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Tennis Elbow: Subject Matter of Concern

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ABSTRACT: Lateral epicondylitis (Tennis Elbow) is a frequently reported medical condition. Its results in considerable morbility and financial cost. The syndrome is seen mainly in those whose work involves repetitive movements of forearm and hand. It is reported that 7.4% of industrial workers and 40-50% of tennis players in USA are at some time affected by it. In 1981, over 1500 workers in Quebec made claims to the workers compensation board for this condition, generating a cost of 4442 canadian dollar per case and an average of 62 days of work lost. The statistics is provided by 1982, Province of Quebec, workman`s compensation board. Its treatment includes NSAIDS, many physiotherapy techniques, cost immobilization, orthosis, surgical operations and less conventional methods such as radiotherapy, acupuncture and vitamins. The aim of this article is to review the current literature, anatomy, sports specific biomechanics, physical examination, causes, types and rehabiliatation of lateral epicondylitis follow up and prevention.

KEYWORDS: Tennis Elbow; Pathophysiology; Treatment; Physiotherapy.

INTRODUCTION

Lateral epicondylitis, or tennis elbow, is the most common overuse injury of the elbow and is observed up to 10 times more frequently than medial epicondylitis. Lateral epicondylitis is usually precipitated by repetitive contraction of the wrist extensors and is characterized by aching pain that is worsened with activity. Early conservative management is the key to symptom resolution, which eventually allows return to vocational and avocational activities without restriction.[1, 2, 3]

The most common overuse syndrome is related to excessive wrist extension and commonly referred to as “tennis elbow,” but it is actually more common in non-tennis players. It is also commonly referred to as lateral epicondylitis, but this is usually a misnomer because, in general, microscopic evaluation of the tendons does not show signs of inflammation, but rather angiofibroblastic degeneration and collagen disarray. Light microscopy reveals both an excess of fibroblasts and blood vessels that are consistent with neovessels or angiogenesis.

Pathophysiology

Lateral epicondylitis is a result of inflammation, or enthesitis, at the muscular origin of the extensor carpiradialisbrevis (ECRB). See **Figure 1**. This inflammation leads to microtears of the tendon, with subsequent fibrosis and, ultimately, tissue failure. Less commonly, the attachments of the extensor carpi radialislongus (ECRL), extensor digitorumcommunis (EDC), or extensor carpi ulnaris (ECU) are involved.[4, 5, 6]

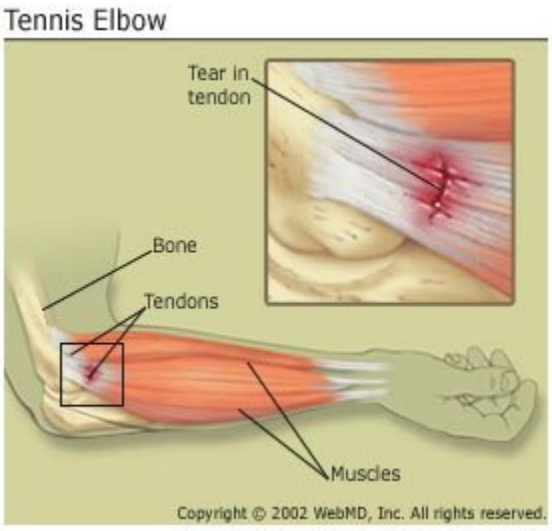

Fig 1

Epidemiology

Sex

The condition affects men and women with equal frequency.

Age

Lateral epicondylitis most often occurs between the third and fifth decades of life

Functional Anatomy

The area of maximal tenderness is usually an area just distal to the origin of the extensor muscles of the forearm at the lateral epicondyle. Most typically the ECRB is involved, but others may include the extensor carpi radialislongus (ECRL), extensor digitorum, and extensor carpi ulnaris.

The radial nerve splits into the superficial radial and posterior interosseus nerve (PIN) at the radiocapitellar joint. The PIN may become entrapped by pericapsular structures, causing radial tunnel syndrome.

Sport-Specific Biomechanics

Tennis is the most common sport to cause lateral epicondylitis, but the condition can also be seen in those who play squash and badminton. Symptoms can occur after an improper backhand hitting technique, which can occur when the athlete attempts to increase power by increasing forearm force rather than relying on core, rotator cuff, and scapular power. This results in snapping the wrist with supination and irritation of the extensor tendons.

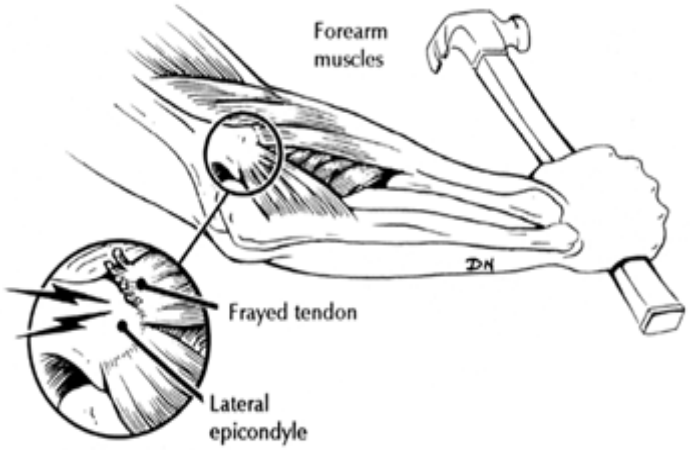

Fig 2[Refer (20)]

Symptoms can also occur when an athlete does not get his or her feet into position and hits the ball late or with a bent elbow. The power of the hit is again generated from the forearm instead of the core. See **Figure 2.**

Other causes of extensor tendinopathy in tennis are using new racquet, using a racquet that is strung too tightly, or using a racquet that is too heavy, as well as hitting wet or heavy balls or hitting into the wind. Another common racquet abnormality that causes lateral elbow extensor tendinosis is having a grip that is too large.

Industrial athletes have certain occupational and leisure activities that lead to overuse injuries of the forearm wrist extensors, causing pain at the lateral epicondyle. These include carpenters, bricklayers, seamstresses and tailors, politicians (excessive handshaking), and musicians (eg, pianists, drummers). Such injuries can also be seen in individuals who perform a lot of computer work, a lot of typing, and a lot of mouse work for their occupations

History

- The typical age of those affected is 40 to 50 years.
- Patients most typically report an insidious onset, but they will often relate a history of overuse without specific trauma.
- Symptom onset generally occurs 24-72 hours after repeated wrist extension activity.
- Delayed symptoms are probably due to microscopic tears in the tendon.
- The patient complains of pain over the lateral elbow that worsens with activity and improves with rest. The patient will also often describe aggravating conditions such as a backhand stroke in tennis or the overuse of a screwdriver.
- Pain may radiate down the posterior aspect of the forearm.
- The patient can often pinpoint pain 1.5 cm distal to the origin of the ECRB.
- Pain can vary from being mild (eg, with aggravating activities like tennis or the repeated use of a hand tool), or it can be such severe pain that simple activities like picking up and holding a coffee cup (ie, "coffee cup sign") will act as a trigger for the pain.

Physical

- Inspection: Very rarely does one notice swelling or ecchymosis.
- Palpation: Maximal tenderness is elicited 1-2 cm distal to the origin of the ECRB at the lateral epicondyle.
- Pain is increased with resisted wrist extension, with the wrist radially deviated and pronated.

- Resisted extension of the middle finger is also painful secondary to stress placed on the ECRB tendon, as it is preferentially stressed in this position when it must contract synergistically to anchor the third metacarpal, such that extension can take place at the digits.[7]
- Increased pain is noted with resisted supination and hand shaking.
- Always examine ROM of the shoulder, elbow, and wrist on the affected side.
- Examine ROM and test for crepitus at the radiohumeral joint of the affected limb to evaluate for radiohumeral bursitis, osteochondritis of the capitellum, or PIN entrapment.

If decreased ROM if noted on physical examination, consider obtaining an x-ray to further evaluate the joint.

Causes

- Poor general conditioning leads to fatigue of the core and shoulder muscles, which puts an overemphasis on the extensor muscles of the forearm. [8]
- Improper training (eg, poor positioning when striking a tennis ball)
- Improper technique (eg, hitting a tennis ball late on the backhand)
- Poor or improper equipment (eg, a grip that is too big or a racquet that is strung too tightly)

Types of tennis elbow

Type 1 : Supracondylar

Type 2 : Tenoperiosteal

Type 3 : Body of the tendon

Type 4 : Muscle belly.

In a Type 1 tennis elbow, the lesion lies in the extensor carpi radialislongus ; in the other types the brevis muscle is affected.

Type 2 is seen very frequently. It is also the most disabling variant : carrying weight, pouring coffee, picking up the phone, shaking hands could all be most painful. There might be radiation of pain into the fingers 2-3-4. Specifically torsion movements can cause very painful twinges. It is the only type of tennis elbow with a tendency to spontaneously recover. Generally this takes about 1 year in a patient younger than 60 years. If older, 2 years becomes more likely. This rule only applies as long as the patient has not had a steroid infiltration. It is remarkable that this type 2 tennis elbow is the only tenoperiosteal lesion in the entire body for which deep friction alone is ineffective. It is treated, after a preliminary deep friction (= anaesthetic effect), by manipulation/stretching.

Imaging Studies

- Imaging studies usually are not necessary, but tendinopathies can be visualized with magnetic resonance imaging (MRI) and with ultrasonography.[9]

Other Tests

- Electrodiagnostic studies may help to determine whether other causes of lateral elbow pain, such as cervical radiculopathy or posterior interosseous nerve palsy, are present.

Histologic Findings

Findings can include collagen disorientation, collagen disorganization, fiber separation by increased mucinoid substance, an increased prominence of cells and vascular spaces (with or without neovascularization), and focal necrosis or calcification. Superimposed evidence of a tear, including fibroblastic proliferation, hemorrhage, and organizing granulation tissue, may be revealed.

Rehabilitation Program

Physical Therapy

Acutely, the goals of treatment are to reduce pain and inflammation. Anti-inflammatory modalities include ice, ultrasonography, and iontophoresis. Iontophoresis with topical nonsteroidal anti-inflammatory drugs (NSAIDs) has been shown to help reduce pain. The use of iontophoresis with corticosteroids is not supported. A wrist splint used during activities can be helpful, because it places the extensor muscles in a position of rest and prevents maximal muscle contraction. Counterforce bracing (tennis elbow strap) is another orthotic alternative that can be used to unload the area of muscle origin at the elbow. A splint or brace should not be used in isolation but should be employed only as an adjunct to modalities and exercise/stretching. [10] Deep-tissue and friction massage help to release underlying adhesions and promote improved circulation to the area.

In the subacute stage, emphasis is placed on the restoration of function of the involved muscle group. Flexibility, strength, and endurance of the wrist extensor muscle group can be achieved through a graded program. ROM for wrist flexion/extension and pronation/supination should be achieved prior to proceeding with a strengthening program. Strength and grip training should progress from isometric to concentric to eccentric contractions of the forearm muscles, especially the wrist extensors.[11, 12]

Jafarian et al compared 3 common types of orthoses for their effect on grip strength in patients with lateral epicondylitis.[13] In a randomized, controlled laboratory study in 52 patients, maximum and pain-free grip strength were assessed, with patients wearing an elbow strap orthosis, an elbow sleeve orthosis, a wrist splint, or a placebo orthosis. Use of either the elbow strap or sleeve orthosis resulted in an immediate and equivalent increase in pain-free grip strength ($p < 0.02$); consequently, the researchers suggested that either of these types of orthosis may be used. The wrist splint provided no immediate improvement in either pain-free or maximum grip strength.

In chronic refractory cases of lateral epicondylitis, scapular stabilization should be addressed to prevent overuse of the wrist extensors during activities. Sports-specific training should also be included in the rehabilitation program, if appropriate.

You may do the stretching exercises right away. You may do the strengthening exercises when stretching is nearly painless.

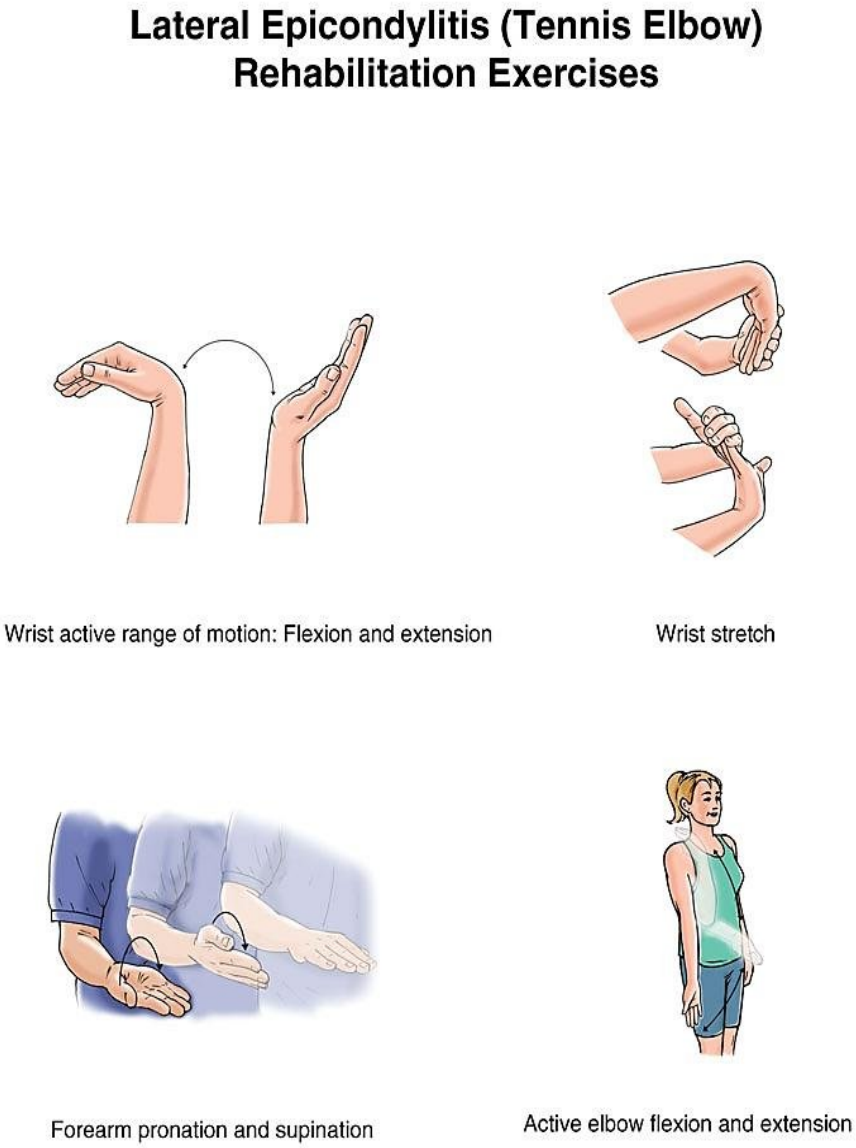

Fig 3[Refer (22)]

Stretching exercises

[1] Wrist active range of motion: Flexion and extension: Bend your wrist forward and backward as far as you can. Do 3 sets of 10.

[2] Wrist stretch: With one hand, help to bend the opposite wrist down by pressing the back of your hand and holding it down for 15 to 30 seconds. Next, stretch the hand back by pressing the fingers in a backward direction and holding it for 15 to 30 seconds. Keep your elbow straight during this exercise. Do 3 sets on each hand.

[3] Forearm pronation and supination: With your elbow bent 90°, turn your palm upward and hold for 5 seconds. Slowly turn your palm downward and hold for 5 seconds. Make sure you keep your elbow at your side and bent 90° throughout this exercise. Do 3 sets of 10.

[4] Active elbow flexion and extension: Gently bring your palm up toward your shoulder and bend your elbow as far as you can. Then straighten your elbow as far as you can 10 times. Do 3 sets of 10.

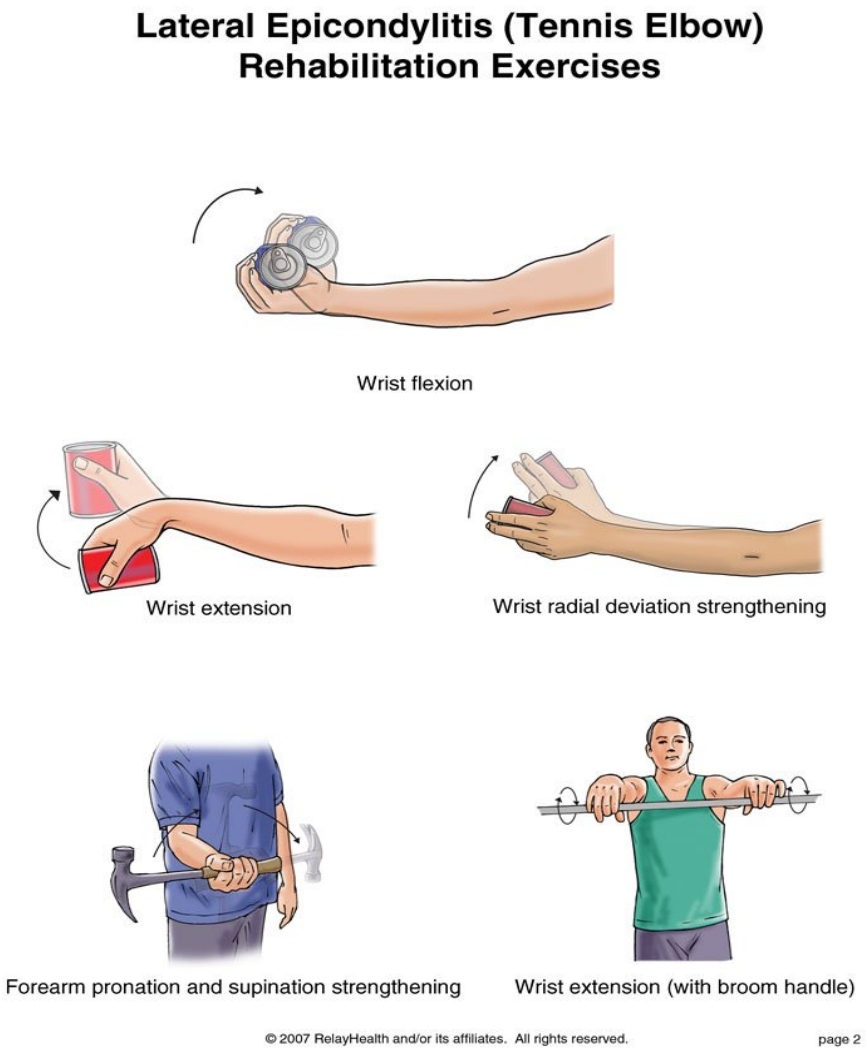

Fig 4[Refer (22)]

Strengthening exercises

[1] Wrist flexion: Hold a can or hammer handle in your hand with your palm facing up. Bend your wrist upward. Slowly lower the weight and return to the starting position. Do 3 sets of 10. Gradually increase the weight of the can or weight you are holding.

[2] Wrist extension: Hold a soup can or hammer handle in your hand with your palm facing down. Slowly bend your wrist upward. Slowly lower the weight down into the starting position. Do 3 sets of 10. Gradually increase the weight of the object you are holding.

[3] Wrist radial deviation strengthening: Put your wrist in the sideways position with your thumb up. Hold a can of soup or a hammer handle and gently bend your wrist up, with the thumb reaching toward the ceiling. Slowly lower to the starting position. Do not move your forearm throughout this exercise. Do 3 sets of 10.

[4] Forearm pronation and supination strengthening: Hold a soup can or hammer handle in your hand and bend your elbow 90°. Slowly rotate your hand with your palm upward and then palm down. Do 3 sets of 10.

[5] Wrist extension (with broom handle): Stand up and hold a broom handle in both hands. With your arms at shoulder level, elbows straight and palms down, roll the broom handle backward in your hand. Do 3 sets of 10.

Rehablitation Protocol For Tennis Elbow

When	Protocol 1 (Severe Symptoms)	Protocol 2 (Mild/Moderate Symptoms)	Protocol 3 (Symptoms Resolved)
	• Pain at rest. • Point tenderness. • Pain with minimally resisted wrist extension. • Swelling. • Grip strength difference (GSD) > 50%. • > 5 degrees motion loss at wrist or elbow.	• Pain with activity only. • Minimal point tenderness. • Minimal pain with resisted wrist flexion-extension. • GSD > 50%. • No motion loss.	• No pain with daily activity. • No referred pain. • Full ROM. • GSD < 10%.
Evaluation	• Duration of symptoms. • Referred pain. • Grip strength measurement. • Elbow palpation. • Motion measurement. • History of injury or inciting activity. • Differential diagnosis.	• Duration of symptoms. • Referred pain. • Grip strength measurement. • Elbow palpation. • Motion measurement. • History of injury or inciting activity. • Differential diagnosis.	• Review initial injury or inciting activity. • Identify requirements for returning to desired activity. • Identify remaining functional deficits.

Treatment	**Phase 1 (Reduce Inflammation)**
	• Rest.
	• Passive ROM.
	• Cold therapy.
	• Medications.
	Phase 2 (Rehabilitation)
	• Limit activity.
	• Cold therapy.
	• Stretching (static).
	• Strengthening (isometric).
	• Ultrasound.
	• HVGS.
	• Proceed to protocol 2 when tolerating above.
	• Surgical indications.
		Phase 1 (Reduce Inflammation)
		• Rest.
		• Passive ROM.
		• Cold therapy.
		• Medications.
		Phase 2 (Rehabilitation)
		• Limit activity.
		• Flexibility.
		• Strengthening.
		• Transverse friction massage.
		• Cold therapy.
		• HVGS.
		• Ultrasound.
		• Proceed to protocol 3.
			• Preactivity flexibility.
			• Strengthening
			  • Isokinetics.
			  • Isotonic.
			• Modalities
			  • Whirlpool.
			  • Ice after activity.
			• Technique modification.
			• Equipment modification.
			• Counterforce bracing.
			• Friction massage.
			• Gradual return to activity.

Goals	• Resolution of pain at rest. • Tolerate stretching/strengthening with minimal discomfort. • Improve ROM. • Maintain cardiovascular conditioning.	• No pain with daily activity. • No pain with stretching/(PREs). • Full ROM. • Prepare for functional rehabilitation. • Maintain cardiovascular conditioning.	• Pain-free return to activity. • Prevent recurrence—maintenance program of stretching.

Occupational Therapy

As activities are resumed, the patient's vocational and avocational pursuits must be considered. Job and recreational tools and/or equipment may need to be modified, especially if repetitive gripping is required. Gradual resumption of activities is recommended to improve tolerance and prevent recurrence.

Surgical Intervention

For cases of refractory lateral epicondylitis, surgical resection of the lateral extensor aponeurosis might be considered.[15, 16]

Differential Diagnosis of Lateral Elbow Pain

	Type, Site of Pain	Provocative Test	Neurologic Findings
Lateral epicondylitis	Well localized point tenderness over lateral epicondyle, pain increases with use	Resisted wrist extension; resisted forearm pronation; chair-lift test	None
Intra-articular pathology	Generalized elbow pain	Axial compression test	None
Cervical radiculopathy	Diffuse lateral arm pain; neck pain and/or stiffness	Limited neck ROM; Spurling test positive	Abnormal reflex, sensory, or motor examination results; abnormal EMG/NCS
Radial tunnel syndrome	Vague, diffuse forearm ache; pain more distal than in lateral epicondylitis; pain present at rest	Resisted long-finger extension; resisted forearm supination; positive differential lidocaine injection	Paresthesias in the first dorsal web space of hand (5–10%); abnormal EMG/NCS (10%)

Other Treatments

Other types of treatment have included acupuncture and extracorporeal shockwave therapy.[17, 18] However, there is insufficient evidence to support acupuncture as a treatment for epicondylitis. Likewise, reviews of trials using shockwave therapy have found reasons not to support this as a treatment option.

Follow Up

Deterrence/Prevention

To avoid a recurrence of lateral epicondylitis, the etiology of the condition must be considered. Job modifications may be necessary and may be facilitated by a job site evaluation. Investigation into avocational activities also is necessary, because contributing factors to this condition may be identified. In addition, adherence to a home exercise program is important in preventing a recurrence of lateral epicondylitis.

Steps of Prevention

[1] Decrease the amount of playing time if already injured or feel pain in outside part of elbow

[2] Stay in overall good physical shape

[3] Strengthen the muscles of the forearm (Pronator quadratus, Pronator teres and Supinator muscle), the upper arm (biceps, triceps, Deltoid muscle), the shoulder and upper back (trapezius)

[4] Increased muscular strength will increase the stability of joints such as the elbow

[5] Like other sports, use equipment appropriate towards your ability, body size and muscular strength

For tennis players

a) Adjust racquet size: Use a midsized racquet. The popular oversized racquets can put too much strain on the arm and increase the risk of injury.

b) Loosen string tension: Higher string tension can increase the torque and vibration the arm experiences, thereby increasing the risk of injury.

c) Adjust grip size: A grip too small or too large decreases your control of the racquet and increases your risk of injury.

D) Check racquet material: Graphite racquets and nylon strings seem to decrease the torque and vibration the arm receives, thus reducing the risk of injury.

Prognosis

Patients who present acutely (< 3 mo) generally respond well to treatment. Chronic cases that are refractory to treatment may take months to resolve.

Patient Education

Education regarding the proper use of tools, good body mechanics, and the importance of flexibility and strength of the involved musculature should be emphasized to the patient.

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