Journal of Hand Therapy 27 (2014) 77–84

Contents lists available at ScienceDirect

Journal of Hand Therapy

journal homepage: www.jhandtherapy.org

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Special Issue

Surgical and therapy update on the management of Dupuytren's disease

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ARTICLE INFO

Article history:
Received 25 June 2013
Received in revised form
1 September 2013
Accepted 30 October 2013
Available online 5 November 2013

Keywords:
Dupuytren's disease
Surgery
Therapy

ABSTRACT

Advancements in surgical and therapy management for Dupuytren's disease are highlighted. Indications for treatment and various surgical options for Dupuytren's disease are described. Non-surgical techniques are also presented. Therapy interventions are reviewed. Treatment techniques for the management of secondary problems resulting from prolonged digit flexion are presented. The benefits, limitations and outcomes of treatments are reviewed to assist the reader to link patient specific problems and goals to the most appropriate treatment choice.

Introduction: treatment overview

Ideal treatment for Dupuytren's disease in the hand would involve managing the cellular mechanisms to prevent or control the development of fibroproliferative disorder. The typical disease process causes collagen nodules and cords in the palmar fascia that usually progress to develop joint contractures.[1] Alternatively, the ideal treatment would provide permanent contracture resolution and prevent the recurrence of contractures and diseased fascia. The ideal treatment would also prevent the development of secondary problems from maintained digit flexion; including joint contractures, tendon and digital nerve pathology and complications post surgery or procedure.

Past and current treatments have fallen short of the "ideal treatment." There have been many types of surgical management described, each with specific benefits and limitations. Historically non-surgical management included: radiotherapy, dimethylsulfoxide injections, topical vitamin A and E application, physical therapy, orthotic intervention, ultrasound therapy, corticosteroid injections, 5-fluorouracil treatment, and gamma interferon injections. These generally were found to be ineffective or not suitable for clinical use.[2–4]

The clinician should address both primary (Dupuytren's tissue) and secondary problems resulting from the finger held in flexion in both the surgical and therapy plan, to maximize restoration of motion and function. Until treatment can be designed to eliminate the disease causing factors, perhaps early treatment for minimal contractures, less extensive surgical management, repeated procedures after expected recurrences or extension of the disease, along with a home therapy program or a brief course of therapy is a short-term solution to a complex disease process. Directions for the future course of Dupuytren's disease will likely focus on treating the disease before contracture develops, rather than treating the late sequelae.

Dupuytren's diathesis (the features of Dupuytren's disease predicting an aggressive course) identifies 4 important risk factors.[5,6] These include ethnicity, family history, bilaterality, and presence of ectopic lesions outside the palm. Hindocha[7] modified this description to include male gender and age onset younger than 50 years. Of particular significance was also the recognition of family history with one or more affected siblings/parents and knuckle pads. The presence of all six factors increases the risk of recurrence by 71% compared with a baseline risk of 23% in those with no risk factors. Perhaps an "at risk" population with the diathesis could be identified when they present with early comorbidities such as trigger finger. In the author's opinion, this group of patients might benefit from regular monitoring by a hand surgeon or self-monitoring tool (currently under development) to identify contractures at an earlier stage. Surgical correction of PIP joint contractures over 60° along with the release of Dupuytren's tissue have been reported as having less favorable outcomes.

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http://dx.doi.org/10.1016/j.jht.2013.10.006

Evaluation of tissue specific impairments as a result of Dupuytren's disease: it is more than the cord

A longstanding joint flexion contracture as a result of Dupuytren's disease may contribute to[8]: extensor attenuation especially at the proximal interphalangeal joint (PIPJ); lateral band migration volar to the axis of the PIPJ with oblique retinacular ligament (ORL) adaptive shortening associated with a PIPJ contracture; joint capsular contracture including volar plate and collateral ligament shortening; joint capsular attenuation dorsally; adaptive digital nerve shortening and digital nerve entrapment within the Dupuytren's cord; vascular adaptive shortening; flexor, lumbrical and interossei muscle adaptive shortening and contracture of the flexor tendon sheath; joint surface incongruity; and secondary skin contracture or breakdown. Also, as noted in other patient populations there may be a potential for changes in the sensory motor cortex when the digit does not move normally for a period of time, resulting in motor planning deficits, even after the local tissues are released, impacting active motion.[9–11] While the Dupuytren's patient does demonstrate limited motion, the sensory motor changes have not been studied specifically in the Dupuytren's population to date. If the impairments described above are not managed surgically, these areas should be addressed in therapy to maximize the restoration of active motion and function.

Evaluation and review of these secondary conditions is presented. Evaluation of tissue specific limitations pre-operatively are often extremely difficult if the joint contracture is fixed or the cord limits testing, not allowing for specific tensioning to confirm secondary tissue impairments. Surgical planning involves an appreciation for altered anatomy based on the Dupuytren's cord displacement of tissues such as digital nerves and vessels. Also, patients may first seek care due to the appearance of Dupuytren's knuckle pads. Finally, outcomes from various interventions are often difficult to compare, due to the additional tissue structures that may/may not be addressed in the specific procedure performed.

Extensor mechanism and tendon attenuation can occur over a period of several months at zone 3 over the dorsum of the PIPJ when the PIPJ is maintained in flexion. Over time the lateral bands may migrate volar to axis of rotation of the PIPJ. As this occurs the ORL adaptively shortens and a Boutonniere deformity results.[12] Smith et al[13] reported using a central slip tenodesis test intraoperatively. This test places the patient's hand in full wrist and Metacarpophalangeal joint (MCPJ) flexion. If the PIPJ extends, the central slip is competent. Also, the tendon can also be imaged through ultrasound to identify attenuation.[14] Extensor attenuation does not typically occur at the MCPJ level.

Joint capsular contracture occurs at the MCPJ and PIPJ volar plate and collateral ligaments when the joint is maintained in flexion. The extensor side of the distal interphalageal joint (DIPJ) capsule can also contract if a PIPJ flexion contracture is present. Evaluation for joint capsular contracture is performed by placing any tight muscle tendon units and Dupuytren's cords in a slack position and assessing isolated joint PROM. Additionally, passive accessory motion is compared between involved and uninvolved joints. This may be a challenge in some patients though, as the contractures may occur on both hands.

Adaptive shortening of digital nerves can occur when the MCP and/or PIP joints are held in flexion. The digital nerves may become entwined in the cords,[15] resulting in displacement of the nerves from their normal anatomical location. Digital nerve involvement is evaluated with by testing light touch using Semmes-Weinstein monofilaments® (Patterson Medical, Warrenville, IL) and two-point discrimination using a discriminator® (Patterson Medical, Warrenville, IL). A patient may have no neuritic symptoms at rest, but may have numbness and tingling when the finger is moved passively into extension. Therefore, the clinician should also test sensibility with the digit in a passively extended position.

Digital vessels can also become encased and surrounded by the Dupuytren's cords, especially in the digits. Clinical evaluation is performed by passively extending the digit and observing for decreased vascularity (the fingertip becomes pale).

Flexor muscle-tendon unit tightness, e.g. adaptive shortening, can occur secondary to either MCPJ or PIPJ maintained flexion contracture. Intrinsic (lumbrical and interossei) muscle tendon unit tightness/adaptive shortening occurs with an MCPJ flexion contracture. In severe cases of MCPJ flexion contractures, active and passive PIPJ flexion can be limited due to intrinsic muscle tightness. Evaluation is performed by selectively tensioning these tissues. This testing may be extremely difficult to perform pre-operatively if there is a fixed joint contracture.

Joint surface incongruity may result in the loss of articular cartilage from the proximal phalangeal head that is not in contact with the middle phalanx. Secondary adherence of the extensor tendon can occur in this location. X-rays may demonstrate articular changes.

Skin contracture and breakdown is evaluated through observation and comparison to normal tissue. Garrod knuckle pads are an ectopic lesion associated with Dupuytren's disease.[16] The presence of a knuckle pad alone does not typically impact joint motion. Knuckle pads do limit the ability for the patient to wear rings and may affect the patient's perspective of the cosmesis of their hand. Observation is used to evaluate for knuckle pads.

Changes in the sensory motor cortex directly related to Dupuytren's contracture will require further investigation.[17]

Advances in surgical management

There has been a seismic shift in the hand surgeon's management of Dupuytren's disease over the last several years. Ongoing debate exists as to the roles of traditional open fasciectomy, limited fasciectomy and dermofasciectomy versus less invasive techniques. These shift in techniques include: minimally invasive needle aponeurotomy (NA) or percutaneous needle fasciotomy (PNF); segmental fasciectomy through multiple transverse incisions; and collagenase collagenase histolyticum (CCH) Xiaflex® (Auxilium Pharmaceuticals, Inc, Malvern, PA) injection and manipulation. Alternative operative techniques include: "wide-awake" open release and two stage treatments using a joint distraction device. Also steroid injection, an irrigation used in combination with techniques has been investigated. New hand surgery fellows are learning more about limited treatment and are not as familiar with open surgical techniques as their mentors were. The open palm technique has been heralded in the past as being both effective and yet without complications such as hematoma, skin necrosis or infection.[18,19] However, most hand fellows today have never seen or performed this technique. In addition, not only is there a trend toward less invasive procedures, there is a push for office-based treatment as opposed to surgical management in the operating theater.

The criteria for needle aponeurotomy (NA) are a contracture due to a palpable cord lying beneath redundant skin in a cooperative patient. Contraindications are inadequate skin or excessive scar, absence of a palpable cord and contracture not due to Dupuytren's disease.[20] The technique described by Lermusiaux[21] and more recently by Beaudreuil[22] and Eaton[20] can be an office-based procedure whereby fasciotomy portals are planned in areas where the skin is soft and the cord is discrete and linear. Local anesthetic is utilized and a 25-gauge needle is used percutaneously as a scalpel. Cords are insensate, but vital structures are not, which allows NA to be performed safely without either sedation or tourniquet. Nerve

and tendon function are monitored throughout the procedure to avoid injury. The cord is disrupted at several levels until the finger can be extended fully or to the maximal extent possible. Patients usually can return to normal activities one week after the procedure. NA is also safe in patients on anticoagulation therapy. Advantages of this technique include in-office setting, shorter recovery, diminished flare reaction and RSD.[23–25] Disadvantages may include more rapid recurrence, inability to correct skin or capsular shortages especially at the PIPJ level, skin tears and inadvertent digital nerve injury.[25–27] Van Rijessen[28] reported five-year results of a randomized clinical trial comparing NA versus limited fasciectomy. Recurrence in the NA group was significantly higher (84.9% vs. 20.9%) and the contracture recurred significantly sooner in the NA group. Patient satisfaction was high for both groups, but those who underwent limited fasciectomy were significantly more satisfied at 5 years than those who underwent NA. In spite of this, many patients preferred the NA treatment as the treatment of choice even when they suffered a recurrence. Duthie[29] reported a 10 year follow up with the average time to further surgery in patients who had a second operation was 60.4 months. Pess[27] reported results of NA in over 1000 fingers. Complication rates were low but recurrence rates were higher than for fasciectomy, especially in younger patients. A systematic review of the literature on NA found significant differences in methodology making a meta-analysis impossible to perform. However conclusions were fairly consistent among articles as described above.[25]

Segmental fasciectomy through multiple transverse incisions, a variation on NA, has also gained popularity.[30,31] Unlike NA, this procedure is performed only in the surgical theater. A series of short transverse incisions are utilized to permit exposure of the cord and visualization of the digital nerves. The incisions are made over the proximal and distal palmar crease before proceeding distally as necessary to the MCPJ crease and the PIPJ crease. Through these small incisions, small segments (approximately 1 cm) of the Dupuytren's cord are excised while visualizing and protecting the flexor tendons and digital nerves. After excision of the segments of cord, the digit is passively extended until the contracture is resolved or significantly reduced. Reports have shown acceptable complication rates similar to other techniques as well as similar recurrence rates to other techniques.[32] Shin and Jones[31] found excellent correction of contractures, mild postoperative pain, rapid return of finger flexion and satisfactory 2 year results.

CCH (Xiaflex®) injection is gaining popularity and is the newest of all the treatment options. The public is keenly aware of the existence of this technique and advertising of collagenase has been aggressive. CCH injections and cord rupture was approved by the Food and Drug Administration in 2010 and marketed as Xiaflex® (Auxilium Pharmaceuticals, Inc, Malvern, PA) as a non-operative biological method in managing this disease problem. Injection of CCH is performed in the office for one cord and one joint. Over a 24 hr. period the CCH weakens/dissolves part of the cord. The patient returns to the office the next day and in our practice receives a lidocaine injection to numb the digit, before the cord is ruptured by passively extending the involved joint and maintaining the flexor tendons in a tension free position with the wrist flexed (see Video). If release is suboptimal, a maximum of two more CCH injections can be used for the same joint with 4 weeks between injections. Short term side effects usually lasting 2–20 days include swelling of the injection site or the hand, bleeding or bruising at the injection site, pain or tenderness of the injection site or the hand, swelling of the lymph nodes (glands) in the elbow or underarm, itching, redness or warmth of the skin, and pain in the underarm. Breaks in the skin can occur with manipulation but usually heal uneventfully. Severe side effects include tendon rupture, pulley damage, ligament damage, nerve injury and allergic reaction. Prior to the introduction of CCH, flexor tendon injury was not at the forefront of discussion when considering contracture correction, although certainly a possible complication of surgery, though rare. This is now something that should be discussed with patients undergoing CCH injection in that flexor tendon rupture has been reported in the literature.[33] Follow up has been reported up to 8 years, as widespread clinical use has only occurred in more recent years. There are some advantages of CCH over NA and fasciectomy reported in the literature including fewer complications.[34] However McMahon et al,[35] found despite initial dramatic contracture correction, recurrence rates for 46 MCP joints was 24% and for 18 PIP joints was 39% with the recurrence criteria of a 20° or greater increase in contracture above the minimum correction value achieved.

Another recent step away from tradition which has proven to be effective is the wide awake approach to Dupuytren's disease in performing fasciectomy under local anesthesia with epinephrine. This technique, popularized by Lalonde[36] is starting to revolutionize the way some surgeons operate on Dupuytren's disease. Traditional approaches to surgery have been to perform this procedure under general or regional anesthesia with the use of a tourniquet. The wide awake local anesthesia no tourniquet (WALANT procedure) is performed without tourniquet and using local anesthetic and no sedation with low dose epinephrine to control bleeding. This type of procedure may be performed outside of the surgical theater. Historically, hand surgeons have been reluctant to use epinephrine for anesthesia for fear of ischemic necrosis of the digits. This has proven to be a largely unjustified concern.[37,38] The use of epinephrine was originally not recommended because when epinephrine was used in conjunction with cocaine for digital anesthetic, patients did develop ischemia. As it turns out, this was the result of the cocaine anesthetic or other reasons and not the epinephrine.[39]

The use of skeletal extension torque in reversing Dupuytren's contracture particularly of the PIP joint has gained acceptance.[40–43] A device such as the Digit Widget® (Sacramento, CA) can be utilized to gradually restore length to the soft tissues palmar to the PIP joint axis of rotation. Simultaneously, the tissues dorsal to the PIP joint's axis will shorten as the digit is maintained in extension. A two-staged approach is utilized; with the contracture reversed with the widget first, and then the diseased tissue is excised at a later date from the finger. Brandes et al[42] have shown histologically that in Dupuytren's disease the contracted palmar fascia reacts to external forces that apply continuous extension with neoformation and reorientation of all tissue components by myofibroblasts. In contrast, studies have shown that capsuloligamentous release for severe PIP joint contracture has not improved outcome with regard to final residual contracture after surgery.[44]

We have a specific interest in the use of steroids in the management of Dupuytren's disease. Steroids have been used in conjunction with Dupuytren's release procedures. Meek found that "steroids induced apoptosis in Dupuytren's tissue and may prevent contracture progression or postoperative recurrence."[45] I (SS) use Bupivacaine Hydrochloride and betamethasone in a syringe with an angiocatheter tip following Dupytren's limited fasciectomy. The incision is closed and then the catheter is introduced between two sutures at the proximal end of the incision to allow the steroid to be injected along the flexor sheath. A retrospective chart review performed at our institution examined the irrigation of the wound with steroids following fasciectomy compared to fasciectomy alone. There were no significant differences in the number of soft tissue complications post-operatively. Neither group had tendon injuries or flare responses. Both groups used a tension free postoperative treatment plan as described by Evans.[46]

At one year there were no statistically significant differences in contracture resolution. However, early responses for the group receiving steroids demonstrated less need for post-operative narcotics for pain control, and an earlier return of range of motion with less edema and stiffness in the early post-operative time frame.

McMillan[47] reported a comparison of flexion deformity in patients who received NA plus a series of steroid injection to those who received NA alone. Correction at 6 months was 87% of preoperative total active extension deficit in the steroid group vs. 64% for NA alone. The steroid was given directly into the cords immediately after NA. Ketchum[48] injected triamcinolone in nodules and reported encouraging results. Aron[49] found favorable results.

Surgical and non-surgical procedures for Dupuytren's have reported complications ranging from 17% to 50%.[50–55] Postoperative complications include loss of flexion, hematoma, skin loss, infection, edema, wound dehiscence, and reflex sympathetic dystrophy (CRPS). These data are confounded by the fact that most studies involve more than one surgeon as well as various techniques. Bulstrode[56] reports his series of patients treated by a single surgeon from 1982 to 1999 with fasciectomy performed. Infection rates were high (24 of 253 patients), attributed to a low threshold for diagnosis.

Other management issues include controlling hematoma formation. Strickland originally described a technique where a butterfly catheter would be left as a drain and hooked to test tube drainage in order to evacuate any hematoma. Kasdan et al[57] described a continuous irrigation technique for 24–36 h postoperatively in order to minimize hematoma. Kasden[58] suggested overall fewer complications with this technique, although he did not specifically find fewer hematomas.

The type of skin incision and technique utilized also has an influence on surgical outcome. Gelberman et al[59] looked at wound complications with various operative incisions. Skin necrosis following partial fasciectomy was related to the severity of the skin involvement and the extent of surgical manipulation. The incidence of flap necrosis was 7% in the Z-plasty group and 12% with a zig-zag Bruner incision. There was no flap necrosis with the open palm technique. Palmar hematoma rates were reduced with the advent of partial, selective fasciectomy. The open palm technique was not more prone to cause infection than in patients who had primary closure of the wound. Open palm technique did have an increased incidence of neurovascular injury, as zig-zag and z plasty incisions gave better wide visualization of these structures. Postoperative pain was thought to be less with the open palm technique.[18] Zig-zag and Z-plasty incisions did have a higher incidence of wound complications compared to the open palm technique.

Complication rate increased with severity of disease, particularly if the PIPJ contracture was greater than 60°.[8,60] Difficulty in maintaining PIPJ extension has lead to alternative therapy recommendations[61–63] and recommendations for additional procedures[64,65] to enhance intra-operative gains in motion for the PIPJ. Controversy regarding surgical management of the PIP joint exists. Although the surgeon may achieve full correction on the operating table, the ability if the patient to achieve full active extension may be impossible due to the nature of the elongated central slip so often seen in chronic cases. Smith[13] recommended immobilizing the PIP joint in full extension and the DIPJ free for 3 weeks. This treatment improved results to the point where results were similar to those patients treated for less severe contracture.

Results following surgery for recurrent Dupuytren's disease have been studied. Roush and Stern[66] looked at the subjective and objective data comparing three treatment groups: limited fasciectomy with IP arthrodesis, fasciectomy and full thickness skin graft (FTSG), and fasciectomy with local flaps. Data showed that patients were more likely to maintain total active motion (TAM) when treated with fasciectomy and local z-plasty or V–Y advancement, contrary to popular belief that dermatofasciectomy and FTSG is the logical choice in these patients. Subjective success in all 3 groups was high and 18 out of 19 patients were unconditionally satisfied and would undergo the procedure again.

Amputation of a digit with a severe recurrent contracture has been performed. When amputation is performed distal to the MCP joint, recurrence is still a problem, especially in the small finger. Ring finger amputations have been less problematic but not problem-free.[67] Arthrodesis of the PIP joint is also an option, but recurrences may be seen here too.

The treatment of Garrond's knuckle pads is not without controversy. Generally knuckle pads are known to be benign, occasionally are associated with pain when they first appear, are of cosmetic concern to patients, and sometimes know to disappear without treatment. Usual treatment is nonoperative. Usually functional issues are minimal. Addson[68] reported a case of significant functional disability from a knuckle pad, whereby the skin and lateral bands were tethered to the central slip, causing a swan neck deformity and inability to flex the PIP joint.

An area of interest to surgeons is the existence of non-Dupuytren's disease of the palmar fascia. These cases involve primarily unilateral disease, without family history or ectopic manifestations.[69] Diabetes and cardiovascular disease as well as trauma are associated with the development of this condition.[69] This rather commonly seen phenomenon occurs when the patient develops a thickened palm from palmar fibromatosis. This can be observed following trigger finger surgery and often the patient with diabetes prone to this condition. Non-Dupuytren's disease is typically not progressive and can be partially regressive, unlike Dupuytren's. A different prognosis can be expected, and this is important in counseling patients who develop a thickened palm after surgery for another condition.

Advances in therapy management

In the last 10 years the therapy techniques for managing Dupuytren's disease have not changed significantly. These therapy treatments are well described in the literature and are not the focus of this paper. The extent and duration of recommended therapy management post CCH injections continues to evolve, with only a few publications on therapy management. Also, management of secondary deficits resulting from longstanding joint flexion contractures is highlighted in this article.

There is a significant paucity of strong evidence for the use of specific therapy techniques and orthoses following surgery or CCH. Some recent studies found there is no evidence to support routine orthotic use for all patients post fasciectomy,[70–72] The literature may not imply ineffectiveness, but simply not enough quality studies or limited ability to accurately measure compliance with an orthosis or therapy program to fully support therapy interventions.

Initial recommendations for therapy following colloidal collagenase injections included having patients use a hand based extension orthosis at night for 8 weeks and no ongoing therapy treatment was required.[73] Using the Cord I therapy treatment program, PIPJ contracture resolution was less than that achieved for the MCPJ. Skirven et al[61] investigated an alternative program post collagenase treatment for the PIPJ contracture greater than 40° due to potential for secondary "collateral ligament and volar plate tightening, development of intra-articular adhesions and attenuation of the central slip."[61] The authors suggested initially holding the PIPJ in maximum extension with the MCPJ flexed in a hand based orthosis day and night, and at 1 week (or as skin condition and edema allows) change to a finger based orthosis for use during the day). The finger orthosis places the PIPJ in maximal extension

and the MP and DIPJ were free. Exercises included: reverse blocking for active PIPJ extension; active MCP and DIPJ joint flexion and extension with the PIPJ held in maximal extension. Full fisting was allowed but frequency and repetitions were titrated based on the degree of active extensor lag. Techniques to mobilize the lateral bands and ORL were also instituted on the first day. It was suggested by the authors that full time extension would allow for the secondary tissues limitations to resolve and allow the patient to maintain active PIPJ extension equal or near equal to what had been achieved passively on the day of manipulation. Initially, it was unknown if the attenuated tissue could be effectively "shortened." The patients were monitored with adjustments to exercise and orthoses at least once a week. Results from 22 digits in 21 patients identified an improvement from a mean baseline PIPJ contracture of 56° (range 40°–80°) to 7° (range 0–35°) at 4 weeks after manipulation. Early results with this program were superior to published results using the Cord I therapy program. Longer-term results will follow in future publications. The authors subscribe to this program for the patient with a PIPJ contracture greater than 40° following both CCH release and surgical release.

For the surgically managed patient, some specific therapy methods used to enhance active and passive motion at the PIPJ and MCPJ are presented. Postoperatively, selective tissue evaluations are performed to determine the factors contributing to limitations in motion. While full resolution of tissue tightness may not be possible, partial resolution of these secondary tissues deficits may enhance motion such that function and patient satisfaction can be improved.

Extensor attenuation in Zone 3 has been reported to occur as often at 80% for patients with passive extension limited to 60° or greater.[13] If the extensor tendon is attenuated, holding the PIPJ in full passive extension with a digital orthosis and limiting full active and passive PIPJ flexion for several weeks may contribute to improved extension[61–63] A PIPJ extension orthosis also allows the lateral bands that may have migrated volar to the axis of the PIPJ to be realigned. ORL tightness is resolved through performing active and passive DIPJ flexion with the PIPJ maintained in maximum extension. Once the several weeks of relative immobilization are complete, the patient then advances the arc of active PIPJ flexion while constantly monitoring the active extensor lag. Active flexion is advanced as long as active extension is maintained. Other orthotic options when managing an active PIPJ extensor lag include: an orthosis to block MCPJ extension/hyperextension to enhance the use of the extensor digitorum communis (EDC) to extend the PIPJ (e.g. an relative motion extension orthosis[74]) perhaps coupled with an orthosis positioning the DIPJ in flexion, or a finger based dynamic orthosis (Capner type) to rest the finger in extension but allow active flexion. The prolonged use of an extension orthosis potentially helps to resolve joint capsular tightness.[75–77] All orthotic use is regularly evaluated and re-fit as edema is reduced and motion improves.

If the flexor muscle tendon unit is shortened, maintained stretch either through positioning, or using a night orthosis to reduce the tightness may allow for improved active and passive MCPJ and PIPJ extension. If the interossei and lumbrical muscles have shortened, maintained interossei stretch or positioning the MCPJ in extension with the PIPJ in flexion in an orthosis may enhance MCPJ extension. Digital nerve and vessel adaptive shortening noted after contracture release may respond to the no tension approach "NT" as described by Evans et al[46] This technique involves orthotic fabrication in a position where there is no wound tension for up to 3 weeks. Therapeutic exercises also were performed in a manner preventing repetitive forces at the wound. This method of treatment resulted in fewer therapy visits, less flare response and no loss of final extension measures as compared to a program where there was wound tension applied initially.

Review of outcomes for specific therapy interventions

Patients managed with CCH where PIPJ flexion contractures are greater than 40° have reported improved outcomes at 4 weeks using an extension orthosis and a therapy program titrating flexion within the first few weeks as compared to a night extension orthosis and no therapy.[61] Outcome beyond 4 weeks for this method has not been reported to date.

The standard use of extension orthosis for all patients after surgical release has been challenged in recent articles. Larson et al[71] performed a systematic review on the use of orthoses after Dupuytren's release. Four studies met inclusion criteria. The authors found there was a lack of sufficient data to determine clinical significance and found patient adherence to orthotic use was a limitation in determining effectiveness. The authors also provide a rationale in the selection for orthotic intervention. An RCT examining treatment effectiveness of a night extension orthosis following fasciectomy or dermofasciectomy found no difference in AROM or self-reported disability in comparison with a group who did not use an orthosis at one year follow up.[78] This finding was also confirmed using a similar orthosis and study design with 3 month follow up.[79] and another pilot study with one year follow up.[72] It is important to note all patients in these studies received hand therapy treatment. The variable was the use or non-use of an extension orthosis at night.

Some of the limitations identified in these studies include: possible non-adherence to orthosis use or the static orthosis lacks significant tension to remodel scar, the type and duration of use of the orthosis used may not provide sufficient positioning for the PIPJ to increase extension[79] and data were underpowered.[72] The clinical importance of results with a technique can vary depending on the responsiveness of the outcome instrument used. The DASH used as an outcome measure may not be sensitive to changes for Dupuytren's patients.[80]

Author's recommendations for therapy intervention

Regardless of surgical procedure, a hand therapist sees all patients for a home program, where treatment and time frames for reaching goals are discussed. If the patient does not achieve the goals within the expected time frame, he/she returns to the therapist for further evaluation and to determine if there is a need for treatment beyond a home program. Loss of extension within the first few weeks after any procedure is the defining factor for the patient to receive further therapy intervention. In our practice, most patients receive an extension orthosis on the first postoperative day or the day of CCH release. This is especially important when the patient demonstrates less active as compared to passive extension. While some recent studies may not show benefit from orthotic use after fasciectomy we feel further examination of the limiting factors identified in these papers and examination of speed of return to function should be studied before discontinuing the recommendation for routine use of orthotic intervention. There are patients who may not respond the same as those reported in the studies: therefore clinical judgment skills of the surgeon and therapist must be considered. Recommended time frames and duration for use of the orthosis is based on each individual's ability to maintain active and passive extension.

Recurrence and contracture correction: a key to the decision making process for the selection of a specific procedure

Lo and Pickford[81] reviewed evidence from 2010 to 2012. Their summary findings included: 1) limited fasciectomy has a lower 5 year recurrence rate and higher satisfaction rate than needle

fasciotomy; 2) night orthotics do not provide additional benefit post contracture release when examined at one year and can be used upon development of contracture in the early postoperative time period; 3) steroid use may be of benefit as an adjunct to needle fasciotomy, 4) cellulose implants may reduce early recurrence after segmental fasciotomy, and 5) collagenase release of contractures may be achieved in 44% of the patients without recurrence at one year, collagenase may be more beneficial with early disease and at the MCPJ. Several problems with interpretation of the studies were outlined including: inconsistencies with objective range of motion measurements, the definition of successful endpoints and recurrence are not consistent, and the limited utility of current outcome measures.

Werker[2] performed a systematic review of Dupuytren's literature and suggested the selection from the treatment options is based on understanding the risks of treatment and optimizing the long term outcomes. He concluded that "clear objective definitions for correction of contracture and for recurrence are needed for more meaningful comparison of results."[2] He found definitions for contracture correction and recurrence were extremely varied and were almost always qualitative, so comparisons among techniques were difficult due to the variety of definitions. Contracture correction at various times after surgery ranged from 15 to 96%. Recurrence rates varied from 12 to 100% following surgical intervention. Also the relationship between Dupuytren's diathesis and recurrence were not included in the analysis of results and the diathesis has been shown to have an increased risk of recurrence.[7] Kan et al[82] also support the need for a consensus on the definition of recurrence.

Both Lo and Werker found the definitions in the CORD I and II studies of CCH[73,83] should be considered in future studies for consistency of comparisons among studies. McMahon et al[35] reviewed the definitions and recurrence rates following CCH treatment. These authors suggested using the definition " an increase in joint contracture to 20° or more from the minimum contracture reached at cord rupture" to filter patients who have a lower baseline contracture initially. It is known the lower the baseline contracture, the less likely the recurrence.

Chen's[34] systematic review found for open partial fasciectomy a recurrence rate of 12–39% with a mean follow up of 1.5–7.3 years. For needle aponeurotomy a recurrence rate of 50–58% with a mean follow up of 3–5 years. CCH was found to have a recurrence rate of 10–31% with mean follow up of 3 months to 4 years. Long-term follow up, clear definition of recurrence and percent lost to follow up is not well reported in any of the studies.

Roush and Stern[66] reported on a case series of 28 digits for surgery for recurrent Dupuytren's disease. Follow up was at a median of 4 years. Three treatments included: limited fasciectomy and IPJ arthrodesis, dermatofasciectomy and FTSG and fasciectomy and local flap. Fasciectomy and local flap was the only group to maintain statistically significant total active motion (TAM) gains. Clearly arthrodesis would limit TAM and patients undergoing arthrodesis had less preoperative TAM. FTSG did not prevent recurrent contracture. Sensory impairments occurred in a majority of the patients.

Extension of Dupuytren's disease is defined as Dupuytren's lesion developing in an area outside of the area previously treated.[84,85] Surgical and in office procedures or CCH do not control the progression or extension of Dupuytren's disease. Further study is needed in this area.

Conclusions

Recommendations for a specific procedure to manage Dupuytren's disease in the hand may change when: long term follow up specific to each technique and each joint are reported; adding additional diagnostic information to include the secondary tissue involvement that is present and the identified treatment for these tissues; co-morbidities and associated diathesis factors are reported initially and at long term follow up; a clear and agreed upon definition for recurrence is quantified; reporting identifies results clearly as active or passive range of motion outcomes; meaningful patient reported outcomes are developed and used; percent lost to follow-up is reported; studies include compliance measures for interventions; and identifying the impact of specific therapy interventions are clearly reported in the literature. Also there is a need for more studies examining revision procedures.

Options for surgery, in office procedures or CCH are discussed with each individual to determine the best plan of care based on the individual's contracture, secondary tissue involvement, other medical history, desired outcome, tolerance for recurrence of contracture and ability to participate in a therapy program.

Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jht.2013.10.006.

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#1. The primary involvement in Dupuytren's is the
   a. flexor tendon sheaths
   b. palmar fascia
   c. PIP joints
   d. MP joints

#2. The following are considered ineffective interventions
   a. ultrasound
   b. steroid injections
   c. splinting
   d. all of the above

#3. Dupuytren's Diathesis refers to
   a. an emotional component
   b. the predomenence of ring finger involvement
   c. the features of the disease that predict an aggressive course
   d. a visible skin contracture

#4. Longstanding PIP flexion contracture may contribute to
   a. elongated MP collateral ligaments
   b. extensor attenuation (especially at the PIP joint)
   c. mallet finger
   d. osteopenia of the proximal phalanx

#5. NA and CCH injection have gained recent popularity
   a. true
   b. false

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