



IFSSH Scientific Committee on Degenerative Arthritis – CMC Joint

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Degenerative Arthritis – Thumb CMC Joint

Key Learning Points

- Thumb base arthritis is very common
- It is usually not symptomatic
- Always delay surgery because symptoms often settle
- Consider joint sparing operations
- Complex, expensive or experimental operations have not been shown to surpass simpler cheaper procedures

Introduction

Thumb base arthritis is a common affliction. It is particularly common in females, with 33% of post menopausal women affected (Armstrong et al 1994). It usually occurs spontaneously, probably with a genetic predisposition. Only occasionally are other causal factors such as trauma or infection identified. Joint laxity may be a factor in those with a younger onset.

The natural history is usually benign. An early painful phase often settles; reassurance is essential. Painkillers, steroid injections, functional aids and perhaps a splint can reduce symptom until the predicted resolution occurs. *Precipitous surgical treatment is wrong.*

Pain is localised to the saddle joint at the base of the thumb. The importance of this joint to hand function means that functional difficulties can be profound. Pain localised to the scaphoid tubercle indicates that the adjacent scapho-trapezo-trapezoid (STT) joint may be involved, either alone or in association with the carpometacarpal (CMC) joint.

Meticulous clinical examination should establish the diagnosis; the joint may be lax or stiff; squaring of the joint with fixed adduction at the base and secondary hyperextension of the metacarpophalangeal (MP) joint is typical in later stages. Radiographs, especially a specific antero-posterior “Robert’s View” should show degenerative changes; MRI or even arthroscopy can identify earlier disease in a pre-radiological phase. There is a poor correlation between radiological degree and symptoms; the most advanced disease may be quiescent; severe symptoms can accompany the mildest of radiological change. This discrepancy underscores the need for calm observation rather than premature surgery. This approach is even further validated by the absence of any clearly superior surgical treatment as assessed by formal systematic review (Wajon et al 2009, Vermeulen et al 2011).

In this article we review the options for treatment, with an emphasis on avoiding or delaying surgery with simple non operative treatment, and a reminder that there are effective joint sparing procedures.

Non-Operative Treatment

Therapy and Splints: The most effective design or program of exercise is unclear but there is RCT evidence that custom made splints can impart durable pain relief and functional improvement (O'Brien et al 2013) s (Rannou et al 2009). (Boustedt et al 2009).

Steroid injections: Cortisone injection to the trapeziometacarpal joint is widely used (Wolf and Delaronde 2012). Injections are effective at least in the short term (Meenagh 2006) but have possible adverse effects and do not improve articular cartilage morphology; they are associated with elevations in blood sugars in diabetic patients.

Hyaluronidase injections: The role of hyaluronidase (HA) in the management of base of thumb arthritis, and whether or not it is equivalent, superior or additive to cortisone, has not yet been established despite randomised trials (Fuchs et al 2006, Stahl et al 2005, Hayworth et al 2008); further data are needed (Moran et al 2009) .

Complications after intra-articular HA viscosupplementation include acute local reactions, the development of acute gout and synovial granulomatous inflammation, especially with more than one course of treatment (Moran et al 2009, Hamburger et al 2003). The treatment is relatively expensive.

Joint preserving Surgery

If non-operative treatment fails, then the hand surgeon joint *should first consider whether an operation which preserves the joint* is suitable. This must be preferable to deletive surgery such as arthrodesis, trapeziectomy or replacement all of which have potentially irreversible disadvantages

Ligament reconstruction: Stabilisation of the painful, hypermobile trapeziometacarpal by reproducing the palmar beak ligament with a portion of the flexor carpi radialis tendon can effectively reduce symptoms; (Lane and Eaton 1987, Takwale et al 2004) ; progression to arthritis is perhaps slowed (Freedman et al 2000). The technique can be very effective in reducing the pain of early stage arthritis as well (Eaton et al 1984). More recently, attention has been drawn to the potential importance of stabilising the dorsal ligamentous structures as well as the palmar beak ligament (Coleman 2007, Lin et al 2013). Potential disadvantages are stiffness and quite a prolonged recovery (Tomaino 2001).

Osteotomy: Extension- or extension-abduction osteotomy shifts mechanical loading at the trapeziometacarpal joint more dorsally and redirects force vectors to increase base of thumb stability against dorsal translation. (Tomaino 2006, Koff et al 2006)

The procedure is straightforward; care must be taken to avoid the superficial radial nerves; the incision should be performed with a cooled saw to preserve the viability of the bone. A 20 to 30 degree wedge should be excised. The anterior cortex should be preserved and broken prior to compression of the dorsal cortex. The fixation should be rigid enough to prevent non-union. Wires, staples and plates can all be used, depending on preference and availability. Several studies show that the procedure is effective and durable (Parker et al 2008). (Gwynne Jones et al 2008).

An alternative theory, to be further validated, is an osteotomy of the trapezium (Cheema 2012).

Arthroscopy: There has been increased interest in base of thumb arthroscopy due to improved fine arthroscopic instruments and patient demand for less invasive treatment options. (Adams et al 2011, Cobb et al 2011). Options include arthroscopic synovectomy, capsular shrinkage, hemitrapeziectomy with or without tendon interposition (Cobb et al 2011) (Furia 2010) (Badia 2007) (Abzug 2011) (Edwards and Ramsey 2010) (Park et al 2012). The role of arthroscopic surgery is still to be defined with proper randomised studies and objective outcomes, to determine whether the glamour and technical challenge is justified by any advantage over simpler and cheaper treatments. Only 10% of hand surgeons completing a large survey of the American Society for Surgery of the Hand (ASSH) members would consider arthroscopic treatment of established, early base of thumb arthritis, when 13% would perform a ligament reconstruction and 11% an extension osteotomy (Wolfe and Delaronde 2012).

Trapeziectomy

Trapeziectomy

- interposition or ligament suspension convey no benefit yet increase complications
- fusion and joint replacement are no better yet increase cost and complications

The operation which has stood the test of time for advanced arthritis, when joint preserving procedures are not suitable, is trapeziectomy (Figure 1). It can be performed alone or with interposition of a spacer (autogenous or artificial) with suspension using tendon.



Vermeulen and colleagues (2011) concluded in a systematic review of literature up to 2009 that there is no evidence of superiority of trapeziectomy alone or with interposition over any of the other techniques.

Similarly, the meta-analysis of Li and colleagues (2011) of literature from 2002 up to 2008 which compared trapeziectomy and trapeziectomy with ligament reconstruction tendon interposition (LRTI), demonstrated no statistically significant differences in postoperative strength, pain, and DASH score. Another meta-analysis (Wajon et al. 2009) reviewing the literature up to 2008, similarly showed similar results for trapeziectomy alone and trapeziectomy with tendon interposition. They concluded that neither interposition nor ligament suspension conveyed any benefit in terms of pain and physical function, yet caused more complications 22% compared to 10% ($p = 0.01$)

Comparative studies performed since these meta-analyses confirm that trapeziectomy alone is as least as effective with fewer complications as pyrocarbon Pi2 interposition (Maru et al 2012) or tendon interposition or ligament reconstruction (Gangopadhyay et al 2012).

If interposition is performed, autologous tissue interposition is preferable, since several studies have shown that non-autologous tissue interposition (Gore-tex; Silastic implants; Permacol TM), Artelon, Pyrocarbon) are associated with increased complications; furthermore these devices are expensive and no advantage has been demonstrated to justify the cost.

Metacarpal collapse: Although it is clear from the literature that ligament suspension has no benefit, there may be circumstances in which there is a role for ligament reconstruction, in particular the patients with advanced arthritis with fixed adduction of the metacarpal and hyperextension of the MP joint (Fig 2). In these patients, trapeziectomy alone may not be adequate; correction of the adducted metacarpal base with a tendon reconstruction readily corrects the adduction once the trapezium is removed. The metacarpophalangeal joint itself may correct automatically once the thumb base is extended; if not then options include temporary pinning in flexion, sesamoid arthrodesis or formal arthrodesis of the MP joint.



STT arthritis

Theories that STT arthritis always represent a late stage of CMC arthritis (Eaton and Glickel 1987) are not supported by radiological evidence, since the STT joint can become arthritic in isolation or in association with CMC arthritis (Armstrong et al 1994). The condition is sometimes associated with tendinopathy, even rupture, of the flexor carpi radialis (FCR) or flexor pollicis longus (FPL).

The arthritic STT joint should be treated non-operatively for as long as possible because symptoms may settle. Isolated STT arthritis can be treated by either fusion or excision of the distal pole of the scaphoid. The former (Wollstein and Watson 2005) has several disadvantages to include technical difficulty, metalwork problems, a risk of non-union, stiffness and pain from overload of other joints. The latter is technically more straightforward (Garcia Elias 2011) but even a judicious excision can lead to hyperextension of the scaphoid and capitate lunate subluxation (Corbin and Warwick 2009). The procedure is best avoided if there is pre-existing extension of the lunate on the lateral radiograph.

If the CMC joints are affected, then the proximal few millimetres of the trapezoid should be excised at the time of trapezium excision.

Trapeziometacarpal Arthrodesis

The three dimensional mobility imparted by the saddle joint is essential to hand function. Fusion carries potential disadvantages. Function is significantly altered as shown by a trial of splinting in the fused position in normal individuals (Thommen et al 2006) . The cosmetic effect of the thumb fixed in abduction, loss of opposition and an inability to place the hand flat on the table is of concern to many. There is the potential to provoke arthritis in the adjacent STT or MP joints (Rizzo et al 2009). It is

contraindicated in STT and MP arthritis. Non union can occur in around 13% although not all are symptomatic (Rizzo et al 2009, Hartigan et al 2001).

Meticulous technique is, as ever, essential. Maintaining adequate trapezium bone stock is essential to allow good proximal fixation. Alteration of the bony surfaces to a cup and cone configuration increases bony contact and allows adjustment to best thumb position. Proper metacarpal positioning is crucial to maximise post-operative function with the thumb at 45° to the coronal and sagittal planes. Methods of fixation include single k-wires, multiple k-wires to avoid rotational instability, tension band, headless compression screws, staples and plates. K-wires need to be removed after union and before irritation or infection (occasionally a contradiction); plates may need late removal due to tendon irritation. (Forseth and Stern 2003).

Since there is no evidence to show that arthrodesis is superior to trapeziectomy (Wajon et al 2009, Vemeulen et al 2011) yet it carries a significant complication rate, it is probably wise to restrict the operation to specific indications such as the active patient younger than sixty years needing a more reliable pinch grip than that imparted by trapeziectomy (de Smet et al 2010, Goldfarb and Stern 2002, Hartigan et al 2001). Implant arthroplasty may be contraindicated in this group.

Joint Replacement

Advantages of Joint Replacement

- Quicker recovery
- Length and mobility retained

Disadvantages of Joint replacement

- Technical difficulty
- Expensive
- Early risk of dislocation
- Inevitable later loosening
- No proven advantage over trapeziectomy

The aim of total prosthetic replacement of the trapeziometacarpal joint is to create a painfree joint, combining the basic advantages of other methods: the stability offered by arthrodesis with the mobility and pain relief offered by resection and/or interposition procedures. Joint replacement in the short term probably gives faster pain relief and a better early function compared to tendon interposition arthroplasty (Ulrich-Vinther et al 2008, Vandenberghe et al 2013). The expense, the paucity of good outcome studies and the inevitable risk of loosening are concerns.

There are reports of promising early function and long term survivorship with some implants in which the concept is not to reproduce the anatomy, but to replace the saddle joint with a ball-in-socket joint (de la Caffinière 1991, Johnston 2012, Martin-Ferrero 2013), Caution is recommended and correct patient selection is essential, restricting use to older low demand individuals. The experience of joint replacement by no means universally favourable. The evidence is usually limited, with small retrospective short-term series without a comparator and perhaps sometimes from enthusiastic proponents with industry relations. More critical publications have found their way to the Journals

which reveal failure and more specifically, high rates of radiographic loosening of 5 to 51%. (Kaszap et al 2012, Klahn et al 2012, Maru et al 2012).

The trend in joint replacement at other sites, and indeed in the thumb base, has been in favour of non-cemented techniques. However bony ingrowth depends on compression and sufficient trabecular bone; in basal joint arthritis the volume of trabecular bone in the metacarpal and trapezium is often very limited and fixation of the stem needs cortical reaming to obtain a firm fixation. Perhaps non-cemented prostheses are inferior in the thumb (Wachtl et 1998).

New Concepts

Several new implants and modifications have been recently developed in an effort to improve the outcomes of patients treated surgically for trapeziometacarpal arthritis of the thumb. As the use of these modalities becomes more commonplace, these alternatives have met with variable success.

Artelon spacers: The Artelon spacer is a T-shaped biodegradable insert composed of polycaprolactone based polyurethaneurea. The purpose is to resurface the distal part of the trapezium and proximal metacarpal thus preserving soft tissue and bone, and stabilising the joint capsule by augmentation. Early studies demonstrated excellent material biocompatibility and good early clinical results. Whilst a small early study was promising (Nilsson et al 2005), several subsequent studies have shown poorer clinical outcomes; there are also reports detailing foreign body reactions to the biomaterial and poor implant survival correlated with pain secondary to inflammation and osteolysis. Blount et al (2013) recently reported their experience with 32 patients treated with the Artelon implant of whom 37% required revision surgery with implant removal. Those treated with the implant had significantly diminished pain improvement and satisfaction compared with those receiving the more traditional LRTI procedure. As a result, the authors state that they have abandoned the clinical use of this implant, a trend which appears to be applicable to many practising hand surgeons.

Suture-Button Suspensionplasty: Systematic reviews of the literature suggest that trapeziectomy alone is as successful as trapeziectomy with soft tissue stabilization, with perhaps a lower incidence of postoperative complications. In spite of these findings, many surgeons prefer to augment the trapeziectomy with stabilization of the thumb metacarpal. Strategies for stabilization include the use of temporary pin fixation and various tendon weaves using FCR or abductor pollicis longus (APL).

Recently, the use of suture-button suspensionplasty has been introduced as an alternative for thumb metacarpal stabilization after trapeziectomy. The implant that has been popularized for use in this setting is the “Mini Tight-rope” device (Arthrex, Naples FL, USA). The device consists of two small metallic buttons joined together with several strands of fiberwire sutures. The buttons are introduced via drill holes in the thumb and index metacarpals, and oppose the ulnar



surface of the index metacarpal and the radial surface of the thumb metacarpal, in effect tethering the two metacarpals together (Figure 3) .

Yao and Song (2013) recently described their experience with 21 patients evaluated retrospectively at two years minimum after partial or full trapeziectomy and suture-button suspensionplasty for stabilization. The implants yielded excellent stability of the metacarpal with low risk of complications. Given the stability of the implant, it was felt that rehabilitation can be started several days after surgery obviating the need for prolonged immobilization after surgery. While this appears to be a safe implant, at least one complication involving an index metacarpal fracture has been reported with the use of this device. More information is required about durability and complications.

Pyrolytic carbon: The advantages of pyrocarbon as a biomaterial include compatibility and low wear rates, which are related to the similarity between the modulus of elasticity between pyrocarbon and cortical bone. Additionally, phospholipids adhere to the surface of pyrolytic carbon, which are an important lubricating component in synovial fluid. While most of the experience with pyrocarbon arthroplasty in the hand has been concentrated on the metacarpophalangeal and proximal interphalangeal joints, there are several commercially available implants for use in the trapeziometacarpal joint eg .Pyrodisk, the Pyrocardan, NuGrip, Pi2.

Recent studies suggest that whilst the short term patient satisfaction is quite high, so is the complication rate and need for revision (Martinez de Aragon et al 2009, van Aaken et al 2011, Colegate-Stone et al 2011) The durability in the medium or long term has not been established for any of these. More information on outcomes is needed to establish safety and longevity with these devices.

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