# Treatment of Basal Thumb Osteoarthritis: A Retrospective Study of Dextrose Prolotherapy Injections as an Alternative Treatment

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ABSTRACT

*A common malady of the thumb in the carpometacarpal (CMC) joint is osteoarthritis (OA), also known as basal thumb arthritis or trapeziometacarpal (TMC) arthritis. This affliction is often the result of ligament laxity or injury to the thumb, which then creates a cascade of arthritic effects. This study documents the benefits of Prolotherapy for 13 patients with TMC joint osteoarthritis in 17 of their thumbs. Specifically, Hackett-Hemwall dextrose Prolotherapy counteracts the tissue degeneration that leads to pain and stiffness by creating a healing cascade, which begins with inflammation and proceeds to connective tissue repair. During each treatment session, patients received an average of 10 injections of dextrose—a simple sugar used as a safe inflammatory agent—in the afflicted thumb joint and surrounding connective tissue. In addition, hGH was added to the intra-articular injections for its hormonal effects on cartilage growth. Using the VAS scale, patients were asked to rate pain and stiffness; they also reported on use of medication. Then, questionnaire responses gathered before Prolotherapy were compared with telephone responses after Prolotherapy sessions. Dextrose injections gave 71% of the patients in the study group 50% or more improvement in their daily overall pain level. The follow-up questionnaire shows that of the 17 thumbs, 15 thumbs had achieved the improvements expected by the patients over the course of an average of 4.5 sessions. Among an array of medical treatments, Prolotherapy is one of the most desirable for physicians and patients to consider because the injections enable the body to regenerate injured tissue and rejuvenate function. This study justifies the use of Prolotherapy to remedy the biomechanical failure of basal thumb arthritis.*

*Journal of Prolotherapy*. 2013;5:e913-e921.
KEYWORDS: basal thumb arthritis, carpometacarpal joint, dextrose Prolotherapy, human growth hormone, trapeziometacarpal joint.

## Background

The opposable thumb is a unique physical trait among primates. According to anatomists, the thumb is the outcome of an evolving process, which allowed the human species, among other primates, to develop fine motor movement through two defining actions: opposition and apposition.[1] Since descriptions of the anatomical movements possible between the thumb and other digits are varied and complex, hundreds of definitions elaborating on the anatomy and functions of the human hand arose. Researchers generally believe that anatomical development allowed humans to use the shorter digits of the hand—longer digits limit other primates—in conjunction with the thumb to perform more intricate tasks, some having to be repeated hundreds and thousands of times. Thus, the ability to "oppose" and "appose" other fingers permits the fine motor coordination necessary for such daily activities as grasping, tool wielding, and eventually writing.

Despite its contributions to movement and function, the thumb is often taken for granted, except when injured. Simple tasks are no longer simple when intricate thumb movements performed each day cause searing pain. A common malady of thumb is osteoarthritis (OA) in the carpometacarpal (CMC) joint, also known as basal thumb arthritis or trapeziometacarpal (TMC) arthritis. The trapezium bone joins the metacarpal bone of the thumb, hence, the "T" in TMC. This study will use the term TMC to differentiate the TMC joint of the thumb from the CMC joints of the digits of the hand.

In order to document the prevalence of this affliction, the Arthritis Research Institute of America examined more than 3,000 ambulatory men and women over the

age of forty and found that 21% had osteoarthritis in their TMC joint. Thumb arthritis was found to be more prevalent in women, with the incidence of OA rising with age. The presence of OA in the TMC joint in this demographic study was documented by radiographic evidence.[2] Census studies also note that the incidence of TMC osteoarthritis is significantly higher in women than in men: 24.3% in women compared to 10.3% in men.[3] The frequency of osteoarthritis in all joints is expected to increase from 15% of the US population in 1990 to 18.2% of the estimated 2020 population (59.4 million). The number of individuals whose activities are limited by arthritis is expected to rise from 2.8% to 3.6% in the same period of time.[4] Since the hand is second to the knee as the most common site of osteoarthritis, data suggests that by 2020, millions of people will have daily activities limited by thumb arthritis.[3]

According to the Mayo Clinic's Foundation for Medical Education and Research, the etiology of thumb arthritis and OA in general is not known. Researchers suspect the cause is multifactorial. Presumptive causes include being overweight, aging, stressing or injuring the joint, having hereditary susceptibility, straining muscles, and using the joint repetitively.[5] In an article written for the *Annals of Rheumatic Diseases*, Brandt and other authors attempt to identify the cause of osteoarthritis. They categorize the disease into idiopathic primary arthritis vs. the arthritis that evolves from metabolic problems or gene mutations, causing abnormalities of the articular cartilage and collagen. The primary version was found to be more common—an osteoarthritis that results from instability of an afflicted joint due to ligament laxity, damage, or overuse.[6] Ligament damage occurs over time from overuse or traumatic injury.

Physicians often underestimate the degree of disability.[7] Disabilities of an arthritic thumb can range from mild to severe. In severe cases, the thumb movements of adduction (toward the hand) and abduction (away from the hand) become difficult. The patient may be limited to simple activities with the affected thumb. Onset of TMC osteoarthritic pain is usually induced with certain activities: sewing, opening jars, and grasping large objects. As the disease progresses, daily tasks become increasingly painful, which leads some patients to give up hobbies and even jobs. Untreated, the pain can progress to the point where the thumb hurts even at rest. Crepitus and swelling may also be present.

The condition is usually diagnosed from a patient history and physical exam; X-rays can help to gauge the severity of the disease. Radiographic imaging may discover narrowing of the joint space and formation of osteophytes—both associated with osteoarthritis of the TMC. The examiner manipulates the thumb to locate the point of maximal tenderness, where degenerative changes or synovitis (inflammation of synovial membrane) occur. The "grind" test is performed by rotating the metacarpal base of the thumb while applying axial (push inward) pressure. (*See Figure 1.*)

**Figure 1. Grind test.**

Pain during this maneuver is considered a positive indication of degeneration. The "distraction" or "torque" test is similar in that the base of the thumb is rotated, but differs with gentle traction (pulling outward). During this test, pain indicates inflammation of the synovial membrane, which produces synovial fluid for joint lubrication. This pain—suggesting synovitis—results from traction on an inflamed joint capsule.[8]

Classification of basal thumb arthritis depends on the progression of the condition, and subsequent treatment depends on the stage. Utilizing radiographic imaging, R. G. Eaton and S. Glickel classified TMC osteoarthritis into four stages to help determine appropriate treatment. (*See Table 1.*)

*Stage I* OA—the mildest form of the disease—reveals an enlarged trapeziometacarpal joint space with subluxation (incomplete or partial dislocation) and synovitis. Treatment usually consists of NSAIDs (nonsteroidal

**Table 1. Eaton and Glickel Stages: trapezio-metacarpal arthritis.**

| Stage | Criteria |
|---|---|
| I | Normal articular contours. Joint space widening due to effusion or synovitis secondary to ligamentous laxity of basal joint. |
| II | Joint space narrowing with some subchondral sclerosis. Joint debris and osteophytes < 2 mm. |
| III | Complete loss of joint space, severe subchondral sclerosis. Joint debris and osteophytes > 2 mm. Scaphotrapezial joint is normal. |
| IV | Changes found in Stage III with the addition of scaphotrapezial joint narrowing and sclerosis. |

anti-inflammatory drugs) and immobilization. At *Stage II*, a narrowed trapeziometacarpal joint space, with or without small bone osteophytes (calcific fragments) less than 2 mm, is observed. Sclerosis—hardening of tissue from chronic inflammation—can be seen. Treatment may include surgical ligament reconstruction and tendon interposition. *Stage III* includes significant joint destruction; subchondral sclerosis or cyst formation; and the appearance of osteophytes greater than 2 mm, although the scaphotrapezial joint is normal. Surgery is traditionally recommended at this point. At *Stage IV*, those advanced degenerative changes observed in *Stage III* are seen but with an additional involvement of the scaphotrapezial joint.[9]

With most orthopedic conditions, conservative approaches to treatment are usually applied first. If TMC joint osteoarthritis is in an early stage, initial therapies include behavior modification, heat and ice treatments, analgesics and NSAIDs, and splinting/immobilization. The goal of these treatments is to reduce pain and improve function. However, if the patient does not stop the precipitating activity that caused the condition, his or her pain or limited thumb function will continue through the four Eaton-Glikel stages. Behavior modification requires that the patient stop activities of repetitive motion with the thumb for a short-term trial period, which may prove its benefit on a permanent basis. One study, which involved splinting the thumb every night, suggested that splinting was not effective in reducing pain during the first month. With splinting, pain and disability was improved after 12 months. To the contrary, research noted that splinting "had no effect on the radiographic progression of osteoarthritis or on other secondary outcomes, including web closure (thumb adduction)."[10]

When these conservative measures fail—as they generally do because underlying causes of the arthritic process have not been addressed—more aggressive and invasive therapies, such as corticosteroid injections, may be given in an attempt to reduce inflammation and pain. A study published in the *Journal of Hand Surgery* concluded that a steroid injection with splinting is effective for Stage I TMC osteoarthritis. For *Stage II* and *III*, only 7 of 17 thumbs received long-term relief.[10] Meenagh's article in the *Annals of the Rheumatic Diseases* also concluded that no clinical benefit was gained from an intra-articular steroid injection to the TMC joint in moderate to severe osteoarthritis compared to a placebo injection.[11] A systematic review of the literature by Brinks found that the incidence of major adverse events with extra-articular corticosteroid injections was 5.8%. In his 2010 systematic review of 87 studies, such complications included increased pain and swelling or "steroid flare" within 48 hours after injections, skin and fat atrophy, osteomyelitis, cellulitis, tendon ruptures, and one fatal necrotizing fasciitis.[12]

Once TMC osteoarthritis reaches *Stage II* or *III*, surgery is recommended. Commonly-performed surgeries on arthritic TMC joints are osteotomy, where the surgeon repositions the bones in an attempt to correct joint deformities; trapeziectomy, where the surgeon removes the trapezium bone; arthroplasty where the surgeon carefully removes a minimal amount of bone or reshapes the joint to allow freer motion; arthrodesis or joint fusion, where the surgeon permanently fuses bones in the affected joint to increase stability; and finally, joint replacement with a prosthesis implant. The surgical success rates are reported as generally good, but even with the best post-operative results, the patient must wear a cast or splint for six weeks.[13] Resuming normal activity can take at least 6 months, since there are heavy lifting and forceful grasping limitations after surgery.[5]

While TMC joint surgeries are done without hospitalization on an outpatient basis, risks are involved. Revisions or second surgeries are sometimes needed. Possible complications include infection, nerve damage, along with temporary or permanent loss of work as a result. Surgical costs vary by region, and out-of-pocket expenses fluctuate, depending on insurance coverage.

Dr. Kristofer Matullo, an orthopedic surgeon and his colleagues at Temple University and Massachusetts General Hospitals, reviewed various treatment options and surgeries for TMC osteoarthritis. Their medical practices reported a success rate of 60 - 70% with the non-surgical conservative treatments previously mentioned. Matullo investigated arthroplasty and TMC joint replacement, using silicone or titanium, and the long-term results. Although 84% of the patients in reviewed studies of 151 silicone implants reported satisfaction with the surgery, there were high incidences of subluxation, cold creep, silicone wear, synovitis, and bone erosion. In the titanium study he reviewed, 50 titanium implants and 10 of the thumbs had failed after 9 months. To correct the complications and failures of treatment, he describes a type of arthroplasty, using ligament reconstruction with tendon interposition (LRTI) to stabilize the joint. Surgeons use a variety of LRTI techniques, according to Matullo, for the "removal of the trapezium and substitution of the flexor carpi radialis tendon into the empty space to help decrease the loss of joint space resulting from the surgically induced bone loss." His review of other surgeons' versions of LRTI, along with his own, show generally favorable results.[14] Nonetheless, even surgeries that provide generally favorable results do not approximate the mobility of a healthy TMC joint.

In view of the current treatment approaches and outcomes, patients seek alternative modalities for a variety of reasons and needs. Primary considerations include the costs and risks of surgeries; the risk and ineffectiveness of steroid injections; and the difficulty of changing jobs or giving up a favorite activity, which is often not a viable option.

Since the 1950s, Prolotherapy is an option that patients have turned to in increasing numbers with the hope of positive results.[15] Prolotherapy works by initiating a temporary inflammatory response, which causes a reparative cascade to generate new collagen and extra cellular matrix, thus giving connective tissue the strength and ability to handle strain and force.[16, 17] This healing cascade produces fibroblasts, which are critical for the repair of tendons and ligaments. Specifically, Prolotherapy stimulates the repair that occurs in a soft-tissue injury, without disrupting the architecture of the tissue. High-resolution ultrasounds have been used to confirm that Prolotherapy does indeed stimulate tissue growth.[20] One double-blind animal study by Dr. Liu showed that Prolotherapy increased ligament mass by 44%, ligament thickness by 27%, and ligament to bone juncture strength by 28%.[19]

The doctor who introduced Prolotherapy into mainstream medicine practice was George S. Hackett, M.D.[20] In a study of 206 traumatic headache patients published by Dr. Hackett and colleagues, 79% were completely relieved of their headaches.[21] In regards to low back pain, a survey revealed that 82% of 1,178 patients treated considered themselves cured.[22]

While Prolotherapy has been traditionally used for ligament and tendon injuries, it has a long history as a treatment for osteoarthritis and other degenerative conditions.[23-25] Prior studies by Ross Hauser, M.D. at an Illinois charity clinic have shown that Prolotherapy eliminates pain even in those patients who have been told by their medical doctor(s) that surgery was the only treatment option for their pain.[26] In 2000, Dr. K. Dean Reeves, a leading medical researcher and Prolotherapist, conducted a study using dextrose Prolotherapy injections on 13 patients with finger and thumb osteoarthritis, or a total of 74 arthritic joints. He compared this group to a control group of 14 who received no treatment for 76 arthritic finger/thumb joints. All participants had finger pain for at least five years and met radiographic criteria for osteoarthritis. The study concluded that dextrose Prolotherapy was both clinically safe and effective in treating the joint movement pain and range of motion limitations of arthritic fingers.[27]

The purpose of this paper is to document the benefits of Prolotherapy for patients with TMC joint OA. Since few studies confirm the viability of dextrose Prolotherapy injections as a treatment option, this retrospective study is necessary to review the positive benefits and minimal risk of this approach.

# Methods

Treatment begins with cleansing the skin and local anesthesia. With Prolotherapy, a 10cc syringe is filled with a solution of 15% dextrose, 10 % Sarapin, and 0.1% procaine. For an intra-articular injection, 1-2 I.U. of human growth hormone (hGH) is added to a second syringe that contains the previous solution. A pituitary hormone exhibiting a wide variety of biological effects,

hGH stimulates growth through the metabolism of protein, carbohydrate, and lipids and the differentiation of bone, muscle, and cartilage.[28] Clinical observations have shown that using hGH for cartilage degeneration results in a better outcome for the patient. The Prolotherapy solution containing hGH is injected at the joint formed by the trapezium and proximal phalange of thumb. The syringe without hGH is injected along the joint line, which begins at the dorsal side and continues to the palmar side. During treatment, patients received an average of 4.5 Prolotherapy injections per TMC joint. (*See Figure 2.*)

**Figure 2. Dextrose Prolotherapy injection site.**

In this study group, complete data was obtained from 13 patients and 17 of their thumbs, which met the inclusion criteria. Of these, 46% (6) were female and 54% (7) were male. The age range of patients was 40 - 78 years, with an average of 61.5 years.

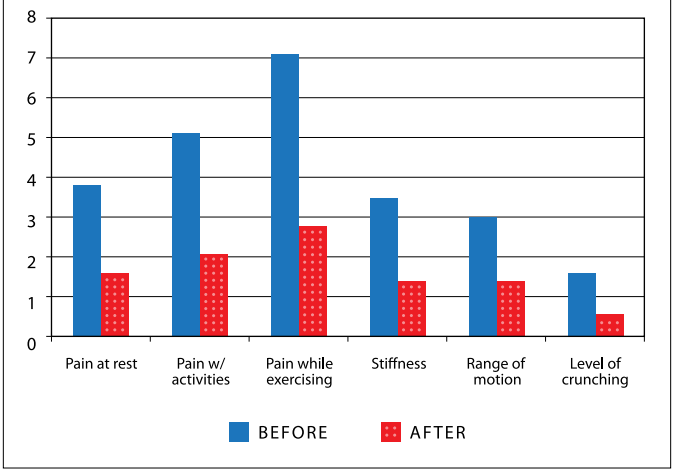
Patients selected for the study completed preliminary written, oral, and visual surveys. Demographic information was also obtained. To compile and compare data—questionnaires and telephone interviews were utilized. Clinical staff members used assessment questionnaires to collect subjective and objective data, such as the duration and type of symptoms, previous tests and treatments, limitations to activity, and former medical opinions. The primary source of subjective data was obtained from the Visual Analog Scale (VAS)—a visual survey, which quantifies pain perception. Specifically, the VAS asks patients to rate these physical concerns: pain at rest, with activities, or while exercising; stiffness; range of motion; and level of crunching. Patient responses gathered before Prolotherapy were then compared with the responses to the same questions after Prolotherapy. For the purpose of analysis, percentages of the various patient responses were calculated.

The average time of follow-up interviews was 18 months after the last Prolotherapy session. Post-Prolotherapy interviews gauged treatment effectiveness through two main indicators: reduced TMC osteoarthritic pain and stiffness. Also considered was whether or not the positive response to treatment continued after the Prolotherapy sessions ended.

# Results

When subjective answers on the VAS were converted and compared, a picture of the overall effectiveness of treatment for the study group could be gauged. (*See Table 2.*) Before treatment, patients reported an average of four years and two months of thumb pain; the longest duration was 20 years and the shortest was three months. Patients were asked to rate a variety of physical conditions on a scale of 0 to 10, with 0 signifying no discomfort and 10 being severe crippling discomfort.

**Table 2. Visual Analog Scale (VAS) results.**




The *p*-values obtained used a matched sample paired t-test, comparing pain at rest, pain with normal activities, and pain with exercise before and after Prolotherapy. The *p*-value analysis confirms that the numerical results exceed the mathematical probability of mere chance.

The 17 TMC joints that were treated had a beginning "*pain at rest*" of 3.8 and an ending "*pain at rest*" of 1.6 ($p = <0.003$). As for *stiffness*, the beginning level was 3.5 and ending level was 1.4. Four patients (5 of the 17 total thumbs) reported a starting pain level of 6 or greater, while only 3 patients had a starting pain level of two or less. Other indicators showed definite and, in some cases, significant improvements: *pain with normal activities was reduced* from 5.1 to 2.1 ($p = <0.0002$); *pain while exercising dropped* from 7.1 to 2.8 ($p = <0.0001$); *range of motion improved* from 3.0 to 1.4; *level of crunching decreased* from 1.6 to 0.6. When patients assessed exercise ability before Prolotherapy, nine of the patient's thumbs were unable to exercise more than 60 minutes; after Prolotherapy, 12 were able to exercise more than 60 minutes.

Data compiled after Prolotherapy sessions demonstrated favorable outcomes. Ninety-two percent (12 of 13) of patients noted less thumb pain, and 85% reported that improvements in thumb pain continued in their daily lives. In terms of overall improvement, 71% percent of thumbs were relieved of at least 50% of their pain. After Prolotherapy, not one patient had a pain level of 7 or greater, while 77% (10 of 13) had a pain level of two or less. When assessing patient reactions to Prolotherapy treatment, 85% of patients answered "yes" to a final question, "Has Prolotherapy changed your life for the better?"

The results of this retrospective study suggest that Prolotherapy decreases pain and stiffness in patients with previously unresolved TMC osteoarthritis of the thumb. Hackett-Hemwall dextrose Prolotherapy gave 71% of the thumbs in the study group 50% or more pain relief.

# Discussion

The outcomes documented in this study indicate that dextrose Prolotherapy, utilizing sugar in its simplest form, is an efficacious option for TMC joint osteoarthritis. In addition, hGH was added to the intra-articular injections for its hormonal effects on cartilage growth. After witnessing significant pain relief and increased thumb dexterity, what remained to be answered was determining the exact source or mechanism of improvement.

Investigating the potential causes of TMC osteoarthritis has helped explain how Prolotherapy works as a remedy. Medical researchers and doctors have established the link between ligament laxity (e.g., overuse) or injury (e.g., sports or industrial injuries) and their relationship to osteoarthritis. Authorities agree that the osteoarthritic process begins with ligament pathology, causing the abnormal movement that destroys cartilage. The consequence of such degeneration is a reduction in the joint space that leads to osteophyte formation and, ultimately, loss of motion. This progression is observed in Eaton-Glikel's definitive studies—a standard in the field—that documents the four stages of TMC osteoarthritis. If the progression through the stages of degeneration is not stopped, the pain and limited use of the thumb continues.

Another study describes how cartilage typically degenerates. In the *Annals of Biomechanical Engineering*, Andriacchi explains that cartilage is normally thickest in the areas where contact pressure is greatest. After ligament injury, joint motion becomes greater, breaking down cartilage. Over time, the contact surfaces of bones may change [i.e., osteophyte formation] allowing more degeneration in areas where the cartilage is thinner. With additional force, the cushioning attributes of cartilage are not adequate to prevent degeneration.[29] Because ligament injury and laxity are the prominent, initial factors in TMC osteoarthritis, a treatment that corrects the underlying mechanical causes has the potential of improving the function of the thumb.

Another study could not differentiate the damage/laxity that results from a single traumatic event or the damage/laxity that results from years of repetitive motion of the TMC joint. Either biomechanical failure has the same eventual pathology. In his manuscript, *Ligament Injury, Reconstruction, and Osteoarthritis*, Fleming summarizes his findings: "the ligament-injured joint is at a high risk for OA (osteoarthritis). OA begins with an injury rendering the joint unstable." Similar to Andriacchi's findings, Fleming reports that joint contact mechanics are altered in ligament injury, cartilage load distribution and bone is changed—causing wear and increasing shear that leads to osteochondral degeneration,[30] [a precise definition of osteoarthritis].

If pain and weakness are due to ligament laxity/injury, as numerous orthopedic studies indicate, then a treatment must address these aggravating conditions. Liu's rabbit studies show that dextrose Prolotherapy increases ligament mass by 44%, ligament thickness by 27%, and ligament attachment to bone strength [enthesis] by 28%.[21] Prolotherapy allows the body to regenerate tissue and rejuvenate function, thereby reducing pain for a wide spectrum of ligament injuries. Dextrose Prolotherapy is, therefore, a viable treatment option for the biomechanical failure seen in basal thumb osteoarthritis.

Prolotherapy works with injectable solutions that initiate a healing process, whereby the fiber-producing cells (fibroblasts) necessary for ligament repair proliferate. In his book, *The Malalignment Syndrome: Implications for Sport and Medicine*, Dr. Wolf explains that the irritant solutions of Prolotherapy— which can be as mild as a solution of hyperosmolar dextrose—are injected into an injured area to stimulate fibroblastic production of collagen, promoting a healing response that mimics what the body does naturally. A sprain, strain, or similar injury—as well as Prolotherapy injections—release cytokines that activate the immune process through inflammation. Inflammation stimulates the monocyte-macrophage system of cellular immunity to remove cellular debris. This *inflammatory phase*—enabling a cascade of healing effects—is followed by the *proliferative phase* as activated fibroblasts synthesize collagen, first in a net-like (reticular) pattern. Platelets and cells of the immune system also release growth factors and other similar agents that stimulate fibroblasts to migrate to the area. During the final, *remodeling phase*—collagen matures and becomes shorter, thicker, more densely packed, orderly collagen fibrils.[31]

Considered a conservative treatment in comparison to surgery, Prolotherapy is a simple procedure, in which solutions of dextrose are injected into the afflicted area. Sessions occur over a period of time. The number of injections administered depends on the individual's progress or failure to progress. Patients typically need three to six treatments to achieve the best outcome, scheduled approximately four weeks apart. The procedure takes a few minutes. A patient could expect to receive 10-15 injections per session for basal thumb arthritis. Patients usually report a mild discomfort in the injected area that may last 24-48 hours after treatment. Normal activities can be resumed as soon as 24 hours.

A comparison of rates of recovery for surgery and Prolotherapy shows that recovery is enhanced and hastened with injection therapy. Data on recovery time establishes a six to eight week period necessary for splinting after surgery, and a month or more timeframe before the patient can resume full activity.

Orthopedic surgeons acknowledge some ongoing criticisms of surgeries on thumb disabilities. As recently as 2006, in *The Journal of Bone and Joint Surgery*, Dr. Peter Amadio of the Orthopedic Department at the Mayo Clinic said: "Arthroplasty of the carpometacarpal joint of the thumb also remains in something of a time warp; the current standard is still some variation of trapezium excision, a procedure first described in the 1930s." He continues, clarifying that, "…results are generally good…but as is typical, this case series included no comparison group."[32] To be fair, orthopedic surgeons report positive outcomes with surgery; in addition, the risks associated with the brachial block used for this type of surgery are less than with general anesthesia, although spinal cord damage has been reported.[33] As Dr. Amadio suggests, most surgical studies, on average, report positive outcomes—otherwise surgeons would not be performing them, the obvious conclusion.

One criticism of Prolotherapy studies is that they do not comply with double-blinded research methods, requiring a placebo group to prove conclusively that the outcomes can be attributed to the injections. The reason for this methodological omission is that a true "placebo" to injections is not possible. Injections with water, normal saline, or a dry needle—all of which would be considered a placebo—still produce an injury to the ligament that leads to an inflammatory response. Since the inflammation causes varying degrees of repair or positive results, a true comparison of the treatment group with the control group is difficult. The same drawback holds true with surgery: it is difficulty to devise a placebo method for comparison. A patient either has an incision site or not. Although Prolotherapy has been established seventy-four years ago (1938) as a successful treatment, along with a medical association—the American Osteopathic Association of Prolotherapy Regenerative Medicine (AOAPRM), the procedure is still deemed experimental by orthodox medicine. On the contrary, surgical methods may acquire widespread acceptance without the research protocol of being a double-blinded study. In view of this research gap, studies that compare benefits, outcomes, and risks of Prolotherapy and surgery are needed.

One study that provides a comparison of Prolotherapy and surgery is Dr. Eiki Nomura's long-term study of osteoarthritis of the knee. In biomechanical injuries to the knee, thumb, or elsewhere, Prolotherapy may be more effective than surgery as a method to repair ligaments. In *The American Journal of Sports Medicine*, Dr. Eiki Nomura discusses the results of surgery to the knee, known as medial patellofemoral reconstruction. Knee surgery is performed to prevent abnormal motion of the patella, and thus, *reconstructs* but does not *regenerate* the ligament. Nomura's study concluded that knee surgery not only prevented additional patellar dislocation, but also limited the progression of osteoarthritis in 21 of 24 knees observed.[34] Prolotherapy—without the risks of surgical trauma, scarring, and wound closure, or the necessity of rehabilitation—**regenerates** tissues, restoring normal motion. Although the repair of ligaments with surgical intervention and dextrose Prolotherapy differs, the outcomes of the two treatments provide a basis for patients to make a more appealing choice.

Among treatment options is steroid injections. The lack of long-term benefits from steroid injection has been documented, along with the possible complications, such as tendon and ligament deterioration and/or rupture.[35, 36] The reason for injecting corticosteroids is reduction of pain and inflammation. In the case of an acute injury, splinting may be used to provide short-term pain relief and promote normal healing. If the underlying cause of TMC osteoarthritis is degeneration, injecting steroids, which halts the inflammatory process, tends to promote degeneration of connective tissue. Therefore, steroidal treatment seems to be counterproductive in chronic degenerative arthritis. No research has been done to show that steroid injections improve connective tissues and stabilize joints suffering from injury/laxity.

In comparison to other options, dextrose Prolotherapy is a cost-effective treatment for basal thumb arthritis, allowing patients to resume normal daily activities quickly. Prolotherapy encourages patients to continue their vocations and avocations, in contrast to some treatment plans that ask patients to discontinue activities. The option of long-term use of NSAIDs and analgesics for chronic pain is not advisable because these medications are known to harm liver and stomach tissue as well as joint cartilage.

The lack of radiographic images showing before and after Prolotherapy-treated TMC joints was a limitation of this study, although a patient's level of pain may not be indicated on an X-ray. A minor distinction might be made between the patients who have TMC osteoarthritis because of degeneration and those who have a metabolic or genetic disorder of connective tissues. Despite the origins of pathology, Prolotherapy is gaining a verifiable track record as an effective treatment option, but future studies might emphasize the clinical differences in the etiology and treatment outcome of separate pathologies.

# Conclusion

In this retrospective study, the Hackett-Hemwall technique of dextrose Prolotherapy was administered to 13 patients suffering from basal thumb arthritis in 17 thumbs, or TMC osteoarthritis—a common pathology of the thumb. Since the opposable thumb permits the fine motor coordination necessary for the complex and intricate tasks of daily life, an injury or laxity of thumb ligaments are painful, debilitating, and incapacitating. This study justifies the use of Prolotherapy based on its probable effectiveness for basal thumb arthritis. A series of injections of dextrose, along with intra-articular hGH, over three to six months was shown to reduce pain, improve function, and, thereby, improve the quality of life for the patients in this study. According to the VAS responses, starting pain and stiffness levels at 3.8 and 3.5 were reduced to 1.6 and 1.4, respectively, by the post-treatment interviews. Future studies need to substantiate these findings, especially if dextrose Prolotherapy enables TMC joint arthritis sufferers to avoid surgery and its possible adverse effects. Studies with more patients in a controlled empirical setting will provide additional data on the efficacy and reliability of Hackett-Hemwall dextrose Prolotherapy. The substantial advantages and minimal drawbacks (e.g., aversion to needles) as well as the reduced risks and increased rewards of Prolotherapy over conventional treatments suggest that this option for the second most common joint arthritis—that of the thumb—should be considered by doctors and patients. ■

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