FLEX CEUs

Elbow Rehabilitation - Common Disorders and Treatment

Introduction

Elbow pain and dysfunction are common clinical presentations that can significantly impact upper extremity function and participation in work, sport, and daily activities. This course introduces an evidence-informed approach to the assessment and management of elbow-related conditions for physical therapists, physical therapist assistants, and occupational therapists. The course will overview relevant elbow anatomy and biomechanics, with particular emphasis on understanding the elbow as a three-joint complex and how structural relationships influence function and load tolerance. The introduction establishes the importance of integrating clinical history, clinical reasoning, and physical examination to support accurate differential diagnosis, including consideration of both local impairments and contributing factors remote from the elbow. Common elbow dysfunctions, key clinical tests, and typical sport-related injuries are framed within a practical, patient-centered context, setting the foundation for developing individualized, multimodal management strategies that address pain, restore function, and support safe progression toward return to activity or sport.

Section 1: Epidemiology and Foundational Anatomy

This section goes through epidemiology and foundational anatomy of the elbow to provide essential context for understanding common sources of pain and dysfunction. By examining how frequently elbow injuries occur and the ways they affect both general and athletic populations, course takers gain insight into the clinical relevance of elbow-related conditions across practice settings. The section then reviews key anatomical structures and the concept of the elbow as a three-joint complex, highlighting how joint structure and biomechanics work together to support movement and load management. This foundational knowledge serves as a framework for clinical reasoning, helping clinicians better interpret examination findings and make informed decisions regarding treatment and rehabilitation.

Prevalence of Elbow Injury

References: 1

Elbow pain is relatively common in the general population, with point prevalence estimates ranging from approximately 1 to 4 percent at any given time and lifetime prevalence reported as high as 10 percent. In occupational settings involving repetitive upper limb use, prevalence rates are consistently higher, with studies of manual laborers and industrial workers reporting elbow pain in 10 to 15 percent of workers, depending on job demands and exposure duration. These higher rates are strongly associated with repetitive gripping, forceful manual tasks, and sustained or awkward upper extremity postures.

In athletic populations, elbow injury prevalence varies by sport and level of participation but is notably higher in activities involving repetitive throwing, overhead motion, or high load transmission through the upper extremity. Epidemiological data indicate that elbow injuries account for approximately 20 to 30 percent of all injuries in overhead throwing sports such as baseball and softball, with pitchers demonstrating the highest rates of injury. In racquet sports, elbow pain has been reported in up to 40 percent of recreational players at some point during participation, while strength and weight-bearing sports such as gymnastics and CrossFit show elevated rates related to compressive and tensile loading at the elbow. Across youth, collegiate, and professional athletes, elbow injuries are a common cause of missed training time and may contribute to reduced performance even when athletes continue to participate.

While acute traumatic injuries such as fractures, dislocations, and ligament ruptures do occur, the majority of elbow conditions seen in rehabilitation settings are nontraumatic and develop gradually. Overuse-related disorders account for a substantial proportion of elbow pain presentations, particularly in adults between 30 and 60 years of age. The insidious onset of symptoms often leads individuals to delay seeking care, allowing low-level tissue irritation to progress to persistent pain, strength loss, or reduced load tolerance. From a clinical perspective, these prevalence patterns highlight the importance of early recognition, patient education, and proactive load management strategies. Given the frequency and functional impact of elbow injuries across occupational, recreational, and athletic populations, competence in elbow assessment and management is essential for clinicians working in outpatient, industrial, and sports rehabilitation environments.

Clinical Impact Across General and Athletic Populations

References: 2, 3

In the general population, elbow pain can have a substantial impact on functional independence and quality of life by limiting the ability to perform routine daily activities. Tasks such as lifting and carrying objects, pushing or pulling doors, gripping tools or utensils, typing, and performing personal care activities often require sustained or repetitive elbow and forearm use. When pain is present, individuals may reduce activity levels, modify movement patterns, or rely on the noninvolved arm, which can contribute to deconditioning, compensatory overuse, and persistence of symptoms. In occupational settings, elbow pain may lead to reduced work efficiency, increased absenteeism, or difficulty meeting physical job demands, particularly in roles that require repetitive manual tasks or sustained upper extremity loading.

In athletic populations, the clinical impact of elbow dysfunction is often magnified due to the high physical demands placed on the upper extremity. Athletes involved in overhead, throwing, racquet, or weight-bearing sports rely on the elbow for efficient force transfer, precision, and load tolerance. Even mild or intermittent elbow symptoms can disrupt training volume, technique, and performance consistency. Pain or stiffness may alter throwing mechanics, grip strategy, or upper extremity sequencing, increasing stress on adjacent joints such as the shoulder or wrist. As a result, what initially presents as localized elbow discomfort may contribute to broader movement dysfunction and elevated injury risk elsewhere along the kinetic chain.

Low-grade elbow symptoms are particularly important from a clinical perspective because they are often tolerated or ignored by both patients and athletes. Continued participation despite pain can lead to cumulative tissue overload, reduced capacity for recovery, and progressive loss of strength or endurance. Over time, this may prolong rehabilitation timelines and increase the likelihood of recurrent symptoms upon return to activity. Understanding the wide-ranging clinical impact of elbow injury across both general and athletic populations emphasizes the need for early recognition, appropriate load modification, and targeted intervention. Timely management not only addresses current symptoms but also plays a critical role in preventing chronic pain, functional decline, and repeated injury episodes.

Review of Elbow Anatomy

References: 4

The elbow is a complex anatomical region that serves as a key mechanical link between the shoulder and the hand, allowing the upper extremity to balance mobility and stability during both precise and forceful tasks. It permits flexion, extension, pronation, and supination while transmitting loads generated throughout the upper limb, enabling efficient positioning of the hand for functional activities. Structurally, the elbow is formed by the distal humerus articulating with the proximal ulna and radius, creating a stable yet mobile joint system that shares load across closely integrated articular surfaces. Muscles crossing the elbow generate movement and transfer force between the shoulder, forearm, wrist, and hand, while ligamentous structures provide passive stability, particularly during valgus and varus stresses.

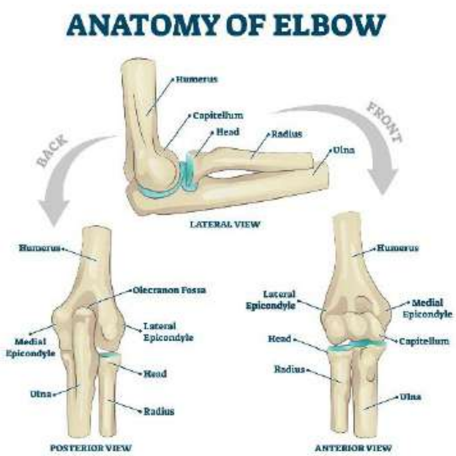
Several major peripheral nerves pass through narrow anatomical regions around the elbow, making them sensitive to joint position, soft tissue tension, and swelling. The ulnar, median, and radial nerves course in close proximity to bony landmarks, ligaments, and musculature, which helps explain why elbow pathology often presents with overlapping pain, strength, or sensory symptoms. Because dysfunction in one tissue can influence others, elbow symptoms may reflect local pathology, altered joint mechanics, or contributing impairments elsewhere in the upper extremity or cervical spine. A brief understanding of elbow anatomy provides an essential foundation for accurate assessment, clinical reasoning, and effective intervention planning in individuals with elbow pain and dysfunction.

Osseous, Articular, Muscular, Ligamentous, and Neural Structures

References: 4, 5

The osseous framework of the elbow consists of the distal humerus and the proximal ulna and radius. The shape and orientation of these bones create a structurally stable region capable of tolerating significant compressive and shear forces. The trochlea of the humerus articulates with the trochlear notch of the ulna, while the capitellum articulates with the radial head, allowing for controlled motion while maintaining joint congruence. Bony landmarks such as the medial and lateral epicondyles serve as important attachment sites for muscles and ligaments and are common sources of localized tenderness in overuse conditions.

The inherent stability provided by the bony anatomy plays a key role in resisting displacement during functional and athletic loading.



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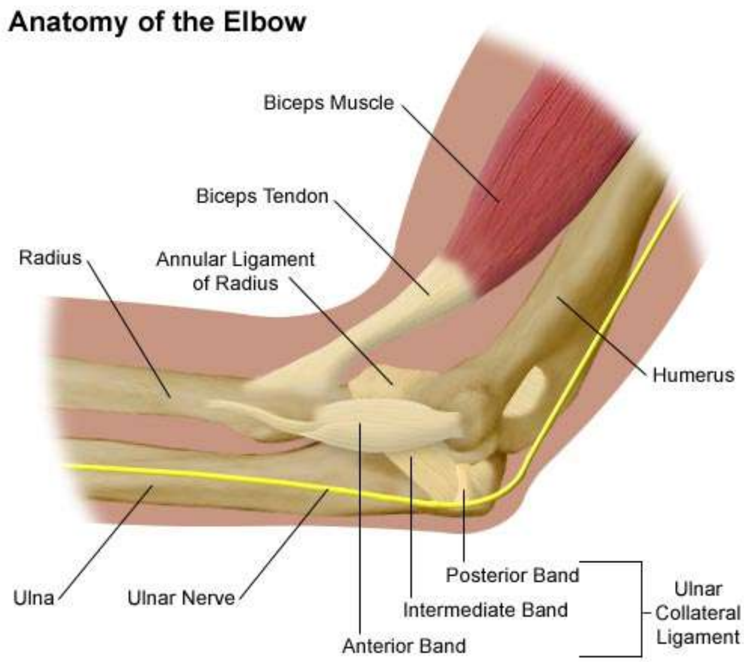
The elbow contains closely integrated articular surfaces that allow both hinge motion and forearm rotation while maintaining joint stability. The trochlea of the humerus articulates with the trochlear notch of the ulna to primarily permit flexion and extension, while the capitellum articulates with the radial head to support both flexion-extension and rotational movements. These joint surfaces are covered with hyaline cartilage, creating a low-friction interface that facilitates smooth motion and distributes compressive forces across the joint during functional and weight-bearing activities. By sharing load across multiple contact areas, the elbow is able to tolerate repetitive use while preserving alignment and joint integrity. Disruptions in joint congruence, cartilage health, or movement quality can alter force distribution and increase localized stress, contributing to pain, stiffness, or mechanical symptoms during higher-demand tasks.



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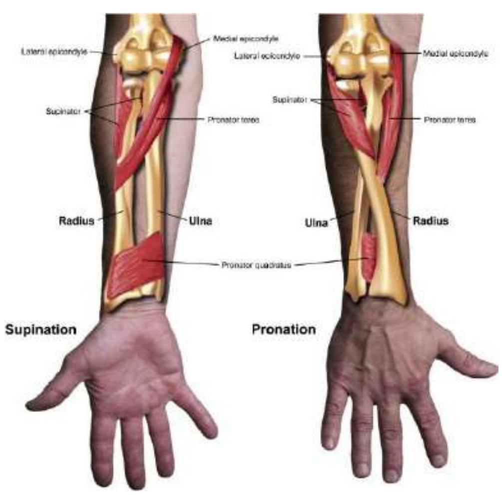
Multiple muscle groups cross the elbow and contribute to flexion, extension, pronation, and supination, allowing the upper extremity to perform a wide range of functional and athletic tasks. Elbow flexion is primarily produced by the biceps brachii, brachialis, and brachioradialis. The brachialis serves as a consistent and powerful flexor regardless of forearm position, while the biceps brachii also contributes to forearm supination and is highly influenced by shoulder position. The brachioradialis assists with flexion, particularly during rapid or resisted movements and when the forearm is in a neutral position. Elbow extension is generated mainly by the triceps brachii, with assistance from the anconeus, and plays a key role in pushing, weight-bearing, and deceleration activities such as throwing.

Forearm rotation is produced by coordinated action of the pronator and supinator muscle groups. Pronation is driven primarily by the pronator teres and pronator quadratus, with the pronator teres crossing the elbow and contributing to dynamic stabilization during gripping and resisted forearm use. Supination is produced by the supinator and the biceps brachii, particularly when greater force or speed is required. Many of these muscles also span the wrist and hand, including the common flexor and extensor muscle groups that originate from the medial and lateral epicondyles. This anatomical arrangement links elbow function directly to wrist and hand demands, allowing efficient force transfer during tasks such as gripping, lifting, throwing, and pushing.

While this multi-joint design supports coordinated movement and load sharing, it also increases susceptibility to cumulative loading and overuse. Repetitive or high-demand activities can place sustained stress on shared musculotendinous structures, particularly when muscle strength, endurance, or motor control are insufficient. Additionally, muscle performance at the elbow is strongly influenced by shoulder position, scapular control, and wrist mechanics, as changes at either end of the kinetic chain can alter muscle length-tension relationships and load distribution. For this reason, assessment of elbow-related muscle dysfunction requires consideration of the entire upper extremity to accurately identify contributing factors and guide effective intervention.



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Ligamentous structures of the elbow provide essential passive stability and guide joint motion during functional and athletic activities. On the medial side, the ulnar collateral ligament complex serves as the primary restraint to valgus stress, particularly during overhead and throwing movements that place high tensile demands on the medial elbow. Laterally, the radial collateral ligament complex contributes to resistance against varus stress and posterolateral rotatory instability, supporting joint alignment during pushing, weight-bearing, and rotational tasks. These ligamentous structures work in concert with bony congruence and muscular control to maintain elbow stability across a wide range of motion. When ligament integrity is compromised or repeatedly stressed, increased reliance is placed on surrounding musculature, which may alter movement patterns and contribute to pain or instability over time.

Neural structures pass through anatomically constrained regions around the elbow and are closely associated with surrounding ligaments, muscles, and bony landmarks. The ulnar nerve travels posterior to the medial epicondyle through the cubital tunnel, where elbow flexion and valgus loading increase neural strain and reduce available space. The median nerve passes anteriorly through the cubital fossa and between the heads of the pronator teres, making it sensitive to repetitive gripping and forearm pronation demands. The radial nerve crosses the lateral elbow and divides into superficial and deep branches, with the posterior interosseous nerve passing beneath the supinator in the radial tunnel, a region commonly associated with activity-related lateral elbow symptoms. Because these nerves lie in close proximity to other soft tissues, swelling, altered joint mechanics, or increased muscle tone can contribute to neural irritation. As a result, elbow pathology may present with combined pain, weakness, sensory changes, or movement intolerance, underscoring the importance of considering both ligamentous and neural contributions during clinical assessment and intervention planning.

Humeroulnar, Humeroradial, and Proximal Radioulnar Joints

References: 4, 6

The elbow does not function as a single joint but rather as a coordinated three-joint complex that allows the upper extremity to meet a wide range of functional and athletic demands. This integrated system includes the humeroulnar, humeroradial, and proximal radioulnar joints, which work together to provide controlled motion, stability, and efficient force transmission between the arm and forearm. Viewing the elbow as a three-joint complex is essential for understanding how movement, load tolerance, and dysfunction occur, as impairments in one component can influence the mechanics and demands placed on the others.

The humeroulnar joint primarily functions as a hinge, allowing elbow flexion and extension and providing much of the elbow's inherent stability due to its bony congruence. This joint plays a central role in positioning the forearm during tasks such as lifting, pushing, and weight-bearing. The humeroradial joint contributes to flexion and extension while also serving as a key load-transmitting interface, particularly during axial loading through the hand, such as during pushing or catching oneself during a fall. Its articulation allows the radius to accommodate changes in forearm position while maintaining contact with the humerus. The proximal radioulnar joint enables forearm pronation and supination, allowing the hand to rotate independently of the upper arm and adapt to task-specific demands such as gripping, tool use, or throwing.

These three joints function in close coordination rather than in isolation. Normal elbow movement requires synchronized motion and appropriate load sharing across all components of the complex. Restrictions in flexion-extension, limitations in forearm rotation, or altered joint mechanics at any one articulation can disrupt overall elbow function and increase stress on surrounding tissues. Understanding the elbow as a three-joint complex supports more accurate clinical assessment and reasoning by encouraging clinicians to evaluate joint motion, stability, and load tolerance across the entire system rather than focusing on a single joint or structure.

Biomechanical Functionality of the Elbow

References: 7

The elbow plays a central biomechanical role in the upper extremity by acting as both a force transmitter and a motion modulator between the shoulder and the wrist. It allows forces generated proximally at the shoulder or distally through the hand to be efficiently transferred across the limb while adapting to varying task demands. During functional activities, the elbow must coordinate flexion, extension, and forearm rotation to position the hand accurately in space while maintaining joint stability and load tolerance. This dual requirement places the elbow in a critical position within the upper extremity kinetic chain, where small alterations in movement or control can have meaningful effects on overall function.

Biomechanically, the elbow is exposed to a wide range of forces, including compressive, tensile, and shear loads. Activities such as pushing, pulling, lifting, throwing, and weight-bearing through the upper extremity generate substantial stress across the joint surfaces, ligaments, and musculotendinous structures. Effective load distribution depends on joint congruence, coordinated motion across the three-joint complex, and appropriate muscular activation to absorb and transmit forces. The elbow must also rapidly transition between stability and mobility, particularly during athletic movements that require both power generation and precise control.

Efficient elbow function relies on coordinated interaction with the shoulder, wrist, and hand. Alterations in shoulder strength or mobility, wrist positioning, or grip demands can significantly influence elbow loading and movement patterns. When biomechanical efficiency is compromised by strength deficits, restricted mobility, altered motor control, or excessive training or work demands, tissue stress can accumulate and exceed load tolerance. Over time, these disruptions may contribute to pain, reduced performance, or injury. Understanding the biomechanical functionality of the elbow provides clinicians with a foundation for identifying movement impairments, guiding load management, and designing interventions aimed at restoring efficient, durable upper extremity function.

Section 1 Key Words

<u>Load Tolerance</u> - The capacity of elbow tissues, including bone, cartilage, muscle, ligament, and nerve, to withstand repetitive or high-magnitude forces without developing pain or dysfunction

<u>Valgus Stress</u> - The lateral force applied at the elbow that places tensile demand on the medial structures, particularly during throwing and overhead activities, and

is highlighted as a primary contributor to medial elbow loading and ligamentous strain

Three-Joint Complex - The coordinated function of the humeroulnar, humeroradial, and proximal radioulnar joints, underscoring that normal elbow movement and load management depend on integrated motion across all three articulations rather than a single joint acting in isolation

Section 1 Summary

This section has established a foundational understanding of elbow pain and dysfunction by reviewing key epidemiological trends and essential anatomical concepts. By examining the prevalence of elbow injuries and their impact across both general and athletic populations, learners gain a clearer appreciation of the clinical significance of elbow-related conditions in a variety of practice settings. The review of elbow anatomy and the elbow's function as a three-joint complex reinforces how structure and biomechanics interact to support movement and manage load. Together, these concepts provide a framework for sound clinical reasoning, enabling clinicians to more accurately interpret examination findings and make informed, evidence-based decisions related to assessment, treatment, and rehabilitation.

Section 2: Form, Function, and Sources of Elbow Pain

This section explores how the anatomical form and biomechanical function of the elbow contribute to common sources of pain and dysfunction. By linking structural design, movement demands, and clinical presentation, this section provides a framework for understanding why elbow pain develops and why symptoms may persist. Emphasis is placed on how daily and sport-related demands influence tissue loading, how movement efficiency affects symptom development, and how both local and remote factors contribute to elbow pain. This integrated perspective supports comprehensive clinical reasoning and more effective intervention planning.

Functional Demands of the Elbow in Daily and Sport Activities

References: 2, 5

In daily life, the elbow is heavily involved in tasks such as reaching, lifting, carrying, pushing, pulling, and sustained or repetitive gripping. These activities often require prolonged or repeated elbow flexion and extension combined with forearm rotation, while simultaneously stabilizing the hand for fine motor control. Many daily tasks also involve sustained low-level loading, which can place cumulative stress on musculotendinous and joint structures over time. In occupational contexts, these demands may be amplified by repetition, forceful exertions, or prolonged postures, increasing the risk of gradual symptom development.

In sport and high-level physical activity, elbow demands increase substantially. Throwing, racquet sports, gymnastics, weight training, and overhead activities require the elbow to tolerate high forces, rapid loading rates, and repeated cycles of acceleration and deceleration. The elbow must efficiently transfer force generated by the shoulder to the hand while maintaining joint alignment and neuromuscular control. Small deficits in strength, timing, or coordination can significantly alter loading patterns, increasing stress on specific tissues and elevating injury risk. Understanding these task-specific demands allows clinicians to better match rehabilitation strategies to the functional realities faced by patients and athletes.

Load Transmission and Movement Efficiency

References: 7

The elbow functions biomechanically as a conduit for force transmission between the shoulder and the wrist. Loads generated proximally during pushing, pulling, or throwing, as well as loads applied distally during gripping or weight-bearing, must pass through the elbow joint complex. Efficient movement relies on coordinated motion across the humeroulnar, humeroradial, and proximal radioulnar joints, supported by appropriate muscular activation to absorb, transmit, and dissipate force. When movement efficiency is high, load is shared across multiple tissues and joint surfaces, reducing stress concentration.

Movement inefficiency occurs when joint motion is restricted, muscular support is insufficient, or timing and sequencing are altered. In these cases, force transmission becomes less evenly distributed, and specific tissues may be exposed to repeated loading beyond their tolerance. Over time, this can contribute to pain, reduced performance, and decreased activity tolerance. From a rehabilitation perspective, improving movement efficiency through targeted mobility, strength, and motor control interventions is often as important as addressing localized symptoms.

Possible Causes of Elbow Pain

References: 2, 8

Elbow pain can arise from a broad and diverse set of mechanisms that extend well beyond simple overuse of a single tissue. While nontraumatic, load-related presentations are most common, the sources of elbow pain may include tendinopathy, muscle strain, joint irritation, ligamentous stress, neural sensitization, vascular involvement, or combinations of these factors occurring simultaneously. Repetitive loading remains a major contributor, but pain may also emerge in response to rapid changes in activity demands, inadequate conditioning, prolonged static postures, altered movement strategies, or insufficient recovery relative to tissue capacity. In some cases, even relatively low loads applied repeatedly or sustained over time can provoke symptoms when tolerance is reduced by fatigue, deconditioning, or prior injury.

Joint-related contributors to elbow pain may include articular irritation, synovial inflammation, capsular stiffness, or altered joint mechanics that increase compressive or shear forces during movement. Ligamentous structures may become symptomatic under repeated valgus or varus stress, particularly in throwing, overhead, or weight-bearing activities, even in the absence of overt instability. Neural contributors are also common and may present as pain, weakness, altered sensation, or movement intolerance due to increased neural strain, compression, or sensitivity associated with joint position, muscle tone, or local swelling. Importantly, neural symptoms may coexist with musculoskeletal findings, further complicating the clinical picture.

Elbow pain may also be influenced by factors distant from the elbow itself. Altered shoulder mobility or strength, poor scapular control, wrist stiffness, or inefficient grip mechanics can all increase mechanical demand at the elbow. Cervical spine dysfunction may contribute through shared neural pathways or altered motor output, resulting in symptoms that localize to the elbow despite a more proximal driver. Psychosocial factors, including stress, workload demands, fear of movement, or prolonged symptom duration, may further influence pain experience, recovery timelines, and activity tolerance.

Because of these overlapping influences, elbow pain rarely reflects a single isolated pathology. Patients commonly present with diffuse or shifting symptoms, including stiffness, aching, sharp pain with specific tasks, weakness, or rapid fatigue during activity. Pain behavior may vary based on load magnitude, speed of movement, joint position, or cumulative exposure rather than being consistently reproduced by a single test or structure. Recognizing the multifactorial nature of elbow pain supports a more comprehensive assessment approach that integrates tissue capacity, movement quality, task demands, and contributing regional factors. This perspective reduces overreliance on single-tissue diagnoses and allows clinicians to develop more individualized, effective management strategies that address both symptom drivers and long-term load tolerance.

Local Tissue and Load-Related Factors

References: 6, 8

Local contributors to elbow pain commonly involve cumulative mechanical stress applied to musculotendinous, articular, and periarticular structures over time. Repetitive gripping, sustained wrist extension or flexion, high-force or high-velocity contractions, and prolonged weight-bearing through the upper extremity place repeated tensile and compressive demands on tissues that may exceed their adaptive capacity. These loading patterns are frequently seen in occupational tasks, recreational activities, and sport, particularly when exposure is prolonged or recovery time is insufficient. Sudden increases in workload, changes in technique, or altered equipment demands may further amplify local tissue stress and contribute to symptom onset.

As symptoms develop, pain-related inhibition can alter normal muscle activation patterns around the elbow. This may present as reduced strength, diminished endurance, delayed muscle firing, or compensatory overuse of adjacent muscle groups. Over time, these changes can further reduce tissue load tolerance and increase reliance on passive structures such as joint surfaces or ligaments. Individuals may also subconsciously modify movement strategies to avoid pain, which can shift stress to other regions of the elbow or increase cumulative load during repetitive tasks. Without appropriate identification and modification of these local contributors, the cycle of overload, symptom persistence, and declining tissue capacity may continue.

Local joint mechanics are an additional and often underappreciated contributor to elbow pain. Restrictions in flexion, extension, or forearm rotation can alter joint alignment and reduce the ability of the articular surfaces to share load efficiently. Changes in joint congruence or capsular mobility may increase compressive forces at specific contact areas, particularly during gripping, pushing, or weight-bearing activities. Swelling or joint irritation can further reduce available motion and alter neuromuscular control, compounding mechanical stress. Effective management of local factors requires careful assessment of both tissue capacity and current loading demands, with rehabilitation strategies focused on restoring movement quality and progressively increasing load tolerance through graded exposure rather than prolonged rest or complete unloading.

Contributing Factors Distant from the Elbow

References: 9, 10

Elbow pain is frequently influenced by impairments away from the site of symptoms, reflecting the elbow's role within the upper extremity biomechanics. Shoulder mobility and strength, scapular control, wrist positioning, and grip strategy all play a significant role in determining how forces are transmitted through the elbow during functional and athletic activities. Limitations in shoulder range of motion or deficits in shoulder and scapular strength may increase reliance on elbow motion to accomplish reaching, lifting, or throwing tasks, thereby elevating mechanical demand at the elbow. Similarly, altered wrist mechanics or sustained nonneutral wrist positions can increase forearm muscle activation during gripping and lifting, amplifying tensile load on the musculotendinous structures crossing the elbow. These regional impairments may not be painful themselves but can meaningfully increase elbow loading over time.

Failure to identify and address contributing factors distant from the elbow can limit rehabilitation outcomes and increase the likelihood of symptom recurrence upon return to activity. Treating the elbow in isolation may reduce symptoms temporarily but often does not resolve the underlying movement or loading strategies that contributed to tissue overload. A comprehensive assessment that includes the shoulder, scapula, wrist, and hand allows clinicians to identify inefficient movement patterns and compensations that place excessive stress on the elbow. Interventions aimed at improving proximal and distal function can help redistribute load more effectively across the upper extremity, supporting more durable symptom resolution and improved long-term function.

Pain Sources from Humeroradial Joint and Proximal Radioulnar Joint

References: 11

The relationship between the humeroradial joint and the proximal radioulnar joint can contribute directly to the development of lateral elbow pain when normal joint mechanics and load-sharing are disrupted. During gripping, lifting, and forearm rotation, compressive and rotational forces are transmitted through the humeroradial joint as the radial head articulates with the capitellum of the humerus. Under normal conditions, smooth and well-coordinated motion at the proximal radioulnar joint allows the radius to rotate efficiently during pronation and supination, helping to distribute these forces across the joint surfaces and surrounding tissues.

When motion at the proximal radioulnar joint is restricted, asymmetrical, or poorly controlled, the radius may not rotate or translate optimally during functional tasks. This altered mechanics can increase compressive stress at the humeroradial joint and place greater demand on the lateral elbow structures responsible for controlling wrist and forearm motion. As a result, the extensor musculature and associated tendons near the lateral epicondyle may be exposed to higher and more repetitive loads than they are able to tolerate. Over time, this imbalance in joint function and load distribution can contribute to pain, reduced grip strength, and activity-related symptom reproduction. Understanding how impaired coordination between the humeroradial and proximal radioulnar joints alters force transmission helps explain why lateral elbow pain may persist and highlights the importance of addressing joint mechanics as part of a comprehensive rehabilitation approach.

Case Study 1

A 42-year-old right-hand–dominant office employee presents with a six-month history of gradually worsening right lateral elbow pain. Symptoms developed without a specific injury and coincided with increased work demands and the recent addition of recreational tennis. At work, she spends prolonged periods typing and using a mouse, along with intermittent lifting and carrying of work materials. Recreationally, she plays tennis twice per week and reports pain during gripping, lifting household objects, prolonged computer use, and backhand strokes. Symptoms worsen with cumulative activity throughout the day and improve with rest.

Examination reveals localized lateral elbow tenderness and pain with resisted wrist extension and sustained gripping. Forearm pronation and supination are mildly restricted under load. Shoulder assessment shows reduced external rotation strength and early scapular fatigue. Wrist positioning during gripping tends toward sustained extension. Cervical screening is unremarkable. Overall findings suggest a load-related elbow presentation influenced by both local tissue stress and contributing factors elsewhere in the upper extremity.

Reflection Questions

1. How do this patient's daily and recreational activities contribute to her elbow pain?
2. Which local tissue and joint-related factors are most relevant?
3. What contributing factors distant from the elbow should be considered?

Responses

1. The patient's daily work requires prolonged computer use, sustained gripping of the mouse, and static elbow and wrist postures, all of which place low-level but cumulative load on the musculotendinous structures of the lateral elbow. The addition of recreational tennis introduces higher-force, repetitive gripping and forearm rotation demands, particularly during backhand strokes. The combination of sustained occupational loading and higher-intensity sport activity likely exceeds current tissue tolerance, contributing to gradual symptom onset rather than an acute injury.
2. Locally, repetitive gripping and sustained wrist extension increase tensile load on the wrist extensor musculature and associated tendons. Pain-related inhibition may reduce muscle endurance and alter recruitment patterns, further lowering tissue capacity. Mild restrictions in forearm rotation suggest altered proximal radioulnar mechanics, which can increase compressive stress at the humeroradial joint during functional activities.

3. Reduced shoulder external rotation strength and early scapular fatigue suggest that proximal support for upper extremity tasks is limited. These deficits may increase reliance on elbow and forearm musculature during both computer use and tennis. Sustained wrist extension during gripping further increases forearm muscle demand. Although these impairments are not painful themselves, they meaningfully increase elbow loading and should be addressed to support long-term recovery.

Section 2 Key Words

<u>Load Tolerance</u> - The capacity of elbow tissues, including muscle, tendon, joint, ligament, and neural structures, to withstand repetitive or high-magnitude forces without developing pain or dysfunction

<u>Movement Efficiency</u> - Describes how effectively forces are absorbed, transferred, and distributed across the elbow and surrounding joints during functional and athletic tasks, with efficient movement allowing load to be shared across multiple tissues rather than concentrated in a single structure

Section 2 Summary

This section emphasizes that elbow pain is best understood by considering how activity demands, movement patterns, and tissue capacity interact, rather than focusing on a single injured structure. The elbow is exposed to a wide range of stresses during daily activities, work tasks, and sport, and successful function depends on smooth force transfer, coordinated joint motion, and effective muscle control. Pain may develop from local tissue overload, changes in joint movement, or nerve sensitivity, but it is often influenced by factors elsewhere in the upper extremity, including the shoulder, wrist, and hand. The interaction between the humeroradial and proximal radioulnar joints further demonstrates how disrupted joint coordination can increase stress and contribute to ongoing lateral elbow pain. Overall, these concepts highlight the importance of thorough assessment and individualized treatment approaches that address activity demands, movement quality, and contributing regional factors to support lasting symptom improvement and functional recovery.

Section 3: Clinical Reasoning and Differential Diagnosis

This section focuses on the systematic use of clinical reasoning to accurately identify the source of elbow pain and guide effective management. Because elbow symptoms often arise from overlapping tissues and are influenced by movement demands and regional factors, accurate diagnosis depends on integrating patient history, physical examination findings, and task-specific analysis. Rather than relying on isolated tests or labels, clinicians are encouraged to use a structured reasoning process to differentiate among potential pain generators and determine the most relevant contributors to symptoms.

Importance of Clinical History and Reasoning in Elbow Pain

References: 5, 12

A thorough clinical history is one of the most important components in the evaluation of elbow pain and often provides greater diagnostic value than physical examination findings alone. Because many elbow conditions develop gradually and are strongly influenced by activity demands, understanding the context in which symptoms arose is essential. Information about symptom onset, progression, and variability helps clinicians distinguish between load-related presentations, traumatic injury, neural involvement, or inflammatory processes.

Details regarding occupational tasks, recreational activities, sport participation, recent changes in workload, technique, or equipment use offer critical insight into potential contributors to tissue overload or altered movement strategies.

Clinical history also helps clarify symptom behavior and tissue irritability. Patterns such as pain that worsens with repetition, sustained gripping, or higher loads may suggest reduced tissue tolerance, whereas symptoms influenced by joint position, speed of movement, or prolonged postures may indicate mechanical or neural sensitivity. Reports of numbness, tingling, weakness, or pain extending beyond the elbow raise the possibility of neural involvement or proximal contributions from the cervical spine or shoulder. In addition, the history allows clinicians to identify psychosocial and contextual factors, such as work demands, stress, or fear of movement, that may influence symptom persistence and recovery.

Clinical reasoning builds upon the information gathered during the history to guide examination, diagnosis, and intervention planning. Rather than relying on isolated tests or pathoanatomical labels, effective clinical reasoning involves generating and refining hypotheses about the source of symptoms based on how tissues are being loaded and how movement is being performed. This process encourages clinicians to consider multiple contributing factors, including local tissue capacity, joint mechanics, neuromuscular control, and regional influences within the upper extremity. As new information is obtained during examination, hypotheses are continually reassessed and refined.

Together, clinical history and clinical reasoning provide the foundation for accurate differential diagnosis and individualized care. By understanding not only where symptoms are located but also why they developed, and what continues to provoke them, clinicians are better equipped to prioritize meaningful impairments and design interventions that address underlying drivers of elbow pain. This approach supports more effective treatment, reduces reliance on single-structure diagnoses, and improves long-term outcomes for individuals with elbow pain and dysfunction.

Physical Examination of the Elbow

References: 4, 13

A comprehensive physical examination of the elbow should be performed as part of an upper quarter assessment that includes the cervical spine, thoracic spine, shoulder, elbow, and wrist, as well as strength, sensation, and nervous system integrity. For occupational therapists and physical therapists, this integrated approach reflects the reality that elbow pain is frequently influenced by proximal and distal factors and may involve neuromuscular contributions in addition to local tissue loading. Incorporating expected active and passive range of motion values across the upper quarter helps clinicians distinguish between normal variation, true mobility restrictions, and movement limitations related to pain, guarding, or altered motor control. All findings should be interpreted in the context of symptom behavior and functional demands.

Assessment begins with the cervical spine. Normal active cervical flexion is approximately 45 to 50 degrees, extension is 60 to 70 degrees, lateral flexion is 35 to 45 degrees bilaterally, and rotation is approximately 60 to 80 degrees to each side. Passive cervical motion may be slightly greater but should be used judiciously. Reproduction of elbow or arm symptoms during cervical motion may indicate neural or proximal contributors, particularly when symptoms are not clearly load dependent.

Thoracic spine mobility is assessed next, as thoracic motion strongly influences shoulder and upper extremity mechanics. Although often evaluated functionally rather than with precise goniometric measures, typical thoracic values include approximately 30 to 40 degrees of combined flexion and extension and 30 to 35 degrees of rotation to each side. Restrictions in thoracic extension or rotation may alter scapular positioning and increase compensatory loading at the elbow during reaching, lifting, or overhead activities.

Shoulder range of motion assessment follows. Normal active shoulder flexion and abduction are approximately 160 to 180 degrees, with passive motion often similar or slightly greater. Shoulder external rotation measures approximately 60 to 90 degrees with the arm at the side and up to 90 degrees with the shoulder abducted to 90 degrees, while internal rotation is typically 60 to 70 degrees. Limitations in shoulder elevation or rotation can increase reliance on elbow and forearm motion, even in the absence of shoulder pain.

Elbow range of motion assessment includes flexion, extension, and forearm rotation. Normal active elbow flexion ranges from approximately 135 to 150 degrees, with full extension to 0 degrees, though mild hyperextension may be present. Passive elbow flexion may slightly exceed active motion, while passive extension should be symmetrical unless limited by stiffness or pain. Forearm pronation and supination are assessed with the elbow flexed to 90 degrees, with normal active values of approximately 75 to 85 degrees in each direction and slightly greater passive motion when tolerated.

Wrist mobility is evaluated due to its close relationship with forearm muscle loading. Normal active wrist flexion is approximately 70 to 80 degrees, with passive motion often reaching 80 to 90 degrees. Wrist extension typically measures 60 to 70 degrees actively and up to 75 to 80 degrees passively. Radial deviation averages 15 to 20 degrees, while ulnar deviation ranges from approximately 30 to 40 degrees. Restrictions in wrist motion, particularly extension, can increase forearm muscle demand and contribute to elbow symptoms during gripping tasks.

Strength testing is performed throughout the upper quarter to assess tissue capacity and neuromuscular control. Key muscle groups include shoulder flexors, extensors, abductors, internal and external rotators, scapular stabilizers, elbow flexors and extensors, wrist flexors and extensors, and forearm pronators and supinators. Strength assessment should consider force production, endurance, coordination, and symptom reproduction rather than maximal force alone. Grip strength testing provides additional information regarding functional capacity and tolerance to common occupational and daily demands.

Assessment of sensation and nervous system integrity is essential, particularly when symptoms include numbness, tingling, burning pain, or unexplained weakness. Sensory testing typically includes light touch and comparison across peripheral nerve distributions and dermatomal regions of the upper extremity. Sensory changes should be interpreted alongside movement and loading responses, as neural symptoms frequently coexist with musculoskeletal impairments.

Reflex testing is an important component of the upper quarter neurological examination and provides information about the integrity of the peripheral nerves and associated cervical nerve roots. Commonly assessed upper extremity reflexes include the biceps reflex, associated primarily with the C5–C6 nerve roots, the brachioradialis reflex, also associated with C5–C6, and the triceps reflex, primarily associated with C7. Reflexes are typically graded on a standardized scale ranging from 0 to 4+, where 0 indicates no response, 1+ indicates a diminished response, 2+ represents a normal response, 3+ indicates a brisk response, and 4+ reflects a hyperactive response that may include clonus. Asymmetry between sides or reflex responses that do not align with the overall clinical picture may suggest neurological involvement and warrant further investigation or referral.

Neural tension testing further assists in evaluating the contribution of peripheral nerves to elbow symptoms. Upper limb neurodynamic tests for the median, ulnar, and radial nerves assess the mechanical sensitivity and mobility of neural tissue throughout the upper quarter. The median nerve bias typically combines shoulder abduction and external rotation with elbow extension, forearm supination, and wrist and finger extension. The ulnar nerve bias emphasizes shoulder abduction and external rotation with elbow flexion, forearm pronation, and wrist extension, while the radial nerve bias commonly incorporates shoulder internal rotation and extension with elbow extension, forearm pronation, and wrist and finger flexion. Reproduction of familiar symptoms, asymmetrical responses, or symptom modulation with cervical movement may indicate neural involvement. These tests should be performed in a controlled, symptom-guided manner and interpreted within the broader clinical context.

Throughout the testing for range of motion, strength, sensory, reflex, and neural tension, clinicians should monitor symptom behavior, movement quality, and changes with posture or joint position. Differences between active and passive motion, asymmetrical strength or sensation, abnormal reflex findings, or positive neural tension responses provide valuable information for clinical reasoning. Including reflex testing alongside other components of the upper quarter examination allows occupational therapists and physical therapists to more confidently differentiate musculoskeletal and neurological contributors to elbow pain and to design individualized intervention strategies that support safe, effective functional recovery.

Lateral, Medial, Posterior, and Anterior Elbow Dysfunction

References: 2, 8, 14, 15

Elbow pain is often organized clinically by the primary region of symptoms, and each region is associated with a characteristic group of diagnoses that reflect common loading patterns, anatomical relationships, and biomechanical demands. Understanding these region-specific diagnoses helps physical therapists and occupational therapists refine differential diagnosis, anticipate contributing factors, and select appropriate examination and intervention strategies. While overlap is common and multiple diagnoses may coexist, regional classification provides a practical framework for clinical reasoning.

Lateral elbow dysfunction most commonly includes lateral epicondylalgia, historically referred to as lateral epicondylitis. This condition is characterized by pain over the lateral epicondyle that is aggravated by gripping, lifting, and resisted wrist or finger extension. Current evidence supports a degenerative and load-related process rather than an inflammatory one, with reduced tendon load tolerance playing a central role. Other diagnoses associated with lateral elbow pain include radial tunnel syndrome, posterior interosseous nerve irritation, and humeroradial joint overload. Radial tunnel–related symptoms may present with more diffuse lateral forearm pain and weakness rather than focal tenderness, while joint-related contributors may be associated with compressive loading during gripping and forearm rotation. These distinctions are important, as lateral elbow pain often persists when treatment focuses only on the extensor tendon without addressing joint mechanics, neural sensitivity, or overall load management.

Medial elbow dysfunction is commonly associated with medial epicondylalgia, previously termed medial epicondylitis or golfer's elbow. This diagnosis involves pain along the medial epicondyle that is aggravated by gripping, wrist flexion, forearm pronation, and valgus loading. It is frequently seen in throwing athletes, weightlifters, and individuals performing repetitive or forceful manual tasks. Ulnar collateral ligament sprain or chronic valgus overload is another important diagnosis in this region, particularly in overhead athletes, and may present with medial pain during high-velocity or high-load activities. Cubital tunnel syndrome is also commonly associated with medial elbow dysfunction and may coexist with musculoskeletal findings, presenting with numbness, tingling, or weakness in the ulnar nerve distribution. Differentiating among these diagnoses requires careful attention to load sensitivity, joint stability, and neural symptoms.

Posterior elbow dysfunction includes diagnoses such as posterior elbow impingement, olecranon bursitis, and triceps tendinopathy. Posterior elbow impingement often presents with pain at end-range extension and is commonly associated with repetitive or forceful extension activities, particularly in throwing athletes and weight-bearing tasks. Olecranon bursitis typically presents with localized swelling and tenderness over the posterior elbow and may be related to prolonged pressure, repetitive irritation, or direct trauma. Triceps tendinopathy may present with pain during resisted elbow extension or pushing activities and is often load related. These posterior conditions are frequently influenced by compressive forces and joint mechanics rather than isolated muscle weakness.

Anterior elbow dysfunction commonly includes distal biceps tendinopathy, distal biceps tendon rupture, and less commonly brachialis strain or anterior capsular irritation. Distal biceps tendinopathy typically presents with anterior elbow pain that is aggravated by resisted elbow flexion and forearm supination, particularly during lifting or pulling tasks. Acute distal biceps rupture is usually associated with a sudden traumatic event and presents with acute pain, weakness, and often visible deformity, requiring prompt referral. Anterior elbow pain may also be influenced by neural involvement or proximal shoulder mechanics, especially when symptoms are diffuse or inconsistent with isolated tendon loading.

Across all regions, it is important to recognize that these diagnoses frequently overlap and may coexist within the same individual. For example, lateral epicondylalgia may occur alongside humeroradial joint overload or radial nerve sensitivity, while medial epicondylalgia may coexist with ulnar nerve irritation. Regional diagnoses should therefore be viewed as clinical patterns rather than isolated labels. For physical therapists and occupational therapists, integrating knowledge of region-specific diagnoses with clinical history, physical examination, and task analysis supports more accurate differential diagnosis and more effective, individualized rehabilitation strategies aimed at restoring load tolerance, movement efficiency, and functional performance.

Clinical Tests for Differential Diagnosis

References: 15–17

Clinical tests are most useful for differential diagnosis when they are selected based on a clear working hypothesis and interpreted alongside the clinical history, symptom behavior, and functional testing. In elbow conditions, many diagnoses share overlapping signs and symptoms, and no single test is sufficiently sensitive or specific to confirm or exclude a diagnosis in isolation. Instead, patterns or clusters of findings across resisted testing, joint stress, neural provocation, and task-based assessment allow clinicians to differentiate among common sources of elbow pain, including tendinopathies, ligamentous injury, joint pathology, and neural involvement. This approach emphasizes understanding how tissues respond to load and movement rather than relying on special tests as definitive answers.

In cases of lateral elbow pain, clinical testing often focuses on differentiating lateral epicondylalgia, radial tunnel syndrome, and humeroradial joint involvement. Resisted wrist extension, resisted middle finger extension, and gripping tasks are commonly used to assess load tolerance of the wrist extensor musculature and may reproduce localized lateral elbow pain consistent with lateral epicondylalgia, particularly when symptoms are load dependent and improve with rest. Within this context, Cozen's test and Mill's test are frequently applied. Cozen's test involves resisted wrist extension with the elbow slightly flexed and the forearm pronated, and reproduction of familiar lateral elbow pain suggests sensitivity to active tensile loading of the extensor tendon complex. Mill's test places the extensor tissues under passive tensile load by positioning the elbow in full extension with the forearm pronated and the wrist and fingers flexed, with pain reproduction indicating reduced tolerance to stretch. When both tests reproduce familiar symptoms and align with the activity history, they support a working diagnosis of lateral epicondylalgia, but they should be viewed as indicators of reduced load tolerance rather than proof of isolated tendon pathology. When pain is more diffuse, located distal to the lateral epicondyle, or accompanied by weakness without clear pain reproduction during resisted extension, radial tunnel syndrome or posterior interosseous nerve irritation should be considered. In these cases, neural provocation testing and palpation along the radial tunnel may provide additional insight. Pain that is primarily reproduced with compressive loading or forearm rotation may instead point toward humeroradial joint involvement rather than a primary tendon disorder.

For medial elbow pain, clinical tests are used to help differentiate medial epicondylalgia, ulnar collateral ligament involvement, and cubital tunnel syndrome. Resisted wrist flexion and forearm pronation may reproduce symptoms associated with medial epicondylalgia, particularly in individuals exposed to repetitive gripping or throwing demands. Valgus stress testing may provoke pain or apprehension in cases of ulnar collateral ligament sprain or chronic valgus overload, especially in overhead athletes. When symptoms include numbness or tingling in the ulnar nerve distribution, reproduction of symptoms with sustained elbow flexion, or sensitivity with tapping over the cubital tunnel, neural involvement should be considered. Tinel's sign at the elbow is performed by gently tapping over the ulnar nerve posterior to the medial epicondyle, and reproduction of paresthesia into the forearm or hand suggests increased ulnar nerve sensitivity consistent with cubital tunnel syndrome. Because medial elbow conditions frequently coexist, findings from resisted testing, ligamentous stress testing, and neural provocation must be interpreted together rather than independently.

Posterior elbow pain is commonly assessed using tests that load the elbow in extension to differentiate posterior elbow impingement, olecranon bursitis, and triceps tendinopathy. Pain reproduced with end-range elbow extension, repeated extension movements, or weight-bearing through the arm may suggest posterior impingement or joint irritation, particularly in athletes or individuals performing repetitive pushing tasks. Localized swelling and tenderness over the olecranon, with pain unrelated to resisted movement, is more consistent with olecranon bursitis. Pain reproduced with resisted elbow extension, especially during high-load or high-speed tasks, may indicate triceps tendinopathy. Distinguishing among these conditions requires attention to whether symptoms are driven primarily by compressive forces, tensile loading, or direct pressure.

Anterior elbow pain requires careful testing to differentiate distal biceps tendinopathy, distal biceps rupture, and less common causes such as brachialis strain or anterior capsular irritation. Resisted elbow flexion and forearm supination that reproduce anterior elbow pain are consistent with distal biceps tendinopathy when symptoms are gradual and load related. The hook test is an essential screening tool when an acute distal biceps rupture is suspected, as inability to palpate the tendon requires prompt referral. Anterior elbow pain without clear strength loss or traumatic onset may reflect muscular or joint-related contributors and should prompt evaluation of shoulder and cervical influences.

Across all elbow regions, neural provocation tests for the median, ulnar, and radial nerves assist in identifying neural contributions when symptoms include paresthesia, burning pain, or weakness that is disproportionate to local tissue findings. Positive neural tests are characterized by reproduction of familiar symptoms, asymmetry compared to the uninvolved side, or symptom modulation with cervical movement, suggesting neural sensitivity rather than primary tissue injury. In clinical practice, the most accurate differential diagnosis emerges from recognizing patterns across resisted muscle testing, joint stress testing, neural provocation, and functional task assessment. By integrating tests such as Cozen's test, Mill's test, and Tinel's sign within a broader reasoning-based framework, physical therapists and occupational therapists can more accurately identify the primary drivers of elbow pain and develop targeted intervention strategies that address load tolerance, joint mechanics, neural sensitivity, and task-specific demands rather than relying on isolated special tests or pathoanatomical labels alone.

Case Study 2

A 42-year-old right-hand–dominant individual presents with a five-month history of progressively worsening pain along the medial aspect of the right elbow. The patient works in a job that requires frequent lifting, sustained gripping, and repetitive forearm use, including prolonged tool handling and computer-based tasks. Symptoms developed gradually during a period of increased workload and have persisted despite activity modification. The patient reports medial elbow pain that is aggravated by gripping, lifting objects with the palm facing upward, and repetitive wrist flexion or forearm pronation. Symptoms often worsen by the end of the workday and occasionally radiate into the medial forearm. The patient also reports intermittent numbness and tingling in the ring and small fingers, particularly with prolonged elbow flexion or sustained gripping. There is no history of acute trauma. The primary concern is declining grip endurance and difficulty tolerating work demands.

Physical examination is performed using a comprehensive upper quarter approach. Observation reveals mild guarding of the right arm during lifting tasks and avoidance of sustained elbow flexion. Cervical active range of motion is within expected limits and does not reproduce symptoms. Thoracic spine assessment reveals limited extension and rotation during functional reaching tasks. Shoulder active range of motion is generally full, though resisted shoulder internal rotation and adduction subtly increase medial elbow discomfort during combined tasks. Elbow active and passive range of motion are within normal limits, though sustained elbow flexion reproduces medial elbow pain and distal paresthesia. Forearm pronation increases symptoms when combined with gripping, while supination is less provocative. Wrist flexion strength testing reproduces familiar medial elbow pain and demonstrates early fatigue compared to the contralateral side. Sensory testing reveals mildly diminished light touch sensation along the ulnar nerve distribution in the hand. Reflex testing of the biceps, brachioradialis, and triceps is symmetrical and within normal limits.

Neural tension testing biased toward the ulnar nerve reproduces the patient's familiar medial elbow pain and distal tingling, with clear asymmetry compared to the uninvolved side. Symptoms are modulated by changes in shoulder position and cervical side bending, supporting a neural contribution. Median and radial nerve tension tests are negative. Resisted wrist flexion and forearm pronation reproduce localized medial elbow pain consistent with medial epicondylalgia. Valgus stress testing produces mild discomfort but no instability. Functional testing involving sustained gripping and lifting reliably reproduces both medial elbow pain and distal neural symptoms.

Reflection Questions

1. What features of the clinical history suggest a load-related medial elbow condition with neural involvement rather than an isolated tendon injury?
2. How do the physical examination findings support medial epicondylalgia as part of the differential diagnosis?
3. What findings indicate that neural sensitivity is a meaningful contributor to this patient’s symptoms?
4. Why is it important to consider thoracic, shoulder, and movement-related factors in this case?

Responses

1. The gradual onset of symptoms, strong relationship to repetitive gripping and forearm use, and worsening with cumulative daily load suggest a nontraumatic, load-related condition. The presence of intermittent numbness and tingling in the ulnar nerve distribution, particularly with sustained elbow flexion, indicates that neural sensitivity is contributing alongside musculotendinous overload. This combination points toward medial epicondylalgia with associated ulnar nerve involvement rather than an isolated tendon disorder.
2. Pain reproduction and fatigue with resisted wrist flexion and forearm pronation and localized medial elbow tenderness are consistent with reduced load tolerance of the medial elbow tendinous structures. The

absence of gross instability on valgus stress testing reduces the likelihood of a primary ulnar collateral ligament injury, supporting medial epicondylalgia as a primary musculoskeletal contributor.

3. Reproduction of familiar medial elbow pain and distal paresthesia during ulnar nerve tension testing, asymmetry compared to the uninvolved side, symptom modulation with shoulder and cervical positioning, and sensory changes in the ulnar nerve distribution all support neural involvement. These findings suggest increased sensitivity of the ulnar nerve rather than purely local tendon pathology and help explain why symptoms extend beyond localized medial elbow pain.
4. Limitations in thoracic mobility and subtle shoulder contributions during resisted tasks suggest that proximal movement restrictions may be increasing reliance on the elbow and forearm during work activities. Reduced efficiency in the upper quarter can increase valgus stress, gripping demand, and sustained muscle activation at the medial elbow, compounding both tendon and neural stress. Addressing only the elbow without improving proximal movement efficiency may limit long-term improvement.

Section 3 Key Words

Tissue Irritability - How reactive a patient's symptoms are to loading or movement, including how easily pain is triggered, how intense it becomes, and how long it lingers after provocation, which helps guide both testing intensity and treatment progression

Neural Sensitivity - Increased responsiveness of peripheral nerves to movement, compression, or tension, which may contribute to pain, altered sensation, or weakness and can coexist with musculoskeletal impairments in individuals with elbow pain

Symptom Behavior - The pattern of how pain or other symptoms change in response to movement, load, position, or activity over time, including factors that aggravate or ease symptoms

Section 3 Summary

This section emphasizes that accurate evaluation of elbow pain depends on integrating clinical history, clinical reasoning, and a comprehensive upper quarter physical examination rather than relying on isolated tests or diagnostic labels. History-taking clarifies onset, activity demands, symptom behavior, and potential neural or regional contributors, while clinical reasoning guides hypothesis formation and refinement throughout the examination. The physical exam incorporates upper quarter range of motion, strength, sensory testing, reflexes, and neurodynamic testing to identify meaningful impairments and differentiate musculoskeletal from neurological contributors. Regional symptom patterns help organize common diagnoses across lateral, medial, posterior, and anterior elbow presentations, and special tests are used to support hypotheses through clusters of findings rather than as standalone confirmations. Together, these approaches support individualized diagnosis and targeted management strategies that address the primary drivers of pain and functional limitation.

Section 4: Comprehensive Management and Treatment Strategies

This section focuses on turning clinical reasoning and differential diagnosis into effective, individualized management strategies for individuals with elbow pain and dysfunction. Because elbow conditions are often multifactorial and influenced by local tissue capacity, joint mechanics, neural sensitivity, and regional movement patterns, management must extend beyond isolated symptom treatment. A comprehensive approach emphasizes matching interventions to the identified drivers of symptoms, current tissue tolerance, and the functional demands of daily life, work, or sport. The goal of treatment is not only pain reduction but also restoration of movement efficiency, load tolerance, and long-term functional capacity.

Developing a Comprehensive Management Plan

References: 18, 19

Developing an effective management plan begins with careful synthesis of information gathered from the clinical history, physical examination, and observation of task-specific movement. Rather than treating isolated findings, clinicians must determine which factors are most strongly linked to the individual's symptoms and functional limitations. This includes identifying which tissues are most sensitive to loading, how and when symptoms are provoked during daily, occupational, or sport-related tasks, and whether symptoms are driven by local tissue overload, altered joint mechanics, neural sensitivity, or regional movement impairments. Understanding the relative contribution of these factors allows clinicians to establish clear treatment priorities and avoid unnecessary or poorly targeted interventions.

An effective management plan is inherently multimodal and integrates multiple treatment strategies to address the complex nature of elbow pain. Exercise therapy serves as the foundation of care by improving tissue load tolerance, strength, endurance, and movement coordination. Manual therapy may be incorporated to address joint restrictions, modulate symptoms, or improve movement options that support participation in active rehabilitation. Education is a critical component, helping individuals understand their condition, expected recovery timelines, and the rationale for graded loading rather than prolonged rest. Activity modification and pacing strategies allow continued participation in meaningful tasks while reducing excessive or poorly distributed load. When used together, these interventions complement one another and support both short-term symptom relief and long-term functional improvement.

Effective management of elbow pain often benefits from collaboration within a broader healthcare team. Physical therapists and occupational therapists typically take the lead in assessment, movement analysis, exercise prescription, and functional retraining. Primary care providers and sports medicine physicians play an important role in medical screening, ruling out serious pathology, managing comorbid conditions, and coordinating care when imaging, medication, or referral is indicated. Orthopedic specialists may be involved when symptoms fail to improve with conservative management, when structural injury is suspected, or when surgical consultation is required. When neural symptoms or complex pain presentations are present, collaboration with neurologists or pain specialists may help clarify diagnosis and guide symptom management strategies. Clear communication among team members ensures consistency in messaging and alignment of treatment goals.

An effective plan also requires consideration of symptom irritability and stage of presentation. Individuals with highly irritable symptoms may require initial emphasis on load modification, symptom modulation, and controlled exposure to movement, whereas those with lower irritability may tolerate more progressive strengthening and functional loading earlier in rehabilitation. The chronicity of symptoms, prior injury history, and previous response to treatment further inform how quickly load can be progressed and which strategies are most appropriate. Progression should be guided by the individual's response to intervention, with ongoing reassessment to ensure that symptoms are improving or at least not worsening as demands increase.

Contextual factors play a critical role in management planning and must be explicitly addressed. Occupational demands, sport participation, training schedules, and recovery opportunities influence both treatment selection and expected timelines. For individuals whose work or sport requires repetitive or high-load elbow use, collaboration with employers, coaches, or athletic trainers may be necessary to modify tasks, adjust training volume, or support a graded return to activity. Psychosocial factors, such as stress, fear of movement, or beliefs about pain, may also influence adherence and outcomes and should be considered when planning education and activity modification.

A comprehensive management plan prioritizes interventions that address the most meaningful impairments while remaining flexible and adaptable. Rather than attempting to correct every identified deficit simultaneously, clinicians should focus on changes that are most likely to reduce symptoms and improve function in the short and long term. As tissue tolerance improves and movement efficiency increases, the plan should evolve to include higher-level tasks and greater exposure to real-world demands. Through coordinated care, integration of a multimodal treatment approach, clear communication among healthcare providers, and ongoing reassessment, this patient-centered strategy supports sustainable recovery and successful return to daily activities, work, and sport for individuals with elbow pain.

Treatment Suggestions for Common Elbow Dysfunctions

References: 8, 18, 20

Treatment strategies for elbow dysfunction should be guided by the primary region of symptoms, the identified drivers of pain, and the individual's functional demands, while remaining adaptable to overlapping presentations and varying stages of recovery. Because many elbow conditions reflect reduced load tolerance, altered joint mechanics, and inefficient movement patterns rather than isolated tissue damage, conservative management emphasizes progressive loading, movement optimization, and task-specific retraining rather than passive symptom management alone. However, it is also important for clinicians to understand common surgical interventions and expected postoperative timelines, as some individuals present after surgery or may require referral when conservative care is unsuccessful.

In lateral elbow dysfunction, treatment commonly focuses on restoring load tolerance of the wrist and finger extensors while addressing contributing joint and movement factors. Progressive strengthening is typically initiated with controlled, tolerable loading and advanced gradually to include higher forces, varied wrist positions, and functional gripping tasks. Attention to forearm rotation mechanics and humeroradial joint loading is important, as excessive compressive stress during gripping or lifting can perpetuate symptoms. Shoulder mobility and strength, particularly in external rotation and scapular control, are frequently addressed to reduce compensatory loading at the elbow. Education regarding grip strategy, wrist position, and pacing of repetitive tasks supports symptom control during daily and occupational activities. When symptoms persist despite extended conservative care, surgical procedures such as extensor tendon debridement or release may be considered, most commonly for chronic lateral epicondylalgia. Postoperative rehabilitation following these procedures typically involves a period of protected motion for the first two to four weeks, gradual strengthening by six to eight weeks, and progressive return to heavier loading or sport-specific tasks over three to six months, depending on tissue response and functional demands.

Medial elbow dysfunction often requires careful management of tensile and valgus stresses while gradually improving tissue capacity. Treatment typically includes progressive strengthening of the flexor–pronator musculature with close attention to load progression and symptom response. In individuals exposed to throwing or overhead activities, proximal interventions targeting shoulder strength, trunk control, and movement sequencing are essential to reduce medial elbow stress. When neural symptoms are present, treatment may also incorporate strategies to reduce ulnar nerve irritation, such as modifying sustained elbow flexion postures and addressing contributing soft tissue or movement restrictions. Education around workload management and gradual return to higher-demand tasks is critical to prevent recurrence. In more severe or refractory cases, particularly in overhead athletes, surgical intervention such as ulnar collateral ligament reconstruction or repair may be indicated. Rehabilitation following ulnar collateral ligament surgery is lengthy and structured, often involving early protected range of motion, progressive strengthening over several months, initiation of interval throwing around four to six months, and full return to competitive throwing commonly between nine and twelve months, depending on sport level and individual progression.

Posterior elbow dysfunction is commonly influenced by compressive loading and end-range extension stress. Treatment strategies often emphasize restoring comfortable elbow extension range, improving tolerance to compressive forces, and gradually reintroducing pushing or weight-bearing activities. Strengthening of the triceps is progressed cautiously, particularly in individuals with high symptom irritability or a history of repetitive extension loading. Joint mobility interventions may be used when extension restrictions or joint stiffness contribute to symptoms, but active strategies that improve load tolerance and movement control remain central to long-term improvement. In cases of persistent posterior impingement, loose bodies, or osteophyte formation, arthroscopic debridement may be performed. Post-surgical timelines often allow early range of motion within the first one to two weeks, strengthening by four to six weeks, and gradual return to higher-load or sport-specific extension activities over two to four months, assuming symptom resolution and adequate strength.

Anterior elbow dysfunction typically involves addressing load tolerance of the elbow flexors and supinators while monitoring for neural or proximal contributions. Progressive strengthening is introduced with careful attention to symptom response during lifting and pulling tasks. In cases of distal biceps tendinopathy, load progression is gradual and emphasizes controlled exposure rather than avoidance. When anterior elbow pain is diffuse or inconsistent with local loading, assessment and treatment of shoulder and cervical contributions may be necessary to reduce excessive demand on the elbow. Clear education regarding activity modification and safe progression of lifting tasks supports confidence and adherence. In the case of acute distal biceps tendon rupture, surgical repair is commonly recommended for individuals who require full strength and endurance. Postoperative rehabilitation typically includes brief immobilization, followed by protected range of motion in the first four to six weeks, gradual strengthening beginning around six to eight weeks, and return to heavier lifting or sport participation over three to six months, depending on healing and functional goals.

Across all elbow dysfunctions, treatment strategies should remain individualized and responsive to symptom behavior rather than diagnosis alone. Manual therapy may be used selectively to address joint restrictions or modulate symptoms, but it is most effective when integrated with active exercise and functional retraining. Activity modification is applied strategically to allow continued participation while avoiding excessive overload, with the goal of gradually expanding tolerance rather than imposing prolonged rest. Understanding common surgical pathways and timelines allows clinicians to appropriately guide expectations, support postoperative recovery, and identify when referral may be warranted. By aligning conservative or postoperative management strategies with the underlying mechanisms of dysfunction and the specific demands faced by the individual, clinicians can support meaningful recovery, safe return to activity, and long-term resilience across a wide range of elbow conditions.

Manual Therapy

References: 21, 22

Manual therapy can be a valuable component of elbow rehabilitation when used as part of a comprehensive, multimodal treatment approach. For physical therapists and occupational therapists, manual techniques are not intended to serve as stand-alone treatments but rather as adjuncts that support symptom modulation, improve movement options, and facilitate participation in active rehabilitation. When guided by sound clinical reasoning, manual therapy can help address joint restrictions, soft tissue sensitivity, and movement-related discomfort that limit function or tolerance to exercise, while reinforcing confidence in movement and loading.

Joint-based manual therapy techniques are commonly used to address restrictions in elbow and forearm motion and to influence joint loading patterns. Mobilizations targeting the humeroulnar, humeroradial, and proximal radioulnar joints may be applied to improve flexion, extension, pronation, or supination when these motions are limited or painful. Low-grade oscillatory mobilizations are often selected when pain or symptom irritability is the primary limiting factor, as these techniques can reduce symptom sensitivity and improve tolerance to movement without placing excessive stress on the joint. Higher-grade mobilizations may be appropriate when joint stiffness or capsular restriction is more prominent and symptom irritability is lower, with the goal of improving end-range motion and restoring more normal joint mechanics. The clinical value of these techniques lies not in passive gains alone but in how they support improved active movement and functional loading.

Mobilization of the radiohumeral joint deserves particular attention due to its role in load transmission during gripping, pushing, and forearm rotation. Restrictions or altered mechanics at this joint can increase compressive stress and contribute to persistent lateral or diffuse elbow pain. Non-thrust mobilizations to the radiohumeral joint may be applied to influence joint congruence and reduce discomfort during flexion, extension, or rotational tasks. These techniques are frequently paired with mobilization of the proximal radioulnar joint, as coordinated motion between these articulations is essential for efficient force distribution. Following mobilization, active movement and task-specific loading are critical to reinforce changes and improve functional carryover.

In select cases, a grade V high-velocity, low-amplitude thrust manipulation to the radiohumeral joint may be considered. This technique is reserved for individuals with clearly identified joint restrictions, low symptom irritability, and no contraindications such as instability, recent trauma, inflammatory conditions, or neurological compromise. The intent of a thrust technique is to produce a rapid mechanical and neurophysiological response that may improve perceived stiffness, range of motion, or pain, thereby facilitating improved movement efficiency. Any immediate changes following a thrust manipulation should be viewed as an opportunity to progress active exercise and functional retraining rather than as a standalone solution. Clear patient education and informed consent are essential, and ongoing reassessment is required to determine whether the intervention meaningfully supports rehabilitation goals.

Soft tissue manual therapy techniques are frequently incorporated to address musculotendinous sensitivity, tone, and perceived stiffness around the elbow and forearm. These techniques may target the wrist extensors and flexors, pronator and supinator muscles, triceps, biceps, and surrounding fascial structures. Approaches such as longitudinal or cross-fiber mobilization, myofascial techniques, or gentle soft tissue release are used to modulate symptoms, improve tissue glide, and increase tolerance to loading rather than to alter tissue structure. Soft tissue interventions are most effective when followed by active movement or strengthening that reinforces adaptive change and functional capacity.

Neurodynamic manual therapy techniques may be appropriate when neural sensitivity contributes to elbow symptoms. These techniques involve controlled, graded movement of the upper limb to influence the mechanical and physiological behavior of the ulnar, median, or radial nerves. Gentle neural gliding techniques may help reduce symptom sensitivity and improve tolerance to movement when symptoms are influenced by joint position or sustained postures. As with other manual approaches, neurodynamic techniques should be applied within tolerable limits and integrated with education, movement retraining, and load management strategies.

Manual therapy may also be applied to regions proximal or distal to the elbow when impairments elsewhere contribute to elbow loading. Techniques directed at the cervical spine, thoracic spine, shoulder, or wrist can improve overall upper extremity mechanics and reduce compensatory stress at the elbow. This regional approach reflects the elbow's role within the upper extremity kinetic chain and reinforces the importance of addressing contributing factors beyond the site of symptoms.

Across all manual therapy techniques, dosage, timing, and integration are critical. Manual interventions are most beneficial when used strategically, either early to reduce symptom sensitivity or later to address specific movement restrictions that limit progress with exercise. Continuous reassessment of symptom response and functional change is essential. When manual therapy is combined thoughtfully with progressive exercise, task-specific training, and patient education, it can enhance treatment efficiency and support durable improvements in elbow function and load tolerance.

Exercise Therapy Integration

References: 14, 21, 23, 24

Exercise therapy for elbow conditions should continue to emphasize progressive strength and load tolerance at the elbow while supporting the joint through coordinated contribution from the neck, shoulder, and wrist. While proximal and distal regions are addressed through strengthening of major muscle groups, elbow-specific exercises are selected to directly challenge flexion, extension, and forearm rotation under controlled but demanding loads. All strengthening exercises are performed for 3 to 4 sets of 6 to 8 repetitions, using resistance that makes the final two repetitions difficult while preserving good movement quality.

At the elbow, strengthening should include multiple variations to expose tissues to different loading vectors and joint positions. Elbow flexion can be trained through resisted curls performed with the forearm in neutral, supinated, and pronated positions to vary stress across the biceps brachii, brachialis, and brachioradialis. Elbow extension strengthening may include resisted press-downs, overhead extension patterns, or closed-chain variations such as wall-supported push-up progressions, depending on tolerance. These variations allow clinicians to progress load while monitoring symptom response and ensuring balanced development across elbow extensors.

Forearm rotation exercises are an essential component of elbow rehabilitation and should be progressed alongside flexion and extension. Pronation and supination can be trained using weighted implements or resistance bands, with the elbow flexed to 90 degrees initially and progressed to more extended positions as tolerance improves. Incorporating combined movements, such as pronation with elbow extension or supination with elbow flexion, more closely reflects functional and sport-specific demands and helps prepare tissues for real-world loading.

Eccentric-focused exercises are particularly useful for elbow conditions involving reduced load tolerance. For example, eccentric elbow flexion or extension exercises may be performed by assisting the lifting phase and controlling the lowering phase against resistance. Similarly, controlled eccentric pronation or supination can be introduced once concentric loading is well tolerated. These exercises should remain within the same 6 to 8 repetition range and be progressed cautiously to avoid excessive symptom provocation.

While elbow-specific strengthening remains the priority, effective rehabilitation also requires targeted support from the surrounding upper quarter musculature to optimize force transfer and reduce compensatory stress at the elbow. Cervical strengthening should specifically address the deep neck flexors and extensors, as these muscles contribute to postural control and upper extremity mechanics. Exercises such as supine or seated deep neck flexor activation with gentle chin nods, progressed to resisted cervical flexion and extension in neutral postures, help improve endurance and control without excessive strain. These exercises support sustained upper extremity activity by reducing reliance on compensatory postures that can increase distal loading.

Shoulder strengthening should focus on muscle groups that directly influence scapular positioning and humeral control during elbow-demanding tasks. Rotator cuff strengthening may include resisted external and internal rotation performed with the arm at the side or in slight abduction to improve dynamic shoulder stability. Scapular stabilizers are addressed through exercises such as resisted rows, serratus anterior–focused protraction patterns, and controlled shoulder elevation tasks that emphasize coordinated upward rotation. Shoulder elevators, including the deltoid, are strengthened through pressing or elevation movements that are progressed within symptom tolerance. Together, these exercises improve proximal force generation and control, reducing the tendency for excessive elbow contribution during lifting, reaching, or throwing activities.

Wrist and hand strengthening should be selected to support functional loading rather than isolated muscle fatigue. Wrist flexor and extensor strengthening may be performed using resisted wrist flexion and extension through mid to full ranges while maintaining neutral forearm alignment, progressing resistance to challenge the final repetitions. Grip musculature can be trained using resisted gripping tasks such as squeezing putty, hand grippers, or weighted carries that reflect real-world demands. These exercises improve the ability of the hand and forearm to accept and distribute load efficiently, which in turn reduces repetitive stress transmitted to the elbow during lifting, carrying, and sustained gripping activities.

Exercise selection and progression should always reflect the individual's functional demands and symptom behavior. Elbow exercises may be modified by changing joint position, lever arm length, or speed of movement to adjust loading without altering repetition ranges. By exposing the elbow to varied but controlled strengthening challenges while maintaining general support from the neck, shoulder, and wrist, clinicians can improve tissue resilience, movement efficiency, and confidence in elbow use across daily, occupational, and athletic activities.

Pain Management and Activity Modification

References: 8, 24

Pain management and activity modification are essential components of elbow rehabilitation and should be integrated alongside exercise therapy rather than used as substitutes for active treatment. The primary goal is to reduce excessive or poorly distributed load while maintaining participation in meaningful activities and supporting progressive improvement in tissue tolerance. For most elbow conditions, complete rest is neither necessary nor desirable, as prolonged unloading can contribute to deconditioning, reduced confidence in movement, and delayed recovery. Instead, clinicians should guide individuals in adjusting how activities are performed to keep symptoms within a tolerable range while rehabilitation progresses.

Effective pain management begins with education regarding symptom expectations and acceptable discomfort. Patients should understand that mild pain or stiffness during or after activity may be a normal response to loading, particularly in chronic or load-related conditions, whereas sharp pain, rapidly escalating symptoms, or pain that persists or worsens over 24 hours may indicate excessive stress. Educating individuals to monitor symptom behavior allows for more effective self-regulation of activity intensity, volume, and frequency. Strategies such as pacing, breaking tasks into shorter bouts, and alternating between activities can significantly reduce cumulative load without eliminating function.

Activity modification focuses on altering task variables rather than avoiding activity altogether. For occupational tasks, this may include adjusting grip size, reducing sustained gripping time, altering wrist position to avoid prolonged end-range extension or flexion, or modifying lifting technique to distribute load more evenly across the shoulder and trunk. In athletic settings, activity modification may involve temporary reductions in training volume, changes in technique, or adjustments to equipment, such as racquet grip size or throwing workload, to reduce excessive elbow stress while maintaining conditioning.

Bracing can be a useful adjunct for pain management in select cases, particularly during periods of high symptom irritability or unavoidable activity demands.

Counterforce braces are commonly used in individuals with lateral epicondylalgia to reduce tensile load on the extensor musculotendinous structures during gripping or lifting tasks. These braces are typically worn during aggravating activities rather than continuously and should be positioned distal to the lateral epicondyle to influence load transmission. Similarly, medial elbow straps may be used in cases of medial epicondylalgia to reduce stress on the flexor–pronator mass during repetitive gripping or throwing activities.

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Elbow sleeves or compression garments may be beneficial for individuals with joint-related symptoms, swelling, or mild instability, particularly during weight-bearing or repetitive tasks. These supports can provide proprioceptive input and perceived stability, which may improve movement confidence and tolerance. In cases involving neural sensitivity, particularly cubital tunnel–related symptoms, night splints or soft braces that limit sustained elbow flexion may be appropriate to reduce prolonged nerve compression during sleep. These devices are typically used temporarily and in conjunction with education and exercise rather than as long-term solutions.

Modalities such as ice, heat, or topical agents may be used to support short-term symptom relief but should be framed as comfort measures rather than primary treatments. Their role is to help individuals tolerate movement and exercise rather than replace active rehabilitation. Pain management strategies should always be reassessed to ensure they are facilitating progress rather than promoting avoidance.

Ultimately, pain management and activity modification should evolve as symptoms improve and load tolerance increases. Bracing and task modifications are gradually reduced as strength, movement efficiency, and confidence are restored. By combining education, strategic activity modification, selective use of bracing, and progressive exercise therapy, clinicians can help individuals manage pain effectively while building the capacity needed for sustained return to daily activities, work, and sport.

Case Study 3

A 45-year-old right-hand–dominant recreational golfer presents with a five-month history of medial elbow pain that developed gradually over the course of a busy golf season. The patient reports pain localized along the medial epicondyle that is aggravated by gripping the golf club, hitting balls from thicker rough, lifting heavy objects, and prolonged tool use at home. Symptoms are described as an aching discomfort with occasional sharp pain during forceful swings but without numbness or tingling into the hand. Morning stiffness is minimal, but pain increases with repeated activity and toward the end of the day. There is no history of acute injury, though the patient notes an increase in practice frequency and recent changes to grip technique.

Physical examination reveals localized tenderness over the medial epicondyle and flexor–pronator mass, with reproduction of familiar pain during resisted wrist flexion and forearm pronation. Valgus stress testing does not reproduce instability but produces mild discomfort at higher loads. Elbow range of motion is full and symmetrical, though gripping at end-range wrist extension increases symptoms. Shoulder assessment demonstrates reduced external rotation strength and limited thoracic extension, while cervical screening is unremarkable. Neural testing does not reproduce paresthesia, supporting a primarily load-related medial elbow dysfunction consistent with medial epicondylalgia.

Reflection Questions

1. How does clinical history help distinguish medial epicondylalgia from other causes of medial elbow pain?
2. What examination findings supported this diagnosis?
3. Why was a counterforce brace included in the management plan?
4. How was exercise therapy structured to address this condition?
5. How did activity modification and education support recovery?

Responses

1. The gradual onset associated with increased golf volume and gripping demands, absence of neural symptoms, and load-dependent pain pattern supported a diagnosis of medial epicondylalgia rather than ulnar nerve entrapment or acute ligament injury.
2. Localized tenderness at the medial epicondyle, pain reproduction with resisted wrist flexion and forearm pronation, and preserved elbow range of motion were consistent with reduced load tolerance of the flexor–pronator muscles. Lack of sensory changes or significant valgus instability further supported this conclusion.
3. A medial counterforce brace was used during golf and heavier gripping tasks to reduce tensile load on the flexor–pronator origin during higher-

demand activities. The brace was positioned distal to the medial epicondyle and emphasized as a short-term adjunct to support continued participation rather than a replacement for rehabilitation.

4. Exercise therapy focused on progressive strengthening of the wrist flexors and pronators using challenging but controlled loading, combined with shoulder and scapular strengthening to improve proximal support and reduce compensatory elbow loading. Load progression was guided by symptom response rather than pain elimination.

5. The patient was educated on pacing practice sessions, modifying grip pressure, and temporarily reducing practice volume while maintaining skill work. As strength and tolerance improved, brace use was gradually reduced, golf activity progressed in a graded manner, and confidence in elbow loading was restored, supporting a successful return to recreational play without symptom recurrence.

Section 4 Key Words

Load Tolerance - The capacity of musculoskeletal and neural tissues to withstand and adapt to physical stress over time without provoking persistent symptoms, and it underpins decisions related to exercise progression, activity modification, and return to function

Multimodal - The integration of multiple treatment strategies, including exercise therapy, manual therapy, education, and activity modification, used together to address the complex and overlapping contributors to elbow pain rather than relying on a single intervention

Clinical Collaboration - Coordinated involvement of multiple healthcare professionals, such as physical therapists, occupational therapists, physicians, and specialists, to ensure comprehensive care, appropriate medical oversight, and alignment of treatment goals across settings

Section 4 Summary

This section emphasizes that effective management of elbow pain requires a comprehensive, patient-centered approach grounded in clinical reasoning and responsive to individual needs. By synthesizing findings from history, examination, and task analysis, clinicians can identify the most meaningful contributors to symptoms and prioritize interventions that address load sensitivity, movement efficiency, and functional demands. A multimodal treatment framework allows exercise therapy, manual therapy, education, and activity modification to work synergistically to support both short-term symptom relief and long-term improvement in function. Collaboration within the healthcare team ensures that care is appropriately coordinated, medically informed, and adaptable when symptoms persist or complexity increases. As symptoms improve, management strategies evolve to include higher-level functional loading and real-world demands, supporting sustainable recovery and confident return to daily activities, work, and sport for individuals with elbow pain.

Section 5: Sports-Related Elbow Injuries and Return to Play

Sports-related elbow injuries pose distinct challenges for physical therapists and occupational therapists because they occur in the context of high physical demand, performance pressure, and repetitive loading. In sport, the elbow is frequently exposed to forces and loading rates that far exceed those seen in daily or occupational activities. Successful management therefore requires more than symptom reduction; it requires restoring tissue capacity, movement quality, and confidence so the athlete can safely tolerate the demands of training and competition. This section integrates common injury patterns, underlying mechanisms, rehabilitation strategies, and return-to-play decision making to support clinicians working with athletic populations.

Common Sports-Related Elbow Injuries and Mechanisms of Injury

References: 17, 21, 22, 25

Sports-related elbow injuries encompass a broad range of conditions that reflect the unique mechanical demands placed on the upper extremity during athletic participation. Although the specific diagnosis varies by sport, position, and level of play, most elbow injuries in athletes develop through repetitive, load-related mechanisms rather than from a single traumatic event. The elbow functions as a critical force transfer point between the shoulder and the hand, and when demands exceed the capacity of local tissues or are poorly distributed across the kinetic chain, injury risk increases. Understanding the common injury patterns and their mechanisms of injury is essential for accurate assessment, targeted rehabilitation, and effective return-to-play planning.

In overhead and throwing sports such as baseball, softball, javelin, and tennis, medial elbow injuries are particularly prevalent due to repetitive valgus stress generated during high-velocity arm movements. During the late cocking and acceleration phases of throwing, substantial tensile forces are placed on the medial elbow structures, including the flexor–pronator musculature and the ulnar collateral ligament. At the same time, compressive forces develop across the lateral elbow as the radial head is driven into the capitellum, and shear forces occur posteriorly as the elbow rapidly extends. When throwing volume, intensity, or velocity increases without adequate recovery, these combined stresses can exceed tissue tolerance and lead to gradual symptom development. In younger athletes, repetitive valgus loading may also contribute to apophyseal irritation or growth plate–related conditions, while in older or more competitive athletes, chronic ligamentous stress or tendinopathy is more common.

Lateral elbow injuries, including lateral epicondylalgia, are frequently observed in racquet sports such as tennis, squash, and pickleball, as well as in sports that require repetitive gripping and wrist extension. The mechanism of injury typically involves repeated tensile loading of the wrist extensor musculature combined with compressive forces at the humeroradial joint during gripping and ball or racquet contact. Rapid changes in training volume, prolonged match play, inadequate recovery, or suboptimal equipment factors such as grip size, string tension, or racquet weight can significantly increase extensor demand. Poor stroke mechanics or excessive wrist dominance during hitting may further concentrate load at the lateral elbow. Over time, this repetitive loading can reduce tendon load tolerance and contribute to persistent lateral elbow pain.

Medial epicondylalgia and flexor–pronator tendinopathy are also common in throwing athletes, golfers, and individuals participating in sports that involve repetitive wrist flexion and forearm pronation under load. In these cases, the flexor–pronator mass functions both as a dynamic stabilizer of the medial elbow and as a force generator during gripping and throwing. When this muscle group is exposed to high repetitive loads, particularly in the presence of valgus stress, tissue overload may occur. Athletes with deficits in shoulder strength, trunk control, or throwing mechanics may rely excessively on the elbow to generate force, further increasing medial elbow stress. In some cases, medial elbow tendinopathy may coexist with ulnar nerve irritation or ligamentous strain, complicating the clinical presentation.

Posterior elbow injuries are commonly associated with sports that involve repetitive or forceful elbow extension, such as baseball pitching, gymnastics, volleyball, and weightlifting. Posterior elbow impingement occurs when repeated terminal extension leads to compressive contact between the olecranon and the olecranon fossa, often in combination with valgus stress. Over time, this can result in posterior joint irritation, osteophyte formation, or pain during end-range extension. Triceps tendinopathy may develop in athletes who perform high volumes of pushing, pressing, or rapid deceleration of elbow extension, particularly when training loads increase abruptly. Olecranon bursitis may also occur in sports involving repeated pressure or contact to the posterior elbow, either from direct impact or sustained weight-bearing positions.

Anterior elbow injuries, though less common, are clinically significant in certain athletic populations. Distal biceps tendinopathy may develop in sports requiring repeated or heavy elbow flexion and supination, such as wrestling, rowing, climbing, and strength training. The mechanism typically involves repetitive tensile loading or eccentric stress during lowering or deceleration tasks. Acute distal biceps rupture, while less frequent, is most often associated with a sudden, high-force eccentric load applied to a flexed elbow, such as attempting to catch a falling object or during maximal lifting. Anterior elbow pain may also arise from brachialis strain or anterior capsular irritation, particularly when athletes perform high volumes of resisted elbow flexion or maintain sustained flexed postures.

Across all sports, several shared risk factors contribute to the development of elbow injuries. Rapid increases in training volume or intensity, inadequate rest periods, and insufficient preseason conditioning are common contributors. Technical factors, such as inefficient movement patterns, poor sequencing of the trunk and shoulder, or excessive reliance on distal joints, can amplify elbow loading. Equipment variables, including grip size, bat or racquet weight, and throwing implements, further influence force transmission. Importantly, many athletes continue training despite early symptoms, allowing low-level irritation to progress to chronic dysfunction.

From a clinical perspective, recognizing the sport-specific mechanisms of injury helps guide both assessment and intervention. Rather than attributing elbow pain solely to local tissue pathology, clinicians should consider how repetitive loading patterns, movement strategies, and training demands interact to create excessive stress at the elbow. This understanding supports rehabilitation strategies that not only address the symptomatic tissue but also modify contributing factors, improve load distribution, and prepare the athlete for the demands of safe and sustainable return to sport.

Sport-Specific Treatment Strategies

References: 17, 22, 25

Sport-specific strengthening is a critical bridge between early rehabilitation and full return to play for throwing and racquet sport athletes. Because these sports place high demands on the elbow through repetitive, high-velocity loading, strengthening must progress in a deliberate, staged manner that reflects how force is generated, transferred, and absorbed during sport-specific movements. For physical therapists and occupational therapists, the goal is not simply to restore strength in isolated muscles but to progressively prepare the elbow and the entire upper extremity to tolerate the speeds, loads, and volumes required for performance.

In throwing athletes, strengthening progression typically begins with foundational upper quarter strength that supports efficient force transfer to the elbow. Early strengthening emphasizes controlled loading of the elbow flexors, extensors, and forearm rotators in mid-range positions, while concurrently addressing shoulder rotator cuff strength and scapular stability. As baseline tolerance improves, strengthening advances to include longer lever arms and combined movements that more closely resemble throwing mechanics. For example, resisted elbow extension may be progressed from short-range, slow movements to longer-range patterns that integrate shoulder flexion or external rotation, reflecting the acceleration phase of throwing. Forearm pronation and supination strengthening is progressed under load, as these motions play a key role in ball release and deceleration.

Once the athlete tolerates these loads without symptom escalation, strengthening progresses into higher-demand phases that emphasize eccentric control and rate of force development. Eccentric loading of the elbow flexors and extensors is particularly important to prepare tissues for the rapid deceleration forces experienced after ball release. Exercises may include controlled lowering phases during resisted elbow extension or flexion, emphasizing smooth control rather than maximal speed. At this stage, strengthening is often paired with low-volume throwing drills, allowing clinicians to assess how strength gains translate to sport-specific movement and to monitor symptom response in real time.

For racquet sport athletes, strengthening progression follows similar principles but is adapted to the unique demands of gripping, wrist control, and repeated stroke execution. Early strengthening focuses on restoring tolerance of the wrist extensors and flexors through controlled loading, as these muscles are heavily involved in stabilizing the racquet during impact. Forearm rotation strengthening is emphasized early, as pronation and supination contribute to stroke power and control. As tolerance improves, strengthening progresses to include combined wrist, forearm, and elbow movements performed in positions that resemble forehand and backhand strokes.

Later-stage strengthening for racquet athletes incorporates higher loads and more dynamic patterns. For example, resisted forearm rotation may be combined with elbow extension to simulate the loading pattern seen during stroke acceleration. Grip strengthening is progressed to reflect sustained and repetitive demands, such as prolonged rallies or match play. At this stage, clinicians may integrate strengthening into sport-specific drills using lighter racquets, reduced swing speed, or controlled hitting volume, gradually increasing intensity as tolerance improves.

Across both throwing and racquet sports, strengthening progression should be closely aligned with on-court or on-field workload. Strength exercises are adjusted based on the athlete's current training volume to avoid excessive cumulative load. Communication with coaches and athletic trainers is essential to ensure that strengthening complements, rather than competes with, sport practice. Progression is guided by symptom behavior, movement quality, and recovery between sessions rather than fixed timelines.

By systematically advancing strengthening from isolated control to high-load, sport-specific patterns, clinicians can better prepare the elbow for the demands of throwing and racquet sports. This approach supports not only symptom resolution but also durable performance, reducing the risk of recurrence as athletes return to full training and competition.

Restoration of Joint Mobility and Movement Quality

References: 15, 18

Restoration of joint mobility and movement quality is a foundational component of rehabilitation for sports-related elbow injuries and plays a critical role in reducing excessive tissue stress and supporting safe return to play. In athletic populations, adequate range of motion alone is not sufficient; the elbow must move efficiently and in coordination with the shoulder, trunk, and wrist to tolerate high loads and rapid movement demands. Restrictions or asymmetries in joint motion, even when subtle, can alter force distribution across the elbow and contribute to symptom persistence or recurrence under sport-specific conditions.

At the elbow, restoration of flexion, extension, and forearm rotation is essential for functional performance. Limitations in extension are particularly relevant in throwing and weight-bearing sports, where rapid or repeated terminal extension is common. Incomplete extension may increase compensatory motion elsewhere in the upper extremity, altering timing and increasing joint stress. Similarly, restricted pronation or supination can disrupt normal load sharing between the humeroradial and proximal radioulnar joints, increasing compressive or torsional forces during gripping, throwing, or racquet strokes. Mobility interventions should therefore address not only total range but also comfort and control through the range required for sport.

Joint mobility at the elbow cannot be addressed in isolation. Shoulder and thoracic spine mobility strongly influence elbow loading by affecting how force is generated and transferred through the kinetic chain. In throwing athletes, limitations in shoulder external rotation, internal rotation, or thoracic rotation may increase reliance on elbow motion to achieve ball velocity. In racquet sports, inadequate shoulder or trunk rotation may lead to excessive wrist and elbow contribution during stroke execution. Restoration of joint mobility must therefore include assessment and treatment of proximal segments to ensure that the elbow is not compensating for restrictions elsewhere.

Movement quality refers to how motion is performed rather than how much motion is available. Athletes with elbow pain often demonstrate altered movement strategies, such as increased wrist dominance, early elbow extension, or delayed trunk rotation, which can concentrate stress on specific elbow tissues. These compensations may persist even after pain decreases unless they are specifically addressed. Clinicians should observe sport-specific movements and functional tasks to identify inefficient patterns and guide targeted intervention. Cueing, video feedback, and progressive task-specific drills can be used to retrain movement patterns that distribute load more effectively across the upper extremity.

Restoration of movement quality also involves reestablishing appropriate timing and sequencing of muscle activation. In high-speed sports, the elbow must transition rapidly between stability and mobility, particularly during throwing or striking motions. Deficits in motor control or coordination can lead to delayed force absorption or excessive joint loading. Exercises that emphasize controlled transitions, variable speeds, and multi-joint coordination help prepare the elbow for these demands. For example, combining shoulder rotation with elbow extension and forearm rotation in a controlled manner can improve coordination before progressing to higher-speed tasks.

Importantly, improvements in joint mobility and movement quality must be reinforced through active use. Passive gains that are not integrated into functional movement are unlikely to translate into meaningful performance changes. Mobility interventions should therefore be followed by active range-of-motion exercises, strengthening, or sport-specific drills that reinforce efficient movement patterns. This integration helps ensure that restored mobility contributes to improved load tolerance rather than simply increasing available range without control.

In the context of return to play, restored joint mobility and movement quality provide the foundation upon which strength, power, and endurance can be safely developed. Athletes who regain motion but continue to move inefficiently remain at risk for reinjury when training volume or intensity increases. By prioritizing both mobility and movement quality throughout rehabilitation, physical therapists and occupational therapists can help athletes return to sport with greater confidence, efficiency, and long-term resilience.

Motor Control, Strength, and Stability

References: 18, 26

Motor control, strength, and stability are central to successful rehabilitation and return to play in athletes with elbow injuries. While restoring joint mobility and reducing pain are important early steps, long-term recovery depends on the athlete's ability to control movement and tolerate load across the elbow and the broader upper extremity kinetic chain. In sport, the elbow is rarely challenged in isolation; it must respond to rapidly changing forces, coordinate with proximal segments, and maintain joint integrity during high-speed, high-load tasks. Deficits in motor control or strength at any point in this system can increase stress at the elbow and undermine rehabilitation outcomes.

Motor control refers to the ability to coordinate muscle activation, timing, and sequencing to produce efficient and adaptable movement. In athletes with elbow pain, motor control deficits often develop as a response to pain, fatigue, or repeated overload. These may include delayed activation of stabilizing muscles, excessive reliance on distal joints, or altered movement sequencing during sport-specific tasks. For example, a throwing athlete may demonstrate early or excessive elbow extension to compensate for limited shoulder contribution, while a racquet sport athlete may rely heavily on wrist motion rather than coordinated trunk and shoulder rotation. These patterns may reduce immediate discomfort but increase cumulative stress on elbow structures over time. Rehabilitation must therefore address not only muscle strength but also how and when muscles are activated during movement.

Strength at the elbow includes the capacity of the elbow flexors, extensors, and forearm rotators to generate and absorb force repeatedly and at varying speeds. Reduced strength or endurance in these muscle groups limits the elbow's ability to tolerate sport-specific demands, particularly during repetitive or high-velocity actions. Importantly, elbow strength is closely linked to proximal strength. Deficits in shoulder rotator cuff strength, scapular stabilization, or trunk control can shift force demands distally, increasing reliance on the elbow to generate or control movement. For throwing and striking athletes, this often results in increased valgus or compressive stress at the elbow during acceleration and deceleration phases. Effective rehabilitation therefore integrates elbow strengthening with proximal strengthening to support efficient force transfer.

Stability at the elbow is a dynamic process that depends on coordinated muscular activity rather than passive structures alone. While ligaments and joint congruence contribute to stability, especially at end ranges, the primary means of controlling joint motion during sport is through active muscular stabilization. The flexor–pronator and extensor muscle groups play key roles in maintaining joint alignment during gripping, throwing, and weight-bearing tasks. When these muscles lack strength, endurance, or coordination, greater stress is placed on passive structures, increasing injury risk. Rehabilitation strategies should challenge elbow stability under progressively more demanding conditions, such as variable loads, changing joint positions, or reactive tasks that mimic sport demands.

As rehabilitation progresses, motor control and strength training should become increasingly task specific. Early phases may emphasize controlled, isolated movements to reestablish baseline activation and strength. Later phases should integrate multi-joint, multiplanar exercises that require the elbow to function as part of a coordinated system. For example, combining shoulder rotation, elbow extension, and forearm rotation in a controlled manner helps prepare athletes for throwing or striking tasks. Progressing speed, load, and complexity allows clinicians to assess whether the athlete can maintain movement quality and joint control under conditions that resemble competition.

Endurance is another critical component of stability in sport. Many elbow injuries emerge not during a single high-force effort but as fatigue accumulates over prolonged training or competition. Reduced muscular endurance can lead to subtle breakdowns in movement quality and increased joint stress late in sessions or matches. Rehabilitation should therefore include endurance-oriented challenges that prepare the elbow and surrounding musculature to sustain repeated loading. Monitoring symptom response during and after these activities provides valuable insight into readiness for progression.

Ultimately, restoring motor control, strength, and stability ensures that the elbow can tolerate the unpredictable and repetitive demands of sport. Athletes who regain strength without addressing movement control, or who demonstrate good control only under low-load conditions, remain vulnerable to reinjury when demands increase. By systematically developing coordinated strength and dynamic stability across the upper extremity, physical therapists and occupational therapists can support safer return to play and more durable athletic performance.

Considerations for Exercise Prescription and Anatomical Integration

References: 18, 21

Exercise prescription for sports-related elbow injuries must be guided by a clear understanding of both anatomical demands and sport-specific loading patterns. In athletic populations, exercises are not selected simply to strengthen isolated muscles but to restore the elbow's ability to tolerate repeated, high-intensity forces while functioning as part of the upper extremity kinetic chain. Clinicians must consider tissue irritability, stage of healing, and the athlete's current training load when determining exercise type, intensity, frequency, and progression.

Exercises that are appropriate in early rehabilitation may be insufficient or even counterproductive later if they do not reflect the speed, range, or coordination required in sport.

Anatomical considerations are central to effective exercise therapy. The elbow is influenced by forces generated proximally at the shoulder and trunk and distally at the wrist and hand, making regional integration essential. For medial elbow conditions, exercises must balance progressive strengthening of the flexor–pronator musculature with strategies that reduce excessive valgus stress, particularly in throwing athletes. For lateral elbow conditions, wrist extensor loading should be varied across forearm positions and integrated with gripping tasks to reflect sport demands. Posterior elbow conditions require careful exposure to extension loading, particularly near end range, while anterior elbow conditions necessitate gradual progression of elbow flexion and supination loads. Across all conditions, exercises should progress from controlled, slower movements to higher-speed, sport-like patterns as tolerance improves.

Exercise dosage is equally important. Strengthening loads should be sufficient to challenge tissue capacity while allowing recovery between sessions, particularly during periods of concurrent sport participation. Volume and intensity must be coordinated with on-field or on-court training to avoid excessive cumulative load. Monitoring symptom behavior during and after exercise provides critical feedback and allows clinicians to adjust progression in real time. Ultimately, exercise prescription should prepare the elbow not only to perform isolated tasks but to tolerate the combined demands of sport-specific movements performed repeatedly and under fatigue.

Pain Management and Return-to-Play Strategies

References: 20, 27

Pain management in athletic populations should be framed as a means of supporting continued participation and progressive loading rather than eliminating discomfort entirely. Athletes often expect some degree of soreness during rehabilitation, and clinicians should provide clear guidance on acceptable versus concerning symptom responses. Pain that is mild, predictable, and resolves within 24 hours is often compatible with ongoing progression, whereas sharp pain, loss of function, or escalating symptoms signal excessive load. Education empowers athletes to self-monitor symptoms and make informed decisions about training intensity and recovery.

Return-to-play strategies should emphasize gradual exposure to sport-specific demands. Rather than a single clearance point, return to play is a staged process that progresses from modified training to full practice and ultimately competition. Early stages may involve reduced volume, intensity, or complexity of sport tasks, allowing the athlete to reintroduce skills while maintaining symptom control. As tolerance improves, demands are systematically increased, with close attention to recovery between sessions. Temporary use of bracing or taping may support confidence or symptom control during early return phases, but these strategies should be reduced as strength and movement efficiency improve.

Key Return-to-Play Factors

References: 20, 21

Successful return to play depends on multiple interrelated factors rather than symptom resolution alone. Athletes must demonstrate sufficient strength, endurance, and coordination to meet the demands of their sport, including the ability to tolerate repeated loading without delayed symptom escalation. Joint mobility and movement quality must support efficient force transfer, reducing reliance on compensatory strategies that increase elbow stress. Psychological readiness is also critical, as fear of reinjury or lack of confidence can alter movement patterns and increase risk. Communication among clinicians, athletes, coaches, and training staff ensures that progression aligns with sport demands and minimizes conflicting expectations.

By integrating thoughtful exercise prescription, anatomically informed loading strategies, and progressive return-to-play planning, clinicians can support safe and durable return to sport. This comprehensive approach recognizes that elbow rehabilitation in athletes is not defined by a single exercise or milestone but by the athlete's ability to tolerate real-world demands with confidence, efficiency, and resilience.

Case Study 4

A 19-year-old collegiate right-handed baseball pitcher presents with gradually developing medial elbow pain that worsened over the course of the season. Symptoms were initially present only after pitching but progressed to pain during warm-up throws. There was no acute injury, and imaging ruled out ulnar collateral ligament rupture, indicating chronic valgus overload. History revealed increased pitching volume with reduced recovery and limited offseason conditioning.

Examination identified mild loss of elbow extension, reduced forearm pronation, tenderness over the flexor–pronator mass, and decreased endurance of the wrist flexors and pronators. Shoulder external rotation strength and scapular control were also reduced. Movement analysis during throwing drills showed early trunk rotation and increased reliance on elbow extension to generate velocity. Management emphasized load modification, restoration of elbow and forearm mobility, progressive strengthening of the flexor–pronator and shoulder musculature, and correction of movement sequencing. A structured interval throwing program was introduced and progressed based on symptom response. The athlete returned to competitive pitching without symptom recurrence following a graded return-to-play process and coordinated load management.

Reflection Questions

1. How did identifying contributing factors beyond the elbow influence the rehabilitation plan in this case?
2. Why was a graded interval throwing program essential for successful return to sport?
3. What indicators suggested the athlete was ready to return to competitive pitching?

Responses

1. Identifying deficits in shoulder strength, scapular control, and throwing mechanics allowed treatment to target proximal contributors that increased medial elbow stress, rather than focusing solely on the elbow. This helped reduce compensatory loading and supported a more durable return to pitching.
2. A graded throwing program allowed progressive exposure to pitching-specific loads while monitoring symptom response and recovery. This approach helped rebuild tissue tolerance, refine mechanics under increasing demand, and reduce the risk of reinjury.

3. Readiness was indicated by restored elbow range of motion, improved forearm and shoulder strength and endurance, efficient throwing mechanics, and the ability to tolerate pitching workloads without symptom escalation beyond 24 hours.

Section 5 Key Words

Return to Play - The structured, criteria-based process of progressing an athlete from modified or restricted activity back to full participation in sport, guided by symptom response, functional performance, load tolerance, and recovery rather than time alone

Eccentric Loading – Muscle activity in which the muscle lengthens while under tension to control or decelerate movement, playing a critical role in absorbing force and improving tissue load tolerance during high-demand activities such as throwing or striking

Valgus Stress - An outward-directed force applied at a joint that tends to open the medial side of the elbow, commonly occurring during throwing and overhead activities and placing tensile demand on the medial elbow structures, including the flexor–pronator musculature and ulnar collateral ligament

Section 5 Summary

Sports-related elbow injuries require a comprehensive and performance-informed approach because they develop within environments characterized by high loads, repetitive stress, and expectations for rapid return to activity. The elbow is routinely exposed to forces and loading rates that challenge tissue tolerance and movement efficiency, particularly in throwing, racquet, and weight-bearing sports. Effective management extends beyond reducing pain and addressing isolated impairments and instead focuses on restoring joint mobility, strength, motor control, and coordinated force transfer across the upper extremity. By integrating an understanding of sport-specific injury mechanisms with targeted rehabilitation strategies and structured return-to-play planning, clinicians are better equipped to support safe, confident, and durable return to sport for athletes with elbow injuries.

Conclusion

Elbow pain and dysfunction represent a frequent and functionally limiting concern across clinical practice, affecting an individual's ability to participate in daily activities, work demands, and athletic performance. This course provides a comprehensive, evidence-informed framework for physical therapists, physical therapist assistants, and occupational therapists to more effectively assess and manage elbow-related conditions. By integrating detailed understanding of elbow anatomy and biomechanics, including the concept of the elbow as a three-joint complex, clinicians are better equipped to appreciate how structure, movement, and load tolerance interact to influence symptoms. Emphasis on clinical history, sound clinical reasoning, and thorough physical examination supports accurate differential diagnosis and recognition of both local and remote contributors to elbow pain. Through exploration of common elbow dysfunctions, clinical testing, and sport-related injury patterns, this course reinforces a patient-centered approach to care and prepares clinicians to design individualized, multimodal treatment strategies that reduce pain, restore function, and promote safe, sustainable return to activity or sport.

References

1. Frey C, Kriz J, Sciascia A, Mathews C, Bowman E. Epidemiological trends of elbow and forearm injuries in high school baseball and softball players. *JSES Rev Rep Tech*. 2025;5(3):401-406. doi:10.1016/j.xrrt.2025.04.006

2. Lucado AM, Day JM, Vincent JI, et al. Lateral Elbow Pain and Muscle Function Impairments. *J Orthop Sports Phys Ther*. 2022;52(12):CPG1-CPG111. doi:10.2519/jospt.2022.0302

3. Lintner LJ, Swisher J, Sitton ZE. Childhood and Adolescent Sports-Related Overuse Injuries. *Am Fam Physician*. 2023;108(6):544-553.

4. Card RK, Lowe JB, Launico MV. Anatomy, Shoulder and Upper Limb, Elbow Joint. In: *StatPearls*. StatPearls Publishing; 2025. Accessed January 23, 2026. http://www.ncbi.nlm.nih.gov/books/NBK532948/

5. Nimura A, Shimura H, Hoshika S, Fukai A, Akita K. Elbow anatomy in perspective of joint capsule and surrounding aponeuroses: a narrative review. *JSES Int*. 2024;8(3):654-660. doi:10.1016/j.jseint.2024.01.006

6. Kunc V, Salavova S, Kachlik D. Osseous variability around the elbow joint. *Acta Radiol*. 2023;64(4):1540-1545. doi:10.1177/02841851221129392

7. Meijering D, Duijn RG, Murgia A, et al. Elbow joint biomechanics during ADL focusing on total elbow arthroplasty - a scoping review. *BMC Musculoskelet Disord*. 2023;24(1):42. doi:10.1186/s12891-023-06149-8

8. Tham JL, Al-Ani Z. Elbow pain and clicking. *Skeletal Radiol*. 2022;51(11):2195. doi:10.1007/s00256-022-04044-2

9. Crookes T, Wall C, Byrnes J, Johnson T, Gill D. Chronic shoulder pain. *Aust J Gen Pract*. 2023;52(11):753-758. doi:10.31128/AJGP-04-23-6790

10. Lau R, Mukherjee S. Prevalence of Shoulder and Elbow Overuse Injuries Among Competitive Overhead Youth Athletes in Singapore. *Orthop J Sports Med*. 2023;11(3):23259671231156199. doi:10.1177/23259671231156199

11. Landesa-Piñeiro L, Leirós-Rodríguez R. Physiotherapy treatment of lateral epicondylitis: A systematic review. *J Back Musculoskelet Rehabil*. 2022;35(3):463-477. doi:10.3233/BMR-210053

12. Zwerus EL, Keijsers R, Colaris JW, The B, van den Bekerom MPJ, Eygendaal D. Clinical diagnosis of lateral-sided elbow pain: predictors for recognizing a diagnosis other than tennis elbow. *J Shoulder Elbow Surg*. Published online November 3, 2025:S1058-2746(25)00762-1. doi:10.1016/j.jse.2025.10.006

13. Yang S, Kim TU, Kim DH, Chang MC. Understanding the physical examination of the shoulder: a narrative review. *Ann Palliat Med*. 2021;10(2):2293-2303. doi:10.21037/apm-20-1808

14. N M, M M, S R, M R. How effective is proprioception exercise on pain, grip force, dexterity and proprioception of elbow joint in patients with tennis elbow? A randomized controlled trial. *J Bodyw Mov Ther*. 2024;40. doi:10.1016/j.jbmt.2024.10.035

15. Gehrman MD, Grandizio LC. Elbow Ulnar Collateral Ligament Injuries in Throwing Athletes: Diagnosis and Management. *J Hand Surg*. 2022;47(3):266-273. doi:10.1016/j.jhsa.2021.11.026

16. Karanasios S, Korakakis V, Moutzouri M, et al. Diagnostic accuracy of examination tests for lateral elbow tendinopathy (LET) - A systematic review. *J Hand Ther Off J Am Soc Hand Ther*. 2022;35(4):541-551. doi:10.1016/j.jht.2021.02.002

17. Terlezky S, Amster Kahn H, Saleh S, Gannot G, Oron A. [MEDIAL EPICONDYLITIS (GOLFER'S ELBOW) - CLINICAL PRESENTATION AND TREATMENT]. *Harefuah*. 2022;161(8):515-519.

18. Yoon SY, Kim YW, Shin IS, Kang S, Moon HI, Lee SC. The Beneficial Effects of Eccentric Exercise in the Management of Lateral Elbow Tendinopathy: A Systematic Review and Meta-Analysis. *J Clin Med*. 2021;10(17):3968. doi:10.3390/jcm10173968

19. Kim HM, Hsu JE, Ricchetti ET. What's New in Shoulder and Elbow Surgery. *J Bone Joint Surg Am*. 2021;103(20):1865-1871. doi:10.2106/JBJS.21.00698

20. Jackson GR, Jawanda H, Batra A, et al. Elbow Ulnar Collateral Ligament Repair With Suture Augmentation Results in Good Clinical Results, a Return-to-Play Rate Between 67% and 93%, and a Postoperative Complication Rate Up to 11.9%: A Systematic Review. *Arthrosc Sports Med Rehabil*. 2023;5(5):100761. doi:10.1016/j.asmr.2023.100761

21. Wallis JA, Bourne AM, Jessup RL, et al. Manual therapy and exercise for lateral elbow pain. *Cochrane Database Syst Rev*. 2024;5(5):CD013042. doi:10.1002/14651858.CD013042.pub2

22. Pathan AF, Sharath HV. A Review of Physiotherapy Techniques Used in the Treatment of Tennis Elbow. *Cureus*. 2023;15(10):e47706. doi:10.7759/cureus.47706

23. Pavlova AV, Shim JSC, Moss R, et al. Effect of resistance exercise dose components for tendinopathy management: a systematic review with meta-analysis. *Br J Sports Med*. 2023;57(20):1327-1334. doi:10.1136/bjsports-2022-105754

24. Cooper K, Alexander L, Brandie D, et al. Exercise therapy for tendinopathy: a mixed-methods evidence synthesis exploring feasibility, acceptability and effectiveness. *Health Technol Assess*. 2023;27(24):1-389. doi:10.3310/TFWS2748

25. Hoppe MW, Brochhagen J, Tischer T, Beitzel K, Seil R, Grim C. Risk factors and prevention strategies for shoulder injuries in overhead sports: an updated systematic review. *J Exp Orthop*. 2022;9(1):78. doi:10.1186/s40634-022-00493-9

26. Shitara H, Tajika T, Kuboi T, et al. Shoulder stretching versus shoulder muscle strength training for the prevention of baseball-related arm injuries: a randomized, active-controlled, open-label, non-inferiority study. *Sci Rep*. 2022;12(1):22118. doi:10.1038/s41598-022-26682-1

27. Hones KM, Kamarajugadda S, Buchanan TR, et al. Variable Return to Play and Sport Performance After Elbow Ulnar Collateral Ligament Reconstruction in Baseball Players: A Systematic Review. *Arthrosc J Arthrosc Relat Surg Off Publ Arthrosc Assoc N Am Int Arthrosc Assoc*. 2024;40(7):1997-2006.e1. doi:10.1016/j.arthro.2024.01.033

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