

# Thumb Problems of Professional Musicians

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## Abstract

A strong, mobile thumb is of critical importance to the professional musician. Rapid, repetitive forces exerted on the musculoskeletal, orthopedic, and neural systems are frequently not physiologic and are often sufficient to result in injury. The treatment of these problems requires an examination that is attentive to the physical demands of playing a specific instrument. In addition to a complete upper extremity examination, it is often helpful to observe the patient playing his or her musical instrument. Such observation may demonstrate not only the pathomechanics of the primary problem, but also compensatory changes in technique that result in other disabilities. When hand problems in the professional musician are accurately diagnosed and treated, the outcome is frequently gratifying.

**H**umans are the only animal species that plays musical instruments. A strong, mobile thumb that can oppose the fingers is an important reason why. In addition to music, the thumb contributes almost 50% of useful hand function in the activities of daily living. Virtually every musical instrument requires thumb dexterity and power. The thumb serves a variety of functions, including support of the instrument, movement of valves or keys, provision of repetitive motion, increased reach between two keys, and increased power for stronger pinch or a louder attack. The musician applies mechanical stresses on the thumb that are often not physiologic and make it a common source of problems and disability. If properly diagnosed and treated, the vast majority of these problems have an excellent prognosis.

## Establishing a Diagnosis

The key to effective treatment is a precise diagnosis. The diagnosis is based on a comprehensive history as well as physical examination of thumb function. With a knowledge of thumb anatomy and mechanics, the symptoms may be localized to a specific anatomic site.

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First, the patient is asked about recent or past trauma. It is not uncommon to find evidence of an old fracture on x-rays, after assuming that the problem was acute. It is also important to establish the patient's practice and performance level. The patient is asked about recent changes in practice time or technique. These changes may account for an overuse syndrome, and an effective treatment program must take these factors into consideration to avoid problems with patient compliance.

The patient is then asked to quantitate the pain on a scale of one to ten. It is important to establish the level of pain as a baseline for evaluation of primary and secondary (compensatory) sites of pain, as well as the effectiveness of treatment. Other important questions to ask are: what is the duration of the pain and does it occur only with playing?

There may also be compensatory pain syndromes. For instance, if the thumb hurts, the wrist, elbow, and shoulder may be positioned to reduce thumb stress. With prolonged playing, the muscles that stabilize the more proximal joints fatigue and also become painful.

The patient must localize the symptoms with one finger and try to establish the point of maximal discomfort on the thumb. Does the symptom remain localized or radiate? Does the symptom occur at specific times or with specific motion? If the physical examination fails to isolate a particular anatomic area, it is helpful to have the musician play the instrument, and to identify specifically which motion causes discomfort. We sometimes use stop-action videotape to isolate flaws in technique.

## The Examination

The components of a complete hand examination are well described in many textbooks.<sup>1</sup> However, a few points should be emphasized. In the musician, it is particularly important to establish the point of maximum tenderness. The upper extremity is linked together by many joints, and compensatory problems often occur when a musician attempts to play the instrument despite pain.

The range of motion and stability of the thumb's three joints—trapezium-metacarpal (CMC), metacarpal-phalangeal (MCP), and interphalangeal (IP)—are always assessed.

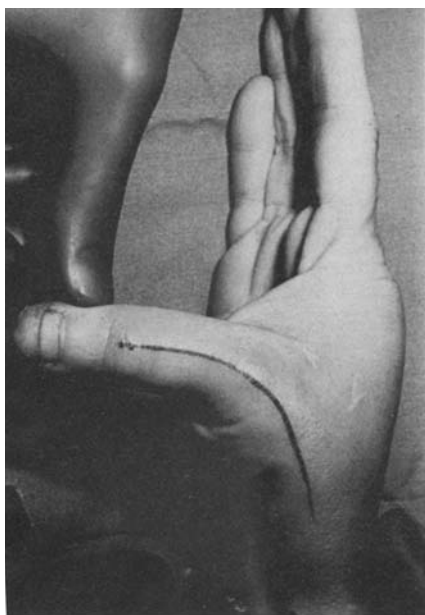
It is important to check the stability of the ulnar collateral ligament of the MCP joint and the volar ligament of the CMC joint (Fig. 1). Instability or hypermobility at one joint will change the mechanical forces throughout this interlinked system.

The musician repetitively uses the tip of the thumb to strike keys or supply pinch power. One pound of pinch at the tip is increased to five pounds at the MP joint and eleven pounds at the CMC joint. This is due to the moment arm effect of applying force at a distance from a point of rotation. Even modest, repetitive forces can injure the MCP ulnar collateral ligament or the CMC volar ligament, which are of primary importance to thumb stability.

Strength is assessed with a pinch meter. Strength is recorded for the single greatest score and with repetition. Some patients will demonstrate good pinch initially, but fatigue rapidly. The most common cause of decreased strength is pain. If the pain is relieved, strength increases. Another cause for decreased strength and early fatigue is significantly reduced practice time and loss of conditioning.

### Treatment Options

Treatment is frequently divided into conservative (non-operative) and operative treatment. Conservative treatment includes splinting, oral anti-inflammatory medication, injectable steroids, muscle relaxants, and hand therapy. To tell the patient that these options are conservative compared to surgery is not always accurate. The side effects of oral and injectable medications, or the time commitment of prolonged courses of splinting and therapy, are frequently less conservative than a single, simple operation. In the appropriate instance, surgery may offer a high likelihood of



**FIGURE 1** Without the restraint of the ulnar collateral ligament, the thumb lacks stability when it is stressed in radial deviation at the metacarpal-phalangeal joint. The stability of each joint is checked during the examination of the thumb.

completely resolving the problem and greatly reducing the musician's period of disability. To illustrate these considerations, case reports are presented.

## The Thumb's Musculotendinous System

### Diagnostic Considerations

The motor units to the thumb are classified as extrinsic and intrinsic muscle groups to distinguish between motor units that have their origin in the forearm (extrinsic) and those that have their origin in the hand (intrinsic).

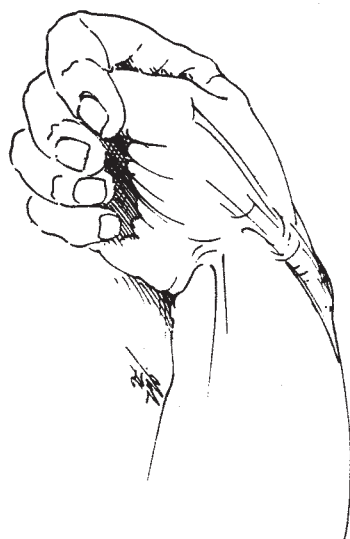
The extrinsic musculotendinous groups are the cause of two common thumb problems in the musician: trigger thumb<sup>2</sup> and de Quervain's tenosynovitis.<sup>3</sup> Similar anatomic situations predispose the thumb to both problems. As tendons enter the hand, they pass through fibro-osseous tunnels. In the digits on the volar surface (palm side), these are called pulleys. However, they are more analogous to the eyelets on a fishing pole, which keep the line from bowstringing as the rod bends across two points. The tendons on the dorsal side (back) of the wrist also pass through fibro-osseous tunnels attached to the distal radius.

Professional musicians frequently develop tenosynovitis (swelling around the tendon) in areas where the tendons glide back and forth in their tunnels during the repetitive motions of playing an instrument. Treatment involves either making the diameter of the tendon smaller with rest and anti-inflammatory medication, or making the diameter of the tunnel larger by surgically opening the point of greatest constriction.

### Case Example: de Quervain's Tenosynovitis

M.L. is a 19-year-old student of classical piano. For two years she had experienced pain over the area of the first dorsal compartment, swelling in this area, and a positive Finkelstein's test (Fig. 2). She was told that this was de Quervain's tenosynovitis. On two prior occasions the first dorsal compartment (Fig. 3) was injected with a steroid. She also took oral anti-inflammatory medication on a daily basis. This initially relieved her pain. However, after two to three months, the symptoms would recur.

She had no history of recent or old trauma. Her practice schedule was six to eight hours per day, and she recently had been practicing increased hours in preparation for a competition. The pain was most severe with "cross-overs," where the thumb is flexed beneath the fingers to strike a key in sequence after the little finger. In fact, this motion is similar to the Finkelstein test. Both maneuvers stretch the abductor pollicis longus and extensor pollicis brevis tendons. There was also pain with thumb extension, a movement that increases the span between the thumb and little finger. When such symptoms are reported, it is important to examine the basal joint of the thumb (Fig. 4), which can produce similar complaints. In this case, there was no pain with palpation, compression, or attempted dislocation of the basal joint. It is also important to examine the patient for evidence of tenosynovitis of the second dorsal



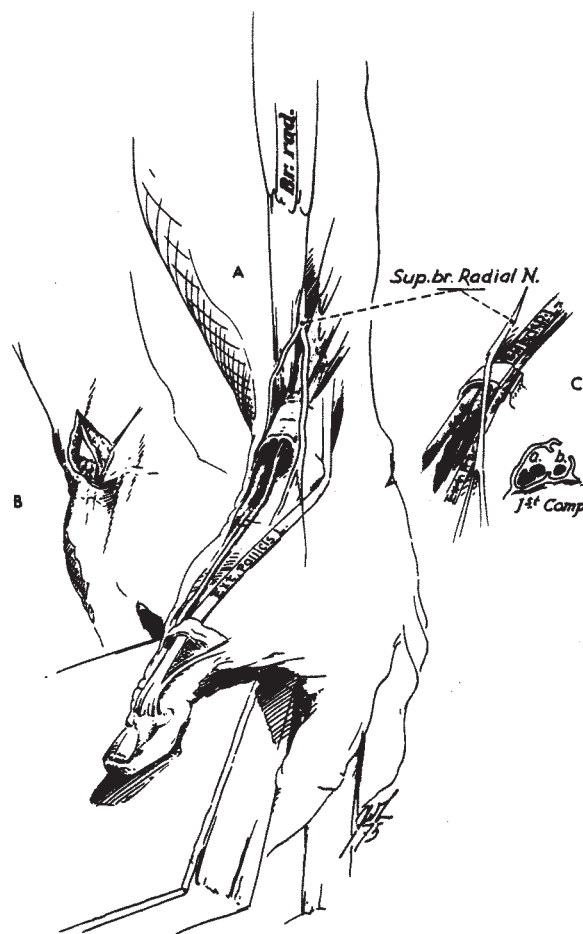
**FIGURE 2** The Finkelstein maneuver tests for pain associated with the first dorsal compartment. The thumb is positioned in the palm, and the wrist is moved in ulnar deviation. This stretches the abductor pollicis longus and extensor pollicis brevis tendons, and causes pain over the first dorsal compartment.

compartment, or intersection syndrome.<sup>4</sup> This patient's symptoms were well localized to the first dorsal compartment. She also reported moderate shoulder pain. She demonstrated on the piano that when the pain increased, she would compensate on cross-overs by raising the shoulder. This was recognized as a compensatory pain syndrome.

The patient requested another steroid injection. We advised her that anti-inflammatory medication and a thumb splint constitute our standard initial treatment of this problem. Steroids cause tissue atrophy, and repeated injections into this area could result in additional problems, including tendon rupture, skin depigmentation, and radial nerve problems.

The patient's history demonstrated that with resumption of activity, the problem recurred. After consideration of the current situation, past treatment, and current therapeutic options, we advised surgical decompression of the first dorsal compartment. Surgical release of the first dorsal compartment was performed. The wrist was immobilized in a plaster cast for two weeks. The patient's practice time was gradually increased over a period of six weeks. Both thumb and shoulder symptoms resolved without the need for medication.

We believe that nonoperative treatment should be recommended only when de Quervain's disease is due to pregnancy or a systemic illness such as rheumatoid arthritis. In the absence of such a condition, conservative treatment usually results in a prolonged period of disability. When musicians return to their normal level of activity, de Quervain's disease frequently recurs. Surgical release of the first dorsal compartment has high success and low recurrence rates.



**FIGURE 3** The anatomy of the first dorsal compartment is depicted. The abductor pollicis longus and extensor pollicis brevis are contained in this compartment. An increase in tendon diameter caused by synovitis will restrict movement of the tendons in the tunnel and cause pain. Note the proximity of the superficial branch of the radial nerve to this compartment. Care must be taken to avoid injury to this nerve during surgery.



**FIGURE 4** The stress view is a posteroanterior x-ray of both thumbs, with the patient pushing the radial sides of the tips of the thumbs against each other. This patient demonstrates a lateral shift of the thumb metacarpals off of the trapezium.

## The Thumb's Skeletal System

### Diagnostic Considerations

The thumb has three joints: the IP, MCP, and CMC articulations. One of the most frequent locations for degenerative arthritis in the hand is the basal joint of the thumb,<sup>5</sup> owing to the multiple planes that this joint allows the thumb to move in, and to the large compressive forces that occur at this location with pinch. It is often difficult for musicians to localize the pain to the basal joint, and they report pain and weakness on the radial side of the hand that is increased by activity and relieved by rest. However, frequently the point of maximum tenderness can be identified by pressing directly over the trapezium. Decreased pinch strength and lateral subluxation (attempted dislocation) of the metacarpal on the trapezium are also frequently present.

To determine the severity of the problem, x-rays with stress views are used, also known as "staging" (Figs. 4, 5). Stage I shows less than one-third subluxation of the joint and normal articular contours. Stage II is more than one-third subluxation and calcific fragments along the joint margins less than 2 mm in size. Stage III is joint space narrowing and articular degeneration. Stage IV is pantra-



**FIGURE 5** The four stages of articular disease at the trapezium-metacarpal joint are shown. A, Stage I includes less than one-third subluxation of the trapezium-metacarpal joint and normal articular contours. B, Stage II shows evidence of early degenerative changes such as small bony fragments at the joint margins. C, Stage III reveals marked joint space narrowing and larger debris, greater than 2 mm, and sclerosis along the joint margins. D, Stage IV is pantrapezial disease.

pezial arthrosis with involvement of the scaphotrapezium joint. Staging of degenerative arthritis is important because it helps to determine the extent of damage as well as suggests the type of reconstructive surgery necessary, should symptoms persist.

The initial treatment of stage I consists of molded splints and anti-inflammatory medication. If nonoperative management fails, a variety of surgical procedures, ranging from volar ligament reconstruction to trapezium implant replacement, are available, depending on the stage.

### Case Example: Basal Joint Laxity

A.B. is a 28-year-old cello player in a metropolitan symphony. He had been instructed to use a "rigid bow technique," which increased the compressive forces on the thumb. Over the previous two years he had experienced progressive pain that was diffuse but centered around the base of the thumb. Prior extensive consultations had included the diagnosis of focal dystonia (writer's cramp) and overuse syndrome. His disability had increased over the past 18 months to where he could play for only 15 to 20 minutes without pain.

On physical examination the patient had an unstable and painful basal joint with a lax basal ligament. Stress x-rays showed stage I disease with 25% subluxation of the metacarpal on the trapezium. The patient subsequently underwent volar ligament reconstruction (the ligament that stabilizes the thumb and prevents subluxation). The thumb was immobilized in a cast for one month, followed by therapy for six weeks. Practice time was increased gradually over a period of one month. The patient subsequently regained the lost strength from disuse and returned to the orchestra with pain-free strength and endurance.

## The Thumb's Neural System

### Diagnostic Considerations

The median nerve supplies virtually all of the thumb's useful sensation. The radial nerve innervates a small area over the dorsal aspect of the metacarpal. The motor innervation has radial, median, and ulnar nerve representation. The radial nerve supplies only extrinsic (forearm) muscles. The median nerve supplies extrinsic and intrinsic (hand) muscles. The median nerve intrinsics are positioning muscles that put the thumb in tip-to-tip opposition with the fingers. The ulnar nerve supplies only intrinsic muscles to the thumb. Of primary importance is the adductor pollicis muscle, which has an almost perpendicular pull on the midportion of the thumb and provides enormous mechanical advantage in power pinch. In addition to examining the appearance, bulk, and function of each of the forearm and hand muscles, a measurement of power with a pinch meter should be recorded.

### Case Example: Ulnar Nerve Neuropathy

R.S. is a 24-year-old professional viola player. Ten years ago he sustained a right elbow injury and subsequently had surgery at the elbow to release a compressed ulnar nerve.

Since that time he reported that his sensation was normal and he had good strength. Over the preceding two months he had been performing more hours than usual. After prolonged periods of playing, the thumb would "get stuck." Once this problem started, it would recur until he rested.

On physical examination there was a slight decrease in the muscle bulk of the first web space of the right hand when compared to the left hand. This fact was remarkable given that the patient is right dominant. Sensory examination was normal. Pinch strength was 16 pounds on the right and 20 pounds on the left. This was abnormal, given his hand dominance. The dominant hand is usually 15–20% stronger than the non-dominant hand. With a short period of playing (10 minutes), the patient could reproduce his symptoms.

The assessment was that the patient had an old, stable ulnar nerve injury, with a reduction of the motor units to the intrinsic muscles. With prolonged playing, the adductor pollicis brevis muscle would cramp and go into spasm. This might be considered a variant of an overuse syndrome.

Treatment consisted of having the patient decrease practicing time by 25%. For all musicians, we believe that it is important that they continue playing their instrument to some degree, to avoid conditioning problems. The patient was also referred to a hand therapist for strength and endurance conditioning, specifically for the ulnar intrinsic muscles. Over a three-month period, the symptoms resolved and the patient returned to his previous practice schedule.

## Summary

Effective treatment of thumb problems requires a comprehensive knowledge of thumb anatomy and mechanics, a complete history, physical examination of the hand, and a knowledge of the special demands that professional musicians place on their hands. At this level of performance, the patient is often highly critical of the effectiveness of treatment. However, when hand problems are accurately diagnosed and treated, the outcome is frequently gratifying for both the musician and the hand specialist.

## ACKNOWLEDGMENT

We would like to thank Dr. J. William Littler for the drawings used in this article.

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