Evaluation of the conservative treatment of Trigger finger by local instillation of corticosteroids

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Abstract

Introduction: Trigger Finger (tenosynovitis stenosans) is a specific, named disease from a group of repetitive strain injury (RSI) diseases, caused by inflammation which results in difficulties during muscle contraction and weakened and painful tendon movement. It is common in the outpatient physical medicine and rehabilitation practice. The aim of our study was to evaluate the success of conservative treatment of Trigger Finger by local instillation of corticosteroids.

Methods: The study was designed as an observational and open analysis of the results of conservative treatment of 45 patients. We used precise instillation of steroid anti-inflammatory antirheumatic drugs in the area of patho-anatomic, microtraumatic injuries of tendon and its sheath. Patients were evaluated before and after the treatment with 0 to 5 evaluation score scale. The data were analyzed using $X^2$ test.

Results: Most of the patients had evaluation score of 2, 3 and 4, before the treatment. After the treatment 10 (29%) patients had achieved score 4 and 35 (71%) patients had achieved score 5. All of the patients with score 5 had excellent working ability with full working capacity. Other patients had well-preserved working ability, which improved to excellent in maximum of 7 days.

Conclusions: Conservative treatment of Trigger finger shows good therapeutic effects and taking into account the benefits, convenience and generally lower cost of conservative treatment for the patient, should be considered as an effective alternative to surgical treatment. © 2011 All rights reserved

Keywords: trigger finger, conservative therapy, corticosteroids

Introduction

Treatment of flexor muscle tendons of finger represents one of the most challenging problems of the pathophysiology of the hand. Although the stability is very important for the function of the hand, additional problem is to recover the movement of the fingers that is often compromised by created adhesions. Usually, the factors which provide stability - prevent mobility, which in this case means that the creation of adhesions leads to restriction of mobility and stiffness (1). Previous studies have focused more on achieving the optimal balance of stability-mobility and less on increasing the power of motion which solves the problem (2,3). The problem, however, is not that simple. Tendon injury is usually associated with synovial sheath damage which results in loss of the synovial fluid which is the only way for delivering nutrition to tendon, by diffusion process. This will decrease the pressure of the synovial fluid resulting in reduced nutrition of the tendon and increase of the stiffness, finally leading to complete immobility of the joint (4). The common name for a group of disorders of muscles, their tendons with membranes and nerves, often caused by repeated movements of the muscle-connective tissue, accompanied by significant local morphophysiological changes in muscles, ligaments and nerves is ‘Repetitive Strain Injury’ (RSI). Trigger finger, as a specific disease, belongs to this group (5-7). Etiology of Trigger finger is a multicausal, idiopathic, without a clear cause and usually occurs due to repeated, automated actions in non-physiological position during long time (8,9). Movements, such as handling the computer mouse or working on a factory production line, affect the muscles and ligaments and when they persist for a long time,
they result in injuries that manifest themselves as pain and reduced mobility. High-risk professions include a wide variety of human activities: the workers on the production line, workers by a computer, miners, butchers, musicians (10-13). Recovery of the flexor muscles tendons is often complicated by the formation peritendinous adhesions that result in loss of normal smoothness, stiffness of the fingers, and functional disability. Trigger finger is also called the stenosing tenosynovitis, which can be misleading, because the inflammation is not of dominant importance, but repetitive movements and forceful use of the fingers, which leads to a narrowing of the finger fibrous membranes that reduces the usability of the hands. The collagen fibrils are parallel to each other and closely packed, but show a wave-like appearance due to planar undulations, or crimps, on a scale of several micrometers (13). In tendons, the collagen I fibers have some flexibility due to the absence of hydroxyproline and proline residues at specific locations in the amino acid sequence, which allows the formation of other conformations such as bends or internal loops in the triple helix and results in a wave-like appearance of collagen fibers (13). The first sign of this condition is pain in the affected finger. Eventually, progression occurs and stretching out the finger becomes difficult with loss of functional capacity of the hand. Pain is primarily treated by the application of available anesthetics. Initiation of topically applied anesthetic and steroid preparations has opened new possibilities of conservative treatment. All conservative methods primarily help the patient in the painful stage. Most used corticosteroid preparations are cortisone, prednisolone, dexamethasone and more successful steroids with prolonged action: betamethasone and triamcinolone. Cortisone is a powerful anti-inflammatory drug, but not analgesic. Analgesic effect is achieved by reduction of the inflammatory process. In chronic inflammation the treatment is extended and may require repeated injections. Cortisone injection in an area of inflammation can locally attain very high drug concentrations, with minimal drug entering into the circulation, thereby minimizing side effects (14). Along with Cortisone, analgesics and anesthetics, such as Lidokain or Marcain, are often injected to achieve a quick pain relief. Topical anesthetics help numb the skin in an area being injected. Satisfactory rates can be predicted in patients with single digit involvement, short duration of symptoms (less than four months), no associated conditions, or a small palpable nodule. Besides conservative, common treatment of Trigger finger is surgical (15). Recent advances our understanding of biology of tissue reparation can lead to improved therapies for tendons and their sheaths. Research in this field provides the basic understanding of tendon healing after injury. Reparation takes place in 3 phases: inflammatory, fibroblast, and remodeling phase (16,17). During the inflammatory phase, inflammatory cells from the surrounding tissue migrate to the location of the injury site. Cells (phagocytes) engulf necrotic tissues and cells (17). During fibroblast phase, fibroblasts proliferate around injured sites and synthesize collagen and other extracellular matrix components. Finally, during the phase of remodeling new collagen fibers are produced and are placed longitudinally along the shaft and tendon. Fibroblasts are the main cells in healing reactions and are responsible for the formation of collagen and scar. It is assumed that there are two mechanisms of tendon healing. The first is called extrinsic, in which fibroblasts and inflammatory cells from the periphery enter the site of damage and promote recovery and healing of injured tendons. The second mechanism is called intrinsic, in which the so-called inner fibroblasts and inflammatory cells enter the site of the injury between the tendon and epitendon hastening recovery (3,18,19). Most likely, cure is achieved by a combination of external and internal mechanisms (1). It appears that extrinsic mechanism is active early, while intrinsic follows subsequently (1,20,21). Some studies have shown that the synovial membrane reacts with more proliferation and inflammatory response compared to endoten and tendon (22). Other studies have shown that synovial fibroblasts are more reactive to cytokines and to have a greater capacity for degradation of extracellular matrix (21). It is believed that the predominance of external mechanisms of healing leads to an increase in collagen content on the site of injury, and that the predominance of external healing mechanism leads to the formation of scar tissue and adhesions between the tendon.
Manipulation of cytokine levels by introducing genetic material into cells, as well as additional pluripotent mesenchymal stem cells to the site of recovery is a potential therapeutic strategy to modulate tendon injury and scar formation. Restoration of normal hand function after flexor tendon laceration requires restoring not only the continuity of the tendon fibers, but also a mechanism for smooth communication between the tendon and surrounding structures. Like many other tissues, the healing of tendon injury creates scar tissue. Although the initial formation of scar tissue between the vessels provides physical continuity at the break, the proliferation of scar tissue between the tendon and adjacent tissues is undesirable, indeed harmful, because the scars of the tendons reduce the smoothness of motion that is of particular importance for the function when tendon is sliding through the bends in the fiber bone channels. This becomes more serious if adhesions occur after healing, which can lead to disability due to restrictions or loss of mobility, contractures and functional disability. Most of the research on the tendon reparations and recovery is focused on the mechanical aspects: improvement and repair techniques and rehabilitation protocols which encourage early start of the motion. Due to innovations that are introduced recently, experts advocate delayed rather than primary surgical reconstruction. Even with the best techniques and optimal rehabilitation protocols, functional restoration can not be achieved with certainty and the results are unpredictable (1).

In the last two decades, our understanding of the molecular biology of growth and repair of soft tissues has expanded dramatically. We now know, though incomplete, how genes are regulated, how genes are expressed, and protein synthesis, and how these proteins affect the macroscopic and biomechanical changes in the tissue.

Methods
The study included 45 patients who were admitted into the physical therapy outpatient practice “Praxis”, and diagnosed as Trigger Finger with pain of varying intensity. The study was conducted between January 1st 2009 and June 30th 2011. All admitted patients gave informed consent for participation into the study. They were subjected to a detailed medical history and physical examination during their first visit and their condition is scored 1 to 5, based on local findings, the intensity of pain, local changes (one or more than one digits affected, active and passive mobility, dominant hand), then duration of the painful phase, working ability, the duration of the recovery phase and working ability for their or other job. The scoring has been done according to the criteria, as follows:

Score 0 or 1. Severe clinical conditions that impair function and require additional assistance.
Grade IV (contractures): evident contracture of interphalangeal joints, with no possible movement.
Score 2. Difficult function and the need for prosthetic device. Grade III B (passive): Demonstrable locking in which the patient is unable to actively flex the digit.
Score 3. Satisfactory function in daily activities, but not capable for working. Grade III A (passive): Demonstrable locking in which passive extension is required.
Score 4. Satisfactory functional status with the minor difficulties that do not adversely affect the working ability. Grade II (active) - Demonstrable catching, but with the ability of active movements of flexion and digit extension, with a painful "snap".
Score 5. Minor changes and slight dysfunction. Grade I (pretriggering): pain; history of catching that is not demonstrable on clinical examination; tenderness.

FIGURE 1. Movement of the needle with flexion of the digit confirms correct positioning of the needle for injection treatment. The patient is actively encouraged to move the digit; in most cases, the triggering is relieved. A follow-up appointment is made after 1 week.
After clinical examination and confirmation of diagnosis, all the patients were treated by single, local instillation of corticosteroids. Patients were followed up and re-evaluated 7 days after the treatment. To evaluate the efficacy of conservative treatment, we have recorded additional parameters which could have influenced the outcomes: gender structure (male/female), age of the patients, profession, relapse and dominant hand. A common technique for local instillation of corticosteroids in the tendon sheath is a simple routine that runs on an outpatient basis, with strict precautions. The inflammation nodule is identified, localized and marked, then instillation of corticosteroids in the sheath is performed. A 26-gauge needle is introduced in a proximal-to-distal direction in the nodule, under the annular ligament, making an angle of 45° with the palm (Figure 1).

Results
To research the effects of the conservative treatment by local corticosteroid instillation we have made a clinical examination and evaluation of the patients before the treatment and 7 days after the single, local corticosteroid instillation. The patients were scored at follow up examination by same scale as on initial examination. Before the treatment none of the patients had score of 1, only 1 patient (2%) was evaluated with score 2. Score 3 was assigned to 28 patients (62%) and score 4 to 16 (36%) patients. None of the patients had score of 5 before the treatment (Figure 2). All the treated patients restored the working ability 7 days after the therapy, which was confirmed on the follow up examination (Table 1). To check whether the age influences the prevalence of Trigger finger, the study patients’ age was recorded. Most of the patients were older than 45 years (Table 2). The average age of the patients treated with conservative method was 56.84, the youngest patient was 31, and the oldest was 83 years old. To see whether sex of the patients has influence on prevalence of the Trigger finger, we recorded this parameter. There were 66.7% women in the study group (Figure 3). We wanted to see whether pathophysiological process is related to the dominant hand of the patient, therefore we recorded this data (Figure 4). The pathophysiological process occurs more frequently at the dominant hand. However, affected digit and hand dominance are not always correlated. Treatment and hand (left or right) are independent (p=0.083). Conservative treatment was applied 13 times on the left hand, and 32 times on the right hand (Figure 4). We found significantly higher incidence of the thumb affection compared to all other fingers. Thumb was merely affected in nearly 60% of cases. Index, the second finger was not affected.

| TABLE 1. Summary of age, duration of symptoms, duration of pain, recovery of hand function, sick leave days and days to relapse |
|-----------------|-----------|----------|---------|---------|---------|----------|----------|
|                 | N | Mean | Std. dev. | Minimum | Maximum | 25<sup>th</sup> | 50<sup>th</sup> | 75<sup>th</sup> |
| age             | 45 | 56.84 | 11.69 | 31.00 | 83.00 | 49.50 | 56.00 | 65.00 |
| days with symptoms | 45 | 143.86 | 199.30 | 15.00 | 730.00 | 45.00 | 60.00 | 120.00 |
| duration of pain in days | 44 | 0.13 | 0.34 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |
| recovered hand function | 45 | 0.42 | 0.69 | 0.00 | 2.00 | 0.00 | 0.00 | 1.00 |
| sick leave days | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| days to relapse | 45 | 63.77 | 168.60 | 0.00 | 660.00 | 0.00 | 0.00 | 0.00 |
by the pathophysiological changes (Table 4). Greatest number of treated patients (active and retired) belongs to a group of non-physical workers. Physical workers were less than one fifth (17.8%). Given the rapid spreading and involvement of information technologies in “clerk” professions, this trend is expected. Jobs which require manual labor in the long term are considered risk factor for Trigger finger. As women are more involved in “clerk” professions, that could be the reason for twice higher morbidity in women, compared to the male population. In the first seven days of conservative treatment 68.9% of patients achieved the optimum function of the hand (Figure 6). Treatment and sick leave are dependent (p = 0.035). After completion of corticosteroid instillation a full working capacity was established and patients were able to work and did not use sick leave. Complications are extremely rare with conservative treatment of Trigger Finger. In our sample there were no complications. Relapses occurred in 15.6% of treated patients, while 84.4% were with no relapse during two years of follow up period. Treatment and relapse are independent (p = 0.077). The average time to relapse was 410 ± 207 days.

### Discussion

Injection treatment has long followed a subjective "feeling" and experience. Today, technological advances introduce ultrasound techniques that can maximize the accuracy of the application of steroid injections, and thus its favorable effects in the treatment of Trigger finger (25). There is no rule how many times can cortisone injection be repeated. Often, physicians do not want to repeat more than three, but actually the limits are not specified. However, there are some practical limitations If a cortisone injection wears off quickly or does not help the problem, then repeating it may not be worthwhile. Also, animal studies have shown effects of weakening of tendons and softening of cartilage with cortisone injections. Repeated cortisone injections multiply these effects and increase the risk of potential problems. This is the reason many physicians limit the number of injections they offer to a patient. The success of treatment depends on the ability of physician to identify the difference between dif-

### TABLE 2. The age of the patients conservatively treated for Trigger finger

| Age group | 15-24 | 25-34 | 35-44 | 45-54 | 55-64 | 65-99 |
|-----------|-------|-------|-------|-------|-------|-------|
| Number of patients | 0 | 2 | 4 | 16 | 14 | 13 |

### TABLE 3. Comparison of pathophysiological process on one or two fingers in treated patients.

| Number of fingers affected | Number of patients | % |
|----------------------------|--------------------|---|
| 1 finger                   | 39                 | 86.7 |
| 2 fingers                  | 6                  | 13.3 |
| Total                      | 45                 | 100.0 |

### FIGURE 3. Trigger finger affects women more than man

### FIGURE 4. Right hand was more affected with Trigger finger but the affected finger and hand dominance are not always correlated
fuse and nodular changes in the tendon, that is, to determine the precise location nodular altered tendon, where it will apply a cure. Splinting is not used routinely in these cases, though the splint is described as useful. It is also necessary to apply immobilization in patients when injection is contraindicated. In those cases metacarpo-phalangeal joint is immobilized at about 15° of flexion. Corticosteroids may cause a temporary rise in blood and urine sugar levels in patients with diabetes. In addition, repeated steroid injections may lead to tendon rupture. In patients with insulin-dependent diabetes, and higher nodule incidence on several fingers, according to some authors, surgical treatment is required more frequently than patients who were not insulin-dependent (26). The most common side effect is the condition in which cortisone crystallizes after injection (cortisone flare). This can cause increased pain sensation of shorter duration and can be treated with local application of ice. Injections may cause skin injury and infection, so it is necessary to perform strict disinfection of the skin which reduces this risk. Patients with darker skin have to be informed about the possibility of local skin discolor, before applying cortisone (27).

According to literature, a different ways of Trigger finger treatment were described as successful. It is estimated that 85% of cases will respond well to conservative treatment (28). If conservative treatment is not effective surgical treatment is recommended (29). Similar results were published by Shaw-Ruey Lyu (30). The best description of the Trigger Finger was made by Charles Sorbie (31).

**Conclusions**

Conservative treatment of Trigger finger had satisfactory effect and can be considered as a first line treatment of this disease in patients where corticosteroids are not contraindicated. Further, conservative treatment demonstrated short functional and working ability recovery time and may be considered cheaper than surgical treatment due to less sick leave days used.

**Conflict of interest**

There is no conflict of interest
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