

EFFECTIVENESS OF CONSERVATIVE MANAGEMENT IN STENOSING TENOVAGINITIS: A CASE STUDY

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ABSTRACT -

A single case study design was used to investigate the effects of Pulse Ultrasound, Paraffin wax bath, Deep transverse friction massage & strengthening exercises in Stenosing tenovaginitis of thumb. Sub items hand and finger function of the Dutch version of the second version of the Arthritis Impact Measurement Scale (DUTCH AIMS-2) was used to measure Functional improvement, JAMAR Hand Grip Dynamometer was used to measure hand grip muscle strength & Visual analogue scale was used to measure pain. The study involved three phases in an ABA design. Patient was assessed at baseline(A), treatment was given for 15 days(B) and again assessed at end of session (A). The technique resulted in reduction in pain, improvement in functional ability and hand muscle strength in case of Stenosing tenovaginitis of thumb.

Although single case study design limits generalization of the results, it does provide evidence of the beneficial response obtained by use of Pulse ultrasound, Paraffin wax bath, Deep friction massage & strengthening exercise in stenosing tenovaginitis of thumb patients.

Key Words : Stenosing tenovaginitis of thumb, Pulse Ultrasound, Paraffin wax bath, Deep friction massage & strengthening exercise.

Introduction - Trigger Finger (also known as stenosing tenosynovitis or stenosing tenovaginitis) is a condition that causes triggering, snapping, or

locking on flexion of the involved finger. Entrapment of the affected tendon sheet results in difficulty in flexing or extending the finger and is frequently associated with pain in the palm of the hand.^[1]

Tenovaginitis is a more accurate term to describe the condition than tenosynovitis. This is because the pathologic inflammatory changes are found in the retinacular sheath and peritendinous tissue rather than in the tenosynovium.^[2]

Generally the condition is more common among women than men, and the age distribution is bimodal with one group below six years of age and the other above 40 years of age (most of the affected individuals are in the fifth or sixth decade of their life).^[1] The lifetime prevalence of trigger finger among a group of nondiabetics above the age of 30 years has been estimated at 2.2%.^[3]

The flexor tendon sheet in the finger is a double-walled, connective tissue cylinder that is held in place by five annular (A1-A5) and three cruciform pulleys (C1-C3). The triggering phenomenon is caused by incompatibility between the tendon and its sheath, most probably due to hypertrophy of the first annular pulley (A1).^[3]

Histologically the A1 pulley demonstrates findings consistent with fibrocartilagenous metaplasia, including more chondrocytes, increased glycosaminoglycan, degenerative changes and proliferation of fibrous tissue. These changes are believed to represent adaptations to shear load. Although trigger finger is also known as tenovaginitis no inflammatory changes were seen in histological studies.^[3]

Trigger finger occurs more commonly in patients with diabetes mellitus (probably due to glucose-induced collagen modifications), carpal tunnel syndrome, Dupuytren's disease, rheumatoid arthritis, amyloidosis, hypothyroidism, mucopolysaccharide storage disorders and congestive heart failure.^[3]

Treatment of trigger finger can be divided into conservative and operative treatment. Conservative treatment includes ice-packing, extension splint,



non-steroidal anti-inflammatory drugs, aggressive physiotherapy and corticosteroid injection. Strenuous activities, especially those that involve grip and fist, must be avoided. Operative treatment for trigger thumb is release of the A1 pulley.^[4]

Physiotherapy is an accepted treatment for trigger fingers but some clinicians have been sceptical of its success. Physiotherapy consists of various modalities with the primary modalities involving heat, stretching and joint motion.^[4]

Paraffin bath therapies have a local effect of relaxing the smooth muscle fibers in arterioles, which in turn results in the vasodilatation of the peripheral blood vessels. This produces hyperemia, increased transduction of tissue fluid, increased lymph flow, and the absorption of exudates.^[5]

Ultrasound interacts with one or more component of inflammation & earlier resolution of inflammation, accelerated fibrinolysis, stimulation of macrophage derived fibroblast mitogenic factors, heightened fibroblast recruitment, accelerated angiogenesis, increased matrix synthesis, more dense collagen fibrils & increased tissue tensile strength. Such finding form the basis for the use of ultrasound to promote & accelerate tissue healing and repair.^[6]

Deep transverse friction massage (DTFM) is a technique popularized by Dr. James Cyriax for pain and inflammation relief in musculoskeletal conditions. DTFM may be part of a physiotherapy program offered in the treatment of various musculoskeletal conditions. DTFM is a technique that attempts to reduce abnormal fibrous adhesions and makes scar tissue more mobile in sub-acute and chronic inflammatory conditions by realigning the normal soft tissue fibres. It has been indicated that DTFM also enhances normal healing conditions by breaking cross bridges and preventing abnormal scarring. Its mechanical action causes hyperemia, which results in increased blood flow to the area.^[7]

The aim of this single case study was to demonstrate the effects of Paraffin wax bath, pulsed ultrasound, Deep friction massage & strengthening exercises in case of stenosing tenovaginitis of thumb.

METHOD - Research Design -

A single case study design was used to achieve the objectives of this project. A-B-A design which was already described for single case study was used for the present study.^[8]

Subject - Subject was 46 years Male at initial assessment presented with history of triggering or locking of a thumb with pain and tenderness at the A1-pulley (Left Side). During Rest relives the pain in subject while, worsens with thumb movement.

Physical Examination revealed following findings:

- History of triggering or locking of a thumb with pain (Left Side).
- Tenderness or Palpable nodule present over the palmar aspect of the base of thumb (Left Side).
- Decrease hand grip muscle strength.

The subject was selected for the study on the basis of this clinical presentation which is usually recognized as stenosing tenovaginitis of thumb.

Measurement Procedure -

- **Functional Improvement using Dutch version of the second version of the Arthritis Impact Measurement Scale**

(DUTCH AIMS-2):-

It was recorded by using the sub items hand and finger function of the Dutch version of the second version of the Arthritis Impact Measurement Scale (DUTCH AIMS-2), Five questions are asked regarding impairment of hand and finger function, using a numerical rating scale from 1 to 5. The sum of the score for each question is the total AIMS-2 score. Higher total AIMS-2 scores correspond with more severe functional impairment. Internal consistency coefficients range of (0.80-0.89), while used in hand and finger function (0.82).^[9,10]

- **Pain -**

The level of current pain perception was measured using a visual analogue scale (VAS). The pain VAS consisted of a 10 cm horizontal line



anchored at one end by the words 'no pain' and at the other end by the words 'worst pain'.² ICC for all paired VAS scores was 0.97.^[11]

▪ **Hand Grip Strength -**

Most of the recent studies of grip strength measurement have reported the JAMAR dynamometer to be the most reliable and accurate device for measurement of hand grip strength.^[12] JAMAR dynamometer is a reliable method (ICC values 0.85–0.98).

The test was performed in the position recommended by the American Society for Hand Therapists :^[1] standing position with straight back;^[2] the shoulder adducted and in neutral rotation;^[3] the elbow flexed 90°;^[4] the lower arm in neutral position; and^[5] the wrist in neutral position. Three measurements of each grip and hand (one test trial) were obtained with each of the three test leaders in a random order. Before the test trial the individual was given technical instructions and performed a sub-maximal trial. Instructions were given to the volunteers as follows : “squeeze the handle as hard as possible”. After a maximal squeeze for about 5 seconds the peak value was registered.^[13]

Treatment Technique -

Treatment techniques under investigation in this study were Paraffin wax bath, pulse ultrasound , Deep friction massage & strengthening exercise.

Paraffin wax bath given in thumb with dip & immerse method, Thumb dipped 3-4 time to form a thin coat and then left immersed in paraffin wax for 15 minutes, at temperature of 50 deg. Celsius, 4 after that pulse ultrasonic, 1 MHz frequency and 0.08 watt/cm² power were applied with a 4^{cm} diameter applicator, 14 for 10 minutes.^[14, 15] & Deep transverse friction massage was done by rubbing across the sore nodule to take away soreness and irritation.^[8] & also strengthening exercise were given like squeezing the ball, or rubber band activities. These treatments were administered daily for 15 days continuously. The patient received a total of 15 treatments.

Protocol -

The study was divided into two phases -

Phase (A) - Pre-treatment assessment -

Baseline outcome measures was Pain using VAS, Hand Grip Strength using JAMAR Hand Dynamometer & Functional Improvement using Dutch version of the second version of the Arthritis Impact Measurement Scale (DUTCH AIMS-2):- were recorded at the beginning of the study in first day. (A)

Phase (B) - Intervention Phase -

Paraffin wax bath, Pulse Ultrasound, Deep transverse friction massage & strengthening exercise was given during this phase over period of 15 days (15 sessions).

Phase (A) - Post-treatment assessment -

Outcome measures were recorded at the end of the 15 days.

RESULTS

The majority of the results are presented in graphic form for visual analysis, which is the traditional way to evaluate single case studies.^[8] Statistical analysis has not been applied to the data; as currently there is little consensus as to whether Inferential analysis is appropriate or not when evaluating single case studies.^[16] Also when a treatment effect is clearly discernable visual inspection alone is considered appropriate.^[17]

Visual analysis of reduction in pain, improvement in hand grip strength, and functional ability can be seen in table and graphs over the pre-treatment (A) and post-treatment assessment (A) phase.



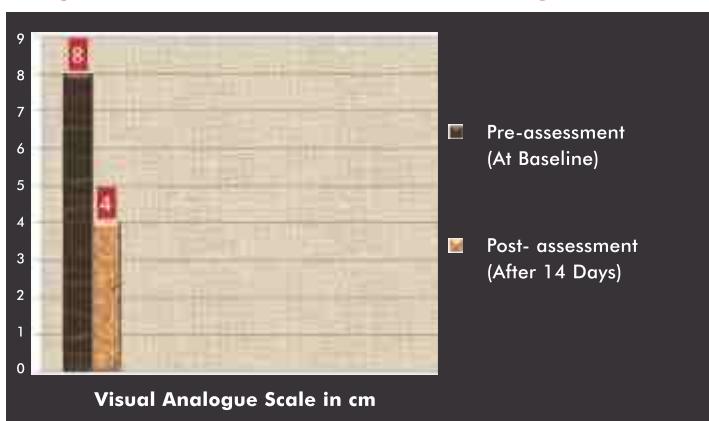
| Sr. No. | Outcome Measure | Pre-treatment (A) | Post-treatment. (A) | Percentage |
|---------|--|-------------------|---------------------|------------|
| 1. | Visual Analogue Test [VAS(0-10cm)] | 8 | 4 | 50% |
| 2. | Dutch version of the second version of the Arthritis Impact Measurement Scale (DUTCH AIMS-2) | 14 | 22 | 36.36% |
| 3. | Hand Grip Strength (Kg) | Left | Left | |
| | Power Grip | 18.6kg | 20kg | 7% |
| | Pinch Grip | | | |
| | a. Thumb & Index finger | 2 kg | 2.2kg | 9.09% |
| | b. Thumb & Middle finger | 2kg | 2kg | 0% |
| | c. Thumb & Ring finger | 1kg | 1.2kg | 20% |
| | d. Thumb & Little finger | 1kg | 1kg | 0% |

Pain-VAS score (8) reduced sharply from assessment phase (A) to the score (4), i.e 50% was found relief in post treatment assessment (A).

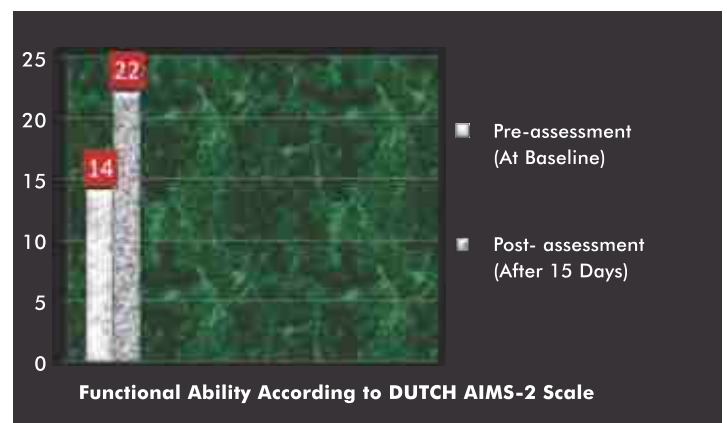
Functional Ability:- Functional ability (14) increased sharply from assessment phase (A) to the score (22) i.e 36.36% was found relief in post treatment assessment (A).

Hand Grip Strength :- Increase in hand grip strength in terms of power grip from assessment (18.6kg) to the (20 kg) & pinch grip for thumb & index finger from assessment (2kg) to the (2.2kg) while in thumb & ring finger from assessment (1kg) to the (1.2kg) of 15 days treatment.

Graph 1:- Assessment of Visual Analogue Scale



Graph 2: Functional Improvement using Dutch version of the Arthritis Impact Measurement Scale (DUTCH AIMS-2):-



Discussion -

The result of study has demonstrated the beneficial effect of applying Paraffin wax bath, Pulse ultrasound, Deep transverse friction massage & strengthening exercise on pain, or triggering, & hand muscle strength related to stenosing tenovaginitis of thumb. The Improvements on baseline measures achieved during the treatment phases of 15 days.

Heat increases blood flow and extensibility of collagen tissue assisting in resolution of edema.



Additionally, heat also decreases joint stiffness and pain. A combination of heat and stretching is even more effective as it capitalizes on the extensibility of collagen producing plastic deformation, e.g. bandage wraps of a joint in flexion prior to application of hot packs. Finally, massaging can 'soften' or remodel tendons reducing tissue bulk at the pulleys. We postulate that in physiotherapy for stenosing tenovaginitis of thumb, the tendon becomes extensile, undergoes plastic deformation and passes more easily through the stenotic A1 pulley.^[4]

Researchers have noted varying results with regard to the therapeutic benefits of heating modalities & deep transverse friction massage (such as pain relief and reducing tissue bulk at the pulleys.)^[3]

Dellhag et al reported that a combination of paraffin bath therapy and exercise was more effective than exercise alone for treating rheumatoid arthritis. They found better improvement of grip function and ROM in the group undergoing paraffin bath therapy followed by active hand exercise, but paraffin wax alone had no significant effect. The loss of function and loss of strength in rheumatoid arthritis are more prominent than in osteoarthritis.^[5]

Deep transverse friction massage combined with other physiotherapy modalities did not significantly reduce tendinitis symptoms compared to control group, DTFM was performed to reduce tendinitis symptoms. The inflammation and pain observed in tendinitis are frequently due to three main factors: 1) biomechanical factors; 2) anthropometric factors and 3) training factors.

Pain is an indirect symptom. Based on the identified factors, pain could therefore be controlled more effectively through other physiotherapy interventions such as strengthening and postural exercises, or changes in functional and sporting activities that correct biomechanical deficiencies restore motion increase strength, endurance and function and gradually return to training.^[7]

Pulsed ultrasound is recommended for the management of soft tissue healing. Whereas pulsed or continuous ultrasound in low intensities (0.1

w/cm² or 0.2 w/cm²) is used to produce non-thermal effects.^[14] It has been suggested that the non-thermal effects of ultrasound, including cavitation and acoustic streaming, are more important in the treatment of soft tissue lesions than are thermal effect.^[6]

The ultrasound intensity applied in W/cm². The advice is to always use the lowest intensity that produces the required therapeutic effect, as higher intensities may be damaging. The intensity used should be between 0.1 and 0.3 W/cm² and should not be higher than 0.5 W/cm² for acute conditions. For more chronic conditions, the levels would typically be between 0.5 and 0.8 W/cm² and should be no higher than 1 W/cm².^[14]

Previous study carried out which shows that the recurrence rate was significant for pain in the corticosteroid group but not for triggering. Recurrence following corticosteroid injection is more likely for patients with diabetes mellitus type I, younger age, involvement of multiple digits, and history of other upper extremity tendinopathies interestingly; there was no recurrence of pain or triggering at all in our patients who were successfully treated with physiotherapy.^[3]

Conclusion - This study has documented that the paraffin wax bath, Pulse ultrasound along with deep transverse friction massage and strengthening exercises leads to reduction in pain or triggering, cause functional improvement & also improve the hand grip muscle strength in case of left side stenosing tenovaginitis of thumb.

The single case study design utilized in this study limits the generalization of its findings. However, it does provide the impetus to conduct controlled clinical trials utilizing Paraffin wax bath, pulse ultrasound along with deep transverse friction massage & strengthening exercise in stenosing tenovaginitis of thumb cases.

Conflict of Interest : The author's report no conflict of interest

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**Fig. 1:-
Paraffin Wax Bath**



**Fig. 2:-
Pulsed Ultrasound
given to left Thumb**



**Fig.3:-
Deep Transverse
Friction Massage**