortens the extensor musculature and reduces the drag on the origin of the extensor brevis muscle at the lateral epicondyle.

A nonsteroidal anti-inflammatory drug (NSAID) is a rational therapy.[15] Corticosteroid injection may be helpful, especially if the patient has disabling pain at the time of initial presentation or if symptoms do not respond to rest, banding and NSAID therapy. An injection of crystalline steroid and local anesthetic can be administered with a 25-gauge needle at the lateral epicondyle and in several other sites, up to one inch distal to the epicondyle. This technique spreads the medication and may prevent corticosteroid-induced skin atrophy. The patient should be instructed to apply ice to the area after the injection and to rest the elbow for two to three weeks.[16,17] After injection, pain commonly flares for several days. Postinjection application of ice may prevent this flare.

Rehabilitation

Rehabilitation is crucial to prevent recurrence of tennis elbow.[18,19] After the pain has subsided, the patient should begin performing stretching exercises of the extensor forearm muscles. After passive stretching, the patient should begin performing strengthening exercises for the forearm muscles by using a 1-lb weight (*Figure 9*).

Strong consideration should be given to a formal rehabilitation program for patients with lateral epicondylitis related to occupational or sports activities. Strategies must be developed to avoid repeated forearm stress. An occupational program may involve a physical therapist or an occupational therapist, or both, as well as a worksite visit. For sports-related cases, the program may include consulting a tennis professional to correct faulty backhand technique or racket selection.

Finally, surgery plays a role in the treatment of unresponsive, disabling lateral

epicondylitis.[20] Surgery may be considered if one or more of the following conditions exists: severe pain in the epicondylar area for at least six months, no response to two weeks of immobilization and no response to two local injections of corticosteroids.

Several surgical techniques are available. One technique[20] involves percutaneous release of epicondylar muscles. Another technique[20] is more extensive and aims not only at releasing the origin of the extensor carpi radialis brevis but also at excising any inflamed or pathologic tissue. Surgery has a diagnostic as well as a therapeutic aspect, because pathologic processes such as radial nerve entrapment may be discovered during surgery.

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