Treatment of de Quervain's Tendinopathy With Eccentric Training Program

NCT Number: not yet assigned

Study Protocol
with Statistical Analysis Plan (SAP)
and Informed Consent Form (ICF)

Sponsor-Investigator: Katalin Lenti, PhD

Document date: 13 April 2026
[Content last modified: 01 June 2017]

Semmelweis University

Faculty of Health Sciences

Treatment of de Quervain's Tendinopathy with Eccentric Training

[redacted]

Nursing and Patient Care Programme

Specialisation in Physiotherapy

2017/2018

Lead Investigator:

Dr. [redacted], Professor

Co-Investigator:

Dr. [redacted] Associate Professor

External Medical Consultants:

Dr. [redacted], Assistant Lecturer

Dr. [redacted], Clinical Specialist

Table of Contents

INTRODUCTION 5

1. The Discovery of de Quervain's Tendinopathy 5
2. The Anatomy of the Human Hand 6
3. Symptoms of de Quervain's tendinopathy 9
4. Histopathology of de Quervain's tendinopathy 10
5. Diagnosis of de Quervain's tendinopathy 12
6. Differential diagnosis of de Quervain's tendinopathy 15
7. Etiology of de Quervain's tendinopathy 16
8. Surgical treatment of de Quervain's tendinopathy 19
9. Conservative treatment of de Quervain's tendinopathy 20

ECCENTRIC TRAINING PROGRAMME 22

1. Introduction 22
2. Outline of the Research 25
3. Inclusion Criteria 27
4. Exclusion Criteria 27
5. Instructions, Exercise Plan 27

Exercise Plan* I. (Weeks 1-2) 29

Exercise Plan II. (Weeks 3-4) 31

Exercise Plan III. (Weeks 5-6) 33

Weeks 7-8 35

REFERENCES 36

APPENDICES 48

PATIENT INFORMATION SHEET 49

CONSENT FORM 53

Data Protection Declaration **55**

Anamnesis Form – Week 1 ..... **56**

Anamnesis Form – Week 1 ..... **59**

QuickDASH form **62**

Scoring the QuickDASH Test **65**

NPRS questionnaire **69**

PRWE questionnaire **70**

Calendar **71**

Visit Log **72**

Statistical Methods for the Analysis of Research Results **73**

Introduction

1. The Discovery of de Quervain's Tendinopathy

Johann Friedrich de Quervain (1868-1940) was a Swiss hand surgeon.[1] In the spring of 1892, he began working in Bern as an assistant to Dr Theodor Kocher.[2] During this time, he first encountered a case in which the patient experienced pain when moving the thumb. The pain radiated from the distal end of the radius towards the forearm. The gripping strength of the hand had completely disappeared. On physical examination, only thickening of the tendon sheath and tenderness in the area differed from normal at the source of the pain. de Quervain performed surgery on the patient, during which he released the affected tendon sheath with an incision. As he had not previously encountered a similar problem, he wrote an article in 1895 about further cases and his observations, outlining a new disease later named after him: de Quervain's stenosing tendinitis/tenosynovitis (de Quervain's stenosing tendosynovitis/tendovaginitis).[3]

Harry Finkelstein, an American surgeon, began collecting cases after reading several of de Quervain's publications, and in 1930 he published a summary supplemented with his own experience. He discussed in detail the knowledge then available about the disease: its symptoms, pathology, treatment methods, prognosis, etc. Many of his findings still hold true today. In the aforementioned article, he also presented two tests that he considered suitable for diagnosing the disease.[4] These tests are still in use today. Unfortunately, shortly after the publication of the article, the two tests were confused by several authors, causing confusion in the literature to this day. The misunderstanding is presumed to have originated with Leao.[5] In my research plan, I adhere to Finkelstein's original description.-

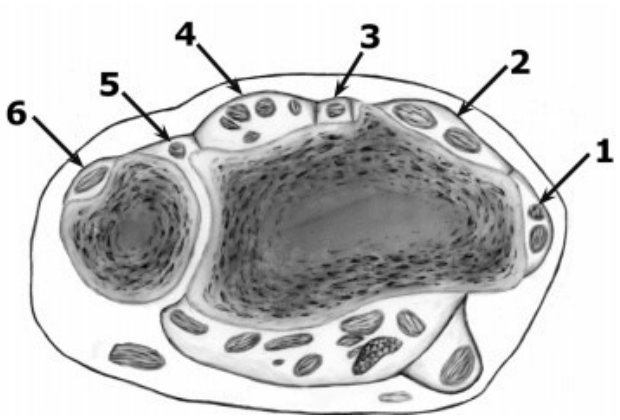
Over the hundred years following the first publication, a protocol for the treatment of the disease evolved. Soon, the first reports also appeared on the side effects associated with the interventions (e.g. postoperative keloid scar, paraesthesia, injury to the radial nerve, etc.).[6]

In the late 1900s, attention turned to the conservative treatment of the disease. Researchers sought, on the basis of evidence, to investigate the causes of the disease and the risk factors, to refine diagnostic tools, and to examine its histological background—in short, to find answers to questions that remained unresolved. The literature has continued to broaden and become more specialised ever since, yet there are still unexplored areas of the problem.

2. THE ANATOMY OF THE HUMAN HAND

de Quervain's tendinopathy is a disorder affecting the wrist and hand region. Numerous structures pass through this area, and their course shows considerable variation. For this reason, knowledge of the anatomy of the region is essential for establishing an accurate diagnosis.[7]

1.

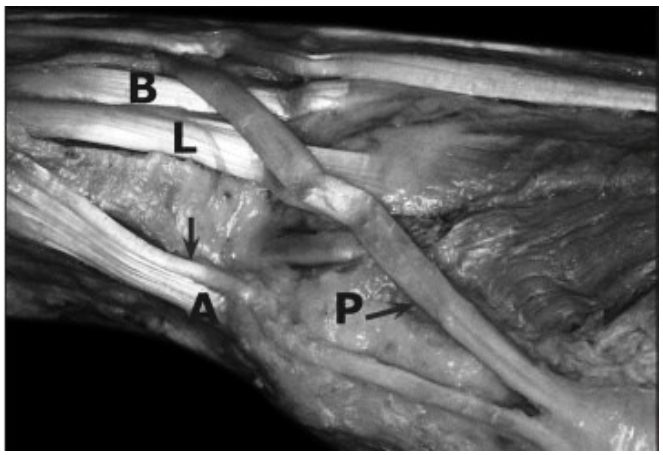


1

The septa originating from the extensor retinaculum on the dorsum of the hand attach to the forearm bones and create osteofibrous, tunnel-like compartments. The tendons of the forearm extensor muscles run through these compartments. The tendons are protected by a tendon sheath beneath the compartments. There are six compartments in total, of which, from the perspective of DQT, the first is affected, namely the compartment containing the tendons of the m. abductor pollicis longus (APL) and m. extensor pollicis brevis (EPB).[8] In Figure 1, which shows a cross-sectional image of the wrist, this is the compartment labelled "1".[7]

- The m. abductor pollicis longus originates from the interosseous membrane between the forearm bones and from the ulna. In the distal third of the forearm, it becomes superficial, then, passing around and thereby stabilising the tendons of the m. extensor carpi radialis longus and brevis muscles, it inserts tendinously at the base of the first metacarpal of the thumb.[8]
- The m. extensor pollicis brevis originates from the interosseous membrane between the forearm bones and from the radius, deep to the APL. Its course is similar to the previous muscle, but it turns towards the dorsal side and inserts at the base of the proximal phalanx of the thumb.[8]

Viewed from the side, it also becomes apparent how much larger the diameter of the APL tendon ("A") is compared with that of the EPB ("arrow"). [7]



2. Radial Nerve

Both muscles are innervated by the radial nerve.[8] A detailed description of its course can be found in the article by Auerbach et al.[9] Both they and de Quervain [3], as well as many other measurements in the literature (e.g. [10], [11]), draw attention to the fact that the branches of the nerve running here require particular care during any surgical procedure, as the branching pattern is highly individual in each person. Robson and colleagues devoted a separate study to determining in which areas of the wrist an incision can be made with the greatest safety for the nerve.[11]

3. Tendon Sheaths

In healthy individuals, the tendon sheath of the muscles has a pearly appearance similar to the inner surface of a shell, and it consists of two layers. On the side facing the tendon there is a layer of squamous epithelium (synovial layer), which is covered by a loose connective-tissue and vascular layer (fibrous layer).[4] Its length is generally 2 cm, and it begins approximately 2 mm distal to the distal end of the radius towards the hand.[10]

Anatomical Variations

Various anatomical variations can occur in the hand and wrist region, many of which are not necessarily pathological. According to Younghusband et al., anatomical structures differing from those described in textbooks are so common that the textbook pattern is almost the exception.[12] Several others have confirmed this observation.[10], [13], [14] These variations can trigger DQT and may determine the appropriate therapy.[15], [16] Some examples:

- Multilamellar APL tendon: if the therapist misinterprets this common phenomenon as a longitudinal tear, an incorrect therapy may be recommended to the patient.[17][18][14] Maeseneer et al. found a multilamellar APL tendon in 89% of their subjects.[7]
- The APL gives off fibrous bundles to another structure.[10][15][19]
- Subcompartment between the APL and EPB: a septum may be present between them, which is not normally found under physiological conditions.[10][15][20][21] If the therapist interprets the septum as a tendon, the patient may be misdiagnosed.[18] The presence of a subcompartment requires precisely executed therapy, otherwise symptoms may persist.[7]
- Subcompartment involving only the EPB: in approximately 70% of cases, the septum contains both tendons, but in about 30% it extends only to the EPB.[22]
- Variable number of tendons: the number of tendons of both the APL and the EPB may vary. Between one and seven have been reported for the APL, while the EPB has at most three tendons and may rarely be absent.[5][10][15][17][18][19]
- Course and branching of the radial nerve: when passing along the radial side of the wrist, it may continue as a single branch, or it may divide into two or three branches.[5]

3. SYMPTOMS OF DE QUERVAIN'S TENDINOPATHY

Numerous case reports are available in the literature, all of which begin by listing the symptoms. Summarising the literature, the following symptoms are the most common:

- Pain on the radial side of the wrist that develops over the course of months and progressively worsens.[23][24] Later, severe pain appears around the processus styloideus radii, radiating toward the thumb and forearm. The pain intensifies with movement. Swelling may also occur. The area is tender to palpation.[4][23][24][25]
- Thumb extension/abduction and ulnar deviation of the wrist are accompanied by sharp pain.[4][25][26] Abduction of the affected thumb may be reduced.[27][23][28] The area may become stiff,[29][28] or numb.[30] Motor function of the hand may become limited,[31][26] and activities such as lifting, gripping, and wrist rotation that require use of the thumb may become painful.[32] Because of the pain, the patient may even completely avoid using the affected hand.[12]
- Crepitus may accompany the condition,[7][25] and a relatively rare but observed symptom is a triggering sensation very similar to trigger finger syndrome in patients with de Quervain's tendinopathy.[33]
- There is no redness characteristic of inflammation, and the area is not warm to the touch either.[28][29]

The symptoms often appear gradually and intensify over time, but the patient may also report a specific preceding injury or a newly adopted unusual movement pattern.[4]

4. HISTOPATHOLOGY OF DE QUERVAIN'S TENDINOPATHY

Despite the considerable interest in DQT, the aetiology and histopathology of the condition remain largely unexplored. Some authors refer to it as "stenosing tenovaginitis", implying that it may originate from acute or chronic inflammation. Others interpret it rather as a combination of inflammatory and degenerative processes.[34] However, views are consistent in that the complaints are caused by pressure and friction exerted on the tendons running within the thickened tendon sheath.[4] Since the histopathology of the condition strongly influences the therapies that may be applied, I will discuss the scientific findings to date in more detail.

The histopathology of DQT was also investigated by de Quervain himself. He found no signs of inflammation, only thickening of the fibrous layer. No pathological changes were found in the tendons.[35] When Watkins and Pitkin described DQT in the California and Western Medicine journal in 1930, they likewise presented it as tissue proliferation without inflammation.[28] Later, a few opinions contradicting this were published (e.g. [36][14][22][37]). Finally, in a 1998 study, the histopathology of DQT was re-examined. Their findings were as follows:

- the diameter of the diseased tendon sheaths may be up to five times greater than that of controls,
- disorganisation of collagen fibres can be observed,
- increased neovascularisation of the tendons,
- the synovial layer is histologically normal,
- mucopolysaccharide accumulates within the tendon sheath,
- myxoid degeneration has been demonstrated,
- chondroid metaplasia may develop,
- regardless of any treatment already started, these changes were always found in patients, whereas they were never found in the control group,
- no active inflammation was demonstrated in any case.[34]

Read and colleagues arrived at similar findings in 2000.[38] John A. Papa therefore refers to the condition more as a tendinopathy and avoids terminology suggestive of inflammation. Knobloch and colleagues likewise approach it as a tendinopathy.[39] McAuliffe devoted a separate section of his paper to clarifying the nomenclature;[40] for him, even the term tendinopathy is not sufficiently precise. After reviewing the literature, I ultimately chose to retain the term tendinopathy.

An interesting point from the histological studies is the paper by Andersson and colleagues, which showed that small nerve branches also grow into the affected area during neovascularisation. These are capable of transmitting pain sensation.[41]

In their ultrasound examinations, Maeseneer and colleagues found that the extensor retinaculum, the tendon sheath compartment, and even the tendons themselves may become thickened.[7]

This raises the question of whether the problem might be caused by the processus styloideus radii itself, since an abnormality of this structure could injure an anatomical structure running nearby. The research by Suresh and colleagues addressed this question, but their results did not support this assumption.[42]

5. DIAGNOSIS OF DE QUERVAIN'S TENDINOPATHY

1. Taking the medical history: In many cases, an accurate history and examination of the hand are sufficient to establish the diagnosis of DQT. It is particularly important to define the parameters of pain (location, timing, nature). The medical history should include questions relating to neurological and structural issues, as well as the social environment and leisure activities. Ramsey Shehab and colleagues point out that, due to the nature of the condition, the patient may not necessarily report any previous injury during questioning.[23]
2. Observation: observation of sitting posture, head position, and shoulder position.[27]
3. Physical examination: During this examination, the cervical spine, the shoulder on the affected side, the elbow, and the wrist are examined. If the patient reports pain during any test, the test is repeated on the unaffected side to check whether the response is symmetrical. [27] [43]
4. Special tests:
    - Eichhoff test[44]: one of the earliest and most commonly used tests for the diagnosis of DQT. The patient clenches the hand into a fist in such a way that the other fingers wrap over the thumb. The examiner supports the forearm and then produces ulnar deviation.
      Positive result: if, during ulnar deviation, the patient feels severe pain over the radial styloid process. Releasing the thumb causes the pain to stop immediately.

    - Finkelstein test[4][37]: the second most commonly used test. The examiner grasps the patient's thumb and suddenly deviates the hand ulnarly.
      Positive result: if pain occurs (usually extremely intense pain).

      I would like to emphasise again that these two tests are often confused in the literature.[45] In my research plan, I adhered to the authors' original descriptions.

The Finkelstein test has been scrutinised by several authors, as it has been regarded as the most widely used test for the diagnosis of DQT[46], and therefore it must meet the criteria established by evidence-based medicine. In 2005, it was shown to assess primarily the tension of the EPB and, to a lesser extent, that of the APL.[47] Its weakness is that it elicits pain by pulling on the tendons instead of creating friction between the A1 pulley and the distal end of the tendon, although in theory this friction is what produces the symptoms of DQT.[48] Finally, Dawson and colleagues observed that the test is not performed uniformly across practitioners.[32] Unfortunately, both of the above-mentioned tests can produce false-positive results in certain cases[44][46], and therefore research is ongoing to refine these tests or develop new ones.

- Brunelli test[48]: the patient performs radial deviation of the wrist while the examiner forcefully abducts the symptomatic thumb. The APL and EPB tendons bend and rub against the A1 pulley.
  Positive result: if severe pain occurs at the radial base of the thumb.

- Stepped Finkelstein test[32]:
  - The patient places the forearm on a table. The thumb points upward, the wrist hangs off the edge of the table toward the examiner, and the patient actively performs ulnar deviation. Positive result: patients in the acute stage already report pain at the tip of the radial styloid process at this stage.
  - If the result is negative, the examiner grasps the patient's hand and performs greater ulnar deviation. Positive result: pain is felt at the tip of the radial styloid process.
  - In cases of chronic wrist pain, it may happen that pain is elicited only when the examiner maintains ulnar deviation and also flexes the thumb.

- Measurement of thumb muscle strength [49]: using a device, loss of thumb function has become objectively measurable. This makes it possible to exclude subjective pain-related sensations, thereby considerably increasing the reliability of the measurement. The disadvantage of the method is that the device suitable for measurement is not commercially available and has not been

validated. Despite these limitations, the introduction of such a device would represent a noteworthy advance.

- WHAT test [44]: (wrist hyperflexion and abduction of the thumb test):
  The patient actively volar-flexes the wrist to the pain threshold while placing the thumb in a maximally extended and abducted position. After the position has been assumed, the examiner supports the hand from the opposite side, thereby stabilising the forearm and wrist and ensuring that only the affected muscles are working. The thumb is then gradually pressed toward the palm with increasing force until the patient is no longer able to resist.
  Positive result: if pain occurs while maintaining the position.
  Its advantage is that it can be adapted to the individual's pain tolerance and can test only the tendons of the APL and EPB muscles, making it less likely to produce false-positive results. It is more sensitive than the Eichhoff test.

5. Imaging procedures:

If the diagnosis is still not clear after performing the tests, or if the medical history suggests another disorder, it may be necessary to use imaging procedures. Conventional X-ray[37], bone scintigraphy[39], ultrasound examination[50], CT[23], and MRI[23][51] may all be useful. It is generally believed that X-ray images do not show abnormalities in DQT[7], although there is a report in the literature indicating that a focal abnormality of the radial styloid process may be a sign of DQT[37]. Bone scintigraphy can demonstrate increased bone uptake along the first dorsal compartment, which may also indicate DQT.[39][52] Ultrasound is also being used increasingly often to establish the diagnosis[7][53][50], and it is increasingly recommended as a monitoring tool alongside certain therapies[53][50]. The use of MRI is also discussed extensively in the literature (e.g. [7][39][51]).

6. DIFFERENTIAL DIAGNOSIS OF DE QUERVAIN'S TENDINOPATHY

Many authors mention conditions that can produce symptoms very similar to those of DQT. Knowledge of these conditions is essential in order to establish the correct diagnosis. The most common of these are:

Neuritis, periostitis, tuberculous osteitis, tuberculous tendovaginitis, tendovaginitis crepitans, arthritis (of rheumatoid, gouty, gonorrhoeal, or syphilitic origin)	[4]
Severe sprain of the radial collateral ligament, the scaphotrapezial ligament, and the carpometacarpal ligament of the thumb	[1]
Arthritis, chronic dislocation, neuralgia, causalgia	[29][12]
Intersection syndrome	[54]
Wartenberg syndrome	[7]
Osteoarthritis of the first carpometacarpal joint	[7]
Anomalies of the extensor pollicis longus tendon	[55]
Trigger finger	[1]
Scaphoid fracture	[56]
Presence of an intraneural ganglion	[57]
Congenital abnormalities of the carpal bones	[58]

7. ETIOLOGY OF DE QUERVAIN'S TENDINOPATHY

A study published in 2009 that assessed the incidence of DQT in the U.S. military found an incidence rate of 2.8 per 1,000 person-years in women and 0.6 per 1,000 person-years in men.[59] In 2011, the prevalence of DQT in a group of French workers ranged between 1.2%, 0.6%, and 2.1%.[60] A third study showed that each year 0.5% of men and 1.3% of women in the working-age population develop DQT.[61] These numbers may not seem high, but from an economic perspective they still represent a loss. In Germany alone, two million workdays per year were reported lost among people with DQT when they had to take leave because of the disease.[62]

Many researchers are concerned with uncovering the background of DQT. Their main questions are why it develops, which repetitive movements trigger it, and whether there is a relationship between the workplace and the development of DQT. As early as 1963, it was observed that the number of patients with DQT was gradually increasing. This may have been due to improvements in the diagnostic tools available for the disease, but changes that had taken place in certain workplaces may also have increased its frequency.[12] If the development of DQT can be proven to be related to work, the WHO and the European Union would classify it as an occupational disease, which would be the first step toward prevention.[63] Fortunately, it is already listed among work-related disorders.[64][65][66]

The extent of the relationship between work tasks and the development of DQT is still debated. Andréu et al. aptly expressed their doubts, since among workers performing the same job, at most one or two will develop complaints, while the others show no symptoms at all. Consequently, either the specific nature of the working conditions or individual susceptibility may explain its development.[67] Not to mention that it is almost impossible to cleanly separate sex- and age-related parameters from the number of years someone has worked and in what position. Because of this, it is unclear what the true risk factor was.[67][68] Two kinds of "selection effects" can also be observed. On the one hand, in the long run people leave workplaces that caused their complaints, so a survey may falsely suggest that DQT is uncommon in that job. On the other hand, women more often occupy positions in which certain movement sequences are repeated frequently, which is a known risk factor for the disease.[68],[69] These data therefore require cautious interpretation. It is also debated to what extent computer use contributes to the development of DQT. Evidence exists on both sides, for example [67][70][71] and [60][72].

A long list could be compiled from the literature of occupations most commonly affected by DQT. I intentionally kept occupations that are mentioned again and again in the list to indicate that multiple authors have demonstrated their involvement. A few examples are keyboard operators, musicians, office workers, and craftspeople[67]; nurses[73]; endoscopists[74]; athletes[75][76]; car mechanics[54]; homemakers, typists, artisans, fishermen, nurses, pianists, golfers, telephone switchboard operators[12]; pianists, typists, people who write a great deal by hand, people who wash clothes by hand, woodcutters, people who carry heavy objects, etc.[4] To me, these data suggest that some kind of relationship can still be found between workplaces and the occurrence of DQT. Unfavourable anatomical variations of the hand, combined with more highly exposed occupations, may create a breeding ground for the development of DQT.

a)	**Summary of possible risk factors in the literature:**	
1.	acute trauma	[77][4][68][12]
2.	extreme, new hand movements (e.g. due to a change of job, after a long break), or holding the hand in an unusual position	[12]
3.	postures maintaining thumb extension-abduction	[67][28]
4.	prolonged wrist flexion	[60][69]
5.	twisting/turning movement performed from the wrist	[69][60]
6,	repetitive movement of the hand and thumb	[77][23] [46][12][60] [46][28][68][72][5]
7.	sport	[76][75]
8.	cumulative microtraumas	[78][75]
9.	hormonal effects	[79][77][60]
10.	anatomical variations (especially the EPB septum)	[63][80][81][82] [17][83][15][84]
11.	superficial position of the tendons	[12]
12.	pregnancy, breastfeeding, child under 6 years of age	[63][80][79][71]
13.	rheumatoid diseases	[63]
14.	certain medications	[63]

15.	age	[63][60][59][77] [72][51]
16.	sex (women are more frequently affected)	[63][59][61][12] [12][60][71]
17.	catastrophic thinking, depression	[85]

b) No association (not a risk factor):		
1.	Vibration (characteristic of CTS)*	[69][60]
2.	Exposure to cold	[60][72]
3.	Stress -> still uncertain	[60]
4.	Smoking (characteristic of CTS)*	[69]

*CTS: Carpal Tunnel Syndrome

8. SURGICAL TREATMENT OF DE QUERVAIN'S TENDINOPATHY

Both surgical and non-surgical solutions are recommended in the literature for the treatment of DQT. There is considerable disagreement as to which one should be used first.[85] As the eponym and discoverer of the disease, de Quervain, being a surgeon, operated on patients with DQT without question [3],[35], but today non-invasive methods are also available.

Using the Delphi Consensus Strategy with 35 experts, Huisstede et al. attempted to standardise the main questions related to DQT. In the published article, they also addressed surgical treatment. The experts agreed on the use of open surgery, although no consensus was reached regarding the direction of the incision (transverse or longitudinal). Local anaesthesia and non-absorbable sutures were also recommended.[46] In their article, Abrisham et al. supported the longitudinal incision because it was significantly more favourable with regard to postoperative complications.[86] Robson et al. also recommend this approach.[11] In contrast, a 2016 study reported that during DQT release the longitudinal incision intersected the branches of the dorsal radial sensory nerve in 75% of cases.[87] As a solution, Kang et al. proposed the endoscopic surgical technique because it produced a better clinical outcome than open surgery.[88]

The success rate of surgery is estimated in the literature to be around 88-100% (e.g. [89][90][91][92]); however, like any operative procedure, it may also have side effects. According to Abrisham et al., lesions may occur in the superficial branch of the radial nerve, vascular injury may occur around the anatomical snuffbox, and a hypertrophic scar may develop along the incision. They also mention the possible subluxation of the tendon of the m. palmaris, and of course the risk of infection can never be completely excluded.[86] For this reason, surgery is now mainly reserved for patients who do not respond adequately to conservative treatment.[88] Surgical failure may be caused by failure to recognise the subcompartment around the EPB, nerve injury, or subluxation.[87][93][9] For these reasons, many surgeons are seeking alternative surgical techniques, such as those of Yuasa et al.[94] and Okada and Kutz.[95] Both groups aimed to develop a simplified technique with fewer harmful after-effects.

Surgeons do everything they can to avoid adverse healing outcomes. If complications do occur, there are options for subsequent treatment (e.g. [96][97]). In our opinion, however, surgery should still be left until the end of the treatment sequence. How an individual responds to surgery depends on many personal factors, so it is more advisable to begin treatment with non-invasive interventions.

9. CONSERVATIVE TREATMENT OF DE QUERVAIN'S TENDINOPATHY

As with surgical techniques, a great many conservative treatment methods are also available. The most common are the following:

1.	Non-steroidal anti-inflammatory drugs	[46][98][33]
2.	Training	[46][98][43]
3.	Splinting, immobilisation	[46][4][28][5][99] [98][100][21][33]
4.	Corticosteroid injection	[46][101][5][16][84][99][102] [103][33]
5.	Some combination of conservative treatments	[5][99][104][105][33]

In conservative treatment, patient education is very important, because the degree of hand activity, the movements to be avoided, and what to do in case of pain must all be defined. Of the splints, the one recommended is the type that starts from the lower part of the forearm and extends at most to the interphalangeal joint.[46] The splint is regarded more as an auxiliary (palliative) rather than a curative device ([98]), and it is usually prescribed for 2-8 weeks.[46][4][5]

Corticosteroid injection deserves a separate chapter. If DQT is not of inflammatory origin, then the mechanism of action of the drug is also obscure.[40] If it is inflammatory, however, the mechanism of action of the injection has already been elucidated.[106] Its efficacy is reported in the literature to be 60-95% ([107][101][98][99][31], etc.), but the Cochrane Collaboration raised serious quality concerns about the studies and did not consider the evidence conclusive.[108] Nevertheless, the first trial that also examined the placebo effect demonstrated an advantage of the injection.[109] Further studies will probably be expected on the topic. At present, experts have agreed on a maximum of 3 injections, although opinions differ regarding the waiting time between them. If complaints persist after the third injection, the patient requires surgical treatment.[46]

Failure of corticosteroid injections is most commonly caused by a septum separating the APL and the EPB, so the medication does not infiltrate one of the compartments.[84][110][111] This can be improved if the injection is accompanied by ultrasound imaging[112]; moreover, the structural changes caused by the injection can then be observed.[50] Steroid injections may also have harmful side effects: skin depigmentation, tissue atrophy, skin rash, disturbance of

the menstrual cycle[113], tendon rupture[114], and their use requires special caution in patients with diabetes.[46][40] There is no consensus as to whether the hand should be rested after administration ([46][54]) or may be loaded immediately ([99]).

McAuliffe objected that we do not know the medium- and long-term effects of corticosteroid injections, because patients are rarely followed for a sufficiently long period. Consequently, some questions remain unanswered, such as how many later return for surgery, in how many people injections alone delay surgery, and whether there is an optimal interval between two injections, etc.[40] In the short term, injection proved more effective than splinting[46]. The question arose whether combining the two could enhance the therapeutic effect. In a systematic review and meta-analysis published in 2016, the authors concluded that the combined treatment was much more effective than injection alone or some type of orthosis alone.[105]

Hadianfard et al. listed additional non-surgical treatment methods that occur in practice. They mentioned rest, early immobilisation, strapping, heating and cooling, diathermy, cross-fiber friction massage, and eccentric training, although the effectiveness of these methods has not yet been proven. They themselves compared the effectiveness of acupuncture and corticosteroid injections. Immediately after treatment, the injections proved more effective, but by the end of the 6-week follow-up the acupuncture treatment showed results similar to those of the injections.[115]

The case study described by John A. Papa documents the success of eccentric training. As a result of the training, the patient's complaints decreased and then disappeared. At the 6-month follow-up, the symptoms had not returned at all.[43] Knobloch et al. combined eccentric training with sclerosing therapy and polidocanol injection. They also reported positive results.[39]

Eccentric Training Programme

1. INTRODUCTION

Our research group has set itself the goal of clarifying the role of eccentric training among the conservative treatment options for DQT. The possible adverse effects of both injection therapy and surgical treatment are known from the literature, and these can easily deter patients,[115] thereby exposing them to unnecessary suffering. As a result, there is concern that many patients present to some level of health care only when conservative treatments are no longer effective.[46]

It is not our aim to question the effectiveness of corticosteroid injections or surgical treatment. Nevertheless, we believe that alternative options should exist, with particular regard to eccentric training, because it has noteworthy advantages:

- in the treatment of DQT recognised at an early stage, exposure of the body to corticosteroids may be avoided,
- in certain conditions (e.g. allergy, diabetes), unwanted bodily reactions may be avoided,
- the psychological aspect of treatment is also not negligible. In our opinion, people would seek medical help earlier if it became common knowledge that DQT can be treated without cutting or injections. Many people are afraid of the pain caused by interventions, so they ask for help only when the problem has already become serious,
- with the increasing prevalence of computer use, in my opinion it can be expected that the incidence of DQT will rise. It is therefore more useful to develop an exercise plan than to treat complaints only afterwards, because it promotes awareness. Meeting a physiotherapist is also educational. By providing appropriate information, the importance of body control and self-observation can also reach the patient's family, helping to prevent DQT or recognise it in time. Treatment procedures should be selected in a way that promotes the development of correct habits in society; indirectly, this would also reduce the burden on the health care system, because less severe cases would need to be treated.

The details of the eccentric training used for the treatment of DQT are described clearly and consistently by John A. Papa.[43] He uses tools that are available in most households or can be obtained easily. However, his report is limited to the presentation of a single case. Our aim is to reproduce the techniques he described in a larger group of patients and then compare the obtained results with the outcome results of patients treated with the treatment methods currently most widely accepted in Hungary (namely locally administered corticosteroid injection, non-steroidal anti-inflammatory drugs, immobilisation, and surgical treatment).

Eccentric training has long been used in the treatment of other tendinopathies: in Achilles tendinopathy (for example, Alfredson et al. in 1998[116]), lateral epicondylitis (summarised by Malliaras et al. in a 2008 review[117]), rotator cuff tendinopathy[118] and patellar ligament tendinopathy.[119] A large number of papers also compare eccentric exercise programmes with other conservative procedures ([120][121][122][123][124]). The general conclusion of these studies and systematic reviews is often that eccentric training is suitable for the treatment of tendinopathies, but its effectiveness is comparable to that of other conservative therapies. The greatest problem, however, is that there are too few evidence-based studies, therefore further research is needed on the topic.[120][125][126][127]

Despite its widespread use and the diverse body of research, the exact mechanism of action of eccentric training is still being investigated. A number of hypotheses have already been proposed in this regard:

- Structural changes: Stanish and colleagues began using eccentric training in 1985 to treat Achilles tendinopathy. According to their hypothesis, this type of training forces the tendon to restructure at both the micro- and macro-levels.[128] H. Alfredson and his team also referred to this in attempting to explain the effect of the training.[116] Reese and colleagues offered an explanation for tendon remodelling that differed from that of Stanish and colleagues. According to them, the fluctuation of the force exerted by the muscle is the key stimulus for tendon reorganisation.[129] The large number of studies made it possible for Drew and colleagues to prepare a systematic review. Although the evidence is contradictory, they considered it more likely that eccentric training does not cause observable structural changes.[130]

- Reduction of neovascularisation: In 2001, Alfredson and another research group observed that if the ankle is passively dorsiflexed, the vessels formed by neovascularisation within the tendon become occluded.[131] A year later, they

observed that when a sclerosing injection was given into the newly formed vessels within the tendon, the vessels became occluded and the pain disappeared.[132] This observation led to the formulation of a hypothesis: if eccentric training is able to occlude the newly formed vessels, and these remain permanently closed because of regular exercise, then the mechanism of action of eccentric training may be explained. The relationship between vessel occlusion and the disappearance of pain has also been confirmed by others (e.g. Maffulli et al.[133][134]), and the hypothesis itself was also supported by Knobloch and his research group.[135] This possibility requires further investigation, because in some studies it has not been confirmed that the presence of neovascularisation (and its elimination by treatment) reliably predicts healing outcomes.[136]

- Neurochemical interactions: Attia's research group demonstrated that glycosaminoglycans (GAGs) accumulate markedly in tendon disorders.[137] If the accumulated proteoglycans make pain receptors more sensitive,[138] the question arises whether eccentric training can trigger a response in the body at the biochemical level and thereby reduce pain.[139] Earlier studies showed that tendon diameter decreases immediately after eccentric training.[140] If this is due to a reduction in the amount of GAGs in the tendons, this may also be a possible explanation.

Further arguments and counterarguments were summarised by O'Neill and colleagues in 2015.[141] Research on this topic is still ongoing. The work of our research group does not extend to clarifying this question.

2. OUTLINE OF THE RESEARCH

1. Establishing the medical diagnosis

   At the Orthopaedic Clinic of Semmelweis University (1082 Budapest, Üllői út 78/b.), the external consultant physicians receive the patient, determine the diameter of the affected tendon sheath by ultrasound examination, have the patient complete the attachment entitled Anamnesis Form Week 1, the QuickDASH questionnaire, record the NPRS, and have the patient complete the PRWE questionnaire. On this basis they establish the diagnosis and prescribe the treatment, then refer the patient to the Faculty of Health Sciences of Semmelweis University (1088 Budapest, Vas utca 17.).

2. Informing the patient

   We inform the patient about the details of the research and hand over one copy of the Informed Consent Form, one copy of the Patient Information Sheet, one copy of the Declaration on the Protection of Personal Data, Training Plan I, and the Calendar.

3. Establishing the functional diagnosis

   - Taking the anamnesis: interviewing the patient
   - Inspection: observation of sitting posture, head position, and shoulder position[27]
     whether there is swelling above the processus styloideus radii
   - Physical examination: we examine the cervical spine, the shoulder and shoulder girdle, the elbow, the wrist, the range of motion of the wrist and thumb (goniometric measurement), the muscle strength of the APL and EPB, and perform a functional test.
   - Special test: Because of the concerns raised in the literature, we did not choose the most commonly used Eichhoff and Finkelstein tests.[32], [44], [46] Considering that these are nevertheless the tests accepted by most professionals, and that most diagnoses are based on them, we use the staged Finkelstein test. This differs least from the original Finkelstein test, as it essentially only breaks it down into its components, while at the same time causing considerably less pain to the patient than the original version.[32]

4. Training period (8 weeks): regular meetings with the patient as described in the detailed plan. Exercise Plan II and III are provided at the appropriate time. The Physiotherapist Visit Sheet is maintained.

5. Final examination: After completion of the training, the external consultant physicians receive the patient again at the Orthopaedic Clinic of Semmelweis University, re-examine the patient, and determine whether any change has occurred. The diameter of the affected tendon sheath is measured again by ultrasound. The Anamnesis Form Week

8 questionnaire, the QuickDASH questionnaire, the NPRS, and the PRWE questionnaire are completed again.

6. Follow-up examination: At the Orthopaedic Clinic of Semmelweis University, the external consultant physicians contact the patient by telephone or electronically at weeks 10 and 12 and 6 months after the start of treatment. If the patient reports recurrent pain, another in-person meeting and additional data collection take place.

3. Inclusion Criteria

- DQT confirmed by medical documentation
- Reported pain around the radial styloid process during medical history taking that has been gradually increasing
- Positive stepped Finkelstein test
- Pain is experienced only during the stepped Finkelstein test, and no radiating pain into the arm is reported elsewhere during the physical examination

4. Exclusion Criteria

- If it is not clear whether the patient has DQT, or it becomes evident that they do not have DQT
- If the patient has another musculoskeletal disorder affecting the hand
- If the patient does not perform the exercises or does not follow the instructions provided
- If the patient begins another treatment method during the study or has been treated with another method within the previous 6 months
- If the patient participates in another study with a similar aim during the study period
- If the patient cannot attend in person at least once per week
- If the patient is a minor

5. Instructions, Exercise Plan

If the patient meets the above criteria, we discuss the exercise plan for the following week and the instructions to be followed during the 8-week period.

1. **Instructions:**	
- we ask the patient to modify their daily activities	[43]
- avoid using the painful hand - increase the use of the symptom-free side instead	[43] [43]
- ask family members to share tasks and take over some burdens	[43]
- develop a rest strategy and reconsider time management	[43] [142]

- in occupations requiring intensive hand use, rest every 15 minutes and never work continuously for more than 25 minutes
- Record the exercise sessions in the calendar we provide and always bring the calendar with you
2. Exercise Plan:
- The treatment lasts 8 weeks
- During the first 4 weeks, we meet the patient twice a week (at minimum once a week)
- During the second 4 weeks, once a week

3. Required equipment:
- Small elastic band
- 0.5 kg dumbbell
- TheraBand resistance band
- Timer
- Calendar
- Exercise Plan I, II, III

EXERCISE PLAN* I. (WEEKS 1-2)

1.	Warm-up: Stand upright with the arms hanging by the sides. – Raise the shoulders, then press them downward – Move the shoulders forward, then backward – Shoulder circles – Bend the elbow, touch the shoulder with the hand, then stretch upward next to the ear. Then touch the shoulder again and lower the forearm – Wrist circles – Clench the hand into a fist, then extend the fingers		
2.	– Passively stretch the thumb muscles		– Hold for 15-20 seconds – 8-10 times daily – 5 times per week
3.	– Stretch the forearm muscles		– Hold for 15-20 seconds – 8-10 times daily – 5 times per week
4.	– Concentric exercises		– The arm is supported up to the wrist – The wrist bends upward
			– Slowly lower the hand
			– With support from the other hand, return to the starting position – Hold for 15-20 seconds – 8-10 times daily – 5 times per week

*The images included in the exercise plans are taken from John A. Papa's article [43].

At the first meeting, we discuss the patient's questions, address whether they will be able to follow the prescribed instructions, and whether we can meet twice weekly during the first four weeks. We then demonstrate the exercises, the patient imitates them, and we correct them if necessary.

During the next three meetings, the exercises are performed under our supervision. The patient may report their experiences and any questions that arise in the meantime.

Required equipment:
- Timer
- Calendar
- Exercise Plan I.

EXERCISE PLAN II. (WEEKS 3-4)

While retaining the previous exercises, we expand the movement sequence.

11.	– The wrist is fully supported, the thumb faces upward, and the hand rests on the ulnar edge of the palm. – Place an elastic band around the index finger and thumb. Fix the index finger, lift the thumb upward in the plane of the palm with the other hand, and hold it there. – Now release the thumb and slowly return it next to the other fingers while resisting the pull of the band. – The band must remain taut throughout!	**starting position**	– Perform 2 x 10-15 repetitions daily – 5 times per week – Aim for 3 x 15 repetitions per day
2.	– Twist the band once around itself to form a figure eight, and place it back onto the fingers in this form. – With the help of the other hand, move the thumb away from the other fingers as shown in the picture. – After assuming the position, release the thumb and slowly return it next to the other fingers while resisting the pull of the band. – The band must remain taut throughout!	starting position	– If this is achieved, increase the resistance (place 2 rubber bands on the thumb)
3.	Cool-down: – Shake out the hand		

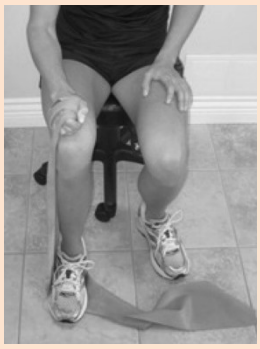
During weeks 3 and 4, the exercises are performed under our supervision at the two weekly meetings. The patient may report their experiences and any questions that arise in the meantime. We gradually increase the number of exercises, aiming to reach 15 repetitions.

Required equipment:
- Small elastic band
- Timer
- Calendar
- Exercise Plan I, II

EXERCISE PLAN III. (WEEKS 5-6)

While retaining the previous exercises, we expand the movement sequence.

<table>
<tr>
<td>1.</td>
<td>– The forearm is supported up to the wrist.
– Take a 0.5 kg dumbbell in the hand.
– With the help of the other hand, move the wrist into the starting position shown in the picture (back of the hand facing upward).
– Then release the wrist with the assisting hand, hold it with one hand, and slowly lower the weight.</td>
<td>starting position</td>
<td rowspan="2">– Perform 2 x 10-15 repetitions daily
– 5 times per week

– Aim for 3 x 15 repetitions per day</td>
</tr>
<tr>
<td>2.</td>
<td>– Now turn the forearm over so that the palm faces upward while holding the dumbbell.
– With the help of the other hand, move the wrist into the starting position shown in the picture (palm facing upward).
– Then release the wrist with the assisting hand, hold it with one hand, and slowly lower the weight.</td>
<td>starting position</td>
</tr>
<tr>
<td>3.</td>
<td>– Sit upright with both feet touching the floor. Place the band under the foot on the same side as the painful hand. Lead the band upward along the outer side of the lower leg to the hand. The hand rests on the thigh with the palm facing downward. Begin wrapping the band from the little-finger side over the back of the hand.
– It is very important that the band remains taut throughout!
– From this tensioned position, slowly turn the hand so that the palm faces upward.</td>
<td> 
starting position</td>
<td>– Perform 2 x 10-15 repetitions daily
– 5 times per week

– Aim for 3 x 15 repetitions per day

If this is achieved, increase the resistance!

The resistance of the band can be increased by folding it in two and holding both strands in the hand</td>
</tr>
</table>

4.	– Sit upright with both feet touching the floor. Place the band under the foot on the same side as the painful hand. Lead the band upward along the inner side of the lower leg to the hand. The hand rests on the thigh with the palm facing upward. Begin wrapping the band from the little-finger side over the palm. – It is very important that the band remains taut throughout! – From this tensioned position, slowly turn the hand so that the palm faces downward.	**starting position**	
5.	Cool-down: – Shake out the hand – Stretch the hand muscles – Stretch the forearm muscles		

We discuss the new schedule, with one meeting per week. At these meetings, the exercises are performed under our supervision. The patient may report their experiences and any questions that arise in the meantime. We gradually increase the number of exercises, aiming to reach 15 repetitions.

Required equipment:
- Small elastic band
- 0.5 kg dumbbell
- TheraBand resistance band
- Timer
- Calendar
- Exercise Plan I, II, III

WEEKS 7-8

No new exercises are introduced; instead, the repetition count of the existing exercises is increased to 15 and the load is increased. The aim of these two final weeks is to gradually reacclimatize the hand to performing everyday activities. The schedule changes, the affected hand may work more, and the breaks between activities become progressively shorter.

At the final meeting, the patient performs the exercises under our supervision. After this, we refer them back to the external consultant physicians working at the Orthopaedic Clinic of Semmelweis University, who carry out the closing stage of the research.

Instruction: from this point onward, it is no longer necessary to continue performing the exercises

Follow-up: at weeks 10 and 12 and 6 months after the start, by telephone or electronic communication. If recurrent pain is reported, an additional in-person visit and data collection will take place.

References

[1] N. K. Ahuja and K. C. Chung, “Fritz de Quervain, MD (1868-1940): Stenosing tendovaginitis at the radial styloid process,” *J. Hand Surg. Am.*, vol. 29, no. 6, pp. 1164–1170, 2004.

[2] A. Mudry, “Johann Friedrich « Fritz » de Quervain (1868 – 1940) und die Sehnenscheidenentzündung am Handgelenk,” *SchweizMed Forum*, vol. 14, no. 40, pp. 739–741, 2014.

[3] F. de Quervain, “On a form of chronic tendovaginitis. (Translated article: Cor-Bl.f.schweiz. Aerzrte 1895:25:389-94).,” *J. Hand Surg. Br.*, vol. 30, no. 4, pp. 388–391, 1895.

[4] Harry Finkelstein, “Stenosing tendovaginitis at the radial styloid process,” *Hosp. Jt. Dis.*, pp. 509–540, 1930.

[5] L. Leao, “de Quervain’s Disease: A clinical and anatomical study,” *J. Bone Jt. Surg.*, vol. 40–A, pp. 1063–1070, 1958.

[6] D. K. Faithfull and D. W. Lamb, “De Quervain’s disease-A clinical review,” *Hand Clin.*, vol. 3, no. 1, pp. 23–30, 1971.

[7] Michel De Maeseneer, S. Marcelis, T. Jager, C. Girard, T. Gest, and D. Jamadar, “Spectrum of normal and patholgic findings in the region of the first extensor compartment of the wrist,” *J. Ultrasound Med.*, vol. 28, pp. 779–786, 2009.

[8] T. Emil and M. Tamás, *Funkcionális anatómia gyógytornászhallgatók számára*. Budapest: Medicina Könyvkiadó Zrt., 2011.

[9] D. M. Auerbach, E. D. Collins, K. L. Kunkle, and E. H. Monsanto, “The radial sensory nerve. An anatomic study.,” *Clinical orthopaedics and related research*, no. 308. pp. 241–249, 1994.

[10] M. H. Gonzalez, R. Sohlberg, A. Brown, and N. Weinzweig, “The first dorsal extensor compartment: An anatomic study,” *J. Hand Surg. Am.*, vol. 20, no. 4, pp. 657–660, 1995.

[11] A. J. Robson, M. S. See, and H. Ellis, “Applied anatomy of the superficial branch of the radial nerve,” *Clin. Anat.*, vol. 21, no. 1, pp. 38–45, 2008.

[12] O. Z. Younghusband and J. D. Black, “De Quervain’S Disease: Stenosing Tenovaginitis At the Radial Styloid Process.,” *Can. Med. Assoc. J.*, vol. 89, pp. 508–512, 1963.

[13] G. A. Brunelli and G. R. Brunelli, “Anatomy of the extensor pollivis brevis muscle,” *J. Hand Surg. (British Vol.*, vol. 17, no. 3, pp. 267–269, 1992.

[14] P. Rousset, V. Vuillemin-Bodaghi, J.-D. Laredo, and C. Parlier-Cuau, “Anatomic variations in the first extensor compartment of the wrist: accuracy of US.,” *Radiology*, vol. 257, no. 2, pp. 427–433, 2010.

[15] B. Y. W. T. Jackson, T. S. C. F. Viegas, J. M. Coon, K. D. Stimpson, A. D. Frogameni, and J. M. Simpson, “Anatomical Variations in the First Extensor Compartment of the Wrist,” *J. Bone Jt. Surgery, Inc.*, vol. 68A, no. 6, pp. 923–926, 1986.

[16] F. J. Harvey, P. M. Harvey, and M. W. Horsley, “De Quervains’s disease: Surgical or nonsurgical treatment,” *J. Hand Surg. Am.*, vol. 15A, no. 1, pp. 83–87, 1990.

[17] T. Kulthanan and B. Chareonwat, “Variations in abductor pollicis longus and extensor pollicis brevis tendons in the Quervain syndrome: a surgical and anatomical study.,” *Scand. J. Plast. Reconstr. Surg. Hand Surg.*, vol. 41, no. 1, pp. 36–38, 2007.

[18] N. Shiraishi and G. Matsumura, “Anatomical Variations of the Extensor Pollicis Brevis Tendon and Abductor Pollicis Longus Tendon – Relation to Tenosynovectomy –,” *Okajimas Folia Anat. Jpn.*, vol. 82, no. 1, pp. 25–30, 2005.

[19] S. R. Nayak, A. Krishnamurthy, M. M. Pai, L. V. Prabhu, L. A. Ramanathan, C. Ganesh Kumar, and M. M. Thomas, “Multiple variations of the extensor tendons of the forearm,” *Rom. J. Morphol. Embryol.*, vol. 49, no. 1, pp. 97–100, 2008.

[20] B. M. Leslie, W. B. Ericson, and J. R. Morehead, “Incidence of a septum within the first dorsal compartment of the wrist,” *J. Hand Surg. Am.*, vol. 15, no. 1, pp. 88–91, 1990.

[21] L. K. Loomis, “Variations of stenosing tenosynovitis at the radial styloid process,” *J. Bone Jt. Surg.*, vol. 33, no. 2, pp. 340–346, 1951.

[22] A. Volpe, M. Pavoni, A. Marchetta, P. Caramaschi, D. Biasi, C. Zorzi, G. Arcaro, and W. Grassi, “Ultrasound differentiation of two types of de Quervain’s disease: the role of retinaculum.,” *Ann. Rheum. Dis.*, vol. 69, no. 5, pp. 938–939, 2010.

[23] R. Shehab and M. H. Mirabelli, “Evaluation and diagnosis of wrist pain: A case-based approach,” *Am. Fam. Physician*, vol. 87, no. 8, pp. 568–573, 2013.

[24] G. Piligian, R. Herbert, M. Hearns, J. Dropkin, P. Landsbergis, and M. Cherniack, “Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity,” *Am. J. Ind. Med.*, vol. 37, no. 1, pp. 75–93, 2000.

[25] A. D. Gupta and D. Mahalanabis, “Study of hand function in a group of shoe factory workers engaged in repetitive work,” *J. Occup. Rehabil.*, vol. 16, no. 4, pp. 675–684,

2006.

[26] M. S. Arons, “de Quervain’s release in working women: a report of failures, complications, and associated diagnoses,” *J. Hand Surg. Am.*, vol. 12, no. 4, pp. 540–544, 1987.

[27] J. González-Iglesias, P. Huijbregts, C. Fernández-de-Las-Peñas, and J. A. Cleland, “Differential diagnosis and physical therapy management of a patient with radial wrist pain of 6 months’ duration: a case report,” *J. Orthop. Sport. Phys. Ther.*, vol. 40, no. 6, pp. 361–368, 2010.

[28] J. T. Watkins and H. C. Pitkin, “Stenosing tendovaginitis of de Quervain,” *Cal. West. Med.*, vol. 32, pp. 101–102, 1930.

[29] S. Kaneko, H. Takasaki, and S. May, “Application of Mechanical Diagnosis and Therapy to a Patient Diagnosed with de Quervain’s Disease: A Case Study,” *J. Hand Ther.*, vol. 22, no. 3, pp. 278–284, 2009.

[30] M. Darowish and J. Sharma, “Evaluation and treatment of chronic hand conditions,” *Med. Clin. North Am.*, vol. 98, no. 4, pp. 801–815, 2014.

[31] M. van Middelkoop, B. M. a Huisstede, S. Glerum, and B. W. Koes, “Effectiveness of interventions of specific complaints of the arm, neck, or shoulder (CANS): musculoskeletal disorders of the hand,” *Clin. J. Pain*, vol. 25, no. 6, pp. 537–52, 2009.

[32] C. Dawson and C. S. Mudgal, “Staged description of the finkelstein test,” *J. Hand Surg. Am.*, vol. 35, no. 9, pp. 1513–1515, 2010.

[33] G. M. Alberton, W. A. High, A. Y. Shin, and A. T. Bishop, “Extensor triggering in de Quervain’s stenosing tenosynovitis,” *J. Hand Surg. Am.*, vol. 24, no. 6, pp. 1311–1314, 1999.

[34] M. T. Clarke, H. A. Lyall, J. W. Grant, and M. H. Matthewson, “The histopathology of de Quervain’s disease,” *J. Hand Surg. (British Eur. Vol.*, vol. 23, pp. 732–734, 1998.

[35] F. de Quervain, “On the nature and treatment of stenosing tendovaginitis on the styloid process of the radius,” *J. Hand Surg. (Original Muenchener Medizinische Wochenschrift)*, vol. 30 (59), no. 4, p. 392–394 (5–6), 1912.

[36] M. C. Sbernardori, V. Mazzarello, and P. Tranquilli-Leali, “Scanning electron microscopic findings of the gliding surface of the A1 pulley in trigger fingers and thumbs,” *J. Hand Surg. Eur. Vol.*, vol. 32, no. 4, pp. 384–387, 2007.

[37] A. J. Chien, J. A. Jacobson, W. Martel, M. U. Kabeto, and D. R. Marcantonio, “Focal radial styloid abnormality as a manifestation of de Quervain tenosynovitis,” *Am. J. Roentgenol.*, vol. 177, no. 6, pp. 1383–1386, 2001.

[38] H. S. Read, G. Hooper, and R. Davie, “Histological Appearances in Post-Partum De Quervain â€TM S Disease,” pp. 70–72, 2000.

[39] K. Knobloch, A. Gohritz, M. Spies, and P. M. Vogt, “Neovascularisation in de Quervain’s disease of the wrist: Novel combined therapy using sclerosing therapy with polidocanol and eccentric training of the forearms and wrists - A pilot report,” *Knee Surgery, Sport. Traumatol. Arthrosc.*, vol. 16, no. 8, pp. 803–805, 2008.

[40] J. A. McAuliffe, “Tendon Disorders of the Hand and Wrist,” *J. Hand Surg. Am.*, vol. 35, no. 5, pp. 846–853, 2010.

[41] G. Andersson, P. Danielson, H. Alfredson, and S. Forsgren, “Nerve-related characteristics of ventral paratendinous tissue in chronic Achilles tendinosis,” *Knee Surgery, Sport. Traumatol. Arthrosc.*, vol. 15, no. 10, pp. 1272–1279, 2007.

[42] S. S. Suresh, H. Zaki, and A. Ali, “Does Radial Styloid Abnormality in de Quervain’s Disease Affect the Outcome of Management?,” *Hand*, pp. 1–4, 2010.

[43] J. A. Papa, “Conservative management of De Quervain’s stenosing tenosynovitis: a case report,” *J. Can. Chiropr. Assoc.*, vol. 56, no. 2, pp. 112–20, 2012.

[44] J. F. Goubau, L. Goubau, a Van Tongel, P. Van Hoonacker, D. Kerckhove, and B. Berghs, “The wrist hyperflexion and abduction of the thumb (WHAT) test: a more specific and sensitive test to diagnose de Quervain tenosynovitis than the Eichhoff’s Test.,” *J. Hand Surg. Eur. Vol.*, vol. 39, no. 3, pp. 286–92, 2014.

[45] B. G. Elliott, “FINKELSTEIN â€TM S TEST : A DESCRIPTIVE ERROR PRODUCE A FALSE POSITIVE,” *J. Hand Surg. Am.*, vol. 17, pp. 481–482, 1992.

[46] B. M. A. Huisstede, P. Hoogvliet, J. H. Coert, and J. Fridén, “Consensus on a Multidisciplinary Treatment Guideline for de Quervain Disease: Results From the European HANGUIDE Study,” *Phys. Ther.*, vol. 94, no. 8, pp. 1095–1110, 2014.

[47] K. Kutsumi, P. C. Amadio, C. Zhao, M. E. Zobitz, T. Tanaka, and K. N. An, “Finkelstein’s test: A biomechanical analysis,” *J. Hand Surg. Am.*, vol. 30, no. 1, pp. 130–135, 2005.

[48] G. Brunelli, “Le test de Finkelstein contre le test de Brunelli dans la tenosynovite de De Quervain Finkelstein ’ s versus Brunelli ’ s test in De Quervain tenosynovitis,” *Chir. Main*, vol. 22, pp. 43–45, 2003.

[49] K. Fournier, D. Bourbonnais, G. Bravo, J. Arsenault, P. Harris, and D. Gravel, “Reliability and validity of pinch and thumb strength measurements in de quervain’s disease,” *J. Hand Ther.*, vol. 19, no. 1, pp. 2–11, 2006.

[50] M. Kamel, K. Moghazy, H. Eid, and R. Mansour, “Ultrasonographic diagnosis of de

Quervainâ€™s tenosynovitis," *Ann. Rheum. Dis.*, vol. 61, pp. 1034–1035, 2002.

[51] S. E. Anderson, L. S. Steinbach, D. De Monaco, H. M. Bonel, Y. Hurtienne, and E. Voegelin, "'Baby Wrist': MRI of an overuse syndrome in mothers," *Am. J. Roentgenol.*, pp. 719–724, 2004.

[52] W. D. Leslie, "The scintigraphic appearance of de Quervain tenosynovitis," *Clin. Nucl. Med.*, vol. 31, no. 10, pp. 602–4, 2006.

[53] M. Bodor and B. Fullerton, "Ultrasonography of the hand, wrist, and elbow," *Phys. Med. Rehabil. Clin. N. Am.*, vol. 21, no. 3, pp. 509–531, 2010.

[54] K. D'Angelo, D. Sutton, P. Côté, S. Dion, J. J. Wong, H. Yu, K. Randhawa, D. Southerst, S. Varatharajan, J. Cox, C. Brown, R. Menta, M. Nordin, H. M. Shearer, A. Ameis, M. Stupar, L. J. Carroll, and A. Taylor-Vaisey, "The effectiveness of passive physical modalities for the management of soft tissue injuries and neuropathies of the wrist and hand: A systematic review by the Ontario protocol for traffic injury management (OPTIMa) collaboration," *J. Manipulative Physiol. Ther.*, vol. 38, no. 7, pp. 493–506, 2015.

[55] G. Rubin, A. Wolovelsky, M. Rinott, and N. Rozen, "Anomalous Course of the Extensor Pollicis Longus," *Ann. Plast. Surg.*, vol. 67, no. 5, pp. 489–492, 2011.

[56] S. C. Chen, "The scaphoid compression test," *J. Hand Surg. (British Vol.*, vol. 14, pp. 323–325, 1989.

[57] J. M. Haller, M. Q. Potter, M. Sinclair, and D. T. Hutchinson, "Intraneural Ganglion in Super fi cial Radial Nerve Mimics de Quervain Tenosynovitis," *J. Wrist Surg.*, vol. 3, pp. 262–264, 2014.

[58] K. Kaneko, K. Matsumura, and Y. Maruyama, "Congenital synostosis between the scaphoid and the trapezium as a cause of tenosynovitis simulating de Quervain's disease," *Chir. Main*, vol. 19, no. 3, pp. 187–190, 2000.

[59] J. M. Wolf, R. X. Sturdivant, and B. D. Owens, "Incidence of de Quervain's Tenosynovitis in a Young, Active Population," *J. Hand Surg. Am.*, vol. 34, no. 1, pp. 112–115, 2009.

[60] A. P. le Manac'h, Y. Roquelaure, C. Ha, J. Bodin, G. Meyer, F. Bigot, M. Veaudor, A. Descatha, M. Goldberg, and E. Imbernon, "Risk factors for de quervain's disease in a French working population," *Scand. J. Work. Environ. Heal.*, vol. 37, no. 5, pp. 394–401, 2011.

[61] K. Walker-Bone, K. T. Palmer, I. Reading, D. Coggon, and C. Cooper, "Prevalence and impact of musculoskeletal disorders of the upper limb in the general population.,"

Arthritis Care Res., vol. 51, no. 4, pp. 642–651, 2004.

[62] F. Liebers and G. Caffier, *Berufsspezifische Arbeitsunfähigkeit durch Muskel-Skelett-Erkrankungen in Deutschland Forschung Projekt F 1996*. 2009.

[63] S. Stahl, D. Vida, C. Meisner, A. S. Stahl, H.-E. Schaller, and M. Held, "Work related etiology of de Quervain's tenosynovitis: a case-control study with prospectively collected data," *BMC Musculoskelet. Disord.*, vol. 16, no. 1, pp. 126–136, 2015.

[64] A. Karjalainen, *International Statistical Classification of Diseases and Related Health Problems (ICD-10) in Occupational health*. 1999.

[65] International Labour Organization, *LIST OF OCCUPATIONAL DISEASES (revised 2010) Identification and recognition of occupational diseases: Criteria for incorporating diseases in the ILO list of occupational diseases*, vol. 74. 2010.

[66] European Commission and E. Commission, *Information notices on occupational diseases: a guide to diagnosis*. 2009.

[67] J. L. Andréu, T. Otón, L. Silva-Fernández, and J. Sanz, "Hand pain other than carpal tunnel syndrome (CTS): The role of occupational factors," *Best Pract. Res. Clin. Rheumatol.*, vol. 25, no. 1, pp. 31–42, 2011.

[68] B. A. Silverstein, L. J. Fine, and T. J. Armstrong, "Hand wrist cumulative trauma disorders in industry.," *Br. J. Ind. Med.*, vol. 43, no. 11, pp. 779–784, 1986.

[69] S. Tanaka, M. Petersen, and L. Cameron, "Prevalence and Risk Factors of Tendinitis and Related Disorders of the Distal Upper Extremity Among U . S . Workers : Comparison to Carpal Tunnel Syndrome," *Am. J. Ind. Med.*, vol. 335, pp. 328–335, 2001.

[70] E. F. Pascarelli and Y. P. Hsu, "Understanding Work-Related Upper Extremity Disorders: Clinical Findings in 485 Computer Users, Musicians, and Others," *J. Occup. Rehabil.*, vol. 11, no. 1, pp. 1–21, 2001.

[71] F. Gerr, M. Marcus, C. Ensor, K. D, S. Cohen, A. Edwards, E. Gentry, D. J. Ortiz, and C. Monteilh, "A Prospective Study of Computer Users: I.Study Design and Incidence of Musculoskeletal Symptoms and Disorders," *Am. J. Ind. Med.*, vol. 41, pp. 221–35, 2002.

[72] Y. Roquelaure, C. Ha, C. Rouillon, N. Fouquet, A. Leclerc, A. Descatha, A. Touranchet, M. Goldberg, and E. Imbernon, "Risk factors for upper-extremity musculoskeletal disorders in the working population," *Arthritis Care Res.*, vol. 61, no. 10, pp. 1425–1434, 2009.

[73] P. C. Leite, M. A. Barbosa Merighi, and A. Silva, "The experience of a woman

working in nursing suffering from De Quervain's disease," *Rev. Lat. Am. Enfermagem*, vol. 15, no. 2, pp. 253–258, 2007.

[74] A. K. Shergill, K. R. Asundi, A. Barr, J. N. Shah, J. C. Ryan, K. R. McQuaid, and D. Rempel, "Pinch force and forearm-muscle load during routine colonoscopy: a pilot study," *Gastrointest. Endosc.*, vol. 69, no. 1, pp. 142–146, 2009.

[75] C. Rossi, P. Cellocco, E. Margaritondo, F. Bizzarri, and G. Costanzo, "De Quervain disease in volleyball players," *Am. J. Sports Med.*, vol. 33, no. 3, pp. 424–427, 2005.

[76] A. S. Tagliafico, P. Ameri, J. Michaud, E. Derchi, M. P. Sormani, and C. Martinoli, "Wrist Injuries Article Title in Nonprofessional Tennis Players : Relationships With Different Grips Article Subtitle," *Am. J. Sports Med.*, vol. 37, pp. 760–767, 2011.

[77] T. Pagonis, K. Ditsios, P. Givissis, A. Pagonis, and A. Christodoulou, "Abuse of growth hormone increases the risk of persistent de Quervain tenosynovitis.," *Am. J. Sports Med.*, vol. 37, pp. 2228–2233, 2009.

[78] M. Ali, M. Asim, S. H. Danish, F. Ahmad, A. Iqbal, and S. D. Hasan, "Frequency of De Quervain's tenosynovitis and its association with SMS texting," *Muscles. Ligaments Tendons J.*, vol. 4, no. 1, pp. 74–8, 2014.

[79] G. Capasso, V. Testa, N. Maffulli, G. Turco, and G. Piluso, "Surgical release of de Quervain's stenosing tenosynovitis postpartum: Can it wait?," *Int. Orthop.*, vol. 26, no. 1, pp. 23–25, 2002.

[80] V. Vuillemin, H. Guerini, H. Bard, and G. Morvan, "Stenosing tenosynovitis," *J. Ultrasound*, vol. 15, no. 1, pp. 20–28, 2012.

[81] M. Maruyama, M. Takahara, N. Kikuchi, K. Ito, T. Watanabe, and T. Ogino, "De Quervain disease caused by abductor pollicis longus tenosynovitis: a report of three cases," *J. Asia-Pacific Fed. Soc. Surg. Hand*, vol. 14, no. 1, pp. 43–7, 2009.

[82] A. M. Alemohammad, N. Yazaki, R. P. Morris, W. L. Buford, and S. F. Viegas, "Thumb Interphalangeal Joint Extension By the Extensor Pollicis Brevis: Association With a Subcompartment and de Quervain's Disease," *J. Hand Surg. Am.*, vol. 34, no. 4, pp. 719–723, 2009.

[83] J. Hoch, H. Fritsch, and H. Lewejohann, "Kongenitale oder erworbene Anlage des separaten Faches fiir die Sehne des M . extensor pollicis brevis bei der Tendovaginitis stenosans de Quervain ? Makroanatomische und fetal-plastinationshistolo- gische Untersuchungen zum 1 . Strecksehnenfach," vol. 186, pp. 305–310, 2004.

[84] J. Witt, G. Pess, and R. H. Gelberman, "Treatment of de Quervain Tenosynovitis," *J. Bone Jt. Surg.*, pp. 219–222, 1991.

[85] A. R. Kachooei, M. E. Menendez, and D. Ring, “Factors Associated with Operative Treatment of De Quervain Tendinopathy,” *Arch. bone Jt. surgery.*, vol. 198, no. 3, pp. 198–203, 2015.

[86] S. J. Abrisham, M. H. A. Karbasi, J. Zare, Z. Behnamfar, A. D. Tafti, and B. Shishesaz, “De Qeurvian Tenosynovitis: Clinical outcomes of surgical treatment with longitudinal and transverse incision,” *Oman Med. J.*, vol. 26, no. 2, pp. 91–93, 2011.

[87] B. Rogozinski and G. M. Lourie, “Dissatisfaction after first dorsal compartment release for de Quervain tendinopathy,” *J. Hand Surg. (American Vol.*, vol. 41, no. 1, pp. 117–119, 2015.

[88] H. J. Kang, S. B. Hahn, S. H. Kim, and Y. R. Choi, “Does endoscopic release of the first extensor compartment have benefits over open release in de Quervain’s disease?,” *J. Plast. Reconstr. Aesthetic Surg.*, vol. 64, no. 10, pp. 1306–1311, 2011.

[89] A. Scheller, R. Schuh, W. Hönle, and A. Schuh, “Long-term results of surgical release of de Quervain’s stenosing tenosynovitis,” *Int. Orthop.*, vol. 33, no. 5, pp. 1301–1303, 2009.

[90] K. T. Ta, D. Eidelman, and J. G. Thomson, “Patient satisfaction and outcomes of surgery for de Quervain’s tenosynovitis,” *J. Hand Surg. Am.*, vol. 24, no. 5, pp. 1071–1077, 1999.

[91] M. Azeem, M. Z. Iqbal, N. Ahmed, A. Ali, and S. Mahmood, “OUTCOME OF SURGICAL TREATMENT OF DE-QUERVAINS DISEASE,” *J. Sheikh Zayed Med. Coll.*, vol. 5, no. 3, pp. 655–657, 2014.

[92] H. J. Lee, P. T. Kim, I. W. Aminata, H. P. Hong, J. P. Yoon, and I. H. Jeon, “Surgical release of the first extensor compartment for refractory de Quervain’s tenosynovitis: surgical findings and functional evaluation using DASH scores,” *Clin. Orthop. Surg.*, vol. 6, no. 4, pp. 405–409, 2014.

[93] G. M. White and a J. Weiland, “Symptomatic palmar tendon subluxation after surgical release for de Quervain’s disease: a case report.,” *J. Hand Surg. Am.*, vol. 9, no. 5, pp. 704–706, 1984.

[94] K. Yuasa and Y. Kiyoshige, “Limited surgical treatment of de quervain’s disease: Decompression of only the extensor pollicis brevis subcompartment,” *J. Hand Surg. Am.*, vol. 23, no. 5, pp. 840–843, 1998.

[95] M. Okada and J. E. Kutz, “Excision of aberrant abductor pollicis longus tendon slips for decompression of de Quervain’s disease,” *J. Hand Surg. Eur. Vol.*, vol. 36, no. 5, pp. 379–82, 2011.

[96] M. McMahon, S. M. Craig, and M. A. Posner, “Tendon subluxation after de Quervain’s release: treatment by brachioradialis tendon flap,” *J. Hand Surg. Am.*, vol. 16, no. 1, pp. 30–32, 1991.

[97] G. El Rassi, R. Bleton, and D. Laporte, “Compartmental reconstruction for de Quervain stenosing tenosynovitis,” *Scand. J. Plast. Reconstr. Surg. Hand Surg.*, vol. 40, no. 1, pp. 46–8, 2006.

[98] A. M. Ilyas, “Nonsurgical Treatment for de Quervain’s Tenosynovitis,” *J. Hand Surg. Am.*, vol. 34, no. 5, pp. 928–929, 2009.

[99] A. P. Weiss, E. Akelman, and M. Tabatabai, “Treatment of de Quervain’s disease.,” *J. Hand Surg. Am.*, vol. 19, no. 4, pp. 595–8, 1994.

[100] M. E. Menendez, E. Thornton, S. Kent, T. Kalajian, and D. Ring, “A prospective randomized clinical trial of prescription of full-time versus as-desired splint wear for de Quervain tendinopathy.,” *Int. Orthop.*, vol. 39, no. 8, pp. 1563–1569, 2015.

[101] J. M. M. Mckenzie, “Conservative Treatment of de Quervain â€TM s Disease,” *Br. Med. J.*, pp. 659–660, 1972.

[102] S. Avci, C. Yilmaz, and U. Sayli, “Comparison of nonsurgical treatment measures for de Quervain’s disease of pregnancy and lactation,” *J. Hand Surg. Am.*, vol. 27, no. 2, pp. 322–324, 2002.

[103] M. B. Stephens, A. I. Beutler, and F. G. O’Connor, “Musculoskeletal injections: A review of the evidence,” *Am. Fam. Physician*, vol. 78, no. 8, pp. 971–976, 2008.

[104] S. A. Mehdinasab and S. A. Alemohammad, “Methylprednisolone Acetate Injection Plus Casting,” *Arch. Iran. Med.*, vol. 13, no. 4, pp. 270–274, 2010.

[105] R. Cavaleri, S. M. Schabrun, M. Te, and L. S. Chipchase, “Hand therapy versus corticosteroid injections in the treatment of de Quervain’s disease: A systematic review and meta-analysis.,” *J. hand Ther.*, vol. 29, no. 1, pp. 3–11, 2016.

[106] D. Cardone and A. Tallia, “Joint and Soft tissue Injection course Joint and soft tissue injection course,” *Am. Fam. Physician*, vol. 66, no. 2, pp. 283–288, 2002.

[107] C. A. Richie and W. W. Briner, “Corticosteroid injection for treatment of de Quervain’s tenosynovitis: a pooled quantitative literature evaluation,” *J. Am. Board Fam. Pract.*, vol. 16, no. 2, pp. 102–106, 2003.

[108] C. Peters-Veluthamaningal, D. van der Windt, J. Winters, and B. Meyboom-de Jong, “Corticosteroid injection for de Quervain ’ s tenosynovitis (Review),” *Cochrane Database Syst. Rev.*, no. 3, p. CD005616, 2009.

[109] C. Peters-Veluthamaningal, J. C. Winters, K. H. Groenier, and B. Meyboom-DeJong,

"Randomised controlled trial of local corticosteroid injections for de Quervain's tenosynovitis in general practice.," *BMC Musculoskelet. Disord.*, vol. 10, p. 131, 2009.

[110] C. Zingas, J. M. Failla, and M. Van Holsbeeck, "Injection accuracy and clinical relief of de Quervain's tendinitis.," *J. Hand Surg. Am.*, vol. 23, no. 1, pp. 89–96, 1998.

[111] C. Mirzanli, K. Ozturk, C. Z. Esenyel, S. Ayanoglu, Y. Imren, and S. Aliustaoglu, "Accuracy of intrasheath injection techniques for de Quervain's disease: a cadaveric study," *J. Hand Surg. (European Vol.*, vol. 37, no. 2, pp. 155–160, 2012.

[112] J. D. McDermott, A. M. Ilyas, L. N. Nazarian, and C. F. Leinberry, "Ultrasound-guided injections for de Quervain's tenosynovitis," *Clin. Orthop. Relat. Res.*, vol. 470, no. 7, pp. 1925–1931, 2012.

[113] A. Brinks, B. W. Koes, A. C. W. Volkers, J. A. N. Verhaar, and S. M. A. Bierma-Zeinstra, "Adverse effects of extra-articular corticosteroid injections: a systematic review.," *BMC Musculoskelet. Disord.*, vol. 11, no. 1, p. 206, 2010.

[114] M. L. Nguyen and N. F. Jones, "Rupture of Both the Abductor Pollicis Longus and Extensor Pollicis Brevis Tendons after Steroid Injection for de Quervain Tenosynovitis," *Plast. Reconstr. Surg.*, vol. 129, no. 5, pp. 882–883, 2012.

[115] M. Hadianfard, A. Ashraf, M. Fakheri, and A. Nasiri, "Efficacy of Acupuncture versus Local Methylprednisolone Acetate Injection in De Quervain's Tenosynovitis: A Randomized Controlled Trial," *J. Acupunct. Meridian Stud.*, vol. 7, no. 3, pp. 115–121, 2014.

[116] H. Alfredson, T. Pietila, Per Jonsson, and R. Lorentzon, "Heavy-Load Eccentric Calf Muscle Training For the Treatment of Chronic Achilles Tendinosis," *Am. J. Sports Med.*, vol. 26, no. 3, pp. 360–366, 1998.

[117] P. Malliaras, N. Maffulli, and G. Garau, "Eccentric training programmes in the management of lateral elbow tendinopathy," vol. 30, pp. 1590–1596, 2008.

[118] B. Dejaco, B. Habets, C. van Loon, van G. Susan, and V. C. Robert, "Eccentric versus conventional exercise therapy in patients with rotator cuff tendinopathy : a randomized , single blinded , clinical trial," *Knee Surgery, Sport. Traumatol. Arthrosc.*, 2016.

[119] H. Visnes and R. Bahr, "The evolution of eccentric training as treatment for patellar tendinopathy (jumper's knee): a critical review of exercise programmes," no. September 2006, 2007.

[120] A. Frizziero, S. Trainito, F. Oliva, N. N. Aldini, S. Masiero, and N. Maffulli, "The role of eccentric exercise in sport injuries rehabilitation," *Br. Med. Bull.*, pp. 1–29, 2014.

[121] J. R. McCormack, F. B. Underwood, E. J. Slaven, and T. A. Cappaert, "Exercise and

Soft Tissue Treatment," *Sports Health*, pp. 1–8, 2016.

[122] M. Peterson, S. Butler, M. Eriksson, and K. Svärdsudd, "A randomized controlled trial of eccentric vs. concentric graded exercise in chronic tennis elbow (lateral elbow tendinopathy)," *Clin. Rehabil.*, vol. 28, no. 9, pp. 862–872, 2014.

[123] J. D. Rompe, B. Nafe, J. P. Furia, and N. Maffulli, "Eccentric Loading, Shock-Wave Treatment, or a Wait-and-See Policy for Tendinopathy of the Main Body of Tendo Achillis," *Am. J. Sports Med.*, vol. 35, no. 3, pp. 374–383, 2007.

[124] R. J. de Vos, A. Weir, R. J. A. Visser, T. C. de Winter, and J. L. Tol, "The additional value of a night splint to eccentric exercises in chronic midportion Achilles tendinopathy: a randomised controlled trial," *Br. J. Sports Med.*, vol. 41, no. 5, pp. 1–7, 2007.

[125] J. J. Kingma, R. De Knikker, H. M. Wittink, and T. Takken, "tendinopathy : a systematic review," pp. 1–5, 2007.

[126] N. J. Wasielewski and K. M. Kotsko, "Does Eccentric Exercise Reduce Pain and Improve Strength in Physically Active Adults With Symptomatic Lower Extremity Tendinosis ? A Systematic Review," vol. 42, no. 3, pp. 409–421, 2007.

[127] B. L. Woodley, R. J. Newsham-west, and G. D. Baxter, "Chronic tendinopathy : effectiveness of eccentric exercise," *Br. J. Sports Med.*, no. 41, pp. 188–200, 2007.

[128] S. Curwin, W. D. Stanish, and R. M. Rubinovich, "Eccentric exercise in chronic tendinitis," *Clin. Orthop. Relat. Res.*, vol. 208, pp. 65–69, 1986.

[129] J. D. Rees, G. A. Lichtwark, R. L. Wolman, and A. M. Wilson, "The mechanism for efficacy of eccentric loading in Achilles tendon injury ; an in vivo study in humans," *Rheumatology*, vol. 47, pp. 1493–1497, 2008.

[130] B. T. Drew, T. O'Smith, C. Littlewood, and B. Sturrock, "Do structural changes (eg , collagen / matrix) explain the response to therapeutic exercises in tendinopathy : a systematic review," *BMJ Br. Med. J.*, pp. 1–8, 2012.

[131] L. Öhberg, R. Lorentzon, and H. Alfredson, "Neovascularisation in Achilles tendons with painful tendinosis but not in normal tendons : an ultrasonographic investigation," *Knee Surgery, Sport. Traumatol. Arthrosc.*, vol. 9, pp. 233–238, 2001.

[132] L. Öhberg and H. Alfredson, "Ultrasound guided sclerosis of neovessels in painful chronic Achilles tendinosis: pilot study of a new treatment," *Br. J. Sports Med.*, vol. 36, pp. 173–177, 2002.

[133] N. Maffulli, F. Spiezia, U. Giuseppe, V. Denaro, and G. D. Maffulli, "High volume image guided injections for the management of chronic tendinopathy of the main body

of the Achilles tendon," *Phys. Ther. Sport*, vol. 14, no. 3, pp. 163–167, 2013.

[134] N. Maffulli, F. Oliva, V. Testa, G. Capasso, and A. Del Buono, "Multiple Percutaneous Longitudinal Tenotomies for Chronic Achilles Tendinopathy in Runners," *Am. J. Sports Med.*, vol. 41, no. 9, pp. 2151–2157, 2013.

[135] K. Knobloch, R. Kraemer, and M. Jagodzinski, "Eccentric Training Decreases Paratendon Capillary Blood Flow and Preserves Paratendon Oxygen Saturation in Chronic Achilles Tendinopathy," vol. 37, no. 5, 2007.

[136] M. Zanetti, A. Metzdorf, H. Kundert, H. Zollinger, P. Vienne, and B. Seifert, "Achilles Tendons: Clinical Relevance of Neovascularization Diagnosed with Power Doppler US," *Radiology*, vol. 227, pp. 556–560, 2003.

[137] M. Attia, G. Carpentier, S. Etienne, S. Thierart, A. Scott, L. Oystein, D. Papy-Garcia, M. C. Tassoni, and I. Martelly, "HISTOCHEMICAL ANALYSIS OF GAGS IN ALTERED TENDON: A MEANS TO EVALUATE THE DEGREE OF PATHOLOGY," *Br. J. Sports Med.*, vol. 47, 2013.

[138] A. Kubo, K. Katanosaka, and K. Mizumura, "Extracellular matrix proteoglycan plays a pivotal role in sensitization by low pH of mechanosensitive currents in nociceptive sensory neurones," *J. Physiol.*, vol. 13, pp. 2995–3007, 2012.

[139] N. MAFFULLI and U. G. LONGO, "How do eccentric exercises work in tendinopathy ?," *Rheumatology*, vol. 47, pp. 1444–1445, 2008.

[140] N. L. Grigg, S. C. Wearing, and J. E. Smeathers, "Eccentric calf muscle exercise produces a greater acute reduction in Achilles tendon thickness than concentric exercise," *Br. J. Sports Med.*, pp. 280–283, 2009.

[141] S. O. Neill, P. He, P. J. Watson, P. He, S. Barry, and P. He, "CLINICAL COMMENTARY WHY ARE ECCENTRIC EXERCISES EFFECTIVE FOR," vol. 10, no. 4, pp. 552–562, 2015.

[142] H. J. Fry, "The treatment of overuse syndrome in musicians. Results in 175 patients.," *J. R. Soc. Med.*, vol. 81, no. October, pp. 572–575, 1988.

Appendices

1. Patient Information Sheet
2. Informed Consent Form
3. Declaration on the Protection of Personal Data
4. Medical History Form Week 1
5. Medical History Form Week 8
6. Quick-DASH questionnaire
7. NPRS questionnaire:
8. PRWE questionnaire
9. Calendar
10. Physiotherapist Visit Form
11. Statistical Analysis Plan

SEMMELWEIS UNIVERSITY

Faculty of Health Sciences

Department of Morphology and Physiology

Bednárikné Dr. Dörnyei Gabriella

head of department, college professor

Completed by investigator!

Study code number:

Name of study site: Semmelweis University Orthopaedic Clinic

1082 Budapest, Üllői Street 78/b.

External consultants: Dr.

Dr.

Name of study site: Semmelweis University Faculty of Health Sciences

1088 Budapest, Vas Street 17.

Department of Morphology and Physiology

Department of Physiotherapy

Investigator: Dr.

Study staff member:

Patient enrolment number:

Patient initials:

PATIENT INFORMATION SHEET

You are invited to take part in a clinical study. Before you decide whether to participate, it is important that you understand the purpose of the study, what participation involves, how the data collected from you will be used, and what the possible benefits, risks, and inconveniences are. Please read the following information carefully and, if you wish, discuss it with your general practitioner. If you are already participating in any other study, you cannot be enrolled in this study.

WHAT IS THE BACKGROUND AND PURPOSE OF THE STUDY?

This study is based on John A. Papa's 2012 article ("Conservative management of De Quervain's stenosing tenosynovitis: a case report", The Journal of the Canadian Chiropractic Association). This is a case study in which the patient reported substantial improvement after 8 weeks of eccentric training.

1088 Budapest, Vas u. 17.

Tel.: +36 1 48-64940, Fax.: +36 1 48-64942

Email: morfologia@se-etk.hu

Address: 1085 Budapest, Üllői út 26. 1428 Budapest, Pf.2.

http://etk.semmelweis.hu

Our aim is to replicate this well-documented study in order to demonstrate that this treatment method may also be effective in a broader population. The ultimate goal of our work is to develop an evidence-based conservative therapeutic program for the treatment of de Quervain's tendinopathy, specifically a set of exercises based on eccentric training.

WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF THIS METHOD COMPARED WITH CURRENTLY USED THERAPIES?

Compared with surgery, this method is conservative. It preserves the anatomical integrity of the hand and does not require the administration of medication. It is not accompanied by scarring or any other surgical complication.

The administration of corticosteroid injections - as the only accepted conservative treatment method - may also be associated with complications. In certain exposed groups (e.g. pregnant women, minors who play musical instruments), steroid treatment is not even recommended. Its mechanism of action has not been proven either.

Eccentric training makes use of the braking activity of the muscles. This type of muscular activity provides the painful tendon, through the nervous system, with a specific stimulus by which the changes that have begun within it may be reversed and the histological structure of the tendon may be restored. We assume that restoration of the tendon structure eliminates the sensation of pain. An advantage of the therapy is that, once learned, it can be performed at home. It does not involve drug treatment and does not exclude pregnant women, nursing mothers, minors, etc. Because it is a form of training, it also strengthens muscles, which may provide additional beneficial effects.

Disadvantage: its effect develops more slowly than the two procedures mentioned above. It also requires equipment.

STUDY PROCEDURE

The training lasts 8 weeks. During the first 4 weeks, there will be two in-person meetings per week (but at least one), and during the second 4 weeks, one in-person meeting per week. During these meetings, the exercises must be performed under the investigator's supervision. At these visits, you may also report on your experiences and ask any questions that arise in the meantime.

At the meetings, you will receive training plans that describe the exercises to be performed. The study leader will demonstrate and teach these exercises during the in-person visits. Please feel free to ask any questions you may have. It is very important that you use the training plans according to the instructions you receive.

You will receive a calendar in which you must record on which days you performed the exercises and when you took breaks. It is very important that the calendar accurately reflects reality, because we will perform statistical analyses on these data. On this basis, we will be able to determine whether the treatment was effective. By keeping the calendar regularly, you can greatly contribute to the future treatment of other patients.

It is also important that you inform the Principal Investigator if you start using any other medication, device, or therapy during the study. Please record in your calendar when you used it and what you used. This is necessary because the demonstration of the training program's effectiveness may be influenced if you use another therapy at the same time.

Follow-up at weeks 10 and 12, and 6 months after the start of the program, is expected by telephone or electronic means. If you experience recurrent pain, an additional in-person visit and further data collection will take place.

WHAT ARE THE POSSIBLE SIDE EFFECTS, RISKS, AND INCONVENIENCES RELATED TO THE TRAINING?

In the source article and in other publications in the literature, we found no information on the possible side effects of eccentric training. This does not mean that side effects cannot occur, only that no information is currently available. The training may involve risks that have not yet been identified in previous studies.

There is always some risk in using a new therapy, but we will take every precaution to avoid these problems, and we also ask you to report any disturbing factor or inconvenience.

The training takes effect more slowly than surgery or corticosteroid injection. It is possible that pain will remain unchanged at the beginning of the training or will decrease only slowly.

WHAT ARE THE POSSIBLE BENEFITS OF PARTICIPATION?

The study offers you the opportunity to participate free of charge in a therapy that is expected to improve your condition.

IS PARTICIPATION MANDATORY?

It is entirely your decision whether or not to take part in the study. If, after reading this Patient Information Sheet, you decide that you do not wish to participate, this will not cause you any disadvantage. If you decide to participate, you must sign this Patient Information Sheet and the attached "Consent Form" as well.

If you decide to participate, you may later withdraw your consent at any time, either verbally or in writing, without giving a reason. Your consent is voluntary and free from undue influence, and you may withdraw it, either verbally or in writing, without any disadvantage to you.

DOES PARTICIPATION INVOLVE ANY ADDITIONAL COST?

We are unable to provide reimbursement of expenses in connection with the study.

HOW WILL MY PERSONAL DATA BE HANDLED?

By signing the document entitled "Consent Form", you consent to the Principal Investigator collecting and using the following personal data during the study:

- date of birth,
- sex,
- telephone number, e-mail address,
- data relating to your physical and mental health and to your illness,
- any other personal data obtained during participation in the study or during follow-up.

Your data will be used by the Principal Investigator for administration and conduct of the study, and for scientific and statistical analysis, in compliance with data protection law. The Principal Investigator also undertakes to ensure that your data do not fall into unauthorized hands.

The study is conducted with the approval of the Medical Research Council.

WHOM CAN I CONTACT IF I NEED FURTHER INFORMATION OR ASSISTANCE?

If you have any questions regarding the study, please contact the Principal Investigator indicated on the first page of this Patient Information Sheet.

By signing, you declare that you have understood the information provided and that you voluntarily agree to participate.

……. …….

Patient signature date *(handwritten by the patient)*

…… …….

External consultant signature date *(handwritten by the external consultant)*

…… …….

External consultant signature date *(handwritten by the external consultant)*

…… …….

Principal Investigator signature date *(handwritten by the Principal Investigator)*

…… …….

Study staff member signature date *(handwritten by the study staff member)*

SEMMELWEIS UNIVERSITY

Faculty of Health Sciences

Department of Morphology and Physiology

Bednárikné Dr. Dörnyei Gabriella

head of department, college professor

Completed by investigator!

Study code number:

Name of study site: Semmelweis University Orthopaedic Clinic

1082 Budapest, Üllői Street 78/b.

External consultants: Dr.

Dr.

Name of study site: Semmelweis University Faculty of Health Sciences

1088 Budapest, Vas Street 17.

Department of Morphology and Physiology

Department of Physiotherapy

Investigator: Dr.

Study staff member:

Patient enrolment number:

Patient initials:

CONSENT FORM

TREATMENT OF DE QUERVAIN'S TENDINOPATHY WITH ECCENTRIC TRAINING

I,_____(name)

_____(place of birth)_____(date of birth)

have received verbal information about the purpose and course of the above study, and I have read the attached Patient Information Sheet. I had the opportunity to discuss the information received and to ask questions. I was informed about the possible and expected side effects. I agree to participate in the study, and my participation is entirely voluntary. I understand that I may withdraw my consent at any time without giving reasons.

1088 Budapest, Vas u. 17.

Tel.: +36 1 48-64940, Fax.: +36 1 48-64942

Email: morfologia@se-etk.hu

Address: 1085 Budapest, Üllői út 26. 1428 Budapest, Pf.2.

http://etk.semmelweis.hu

By signing this written Consent Form, I agree that my personal data, including data relating to my physical or mental health status, may be used as described in the Patient Information Sheet. I acknowledge that I will receive one copy of the Patient Information Sheet and one copy of this written Consent Form.

…… ……

Patient's signature the date *(in the patient's own hand)*

SEMMELWEIS UNIVERSITY

Faculty of Health Sciences

Department of Morphology and Physiology

Bednárikné Dr. Dörnyei Gabriella

head of department, college professor

DATA PROTECTION DECLARATION

I hereby declare that - with due regard also to the relevant international documents - I am familiar with, and during the research I comply with, the provisions of the Fundamental Law of Hungary and the applicable legislation concerning personality rights, the protection of personal health data, and copyright protection.

Dated: Budapest, 20_____

_____

Principal Investigator

1088 Budapest, Vas u. 17.

Tel.: +36 1 48-64940, Fax.: +36 1 48-64942

Email: morfologia@se-etk.hu

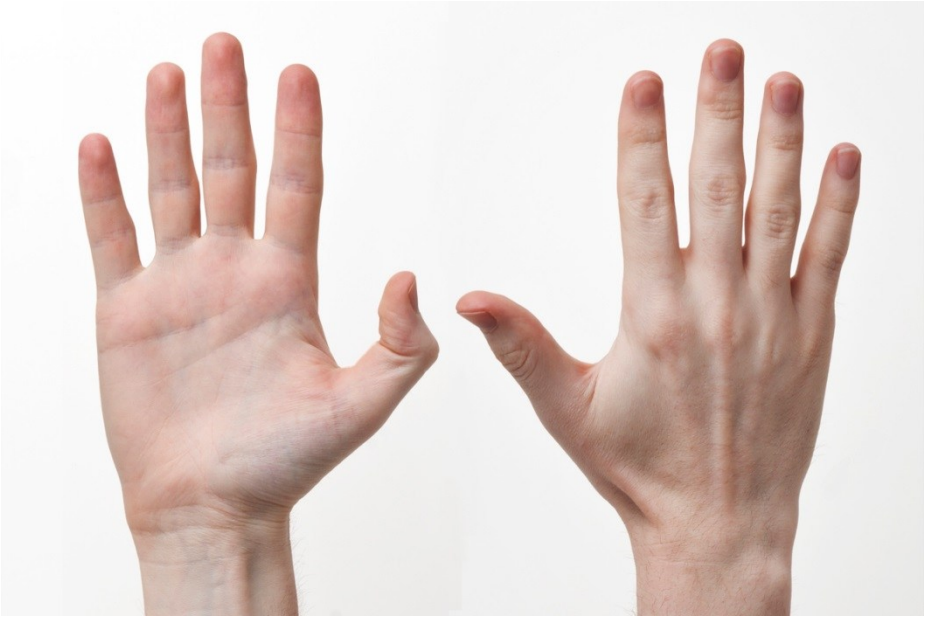
Address: 1085 Budapest, Üllői út 26. 1428 Budapest, Pf.2.

http://etk.semmelweis.hu

ANAMNESIS FORM – WEEK 1

Identification number:_____

1. Where does it hurt? Mark it on the image!



Source: https://en.wikipedia.org/wiki/Hand#/media/File:Human-Hands-Front-Back.jpg
Last visit: 19/02/2017

2. Completion of the Quick-DASH, PRWE and NPRS questionnaires

INSPECTION

1.	Fej	normál	eltérő:_____
2.	Nyak	normál	eltérő:_____
3.	Vállak	normál	eltérő:_____
4.	Könyök	normál	eltérő:_____
5.	Csukló	normál	eltérő:_____
6.	Hüvelykujj	normál	eltérő:_____

PHYSICAL EXAMINATION

1. Examination of movements (goniometry):

Wrist	Active ROM		Passive ROM	
	R	L	R	L
Flex. (90)°				
Dorsiflex. (90)°				
Ulnar dev. (2x–3x↑)				
Radial dev.				
Thumb				
CMC flex. (15–20)°				
CMC ext.				
CMC abd. (70)°				
CMC add.				
MCP flex. (50)°				
Opposition				

2. Muscle strength examination:

	0	1	2	3	4	5
APL						
EPB						

3. Special tests*:

Special tests	Right		Left	
Cervical spine	+	-	+	-
- **Compression**				
- **Distraction**				
- **Spurling test**				
- **Myotome test**				

Shoulder/shoulder girdle	+	-	+	-
- Adson test				
- Wechsler sign				
- Costoclavicular syndrome				
- Scalenus syndrome				
- Hyperabduction syndrome				
Wrist	+	-	+	-
- Staged Finkelstein test				
- Radial nerve stretch test				

*The tests are based on David J. Magee: ORTHOPEDIC PHYSICAL ASSESSMENT

4. Functional test:

Functional test	Right		Left	
- Lifting a baby	+	-	+	-

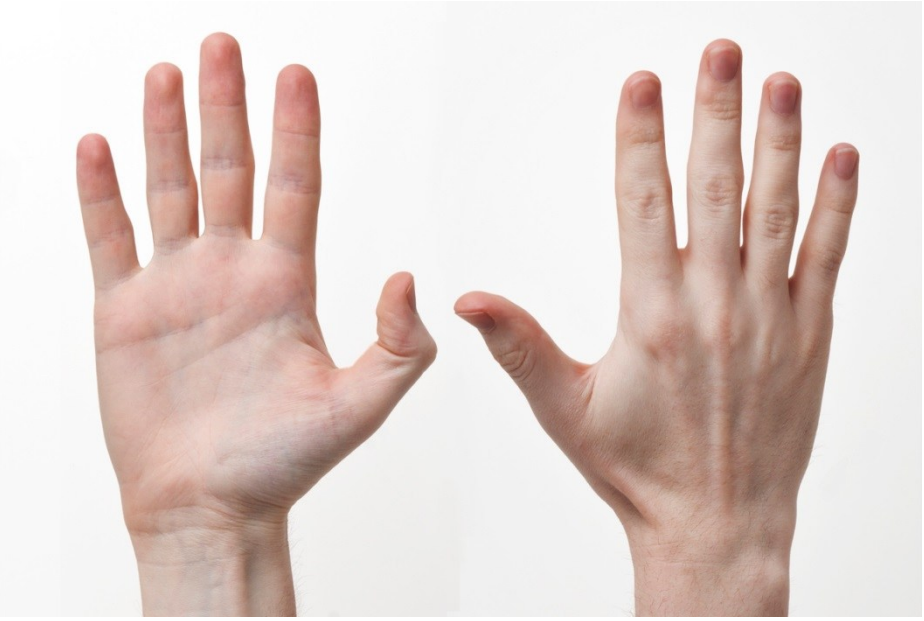
5. Other remarks:

Gait analysis	No	Yes
- Walking independently / with an assistive device		
- Stair climbing with assistance		
- Use of assistive device / orthosis / prosthesis		

ANAMNESIS FORM – WEEK 1

Identification number:_____

1. Does the complaint for which you sought physiotherapy still persist? yes no



If yes, where does it hurt? Mark it on the picture!

Source: https://en.wikipedia.org/wiki/Hand#/media/File:Human-Hands-Front-Back.jpg
Last visit: 19/02/2017

2. Completion of the Quick-DASH, PRWE and NPRS questionnaires

INSPECTION

7. Head normal different:_____
8. Neck normal different:_____
9. Shoulders normal different:_____
10. Elbow normal different:_____
11. Wrist normal different:_____
12. Thumb normal different:_____

PHYSICAL EXAMINATION

6. Examination of movements (goniometry):

Wrist	Active ROM		Passive ROM	
	R	L	R	L
Flex. (90)°				
Dorsiflex. (90)°				
Ulnar dev. (2x–3x↑)				
Radial dev.				
Thumb				
CMC flex. (15–20)°				
CMC ext.				
CMC abd. (70)°				
CMC add.				
MCP flex. (50)°				
Opposition				

7. Muscle strength examination:

	0	1	2	3	4	5
APL						
EPB						

8. Special tests*:

Special tests	Right		Left	
Cervical spine	+	-	+	-
- **Compression**				
- **Distraction**				
- **Spurling test**				
- **Myotome test**				

Shoulder/shoulder girdle	+	-	+	-
- Adson test				
- Wechsler sign				
- Costoclavicular syndrome				
- Scalenus syndrome				
- Hyperabduction syndrome				
Wrist	+	-	+	-
- Staged Finkelstein test				
- Radial nerve stretch test				

*The tests are based on David J. Magee: ORTHOPEDIC PHYSICAL ASSESSMENT

9. Functional test:

Functional test	Right		Left	
- Lifting a baby	+	-	+	-

10. Other remarks:

Gait analysis	No	Yes
- Walking independently / with an assistive device		
- Stair climbing with assistance		
- Use of assistive device / orthosis / prosthesis		

THE QuickDASH OUTCOME MEASURE

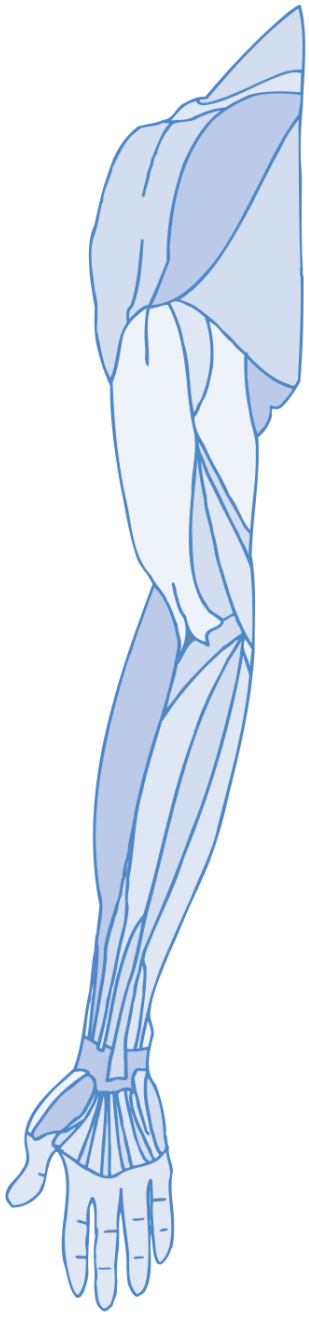
INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* of which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.



NAME _____

DATE _____

MR No. _____

*Quick*DASH

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Do heavy household chores (e.g., wash walls, floors).	1	2	3	4	5
3. Carry a shopping bag or briefcase.	1	2	3	4	5
4. Wash your back.	1	2	3	4	5
5. Use a knife to cut food.	1	2	3	4	5
6. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
7. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups?	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
8. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem?	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*	NONE	MILD	MODERATE	SEVERE	EXTREME
9. Arm, shoulder or hand pain.	1	2	3	4	5
10. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
11. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

*Quick*DASH DISABILITY/SYMPTOM SCORE = $\left(\left[\frac{\text{sum of n responses}}{n}\right] - 1\right) \times 25$, where n is equal to the number of completed responses.

A *Quick*DASH score may <u>not</u> be calculated if there is greater than 1 missing item.

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including homemaking if that is your main work role).

Please indicate what your job/work is:_____

❒ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week.

Did you have any difficulty:	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you:_____

❒ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week.

Did you have any difficulty:	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	1	2	3	4	5
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3. playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4. spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

SCORING THE OPTIONAL MODULES: Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.
An optional module score may <u>not</u> be calculated if there are any missing items.

Institute for Work & Health | Research Excellence Advancing Employee Health

SCORING THE QUICKDASH TEST

About the QuickDASH Questionnaire

Since its release in 1996, the popularity of the QuickDASH questionnaire has increased. Today, this tool is used worldwide in both clinical practice and research, as it has proven to be a useful self-assessment method for patients suffering from musculoskeletal disorders of the upper limb.

QuickDASH is the shortened version of the DASH questionnaire. Instead of 30 questions, QuickDASH uses 11 questions to determine the functional disability index / symptom score. Like the DASH, it also contains 4 optional modules that can be evaluated independently of one another. This abbreviated version of the DASH enables clinicians to assess functional impairment and symptoms more quickly, although there are advantages to using the full DASH test as well. (See Psychometric Test Characteristics.)

The QuickDASH questionnaire may be used free of charge (for non-commercial purposes) and can be downloaded from the DASH website (www.dash.iwh.on.ca). Information on scoring is also available there.

The Development History of QuickDASH

Statistical analysis of the 30 questions of the DASH led to the conclusion that acceptable assessment can also be achieved by using 11 questions (that is, Cronbach's alpha > 0.90). Shortening the DASH questionnaire seemed a very attractive option while preserving its psychometric properties. The shortening was carried out by three methods using data from the full DASH. As a result, 3 different QuickDASH versions were created.

Theoretical Considerations

The first set of QuickDASH questions was developed by selecting the theoretically key parts of the full DASH test.

The original 16 domains were reduced to 11 because of the similarities between the domains. The domains of the original DASH test were ranked from the patient's perspective according to importance and difficulty, and the first 11 were included in the QuickDASH test.

The second set of questions contained those questions with which results most similar to those obtained using the full item set could be achieved.

The third set of questions included those items that matched one another most closely in terms of difficulty.

Evaluation and Comparison

3 different QuickDASH versions were created using the method described above. The sets of questions were evaluated and the response values obtained were compared with the results obtained using the original 30-question DASH questionnaire (that is, with questionnaire response data from 200 patients suffering from different upper-limb disorders).

The Decision During the Selection Among the Question Sets

The 3 versions were similar, although their content differed. The set of questions selected by the first method proved to be better than the other two versions; therefore, the Upper Extremity Collaborative Group unanimously supported it and named it the QuickDASH questionnaire.

Psychometric Test Characteristics

Determining the psychometric factors of questionnaires is the result of a process and is context-specific. In other words, for every new population, disease, and treatment, pilot testing is recommended to determine how it works and how it can be used in that given setting. Initial testing showed that QuickDASH can be used well in different patient groups (in research or follow-up studies); however, clinicians, knowing the advantages of the original DASH, may also use it during the follow-up of individual patients. The precision and sensitivity of the measurement are slightly better when the original DASH is used, as indicated by the higher confidence and validity index values (see the table results). In light of the following statistical evaluation and comparison of the DASH and QuickDASH results, clinicians may consciously choose between the more advantageous use of the two tests.

	QuickDASH	DASH
Reliability		
internal consistency (“internal consistency”)	Cronbach's alpha: 0.94	Cronbach's alpha: 0.97
reproducibility (“test-retest reliability”)	ICC = 0.94	ICC = 0.96
Validity		
Convergent / construct validity		
VAS overall problem caused by illness	r = 0.70	r = 0.70
VAS assessment of bodily pain	r = 0.70	r = 0.70
VAS ability to perform daily activities	r = 0.70	r = 0.70
VAS ability to work	r = 0.70	r = 0.70
Known groups		
able to perform all activities ~ unable to perform any	M = 25.4 vs 48.6	M = 23.6 vs 47.1
able to work ~ unable to work due to upper-limb problem	M = 27.5 vs 52.6	M = 26.8 vs 47.1
Responsiveness		
Change within the treated patient group; expected improvement	SRM = 0.79	SRM = 0.78
Change in those who reported improvement	SRM = 1.03	SRM = 1.05

ICC = intra-class correlation coefficient (2,1)

M = mean questionnaire score, r = Pearson correlation coefficient

SRM = standardized response mean, VAS = visual analogue scale

All Pearson correlation coefficients and the differences between the “known groups” were significant ($p < 0.05$).

Calculating the QuickDASH Test Score

The “QuickDASH” score consists of two parts: the functional disability index / symptom score section (11 questions, scored 1-5) and the optional section evaluating high-level professional sports/music or work activity (4 questions each, scored 1-5).

Calculating the QuickDASH functional disability index / symptom score

At least 10 of the 11 questions must be marked, that is, answered, in order to calculate the score. The marked values of the completed responses are simply added together and then averaged, resulting in a value between 0 and 5. This value is transformed to a value between 0 and 100 - first subtracting 1, then multiplying by 25. This transformation makes the result much easier to compare with other scales measured on a 0-100 scale. A higher score indicates greater disability.

QuickDASH - functional disability index / symptom score =

$$\frac{\text{((sum of n response values) - 1) x 25}}{\text{n}}$$

where n equals the number of completed responses.

Scoring the optional modules: (related to sports/performing arts or work). The scores of the optional modules can be calculated using the same method as above. Simply add the response values, divide by the number of questions (4), subtract 1 from the result, and finally multiply by 25 to obtain an index value between 0 and 100. All four questions must have completed responses in order to determine the result. Scoring cannot be used if even a single response is missing.

Missing responses If more than 10% of the questions are missing a response (that is, more than 1 response left blank), then the functional disability index / symptom score cannot be determined for the QuickDASH questionnaire. If more than 10% of the questions (that is, more than 1 question) are left unanswered, the QuickDASH disability / symptom score cannot be calculated. The same rule applies to the module related to high-performance sports/performing arts or work activity (that is, more than 10% missing responses are not allowed), although the module consists of only 4 questions. This missing data rule applies to both the original and the revised scoring systems.

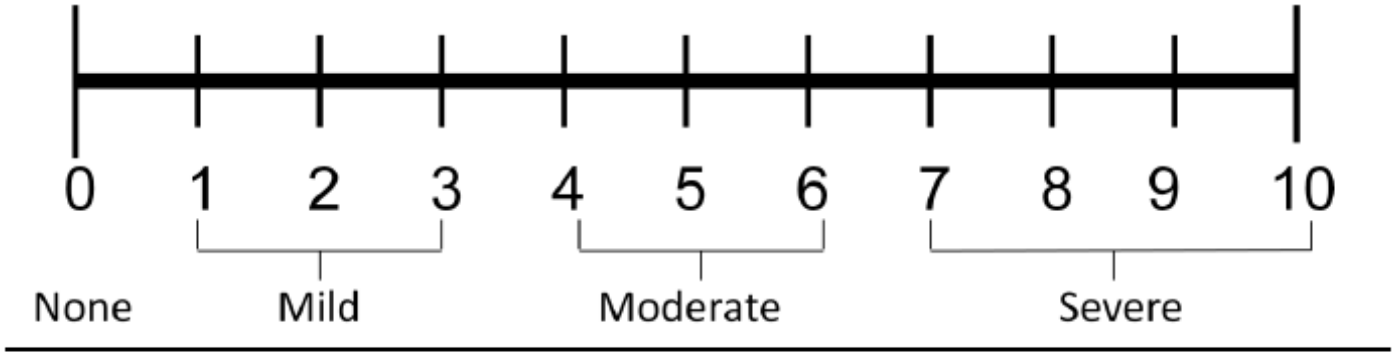
The Numeric Pain Rating Scale Instructions

General Information:

- The patient is asked to make three pain ratings, corresponding to current, best and worst pain experienced over the past 24 hours.
- The average of the 3 ratings was used to represent the patient's level of pain over the previous 24 hours.

Patient Instructions (adopted from (McCaffery, Beebe et al. 1989):

"Please indicate the intensity of current, best, and worst pain levels over the past 24 hours on a scale of 0 (no pain) to 10 (worst pain imaginable)"



Reference:

McCaffery, M., Beebe, A., et al. (1989). Pain: Clinical manual for nursing practice, Mosby St. Louis, MO.

Name: _____ Date: _____

PATIENT RATED WRIST EVALUATION

*The questions below will help us understand how much difficulty you have had with your wrist in the past we You will be describing your **average** wrist symptoms **over the past week** on a scale of 0-10.* Please provid answer for **ALL** questions. If you did not perform an activity, please **ESTIMATE** the pain or difficulty you wou expect. If you have **never** performed the activity, you may leave it blank.

1. PAIN

Rate the **average** amount of pain in your wrist over the past week by circling the number that best describes your pain on a scale from 0-10. A zero **(0)** means that you **did not** have any pain and a **ten (10)** means that you had the **worst pain you have ever experienced** or that **you could not do the activity because of pain.**

RATE YOUR PAIN: Sample Scale ☞	0 (No Pain) 1 2 3 4 5 6 7 8 9 10 (Worst Ever)
At rest	0 1 2 3 4 5 6 7 8 9 10
When doing a task with a repeated wrist movement	0 1 2 3 4 5 6 7 8 9 10
When lifting a heavy object	0 1 2 3 4 5 6 7 8 9 10
When it is at its worst	0 1 2 3 4 5 6 7 8 9 10
How often do you have pain?	0 (Never) 1 2 3 4 5 6 7 8 9 10 (Always)

2. FUNCTION

A. SPECIFIC ACTIVITIES

*Rate the **amount of difficulty** you experienced performing each of the items listed below - over the past week, by circling the number that describes your difficulty on a scale of 0-10. A **zero** (0) means you did not experience any difficulty and a **ten** (10) means it was so difficult you were unable to do it at all.*

Sample scale →	0 (No Difficulty) 1 2 3 4 5 6 7 8 9 10 (Unable To Do)
Turn a door knob using my affected hand	0 1 2 3 4 5 6 7 8 9 10
Cut meat using a knife in my affected hand	0 1 2 3 4 5 6 7 8 9 10
Fasten buttons on my shirt	0 1 2 3 4 5 6 7 8 9 10
Use my affected hand to push up from a chair	0 1 2 3 4 5 6 7 8 9 10
Carry a 10lb object in my affected hand	0 1 2 3 4 5 6 7 8 9 10
Use bathroom tissue with my affected hand	0 1 2 3 4 5 6 7 8 9 10

B. USUAL ACTIVITIES

*Rate the **amount of difficulty** you experienced performing your **usual** activities in each of the areas listed below, over the past week, by circling the number that best describes your difficulty on a scale of 0-10. By "usual activities", we mean the activities you performed **before** you started having a problem with your wrist. A **zero** (0) means that you did not experience any difficulty and a **ten** (10) means it was so difficult you were unable to do any of your usual activities.*

Personal care activities (dressing, washing)	0 1 2 3 4 5 6 7 8 9 10
Household work (cleaning, maintenance)	0 1 2 3 4 5 6 7 8 9 10
Work (your job or usual everyday work)	0 1 2 3 4 5 6 7 8 9 10
Recreational activities	0 1 2 3 4 5 6 7 8 9 10

CALENDAR

1.	2.	3.	4.	5.	6.	7.
8.	9.	10.	11.	12.	13.	14.
15.	16.	17.	18.	19.	20.	21.
22.	23.	24.	25.	26.	27.	28.

29.	30.	31.	32.	33.	34.	35.
36.	37.	38.	39.	40.	41.	42.
43.	44.	45.	46.	47.	48.	49.
50.	51.	52.	53.	54.	55.	56.

VISIT LOG

No.	Date	Time spent	Activity performed, notes
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
Follow-up			
13. Week 10			
14. Week 12			
15. After 6 months			

STATISTICAL METHODS FOR THE ANALYSIS OF RESEARCH RESULTS

The following statistical methods and software will be used for the processing and analysis of the results:

Microsoft Excel

Statistical Package for the Social Sciences (SPSS) software, including:

- Chi-square test
- ANOVA
- t-test
- Bonferroni-corrected post hoc analysis
- Bernoulli test
- Fisher's exact test

Dated: Budapest, 20_____

_____

Principal Investigator