

Dupuytren's Contracture

An Evidence Based Review

Juan Rodolfo Mella, MD, MPH,* Lifei Guo, MD, PhD,* and Virginia Hung, MD†

Abstract: Dupuytren's contracture, a benign condition characterized by fibrosis of the palmar and digital fascia, may be a debilitating condition that limits daily function. Several techniques exist for managing symptomatic contractures of the hand related to Dupuytren's. These techniques include the more invasive open fasciotomy or fasciectomy. More recently, less invasive techniques including administration of collagenase *Clostridium histolyticum* (CCH) or percutaneous needle aponeurotomy (PNA) have become part of the treatment armamentarium. A comprehensive review of the literature is performed and an algorithm for management of Dupuytren's contracture is proposed.

Key Words: Dupuytren's, percutaneous needle aponeurotomy, fasciectomy

(*Ann Plast Surg* 2018;81: S97–S101)

Initially described by Sir Henry Cline in 1777 and in more detail shortly thereafter by his pupil Sir Astley Cooper in 1822, contracture of the hand and fingers due to a pathologic process of the superficial palmar fascia has the potential to cause significant disability.¹ Guillaume Dupuytren elucidated the nature of this pathologic process 10 years later in 1831. Coining this benign fibro-proliferative process "Dupuytren's disease," its pathology is focused in the palmar fascia of the hand and digits. While the pathologic basis has not been fully described, a working theory suggests that a compensatory inflammatory response to mechanical forces may be responsible.² This response alters several molecular pathways that contribute to the release of inflammatory cytokines such as TGF- β , alteration of fibroblast gene expression, down-regulation of genes encoding extracellular matrix, and disruption of normal wound healing processes by production of elevated concentrations of type III collagen.^{3,4}

Occurring predominantly in older men of European descent, it is an inheritable condition that is autosomal dominant with variable penetrance. This incurable condition is associated with other conditions including alcohol consumption, diabetes mellitus, age, and occupational exposure to vibration.^{5–7}

When affected, patients with Dupuytren's will have alterations of normal fascial bands of the hand. First, nodules will form as a result of myofibroblasts influx and increased type III collagen deposition. This can progress to pathologic cord formation, which may ultimately lead to symptomatic contractures. Tubiana developed a classification system in an effort to clinically classify severity of these nodules and cords.⁸ Staging is based on degree of contracture or extension deficits with stage 1 being the most benign form and stage 4 the most advanced (Table 1).

On presentation, ulnar digits tend to be affected more commonly. Long and ring fingers have the highest incidence of developing contractures while the thumb and index fingers are least likely to be affected. It is important to assess not only the quality of glabrous skin as it is often

tethered to the underlying fibrosed fascia, but also type and location of cords, nodules and severity of contractures. Patients will tend to have critical cord contractures at specific thresholds. According to Raymond, metacarpophalangeal (MCP) joint contracture of 53° and proximal interphalangeal (PIP) joint contracture of 77° will result in critical impairment of the hand.⁹ Performing a Hueston's table-top test that demonstrates a patient's inability to place fingers flat on a table may assist with evaluating the need for surgery. While intervening on symptomatic contractures that impair hygiene or limit function of the hand are relative indications for intervention, a flexure contracture of 30° at the MCP joint or 15° at the PIP joint are representative values that serve as a threshold for surgery.¹⁰ Lastly, appreciating ectopic disease such as Garrod's pads, Ledderhose disease, or Peyronie's disease could also influence management.

A variety of treatment options exist in treating Dupuytren's disease. Non-operative means of managing this condition, such as ultrasound, radiation, and oral medications including tamoxifen, colchicine and interferon have all been used without dependable outcomes.¹¹ Therefore, procedure based modalities are generally used to handle symptomatic contractures. These range from less invasive collagenase injections and percutaneous aponeurotomy to more invasive open fasciotomy and limited or radical fasciectomy. Each modality has advantages and disadvantages (Table 2).

There is no consensus recommending one specific intervention over others. Instead, a decision is made with the patient that is multifactorial and based on disease severity, patient preferences, risk of complications, concern for recurrence, cost effectiveness, and surgeon skill level. It is important to note that performing any of these techniques will not cure the disease but rather treat and temporize hand function limitations.

TREATMENT MODALITIES

Surgery has traditionally been considered the standard of care and only option for the management of Dupuytren's disease. Limited fasciectomy is the most commonly performed operation for such contractures. Excising diseased fascia of affected digits and palm is very effective at treating contractures with a relatively low long-term recurrence rate. Using this modality, Van Rijssen treated MCP contractures with a mean pretreatment MCP contracture of 41° to less than 5° at 6 week follow up with a 94% success rate. Management of PIP joint contractures resulted in 47% of joints treated successfully with a reduction to passive extension deficit of 0–5°; 77% of those undergoing limited fasciectomy did not develop recurrence of contractures at 5 year follow up.¹² Trickett demonstrated similar findings with 82% correction of the joint contracture at the MCP joint and 44% correction at the PIP joint by excising central cords.¹³ Overall complications for limited fasciectomy range from 3.9 to 39.1%. Adverse events related to limited fasciectomy include wound healing complications, complex regional pain syndrome, injury to the digital neurovascular bundle, infection, and hematoma.¹⁴ Utilizing the McCash technique, a variant of limited fasciectomy that incorporates use of transverse incisions and leaving them open to allow skin to heal by secondary intention reduces hematoma formation, negates the need for skin grafting, and allows for earlier return to work.¹⁵

Received June 18, 2018, and accepted for publication, after revision June 27, 2018.
From the *Department of Plastic, Reconstructive and Hand Surgery, Lahey Hospital and Medical Center, Burlington, Massachusetts; and †Dexterity Surgical, Winchester Hospital, Winchester, MA.

There are no conflicts of interest. We have no disclosures.

Reprints: Virginia Hung, MD, Lahey Hospital and Medical Center 100 Unicorn Park, Suite 102, Woburn, MA 01801. E-mail: vhung@hotmail.com.

Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.

ISSN: 0148-7043/18/8106–0S97

DOI: 10.1097/SAP.0000000000001607

TABLE 1. Tubiana's Staging of Dupuytren's Contracture

Stage	Extension Deficit
0	0, no disease
N	0, presence of nodules
I	1–45
II	46–90
III	91–135
IV	>135

More aggressive means of management such as radical fasciectomy and dermatofasciectomy have fallen out of favor. Radical fasciectomy involves extensive excision of both diseased and normal fascia. Dermatofasciectomy requires excision of diseased fascia overlying tethered skin. Neither modality has proven to be superior to limited fasciectomy. Moreover, complications rates are higher and oftentimes require the need for skin grafting and a prolonged post-operative rehabilitation course.

Fasciotomy, a procedure that results in division of pathologic cords without excising them, is a less invasive means of managing this disease without formally removing fascia. This may be performed using an open or percutaneous technique. The open technique requires small transverse incisions, approximately 1–1.5 cm with sharp division of the cord. Theoretically, the recurrence rate is higher relative to fasciectomy; however, this has not been conclusively reported. Stewart demonstrated complete intra-operative contracture release in 93% of cases using the open fasciotomy technique with only 13.5% reoperation rate 46 months later.¹⁶

Claiming that utilizing a percutaneous technique for treating Dupuytren's contracture minimized infections in an era when antibiotics had not yet been established, Astley Cooper advocated for this approach. Two hundred years later, this minimally invasive approach has started to regain acceptance. Percutaneous needle

aponeurotomy (PNA) is performed in an office setting under local analgesia. According to Eaton, a cooperative patient must have a contracture caused by a palpable cord deep to redundant skin in order for a patient to achieve optimal results using this approach.¹⁷ A small hypodermic needle is introduced into the cord, used as a scalpel to violate the integrity of the cord resulting in fragmentation and thus weakening the cord. Manipulating the finger after this step results in cord rupture. Tens to hundreds of perforations may be required to release each cord. Foucher evaluated this technique in a series of 311 MCP joint and PIP joint contractures. They found that this technique was more effective in treating MCP joint contractures with a mean contracture decrease from 65° to 15°.¹⁸ Figure 1 demonstrates the dramatic immediate results appreciated with PNA. The major complication is digital nerve injury associated neuropraxia and prolonged numbness; tendon rupture, skin tears, complex regional pain syndrome were others.^{17,19–21} Moreover, fat may be harvested from the flanks or abdominal wall and grafted into the subcutaneous plane in aliquots of up to 10 mL per ray in an effort to reduce recurrence and softens the scar and overlying skin following extensive PNA.²²

An alternative minimally invasive approach to managing Dupuytren's contracture is with the use of collagenase Clostridial histolyticum (Xiaflex-Auxilium Pharmaceuticals, Inc., Malvern PA). Approved by the FDA in 2010 for the management of Dupuytren's, CCH is composed of two different enzymes that soften and degrade collagen. Manipulation of the finger a day after injection should result in cord rupture. Manipulation can be extended out to a week following injection. This technique can be repeated on the same cord up to three times over the course of 3 months. It produces comparable results to limited fasciectomy with improved effectiveness when administered to the MCP joint compared to PIP joint contractures. Hurst demonstrated that treatment with collagenase resulted in MCP contracture improvement to 0–5° in 77% of MCP joint contractures and 40% of PIP joint contractures.^{23,24} Follow up data revealed that recurrence with

TABLE 2. Advantages and Disadvantages of the Various Invasive Treatment Modalities for Management of Dupuytren's Disorder

Procedure	Advantages	Pitfalls
Dermatofasciectomy	Effective for severe disease including skin	Moderate peri-operative morbidity Potential need for skin grafting Increased complication rate Prolonged rehabilitation Higher cost (\$3,000–10,000)
Limited fasciectomy	Effective for moderate to severe disease Removes diseased fascia Decreases recurrence rate Increases time before recurrence	Moderate peri-operative morbidity Higher cost (\$3,000–10,000) Longer recovery time Rehabilitation process Increased scarring
Open fasciotomy	Moderately invasive Improved visualization Low complication rate	Diseased tissue is not excised Recurrence is higher than fasciectomy
Percutaneous needle aponeurotomy	Minimally invasive Quick recovery Cost effective (Medicare \$325) Performed in outpatient center Local anesthesia	Does not remove diseased tissue Steep learning curve Skin tears Higher long term recurrence rate Less effective for severe disease
Collagenase Clostridium histolyticum (Xiaflex)	Minimally invasive Low risk of complications	Costly (\$3,000–5,000) Can only perform on a single cord May require multiple procedures Limited information for long term More follow up

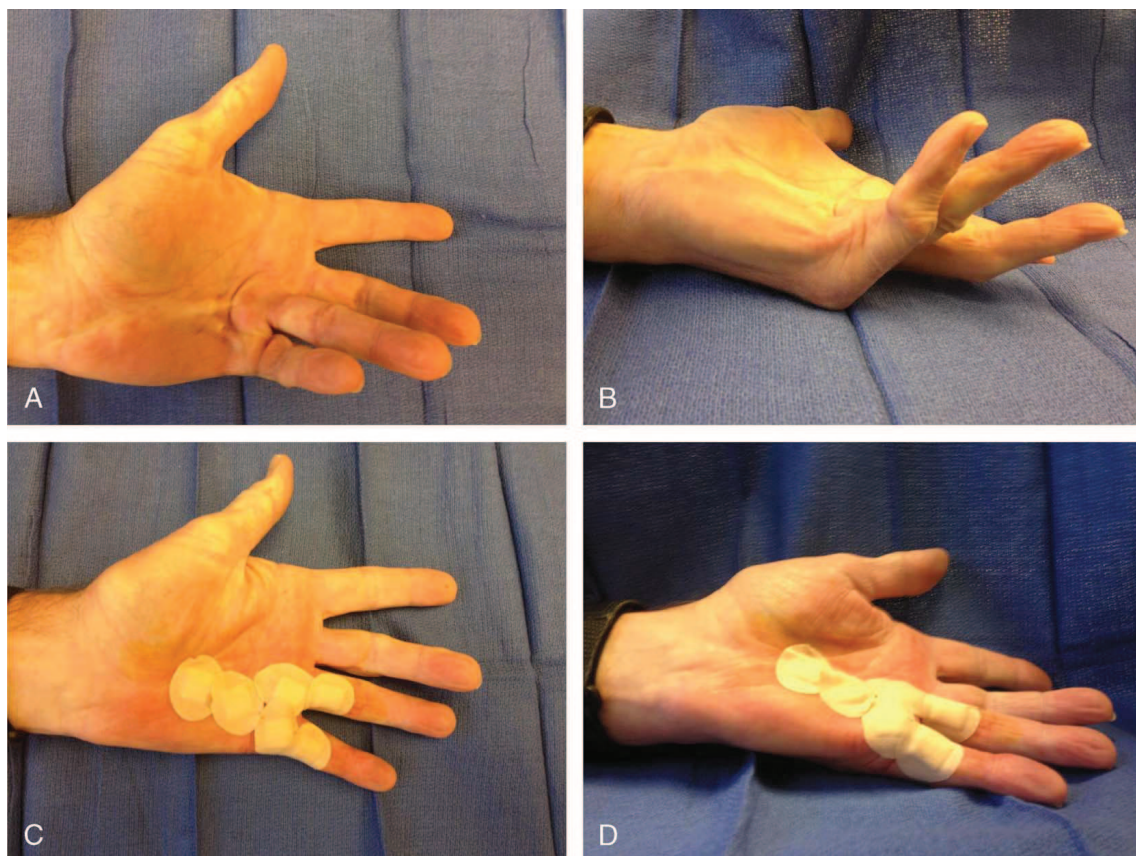


FIGURE 1. Moderate Dupuytren's contracture of the small and ring finger metacarpals before treatment. (A) AP view and (B) lateral view. Immediate results following an office based percutaneous needle aponeurotomy treatment (C) AP view and (D) lateral view.

contracture recurring at greater than 20° was 35% at 3 years and 47% at 5 years.²⁵ The most common complications related to collagenase injection include localized swelling, pain and bruising, pruritis, tenderness and transient lymphadenopathy and less commonly complex regional pain syndrome and tendon rupture.²⁶

STEPWISE APPROACH TO MANAGING DUPUYTREN'S CONTRACTURE

Many factors need to be taken into consideration when proposing a treatment plan for patient who carries a new diagnosis of Dupuytren's. It is vital that patients with Dupuytren's are educated and acquire a clear understanding of the progressive nature of this disease. They must be made aware of the various treatment modalities as well as the short and long-term implications of undergoing any of the various methods of treatment. These factors are summarized in Table 3. The HANDGUIDE Study, a European multidisciplinary consensus that aids in determining treatment strategies for hand disorders, has evaluated many of these similar factors in an effort to assist patients in making a well informed decision regarding their personal management.²⁷

No standard consensus exists when it comes to tailoring management of Dupuytren's disease to the individual patient since the newer

minimally invasive treatment modalities have come in to vogue. While numerous studies evaluated the management of Dupuytren contractures, there are no long-term prospective trials comparing outcomes of the three modalities to each other (fasciectomy, PNA, and CCH). Van Rijssen compared limited fasciectomy to percutaneous fasciotomy at 6 weeks appreciating that there was no difference in passive extension deficit for patients with Tubiana stage I or II. However, passive extension deficit was significantly improved in those with advanced Tubiana staging who underwent fasciectomy. Complication rates were higher when fasciectomy was performed. Meanwhile, patient comfort and hand function was higher for those who underwent PNA.¹² Re-evaluation of this study group at 5 years, demonstrated that contracture recurrence was significantly higher in those who underwent PNA compared to managed by fasciectomy. It was concluded that PNA is a reasonable treatment strategy for elderly patients or those willing to trade off a high recurrence rate for a minimally invasive approach that results in less pain and reduction in complication rates.⁹ Surveys weighing patient preferences regarding the various factors have yielded mixed results depending on patient populations examined.²⁸

Comparing PNA to CCH, Nydick demonstrated in a retrospective review that patient satisfaction, passive extension deficits, and complications were comparable when patients were randomized to PNA

TABLE 3. Factors that Should be Considered Prior to Managing Symptomatic Dupuytren's Contracture

Patient Related Factors	Disease Related Factors	Intervention Related Factors
Age	Presence of palpable cord	Cost
Comorbidities	Contracture severity	Surgeon experience
	Cutaneous involvement	Post-operative recovery/rehab

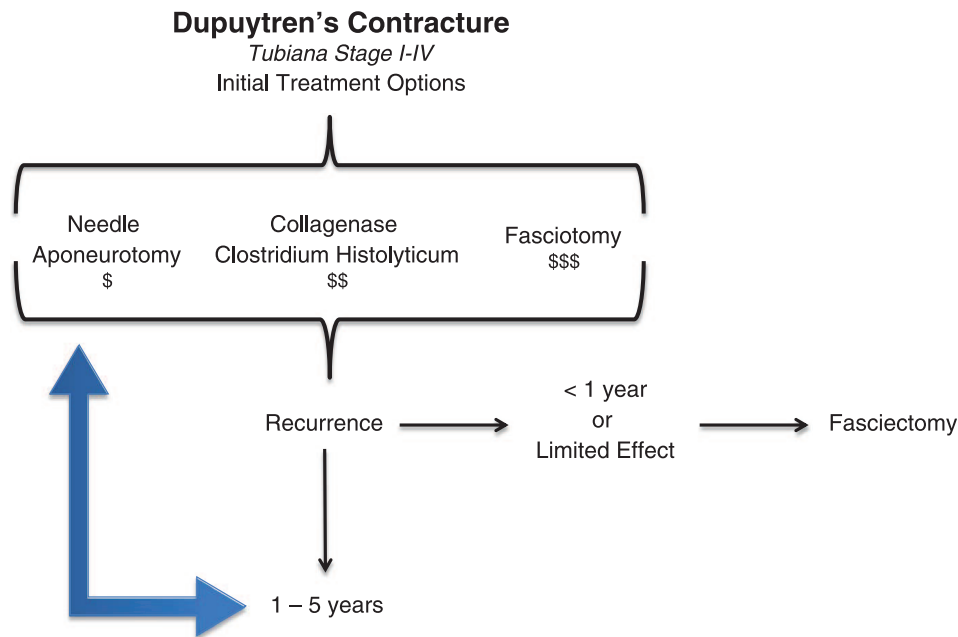


FIGURE 2. Algorithm for the management of symptomatic Dupuytren's contracture.

versus CCH injection in the short term.²⁹ More recent outcomes comparing the effectiveness of PNA and CCH were evaluated in daily practice at various practice locations. Using propensity score matching, it was demonstrated that effectiveness of reducing MCP and PIP contractures using both techniques was similar. This was further corroborated by the results of the Michigan Hand Score Questionnaire (MSQ) that showed similar improvement in effectiveness of each treatment strategy. While no serious complications were appreciated in either group, those managed with CCH experienced increased peripheral edema, transient pain, and bruising. Moreover, both groups experienced a similar incidence of skin fissures and sensory disturbances.³⁰ Lymphadenopathy has been an additional reaction in those managed with CCH. Furthermore, only two randomized trials have compared the two minimally invasive approaches both of which suggest that efficacy is similar.^{31,32}

One more important consideration in deciding treatment course of Dupuytren's disease is the cost to healthcare, the patient, and society. Cost-effectiveness has been analyzed in various models supporting non-surgical approaches. Although the cost of each depends on geographic location, managing a patient with PNA is less costly given the low material costs compared to CCH. Moreover, patients treated with CCH may require multiple office visits and as a result, time away from work. These models have demonstrated that PNA is the more cost effective option of the two minimally invasive approaches and thus recommended over collagenase especially if the success rate is high.^{33,34} The DETECT Trial, a prospective randomized control trial comparing the effectiveness and cost between the three main treatment modalities (LF, PNA, and CCH) will be able to provide further evidence that will help determine the most optimal strategy for the patient with Dupuytren's disease.³⁵

Based on the literature presented, we have proposed a simplified algorithm incorporating patient, disease, and intervention related factors to assist in the decision making process (Fig. 2). This treatment plan recommends pursuing a minimally invasive approach prior to considering open fasciotomy. Should recurrence occur more than 1 year following a minimally invasive approach, we recommend returning to a minimally invasive approach for further treatment. However, should the patient develop an aggressive or rapid (less than 1 year from initially treatment) recurrence, the patient would likely benefit from an open operative approach instead of a minimally invasive one.

CONCLUSION

Hand surgeons should have a thorough understanding of the various treatment modalities for the management of Dupuytren's disease. While treatment can range from invasive surgical excision to minimally invasive pathologic cord rupture, it is recommended that the surgeon tailor management to the patient's preferences. Determining the patient's life limiting factors, evaluating disease severity, and functional recovery are critical in the decision making process. It is important that this patient population be counseled regarding the progressive nature of this disease at the initial presentation given that current interventions for management of Dupuytren's contractures manage symptoms rather than eradicate the disease when developing a long-term treatment algorithm. A stepwise approach should be considered in an attempt to alleviate symptomatology. Beginning with mechanical rupture with needle aponeurotomy or chemical rupture with collagenase should be considered especially in the setting of mild to moderate disease or in an elderly patient with comorbidities. Aggressive disease or rapid recurrence following minimally invasive management could be treated with a minimally invasive approach or limited fasciotomy. Furthermore, the role of fat grafting, Botox and radiotherapy for the management of Dupuytren's as well as Xiaflex for the treatment of nodules are in the process of being explored.^{22,36-38} More evidence is needed to determine the optimal approach to managing Dupuytren's disorder.

REFERENCES

- Hutchison RL, Rayan GM. Astley Cooper: his life and surgical contributions. *J Hand Surg Am.* 2011;36:316-320.
- Eaton C. Evidence-based medicine: Dupuytren contracture. *Plast Reconstr Surg.* 2014;133:1241-1251.
- Krause C, Kloen P, Ten Dijke P. Elevated transforming growth factor β and mitogen-activated protein kinase pathways mediate fibrotic traits of Dupuytren's disease fibroblasts. *Fibrogenesis Tissue Repair.* 2011;4:14.
- Satish L, LaFramboise WA, O'Gorman DB, et al. Identification of differentially expressed genes in fibroblasts derived from patients with Dupuytren's contracture. *BMC Med Genomics.* 2008;23:1-10.
- Lucas G, Brichet A, Roquelaure Y, et al. Dupuytren's disease: personal factors and occupational exposure. *Am J Ind Med.* 2008;51:9-15.
- Palmer KT, D'Angelo S, Syddall H, et al. Dupuytren's contracture and occupational exposure to hand-transmitted vibration. *Occup Environ Med.* 2014;71:241-245.

7. Broekstra DC, Groen H, Molenkamp S, et al. A systematic review and meta-analysis on the strength and consistency of the associations between Dupuytren disease and diabetes mellitus, liver disease, and epilepsy. *Plast Reconstr Surg.* 2018;141:367e–379e.
8. Tubiana R. Evaluation of deformities in Dupuytren's disease. *Ann Chir Main.* 1986;5:5–11.
9. Raymond A, Parry M, Amirfeyz R. Critical angles of deformity in Dupuytren's contracture of the little and ring fingers. *Hand Surg.* 2015;20:290–297.
10. Mafi R, Hindocha S, Khan W. Recent surgical and medical advances in the treatment of Dupuytren's disease—a systematic review of the literature. *Open Orthop J.* 2012;6:77–82.
11. Denkler KA, Vaughn CJ, Dolan EL, et al. Evidence-based medicine: options for Dupuytren's contracture: incise, excise, and dissolve. *Plast Reconstr Surg.* 2017;139:240e–255e.
12. van Rijssen AL, ter Linden H, Werker PM. Five-year results of a randomized clinical trial on treatment in Dupuytren's disease: percutaneous needle fasciotomy versus limited fasciectomy. *Plast Reconstr Surg.* 2012;129:469–477.
13. Trickett RW, Savage R, Logan AJ. Angular correction related to excision of specific cords in fasciectomy for Dupuytren's disease. *J Hand Surg Eur Vol.* 2014;39:472–476.
14. Denkler K. Surgical complications associated with fasciectomy for Dupuytren's disease: a 20-year review of the English literature. *Eplasty.* 2010;10:e15.
15. Mccash CR. The open palm technique in Dupuytren's Contracture. *Br J Plast Surg.* 1964;17:271–280.
16. Stewart CJ, Davidson DM, Hooper G. Re-operation after open fasciotomy for Dupuytren's disease in a series of 1,077 consecutive operations. *J Hand Surg Eur Vol.* 2014;39:553–554.
17. Eaton C. Percutaneous fasciotomy for Dupuytren's contracture. *J Hand Surg Am.* 2011;36:910–915.
18. Foucher G, Medina J, Navarro R. Percutaneous needle aponeurotomy: complications and results. *J Hand Surg Br.* 2003;28:427–431.
19. Herrera FA, Mitchell S, Elzik M, et al. Modified percutaneous needle aponeurotomy for the treatment of Dupuytren's contracture: early results and complications. *Hand (N Y).* 2015;10:433–437.
20. van Rijssen AL, Gerbrandy FS, Ter Linden H, et al. 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 Am.* 2006;31:717–725.
21. Pess GM, Pess RM, Pess RA. Results of needle aponeurotomy for Dupuytren contracture in over 1,000 fingers. *J Hand Surg Am.* 2012;37:651–656.
22. Hovius SER, Kan HJ, Smit X, et al. Extensive percutaneous aponeurotomy and lipografting: a new treatment for Dupuytren disease. *Plast Reconstr Surg.* 2011;128:221–228.
23. Hurst LC, Badalamente MA, Hentz VR, et al. Injectable collagenase clostridium histolyticum for Dupuytren's contracture. *N Engl J Med.* 2009;361:968–979.
24. Peimer CA, Blazar P, Coleman S, et al. Dupuytren contracture recurrence following treatment with collagenase clostridium histolyticum (CORDLESS study): 3-year data. *J Hand Surg Am.* 2013;38:12–22.
25. Peimer CA, Blazar P, Coleman S, et al. Dupuytren contracture recurrence following treatment with collagenase Clostridium histolyticum (CORDLESS [Collagenase Option for Reduction of Dupuytren Long-Term Evaluation of Safety Study]): 5-year data. *J Hand Surg Am.* 2015;40:1597–1605.
26. Morhart M. Pearls and pitfalls of needle aponeurotomy in Dupuytren's disease. *Plast Reconstr Surg.* 2015;135:817–825.
27. Huisstede BM, Hoogvliet P, Coert JH, et al. Dupuytren disease: European hand surgeons, hand therapists, and physical medicine and rehabilitation physicians agree on a multidisciplinary treatment guideline: results from the HANDGUIDE study. *Plast Reconstr Surg.* 2013;132:964e–976e.
28. Kan HJ, de Bekker-Grob EW, van Marion ES, et al. Patients' preferences for treatment for Dupuytren's disease: a discrete choice experiment. *Plast Reconstr Surg.* 2016;137:165–173.
29. Nydick JA, Olliff BW, Garcia MJ, et al. A comparison of percutaneous needle fasciotomy and collagenase injection for Dupuytren disease. *J Hand Surg Am.* 2013;38:2377–2380.
30. Zhou C, Hovius SER, Pieters AJ, et al. Comparative effectiveness of needle aponeurotomy and collagenase injection for Dupuytren's contracture: a multicenter study. *Plast Reconstr Surg Glob Open.* 2017;5:e1425.
31. Strömberg J, Ibsen-Sørensen A, Fridén J. Comparison of treatment outcome after collagenase and needle fasciotomy for Dupuytren contracture: a randomized, single-blinded, clinical trial with a 1-year follow-up. *J Hand Surg Am.* 2016;41:873–880.
32. Scherman P, Jenmalm P, Dahlin LB. One-year results of needle fasciotomy and collagenase injection in treatment of Dupuytren's contracture: a two-centre prospective randomized clinical trial. *J Hand Surg Eur Vol.* 2016;41:577–582.
33. Chen NC, Shauver MJ, Chung KC. Cost-effectiveness of open partial fasciectomy, needle aponeurotomy, and collagenase injection for Dupuytren contracture. *J Hand Surg Am.* 2011;36:1826–1834.e32.
34. Baltzer H, Binhammer PA. Cost-effectiveness in the management of Dupuytren's contracture. A Canadian cost-utility analysis of current and future management strategies. *Bone Joint J.* 2013;95-B:1094–1100.
35. Räisänen MP, Karjalainen T, Göransson H, et al. Dupuytren Treatment Effectiveness Trial (DETECT): a protocol for prospective, randomised, controlled, outcome assessor-blinded, three-armed parallel 1:1:1, multicentre trial comparing the effectiveness and cost of collagenase Clostridium histolyticum, percutaneous needle fasciotomy and limited fasciectomy as short-term and long-term treatment strategies in Dupuytren's contracture. *BMJ Open.* 2018;8:e019054.
36. Namazi H, Abdinejad F. Botulinum toxin as a novel addition to the antidupuytren armamentarium. *Med Hypotheses.* 2007;68:240–241.
37. Zirbs M, Anzeneder T, Eberlein B. Radiotherapy with soft X-rays in Dupuytren's disease—successful, well-tolerated and satisfying. *J Eur Acad Dermatol Venereol.* 2015;29:904–911.
38. Costas B, Coleman S, Gaston RG. Efficacy and safety of collagenase Clostridium histolyticum for Dupuytren disease nodules: a randomized controlled trial. *BMC Musculoskelet Disord.* 2017;18:374.