

# Chapter 2

## Needle Aponeurotomy in the Management of Dupuytren's Contracture

Clifford T. Pereira and Prosper Benhaim

### Introduction

Dupuytren's contractures (DC) is a benign fibroproliferative disorder of the fascia of the hand and fingers, resulting in progressive thickening and shortening of the palmar fascia. This results in the formation of cords, flexion deformities of the digits, and ultimately loss of range of motion, especially loss of functional finger extension [1]. The aim of surgical intervention involves the preservation and improvement of hand function by either division of (fasciotomy) or removal of (fasciectomy) the diseased tissue. Standard treatment

---

C.T. Pereira, MD, FRCS (Eng) • P. Benhaim, MD (✉)  
Department of Orthopedics Surgery and Division of Plastic Surgery,  
University of California–Los Angeles, Box 957326,  
10945 LeConte Avenue, Room 33-55 PVUB,  
Los Angeles, CA 90095-7326, USA  
e-mail: [cpereira72@yahoo.com](mailto:cpereira72@yahoo.com); [pbenhaim@mednet.ucla.edu](mailto:pbenhaim@mednet.ucla.edu)

indications include metacarpophalangeal (MCP) joint contracture of greater than  $30^\circ$  and/or any proximal interphalangeal (PIP) joint contracture. Current treatment options for DC include open fasciectomy (OF), limited fasciectomy (LF), needle aponeurotomy (NA), and Clostridial collagenase injections. Percutaneous needle fasciotomy or needle aponeurotomy (NA) is a minimally invasive technique that uses a small hypodermic needle as a percutaneous scalpel blade to perforate, weaken, and/or divide the cord to the point where finger manipulation can result in rupture of the cord and improvement in finger extension. This chapter focuses on the use of NA, its indications, advantages, disadvantages, technical pearls, and literature review. A detailed discussion on other treatment options including open fasciectomy or collagenase injections is beyond the scope of this chapter and will be presented in other chapters. Pertinent comparisons between NA and other treatment options, however, will be discussed.

## **Case Presentation**

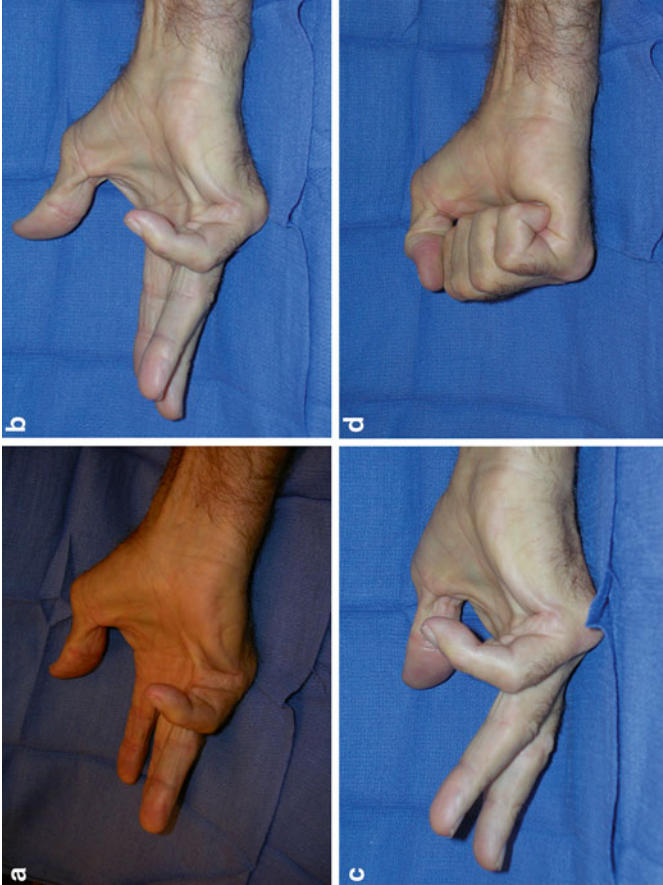
### **History**

The patient is a 72-year-old right hand dominant retired aerospace engineer who presented with a 10-year history of bilateral hand Dupuytren's contractures. The right side was worse than the left, with progressive worsening of the contractures over the previous year. The contractures had advanced to a point where they interfered with his ability to play tennis and a number of other activities of daily living. The patient had had no prior treatment for this on either hand. He had no numbness or tingling. He did not remember any specific inciting event or trauma. His family history was negative for DC. His ancestry included French and Belgian lineage. He denied any involvement of the soles of his feet (Ledderhose disease) or shaft of his penis (Peyronie's disease). He was not diabetic or epileptic. He denied abuse of tobacco or recreational drugs, and consumed alcohol only socially.

## Examination

The *right* hand had evidence of Dupuytren's disease, including a distal first web space commissural cord and pretendinous cords over the first, second, third, fourth, and fifth metacarpals. The most predominant of these was the fifth metacarpal pretendinous cord. There was no natatory cord formation in the web spaces. The right thumb had a radial lateral cord at the radial border of the proximal phalanx, with a Dupuytren's nodule at the A1 pulley level. The ring finger had an ulnar lateral cord at the ulnar border of the proximal phalanx. The small finger had a radial lateral cord at the radial border of the proximal/middle phalanges and a central cord at the proximal/middle phalanx level. The small finger also had a Dupuytren's nodule at the A1 pulley level and at the proximal phalanx level. There were no dorsal proximal interphalangeal joint Garrod's pads noted. Contractures in the right hand included 15° at the middle finger MP joint, 35° at the ring finger MP joint, 85° at the small finger MP joint, 60° at the small finger PIP joint, and 30° at the small finger DIP joint. The other finger joints of the right hand had full extension and all joints had full flexion. Sensation was intact in all digits. No triggering of any of the digits was noted. All extensor and flexor tendons were intact, without any evidence for extensor tendon subluxation or sagittal band rupture (Fig. 2.1).

The *left* hand had evidence of Dupuytren's disease, including a distal first web space contracture cord and pretendinous cords over the first, second, third, fourth, and fifth metacarpals. The fifth metacarpal pretendinous cord was the most prominent cord. There was no natatory cord formation in the web spaces. The small finger had a central cord at the proximal phalanx level and nodule formation over the A1 pulley and proximal phalanx in the small finger. There were no Garrod's pads noted. Contractures in the left hand included 15° at the ring finger MP joint and 50° at the small finger MP joint. The other finger joints of the left hand had full extension and all joints had full flexion. Sensation was intact in all digits. No triggering of any of the digits was noted. All extensor and flexor tendons were intact, without any evidence for extensor tendon subluxation or sagittal band rupture.



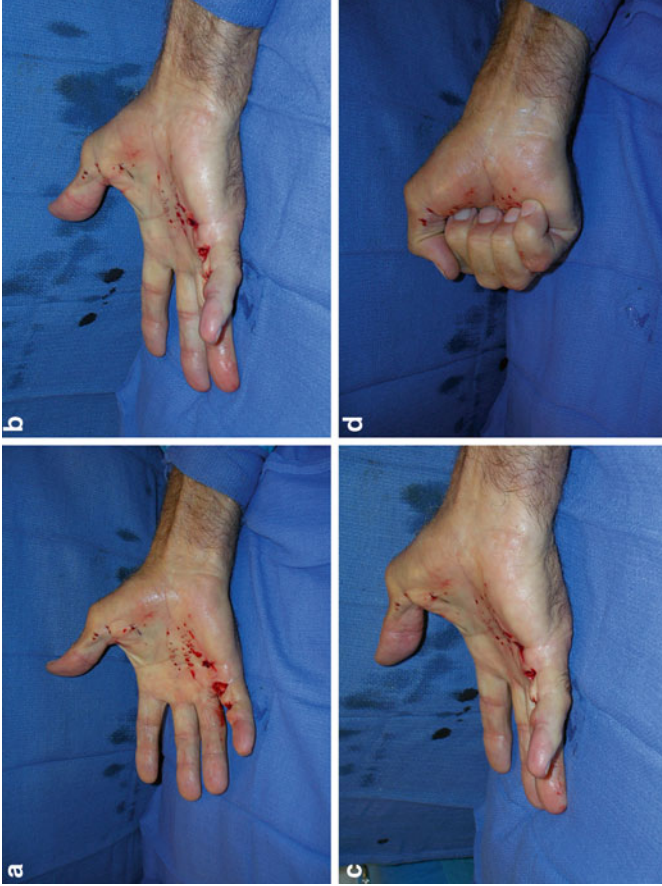
**Fig. 2.1** Dupuytren's contracture of *right* hand—before needle aponeurotomy, (a) anterior-posterior view, (b) oblique view, (c) lateral view, (d) composite fist

## Diagnosis and Assessment

The patient had bilateral hand Dupuytren's disease involving both MP and PIP joints, right side worse than left. Treatment options offered to the patient included conservative management with splints and hand therapy vs. needle aponeurotomy vs. a combination of needle aponeurotomy and limited fasciectomy vs. open palmar fasciectomy vs. collagenase injection. The relative advantages, disadvantages, potential complications, and alternatives of each of these approaches were discussed with the patient in detail. The patient carefully considered these options and elected to undergo needle aponeurotomy (NA). Specific to NA, in addition to general procedure-related risks, the patient was explained that it is a blind percutaneous procedure that carries a risk of injury to nerves, vessels, tendons, and a higher risk of recurrence when compared to conventional Dupuytren's contracture release surgery. We also explained the risk of skin tears that may occur as a result of the procedure, which would necessitate local wound care postoperatively. Such skin tears can take 1–4 weeks to heal fully, depending on their size and location. Finally, the patient also understood that no surgical approach, whether conventional or needle aponeurotomy, could guarantee full range of motion following surgery, either immediately or in the long run.

## Management and Outcome

The patient underwent NA initially on the *right* hand (Fig. 2.2). The fifth metacarpal pretendinous cord was approached first at the proximal portion of the palm and extended all the way to the MP flexion crease of the small finger. Caution was taken to remain central on the cord in order to avoid injury to the nearby neurovascular bundles. In addition, care was taken to avoid going too deeply with the needle in order to avoid injury to the underlying flexor tendons and neurovascular structures. With each pass of the needle, there was progressive release of the Dupuytren's contracture in the small finger, especially at the MP joint. A nearly identical procedure was repeated for the second, third, and fourth metacarpal



**Fig. 2.2** Dupuytren's contracture of *right* hand—immediately after needle aponeurotomy, (a) anterior-posterior view, (b) lateral view, (c) composite fist

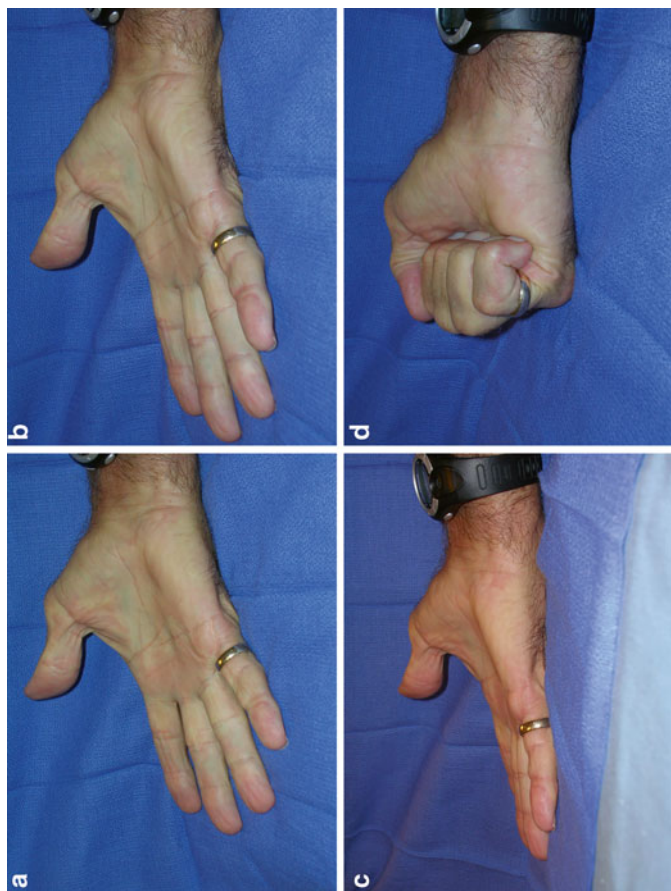
pretendinous cords, as well as for the first metacarpal pretendinous cord extending to the thumb. The first web space contracture cords were also released in this fashion. The Dupuytren's contracture in the small finger was next addressed at the proximal and middle phalanx level using the same needle aponeurotomy technique, this time addressing the central cord and radial lateral cord at the proximal and middle phalanx level. As in the palm, great care was taken to avoid injury to the neurovascular structures and to the underlying flexor tendons. Marked improvement was achieved in extension of both the PIP and DIP joints with this technique. In a similar fashion, the ring finger Dupuytren's contracture release was performed at the proximal phalanx level by releasing the ulnar lateral cord in the ring finger at the proximal phalanx level, at multiple locations. The right thumb radial lateral cord at the radial border of the proximal phalanx was released in a similar fashion at the thumb level, with care being taken to avoid injury to the radial digital nerve and artery. The needle aponeurotomy technique was able to achieve full extension in the thumb, index finger, middle finger, and ring finger. However, the small finger PIP joint still had a residual contracture secondary to an independent PIP joint volar capsular contracture. This was addressed at the end of the procedure, by infiltrating all the fingers with 0.5% Marcaine to achieve a digital block in all digits. The fingers were manipulated with forceful extension to achieve completion rupture of the cords, thereby further improving extension and even hyperextension of the MP joints. In addition, we specifically performed a PIP joint closed capsulotomy to increase the extension of the small finger PIP joint. This was successful in achieving full extension of the PIP joint in the small finger. The procedure did produce several skin tears, including a skin tear at the distal palmar crease over the fifth metacarpal, a skin tear at the MP flexion crease of the small finger, and a skin tear at the PIP flexion crease of the small finger. All three tears were less than 1 cm in diameter and did not involve exposure of the flexor tendon sheath or neurovascular bundles. The remaining discontinuous segments of the pretendinous cords and associated nodules were locally infiltrated with a total of 50 mg of triamcinolone to minimize the risk of a flare reaction postoperatively and to minimize the risk of recurrence. The skin tears were

dressed with antibiotic ointment and a sterile soft dressing. The patient commenced supervised hand therapy on postoperative day 1, including use of a nighttime extension splint to maintain the fingers at full extension at night for 4 months following the procedure. At his 2-month postoperative visit, the patient's right hand wounds had fully healed with no residual open wounds. All extensor and flexor tendons were intact. Light touch sensation was normal in all digits. All fingers of the right hand had full range of motion, *including full active and passive extension of the digits* (Fig. 2.3). The patient subsequently returned in 5 months and had NA performed on his left hand, which was also successfully corrected. At his 2-year follow-up, his right hand still had full flexion and extension with no signs of recurrence (Fig. 2.4).

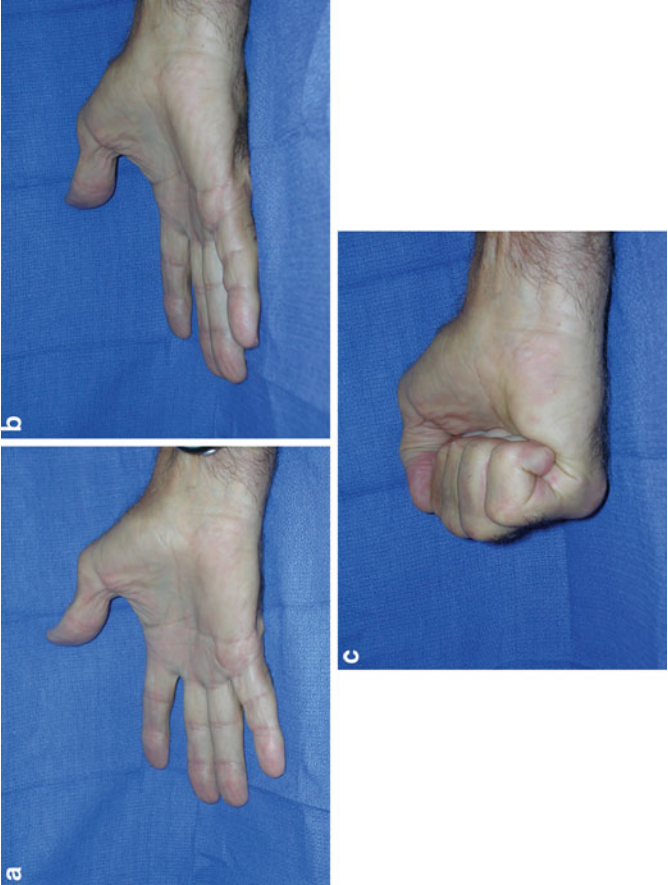
## Technique

*Preoperative preparation:* Needle aponeurotomy can be performed in either an office setting or an outpatient surgery center, the choice of which may be dictated by patient preference, surgeon preference, and/or insurance coverage eligibility issues. Some insurance companies will require that this type of procedure be performed in a Medicare-approved procedure room, which may or may not be available in every surgeon's office. Some surgeons prefer the formal setting of an outpatient surgery center with better lighting and monitoring by a nurse. The procedure is performed under local anesthesia, without intravenous sedation, regional block, or monitored anesthesia care. Patients are asked to stop anticoagulation before the procedure, if possible. However, anticoagulation is not considered an absolute contraindication to the procedure. The patient is placed recumbent to minimize possible vasovagal responses. The technique is explained to the patient in detail, including the importance of reporting paresthesias that may develop during the procedure and of avoiding sudden movements. Short excursion fingertip flexion/extension is explained to the patient and demonstrated.





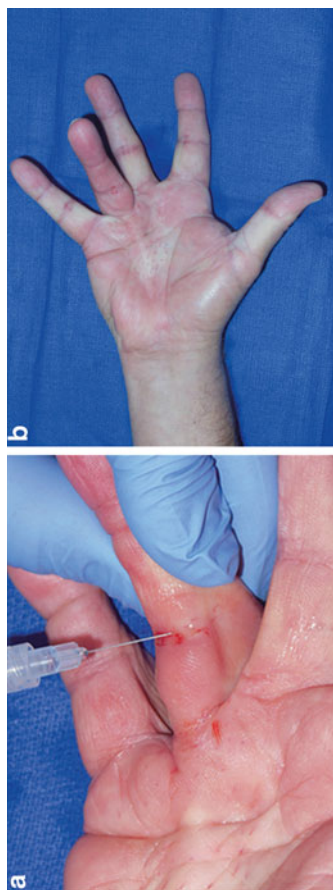
**Fig. 2.3** Dupuytren's contracture of *right* hand—2 months after needle aponeurotomy, (a) anterior-posterior view, (b) oblique view, (c) lateral view, (d) composite fist



**Fig. 2.4** Dupuytren's contracture of *right* hand—2 years after needle aponeurotomy, (a) anterior-posterior view, (b) lateral view, (c) composite fist

*Local anesthetic field block:* Sensory end organs of the skin are located in the deep dermis, but the subdermal fat, palmar aponeurosis, and cords are insensate. Digital nerves are sensitive to pressure or direct contact; joint capsules and flexor tendon sheaths are innervated as well [2]. Thus, vital structures are sensate and cords are not, allowing NA to be performed safely under local anesthesia. This also makes it imperative that just the skin overlying the cords is blocked by the local anesthetic injected, performing a superficial intradermal anesthetic injection only and carefully avoiding deeper injection that may block the digital nerves. It is critical that the subcutaneous tissues and underlying nerves are not blocked, since that would eliminate the ability of the nerves to respond to direct contact. As the NA procedure is performed, since it is a blind procedure that does not allow direct visualization of the digital nerves, the primary method by which one avoids injury to the underlying nerves is to rely on a Tinel's type of response from the nerve if the needle comes into contact or even just close proximity to the nerve. Report by the fully awake patient of Tinel's-like paresthesias would indicate that the needle is too close to the nerve, allowing the surgeon to redirect the needle to another location and avoid injury to the digital nerves. This is especially important in high-risk areas such as spiral cords at the base of fingers, where digital nerves can be displaced from their normal anatomical location.

To achieve the local dermal block, the upper extremity is prepped and draped in the usual sterile fashion. Under standard sterile and antiseptic conditions, the selected area is infiltrated with 1 % lidocaine (with 1:100,000 epinephrine) in a 3 ml syringe with a luer lock and a short 30-gauge needle in order to achieve the local dermal block. Infiltration pain can be reduced by buffering the local anesthetic with sodium bicarbonate. For precise surface anesthesia, 0.05–0.1 ml intradermal injections are infiltrated at multiple focal positions along the entire length of the cords targeted for release (Fig. 2.5). Despite careful technique, anesthetic diffusion can cause partial digital nerve block. Loss of light touch denoting complete digital nerve block may be an indication that the procedure may need to be aborted until such time that light touch returns. To minimize this possibility, some surgeons will advocate a progressive sequential local anesthetic injection approach, starting distally, releasing a portion of the cords distally, and then subsequent more



**Fig. 2.5** (a) Local anesthetic injection technique demonstrating intradermal injection. (b) Blanched skin demonstrating area injected with 1% lidocaine with 1:100,000 epinephrine

proximal local anesthetic injection in multiple stages. With this modification, the Tinel's sign response proximally can be preserved, even if the distal portion of the nerve is inadvertently blocked. No tourniquet is required for the procedure.

*Technique:* The needle aponeurotomy is performed with a hypodermic needle, with different surgeons preferring different gauged needles ranging in size from 25-gauge to 18 gauge. The smaller-25 gauge needle will typically be employed using a combination of perforation and sweeping maneuvers designed to weaken the cords, while a larger 18-gauge needle is more typically utilized as a percutaneous fasciotome in a windshield wiper back and forth fashion with the goal to create a transverse percutaneous fasciotomy. Treatment portals are best planned in areas of maximal bowstringing of cords, especially if the cords become more taut on joint extension [3]. Nodules are firm regardless of joint position and should be avoided unless directly contributing to the contracture and only if proven to be so after proximal and/or distal non-nodular cord segments are released [3]. Placing portals over flexor creases is not preferred due to the proximity of the flexor sheath and the increased likelihood of skin tears, although release at creases is sometimes necessary for successful release. Cords are tensioned, palpated, and pinched between the fingertips of the surgeon's non-dominant hand to stabilize the cord. Gentle skin traction is placed over the cords to accentuate the bowstringing of the cord, thus pulling the cord away from deeper structures. Extreme extension of the finger is avoided and the patient asked to relax the fingers to keep the flexor tendons slack, reducing the risk of inadvertent tendon injury. This is especially important at the volar aspect of the MP joint, where hyperextension of the MP joint brings the flexor tendons in close approximation to the overlying skin in the region of the distal palmar crease, placing the flexor tendons at greater risk for injury or even complete transection [3].

Fasciotomy portals are usually made equal to the cord width. Once the dermis is penetrated, the needle is oriented tangentially to create a plane between the dermis and cord. The needle tip is then reoriented perpendicular to the cord's longitudinal axis, with the bevel transverse to the cord. A repeated side-to-side sweeping movement is made with the needle tip to graze or scratch the cord.

If using a smaller 25-gauge needle, multiple perforations of the cord are also used to weaken the cord for subsequent manipulation/cord rupture at the end of the procedure. A constant proprioceptive feedback is obtained during the cord division. This is in the form of a gristly and firm feel with a concomitant scraping sound as the needle scratches through the cord. The needle is changed frequently to maintain sharpness. The end point of the fasciotomy at each point is reached when firm feedback at the needle tip stops, and further gentle probing yields a soft feel. A “trampoline” fingertip bouncing can also be used to assess the adequacy of the cord rupture [3].

Some surgeons prefer release that commences proximally and progresses distally to the MP and/or PIP joints, as required. Others prefer a distal-to-proximal technique. Portals are placed an average of 5 mm apart. Care is taken to remain central on the cord in order to avoid injury to the adjacent neurovascular bundles. Care is also taken to avoid going too deeply in order to avoid injury to the underlying flexor tendons and neurovascular structures, including superficial palmar arch and proximal branches of the median and/or ulnar nerves as they exit from the carpal and ulnar tunnels, respectively. Fingertip sensation to light touch stimulation is repeatedly checked throughout the procedure. Each pass with the needle is made deliberately, allowing the patient enough time to react. The slicing or perforating motion of the needle is stopped and the needle redirected immediately if the patient reports electric current sensation or the equivalent of a Tinel’s sign down the treated finger. Tendon proximity is checked regularly by leaving the needle in place and watching for the presence or absence of needle motion with short gentle active tendon excursion.

Areas of pitting are best avoided, since portal placement can transect a dimple sinus, with higher risk for multiple skin tears in close proximity. The skin at the depths of the pits is also likely not well anesthetized, causing pain. Spiral cords usually occur at the junction of the palm and the base of the finger; caution must be exercised in these areas since they can displace the neurovascular bundle superficially and centrally. Since the neurovascular bundles are embedded in subcutaneous fat, the presence of fat between the dermis and the cord should alert the surgeon to a displaced

neurovascular bundle. These areas should be avoided, if possible. Eaton describes the use of Doppler or ultrasound, especially in areas of a suspected spiral cord, to identify the neurovascular bundle [3]. The senior author does not generally use this in his practice, relying instead on Tinel's sign feedback. Finally, sometimes release of a radial or ulnar lateral cord does not result in full extension of the proximal interphalangeal joint (PIPJ). This may be secondary to a nonpalpable central extension of the cord. An additional release centrally, just proximal to the PIPJ flexion crease, usually completes the correction, although release in this area can carry higher risk for tendon injury since the central cord will often blend into the A3 pulley in this area. Some patients will also have independent PIP joint volar capsular contractures or relative shortening/tightening of the flexor tendon sheath specifically at the A3 pulley level, which may need to be addressed separately during the manipulation portion of the procedure.

*Final manipulation:* Once the cords have been adequately weakened/divided at multiple sites, the patient is tested in a formal fashion to confirm that all flexor tendons (individual testing of the flexor digitorum superficialis and profundus tendons going to each digit) and all individual digital nerves remain intact. Once so verified, the treated sites are injected with local anesthetic to achieve combined palmar and digital blocks that will allow forceful manipulation of the fingers without significant pain. Our preference is to use 0.5 % bupivacaine without epinephrine, while others prefer 1 % lidocaine instead. After good digital block and palmar anesthesia has been established, the fingers are passively stretched to achieve completion rupture of the cords and to break any residual tethering. The wrist should be flexed as the finger is being extended to minimize risk of tendon rupture [3]. Manipulation of the digits under local anesthesia also allows release of a tight flexor tendon sheath and/or PIP joint closed volar capsulotomy, as needed. Intra-articular local anesthetic injection of the PIP and MCP joints has been employed by some prior to the final manipulation, after all needle manipulations are completed. This enables the patient to tolerate a greater amount of force during the finger extension process to facilitate residual cord rupture, and enhance the results.

*Post-procedure:* Once all cords have been released, nodules and segmental areas of the released cords can be injected with depot corticosteroid such as triamcinolone acetate 10 mg/cc or betamethasone 6 mg/cc to minimize the risk of recurrence and to minimize the risk of a Dupuytren's flare reaction postoperatively. Skin tears are dressed with ample antibiotic ointment to prevent desiccation of underlying structures, nonadherent gauze (e.g., Xeroform gauze), and a light gauze bandage. Coverage with antibiotic ointment to prevent tissue desiccation is especially critical if there is any exposed tendon noted at the base of a skin tear. The patient is instructed to change the dressings after 48 h, and daily thereafter. Depending on the severity of the initial contracture, the hand may be placed in a volar short arm splint extending to the finger tips, with the involved digits placed at full extension. The patient is referred to hand therapy for active flexion and extension range of motion exercises and gentle passive extension stretching. Heavy grasping is deferred until the wounds have healed completely. Nighttime extension splinting is continued for 6–16 weeks.

## Literature Review

Dupuytren's contracture was first described by a Swiss physician—Felix Plater, in his book titled “Observationum in Hominis Affectibus” in 1614. Sir Henry Cline, in 1777, recognized the involvement of the palmar fascia and described the first treatment of this disease, which consisted of division of the pathologic cords, although he incorrectly conceptualized the underlying cause of the palmar fascia contracture as secondary to trauma to the underlying tendons [4]. Later in 1831, a French military surgeon—Baron Guillaume Dupuytren—described and operated on the palmar fibrosis that now takes his name [5]. The first closed percutaneous fasciotomy was performed by Cooper in 1822. The technique now bears his name—Coopers fasciotomy [3]. With the advent of anesthesia, Goyrand [6] introduced limited fasciectomy (LF); and Fergusson [7] introduced open fasciectomy (OF). Thereafter, surgery became more aggressive until the 1950s, when total palmar fasciectomy was popularized by McIndoe and Beare [8]. However,



the high complication rates associated with this technique forced surgeons to return to LF. J. Vernon Luck reestablished the concept of a percutaneous fasciotomy approach in 1959 with a specially designed percutaneous fasciotome (Luck fasciotome). It was not until 1972, however, that French rheumatologists Lermusiaux and Debeyre [9] reintroduced and repopularized the Cooper fasciotomy, but performed it using 25-gauge needles under local anesthesia. They called it *percutaneous needle fasciotomy* (PNF). The technique is now also called Needle Aponeurotomy (NA).

Currently, the four requirements to perform NA in Dupuytren's disease as described by Eaton [3] include (1) a contracture, secondary to a (2) palpable cord that lies beneath (3) redundant skin, in a (4) cooperative patient. It should not be performed in the absence of a palpable cord or overlying scarred tissue/skin, although prior surgery or scar tissue is not an absolute contraindication if there is still an appropriate and identifiable cord that can be safely released by NA. Needle aponeurotomy should not be performed on contractures not due to Dupuytren's disease, such as postsurgical scarring, PIP joint volar capsular contractures, scleroderma-related contracture, or burn scar contractures. It should also be performed with particular precaution in PIP joint contractures when there is a large nodule or cord between the PIPJ flexion crease and the proximal digital crease [10]. Finally, NA should never be performed in infiltrative disease, Dupuytren's diathesis, or constitutionally treatment-resistant Dupuytren's, since this will likely result in rapid recurrence [11]. Young age is a relative contraindication for NA, due to the high likelihood of recurrence and a relatively more aggressive disease presentation in the patient who presents at a younger age.

Several groups of surgeons and rheumatologists have reported the French experience with NA [12–15]. In 1993, Badois et al. performed NA in 138 patients and found that 81% had good or excellent primary results with a Tubiana Class I or II Dupuytren's contracture. In the group of patients with Tubiana stage IV disease, 48% had good results. There were no major complications, although there was skin tear in 16%, digital dysesthesia in 2%, and infection in 2% [12]. Bleton et al. documented the results of a prospective study of NA on 59 patients [13]. Sixty-one percent

of patients had a good result, with an improvement of more than 50 %. Lermusiaux et al. reported the results of a large experience with NA, with an improvement of over 70 % in 81 % of hands. The complication rate was 0.05 % for both tendon and digital nerve injuries [14]. Foucher et al. reported an average 79 % gain in extension for the MCP joints and 65 % for the PIP joints in their cohort of patients. All complications were minor, including skin tear in 4 %, temporary paresthesias in 2 %, and superficial infection in 1 % [15].

It should be noted that published studies on Dupuytren's contracture tend to use a variety of definitions of both correction of contracture and recurrence [10–18]. For instance, Hueston's definition for Dupuytren's contracture recurrence was the most widely accepted definition. Hueston used "appearance of new Dupuytren's tissue within the area cleared at operation" [19]. This definition, however, could not be utilized in NA treatment series, since tissue is never removed. This makes it difficult to compare the results of NA with other techniques. Older studies therefore never clearly defined recurrence in Dupuytren's disease [12–15]. Van Rijssen et al. redefined recurrence indirectly, as an increase of the total passive extension deficit of 30° or more in a ray [16]. A worsening of digital extension of 30° was chosen because it corresponds to the Hueston tabletop test and is considered the minimal contracture required to qualify for surgery. This measure is reproducible and clinically more relevant. The issue of recurrence of disease versus progression of disease in previously untreated areas of the hand is not necessarily well defined in the literature, as well.

Needle aponeurotomy has also been tried in recurrent Dupuytren's disease. Van Rijssen et al. performed a retrospective review of recurrent Dupuytren's disease (defined as total passive extension deficit (TPED) of at least 30° in one or more rays) in patients previously treated with NA or LF. Needle aponeurotomy was performed on all these patients. They found NA to be especially effective for the MCP joint, with an average improvement in TPED of 93 % at MP joints, compared to 57 % in PIP joints. They concluded that NA leads to good immediate results for both post-NA and post-LF recurrence. A secondary recurrence occurred in 50 % cases after 4.4 years on an average, and these were successfully treated with LF. By using NA at the first

recurrence, they were able to postpone the LF procedure by 2.9 years, and the LF was not more complicated than in cases of primary disease [20].

Needle aponeurotomy has several advantages over LF and OF, namely being able to be done in an office/ambulatory surgical setting; optimal return of hand function usually within a week post-procedure; and allows both hands to be treated fairly quickly and more safely in high-risk patients (e.g., those on anticoagulants or with significant medical comorbidities that increase risk of anesthesia) [3, 10]. Disadvantages of NA include more rapid and higher overall recurrence rate than with open surgery [10]. There is also an inability to correct skin shortage and to address severe or fixed capsular contractures of the PIP joint [10]. The NA technique itself does require good knowledge of the pathologic anatomy seen in Dupuytren's contracture, with a definite learning curve associated with its adoption and application by the treating surgeon, especially in the context of a blind procedure that places digital neurovascular structures at significant risk if the technique is not performed in a precise and cautious manner.

One of the few available randomized, controlled studies showed NA and LF to be similarly effective for contracture release in lower Tubiana stages (see Table 2.1) [16]. This report also demonstrated recovery after NA to be much faster than after LF. Compared to NA, limited fasciectomy has a cumulative complication rate of 19% [17]. Another disadvantage of LF is the relatively long recovery period of 21–58 days [18]. Despite these differences, many patients prefer NA over LF because it is minimally invasive and has a short recovery period [16].

**Table 2.1** Tubiana classification of Dupuytren's contracture of the fingers

Tubiana class	TPED (°)
I	0–45
II	46–90
III	91–135
IV	>135

*TPED* total passive extension deficit

In 2010, the U.S. Food and Drug Administration granted American approval for clinical use of injectable collagenase produced by the *Clostridium histolyticum* species. To date, clinical efficacy and safety of Dupuytren's treatment with collagenase has been demonstrated in two double-blind, placebo-controlled studies, the Collagenase Option for Reduction of Dupuytren's I and II trials [21, 22]. The CORD I study obtained clinical success in 130 of 203 patients (64%), with a mean of 1.7 injections required per affected joint to reach the desired end point of joint motion to within 0–5° of full extension [21]. A mean of 1.5 injections was required to achieve clinical success in 20 of 45 patients (44%) in the CORD II study [22]. In a recent review comparing NA to collagenase, Nydick et al. showed that short-term (3 months) clinical outcomes and patient satisfaction were equal. Both clinical success (defined as reduction of contracture to within 0–5° of normal) and mean reduction in contracture were similar between groups [23]. The number of required or recommended collagenase injections is not known and is currently being investigated. The optimum timing of post-injection manipulation after collagenase injection remains unanswered, although a number of treating physicians have manipulated the treated fingers as long as 1–2 weeks after the initial collagenase injection. Although NA can be accomplished during one office visit, as opposed to two office visits for the collagenase-treated patient, NA routinely requires more treatment time when compared with collagenase injection.

The three currently available techniques for treating Dupuytren's contracture, i.e., FA, NA, and collagenase, have been compared with regard to cost-effectiveness. Using a cost-effective treatment based on the traditional willingness-to-pay of \$50,000 per quality-adjusted life years (QALY) gained, Chen et al. showed that open partial fasciectomy is not cost-effective (\$820,114 per QALY gained over no treatment). Needle aponeurotomy is only cost-effective if the success rate is 100% (\$49,631 per QALY gained over no treatment). Collagenase injection is cost-effective when priced under \$945 per injection (\$49,995 per QALY gained over no treatment). However, if priced at market price of approximately \$5400 per injection, the cost was \$166,268 per QALY gained [24].

Finally, since during the initial NA, the cord is directly accessible, studies have been conducted to inject substances at the time

in order to augment the outcome of NA. Depot steroid injections such as triamcinolone acetonide (TA) and autologous fat transfers have shown promising results. To answer the question if steroid injections are beneficial at the time of NA, McMillan and Binhammer performed a randomized controlled study on 47 patients with DC. Patients were randomized to either receive TA injections immediately following, 6 weeks, and 3 months after the procedure, or not receive any injections. Injections were administered into the cords. Total active extension deficit (TAED) was measured at 6 months post-procedure. There was a statistically significant improvement in TAED in the steroid-injected group (87%), vs. the non-injected group (64%). They conclude that at least in the short term (6 months), steroid injections improve NA outcomes. The authors also report subjective observation of fat survival, which is both palpable and visible between the skin and the released cords. They theorize that fat grafts help to decrease adhesions and separate strands of cord scar in the hand. The study did have some limitations. The short follow-up period of 6 months is not adequate to judge the long-term effectiveness of their technique. Furthermore, the baseline TAED was  $103^{\circ}$  in the steroid-injected group vs.  $80^{\circ}$  in the non-injected group. The result of increase in percentage of correction could well have been due to the greater potential for correction in the steroid-injected group. Although steroid injection may prove to be a promising adjunct to NA, longer-term studies with equivalent cohorts are therefore needed [25].

Hovius et al. reported their experience of 91 patients (99 hands) where a novel combination of percutaneous release with percutaneous autologous fat grafting was performed. The procedure consists of an extensive percutaneous aponeurotomy that completely disintegrates the cord and separates it from the dermis. Subsequently, the authors injected the subcutaneous plane of dissection with autologous lipoaspirate obtained by liposuction. Patients were placed in an extension splint for 1 week and continued with nighttime splinting for 3–6 months. The average contracture at the proximal interphalangeal joint improved significantly from  $61^{\circ}$  to  $27^{\circ}$ , and contracture at the MCP joint improved from  $37^{\circ}$  to  $-5^{\circ}$ . Ninety-four percent of patients returned to normal use of the hand

within 2–4 weeks and 95% were very satisfied with the result. No new scars were added, and a supple palmar fat pad was mostly restored [26]. Thus, preliminary results appear to support autologous fat and steroid injections to augment NA outcomes. It seems likely that combinations of surgery, needle aponeurotomy, collagenase, steroids, and fat grafting will be the future of treatment for Dupuytren's contracture. Much work needs to be still done to clarify the best indications and combinations of these treatment modalities.

## **Clinical Pearls/Pitfalls**

1. Precision superficial infiltration of local anesthetic limited to just the skin overlying the cords and not deeper structures, in order to prevent digital nerve block.
2. Abort the procedure if light touch is lost due to local anesthetic diffusion and inadvertent digital nerve block.
3. Use an appropriate needle size, based on surgeon preference, ranging from 25 gauge to 18 gauge needle.
4. Needle tip is placed perpendicular to the cord's longitudinal axis, with the bevel transverse to the cord.
5. Change needle frequently to maintain sharpness.
6. A windshield wiper back and forth slicing motion used for larger gauge needles; perforating technique for smaller gauge needles.
7. Fasciotomy portals placed at areas of maximal bowstringing of the contracture cords.
8. Avoid flexor creases or pits.
9. Avoid forceful hyperextension of fingers to tense cords, especially when releasing at the MP joint (distal palmar crease) level.
10. Monitor constantly for proprioceptive feedback.
11. Stop if patient complains of paraesthesias or resistance to the needle tip stops.
12. Release is commenced either proximally and progressing distally to the MP and/or PIP joints, or vice versa, based on surgeon preference.

13. Portals are placed an average of 5 mm apart.
14. Care is taken to remain central on the cord.
15. Fingertip sensitivity is checked repeatedly.
16. Each move is made deliberately, allowing the patient enough time to react with a possible Tinel's sign type of response that would indicate close proximity to the nerve.
17. Tendon proximity is checked regularly with short gentle active tendon excursion.
18. Once the cord has been adequately weakened/divided at multiple sites, the finger is passively stretched under local anesthesia to achieve completion rupture of the cords.
19. After final manipulation, nodules can be injected with depot corticosteroid.
20. Skin tears are dressed with ample antibiotic ointment.
21. Aggressive active/passive range of motion exercises with or without supervised hand therapy commenced as soon as possible.
22. Nighttime extension splinting continued for 6–16 weeks.

## References

1. Shih B, Bayat A. Scientific understanding and clinical management of Dupuytren disease. *Nat Rev Rheumatol*. 2010;6:715–26.
2. Schultz RJ, Krishnamurthy S, Johnston AD. A gross anatomic and histologic study of the innervation of the proximal interphalangeal joint. *J Hand Surg*. 1984;9A:669–74.
3. Eaton C. Percutaneous fasciotomy for Dupuytren's contracture. *J Hand Surg*. 2011;36A:910–5.
4. Cline H. Notes on pathology. London: St. Thomas's Hospital Medical School Library; 1777. p. 185.
5. Elliot D. The early history of contracture of the palmar fascia. *J Hand Surg*. 1988;13B:246–53.
6. Goyrand G. Nouvelles recherches sur la rétraction permanente des doigts. *Gazette Medicale Paris*. 1883;3:481–6.
7. Fergusson W. A system of practical surgery. London: Churchill; 1842.
8. McIndoe AH, Beare RL. The surgical management of Dupuytren's contracture. *Am J Surg*. 1958;95:197–203.
9. Lermusiaux JL, Debeyre N. Le traitement médical de la maladie de Dupuytren. *Rhumatologique*. Paris: Expansion Scientifique; 1979. p. 338–43.

10. Van Rijssen AL, Gerbrandy FSJ, Linden HT, Klip H, Werker PMN. A comparison of the direct outcomes of percutaneous needle fasciotomy and limited fasciectomy for Dupuytren's disease: a 6-week follow-up study. *J Hand Surg.* 2006;31A:717–25.
11. Degreef I, De Smet L. Risk factors in Dupuytren's diathesis: is recurrence after surgery predictable? In: Degreef I, editor. *Therapy resisting Dupuytren's disease. New perspectives in adjuvant treatment.* Leuven: Katholieke Universiteit; 2009. p. 50–5.
12. Badois FJ, Lermusiaux C, Masse C, Kuntz D. Nonsurgical treatment of Dupuytren disease using needle fasciotomy. *Rev Rhum Engl Ed.* 1993; 60:692–7.
13. Bleton R, Marcireau D, Almot J-Y. Treatment of Dupuytren disease by percutaneous needle fasciotomy. In: Saffer P, Amadio PC, Foucher G, editors. *Current practice in hand surgery.* London: Martin Dunitz; 1997. p. 187–93.
14. Lermusiaux JL, Lellouche H, Badois F, Kuntz D. How should Dupuytren contracture be managed in 1997? *Rev Rhum Engl Ed.* 1997;64:775–6.
15. Foucher G, Medina J, Navarro R. Percutaneous needle aponeurotomy: complications and results. *J Hand Surg.* 2003;28B:427–31.
16. Van Rijssen AL, Ter Linden H, Werker PM. 5-year results of randomized clinical trial on treatment in Dupuytren's disease: percutaneous needle fasciotomy versus limited fasciectomy. *Plast Reconstr Surg.* 2012; 129:469–77.
17. McFarlane RM, McGrouther DA. Complications and their management. In: McFarlane RM, McGrouther DA, Flint M, editors. *Dupuytren's disease: biology and treatment.* Edinburgh: Churchill Livingstone; 1990. p. 377–82.
18. Rodrigo JJ, Niebauer JJ, Brown JL, Doyle JR. Treatment of Dupuytren's contracture. Long-term results after fasciotomy and fascial excision. *J Bone Joint Surg.* 1976;58A:380–7.
19. Hueston JT. Current state of treatment of Dupuytren's disease. *Ann Chir Main.* 1984;3:81–92.
20. Van Rijssen AL, Paul MN, Werker MN. Percutaneous needle fasciotomy for recurrent Dupuytren disease. *J Hand Surg.* 2002;37A:1820–3.
21. Hurst LC, Badalamente MA, Hentz VR, et al. Injectable collagenase clostridium histolyticum for Dupuytren's contracture. *N Engl J Med.* 2009;361(3):968–79.
22. Gilpin D, Coleman S, Hall S, Houston A, Karrasch J, Jones N. Injectable collagenase clostridium histolyticum: a new nonsurgical treatment for Dupuytren's disease. *J Hand Surg Am.* 2010;35(12):2027–38.
23. Nydick JA, Olliff BW, Garcia MJ, Hess AV, Stone JD. A comparison of percutaneous needle fasciotomy and collagenase injection for Dupuytren Disease. *J Hand Surg Am.* 2013;38(12):2377–80.
24. Chen NC, Shauver MJ, Chung KC. Cost-effectiveness of open partial fasciectomy, needle aponeurotomy and collagenase injection for Dupuytren Contracture. *J Hand Surg.* 2011;36A:1826–34.



25. McMillan C, Binhammer P. Steroid injection and needle aponeurotomy for Dupuytren contracture: a randomized, controlled study. *J Hand Surg.* 2012;37A:1307–12.
26. Hovius SE, Kan HJ, Smit X, Selles RW, Cardoso E, Khouri RK. Extensive percutaneous aponeurotomy and lipografting: a new treatment for Dupuytren disease. *Plast Reconstr Surg.* 2011;128:221–8.

Dupuytren's Contracture

A Clinical Casebook

Rizzo, M. (Ed.)

2016, XIII, 273 p. 122 illus., 115 illus. in color., Softcover

ISBN: 978-3-319-23840-1