This week's study guide is all about: Trigger Finger
An Occupational Therapist Knows...

Symptoms of Trigger Finger

The most common symptom of trigger finger is the locking and snapping of the finger, but here are some additional symptoms:

• Snapping sensation as you attempt to straighten your finger
• Grasping objects may cause the finger to lock
• Finger stiffness in the morning
• Bump at the base of the affected finger

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WHAT ARE THE SYMPTOMS OF TRIGGER FINGER?

- Restricted hand movement
- Palpable nodule in your palm
- Finger stiffness
- Finger stuck in a bent position which suddenly straightens
- Difficulty in keeping the finger straight
- Swelling of the finger
- Pain in the whole hand
- Popping sensation when moving the finger

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HOW TO DEAL WITH TRIGGER FINGER

- USE A SPLINT
- REST THE FINGER
- COLD COMPRESS
- WARM WATER SOAK
- ACUPUNCTURE
- TURMERIC
- ALOE VERA

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Most of the clinicians consider that such disorder is sourced by the ligament sheath since it becomes swollen or thickened and squeezes the ligament and stops it from sliding smoothly. However, common sense discloses that the records of patients experience Trigger Finger have a general character, excessive use or ill-treatment of the hands from work & recreational activities. Other factors or contributors of trigger finger are partial tendon lacerations, Rheumatoid Arthritis, recurred shock from firearm gripped power equipments, or long hours grabbing a steering wheel.

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FIGURE 3. Trigger finger showing the flexor tendons of the index finger with the pulleys holding them in place and an inflammatory ‘trigger nodule’.

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TRIGGER FINGER

1. THE PULLEY AND TENDON IN FINGER - GLIDING NORMALLY
2. PULLEY BECOMES TOO THICK - TENDON CANNOT GLIDE THROUGH IT

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Signs & Symptoms

- “Catching,” "locking,” and pain with PROM or AROM finger flexion

- “Snapping” phenomenon
  - Nodule/enlarged tendon pulls suddenly through the tight A1 pulley

- Flexion contracture at PIP joint in severe cases due to unwillingness to extend digit because of symptoms

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TRIGGER FINGER

- It is a Stenosing tenosynovitis caused by inflammation of the flexor tendon sheath
- Epidemiology
  - more common in diabetics
  - ring finger most commonly involved
- Mechanism
  - caused by entrapment of the flexor tendons at the level of entrance to its sheath
  - On forced extension tendon passes the constriction with a snap.
- Associated conditions
  - diabetes mellitus
  - rheumatoid arthritis
  - amyloidosis

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Prospective study of the conservative treatment of trigger finger: evaluation of 131 fingers

Estudo prospectivo do tratamento conservador do dedo em gatilho: avaliação de 131 dedos

Debora Alves Camargo1, Luiz Carlos Angelini2, Marcelo Tavares de Oliveira3, Dirce Mineko Sawaeda4

ABSTRACT

Objective: To demonstrate the progression of individual trigger fingers treated conservatively by corticosteroid injection.

Method: Data on 131 fingers subjected to corticosteroid injection was gathered from March 2006 to September 2007. Affected fingers were classified according to Green’s classification. Results were assessed after 30, 60 and 180 days and no more than three injections were done per digit.

Results: Results were described and evaluated according to the involvement grade and the affected digit. The dominant hand was the most affected; the thumb was the most affected individual digit. Most digits were grade II. At the end of treatment 115 fingers were symptom-free; only 16 digits required surgery.

Conclusion: Corticosteroid injection is an effective, safe and low-cost method. Insulin-dependent diabetes mellitus patients and grade III B patients submitted to corticosteroid injection with no success may require surgery.

Keywords: Trigger finger disorder/drug therapy; Stenosing tenosynovitis; Adrenal cortex hormones/therapeutic use; Anti-inflammatory agents/therapeutic use; Prospective studies.

INTRODUCTION

Trigger finger, or stenosing tenosynovitis, may be defined as a condition characterized by snapping or locking of fingers (with or without pain). The first annular finger pulley operates as a tunnel within which the flexor tendon rests. It has been postulated that this tunnel is the cause of focal tendon degeneration, resulting in thickening of the sheath and nodules on tendons. The nodule increases the diameter of the tendon when it enters the flexor sheath, which interferes with the gliding mechanism of the first annular pulley1-2.

The first descriptions of trigger finger date from 1850 and 1859, in which Nelaton and Notta, in Paris, described tendon sheaths in cadavers, including the portion currently known as the A1 pulley, and other
pulleys\(^{3-4}\). In 1895, Jeannin studied 12 patients and described the pathology and probable etiologies\(^{5}\).

The etiology remains unknown\(^{6}\), but it may be associated with the use of certain tools, such as gardening shears, crutches, household chores, and heavy work, which cause minor trauma in the palm due to repetitive strain\(^{2,7-8}\).

In 1972, Houston and Wilson conducted an anatomical study and showed that the spiral arrangement of the intratendinous fiber architecture could facilitate the development of nodules distal to the A1 pulley\(^{9}\).

The condition may be considered as primary or idiopathic if only one digit is affected and if there is no underlying disease, or secondary if multiple digits are involved or if there is an associated condition, such as the carpal tunnel syndrome, the Quervain’s tenosynovitis, diabetes mellitus, osteoarthritis, rheumatoid arthritis or hypothyroidism\(^{2,6,10-14}\).

Trigger finger affects mainly women aged from 50 to 59 years\(^{1,6-7,11-12,15-16}\); it is considered rare in the black race\(^{2}\).

The thumb is the digit most often involved, followed by the ring, the middle, the little and the index fingers. The dominant hand is affected about four times more often than the non-dominant hand\(^{2,6-8,11,16-17}\).

In most cases the diagnosis is clinical. Trigger finger may be classified, depending on the symptoms, into four types, according to Green (1997)\(^{18}\):

- grade I (or pre-trigger): patients present only local pain;
- grade II (or active): patients present the trigger, but can actively extend the digit;
- grade III (passive): divided into grade IIIA – extension of digit requires passively moving the finger; and grade IIIB – incapable of flexing the digit;
- grade IV (contracture): patients present fixed flexion (contracture) of the proximal interphalangeal joint of the digit.

Therapy ranges from rest to corticosteroid injections, oral anti-inflammatory drugs, percutaneous release drugs, physical therapy, orthoses and surgery\(^{1,7,19-20}\). Many authors defended corticosteroid injection as the first line treatment for trigger finger; it is considered a simple, easily performed and low-cost method, compared to surgery\(^{7,12-13,16}\).

**OBJECTIVE**

The purpose of this study was to show the progression of individual trigger finger in various grades, following conservative therapy with corticosteroid injections.

**METHODS**

Patients seen at the Hand Surgery Outpatient Unit at Hospital do Servidor Público Municipal de Sao Paulo (HSPM), were selected if trigger finger was present and included in the study.

Exclusion criteria were patients that had already been treated with corticosteroid injections by other researchers, immunosuppressed patients, those allergic to the medication used in therapy, patients with decompensated underlying disease (arterial hypertension, diabetes, rheumatoid arthritis, etc), patients with pediatric tenosynovitis (congenital trigger digit) or those that for any reason did not wish to participate in the study.

There were 131 treated digits from 121 patients seen at the outpatient unit of HSPM from March 2006 to September 2007, with a history of trigger finger.

Patients were allocated according to the involvement grade of each digit (see classification above).

Relevant information such as sex, age, dominant hand, involved digit, main complaint, duration of disease, and associated diseases were recorded according to a previously defined protocol. The same researcher carried out the consultations and the procedure. The diagnosis was made clinically in all cases; no additional exams were required.

Asepsis was performed with alcohol 70\%, followed by an injection of methylprednisolone acetate 40 mg (Depomedrol\(^{8}\)) and lidocaine (1 ml) without vasoconstrictor.

The injection technique consisted of inserting a 13 x 0.45 needle (attached to a 5 ml syringe) into the first annular pulley of the involved digit. The needle was introduced at a 45° angle on the metacarpal longitudinal axis.

A compressive dressing was applied after injection and each patient was instructed to rest (only on the day of the procedure), to apply ice locally, and to take a systemic analgesic (paracetamol) in case of pain.

Patients were assessed 30, 60, and 180 days after corticosteroid injection. In these visits, intercurrent events, complaints (improving, worsening or unstable symptoms), time until symptoms subsided, and skin changes, such as patches and trophic alterations on the injection site. Pain analysis was conducted using the visual pain scale.

Patients were deemed asymptomatic when returning with no complaints about the condition and the absence of complaints was maintained for six months.

No more than three injections were done\(^{10-12,21}\). Patients were scheduled for surgery if symptoms worsened or remained unchanged for 180 days.
RESULTS

Of 131 digits, 119 belonged to female patients and 12 to male patients; the ratio was 9:1.

After a six-month follow-up period, one digit belonging to a male patient and 15 digits of female patients were operated (12.2%).

Most patients were white (57.2%); 42.8% were brown or black. There were no Asian patients.

The thumb was involved most often (57 digits), followed by the middle finger (40 digits), the ring finger (31 digits), the index finger (2 digits), and the little finger (1 digit).

Digits from the dominant limb were involved in 57.3% of cases compared to non-dominant digits (42.7%). Table 1 shows the involvement grade of digits.

The time from onset of symptoms varied significantly; it was three months or less in 64.9% of patients, three to six months in 17.6% of patients, and over six months in 17.6% of cases.

Table 1. Sample distribution according to the variable initial grade

<table>
<thead>
<tr>
<th>Initial grade</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>8</td>
<td>6.1</td>
</tr>
<tr>
<td>II</td>
<td>56</td>
<td>42.7</td>
</tr>
<tr>
<td>IIIA</td>
<td>36</td>
<td>27.5</td>
</tr>
<tr>
<td>IIIB</td>
<td>29</td>
<td>22.1</td>
</tr>
<tr>
<td>IV</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>100</td>
</tr>
</tbody>
</table>

The main complaint was pain (57.3%), followed by locking (18.3%), and difficulty in flexing the digit (11.5%). Palpable nodules were found in 89 digits; there were no nodules in 42 digits.

The main complaint and the presence or absence of nodules did not statistically alter the results. Only 24.4% of patients had no associated diseases.

Symptoms subsided within a week in over half of the involved digits (69.5%); symptoms did not improve at all after corticosteroid injection in only 24.4% of digits (Table 2).

Sixteen patients underwent surgery; of these, 68.75% were white and 31.25% were brown and black.

Table 2. Sample distribution according to the variable affected finger and with no symptoms after six months

<table>
<thead>
<tr>
<th>Affected finger</th>
<th>No symptoms after six months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Thumb</td>
<td>50</td>
</tr>
<tr>
<td>Index</td>
<td>1</td>
</tr>
<tr>
<td>Middle</td>
<td>37</td>
</tr>
<tr>
<td>Ring</td>
<td>27</td>
</tr>
<tr>
<td>Little</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
</tr>
</tbody>
</table>

In patients treated initially within six months of onset of symptoms, 30% underwent surgery; in patients treated after six months of onset, 21.7% were operated.

Among associated diseases, insulin-dependent diabetes mellitus stood out relative to symptom improvement. In these patients, 5 of 14 treated digits did not progress favorably (Table 3). Other conditions did not interfere with the final results.

Table 3. Sample distribution according to the variable insulin-dependent DM and result after six months

<table>
<thead>
<tr>
<th>Insulin-dependent DM</th>
<th>No symptoms after six months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>9</td>
</tr>
<tr>
<td>No</td>
<td>106</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
</tr>
</tbody>
</table>

During therapy it was found that 48.8% of treated digits were symptom-free within the first month. In the remaining fingers, 100% of grade I digits also progressed satisfactorily. Surgery was required in 23.8% of grade II digits, in 22.2% of grade IIIA digits, and in 100% grade IIIB digits six months after the first corticosteroid injection (Table 4). It was not noted complications or complaints following corticosteroid therapy.

Table 4. Sample distribution according to the variable initial grade and results after six months

<table>
<thead>
<tr>
<th>Initial grade</th>
<th>No symptoms after six months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>I</td>
<td>8</td>
</tr>
<tr>
<td>II</td>
<td>50</td>
</tr>
<tr>
<td>IIIA</td>
<td>30</td>
</tr>
<tr>
<td>IIIB</td>
<td>25</td>
</tr>
<tr>
<td>IV</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
</tr>
</tbody>
</table>

DISCUSSION

Trigger finger is one of the most commonly found conditions in orthopedic and hand surgery outpatient clinics.

Women are more affected than men, in a 3:1 ratio. The mean age of onset is 50 to 59 years. It was found that the ratio above is higher than that in our unit (9:1); the mean age, however, was similar. The dominant limb was affected more often.

This condition affects more white patients, but may also occur in brown and black patients. It is rare in Asians.
The thumb is the most frequent site of tenosynovitis\(^{(15)}\), followed by the middle and ring digits.

Grade II (active) is the most common; most patients present with pain, which is the dominant symptom. The mean duration of symptoms before therapy is three months\(^{(16)}\).

Diseases such as arterial hypertension, diabetes mellitus, carpal tunnel syndrome, thyroid conditions, rheumatoid arthritis, and other, were found in 75.6\% of patients.

Abnormal collagen metabolism is an important factor in the pathogenesis of tenosynovitis in diabetic patients. Hyperglycemia increases periarticular collagen and fibrous tissue proliferation in the tendon sheath, leading to stenosis\(^{(23)}\).

Published papers have shown that insulin-dependent diabetes mellitus patients respond worse to corticosteroid injection than other patients\(^{(13)}\); this was demonstrated in the present study, in which improvement in such patients was up to five times worse after six months.

Use of corticosteroid injections for treating musculoskeletal lesions has always been controversial\(^{(15)}\).

In the middle of the year of 1950, use of corticosteroid injections in the treatment of stenosing tenosynovitis was shown to provide clinical benefit\(^{(6,21,24-25)}\).

As long as patients tolerate the treatment well, it is preferable to inject corticosteroids with lidocaine as the initial treatment of trigger finger\(^{(2)}\).

We found that time did not alter our results, as opposed to various papers reporting that patients with symptoms lasting over six months are more likely to undergo surgical therapy, which altered their final results\(^{(5,10,12,16)}\).

The severity of symptoms is not a contraindication for conservative therapy\(^{(22)}\), as all of our treated grade IV patients had a 100\% cure rate.

A corticosteroid injection should be applied in grade I patients with significant pain that do not improve with anti-inflammatory drugs, as an attempt to improve the symptoms.

Only 16 of 131 digits in this sample required surgery. We found that about 49\% of digits require no further treatment after the first corticosteroid injection; other authors have also reported this finding\(^{(3,17,22)}\).

The middle digit responded best to therapy, followed by the thumb and the ring digit. A worse response was seen in the index and little fingers; however, the sample of affected digits is too small for a comparison with the first three.

Recurrences may occur within six months; a good result in this period is usually attained. Persistent symptoms with no improvement after three corticosteroid injections indicate the need for surgery. The present study confirms the safety of corticosteroid injections in the treatment of trigger finger, since there were no side effects described in the 131 digits\(^{(2,11,15,21-22,26)}\).

It is not worth that we found no published paper comparing the grades of trigger finger and the results of conservative therapy with corticosteroid injections.

**CONCLUSIONS**

Local corticosteroid injection is the first choice therapy for treatment of flexor tenosynovitis, since it is easily performed, has a low complication rate and a low cost.

Insulin-dependent diabetes mellitus patients and grade IIIB patients who were treated with one corticosteroid injection, and had an unfavorable progression, may be referred to surgery.

**REFERENCES**

Abstract  Trigger finger is a common finger ailment, thought to be caused by inflammation and subsequent narrowing of the A1 pulley, which causes pain, clicking, catching, and loss of motion of the affected finger. Although it can occur in anyone, it is seen more frequently in the diabetic population and in women, typically in the fifth to sixth decade of life. The diagnosis is usually fairly straightforward, as most patients complain of clicking or locking of the finger, but other pathological processes such as fracture, tumor, or other traumatic soft tissue injuries must be excluded. Treatment modalities, including splinting, corticosteroid injection, or surgical release, are very effective and are tailored to the severity and duration of symptoms.

Keywords  Trigger finger · Conservative treatment · Percutaneous release · Surgical management

Introduction

The malady trigger finger earns its name from the painful popping or clicking sound elicited by flexion and extension of the involved digit. First described by Notta in 1850 [1], it is caused by a difference in diameters of a flexor tendon and its retinacular sheath due to thickening and narrowing of the sheath. Though often referred to as stenosing tenosynovitis [2–4], histologic studies have shown that the pathologic inflammatory changes localize specifically to the tendon sheath (tendovagina) and not the tenosynovium [5]. In light of this, the term tendovaginitis has been proposed as a more appropriate description of trigger finger [6].

Pathophysiology

In trigger finger, inflammation and hypertrophy of the retinacular sheath progressively restricts the motion of the flexor tendon [7, 8]. This sheath normally forms a pulley system comprised of a series of annular and cruciform pulleys in each digit that serve to maximize the flexor tendon’s force production and efficiency of motion [9]. (Fig. 1) The first annular pulley (A1) at the metacarpal head is by far the most often affected pulley in trigger finger, though cases of triggering have been reported at the second and third annular pulleys (A2 and A3, respectively), as well as the palmar aponeurosis [10].

Due to its location, the A1 pulley is subjected to the highest forces and pressure gradients during normal as well as power grip [10]. The repeated friction and resulting intratendinous swelling caused by movement of the flexor tendon through the A1 pulley has been compared to the fraying at the ends of a string after repeated threading through the eye of a needle [11]. Microscopic examination of trigger A1 pulleys have shown degeneration and inflammatory cell infiltrate [5], but recent ultrastructural comparisons of normal and trigger A1 pulleys may have elucidated what may be a key phase in the pathogenesis of trigger finger. Studies using scanning and transmission electron microscopes to examine the gliding surface of the A1 pulleys demonstrated that normal specimens had an
amorphous extracellular matrix, including chondrocytes, coating the pulley’s entire innermost layer. Pathologic samples had a similar general appearance, but with varying sized and shaped areas of extracellular matrix loss. These areas were characterized by chondrocyte proliferation and type III collagen production [12]. It has thus been postulated that this fibrocartilagenous metaplasia results from the repeated friction and compression between the flexor tendon and the corresponding inner layer of the A1 pulley [8].

Etiology

Several causes of trigger finger have been proposed, though the precise etiology has not been elucidated. Understandably, repetitive finger movements and local trauma are possibilities [13–15], with such stress and degenerative force also accounting for an increased incidence of trigger finger in the dominant hand [8, 16]. There are reports linking trigger finger to occupations requiring extensive gripping and hand flexion, such as use of shears or hand held tools [5, 14, 17]. This relationship is questionable, however, with studies finding no association between trigger finger and the workplace [18, 19]. In reality the causes of trigger finger are multiple and in each individual often multifactorial.

Incidence

Primary trigger finger occurs most commonly in the middle fifth to sixth decades of life and up to 6 times more frequently in women than men [5, 7, 16, 20], although the reasons for this age and sex predilection are not entirely clear [21]. The lifetime risk of trigger finger development is between 2 and 3%, but increases to up to 10% in diabetics [22, 23]. The incidence in diabetics is associated with actual duration of the disease, not with glycemic control [24]. This also appears to be a higher risk for trigger finger development in patients with carpal tunnel syndrome, de Quervain’s disease, hypothyroidism, rheumatoid arthritis, renal disease, and amyloidosis [24–27]. The ring finger is most commonly affected, followed by the thumb (trigger thumb), long, index, and small fingers in patients with multiple trigger digits [21, 28].

Presentation

The initial complaint associated with trigger finger may be of a painless clicking with digital manipulation. Further development of the condition can cause the catching or popping to become painful with both flexion and extension, and be related as occurring at either the metacarpophalangeal (MCP) or PIP joints. Other patients may notice a feeling of stiffness and then progressive loss of full flexion and/or extension of the affected digit without ever developing the catching and locking of a “typical” trigger finger. A painful nodule, a result of intratendinous swelling, may be palpated in the palmar MCP area. The patient may report MCP stiffness or swelling in the morning, or that they awaken with the digit locked and that it loosens throughout the day. A history of recent trauma to the area may also be reported. With continued deterioration the finger may present locked in flexion, requiring passive manipulation to achieve full extension. This occurs because the flexor mechanisms of the digit are generally strong enough to overcome the restrictive and narrowed retinacular sheath, while the extensors are not. Over time, the patient’s desire to avoid the painful triggering caused by manipulation or use of the involved digit may lead to the development of secondary PIP contractures and digital stiffness.

Diagnosis

The classic presentation of popping and locking of a trigger finger is typically all that is needed for diagnosis; however, with acute onset of symptoms patients may present with pain and swelling over the involved flexor sheath with avoidance of finger motion. In these cases, the classic popping and triggering are not seen and the diagnosis of trigger finger must be differentiated from infection or some other traumatic injury. If desired, the diagnosis may be confirmed with an injection of lidocaine into the flexor sheath, which should relieve the pain associated with the triggering and allow the digit to become actively or passively extended. There is no role for imaging in diagnosis, with x-rays considered unnecessary in patients without history of inflammatory disease or trauma [29].
The finding of a locking digit is not unique to trigger finger, and can be associated with dislocation, Dupuytren’s contracture, focal dystonia, flexor tendon/sheath tumor, sesamoid bone anomalies, post-traumatic tendon entrapment on the metacarpal head, and even hysteria. The differential diagnosis of pain at the MCP joint includes de Quervain’s tenosynovitis (for trigger thumb only), ulnar collateral ligament injury of the thumb (gamekeeper’s thumb), MCP joint sprain, extensor apparatus injury, and MCP osteoarthritis [30–34]. Imaging with ultrasound or MRI may help with these diagnoses in atypical presentations of trigger finger.

Conservative treatment

Initial management of trigger finger is conservative and involves activity modification [35], non-steroidal anti-inflammatory drugs for pain control, MCP joint immobilization, and corticosteroid injection.

Splinting

The goal of splinting is to prevent the friction caused by flexor tendon movement through the affected A1 pulley until the inflammation there resolves [10]. It is generally considered that splinting is an appropriate treatment option in patients who refuse or wish to avoid corticosteroid injection. A study of manual workers with distal interphalangeal (DIP) joint splints in full extension for 6 weeks demonstrated abatement of symptoms in over 50% of the patients [36]. In another study, splints of the MCP joint at 15 degrees of flexion (leaving the PIP and DIP joints free) were shown to provide resolution of symptoms in 65% of patients at 1-year follow-up [16]. For patients who are most bothered by symptoms of locking in the morning, splinting the PIP joint at night can be effective. Splinting yields lower success rates in patients with severe triggering or longstanding duration of symptoms.

Corticosteroid injection

Injection of corticosteroids for treatment of trigger finger was described as early as 1953 [37]. It should be attempted before surgical intervention as it is very efficacious (up to 93%) [38], especially in non-diabetic patients with recent onset of symptoms and one affected digit with a palpable nodule [39]. It is believed that corticosteroid injection is less successful in patients with longstanding disease (>6 months duration), diabetes mellitus, and multiple digit involvement as it is unable to reverse the changes of chondroid metaplasia that take place at the A1 pulley. The injection is traditionally given directly into the sheath, however, reports of extrasynovial injection show that it may be as effective, while reducing risk of tendon damage [40, 41]. (Fig. 2) Tendon rupture is a very rare complication, with only one case being reported [42]. Other complications include dermal atrophy, fat necrosis, skin hypopigmentation, transient elevation of serum glucose in diabetic patients [43], and infection [10, 35]. If symptoms do not resolve after the first injection, or recur afterwards, a second injection is typically half as likely to succeed as the initial treatment [25].

Surgical treatment

Operative treatment, whether by percutaneous or open release, is highly successful and widely regarded as the ultimate treatment for trigger finger. Indication for surgical treatment is generally failure of conservative treatment to resolve pain and symptoms. The timing of surgery is somewhat controversial with data suggesting surgical consideration after failure of both a single as well as multiple corticosteroid injections [44, 45].

The percutaneous trigger finger release has been described and was first introduced by Lorthioir in 1958 [46]. In this procedure, the MCP joint is hyperextended with the palm up, thus stretching out the A1 pulley and shifting the neurovascular structures dorsally. After ethyl chloride is sprayed and lidocaine injected for pain management, a needle is inserted through the skin and onto the A1 pulley. It is then swept to slice the pulley proximal and distal to the injection site. Success rates have been reported as over 90% with this procedure [39]; however, use of this
technique is tempered by the risk of digital nerve or artery injury. Other complications, including tendon bowstringing, infection, and pain are less common [47–49].

Open release of trigger finger has been used as treatment for over a century [35]. (Fig. 3 a,b) The aim of the procedure is generally the same as with the percutaneous release, which is full sectioning of the A1 pulley. The open release provides greater exposure and may be safer with regard to iatrogenic neurovascular injury. Reported success rates range from 90% to 100% proving the efficacy of this procedure. Overall complication rates may be slightly higher than with the percutaneous release, including reflex sympathetic dystrophy, infection, stiffness, nerve transection, incision pain, flexion deformity, flexor tendon bowstringing, and recurrence (3%) [10, 39, 50], but in general this procedure is safe and effective.

Conclusion

Trigger finger is a long recognized condition characterized by a sometimes painful locking of the digit on flexion and extension. It is caused by the inflammation and subsequent narrowing of the A1 pulley through which the flexor tendon passes at the metacarpal head, leading to restricted movement of the tendon through the pulley. It is much more common in women than men, may be related to occupations involving constant gripping or repetitive local trauma and appears to be associated with systemic inflammatory diseases. The diagnosis is typically made by the characteristic presentation and findings on exam, and first-line treatment includes splinting and corticosteroid injections. Surgical management of this condition is indicated with recurrence after or failure of conservative management or initially in cases of >6 months duration and is highly effective with low complication and recurrence rates.

References

Surgical Treatment and Rehabilitation of Trigger Thumb and Finger

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2 Department of Physical Education and Health Promotion, University of Szczecin
A Study Design; B Data Collection; C Statistical Analysis; D Manuscript Preparation

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Abstract The aim of the study was to evaluate the results of surgical treatment and rehabilitation of patients with trigger thumb and finger. In 40 patients, comprising 30 women and 10 men aged 26 to 64, a total of 42 cases of trigger thumb and finger. In the preoperative period, the severity of changes were studied according to the classification developed by Newport et al. Five patients were classified in the first stage, 28 in the second, 6 in the third, and 1 in the fourth. The mean duration of symptoms was five months. The indication for surgery was a lack of improvement following conservative treatment. All of the patients were treated surgically using the open method by cutting the flexor tendon sheath in part A1. The rehabilitation treatment included exercises to improve the range of mobility of the thumb and fingers and to stretch, gnelax, and strengthen muscles. Neuromobilisation and automobilisation exercises were conducted. After 5 months, swelling, pain and restricted mobility of the thumb and fingers subsided in all patients. There were no ‘jumping’ symptoms. Apart from a slight transitory inflammatory reaction in 2 patients there were no complications. In patients with trigger finger, open surgery and competent rehabilitation therapy enables the achievement of very good results, with a low complication rate.

Key words trigger thumb and finger, surgical treatment and rehabilitation of trigger thumb and finger

Introduction

Trigger thumb and finger (Latin: tendovaginitis stenosans) is also known as stenosing tenosynovitis of the flexor tendon and its sheath. A characteristic symptom of this disease is an audible crack and frequently perceptible pain in the affected thumb or finger when being bent and straightened. The reason for this is the ‘jumping’ of a thickened flexor constricted by a fibrous sheath in part A1. The initial ‘jumping’ can develop into complete blockage at the entrance of the tendon sheath. The disorder often occurs in women around 50 years of age and mostly affects the thumb. The cause of such changes may be frequent repeated, minor injuries and overload of the flexor tendons. Cases of trigger thumb and fingers are common in individuals participating in sport climbing, and tennis, or playing...
various instruments involving the fingers. The condition also affects carpenters and people laundering items by hand (Cakmak, Wolf, Bruckner, Hahn, Unglaub, 2012; Lange-Riess, Schuh, Honle, Schuh, 2009).

In the initial phase of the disease, where there are no symptoms of the tendon conservative treatment, involving local and general use of anti-inflammatory drugs is recommended. If there is no improvement following conservative treatment, open or percutaneous surgery is conducted. Surgical treatment achieves better results than conservative treatment, with fewer relapses. Some argue that there is no difference between the results of percutaneous and open surgical treatment (Wang et al., 2013). In trigger thumb syndrome cutting of the annular ligament is done with a thick injection needle. Surgical treatment using the open method produces a 97–99% cure; relapses occur in 2–3% of cases and complications in 2% of patients; however, the percutaneous method results more often in restricted mobility of the fingers, soreness or infection (Finsen, Hagen, 2003; Lange-Riess, Schuh, Honle, Schuh, 2009; Turowski, 1997; Will et al., 2010). Following the surgery, rehabilitation is recommended as soon as possible. Patients are warned against performing excessive gripping movements and lifting heavy objects (Delsk, Deskur, Zawadzki, 2014).

Material and methods

In the years 2006–2013, 40 patients were treated, comprising 30 women and 10 men, aged 26 to 64, with 42 cases of trigger thumb and finger (Table 1).

Table 1. Number of men and women treated with trigger thumb and fingers

<table>
<thead>
<tr>
<th>The age of patients in years</th>
<th>Number of patients</th>
<th>Together</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>women n %</td>
<td>men n %</td>
</tr>
<tr>
<td>21–30</td>
<td>– –</td>
<td>1 2.5</td>
</tr>
<tr>
<td>31–40</td>
<td>4 10.0</td>
<td>1 2.5</td>
</tr>
<tr>
<td>41–50</td>
<td>9 22.5</td>
<td>4 10.0</td>
</tr>
<tr>
<td>51–60</td>
<td>17 42.5</td>
<td>3 7.5</td>
</tr>
<tr>
<td>61–70</td>
<td>1 2.5</td>
<td>– –</td>
</tr>
<tr>
<td>Together</td>
<td>31 77.5</td>
<td>9 22.5</td>
</tr>
</tbody>
</table>

Treatment and testing was carried out at the SP Regional Hospital in Nowogard by the authors. The severity of clinical changes in the thumb and fingers was rated according to the classification of Newport et al. (Cakmak, Wolf, Bruckner, Hahn, Unglaub, 2012) – Table 2.

Table 2. Classification of trigger digits according to Newport et al.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pain and tenderness on the level of the A1 pulley, no palpable nodule or triggering</td>
</tr>
<tr>
<td>2</td>
<td>Tenderness, swelling or tendon nodularity with occasional triggering or catching during active movements</td>
</tr>
<tr>
<td>3</td>
<td>Manifestations of stage 2 with frequent triggering or catching, additionally locking of the digit</td>
</tr>
<tr>
<td>4</td>
<td>Digit is flexed in the proximal interphalangeal joint</td>
</tr>
</tbody>
</table>
Limitation of mobility of the thumb and fingers was examined using the Buck-Gramcko classification (Cakmak, Wolf, Bruckner, Hahn, Unglaub, 2012).

**Table 3.** Classification of severity of limitation of motion finger according to Buck-Gramcko

<table>
<thead>
<tr>
<th>Grade</th>
<th>Finger-palm distance</th>
<th>Severity of limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>No limitation</td>
</tr>
<tr>
<td>1</td>
<td>&gt;0–2.5</td>
<td>Light</td>
</tr>
<tr>
<td>2</td>
<td>&gt;2.5–4</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>&gt;4–6 and fixed digit</td>
<td>Severe</td>
</tr>
<tr>
<td>4</td>
<td>Whole hand</td>
<td></td>
</tr>
</tbody>
</table>

The range of motion of the thumb was examined using goniometer (Table 4).

**Table 4.** Classification of severity of limitation of motion thumb according to Buck-Gramcko

<table>
<thead>
<tr>
<th>Thumb (IP-joint)</th>
<th>Range of motion</th>
<th>Severity of limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>&gt;70</td>
<td>No limitation</td>
</tr>
<tr>
<td>1</td>
<td>50–70</td>
<td>Light</td>
</tr>
<tr>
<td>2</td>
<td>30–45</td>
<td>Moderate</td>
</tr>
<tr>
<td>3</td>
<td>&lt;29</td>
<td>Severe</td>
</tr>
</tbody>
</table>

The extent of swelling in the fingers was studied by following the appropriate scale (Table 5).

**Table 5.** Extent of swelling of thumb and fingers

<table>
<thead>
<tr>
<th>Swelling</th>
<th>Severity of swelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No swelling</td>
</tr>
<tr>
<td>1</td>
<td>Light, without limitation of motion</td>
</tr>
<tr>
<td>2</td>
<td>Moderate, with limitation of motion</td>
</tr>
<tr>
<td>3</td>
<td>Severe, with limitation of motion of the whole hand</td>
</tr>
</tbody>
</table>

Pain in the thumb and fingers was assessed using the VAS scale (Table 6).

**Table 6.** Grade of pain thumb and finger

<table>
<thead>
<tr>
<th>VAS</th>
<th>Grade of pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No pain</td>
</tr>
<tr>
<td>1–3</td>
<td>Light</td>
</tr>
<tr>
<td>4–6</td>
<td>Moderate</td>
</tr>
<tr>
<td>7–10</td>
<td>Intense</td>
</tr>
</tbody>
</table>

All patients were treated with open surgery. A transverse incision of approximately 1 cm was made on the palmar side of the hand circumferentially from the distal palmar flexion crease. On the thumb, an incision was made in the metacarpophalangeal area. The vascular-nervous bunch was moved aside. Following the introduction of the
probe to the entrance of the channel sheath, the thumb was incised with a knife in the initial portion of the A1 sheath. The free passage of the thickened tendon was tested. If needed, tenolysis was performed to remove adhesions (Choudhur, Tay, 2013; Froimson, 1999). On the fourth day following surgery, exercises were cautiously introduced to improve full flexion and to straighten the fingers as well as stretch, relax and strengthen muscles. Neuromobilisation and automobilisation exercises were conducted. The soft tissue surrounding the scar was mobilised. Patients were taught how to prevent overloads of the fingers (Dekur, Dekur, Zawadzki, 2014; Kuzdzal, 2009).

**Results**

Forty-two cases of trigger thumb and fingers in 40 patients, treated with surgery and rehabilitation were studied. The changes affected 24 fingers on right hands and 18 on left hands. The finger most frequently affected by changes was I (21 cases), followed by IV (10) and III (9) – Table 7.

**Table 7. Number of men and women treated with trigger thumb and fingers**

<table>
<thead>
<tr>
<th>Thumb and fingers</th>
<th>Numer of hands</th>
<th></th>
<th></th>
<th></th>
<th>Together</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>right n</td>
<td>%</td>
<td>left n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>I</td>
<td>12</td>
<td>28.6</td>
<td>9</td>
<td>21.4</td>
<td>21</td>
<td>50.0</td>
</tr>
<tr>
<td>II</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>11.9</td>
<td>4</td>
<td>9.5</td>
<td>9</td>
<td>21.4</td>
</tr>
<tr>
<td>IV</td>
<td>5</td>
<td>11.9</td>
<td>5</td>
<td>11.9</td>
<td>10</td>
<td>23.8</td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>4.8</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>4.8</td>
</tr>
<tr>
<td>Together</td>
<td>24</td>
<td>57.1</td>
<td>18</td>
<td>42.9</td>
<td>42</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The mean duration of symptoms was 5 months. Prior to surgery, the severity of changes in lesions thumbs and fingers was assessed according to the classification of Newport et al. (Cakmak, Wolf, Bruckner, Hahn, Unglaub, 2012). Most patients were characterized by the second level of severity (Table 8).

**Table 8. Number of patients with varying degrees of severity changes hands trigger thumb and fingers according to the classification of Newport before surgery**

<table>
<thead>
<tr>
<th>Degrees</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Together</td>
<td>40</td>
</tr>
</tbody>
</table>

Following surgery, and during rehabilitation, a study of persisting symptoms, such as swelling, pain and limitation of movement of the thumb and fingers, was carried out. After 1 month, 15 patients were symptom-free. In the third month of the study, pain subsided; after 5 months, swelling and limitation of movement disappeared (Table 9). All patients were very satisfied with the results of the treatment.
Table 9. The number of thumb and fingers with persisting symptoms after the surgery

<table>
<thead>
<tr>
<th>Degrees</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swollen</td>
<td>25</td>
<td>12</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Pain of thumb and fingers</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Restriction of mobility</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Pain regional scars</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

In this study, cases of trigger thumb and fingers were more common in women aged 51 to 60 and involved the thumb and fingers III and IV, which is consistent with other reports (Cakmak, Wolf, Bruckner, Hahn, Unglaub, 2012; Choudhury, Tay, 2013; Lange-Riess, Schuh, Honle, Schuh, 2009; Moriya, Uchiyama, Kawai, 2005). Surgical treatment of trigger thumb and finger is indicated by lack of improved results following conservative treatment. Incision of the initial part of the flexor tendon sheath can be done using either the open or percutaneous method. While the presently recommended treatment is percutaneous, many authors see no significant difference between the results of the two methods (Wang, Zhao, Liang, 2013). The open surgery method enables better control of the tendon and the opportunity to carry out additional procedures where necessary. In our study, swelling, pain and restricted mobility of the thumb and fingers subsided after 5 months in all patients. There were no signs of ‘jumping’. Apart from slight transient inflammatory reaction in 2 patients there were no complications. In recent years, not many results of open-method surgical treatment of trigger thumb and fingers have been published. I will cite some of these here. Papież, Trybus, Stepansczak, Łoboda, Pokrowiecki, Gądek (2013) studied 50 patients undergoing surgery and recorded that after 3 months most patients achieved total restoration of motion in their thumbs and fingers, full dexterity, and hand grip strength, as well as the abolition of pain. Further improvement was shown after a year had passed. The majority (84%) of patients were very satisfied with the treatment. Choudhury and Tay (2013) found that 25 months following surgery 216 thumbs and fingers had achieved average mobility 84% according to TAM. One patient experienced minor wound dehiscence. Patients undergoing tenolysis also experienced worse results. Cakmak, Wolf, Bruckner, Hahn, Unglaub (2012) reported that 6 months following operations on 117 thumbs and fingers all symptoms had disappeared. One patient experienced dysesthesia and 2 experienced inflammation of the wound. Lim, Lim, Rasheed, Narayanan, Beng-Hoi (2007) reported that 483 patients had achieved good results 6 months after surgical treatment, with minor complications in 1% of patients. There was no recurrence ‘jumping’. Moriya, Uchiyama, Kawai (2005) studied 110 fingers and reported that 3 weeks after surgery 64% of the fingers were characterized by limited mobility in the PIP joint and patients felt pain while flexing and extending the fingers. None had trigger fingers.

Conclusions

1. Cases of trigger thumb and finger are most common in women aged 51 to 60 and involve the thumb and fingers III and IV.
2. Lack of improvement following conservative treatment of trigger thumb and finger is an indication for surgery.
3. Open surgery of the thumb and fingers and competent rehabilitation treatment enables a significant and rapid improvement in the efficiency of the hand, with a relatively low rate of complications.

4. In the treatment of trigger thumb and finger, the best results can be achieved in patients treated by a team of specialists.

References


RESEARCH ARTICLE

Occupation-based Assessments and Treatments of Trigger Finger: A Survey of Occupational Therapists from Israel and the United States‡

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Abstract

The purpose of this study was to describe the reported evaluation and treatment methods commonly administered by occupational therapy (OT) specialists in hand therapy for patients with trigger finger (TF).

Sixty-one therapists from Israel and the United States completed an electronic survey.

Sixty-nine per cent of the therapists reported evaluating TF symptoms (body function level) as part of their assessment protocol; however, only 25% reported the use of occupation-based measures for the assessment of people with TF. All therapists reported using orthoses to treat TF, yet significant differences were found between the groups regarding the frequency of using physical agent modalities, exercise and activity modifications.

The results of the study point to the limited use of occupation-based assessments and to a lack of consensus regarding treatment guidelines for TF. The study is limited by a restricted sample size and a low response rate from US therapists, which warrant caution in generalization of the findings. Further research is needed to study the broad implications of TF in order to inform the assessment of TF in OT and to establish the foundations for future treatment efficacy studies. Copyright © 2014 John Wiley & Sons, Ltd.

Keywords

trigger finger disorder; survey; occupation-based assessment

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‡This article was published online on 12 May 2014. An error in the second author’s name was subsequently identified. This notice is included in the online and print versions to indicate that both have been corrected [22 August 2014]

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Introduction

Trigger finger (TF), also called stenosing flexor tenosynovitis, is a common hand disease in adulthood. Triggering of the finger flexor tendons commonly occurs at the fibro-osseous tunnel formed by the metacarpal neck and the first annular pulley (Rayan, 1990). TF is characterized by pain, swelling and clicking of a digit during flexion or extension (Tarbhai et al., 2011), as well as functional limitations and restrictions in daily activities (Tung et al., 2010; Tarbhai et al., 2011) . The incidence of TF is 28:100,000 per year or a lifetime risk of 2.6% in the general population, but it increases to 10% in the diabetic population (Akhtar et al., 2005). The mean
age of onset for TF is 58 years, and it is diagnosed in women two to six times more frequently than in men (Makkouk et al., 2008). The primary aetiology of TF is idiopathic without a clear history of trauma or change in the level of activity (Lee et al., 2011).

There are a variety of methods to treat TF; interventions include both non-surgical and surgical treatments. In most cases, conservative treatment is recommended before surgical intervention (Ryzewicz and Moriatis Wolf, 2006; Valen and Foxworth, 2010). Conservative treatment includes anti-inflammatory drugs, steroid injections and rehabilitation. Occupational therapy (OT) recommendations for TF include orthotic fabrication and adjustment and modification of activities and environment; however, few studies have examined the efficacy of these practices (Radomski and Trombly, 2002). Ergonomic modifications, including altering techniques to prevent recurrence, may be introduced, and after a period of rest, activities should be resumed gradually and performed in a pain-free manner (Lee et al., 2011). Psychometric evidence from common hand assessment tools such as the Disabilities of Arm Shoulder and Hand (DASH) questionnaire (Hudak et al., 1996), the grip strength dynamometer and various desk-based dexterity tests in this population is lacking, and there are no specific OT assessment guidelines for TF.

Researchers have reported short-term success rates as determined by symptom resolution and an increase in grip strength in 66–92% of patients treated with a metacarpophalangeal (MCP) blocking orthosis worn for 3–9 weeks (Evans et al., 1988; Patel and Bassini, 1992; Colbourn et al., 2008). Rodgers et al. (1998) reported a 55% success rate after an average of 8 weeks of treatment with a distal interphalangeal (DIP) joint orthosis. Other authors compared the efficacy of two orthosis designs, a DIP orthosis and an MCP orthosis. They reported a 77% success rate for MCP orthosis and 47% for DIP orthosis, at 6 weeks. Participants who wore the MCP joint orthosis reported higher rates of comfort compared with those who wore the DIP orthosis (Tarbhai et al., 2011). Most recently, Valdes (2012) conducted a retrospective study to determine the long-term efficacy of orthoses for TF. The author reported that 87% of the participants did not require further intervention in the year after orthosis application.

Although some research regarding the conservative treatment of TF is available, treatment is inconsistent among therapists, and there is limited evidence pointing to the success of one intervention versus another (Altman, 2008). There is a need for high-quality research regarding the long-term and functional outcome of conservative treatment for TF (Valen and Foxworth, 2010). In order to conduct prospective research regarding conservative treatment for TF, there is a need to first establish the standard treatment that is given to the TF population by occupational therapists and the outcome measures that are used. These practices need to be examined in light of the Occupational Therapy Practice Framework and the International Classification of Function (ICF), which provide a broad perspective on the implications of health conditions, addressing the interactions between person (body systems and structures), occupation (activity and participation in life roles) and environment factors (Figure 1) (Roley et al., 2008; World Health Organization, 2002).

**Study objectives**

The aim of this exploratory and descriptive study was to examine the process of evaluation and intervention given by OT hand therapists, for patients with TF. Therefore, the objectives of the study were as follows:

1. **Review the evaluation and treatment methods administered by OT hand therapists, for patients with TF.**
2. **Determine if the assessment and treatment practices of OT hand therapists for TF address the diverse aspects of the domain of OT and the ICF.**
3. **Explore the consistency of assessment and treatment practices for TF between two different countries.**

**Method**

An electronic survey was sent to OT specialists in hand therapy in Israel and the United States. The study was approved by the Institutional Review Board of Hadassah Medical Center in Jerusalem, Israel. The United States was chosen as the additional country for the survey because the OT curricula in Israel are derived from the American model and literature. This selection was performed in order to control for academic differences, although it can be assumed that OTs from both countries use similar sources of evidence, such as textbooks and peer-reviewed journals. The common curricula between countries led to the formulation of the hypothesis that no significant practice differences between the countries will be found in assessment and treatment methods for TF.

**Participants**

The research participants were OT specialists in hand therapy in Israel and the United States that responded...
to the online survey. The response rate was 66% among therapists in Israel and 35% in the United States. Sixty-one therapists participated in the study, 54% from Israel and 46% from the United States (Table I). Eighty per cent of the therapists had more than 5 years’ experience in hand therapy (mean = 15.54, SD = 9.46); 41% reported working in a hospital setting and the rest in community-based hand clinics. Half of the participating therapists (51%) reported seeing TF patients very often, 37% reported seeing TF patients sometimes and only 12% reported rarely seeing TF patients.

Table I. Descriptive characteristic of participant hand therapists

<table>
<thead>
<tr>
<th></th>
<th>N = 61</th>
<th>Israel (n = 33)</th>
<th>United States (n = 28)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>43.48 (12.06)</td>
<td>40.97 (9.68)</td>
<td>49.06 (10.53)</td>
</tr>
<tr>
<td>Years of experience</td>
<td>15.54 (9.46)</td>
<td>12.10 (8.11)</td>
<td>19.29 (9.19)</td>
</tr>
<tr>
<td>Clinical setting, % (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>41 (25)</td>
<td>36 (12)</td>
<td>45 (13)</td>
</tr>
<tr>
<td>Community</td>
<td>59 (36)</td>
<td>64 (21)</td>
<td>55 (15)</td>
</tr>
<tr>
<td>Frequently treating TF patients</td>
<td>51 (31)</td>
<td>64 (21)</td>
<td>41 (11)</td>
</tr>
</tbody>
</table>

SD = standard deviation; TF = trigger finger.
Instruments

The research was conducted using an electronic survey developed by the authors on the basis of a review of the literature and input from five experts in hand therapy and research (four OTs and one hand surgeon). The survey (Appendix 1) comprised open-ended and multiple-choice questions regarding three main topics: (1) demographic information of the therapist; (2) the evaluation tools used for their clients with TF as well as other hand health conditions (assessment methods and tools); (3) the treatment practices used for their clients with TF (treatment methods and duration of treatment and frequency). Open-ended questions were included in order not to miss practices that may be masked by multiple-choice questions.

Procedure

The study was conducted using an electronic survey that was sent to a convenience sample. The sampling frame was determined by the list of hand clinics published by the Israeli Society of Hand Surgeons (www.issh.org.il/institutes.asp) and by the clinical affiliations of three central OT academic programmes in the United States. The survey was sent to 50 clinics in Israel and 80 clinics in the United States. The survey was accessible on the Internet for 6 months.

Statistical procedures

Results were analysed using the Statistical Package for Social Sciences (SPSS) version 18 (SPSS v. 18, IBM Corporation, Armonk, NY, USA). Descriptive and inferential statistics were used to analyse the data. Descriptive statistics included the assessment of frequencies, percentages, means and standard deviations for socio-demographic and survey data. To explore the differences between the Israeli and US samples, Pearson chi-square test was used. The answers to the open-ended questions were grouped into categories determined by the four experts in rehabilitation and hand therapy in line with professional models of practice.

Results

Assessment practices

The therapists were presented with an open-ended question regarding their assessment protocol for their clients with TF. The responses were grouped into six categories: occupation, dexterity, hand strength, range of motion (ROM), pain and TF symptoms (Table II). Overall, the most frequent assessment practice addressed the category of TF symptoms (67%), followed by ROM, pain, hand strength, occupation and dexterity. The frequency of assessment practice that addressed the category of occupation was only 25%. This trend of bottom-up assessment was found in both countries; however, some differences were found between the groups. The US group tended to use measures of ROM (57%) more frequently than the Israelis (35%), whereas the Israelis used pain measures (42%) more frequently than the US therapists (27%). A significant difference was found between the groups in the frequency of their use of hand strength measures (chi-square = 9.467; \( p = 0.002 \)), with Israeli therapists using these less frequently. The therapists were also asked to rate how frequently they use a list of well-documented evaluation tools in their general practice (not specifically for TF). The most common assessment areas were grip strength (91%), ROM (93%) and pain (75%). Thirty-seven per cent of the therapists reported frequent use of the DASH questionnaire, and only 3% reported frequent use of the Canadian Occupational Performance Measure (COPM) (Law et al., 1991) in their general practice. Furthermore, 21% of the sample reported never using the DASH, and 37% reported never using the COPM (Table III).

Treatment practices of trigger finger

The therapists were presented with an open-ended question regarding the treatment protocol for TF. The responses were grouped into four categories: orthoses, physical agent modalities (PAM), exercise, and activity and environment modification (therapists reported using activity modifications to prevent recurrence and

| Table II. Percentage of therapists that reported frequently using the assessment methods for TF |
|----------------------------------|------------------|------------------|------------------|
| N = 52                          | Israel (n = 31)  | United States (n = 21) |
| % (n)                           | % (n)            | % (n)            |
| Occupation                      | 25 (13)          | 26 (8)           | 24 (5)           |
| Dexterity                       | 8 (4)            | 3 (1)            | 14 (3)           |
| Hand strength                   | 17 (9)           | 3 (1)            | 38 (8)           |
| ROM                             | 44 (23)          | 35 (11)          | 57 (12)          |
| Pain                            | 37 (19)          | 42 (13)          | 27 (6)           |
| TF symptoms                     | 67 (35)          | 74 (23)          | 57 (12)          |

SD = standard deviation; ROM = range of motion; TF = trigger finger.
Table III. Standard assessments frequently used in general practice

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Common % (n)</th>
<th>Rarely % (n)</th>
<th>Never % (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Occupational</td>
<td>57 3 (2)</td>
<td>65 37 (37)</td>
<td>32 18 (18)</td>
</tr>
<tr>
<td>Performance Measure</td>
<td>57 37 (21)</td>
<td>42 22 (21)</td>
<td>21 12 (12)</td>
</tr>
<tr>
<td>Disabilities of Arm Shoulder and Hand</td>
<td>57 4 (2)</td>
<td>59 34 (34)</td>
<td>37 21 (21)</td>
</tr>
<tr>
<td>The Jepsen Test of Hand Function (Jepsen et al., 1969)</td>
<td>57 9 (5)</td>
<td>42 24 (24)</td>
<td>47 28 (28)</td>
</tr>
<tr>
<td>Box and Block Test (Mathiowetz et al., 1985a)</td>
<td>50 46 (23)</td>
<td>36 18 (18)</td>
<td>18 9 (9)</td>
</tr>
<tr>
<td>Nine-hole Peg Test (Mathiowetz et al., 1985b)</td>
<td>54 21 (11)</td>
<td>43 23 (23)</td>
<td>36 20 (20)</td>
</tr>
<tr>
<td>Functional Dexterity Test (Aaron &amp; Jansen, 2003)</td>
<td>57 40 (23)</td>
<td>37 21 (21)</td>
<td>23 13 (13)</td>
</tr>
<tr>
<td>Purdue Pegboard Test (Tiffin 1948)</td>
<td>57 9 (5)</td>
<td>42 24 (24)</td>
<td>47 28 (28)</td>
</tr>
<tr>
<td>Modified Kapandji Index (Lefevre-Colau et al., 2003)</td>
<td>57 32 (18)</td>
<td>31 18 (18)</td>
<td>37 21 (21)</td>
</tr>
<tr>
<td>Grip strength</td>
<td>57 91 (52)</td>
<td>5 3 (3)</td>
<td>4 2 (2)</td>
</tr>
<tr>
<td>Pinch strength</td>
<td>57 88 (50)</td>
<td>9 5 (5)</td>
<td>3 2 (2)</td>
</tr>
<tr>
<td>Range Of motion</td>
<td>57 93 (53)</td>
<td>4 2 (2)</td>
<td>3 2 (2)</td>
</tr>
<tr>
<td>Pain</td>
<td>56 75 (42)</td>
<td>14 8 (8)</td>
<td>11 6 (6)</td>
</tr>
<tr>
<td>Semmes–Wienstein monofilaments</td>
<td>57 67 (38)</td>
<td>25 14 (14)</td>
<td>8 5 (5)</td>
</tr>
<tr>
<td>Two-point Discrimination</td>
<td>57 48 (27)</td>
<td>39 22 (22)</td>
<td>14 8 (8)</td>
</tr>
</tbody>
</table>

Table IV. Percentage of therapists that reported frequently using the listed treatment options for trigger finger

<table>
<thead>
<tr>
<th>Treatment Options</th>
<th>United States = 28</th>
<th>Israel = 33</th>
<th>Pearson chi-square</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthoses</td>
<td>100 (61)</td>
<td>100 (61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAM</td>
<td>81 (49)</td>
<td>84 (48)</td>
<td>4.31²</td>
<td>0.038</td>
</tr>
<tr>
<td>Exercise</td>
<td>49 (30)</td>
<td>61 (20)</td>
<td>3.96²</td>
<td>0.007</td>
</tr>
<tr>
<td>Activity and environment modification</td>
<td>75 (46)</td>
<td>59 (19)</td>
<td>9.72²</td>
<td>0.002</td>
</tr>
</tbody>
</table>

PAM = physical agent modalities.

environment modification significantly more than the Israeli group did (p < 0.05; Table IV). The most common PAM was the paraffin bath in the Israeli sample (69%) and ultrasound in the US group (81%).

The therapists were also presented with multiple-choice questions regarding the type of orthosis they commonly used for TF and the protocol they recommend for using it. The Israelis reported that they use a proximal interphalangeal joint blocking orthosis most frequently (97%), whereas the US therapists reported that they use an MCP joint blocking orthosis most frequently (88%). The US therapists also reported using a DIP joint blocking orthosis (46%) that is rarely (6%) used in Israel (Table V). The therapists were presented with an open-ended question regarding their clinical reasoning in choosing which orthosis to use. The responses were grouped into three categories: TF symptoms, occupational concerns and other. Seventy-nine per cent of the therapists reported considering TF symptoms in their clinical reasoning (United States 83%; Israel 74%). Thirty-eight per cent of the therapists reported considering occupational concerns in their clinical reasoning (United States 33%; Israel 43%); and 21% of the therapists gave other reasons for choosing which orthosis to use. The common answers in the category of “other” were “evidence of effectiveness,” “using only one or two orthoses designs” and “according to physician request.” Just over half of both groups (57%) recommend wearing the orthosis both day and night. Both groups reported that an average course of treatment was 7 weeks, but significant differences were found (t = -2.758, p = 0.008) regarding the period of orthosis use. The Israelis recommended using the orthosis for a longer period (mean = 7.9 weeks, SD = 4.7) than the US sample did (mean = 4.8 weeks, SD = 1.5).

Table V. Percentage of therapists that reported using each type of orthosis and recommended length of use

<table>
<thead>
<tr>
<th>Orthosis</th>
<th>United States = 28</th>
<th>Israel = 33</th>
<th>Pearson chi-square</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCP orthosis</td>
<td>73 (24)</td>
<td>88 (25)</td>
<td>1.82²</td>
<td>0.117</td>
</tr>
<tr>
<td>PIP orthosis</td>
<td>97 (32)</td>
<td>38 (11)</td>
<td>23.69²</td>
<td>0.000</td>
</tr>
<tr>
<td>DIP orthosis</td>
<td>6 (2)</td>
<td>46 (13)</td>
<td>12.48²</td>
<td>0.000</td>
</tr>
<tr>
<td>Length of orthosis use in weeks, mean (SD)</td>
<td>7.85 (4.71)</td>
<td>4.8 (1.64)</td>
<td>2.75 0.008</td>
<td></td>
</tr>
</tbody>
</table>

MCP = metacarpophalangeal joint; PIP = proximal interphalangeal joint; DIP = distal interphalangeal joint; SD = standard deviation.
Discussion

The aim of this study was to describe the evaluation and treatment protocols for patients with TF administered by experienced OT hand therapists in two countries. The results revealed that only 25% of therapists in both countries use occupational measures as part of their assessment for people with TF. Most of the therapists reported assessing mainly the symptoms of TF. This restricted approach to assessment is not consistent with the OT guidelines, underlining the need for incorporating occupation-based assessments in practice (Roley et al., 2008). The Occupational Therapy Practice Framework emphasizes the importance of including all aspects of the domain to understand the client’s engagement in occupations, participation and health. Moreover, this integrative approach was further endorsed by the World Health Organization’s ICF, which highlights the need to address the broader impact of health conditions (WHO, 2001).

These findings are in line with previous studies of other hand conditions. Michlovitz et al. (2001) surveyed common practices and outcome measures used by hand therapists for the treatment of distal radius fractures. They found that physical measures were used more frequently (85%) than functional measures (2–3%). More recently, Winthrop Rose et al. (2011) examined the frequency with which ICF domains were included in 788 papers from the Journal of Hand Therapy and 78 hand therapy papers from other sources. They found that an emphasis was placed on body structures and body functions and that far less emphasis was placed on activities and participation factors. The authors also found that this trend has remained stable over time despite the emergence of patient-centred disability measures.

The issue of occupation-based assessment in TF is not well documented. A recent study by Tarbhai et al. (2011) examining the efficacy of orthoses for TF found that patients with TF did not identify functional limitations prior to treatment using the COPM. Nevertheless, Tung et al. (2010) found that the DASH score identified functional limitations among adults with TF and significantly differentiated between levels of severity of TF. Further research is required to understand the functional implications of TF, and the appropriate outcome measures that should be used for this population. This research should attempt to incorporate all domains of the ICF and may require the use of several measures. Drummond et al. (2007) found that the 30 items in the DASH questionnaire and four items from the optional modules were linked to the ICF body functions component and participation component. There were no items linked to body structure or environmental factors.

Despite the lack of demonstrated efficacy for occupation-based interventions in TF, the finding that most OTs (75%) in the sample reported the use of activity and environment modifications in their practice is encouraging. Similar results were found in a recent survey of hand therapists regarding conservative thumb carpometacarpal joint care. The therapists in this study also reported using activity modifications (96.4%) more frequently than using functional outcome measures (66.2%) (O’Brien and McGaha, 2014). Within the limited body of research regarding rehabilitation for TF, the majority of studies centred on the efficacy of orthoses for reducing symptomatology. High success rates (66–92%) for orthotic intervention have been found for reducing symptoms of TF in the short term (Evans et al., 1988; Patel and Bassini, 1992; Rodgers et al., 1998; Tarbhai et al., 2011; Colbourn et al., 2008), and one study demonstrated an 87% success rate in the long term (Valdes, 2012). The results of our study demonstrate that experienced professionals are adhering to this research, yet differences were found among therapists from two countries regarding the type of orthoses they use in their practice. These findings could be attributed to the paucity of evidence comparing different orthoses for TF. Furthermore, there are marked inconsistencies in the literature concerning the regimen of orthosis use, and there are no standardized guidelines as to what is considered best practice for TF (Kerrigan and Stawix, 2009). Similarly, the length of time for using the orthosis in studies varied between 6 and 10 weeks (Evans et al., 1988; Patel and Bassini, 1992; Colbourn et al., 2008; Tarbhai et al., 2011; Valdes, 2012). This variation was also confirmed in the present study with significant differences between the countries, where the Israeli therapists recommended using the orthosis for a longer period than the US therapists did. On the other hand, both groups reported applying the orthosis day and night, which reflected the protocols that were used in TF studies, although the efficacy of this practice in comparison with others has not been established (Evans et al., 1988; Patel and Bassini, 1992; Colbourn et al., 2008; Tarbhai et al., 2011; Valdes, 2012).

In summary, the present study informs our understanding of the assessment and interventions provided by OT hand therapists for patients with TF. Overall, this survey has shown that TF practices are predominantly focused on client factors/body functions with variations...
implications for occupational therapy practice

The results of the present study shed light on the common practices of occupational therapists in the treatment of patients with TF. Therapists should consider incorporating occupation-based assessments such as the DASH and COPM into their practice when treating people with a diagnosis of TF. The present study demonstrated that most therapists in both countries adhere to the evidence available for treating TF. Yet some of the methods need further investigation; therefore, we recommend that therapists take an active role in research regarding the outcome of OT for patients with TF using the broad perspective of the ICF.

implications for research

Further research should be conducted in order to validate disease-specific outcome measures in accordance with the OT practice and ICF frameworks. This research should examine the broad impact of TF on participation and quality of life and could be used to determine the efficacy of various treatment protocols.

REFERENCES


### Appendix A

Evaluation and treatment of trigger finger among hand therapists

1. **Where do you live?**
   - USA
   - Canada
   - Europe

2. **Gender**
   - male
   - female

3. **Age**

4. **Higher education: please state what did you major in**
   - Bachelor degree:
   - Master degree (OT, PT, Other):
   - Doctorate degree

5. **Are you a certified Hand therapists?**
   - yes
   - no

6. **How many Years of experience do you have working as an OT/PT?**

7. **Years of experience in the field of hand rehabilitation?**

8. **What Clinical setting are you currently working at?**
   - hospital
   - HMO
9. How frequently do you see patients diagnosed with Trigger Finger in your clinic?
- Very often
- Sometimes
- Rarely

10. Which assessment tools do you use to evaluate people with a diagnosis of Trigger finger?

11. Please check the assessment measures that are in use generally at your clinic (not specifically for Trigger finger). Please state next to each tool if it is commonly or rarely used.

Disabilities of the Arm Shoulder and Hand (DASH)  
The Jebsen Test of Hand Function  
Box and Block test  
Purdue Pegboard test  
Nine-Hole Peg test  
Functional Dexterity Test (FDT)  
Modified Kapandji Index
| Grip Strength | | |
| Pinch Strength | | |
| Semmes-Weinstein monofilaments | | |
| Tow point discriminations | | |
| ROM - Range of Motion | | |
| Stages of Stenosing Tenosynovitis (SST) | | |
| Pain evaluation | | |
| Other | | |

12. In general, which methods of treatment are most commonly used in your clinic for treating Trigger Finger?

13. Do you use Paraffin baths to treat patients with Trigger finger?
   - [ ] Yes
   - [ ] No

   Number of treatments given in a series of meetings: [ ]

14. Do you use Jet stream baths to treat patients with Trigger finger?
   - [ ] Yes
   - [ ] No

   Number of treatments given in a series of meetings: [ ]

15. Do you use Ultrasound to treat patients with Trigger finger?
   - [ ] Yes
   - [ ] No

   Number of treatments given in a series of meetings: [ ]
16. Do you use Hot packs to treat patients with Trigger finger?
☐ Yes ☐ No

Number of treatments given in a series of meetings:

17. Do you use Massage to treat patients with Trigger finger?
☐ Yes ☐ No

Number of treatments given in a series of meetings:

18. Is exercises part of the treatment provided in the clinic? If yes, which exercises do you use?

19. Do you recommend exercising at home? If yes, what are your recommendations?

20. Do you give counseling regarding work and environmental adaptation and changing habit which might aggravate the symptoms?
☐ Yes ☐ No

21. Do you use splints for the treatment of Trigger finger?
☐ Yes ☐ No

22. If yes, what type of splint/s? (You can check more than one answer)
☐ Splint for MP joint
☐ Splint for PIP joint
☐ Splint for DIP joint
23. How do you decide which splint to use?

24. How many hours do you recommend the splint to be worn, over a 24 hour period:

25. How long (on average) does the treatment with the splint lasts?

26. Number of treatment sessions given, on average, to patients that suffer from Trigger finger?

27. Do you invite patients for a follow-up visit/s?
   
   - Yes
   - No

   If yes, for how long do you follow these patients.

28. What outcome measures do you use to evaluate treatment effectiveness?
Research Article
Evaluating Hand Function in Clients with Trigger Finger

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Background. Trigger finger (TF) is a common hand pathology frequently encountered in hand clinics. Occupational therapists predominantly assess TF symptoms as opposed to using standardized hand functioning assessments. The purpose of this study was to assess the construct validity of dexterity and grip strength assessments for clients with TF. Method. Sixty-three participants with TF and 66 healthy controls were administered the Functional Dexterity Test (FDT), Purdue Pegboard Test (PPT), and Jamar Hydraulic Hand Dynamometer (JD) and completed the Disabilities of Arm Shoulder and Hand questionnaire (DASH). TF symptoms were graded using the Quinnell classification. Results. Statistically significant differences were found between the groups in dexterity and grip strength. A statistically significant difference between the three TF grades was found on the PPT. All three tests scores were moderately correlated with the DASH scores. Conclusion. This study provides innovative evidence for the validity of common hand function assessments for individuals with TF and recommends incorporating these tools in clinical practice. Further research is needed with larger samples and better representation of each TF clinical grade.

1. Introduction

Hand function is a broad term that incorporates several components, including strength, sensation, range of motion, and dexterity. Normal function of the hand is an important factor in a person’s ability to independently engage in daily activities and occupations [1]. Damage to one or more of these components can lead to dysfunction of the hand and limit participation in everyday life [2]. According to the International Classification of Function (ICF), there is an interaction between the elements of body systems and structures (such as dexterity and strength), activity and participation in life roles, and contextual factors (environmental factors and personal factors) [3].

Trigger Finger (TF), also termed Stenosing Flexor Tenosynovitis, is one of the most common pathologies seen in hand surgery clinics and is the fourth leading cause of referral to these clinics [4]. Triggering of the finger commonly occurs at the fibroosseous tunnel formed by the metacarpal neck and the first annular pulley. The initial complaints associated with TF are pain over the A1 pulley or clicking and may worsen to severe pain and locking of the digit in flexion [5]. The incidence of TF is 28 : 100,000 per year or a lifetime risk of 2.6% in the general population, but it increases to 10% in the diabetic population [6]. The mean age of onset for TF is 58 years and it is diagnosed in women two to six times more frequently than men [5]. The diagnosis of TF is based on symptoms and physical examination, yet in recently published consensus guidelines for managing TF no uniform grading system has been recommended [7]. There are a variety of methods to treat TF; interventions include both nonsurgical and surgical treatment options [8]. In recently published guidelines, experts agreed on the following methods for the management of TF: orthotics, corticosteroid injections, and surgical treatment. When planning a treatment regimen, they recommend considering the severity and duration of the pathology as well as previous treatment [7].

The majority of the intervention studies regarding TF utilized symptom resolution as the outcome measure, as opposed to utilizing hand function outcomes, such as dexterity and strength [9–12]. A similar trend was found among a cohort of 61 occupational therapists from Israel and the
United States, who reported on their assessment practices for clients with TF. These therapists predominantly evaluate TF symptoms, as opposed to the use of standardized hand functioning assessments in clients with other hand conditions [13]. This trend could be attributed to the fact that assessments for hand function have not been validated for individuals with TF. In addition, the lack of validated measures may impede documenting and establishing evidence based occupational therapy for treating individuals with TF [14]. Therefore, the aim of the present study was to assess the construct validity of tools for measuring several components of hand function in clients with TF.

The focus of this study is on hand function measures of dexterity and strength. Dexterity is the ability to use your hands skillfully and is defined as fine, voluntary movement used to manipulate small objects during a specific task [15]. Dexterity can be subcategorized into gross manual dexterity, which is the ability to handle objects with the hand and into fine motor dexterity, which refers to in-hand manipulations using the thumb and second or third digit (McPhee in [16, 17]). Grip strength is defined as the force applied by the hand and fingers or the measurable ability to exert pressure on objects. In the consensus guidelines for the assessment of clients with hand conditions it was agreed that the Jamar Hydraulic Hand Dynamometer (JD) and the Pinch Gauge device should be used to assess strength, yet no consensus was reached regarding the assessment of dexterity [18]. The evaluation of dexterity can provide information about the neuromotor function of the hand, since sensation and intrinsic hand strength are essential for performing manipulative movements [15].

There are many methods available to assess dexterity and the selection of an appropriate tool is often based on a variety of factors, including availability, familiarity, and applicability to a given population and psychometric soundness. For the assessment of dexterity in the present study we used the Functional Dexterity Test (FDT) and the Purdue Pegboard Test (PPT) whose psychometric properties have been well established in other targeted health populations [1, 15] and have been reported to be commonly used by occupational therapists in hand clinics [13].

**Study Objectives.** The objectives of the study were to assess the construct validity of the FDT, PPT, and the JD for people with TF, specifically to (a) evaluate the ability of these measures to distinguish amongst grades of TF severity; (b) to distinguish between groups with and without TF; (c) to assess whether the side of the involved hand (radial or ulnar) effects grip strength and dexterity; and (d) finally to evaluate the correlation between measures of hand function and self-reported disability. Accordingly the research questions were as follows: (a) Will statistically significant differences be found between the three TF grades in the scores of the FDT, PPT, and JD? (b) Will statistically significant differences be found between the TF and control groups in the scores of the FDT, PPT, and JD? (c) Will statistically significant differences be found between participants with TF on the radial side and the ulnar side in the scores of the FDT, PPT, and JD? (d) Will statistically significant correlation be found between the DASH score and the FDT, PPT, and JD scores of the TF group?

**2. Method**

**2.1. Study Design.** The study was a cross-sectional study.

**2.2. Participants.** The study protocol was approved by the Institutional Helsinki Committee. One hundred and fifty consecutive clients with TF that presented to a central orthopedic clinic of a major health maintenance organization (HMO) and an outpatient clinic in a major hospital between March 1st 2012 and April 30th 2013 were invited to participate in the study. Inclusion criteria were adult clients (age 18 years or above) with a diagnosis of one or more digits with TF of a Quinell grade one or higher. According to the Quinell grading system, TF fingers are rated as follows: 0, normal movement of the digit; 1, uneven movement; 2, actively correctable locking of the digit; 3, passively correctable locking; and 4, fixed deformity [19]. The exclusion criteria were upper extremity trauma in the preceding year, known neurological deficits, known cognitive deficits, and pregnant women. Written informed consent was obtained from all participants in the study. The demographic and clinical data of the participants were recorded. Participants were classified as having additional medical conditions if they reported one or more medical condition besides TF. The severity of the TF was recorded by the hand surgeon using the Quinell grading system. Consenting TF participants were administered the FDT, PPT, JD, numeric pain scale, and the Disabilities of the Arm Shoulder and Hand (DASH) questionnaire immediately after their visit with the doctor. A control group of 66 healthy participants was recruited using a convenience sample and matched for age and gender to the research group. The TF and control groups data was previously analyzed and published [20, 21]. The results of these two studies demonstrated (a) the effect of TF severity on functioning and quality of life as measured by the DASH and the World Health Organization Quality of Life Brief questionnaire (WHOQ-BRIEF) [21] and (b) the wide impact of TF on hand functioning, activities of daily living, and quality of life [20].

**2.3. Measures**

**2.3.1. Functional Dexterity Test (FDT).** The FDT tool is suitable for the adult population, 20–70 years old, with various injuries to the upper limb. The FDT gives information regarding the clients’ ability to use their hands for functional tasks requiring a dynamic 3-jaw chuck grasp pattern. It is made of a square wooden pegboard with 16 pegs. The examiner documents the time required to turn over all the pegs. Execution time is measured on each hand separately. A five-second penalty is added every time the participant supinates or touches the board and a 10-second penalty is added if the participant drops a peg. Two scores are obtained for each hand: the net time in seconds and the total score (net time plus penalties). The net time score was used in the present study. The FDT was found to have good interrater and good test retest reliability [16, 22].
2.3.2. Purdue Pegboard Test (PPT). The PPT was developed in 1948, in order to assess manual dexterity and precision of applicants for industrial work [23]. Since then, the PPT has been used in rehabilitation and in research [24]. The PPT includes four subtests; in the first three subtests participants are asked within 30 seconds to place the maximum number of metal pins, one at a time, into a row of pegboard holes, first with their dominant hand and then with their nondominant hand followed by placing pairs of pins with both hands simultaneously. In the fourth and final subtest, the participant uses alternate hands to form the maximum number of assemblies consisting of a pin, washer, collar, and second washer within 60 seconds. The PPT tests the quality and speed of performance of the hand as the person accomplishes the four subtests [23].

2.3.3. Jamar Hydraulic Hand Dynamometer (JD). The JD was designed to measure gross power fist grip and is considered to be the most accurate test for this skill. The American Society of Hand Therapists (ASHT) recommended the use of this tool for the assessment of grip strength [25]. The test was administered with the guidelines of the ASHT. Psychometric testing found good interrater reliability and high test retest reliability [26].

2.3.4. Disabilities of the Arm Shoulder and Hand (DASH). The DASH was developed in order to describe the disability experienced by people with upper-limb disorders and also to monitor changes in symptoms and function over time. The questionnaire consists of 30 questions related to physical function, social function, and different symptoms. Each item has five response options. The scores for all items are then used to calculate a scale score ranging from 0 (no disability) to 100 (most severe disability). There are two additional parts with four questions that are relevant for people that engage in sports, music, and work [27]. These parts were not included in the present study.

2.3.5. The Quinnell Grading System. The Quinnell grading system is used to assess clinical severity of TF. According to this classification, TF fingers are rated as follows: 0, normal movement of the digit; 1, uneven movement; 2, actively correctable locking of the digit; 3, passively correctible locking; and 4, fixed deformity [19].

2.3.6. Numerical Pain Rating Scale (NRS). The NRS is a scale with 11 degrees, reflecting the subjective intensity of pain experienced by a person during the preceding day or the previous week (see Figure 2). The pain scale can be administered verbally or by using a visual scale [28].

2.4. Data Analysis. The distribution of variables in the study (FDT, PPT, JD, pain, and age) met the criteria for normality based on the Shapiro-Wilk test of normality ($p > 0.05$). Prior to main hypotheses testing, between groups comparisons of demographics and background clinical data were performed in order to rule out extraneous factors (demographics and background clinical data) that might influence the results. Analysis of variance (ANOVA) was used to compare age and pain intensity between the TF subgroups (TF grades 1–3). A Chi-Square analysis was used to compare gender, hand dominance, affected hand, and presence of additional medical conditions between study and control group and between TF subgroups.

For the hypotheses testing, one-way ANOVA was used in order to compare the mean scores (FDT, PPT, and JD) obtained by the different TF grades and post hoc Tukey HSD test comparisons between groups were conducted. The TF group was divided according to affected finger. If the affected finger was the thumb index or middle finger the participant was assigned to the radial side affected group and if affected finger was the ring or small finger the participant was assigned to the ulnar side affected group. An independent sample $t$-test was used to compare FDT, PPT, and JD between radial and ulnar affected side groups. The correlations between the FDT, PPT, JD, and DASH were calculated using Pearson's correlations. Effects sizes were calculated according to the statistical test, partial eta squared for ANOVA [29], and Cohen's $d$ for $t$-test and correlation [30].

2.5. Procedure. Informed consent was obtained by hand surgeons. The hand function assessments and questionnaires were administered by experienced occupational therapists to participants immediately after their visit with the doctor. The occupational therapists were trained in the administration of the assessments and were tested for correct administration by the head researcher. Healthy participants were administered the same assessment protocol.

3. Results

Of 150 clients presenting with TF during the study period, a total of 63 met the inclusion criteria, agreed to participate in the study, and completed all assessments. The study group included participants with TF grades 1–3. Demographic and clinical data of participants are presented in Table 1 and distribution of affected digits in Figure 1. No statistically significant differences in demographic and background clinical data were found between subgroups of TF grades, between healthy and control groups, and between radial affected side and ulnar affected side groups ($p > 0.05$).

3.1. Differences in Hand Function between TF Grades. A statistically significant large effect of TF grade was found for PPT subtests demonstrating a decrease in PPT scores with...
Table 1: Demographic and clinical data: comparison of TF subgroups.

<table>
<thead>
<tr>
<th></th>
<th>TF (n = 63)</th>
<th>TF 1 (n = 11)</th>
<th>TF 2 (n = 43)</th>
<th>TF 3 (n = 9)</th>
<th>Control (n = 66)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>60.48 (11.34)</td>
<td>57.08 (16.8)</td>
<td>60.53 (9.87)</td>
<td>63.44 (10.87)</td>
<td>58.60 (11.55)</td>
</tr>
<tr>
<td>Pain</td>
<td>5.52 (2.45)</td>
<td>5.82 (1.53)</td>
<td>5.48 (2.78)</td>
<td>5.33 (1.58)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>20 (32)</td>
<td>5 (45)</td>
<td>13 (30)</td>
<td>2 (22)</td>
<td>23 (35)</td>
</tr>
<tr>
<td>Female</td>
<td>43 (68)</td>
<td>6 (55)</td>
<td>30 (70)</td>
<td>7 (78)</td>
<td>43 (65)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dominance</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>56 (89)</td>
<td>10 (91)</td>
<td>40 (93)</td>
<td>6 (67)</td>
<td>57 (86)</td>
</tr>
<tr>
<td>Left</td>
<td>7 (11)</td>
<td>1 (9)</td>
<td>3 (7)</td>
<td>3 (33)</td>
<td>9 (14)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affected Hand</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominant</td>
<td>36 (57)</td>
<td>9 (82)</td>
<td>21 (49)</td>
<td>6 (67)</td>
<td></td>
</tr>
<tr>
<td>Nondominant</td>
<td>17 (27)</td>
<td>1 (9)</td>
<td>14 (33)</td>
<td>2 (22)</td>
<td></td>
</tr>
<tr>
<td>Both</td>
<td>10 (16)</td>
<td>1 (9)</td>
<td>8 (18)</td>
<td>1 (11)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional conditions</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>34 (54)</td>
<td>5 (45)</td>
<td>24 (56)</td>
<td>4 (44)</td>
<td>27 (41)</td>
</tr>
<tr>
<td>No</td>
<td>29 (46)</td>
<td>6 (55)</td>
<td>19 (44)</td>
<td>5 (56)</td>
<td>39 (59)</td>
</tr>
</tbody>
</table>

1TF = trigger finger.

Figure 2: Numerical Pain Rating Scale.

Increasing severity of TF (p < 0.05) (see Table 2). Post hoc comparisons revealed statistically significant differences between grades 1 and 3 TF subgroups on the affected hand, both hands, and assembly subtests. For both hands, subtest a statistically significant difference was also found between grades 2 and 3. As for the FDT, a nonstatistically significant trend was found of increased scores (a higher score reflects reduced dexterity) with higher grade of pathology severity. As for grip strength, no group effect was found (see Table 2).

3.2. Decreased Hand Function in TF Group versus Control Group.

A statistically significant difference was found between the TF group and controls in all tests scores. The control group achieved superior scores in all the tests (see Table 3).

3.3. Differences in Hand Function between TF Participants with Radial versus Ulnar Side Affected.

There were 44 participants with TF on the radial side of the hand and 19 with TF on the ulnar side. No statistically significant differences were found between these two groups in all the measures (see Table 4).

3.4. Dexterity and Grip Strength Test Scores Correlate with Disability Score.

Statistically significant moderate correlations were found between the DASH and all the test scores of the affected hand in the TF group except for the PPT affected hand subtest (see Table 5).

4. Discussion

The purpose of the study was to evaluate the construct validity of the FDT, PPT, and JD for participants with TF. The results of the present study demonstrated that all three tools discriminated between people with and without TF. However, only the PPT had a statistically significant group effect on the clinical grades. Statistically significant differences were found between clinical grades 1 and 3 for all subtests of the PPT. No statistically significant differences were found between participants who had TF on the radial or ulnar side. Furthermore, all the tools (excluding one PPT subtest) were statistically significantly correlated with the DASH.

The results of the present study demonstrated the impairment in dexterity among individuals with TF in comparison to controls and that this impairment increased with the severity of TF. The FDT and PPT are both commonly used in clinical settings [13] yet there is a paucity of studies that examined the degree to which these tools are valid for assessing populations with specific hand conditions [24]. The current findings support the validity of the PPT in the TF population and are in line with studies of dexterity in individuals with other hand conditions. A study that examined the validity and reliability of the PPT for people with Carpal Tunnel Syndrome (CTS) found an association between disease severity and all the subtests of the PPT in patients aged 60 and older and statistically significant differences between the CTS group and controls [31]. An earlier study conducted by Ben Shahar et al., in 1998, also found that the PPT differentiated between a group of clients with a variety of hand conditions and controls. In addition to the evidence obtained regarding construct validity, the findings of this study also support...
<table>
<thead>
<tr>
<th>TF grades</th>
<th>TF 1 (n = 11)</th>
<th>TF 2 (n = 42)</th>
<th>TF 3 (n = 9)</th>
<th>ANOVA</th>
<th>I versus II</th>
<th>I versus III</th>
<th>II versus III</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>95% CI</td>
<td>Mean (SD)</td>
<td>95% CI</td>
<td>F</td>
<td>p</td>
<td>η²</td>
</tr>
<tr>
<td>FDT affected hand</td>
<td>28.34 (4.98)</td>
<td>13.22–43.45</td>
<td>37.41 (28.74)</td>
<td>29.67–45.14</td>
<td>1.453</td>
<td>0.246</td>
<td>0.046</td>
</tr>
<tr>
<td>PPT affected hand</td>
<td>13.18 (2.04)</td>
<td>11.83–14.53</td>
<td>11.55 (2.13)</td>
<td>10.86–12.24</td>
<td>5.083</td>
<td>0.009*</td>
<td>0.147</td>
</tr>
<tr>
<td>PPT both hands</td>
<td>10.64 (1.21)</td>
<td>9.55–11.73</td>
<td>9.38 (1.89)</td>
<td>8.82–9.94</td>
<td>6.705</td>
<td>0.002*</td>
<td>0.185</td>
</tr>
<tr>
<td>PPT assembly</td>
<td>28.36 (7.55)</td>
<td>25.12–31.61</td>
<td>23.88 (4.68)</td>
<td>22.22–25.54</td>
<td>7.191</td>
<td>0.002*</td>
<td>0.196</td>
</tr>
<tr>
<td>JD affected hand</td>
<td>21.4 (5.29)</td>
<td>15.72–27.01</td>
<td>16.25 (9.87)</td>
<td>13.34–19.16</td>
<td>1.324</td>
<td>0.274</td>
<td>0.043</td>
</tr>
</tbody>
</table>

TF = trigger finger; FDT = Functional Dexterity Test; PPT = Purdue Pegboard Test; JD = Jamar Hydraulic Hand Dynamometer.

* p ≤ 0.05; ** p ≤ 0.001.
Table 3: Mean difference in FDT, PPT, and JD among TF and control groups.

<table>
<thead>
<tr>
<th></th>
<th>TF group mean (SD)</th>
<th>Control group mean (SD)</th>
<th>t(df)</th>
<th>p</th>
<th>Effect size</th>
<th>95% CI of the difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDT DH (n = 44)</td>
<td>36.5 (28.3)</td>
<td>27.7 (8.5)</td>
<td>2.0</td>
<td>0.05</td>
<td>0.421</td>
<td>16.1–1.4</td>
</tr>
<tr>
<td>FDT NDH (n = 19)</td>
<td>38.8 (15.8)</td>
<td>29.2 (7.7)</td>
<td>2.6</td>
<td>0.017</td>
<td>0.772</td>
<td>17.5–1.9</td>
</tr>
<tr>
<td>PPT DH (n = 44)</td>
<td>11.9 (2.5)</td>
<td>13.5 (2.5)</td>
<td>3.3</td>
<td>0.001</td>
<td>0.639</td>
<td>0.6–2.5</td>
</tr>
<tr>
<td>PPT NDH (n = 19)</td>
<td>10.6 (2.9)</td>
<td>13.0 (2.4)</td>
<td>4.1</td>
<td>0.001</td>
<td>1.108</td>
<td>1.3–3.6</td>
</tr>
<tr>
<td>PPT BH (n = 63)</td>
<td>9.3 (2)</td>
<td>10.5 (2.1)</td>
<td>3.3</td>
<td>0.002</td>
<td>0.585</td>
<td>0.5–1.9</td>
</tr>
<tr>
<td>PPT assembly (n = 62)</td>
<td>24 (5.9)</td>
<td>27.5 (8.23)</td>
<td>2.8</td>
<td>0.006</td>
<td>0.489</td>
<td>1.1–6.01</td>
</tr>
<tr>
<td>JD DH (n = 44)</td>
<td>19.2 (8.8)</td>
<td>28.5 (10.2)</td>
<td>4.9</td>
<td>0.001</td>
<td>0.976</td>
<td>5.6–13.1</td>
</tr>
<tr>
<td>JD NDH (n = 19)</td>
<td>11.1 (8.5)</td>
<td>26.4 (10.1)</td>
<td>6.1</td>
<td>0.001</td>
<td>1.639</td>
<td>10.3–20.4</td>
</tr>
</tbody>
</table>

TF = trigger finger; FDT = Functional Dexterity Test; PPT = Purdue Pegboard Test; JD = Jamar Hydraulic Hand Dynamometer; DH = dominant hand; NDH = nondominant hand; BH = both hands.

Table 4: Mean difference in FDT, PPT, and JD scores between TF participants with radial versus ulnar side affected.

<table>
<thead>
<tr>
<th></th>
<th>Radial affected side group n = 44 Mean (SD)</th>
<th>Ulnar affected side group n = 19 Mean (SD)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDT affected hand</td>
<td>40.7 (18.5)</td>
<td>45.5 (39.4)</td>
<td>NS</td>
</tr>
<tr>
<td>PPT affected hand</td>
<td>11.6 (2.7)</td>
<td>11.4 (1.7)</td>
<td>NS</td>
</tr>
<tr>
<td>PPT both hands</td>
<td>9.3 (2.1)</td>
<td>9.3 (1.8)</td>
<td>NS</td>
</tr>
<tr>
<td>PPT assembly</td>
<td>23.7 (6.1)</td>
<td>24.7 (5.3)</td>
<td>NS</td>
</tr>
<tr>
<td>JD affected hand</td>
<td>16.6 (8.6)</td>
<td>19.4 (11.6)</td>
<td>NS</td>
</tr>
</tbody>
</table>

FDT = Functional Dexterity Test; PPT = Purdue Pegboard Test; JD = Jamar Hydraulic Hand Dynamometer.

Table 5: Correlations between FDT, PPT, and JD scores and DASH scores in TF group.

<table>
<thead>
<tr>
<th></th>
<th>FDT affected hand</th>
<th>PPT affected hand</th>
<th>PPT both hands</th>
<th>PPT assembly</th>
<th>JD affected hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>DASH</td>
<td>0.301*</td>
<td>-0.214**</td>
<td>-0.418**</td>
<td>-0.350**</td>
<td>-0.472**</td>
</tr>
</tbody>
</table>

* p < 0.05; ** p < 0.01.
FDT = Functional Dexterity Test; PPT = Purdue Pegboard Test; JD = Jamar Hydraulic Hand Dynamometer; DASH = Disabilities of the Arm Shoulder and Hand.

The findings regarding grip strength differed from dexterity, as no group effect of the clinical grades was demonstrated on the JD. However, TF participants had statistically significant weaker grip strength than the control group. Furthermore, a moderate statistically significant correlation was found between the JD and the DASH, supporting its ecological validity for the TF population. We were unable to find similar studies which used the JD with TF participants. However, several studies have demonstrated a similar trend of decreased grip strength among people with upper extremity musculoskeletal disorders in comparison to healthy controls [34]. Regarding correlation between grip strength and ADL, similar correlations were demonstrated in studies of elderly and individuals after distal radial fracture [35, 36].

5. Conclusions

The current findings suggest that the PPT and FDT are valid tools for measuring dexterity and the JD is a valid measure of strength in clients with TF. According to the results of the current study the PPT was more sensitive to the clinical grades of TF than the other measures. The PPT, FDT, and JD were moderately correlated with a measure of disability (DASH). These findings are important in light of recent findings whereby a very low percentage of occupational therapists use these assessments in their practice with clients with TF, despite the fact that they commonly use these tools with other clients [13]. Based on the findings of the present study therapists may consider incorporating these measures into their assessment protocol for clients with TF.

Additional Points

Study Limitations and Recommendations. The distribution of participants among the TF grades was not equal. Therefore, the findings of this study should be interpreted with caution. Further studies with larger representation of TF grades are recommended.

Competing Interests

The authors declare that they have no competing interests.
References


Multidisciplinary Consensus Guideline for Managing Trigger Finger: Results From the European HANDGUIDE Study

Bionka M.A. Huisstede, Peter Hoogvliet, J. Henk Coert, Jan Fridén; for the European HANDGUIDE Group

Background. Trigger finger is characterized by sometimes painful snapping or locking when flexing the finger. Although trigger finger is frequently seen in clinical practice, no standard treatment protocol has been established as “best practice.”

Objective. The aim of this study was to achieve consensus on a multidisciplinary treatment guideline for trigger finger.

Design. A European Delphi consensus strategy was initiated. Systematic reviews reporting on the effectiveness of surgical and nonsurgical interventions were conducted and used as an evidence-based starting point for this study.

Setting. In total, 35 experts (hand therapists and hand surgeons selected by the national member associations of their European federations and physical medicine and rehabilitation physicians) participated in the Delphi consensus strategy.

Measurements. Each Delphi round consisted of a questionnaire, an analysis, and a feedback report.

Results. After 4 Delphi rounds, consensus was achieved on the description, symptoms, and diagnosis of trigger finger. The experts agreed that use of orthoses (splinting), corticosteroid injections, corticosteroid injections plus use of orthoses, and surgery are suitable treatment options. Relevant details for the use of orthoses, corticosteroid injections, and surgery were described. Main factors for selecting one of these treatment options were identified as severity and duration of the disease and previous treatments received. A relationship between the severity and duration of the disorder and the choice of therapy was indicated by the experts and reported on in the guideline.

Limitations. The results represent a group’s opinion at a given point in time. When the evidence for the effectiveness of interventions increases, experts’ opinions will change, and the guideline should be re-evaluated and adjusted in view of these new insights.

Conclusions. This multidisciplinary treatment guideline may help involved therapists and physicians in the treatment of trigger finger and indicate areas needing additional research.
Trigger Finger Treatment Guideline

Locking and sometimes painful snapping are characteristics of trigger finger (stenosing tenosynovitis). In less severe cases, patients have pain in the affected finger, stiffness (especially in the morning), and tenderness over the A1 pulley without triggering. Several causes have been proposed, but the precise etiology remains unclear.1 Although being proposed, but the precise etiology remains unclear.1 Although trigger finger is one of the most common conditions seen in a hand surgeon’s office, no standard treatment protocol has been established as “best practice.”2 Different treatment strategies can be followed, from use of orthoses (splinting) or corticosteroid injections to percutaneous or open surgery.3 Developing evidence-based multidisciplinary treatment protocols and guidelines can help to optimize the care for hand disorders4 and guide health care professionals to provide the patient with trigger finger with the most effective and efficient treatment available. This study was part of the European HANDGUIDE study, a project with the goal to develop treatment guidelines for the following 5 nontraumatic hand disorders: trigger finger, de Quervain disease, Dupuytren disease, carpal tunnel syndrome, and Guyon canal syndrome. This article concentrates on trigger finger.

To establish an evidence-based starting point, a systematic review was published on the evidence for the effectiveness of nonsurgical, surgical, and postsurgical interventions for trigger finger.4 Subsequently, in the absence of sufficient evidence-based information, a Delphi consensus strategy was performed to achieve consensus on a treatment guideline for trigger finger. In a Delphi consensus strategy, a series of sequential questionnaires (or rounds) is presented to a panel of experts, interspersed with controlled feedback, with the aim to achieve consensus of opinions among these experts.5 This is a proven method when insufficient conclusive evidence is found in the literature and additional expert opinion is needed to achieve consensus.6–8 In this article, the results of the Delphi consensus strategy are reported.

Method
Preparation of the Study—Systematic Review Evidence for effectiveness of interventions for trigger finger. To provide an evidence-based overview of nonsurgical and surgical interventions for trigger finger, we searched the Cochrane Library, PEDro, PubMed, EMBASE, and CINAHL up to February 2009 to select potential relevant studies from the titles and abstracts of the references retrieved by the literature search. Relevant Cochrane reviews and randomized controlled trials (RCTs) were included. Two reviewers independently extracted the data and performed a methodological quality assessment. Because of heterogeneity of the data, a meta-analysis was not possible; therefore, a best-evidence synthesis was performed to summarize the results of the included trials (Appendix 1). One Cochrane review and 13 RCTs were included, reporting on steroid injections and surgery. No studies reporting on physical therapy could be included. Table 1 shows a summary of the evidence for treatment of trigger finger. A more detailed description of the method and the results is available in the article by Huissi et al.4 The results were used as an evidence-based starting point for the Delphi consensus strategy.

Delphi Consensus Strategy
Steering committee, advisory team, and selection of experts. A steering committee comprising a hand surgeon, a physical medicine and rehabilitation (PM&R) physician, and a physical therapist was composed to initiate and guide the study. All 3 Steering Committee members have PhD degrees as well as a clinical and a scientific or epidemiological background. They designed the questionnaires, analyzed the responses, and formulated the feedback reports. Furthermore, an advisory team (consisting of 2 professors of hand surgery, 1 professor of PM&R, and an internationally renowned hand therapist) was formed, which could be consulted at any time and could give their opinions and advice as they saw fit.

The Federation of European Societies for Surgery of the Hand (FESSH) and the European Federation of Societies for Hand Therapy (EFSHT) supported this study. The national member associations of these organizations selected the experts in their respective fields. Each national member association was invited to select a maximum of 3 representative experts for this Delphi consensus strategy. In addition, some European PM&R physicians who specialized in hand rehabilitation were invited to

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Evidencea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsurgical</td>
<td></td>
</tr>
<tr>
<td>Physical therapy</td>
<td>No data</td>
</tr>
<tr>
<td>Oral medication</td>
<td>No data</td>
</tr>
<tr>
<td>Injection</td>
<td>Moderate or strong evidenceb</td>
</tr>
<tr>
<td>Otherc</td>
<td>No data</td>
</tr>
<tr>
<td>Surgical</td>
<td>0d</td>
</tr>
<tr>
<td>Postsurgicald</td>
<td>No data</td>
</tr>
</tbody>
</table>

a Searches in PubMed, EMBASE, CINAHL, and PEDro up to February 2009.
b Moderate evidence for effectiveness in favor of steroid injection plus lidocaine versus lidocaine injection in the short term (about 4 weeks) and for effectiveness in favor of corticosteroid injection versus placebo in the short term (1 week).
c Other than physical therapy, oral medication, or treatment with an injection.
d Randomized controlled trials were available, but only limited, conflicting, or no evidence was found for the effectiveness of the interventions.
e Treatment after surgery.

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trigger finger. In the first round questionnaire, generally accepted nonsurgical interventions (ie, use of orthoses and corticosteroid injection) and surgical interventions (ie, open or percutaneous division of the A1 pulley) for trigger finger were listed. The evidence for the effectiveness of each type of intervention, including the full text of the review and the “evidence table” as reported in this review, was incorporated into this questionnaire.

The above-mentioned interventions were then discussed. For each intervention, questions were included about its usefulness and the main factors for starting and discontinuing the intervention. To identify useful treatments, combinations of treatments, and a therapeutic hierarchy of interventions, the experts were asked if the interventions could be used as sole treatment or combined with another treatment, whether a specific intervention is the first choice in treatment, and to identify the treatment strategy in case the intervention was insufficient. Additional questions were included on the use of orthoses, corticosteroid injections, and surgery. In all situations where treatment options were suggested by the Steering Committee, the experts were invited to provide additional options to avoid any limitations in the experts’ choices.

Table 2. Experts’ Criteria for Participation in the Delphi Consensus Strategy

<table>
<thead>
<tr>
<th>Criterion No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The expert should be a medical or health care professional with considerable experience in treating patients with nontraumatic tendinopathies of hand disorders</td>
</tr>
<tr>
<td>2</td>
<td>The expert should be considered by his or her own professional specialty to be a key person in the field of nontraumatic hand disorders</td>
</tr>
<tr>
<td>3</td>
<td>The expert should have basic knowledge of evidence-based practice</td>
</tr>
</tbody>
</table>

* Participating hand surgeons and hand therapists participated as delegates for their respective professional association.

We used structured questions with answer formats such as “yes/no/no opinion,” after which the experts were invited to explain their individual choices. After each round, a feedback report was made to inform the experts about the answers and explanations of all experts, and on which items consensus was achieved. Based on the answers and arguments of the experts, the Steering Committee formulated the question for the following questionnaire. Finally, conclusions were presented and explained in the feedback report.

To avoid any imprecise definition for consensus, the experts were consulted about the cutoff point for consensus. A cutoff point of 70% was proposed in the first round of the Delphi consensus strategy because this cutoff is often used in Delphi strategies. In case of consensus, this percentage also was calculated for each of the 3 participating professional groups. To reveal any discordant viewpoints among these groups, a remark was made in the feedback report when fewer than 50% of the experts within a professional group answered in accordance with the achieved consensus.

**Target population.** All physicians and health care professionals who are involved in the treatment of patients with a trigger finger can use this guideline.

**Delphi Questionnaires Description, symptoms, and diagnosis of trigger finger.** In the first round questionnaire, we included short descriptions of trigger finger, the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10) code, the symptoms, and its diagnostic process and asked the experts if they agreed with these descriptions. Furthermore, the grading systems of Patel and Moradia and Peter et al are often used to stage the severity of trigger finger. In the first round questionnaire, these 2 systems were incorporated into questions about its usefulness and the main factors for starting and discontinuing the intervention. We also asked if all health care professionals should use a grading system and, if so, which grading system was preferable. The questions of the subsequent rounds were formulated based on the results of the respective previous rounds.

**Interventions to treat trigger finger.**

| Procedure. Each round of the Delphi consensus strategy consisted of a questionnaire and a feedback report. In the feedback report, the results of the previous questionnaire or round were reported. The questionnaires of the Delphi rounds on trigger finger included questions on the description, symptoms, diagnosis, grading systems, and interventions for this disorder. In this Delphi consensus strategy, only the hand surgeons and PM&R physicians answered questions on treatments with medication and injections, and only the hand surgeons answered questions on surgical treatments. All experts answered remaining questions, including questions on advice after treatment with corticosteroid injections and postsurgical treatment.

We used structured questions with answer formats such as “yes/no/no opinion,” after which the experts were invited to explain their individual choices. After each round, a feedback report was made to inform the experts about the answers and explanations of all experts, and on which items consensus was achieved. Based on the answers and arguments of the experts, the Steering Committee formulated the questions for the following questionnaire. Finally, conclusions were presented and explained in the feedback report.

To avoid any imprecise definition for consensus, the experts were consulted about the cutoff point for consensus. A cutoff point of 70% was proposed in the first round of the Delphi consensus strategy because this cutoff is often used in Delphi strategies. In case of consensus, this percentage also was calculated for each of the 3 participating professional groups. To reveal any discordant viewpoints among these groups, a remark was made in the feedback report when fewer than 50% of the experts within a professional group answered in accordance with the achieved consensus.

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**Interventions to treat trigger finger.** In the first round questionnaire, generally accepted nonsurgical interventions (ie, use of orthoses and corticosteroid injection) and surgical interventions (ie, open or percutaneous division of the A1 pulley) for trigger finger were listed. The evidence for the effectiveness of each type of intervention, including the full text of the review and the “evidence table” as reported in this review, was incorporated into this questionnaire.

The above-mentioned interventions were then discussed. For each intervention, questions were included about its usefulness and the main factors for starting and discontinuing the intervention. To identify useful treatments, combinations of treatments, and a therapeutic hierarchy of interventions, the experts were asked if the interventions could be used as sole treatment or combined with another treatment, whether a specific intervention is the first choice in treatment, and to identify the treatment strategy in case the intervention was insufficient. Additional questions were included on the use of orthoses, corticosteroid injections, and surgery. In all situations where treatment options were suggested by the Steering Committee, the experts were invited to provide additional options to avoid any limitations in the experts’ choices.
In the second round questionnaire, the treatment options (and their combinations) mentioned by the experts were summarized, and the experts were asked to state (separately for each treatment option/combination of treatment options) whether this treatment option is applicable to treat trigger finger. Based on the answers given by the experts in the first round on the question about what should be done in case one of above-mentioned treatment was not successful, a therapeutic hierarchy was formulated (i.e., from the lightest—in the context of this article, the term “lightest” contains elements of invasiveness as well as effectiveness—to the most intense form of treatment). Subsequently, the experts were asked (“yes/no/no opinion”) if they agreed with this therapeutic hierarchy. Any remaining questions on this table and all other items, for which no consensus was achieved in the second or third round, were added in the third and fourth rounds, respectively.

In the third round, the summary of the consensus on the main factors for choosing a treatment option for trigger finger were combined and presented in one table.

Any remaining questions on this table and all other items, for which no consensus was achieved in the second or third round, were added in the third and fourth rounds, respectively.

### Data Analysis

A quantitative and qualitative analysis was made of the responses from the Delphi rounds. Quantitatively, for each question we determined and reported the number and percentages of experts who gave a certain answer. Subsequently, the levels of conformity were calculated to decide whether consensus was achieved. In the qualitative analysis, key elements were extracted from the rationale for the answers as well as additional information given by each expert. When consensus was reached on a subject, these elements could be used to compose new questions on related subjects.

### Role of the Funding Source

The study was funded by Fonds NutsOhra, the Netherlands.

### Results

#### Expert Panel

A total of 112 experts (52 hand surgeons, 47 hand therapists, and 13 PM&R physicians) from 17 European countries were selected to participate in 1 of the 3 Delphi consensus strategies of the HANDGUIDE study, which was performed between June 2009 and December 2012. For the Delphi consensus strategy on trigger finger, 38 experts (16 hand surgeons, 16 hand therapists, and 6 PM&R physicians) were selected. Three of the selected experts (2 hand surgeons and 1 PM&R physician) did not complete any of the questionnaires. Response rates for the first, second, third, and fourth round questionnaires of the remaining 35 experts were 97%, 94%, 91%, and 91%, respectively. Table 3 lists the participating countries, the total number of experts for the HANDGUIDE study, and the number of participating experts in the Delphi consensus strategy on trigger finger and

<table>
<thead>
<tr>
<th>Profession (European Federation)</th>
<th>Participating Countries (In Alphabetic Order)</th>
<th>Total No. of Experts</th>
<th>No. of Experts for Trigger Finger and Years of Experience</th>
<th>X (Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand surgeons (FESSH)</td>
<td>Belgium, Denmark, Estonia, Finland, France, Germany, Italy, Norway, the Netherlands, Spain, Sweden, Switzerland, Turkey, and United Kingdom</td>
<td>52</td>
<td>14</td>
<td>15.2 (8–30)</td>
</tr>
<tr>
<td>Hand therapists (EFSHT)</td>
<td>Belgium, Denmark, Finland, France, Italy, Norway, the Netherlands, Slovenia, Sweden, Switzerland, Turkey, and United Kingdom</td>
<td>47</td>
<td>16</td>
<td>17.5 (6–33)</td>
</tr>
<tr>
<td>PM&amp;R physicians</td>
<td>Austria, the Netherlands, Portugal, Slovenia, Switzerland, and Turkey</td>
<td>13</td>
<td>5</td>
<td>16.0 (10–20)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>112</td>
<td>35</td>
<td>16.5 (6–33)</td>
</tr>
</tbody>
</table>

* FESSH: Federation of European Societies for Surgery of the Hand, EFSHT: European Federation of Societies for Hand Therapy, PM&R: physical medicine and rehabilitation.

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**Table 3.** Experts and Participating Countries in the HANDGUIDE Study

In the third round, the summary of the consensus on the main factors for choosing a treatment option for trigger finger were combined and presented in one table.

Any remaining questions on this table and all other items, for which no consensus was achieved in the second or third round, were added in the third and fourth rounds, respectively.

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**Results**

**Expert Panel**

A total of 112 experts (52 hand surgeons, 47 hand therapists, and 13 PM&R physicians) from 17 European countries were selected to participate in 1 of the 3 Delphi consensus strategies of the HANDGUIDE study, which was performed between June 2009 and December 2012. For the Delphi consensus strategy on trigger finger, 38 experts (16 hand surgeons, 16 hand therapists, and 6 PM&R physicians) were selected. Three of the selected experts (2 hand surgeons and 1 PM&R physician) did not complete any of the questionnaires. Response rates for the first, second, third, and fourth round questionnaires of the remaining 35 experts were 97%, 94%, 91%, and 91%, respectively. Table 3 lists the participating countries, the total number of experts for the HANDGUIDE study, and the number of participating experts in the Delphi consensus strategy on trigger finger and
their years of experience with this topic.

**Delphi Consensus Strategy on Trigger Finger**

**Cutoff point for consensus.** In the first round, consensus was achieved on a cutoff point of 70% for consensus. In this Delphi consensus strategy, there was only one discordant viewpoint between a professional group and the general consensus; <50% (2 of the 5) of the PM&R physicians agreed to add a local anesthetic to treatment with a corticosteroid injection.

**Guideline for trigger finger.** Four rounds were needed before consensus on the treatment guideline for trigger finger could be achieved. The guideline is shown in Appendix 2.

**Description, Symptoms, and Diagnosis of Trigger Finger**

In the first round, consensus was achieved on a short description of a trigger finger, its ICD-10 (2006) code, its symptoms, and the diagnosis of the disorder. Nevertheless, some experts noted that the definition of the disorder could be used only for adults and not for children (ie, congenital). Therefore, it was suggested to add the word “acquired” to this description. However, because in subsequent rounds no consensus was achieved on this change, the use of the word “acquired” was omitted.

**Grading the Severity of Trigger Finger**

In the first round of the Delphi consensus strategy, the experts indicated that different classification systems for trigger finger are used in clinical practice. Besides the above-mentioned grading systems of Patel and Moradia11 and Peter et al,12 in the first round the experts mentioned the Quinnell grading13 and the Newport classification.14 Nevertheless, almost 70% of the experts stated that they do not use a grading system themselves. They make their own assessment of the severity of trigger finger on the basis of the clinical picture and felt using a grading system had no additional value for this assessment. Despite this finding, about 50% of the experts indicated that a grading system should be used, which means that almost 20% of these experts prefer to use a classification but do not use it. In general, it was indicated that it is important that studies compare the outcomes; on the other hand, it also is important to achieve uniformity in clinical practice. Moreover, in the first round of the Delphi consensus strategy, it was indicated that the severity of trigger finger should be documented. Regarding which grading system should be used, 22.2% and 33.3% of the experts prefer to use the grading system of Patel and Moradia11 and Peter et al,12 respectively; the remaining experts had no opinion on this subject. Therefore, this question had no equivocal answer. Adding 2 more grading systems (ie, those of Quinnell13 and Newport et al14) would only increase the amount of disagreement on this topic.

When experts were asked if they had additional remarks on the use of a grading system for trigger finger, the most important was that (besides locking and triggering, as mentioned in all the above-mentioned grading systems) the factor “pain” should be added to the grading system. Based on the answers given by the experts after the first round of this Delphi consensus strategy, it was concluded that we would not achieve consensus on a single grading system to be used in clinical practice. However, it was indicated that, besides locking and triggering, pain is an important factor to assess the severity of trigger finger. This topic was subsequently discussed in the second to fourth rounds of the Delphi consensus strategy, in anticipation of the answers on other questions regarding components of importance in relation to the choice of treatment strategy.

**Interventions to Treat Trigger Finger**

**Treatment options and therapeutic hierarchy.** Experts did not add any interventions that should be included as “most commonly used interventions” to the list of nonsurgical and surgical interventions (as described in the “Method” section). Consensus was achieved that use of orthoses, corticosteroid injections, corticosteroid injections plus use of orthoses, and surgery are applicable in the treatment of trigger finger. Use of orthoses was considered the lightest form of treatment, followed by corticosteroids and, finally, surgery for the most serious forms of trigger finger. Consensus was achieved on a therapeutic treatment hierarchy (Tab. 4).

**Additional questions for use of orthoses, corticosteroid injections, and surgery.** For use of orthoses, corticosteroid injections, and surgery, consensus was achieved on the aim of the treatment and when that treatment should be adjusted or stopped. Other items for each specific treatment are discussed below.
**Trigger Finger Treatment Guideline**

**Table 5.**
Kinds of Orthoses Used in Clinical Practice for Trigger Finger and Presented in the First Round Questionnaire

<table>
<thead>
<tr>
<th>Orthosis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0° MCP blocking orthosis to prevent the tendon from loading the A1 pulley</td>
</tr>
<tr>
<td>2</td>
<td>10°–15° (hyperextension) MCP blocking orthosis; this orthosis blocks the MCP joint in extension to prevent the finger from flexing and thereby prevents the tendon from loading the A1 pulley</td>
</tr>
</tbody>
</table>

*MCP = metacarpophalangeal.*

**Use of orthoses.** In the first round questionnaire, 2 kinds of orthoses (splints) often used in clinical practice were considered (Tab. 5). The experts preferred to use a metacarpophalangeal (MCP) blocking orthosis in 0 degrees. No additional orthoses were considered to be adequate. The orthosis should be worn for 3 to 6 weeks. Of all suggested orthotic regimens (splinting regimens) (ie, only during daytime, only during nighttime, 24 hours per day, or depending on the trigger pattern of the patient), there was a slight preference for the latter regimen. However, no consensus was achieved on this issue, and this topic could not be included in the guideline.

**Corticosteroid injection.** All experts indicated that an intermediate-acting corticosteroid should be used to treat trigger finger. Consensus also was achieved on the maximum number of injections (ie, 1–3) that a local anesthetic should be used with the corticosteroid injection and on what advice the patient should receive after this treatment.

**Surgery.** Consensus was achieved that open surgery (in preference to a percutaneous technique) with use of a local anesthesia technique, a transversal incision, and use of nonresorbable sutures is preferable for trigger finger. Recommendations for treatment of the primary postoperative period (ie, up to 10–14 days postsurgery) are included in the guideline. Consensus was achieved on the main goal of postsurgical treatment after this period.

**Other therapeutic interventions.** Besides use of orthoses, corticosteroid injections, and surgery (or a combination thereof), the experts also mentioned nonsteroidal anti-inflammatory drugs (NSAIDs) and cold therapy. To indicate that the guideline concentrates on the most commonly used interventions but that additional therapeutic modalities can be added, consensus was achieved to include the following note in the guideline: “Depending on the patient’s situation and personal preferences, additional therapeutic modalities, such as NSAIDs and cold therapy, can be added.”

**Main factors for indications of the use of a treatment option.** In the first Delphi round, experts’ answers suggested that the main factors for choosing a treatment option are: (1) severity of the disease, (2) duration of the disease, and (3) previous treatments given. The latter item also was incorporated in the therapeutic hierarchy. The relationship between severity or duration of the disease and the choice of therapy was further explored in the subsequent Delphi rounds. On the basis of the terminology used by the experts for severity and duration, 5 levels were created for both variables. In the first Delphi round, the experts described the severity of trigger finger in terms of the amount of pain or severity of symptoms (eg, mild, severe) of pain and snapping or locking. The duration of trigger finger was expressed in terms of acute, subacute, and chronic or by mentioning the exact duration in terms of number of weeks or months. Combining these expressions for severity and duration resulted in the identification of 5 subgroups for both severity and duration (Tab. 6).

In the second round, the experts were asked which treatment options, as listed in Table 4, were suitable for the different subgroups of severity of symptoms. Subsequently, for each level of severity,

**Table 6.**
Subgroups Related to the Severity and Duration of Trigger Finger

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Pain</th>
<th>Duration (Stage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: very mild</td>
<td>Very mild pain/no snapping or locking</td>
<td>1: ≤1 mo (acute)</td>
</tr>
<tr>
<td>2: mild</td>
<td></td>
<td>2: 1 ≤2 mo (subacute)</td>
</tr>
<tr>
<td>3: moderate</td>
<td></td>
<td>3: ≥3 mo</td>
</tr>
<tr>
<td>4: severe</td>
<td>Unbearable pain/cannot be unlocked</td>
<td>4: 3 ≤6 mo (chronic)</td>
</tr>
<tr>
<td>5: very severe</td>
<td></td>
<td>5: ≥6 mo (chronic)</td>
</tr>
</tbody>
</table>
the Steering Committee calculated for which treatment or combination of treatments the cutoff point of 70% for consensus was reached or exceeded. The same process took place for the duration of the complaints.

The results for severity and duration were combined and reported in a table that was included in the final guideline. In this table, each cell represents a subgroup of patients with a certain severity and duration of trigger finger and the corresponding treatment options. After the second Delphi round, some cells in this table remained empty. After the fourth Delphi round, all cells included one or more treatment options (see the table in the guideline presented in Appendix 2).

Discussion
The aim of this European Delphi consensus strategy was to decide on a treatment guideline for trigger finger that can be used by all relevant medical and paramedical specialties involved in its treatment. After 4 Delphi rounds, multidisciplinary consensus was achieved on the majority of the items relevant to the subject. This is the first time that a multidisciplinary treatment guideline for trigger finger has been developed on a European level.

To differentiate between an acquired trigger finger and a congenital trigger finger, some experts suggested adding the word “acquired” to the description of trigger finger; however, no consensus was achieved on this topic. Initially, the congenital trigger finger was seen and treated as being different from the adult acquired trigger finger. However, due to recent debate on the existence of a true congenital form of trigger finger, treatment is starting to resemble that of the acquired form.

For use of orthoses, no evidence for effectiveness was found in our systematic review. One recent RCT compared 2 different orthoses: the MCP joint blocking orthosis and the distal interphalangeal (DIP) joint blocking orthosis. At the 6-week follow-up, the MCP joint blocking orthosis resulted in complete relief of symptoms in 31% of the patients compared with 27% of those treated with the DIP joint blocking orthosis, whereas partial relief was achieved in 46% and 20%, respectively. In that study, about 75% of the patients wore the orthosis for more than 18 hours per day, and about 25% wore the orthosis for less than 12 hours per day. The MCP joint blocking orthosis was found to be more comfortable than the DIP joint blocking orthosis.

The experts in our study achieved consensus that the MCP blocking orthosis in 0 degrees is preferable. Neither incorporation of the wrist into the orthosis nor the wrist angle were mentioned by the experts, probably because when the MCP joint is in the neutral position (or slight hyperextension), the tension in the involved flexor tendon is not transferred to the A1 pulley. Therefore, the wrist angle and flexor tendon tension are not relevant for use of orthoses in trigger finger.

No consensus could be achieved on the optimal orthotic regimen. The fact that no consensus could be reached on the duration of wearing the orthosis during the day does not mean that the efficacy of use of orthoses is independent of how much the orthosis is used. It is the result of the democratic nature of a Delphi consensus strategy combined with the varied experience of the experts that wearing an orthosis has advantages as well as disadvantages. The experts differed sufficiently in their opinions about the optimal balance between these 2 opposing qualities of use of orthoses to prevent consensus from being reached. Future research should concentrate on the effectiveness and optimal use of orthoses for trigger finger.

Evidence for the effectiveness of corticosteroid injections or surgery to treat trigger finger is scarce. Only a small number of RCTs concentrating on treatment with corticosteroid injections or surgery were found. Corticosteroid injections were found to be effective (moderate evidence) for the first 1 to 4 weeks but did not remain effective in the mid term or long term. Similar findings were found for the effectiveness of corticosteroid injection for specific upper extremity disorders. The mechanism behind the reduction of symptoms when using corticosteroid injections remains unclear. To emphasize that the effect of this treatment is not anti-inflammatory, the experts decided to add a note clarifying this fact when describing the aim of this treatment in the guideline.

Consensus was achieved on the maximum number of corticosteroid injections (ie, 1–3) that can be used in the treatment of trigger finger. Accidentally, the time interval between these injections was not discussed in this Delphi consensus strategy. However, in future updates of the guideline, this time interval definitely should be included in the Delphi consensus strategy.

In the systematic review that was performed before the Delphi consensus strategy and used as a basis for this study, conflicting evidence regarding surgery was found for the effectiveness of an open versus a percutaneous technique. However, the experts participating in this study achieved consensus that an open surgical technique is preferable; it is considered the safest technique.
because it allows more careful inspection of the surgical area.

Some recent RCTs studied treatment with surgery versus corticosteroid injections and were published after we conducted the systematic review that was used as a starting point for the Delphi consensus strategy. In a recent RCT,25 percutaneous A1 pulley release was compared with one steroid injection for trigger finger. At the 6-month follow-up, there were significantly more recurrences after corticosteroid injection than after surgery. Furthermore, differences in pain favor of surgery and in grip strength in favor of corticosteroid injections were found. Because the researchers of this RCT considered recurrences as their main outcome measure, they concluded that surgery (although more costly) is more effective than treatment with one corticosteroid injection for trigger finger.

Another recent RCT26 reported on the effectiveness of corticosteroid injections versus percutaneous release versus open surgery. At the 6-month follow-up, of those patients treated with 1 and 2 corticosteroid injections, 57% and 86%, respectively, were cured from triggering compared with 100% in both surgery groups. For pain and movement of the fingers, no significant differences were found between the groups. In a recent small-scale RCT,27 ultrasound-guided corticosteroid injection was compared with open surgery; although the differences are not significant, at the 6-month follow-up those patients treated with corticosteroid injections had a shorter recovery time than those treated with surgery (which has an impact on reduced absence from work and other activities).

As shown in the above-mentioned studies, depending on the primary outcome measurement used, conclusions can differ regarding the effectiveness of surgery versus corticosteroid injections. Kerrigan and Stanwix2 performed a cost-minimization analysis to identify the least costly strategy for successful treatment of trigger finger. Five different corticosteroid injections or surgical treatment regimens were studied: 1, 2, or 3 corticosteroid injections before open surgery; open surgical release as first option; and percutaneous release with definitive open surgery for failures.2 They found that the costs were lowest in case the treatment strategy concerns a corticosteroid injection, followed by a second injection for failures or recurrence, followed by definitive surgery if needed. Moreover, the costs were 248% to 340% lower when open surgery was performed as first option. In our opinion, more RCTs are needed (taking into account the number of corticosteroid injections needed for successful treatment and using different outcome measurements) before firm conclusions can be drawn regarding the evidence for treatment and cost-effectiveness of corticosteroid injections compared with surgery.

The guideline was developed in cooperation with many experts in the field of hand disorders, with different clinical backgrounds and from different countries. By providing feedback from previous Delphi rounds, the Delphi consensus strategy has the advantage of a group process of building on the work and expertise of all participating experts.28 Furthermore, only guidelines developed in international collaboration have a reasonable chance of becoming widely used. Moreover, standardization is one of the best methods to improve quality and reduce costs of care.29

An important limitation of a Delphi consensus strategy is that bias might be introduced due to individual interpretation of the findings. Therefore, objectivity of the researchers is most important when performing a Delphi consensus strategy. In the present study, the Steering Committee tried to avoid this kind of bias by adding notes in the feedback report, including summaries of the explanations given by the experts and interpretation of these summaries. Subsequently, the experts were asked if they agreed with this and if they had other concerns or considerations that should be taken into account. Another limitation of a Delphi consensus strategy is its temporariness. The results of a Delphi consensus strategy generally represent a group’s opinion at a given point in time.30 When the evidence for the effectiveness of interventions increases or new treatment options are developed, experts’ opinions will change. Consequently, the guideline should be re-evaluated and adjusted in view of these new insights.

In conclusion, by means of a European Delphi consensus strategy, hand therapists, hand surgeons, and PM&R physicians achieved multidisciplinary consensus on a treatment guideline for trigger finger. This guideline can be of use for physical therapists, occupational therapists, and hand therapists as well as physicians involved in the treatment of patients with a trigger finger. The guideline also may help in targeting future research on trigger finger.
Selection experts in Delphi consensus strategy: The FESSH (Federation of European Societies for Surgery of the Hand), the EFSHT (European Federation of Societies for Hand Therapy), and the national member associations of the FESSH and the EFSHT.


* Only experts who filled in at least 2 questionnaires are mentioned.

The authors also thank the following individuals from Erasmus MC Rotterdam, the Netherlands: S.E.R Hovius, MD, PhD, and H.J. Stam, MD, PhD, for being part of the Advisory Team; A.R. Schreuders, PT, PhD, for being part of the Advisory Team and for his cooperation in initiating this research project; and J. Soeters, PT, for being our webmaster.

The study was funded by Fonds NutsOhra, the Netherlands.


References


Appendix 1.
Levels of Evidence for Effectiveness Used in the Systematic Review

1. Strong evidence for effectiveness: consistent (when ≥75% of the trials report the same findings) positive (significant) findings within multiple higher-quality randomized controlled trials (RCTs)

2. Moderate evidence for effectiveness: consistent positive (significant) findings within multiple lower-quality RCTs or 1 high-quality RCT, or both

3. Limited evidence for effectiveness: positive (significant) findings within 1 low-quality RCT

4. Conflicting evidence for effectiveness: provided by conflicting (significant) findings in the RCTs (<75% of the studies reported consistent findings)

5. No evidence found for effectiveness of the inventions: RCTs available, but no (significant) differences between intervention and control groups were reported

6. No systematic review or RCT found
Appendix 2.
Guideline for Trigger Finger

The European HANDguide study
The aim of the European HANDguide study was to achieve consensus on multidisciplinary treatment guidelines for the following five non-traumatic hand disorders: trigger finger, De Quervain’s disease, Dupuytren’s disease, carpal tunnel syndrome, and Guyon’s canal syndrome.

To establish an evidence-based starting point for the HANDguide study, systematic reviews were written reporting on the evidence for effectiveness of non-surgical, surgical, and post-surgical interventions for these five hand disorders. Supplementary to the available evidence-based information, a Delphi consensus strategy was used to achieve consensus on each treatment guideline. In a Delphi consensus strategy a series of sequential questionnaires or rounds is presented to a panel of experts, interspersed by controlled feedback, with the aim to achieve consensus of opinion within this group of experts.

A total of 132 experts - hand surgeons, hand therapists, and PM&R physicians - from 17 countries were selected by their national member associations of the Federation of European Societies for Surgery of the Hand (FESSH) and the European Federation of Societies for Hand Therapy (EFSHT) to participate in the HANDguide study. Also, a number of Physical Medicine and Rehabilitation (PM&R) physicians specialized in hand rehabilitation were added to the expert group. The HANDguide study was performed between June 2009 and December 2012.

Treatment guideline for trigger finger
This guideline concerns the treatment of trigger finger. A total of 35 experts (14 hand surgeons, 16 hand therapists, and 5 PM&R physicians) cooperated in the Delphi consensus strategy to achieve consensus on this treatment guideline.

For whom?
All physicians and allied healthcare professionals who are involved in the treatment of patients with trigger finger can use this guideline.

GUIDELINE FOR TRIGGER FINGER

Description of trigger finger
Trigger finger is a disorder characterized by snapping or locking of a finger or thumb with or without pain, generally occurring in the palm at the level of the metacarpophalangeal (MP) joint. In most cases this is due to a non-inflammatory thickening of the digit’s A1 pulley with secondary entrapment and sometimes thickening of the tendon(s).

ICD-10 (2010)
Soft tissue disorders (M60-M79)
| Disorders of synovium and tendon (M65-M68) |
| M65.3 Synovitis and tenosynovitis, |
| M65.3 Trigger finger (Nodular tendinous disease) |

Symptoms of patients
When attempting to extend the digit after full flexion, there is a sensation of snapping or actual locking. This snapping or locking is frequently associated with pain.

Diagnosis
History
The initial diagnosis of trigger finger is usually made on the basis of clinical symptoms, as described above.

Physical examination
Palpation of the region of the A1 pulley can reveal tenderness or swelling. When the tendon is moved, some grinding, unevenness or swelling of the tendon can be felt and triggering can be provoked.
### I NON-SURGICAL TREATMENT

<table>
<thead>
<tr>
<th>Step</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| 1 Splinting | **Aim of splinting:** To decrease the amount of mechanical friction of the tendon within the tendon sheath by immobilization of the affected finger and consequently avoiding movement between the aforementioned structures in order to decrease the amount of triggering and other symptoms.  
**Type of splint:** A MCP blocking splint in 0 degrees.  
**Duration of wearing the splint:** 3 to 6 weeks.  
**When should a splint be adjusted or stopped?** If the patient is free of symptoms or splinting has insufficient or no effect after a certain period of splinting, or when complications, such as skin problems, occur. |
| 2 Corticosteroid injection | **Aim of a corticosteroid injection:** To reduce the symptoms of trigger finger. The mechanism behind this reduction still needs to be elucidated.  
**Kind of corticosteroid injection:** Intermediate-acting corticosteroid injections, such as methylprednisolone or triamcinolone, should be used. It is preferable to add local anaesthetic to a corticosteroid injection to treat trigger finger.  
**Maximum number of injections:** 1-2.  
**Advice after treatment with corticosteroid injections should focus on 2 items:**  
1. Possible adverse effects of the corticosteroid injection:  
   - Pain: The patient can have pain for 1 or 2 days. If the pain persists for a longer period, a physician should be contacted.  
   - Infection: Transverse incision, open surgery, suture: Non-resorbable.  
2. Aftercare:  
   - Resting the hand: Partial or complete rest for 0-7 days depending on the clinical situation of the patient.  
**When should treatment with corticosteroid injections be stopped?** If the patient is free of symptoms, if the maximum number of steroid injections (2) has been given, and in case of complications such as allergy, increased pain or nerve injury. |

### II SURGICAL TREATMENT

<table>
<thead>
<tr>
<th>Step</th>
<th>Treatment</th>
</tr>
</thead>
</table>
| Surgical division of the A1 pulley | **Aim of surgery:** To reduce the mechanical friction of the tendon within the A1 pulley due to surgical division or partial resection of the A2 pulley in order to reduce the symptoms of trigger finger.  
**Preferable technique:**  
- Anesthetic technique: Local anesthesia,  
- Incision: Transverse incision, open surgery, suture: Non-resorbable.  
**What to do if surgery is not successful?** If division of the A1 pulley does not resolve trigger finger, the patient can be re-examined to check for other diagnosis such as tenosynovitis or A2 pulley problems. If the diagnosis is correct, operations can be repeated or conservative treatment, such as hand therapy, NSAIDs or corticosteroid injections, can be initiated.  
**Post-surgical treatment**  
- Primary post-operative advice: During this primary post-operative period, i.e. up to 10-14 days after surgery, when the sutures are removed, advice for the patient consists of:  
   1. Elevation of the hand, i.e. hand above heart level to prevent swelling.  
   2. Move the finger to prevent scar adhesions.  
   3. No heavy lifting or forceful activities until 2 weeks post-surgery.  
   4. Hand therapy, bandaging, or cold therapy if necessary.  
- Post-surgical treatment can be prescribed if necessary.  
**Main goal of post-surgical therapy:** Is (if necessary) to return the patient to full function by increasing range of motion, and preventing edema and scar adhesions. In addition, instructions should be given to the patient on how to best use the hand. |

### Treatment options and combinations for trigger finger

<table>
<thead>
<tr>
<th>Treatment options</th>
<th>Therapeutic hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splinting (S)</td>
<td>1 S</td>
</tr>
<tr>
<td>Corticosteroid injection (C)</td>
<td>2 C</td>
</tr>
<tr>
<td>Corticosteroid injection plus splinting (CS)</td>
<td>3 CS</td>
</tr>
<tr>
<td>Operative treatment/surgery (O)</td>
<td>4 O</td>
</tr>
</tbody>
</table>

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1. Originally, the aim of corticosteroid use was to decrease the amount of inflammation. However, because tissue changes in hand and wrist, including trigger finger, appear to be more degenerative than inflammatory in nature, the exact mode of action of corticosteroids remains unclear, although some hypotheses do exist.

2. Depending on the patient’s situation and personal preferences, additional therapeutic modalities, such as NSAIDs and cold therapy, can be added.

3. Usually, the aim of post-surgical therapy is to return the patient to full function by increasing range of motion, and preventing edema and scar adhesions. In addition, instructions should be given to the patient on how to best use the hand.

4. Depending on the patient’s situation and personal preferences, additional therapeutic modalities, such as NSAIDs and cold therapy, can be added.
### Appendix 2.
Continued

Table Severity and duration of trigger finger and suitable treatment options
Severity and duration of trigger finger are the main factors when deciding on the type of treatment. Both severity and duration were divided into five subgroups. For each subgroup of patients the suitable treatment options are indicated below:

<table>
<thead>
<tr>
<th>Duration</th>
<th>Severity</th>
<th>Treatment Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic stage &gt; 6 months</td>
<td>1 Very mild symptoms</td>
<td>C Corticosteroid injection</td>
</tr>
<tr>
<td>Chronic stage 3 ≤ 6 months</td>
<td>2 Mild symptoms</td>
<td>CS Corticosteroid injection plus splitting</td>
</tr>
<tr>
<td>Subacute stage 2 ≤ 3 months</td>
<td>3 Moderate symptoms</td>
<td>CS Corticosteroid injection plus splitting</td>
</tr>
<tr>
<td>Subacute stage &gt; 3 months</td>
<td>4 Severe symptoms</td>
<td>CS Corticosteroid injection plus surgery</td>
</tr>
<tr>
<td>Acute stage (≤ 1 month)</td>
<td>5 Very severe symptoms</td>
<td>CS Corticosteroid injection plus surgery</td>
</tr>
</tbody>
</table>

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All rights reserved. No part of the report may be reproduced or transmitted in any form or by any means, electronically or mechanically, including photocopying, recording, or using any information storage and retrieval system, without the permission in writing of the project coordinator of the HANDGUIDE study.
Does exercise or splinting in the treatment of trigger finger reduce pain, improve range of movement, grip strength, function and return to work when compared with usual care?

Clinical Bottom Line
There is limited, poor quality evidence showing the benefit of splinting or exercise for the management of trigger finger. However, splinting is suggested when individuals wish to avoid invasive treatment and for those with mild to moderate symptoms.

Criteria for Critically appraised Topic
Population
Male and female adults 18 years plus

Intervention
- Passive and/or active exercises to maintain/improve ROM
- Bespoke splint for affected digits to reduce pain, triggering and help maintain function

Comparison
Usual care, which may include:
- NSAID’s
- Steroid injection
- Physiotherapy – ultrasound, acupuncture, mobilisation
- Surgery
- Ergonomic advice

Outcomes
- Increase in function
- Increase in range of movement
- Increases in grip strength
- Reduction in pain
- Return to work
- Cost effectiveness
- Improved quality of lifestyle

Inclusions
Patients with a medical diagnosis of trigger finger (stenosing tenosynovitis)

Exclusions
- Children
- Red flags /cancer
- Previous steroid injections
- Post-operative patients
### Search Terms Used

<table>
<thead>
<tr>
<th>Population</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Outcomes</th>
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<td>Routine care</td>
<td>Range of movement (ROM)</td>
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<tr>
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<td>Passive exercises / stretches</td>
<td>Usual care</td>
<td>Grip strength</td>
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<td>Trigger finger</td>
<td>Splint</td>
<td>Advice</td>
<td>Return to work</td>
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<tr>
<td>Stenosing tenosynovitis</td>
<td>Orthotics</td>
<td>Any other treatment</td>
<td>Function</td>
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<td>Steroid injection</td>
<td>Reduction in pain</td>
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<td></td>
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<td>Quality of life</td>
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### Results from search in October 2010

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</table>

### Studies found to be relevant to the CAT

  A one year study including 50 fingers. Participants provided with a thermoplastic splint with MCPJ at 10 - 15° flexion and PIPJ free for extrinsic tendon gliding. Splint removed for hygiene only. There were variations in splint duration from 3 weeks to 12 weeks. Splinting compared with 50 receiving cortisone injection. Patients were followed up for at least a year.

  **Results:**
  Splinting was successful in 77% patients with symptoms of 6 months or less and in 44% in those with symptoms of longer than 6 months. This compared to successful injection of 84% of patients with symptoms of 6 months or less and 71% in those with symptoms longer than 6 months. These figures exclude the thumb where splinting has poor outcomes (50% success).

  A 2 part study investigating the efficacy of functional DIPJ splinting for trigger finger involving 21 labourers and 16 fingers in 4 fresh cadavers. In part one, labourers were treated with NSAID’s and full-time DIPJ splinting (taped Alumafoam to the dorsum of the digit or a Stax splint). Corticosteroid was offered if the stage of triggering was 4 or more (unlocked with active movement to locked) or persisted after 6 weeks of splinting. Average follow-up was 12 months. In part two, 4 fresh cadavers were studies to evaluate the effectiveness of DIPJ splinting on FDP
excursion again using Alumafoam and Stax splints. Tendon excursion was measured with a micrometer with manual tension on the tendon to maintain tip to palm opposition. Three repeated measurements were taken on each finger with no splint, with an Alumafoam splint and a Stax splint.

Results:
Part 1: Splinting alone treated 52% (11) of the patients, 4 patients had a recurrence of triggering, 3 of which resolved with another period of splinting. Average splint wear was 8 weeks (1 to 20 weeks). Work time was not lost through splint wear and splints were well tolerated with the alumafoam proving the most convenient and functional.
Part 2: Tendon excursion measured in 16 digits was decreased by a mean of 4.2 mm with the dorsal alumafoam splint and 4.8 mm with the Stax splint – this was statistically significant although the differences between the two splints were not significant.
The study suggests that DIPJ splinting was an effective primary and adjunctive treatment for the population concerned.

  Describes a literature review from English language literature located on Medline, PubMed, and guidelines and key points suggested to aid management of trigger finger. NSAIDS, splintage, steroid injection, percutaneous finger release and surgery discussed.

  Splinting aim is reduce/remove tendon excursion through A1 pulley for sufficient time to allow synovitis around the pulley to resolve. Describes Rodgers et al study (1998) and Patel & Bassini (1992) study and highlights that those with more severe disease and longer duration are less likely to benefit from splinting.

  Algorithm suggested for adult patients. Splinting and NSAIDS suggested for those unwilling to consider invasive treatment. Either a DIPJ splint (Stax splint for 6 weeks) or a MCPJ splint at 15 of MCPJ flexion for 6 weeks

  Study included 28 participants (excluded those with trigger thumb, more than one triggering digit, flexion contracture and previous steroid injection)
  Five outcome measures identified: grip strength, stages of stenosing tenosynovitis (SST), NPRS (0-10), number of triggering events in 10 active fists and patient perceived symptom improvement (scale 1-5).
  Participants provided with a custom thermoplastic splint (MCPJ’s at approx 15˚, allowance for tip-to-tip prehension) at initial assessment to be worn for 24 hours for 6 weeks. If triggering continued at 6 weeks, treatment extended to 10 weeks. Participants were given an educational leaflet on trigger finger and exercise sheet demonstrating passive IPJ flexion, composite full finger flexion, extension and active hook exercises. Exercises completed 5 repetitions 3 times per day without splint.
  There was no control group, small sample size with varied demographics.

Results:
Study reported significant outcome measures for SST, NPRS and the number of triggering events in 10 active fists & patients’ perceived improvement.
46.4% experienced less triggering post splint wear, none had increased triggering
53.6% reported total resolution, 39% partial resolution with 7.1% reporting no change to triggering.
57% participants did not comply with splint wear i.e. continuous wear day & night. Only 37% completed exercises daily. In those with a longer duration of triggering, 14.3% resolved fully
after 10 weeks of splint wear rather than 6 weeks. There was no significant difference between those using NSAids and those not using NSAID’s in trigger finger resolution.


  Authors suggest (citing references) that splinting is an appropriate treatment option for those who do not want corticosteroid injections. They suggest that splinting the PIPJ at night can be effective for those with symptoms of locking in the morning. States that splinting has lower success rates in those with severe triggering or longstanding duration of symptoms.


  CRD Summary: “The authors concluded that corticosteroid use was associated with an improvement in symptoms in 57% of patients. Limitations in the literature search, the poor quality and small number of included studies, and failure to appropriately synthesise the results mean that these findings should be interpreted with extreme caution”


  Two RCT’s identified with 63 participants. The available evidence for the effectiveness of intratendon sheath corticosteroid injection for trigger finger can be graded as a silver level evidence for superiority of corticosteroid injections combined with lidocaine over injections with lidocaine alone. It states that it is not clear if steroid injection is superior to splinting or surgery in either efficacy or safety and cites the need for more comparison studies between surgery and splinting.

- **Corticosteroid injections compared to splinting or surgery for trigger finger in adults, (April 2010), DUETS**

  A record stating uncertainties identified in research recommendations. States that further research is needed with RCT’s with adequate sample sizes, better methodology and reporting according to the CONSORT statement. It recommends more comparison studies between injection, splinting and surgery, different types and dosages of corticosteroids and different care settings.


  Recommendations for management of mild to moderate trigger finger:
  - Consider referral to occupational therapy to help the patient to use their hand following injection; splinting if necessary and appropriate.

  Splinting:
  - a Cochrane review in 2009 recommends that splinting may also be appropriate as a first line intervention (although not evaluated in the review); however, according to expert opinion splintage does not work for trigger finger
  - rests the joint
• extends the affected finger and maintains extension
• prevents involuntary curling of fingers, eg while sleeping
• the metacarpophalangeal (MCP) joint is splinted at approximately 15° of flexion
• splinting is not thought to be as effective as corticosteroid injection or surgery

Physical therapy:

• involves gentle exercises to maintain joint mobility

References:

Summary
There is no sound clear evidence supporting the benefits of splinting or exercise in the treatment of trigger finger, especially when compared to steroid injection. When considering the use of splints the stage and duration of triggering needs to be taken into account. Further research with good methodology, highlighting splint position and duration is required. However, the Map of Medicine for trigger finger and trigger finger/thumb algorithm described by Akhtar et al (2005) would appear appropriate to use in the management of this condition until further evidence is available.