

CASE REPORT

Stabilization of Rheumatoid Thumb Interphalangeal Joint Boutonniere Deformity and Severe Subluxation with Splinting and Prolotherapy: A Case Report

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ABSTRACT

In this clinical case, a 57-year-old white female afflicted with rheumatoid arthritis received treatment for a 35-degree interphalangeal (IP) thumb joint deviation. The thumb deviation clinically described as a boutonniere (French for buttonhole) deformity was treated with a combination of Prolotherapy and splinting. She wore a custom three-point splint for six weeks and received three separate Prolotherapy treatments within that six-week period. After treatment, the deviation decreased from 35 degrees to 10 degrees, and her thumb pain decreased from 7 to 1 on a pain scale of 10 as the highest level.

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KEYWORDS: boutonniere deformity, interphalangeal (IP) joint, Prolotherapy, rheumatoid arthritis, splinting, thumb pain.

Table 1. The Nalebuff classification system places finger and thumb deformities into six separate categories. Note: Adapted from *The Rheumatoid Thumb*,² *Diagnosis, classification, and management of rheumatoid thumb deformities*.¹³ *The Rheumatoid Hand*¹⁴ and the lecture notes of HCJR Belcher.¹⁵

Nalebuff Classifications for Thumb Deformities

I	Boutonniere, passively correctable, MP joint flexion, and IP joint hyperextension
II	Boutonniere, CMJ affected, adduction deformity
III	Swan neck, hyperextension of MP joint, and IP joint flexion
IV	Gamekeeper, injury to the UCL
V	Swan neck, alone
VI	Skeletal collapse with bone loss, arthritis mutilans

Introduction

As a disabling, systemic, inflammatory disease—rheumatoid arthritis can severely restrict and deform any joint in the body, including those in the hand and fingers. Rheumatoid arthritis occurs in about 1.5% of the population of the United States and is three times more likely to affect women than men.¹ When rheumatoid arthritis occurs in the thumb, it limits both grip strength and pinching ability, which can severely limit activities of daily living. Rheumatoid arthritis can also lead to joint subluxation or dislocation, which occurs when the ligaments around the joint weaken. Thumb deformities are commonly classified using the Nalebuff classification system (See Table 1), which includes six deformities and their respective pathological mechanics. Boutonniere, or type 1, is the most common deformity.^{2,3} (See Figure 1.)



Figure 1. A Boutonniere Deformity. This is the most common type of deformity in patients with rheumatoid arthritis.

A rheumatoid thumb can make basic tasks of daily living, such as opening doors, writing, gripping, and typing infinitely more difficult, if not impossible, to execute. At the point that activities of daily life are compromised, medical intervention is necessary.

Currently, different treatments are available for thumb joint deformities and subluxations. The most common option is stabilization of the deformity with a splint. Typically, a clam shell splint or an extension block splint are used; in more severe cases, a Kirchner wire or screw is used.^{4,5} Splinting is designed to carefully but forcefully realign a subluxed joint. In the case of more severe symptoms, surgery is an option. Surgical options vary with the stage and nature of the arthritis. Surgical methods fall into one of two categories. The first involves arthrodesis, which is a fusion of the metacarpophalangeal or interphalangeal joint of the thumb. For less severe cases, multiple techniques of arthroplasty or joint replacement are available. Arthroplasty techniques range from simple or partial bone excisions (surgical removal) to various implants as well as ligament and tendon interposition and reconstructions.^{6,7,8,9,10} While many of these surgeries show promise, potential risks or side effects include implant wear, synovitis, bony erosions, and continued pain and disability.⁵ For these reasons patients are seeking safer alternatives to surgery, including Prolotherapy. Statistics indicate that increasing numbers of adults (38%) and children (11%) use some kind of alternative medicine.¹¹

As a nonsurgical option, Prolotherapy is an injection technique that is designed to stimulate the repair and regrowth of injured ligaments and tendons. It is gaining in popularity as a method to stabilize loose or lax joints, including the sacroiliac joint.¹² This is the first clinical report of a thumb boutonniere deformity with a subluxed interphalangeal (IP) joint that was stabilized using a splint and Prolotherapy.

Case Report

With a six-year history of rheumatoid arthritis, a 57-year-old, left-handed female required the use of anti-rheumatic drugs for several years to relieve symptoms. For the past six months, however, she had been off of all medications, controlling her rheumatoid arthritis with diet, exercise, and other lifestyle modifications. She worked as a real estate agent and the thumb deformity was giving her almost constant pain, level 7 (0 to 10 scale) with activity, as well as decreased grip and pinch strength. Due to disruptive thumb pain, weakness, and deformity, the patient scheduled a Prolotherapy consultation with hopes for an alternative treatment.

After a physical examination, a thumb boutonniere deformity was noted with a 35-degree left thumb IP joint radial deviation. (See Figure 2.)



Figure 2. Patient with a 35-degree IP left thumb joint deformity.

The IP joint was tender with palpation. The IP joint deformity was also correctable with three-point pressure. (See Figure 3.)



Figure 3. Correcting the IP joint with three-point pressure.

Prior to her first Prolotherapy treatment, the patient was advised to get a custom splint and wear it continuously for six weeks, during which time she would receive three Prolotherapy treatments.

On February 16, 2011, the patient received Prolotherapy to the ulnar side of the thumb IP joint with 1.5cc of a solution, consisting of 0.5cc of sodium morrhuate and 1.0cc of procaine. (See Figure 4.)



Figure 4. Prolotherapy to the IP joint of the thumb.

When she returned to the office two weeks later, she reported increased pain, primarily due to friction pressure between the swollen joint and the splint. (See Figure 5.)



Figure 5. Left thumb swelling at IP joint two weeks after first Prolotherapy treatment. Note: pressure excoriation from swollen IP joint rubbing on splint band.

The patient was instructed not use the splint for two weeks and have an occupational therapist re-adjust the splint to allow for the swelling that occurs with Prolotherapy.

Next, the therapist made a custom volar digital gutter splint with padding that was applied to the lateral aspect of the P2 segment and then placed padding medially on the P1 segment to encourage proper DIP alignment. A Thera-Band® finger loop was also applied to the P2 segment of the thumb, providing a gentle, continuous pressure to correct DIP alignment. (See Figure 6.)



Figure 6. The custom volar digital gutter splint made by the occupational therapist to allow for the swelling that accompanies Prolotherapy treatment.

Using the same solution, a second Prolotherapy treatment was administered to the patient. She was instructed to call the office, if there were any visible changes in the skin from splint irritation. She was seen bi-weekly for two more Prolotherapy sessions. After her last Prolotherapy session, she wore the splint for two more weeks. The original plan was for three Prolotherapy treatments and constant splinting over a six-week period, but the patient actually received four Prolotherapy treatments. Due to swelling after the first treatment, she did not wear the splint continuously, so the first Prolotherapy injection was not considered part of the treatment plan. After the six weeks of immobilization and the four Prolotherapy sessions, the radial deviation had decreased to 10 degrees, and her pain level was lessened to a 1 (0 to 10 scale). At follow-up three months later, her pain level remained at a level 1 with activity, and her IP joint subluxation continued at 10 degrees. (See Figure 7.)



Figure 7. IP joint deviation improved to ten degrees.

Discussion

Rheumatoid arthritis of the thumb is a common and important cause of impaired function and disability. The thumb is involved in 60% of hand usage. When the thumb movement is limited by pain, instability or deformity, hand function is greatly reduced. A patient with rheumatoid arthritis may develop joint deformities in the hand and wrist that can limit grip and pinch strength, eventually restricting their activities of daily living. In 1968, Nalebuff devised a classification system for digit deformities in rheumatoid arthritis.¹³ His classification accounts for the severity of the deformity and the effects on adjacent structures. Thumb deformities are classified from type 1 to type 6. (See Table 1.)

The patient had the most common type of rheumatoid thumb deformity, type 1 or boutonniere deformity, but one may ask what causes this condition. With the onset of rheumatoid arthritis, this inflammatory process initiates a cascade of effects. Besides exhibiting flexion at the metacarpophalangeal (MP) joint and hyperextension at the interphalangeal joint, she had a 35-degree radial subluxation of the interphalangeal joint. Nalebuff type 1 deformities such as hers are typically caused by laxity of the dorsal capsule from proliferative synovitis around the MP joint, and elongation or erosion of the attachment of the extensor pollicis brevis tendon to the base of the proximal phalanx (leading to flexion deformity). This condition in turn allows volar and ulnar subluxation of the extensor pollicis longus tendon, which results in MP joint flexion and weakened active extension. Subluxation of the EPL tendon eventually causes IP joint hyperextension and adduction of the first metacarpal.^{16, 17}

Boutonniere deformities have other possible causes. The first is capsular distention of the PIP joint. The second is a lengthening of the central long extensor tendon, without a lengthening of the middle phalanx. Third, lengthening of the transverse fibers, subluxation of the lateral bands that stress the PIP joint, and increased extensor pull on the distal phalanx can also cause boutonniere deformity. Fourth, a self-perpetuating collapse deformity and ligament or tendon contracture, joint stiffness, and disorganization are also known causes.¹⁸

The digit deformity follows the mechanical changes. The MP flexion deformity results from the displaced

EPL, which bypasses the MCP joint and applies its power instead to the distal phalanx. Then, the collateral ligaments elongate and the MCP joint subluxes.

According to O'Brien (1996), the rheumatoid arthritis patient typically exhibits one of four stages of thumb involvement. The treatment of thumb deformities depends on the severity of disease in each afflicted joint. In stage 1, synovitis (inflammation of a synovial membrane) is present for less than six months. When synovitis is greater than six months, it is considered stage 2. Conservative care including medications, splinting, and steroid injections are recommended for stages 1 and 2 of the disease. Stage 3 is used to classify thumb and hand deformities, including boutonniere and swan-neck deformities, often treated with reconstructive surgery. With progression of the disease, the deformity becomes fixed and can no longer be corrected passively. Eventually, gross bone and cartilage destruction with severe arthritis mutilans, classified as stage 4, necessitates salvage procedures.⁷

The large volume of literature dealing with rheumatoid hands and wrists reveals numerous surgical techniques available for the care for these patients. The goals of surgery are to relieve pain, restore function, prevent further damage, and provide cosmetic improvement, while following certain surgical principles.⁵ (See Table 2.)

Table 2. The principles and theories of hand, thumb, and wrist surgery. Note: Adapted from Surgical Principles and Planning for the Rheumatoid Hand and Wrist.⁷

Principles of Hand and Thumb Surgery
<ul style="list-style-type: none"> • The existence of deformity is not necessarily an indication of the need for surgery. • Tailor the surgical plan to the individual patient. • Do the uncomplicated procedures with the best chance of success first. • Prophylactic surgery does not stop the progression of the disease. • Do not try to do too much at once. • Be realistic with your patients and yourself with regard to what can be achieved.

When the bone is intact but the joint is destroyed, a joint replacement called arthroplasty may be recommended. Patients with advanced disease and major bone destruction may require a joint fusion called arthrodesis. Generally, a fixed joint deformity with bony destruction is more amenable to fusion than arthroplasty. Concerning thumb boutonniere deformities, the MP and IP joints are operated on at the same time. A common surgical

procedure for a thumb boutonniere deformity with IP subluxation would be MP arthroplasty with IP joint fusion and synovectomy.^{19, 20, 21} This operation offers minimal functional improvement and a high recurrence rate. A poor outcome may be considerable, since extension can be gained at the loss of function.²¹ Other operations include concomitant IP and MP fusion, if the carpometacarpal (CMC) or wrist joint is mobile, or fusion of the IP joint and transfer of the EPL to the base of the proximal phalanx for a patient with a mobile-flexion deformity of the MCP joint and a stiff IP.⁸

As for the patient's wishes, she adamantly rejected surgery. She had worked to control her rheumatoid arthritis with such lifestyle modifications as diet and herbal remedies. She had been off anti-rheumatic drugs, including Humira®, for six months prior to her first consultation. On the initial examination, her boutonniere deformity and IP subluxation were clearly reducible, which made joint stability with Prolotherapy and splinting good treatment options.

Prolotherapy, in this patient, was recommended and administered to the IP joint and collateral ligaments. The IP joint was splinted to encourage joint alignment, and injections shortened and strengthened the collateral ligament on the IP ulnar side of the thumb. Normally, Prolotherapy is given every four to six weeks because most ligaments heal over this time period.²¹ In this particular case, the patient worked as a realtor and wished to limit the time of immobility, as it made it difficult for her to do her job. As a result, Prolotherapy treatments were given every two weeks. Sodium morrhuate, used as the proliferant instead of the more commonly used dextrose, produced a stronger inflammatory reaction.²² Prolotherapy is known to stimulate ligament growth, strengthening, and tightening, as well as joint stabilization.^{23, 24, 25, 26} In one double-blind placebo-controlled trial, Prolotherapy was shown to be effective at treating the pain of thumb osteoarthritis.²⁷

While multiple studies of patients with rheumatoid arthritis have documented that splints can decrease hand and digit pain and improve grip strength, splinting alone is not effective in permanently stabilizing joints.^{28, 29} Before this case report revealed the complimentary efficacy of Prolotherapy and splinting, surgery was the primary option.³⁰

After this patient's initial Prolotherapy treatment, the swelling created friction with the splint, which could not accommodate the increased size of the joint. For this reason, the patient was without the splint for two weeks, and another splint had to be made to accommodate the swelling. Once the second splint was fitted, bi-weekly Prolotherapy treatments continued for three sessions. Over the course of treatment, the patient's thumb was immobilized for six weeks. This was sufficient time to allow the collateral ligaments to tighten and correct the IP subluxation.

Conclusion

In cases of a severe hand or thumb affliction known as boutonniere's deformity, surgery, such as arthroplasty or fusion, is the preferred treatment. When the patient refused the surgical option, her 35-degree IP subluxation was treated instead with a combination of Prolotherapy and splinting. The patient agreed to wear a custom three-point splint without removal and complete three sessions of comprehensive Prolotherapy injections over a six-week period. The Prolotherapy solution was boosted with sodium morrhuate, which accelerates the inflammatory healing process. To allow for the swelling that accompanies Prolotherapy treatment, the splint was designed with an adjustable strap. After a program of splinting and Prolotherapy, the deformity was reduced from 35 to 10 degrees, presumably the result of shortened and strengthened ulnar side IP collateral ligaments. While surgery is still the dominant treatment for digital IP joint deviations, this case documents Prolotherapy as an effective alternative for severe IP deformities. ■

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