Osteoarthritis of the Trapeziometacarpal Joint of the Thumb Treatment by Injection Therapy

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Introduction

As the human thumb climbed the evolutionary ladder the trapeziometacarpal joint was provided with greater mobility at the expense of decreased bony stability (Pellegrini 2001). The trapeziometacarpal joint is also be referred to in the literature as the basal joint, the root joint, the trapeziofirstmetacarpal joint or the 1st carpometacarpal joint.

This joint, located at the base of the thumb, is subject to large physical stresses throughout life. Osteoarthritis (post traumatic or idiopathic), inflammatory arthritis such as rheumatoid and postmenopausal laxity of the capsular ligaments may all predispose to structural instability and impairment of this important joint. The instability is characterized by varying and often progressive dislocation of the joint surfaces, resulting in a displaced axis of rotation and abnormal actions of thumb muscles. The consequences of instability at this joint are commonly pain and weakness most notably during pinch and grasping actions. (Neumann and Bielefeld 2003). Trapeziometacarpal arthritis commonly afflicts women older than 40 years of age with pain and swelling over the joint being the earliest symptoms. As the disease progresses, subluxation of the metacarpal base and collapse deformity of the thumb develops (Menon 1983).

There are numerous classification systems for osteoarthritis of the trapeziometacarpal joint. Glickel (2001) reports the most widely used system of Littler and Eaton which involves a staging system dividing the progression of osteoarthritis into four:

- Stage 1: No joint destruction, less than one-third subluxation of the joint, joint space may be widened if effusion present
- Stage 2: Slight decrease in joint space, up to one-third subluxation of the joint, marginal osteophytes less than 2mm may be present
- Stage 3: Significant joint destruction with cysts and sclerosis, greater than one-third subluxation, osteophytes greater than 2mm
- Stage 4: Involvement of multiple joint surfaces

Littler and Eaton suggest that this staging system should be used to determine treatment but Glickel (2001) disagrees stating that *"The severity of clinical symptoms does not necessarily correspond with the radiographic stage of disease, however, so decisions about treatment are predicated upon the notion that we "treat patients, not x-rays." Treatment is based upon the extent to which the pain and functional limitations caused by the disease impact upon the patient's activities of daily living. Conservative treatment includes splinting, nonsteroidal anti-inflammatory drugs, thenar intrinsic strengthening exercise, and corticosteroid injection."* Pellegrini (1992) adds:-*"Degenerative disease is predicted on instability of the trapeziometacarpal joint secondary to deterioration of the capsular and ligamentous restraints."*

Anatomy

The trapeziometacarpal joint is a saddle joint with a lax capsule, the articular surfaces are concave in one direction and convex in the other. The surfaces are congruent after 90 degrees of rotation (opposition) (Kapanji 1982). The stabilising ligaments of the trapeziometacarpal joint were identified and studied by Imaeda et al (1993) during anatomic dissections of 30

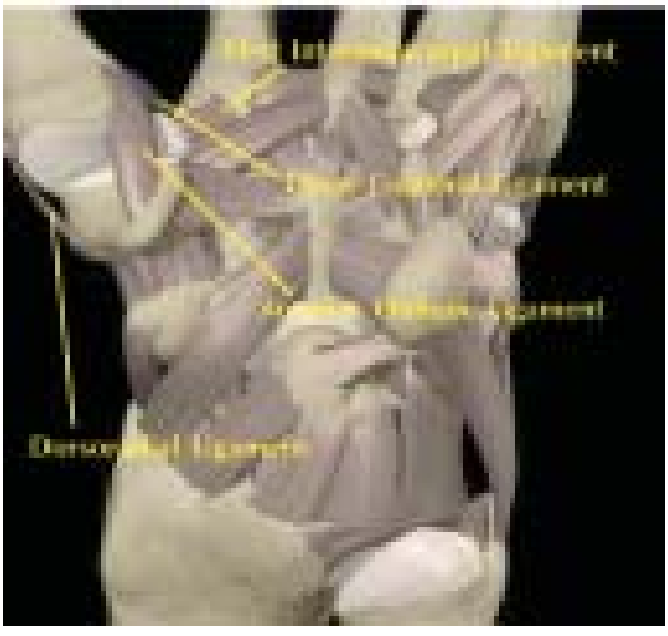
hand specimens. Five main ligamentous structures were identified:

- anterior oblique ligament
- ulnar collateral ligament
- first intermetacarpal ligament
- posterior oblique ligament
- dorsoradial ligament

The anterior oblique ligament was observed to be the primary stabiliser of the trapeziometacarpal joint.

Bettinger et al (1999) give importance to the anterior oblique ligament which is sometimes referred to as the beak ligament. Najima et al (1997) examined 32 hand specimens and concluded that that the anterior oblique ligament, intermetacarpal ligament and posterior oblique ligament play a large role in stabilising the trapeziometacarpal joint and that the decrease in their strength is related to the pathogenesis of trapeziometacarpal osteoarthritis. An anatomic study of the trapeziometacarpal joint conducted on 47 cadaver thumb specimens by Pellegrini (1991) determined that the anterior oblique ligament was essential for translational stability of the metacarpal on the trapezium during flexion of the thumb. A direct correlation between the status of the articular surfaces and the integrity of the anterior oblique ligament was established. Whilst Menon (1983) suggested that trapeziometacarpal arthritis may be due to the inherent shallowness of the saddle joint and the laxity of the volar ligaments.

Anatomy Diagram



Function

Cooney et al (1981) demonstrated that during functional activities of the thumb, a position of adduction and flexion of the trapeziometacarpal joint was most commonly maintained. Cooney and Chao (1997) measured compression forces across the joint discovering compression forces of 12 kilograms at the trapeziometacarpal joint during simple pinch (1kilogram of applied force) and as much as 120 kilograms during strong grasp. Chaisson et al (2000) argued that although quadriceps strength may protect against knee osteoarthritis, subjects with higher maximal grip strength were at increased risk for development of osteoarthritis of the thumb base joint. It was concluded that increased grip strength, which is the major force of loading across proximal hand joints, increased the risk of osteoarthritis in those joints.

As a profession we have a special interest in this subject. Snodgrass et al (2003) reviewed a group of 24 physiotherapists with work-related thumb pain and 20 physiotherapists without thumb or wrist pain who were working at least 20 hours per week in an outpatient musculoskeletal setting. All physiotherapists in the pain group reported thumb pain related to and initially caused by the performance of manual techniques and 88% had altered their manual techniques because of pain in the thumb. There was slightly high prevalence of osteoarthritis (22.7%) considering the mean age of the total sample (38.6 years). Statistically significant differences between groups included increased right trapeziometacarpal joint laxity and decreased right tip pinch strength. These results indicate that work-related thumb pain affects physiotherapists' ability to administer manual treatments and suggest that decreased stability and strength of the thumb may be associated with work-related thumb pain.

Examination and Clinical Diagnosis (Cyriax J 1982; Kesson and Atkins 1998)

Subjective Assessment

A detailed history is necessary to establish that the typical history of OSTEOARTHITIS is present. Patients would be expected to be over 40 years of age unless there is a history of previous injury or a high risk profession e.g. physiotherapy! The patient complains of a gradual onset of pain and tenderness at the base of the thumb over long periods of exacerbations and remissions. Peripheral lesions localise pain well and little spread should be felt. Significant spread may be more indicative of a proximal lesion or a neural tension component. Absence of trauma excludes scaphoid or Bennet's fracture of the proximal metacarpal and ligament sprains. Aggravating factors include using the thumb under compression e.g. writing, gripping. Paraesthesia or sympathetic signs are usually absent.

Screening questions for general health, drugs and any other joint involvement should be included to eliminate systemic disease such as gout and inflammatory arthritis, and to establish whether or not contra-indications to injection exist.

Objective Assessment

Inspection

The area should be inspected for bony deformity, colour changes, muscle wasting and swelling. Palpation for heat, swelling, synovial thickening and pulses helps to establish levels of activity and exclude circulatory disorders. The state at rest should be established

Objective Examination

Selective tension, the use of passive and resisted tests exclude the wrist joint complex, the radial collateral ligament and the radial flexors and extensors as possible causes of symptoms. Osteoarthritis of the trapeziometacarpal joint produces painful limitation of movement in the capsular pattern (the typical pattern of limited movement adopted by an arthritic joint) which in this case is most limitation of extension.

Axial compression (the grind test) confirms the diagnosis where longitudinal pressure is applied down the shaft of the first metacarpal to grind the articular surfaces together. Resisted tests at the thumb and a negative Finkelstein's test exclude de Quervain's tenosynovitis, whilst Phalen's and Tinnel's tests may exclude carpal tunnel syndrome. Palpation around the anterior joint line for tenderness confirms the site of the lesion.

Confirmation of the capsular limitation of extension can be made by asking the patient to put the hands into the prayer position and spreading the thumbs, comparing the two sides.

Treatment

There have been few studies evaluating the results of non surgical treatment for symptomatic trapeziometacarpal joint osteoarthritis of the thumb. Day et al (2004) conducted a prospective study to examine the effectiveness of a single steroid injection and 3 weeks of splinting in patients with osteoarthritis in the Eaton Stages 1 to 4 (mentioned above) with a minimum of 18 months follow-up. Steroid injection with splinting provided reliable long-term relief in thumbs with Eaton Stage 1 but provided long-term relief in only 7 of 17 thumbs with Eaton Stage 2 and 3 osteoarthritis. Carr and Freiberg (1995) recommended that early osteoarthritis be treated with rest, anti-inflammatory agents or analgesics, intra-articular steroid injections and splints stating that since the course of osteoarthritis is often benign, avoiding early invasive treatment is important except in the presence of proven anatomic deformity. Hautefeuille and Duquesnoy (1991) also recommend that initial treatment should always be conservative.

Treatment by corticosteroid injection

Corticosteroids have a potent anti-inflammatory effect and are most appropriate where an inflammatory component is present e.g. inflammatory arthritis, traumatic arthritis and acute episodes of osteoarthritis (Kesson and Atkins 1998). Triamcinolone acetonide is the

corticosteroid recommended in most Orthopaedic Medicine publications as it has good potency and moderate half-life of 14-21 days. Lidocaine in conjunction with the corticosteroid is also endorsed as it has a rapid rate of onset and a medium duration of action.

Injection of the Trapeziometacarpal Joint

Kesson and Atkins (1998)

Technique

Suggested dosage:

- Kenalog 40 mg/ml (triamcinolone acetonide): 0.25ml
- Total steroid:10mg
- Lidocaine 1%: 0.25ml
- Total volume: 0.5ml

Suggested needle size:

- 25G x $^{5}/_{8}$in (0.5 x 16 mm) orange needle

Procedure

- Explain the procedure to the patient and gain consent
- Wash hands using surgical scrub
- Draw up drugs into a 1ml syringe, change needle
- Position the patient with the hand resting comfortably
- Identify the joint line by running your thumb down the first metacarpal into the anatomical snuffbox
- The patient can apply a degree of distraction to the affected thumb
- Mark the site of the joint line with a thumbnail
- Clean the site with appropriate antiseptic
- Insert the needle perpendicular to the skin, into the joint, pull back on the plunger to ensure the needle does not lie in the radial artery which lies in the proximal part of the anatomical snuff box. Give the injection as a bolus, there should be no resistance to the plunger. Osteophyte formation may make the injection difficult
- Apply appropriate dressing. The patient should remain in the practice for 30 minutes after injection for observation in case of adverse reactions
- The patient is advised to avoid aggravating factors for approximately 2 weeks following injection

Contra-indications and complications to injection therapy

All practitioners should be aware of the contra-indications to injection which include local or general infection, poorly controlled diabetes, anticoagulants and blood clotting disorders.

Complications and side effects may include simple faint, allergy, anaphylactic shock, post injection flare, skin depigmentation and fat atrophy.

To avoid infection an aseptic technique is especially important as corticosteroids suppress macrophage activity increasing the risk of infection. The needle should be changed after drawing up the solution, the injection should never be given in presence of general or local infection and single dose containers should always be used where possible.

Conclusion

Osteoarthritis of the trapeziometacarpal joint is a common problem producing pain and limited function in the over 40s. Compression forces across the joint in pinching and gripping range from 15 to 150 kg. It is interesting to note that predisposing professional groups include physiotherapists. As demonstrated above, laxity of the anterior oblique ligament has also been associated with the condition. Many authorities suggest conservative treatment including corticosteriod injection as the treatment of choice in early arthritis with good long term relief being demonstrated. Careful examination and history taking excludes other pathology and confirms the clinical diagnosis. Other modalities of physiotherapy treatment maybe appropriate, but if these prove ineffective, injection should be considered. Providing the guidelines are adhered to, injection is a safe and effective tool in the hands of an experienced injection therapist.

References

Barron OA, Glickel SZ, Eaton RG. (2000) Basal joint arthritis of the thumb. J Am Acad Orthop Surg. Sep-Oct;8(5):314-317

Bettinger PC, Linscheid RL, Berger RA, Cooney WP 3rd, An KN.(1999) An anatomic study of the stabilizing ligaments of the trapezium and trapeziometacarpal joint. J Hand Surg [Am]. Jul;24(4):786-98

Carr MM, Freiberg A. (1995)Osteoarthritis of the thumb: clinical aspects and management. Am Fam Physician May 1;51(6):1404

Chaisson CE, Zhang Y, Sharma L, Felson DT.(2000)Higher grip strength increases the risk of incident radiographic osteoarthritis in proximal hand joints. Osteoarthritis Cartilage. 8 Suppl A:S29-32

Chaisson CE, Zhang Y, Sharma L, Kannel W, Felson DT.(1999)Grip strength and the risk of developing radiographic hand osteoarthritis: results from the Framingham Study. Arthritis Rheum. Jan;42(1):33-8

Cooney WP 3rd, Lucca MJ, Chao EY, Linscheid RL (1981)The kinesiology of the thumb trapeziometacarpal joint. J Bone Joint Surg Am. Dec;63(9):1371-81

Cooney WP III, Chao EY. (1997)Biomechanical analysis of static forces in the thumb during hand function. Bone Joint Surg Am. Jan;59(1):27-36

Cyriax J. Textbook of Orthopaedic Medicine Volume One: Diagnosis of Soft tissue Lesions 8th Edition. Bailiere Tindall

Cyriax J. Textbook of Orthopaedic Medicine Volume Two:Treatment by Manipulation, Massage and Injection11th Edition. Bailiere Tindall

Day CS, Gelberman R, Patel AA, Vogt MT, Ditsios K, Boyer MI.(2004) Basal joint osteoarthritis of the thumb: a prospective trial of steroid injection and splinting. J Hand Surg [Am]. Mar;29(2):247-51

Eaton R, Glickel S.(2001) Trapeziometacarpal Osteoarthritis. Hand Clinics. 1987: 3 (4) 455-469

Glickel SZ.(2001)Clinical assessment of the thumb trapeziometacarpal joint. Hand Clin. May;17(2):185-95

Hautefeuille P & Duquesnoy B. (1991) Root arthrosis of the thumb Rev Prat. 1991 Dec 15;41(26):2714-7.

Neumann DA, Bielefeld T.(2003)The carpometacarpal joint of the thumb: stability, deformity, and therapeutic intervention. J Orthop Sports Phys Ther. Jul;33(7):386-99

Imaeda T, An KN, Cooney WP 3rd, Linscheid R.(1993)Anatomy of trapeziometacarpal ligaments. J Hand Surg [Am]. Mar;18(2):226-31

Kesson M, Atkins E (1998) Orthopaedic Medicine A practical Approach. Butterworth-Heinemann

Kapanji I.A. (1982) The Physiology of the Joints Vol1 2nd Ed Churchill Livingstone

Menon J. (1983)The problem of trapeziometacarpal degenerative arthritis. Clin Orthop. May;(175):155-65

Moulton MJ, Parentis MA, Kelly MJ, Jacobs C, Naidu SH, Pellegrini VD Jr.(2001)Influence of metacarpophalangeal joint position on basal joint-loading in the thumb. J Bone Joint Surg Am. May;83-A(5):709-16

Najima H, Oberlin C, Alnot JY, Cadot B. (1997)Anatomical and biomechanical studies of the pathogenesis of trapeziometacarpal degenerative arthritis. J Hand Surg [Br]. Apr;22(2):183-8

Pellegrini VD Jr.(2001)Pathomechanics of the thumb trapeziometacarpal joint. Hand Clin. May;17(2):175-84, vii-viii

Pellegrini VD Jr.(1991) Osteoarthritis of the trapeziometacarpal joint: the pathophysiology of articular cartilage degeneration. I. Anatomy and pathology of the aging joint. J Hand Surg [Am]. Nov;16(6):967-74

Pellegrini VD Jr.(1992)Osteoarthritis at the base of the thumb. Orthop Clin North Am. Jan;23(1):83-102

Snodgrass SJ, Rivett DA, Chiarelli P, Bates AM, Rowe LJ.(2003) Factors related to thumb pain in physiotherapists. Aust J Physiother. 49(4):243-50

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