Verma *et al.*
Bulletin of Faculty of Physical Therapy (2022) 27:45
https://doi.org/10.1186/s43161-022-00103-w

Bulletin of Faculty of Physical Therapy

CASE REPORT

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Does shockwave therapy have a role on trigger thumb?—a single-case design

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Abstract

Background: The trigger thumb is a clinically unusual and rare phenomenon. The trigger finger is most observed on the ring or middle fingers. Clinical signs include reduced tendon excursion and the formation of nodules at the base of the metacarpals. As a result, grip strength may be reduced, making gripping tasks uncomfortable. Many treatments have been proposed to treat trigger finger symptoms; however, the effectiveness of shockwave therapy is still being contested. As a result, the purpose of this trigger thumb case study is to assess the effect of shockwave therapy on grip performance.

Case presentation: A 53-year-old housewife reported to the outpatient department with pain at the base of her right thumb, recurring locking episodes, morning pain and stiffness, and a 10-year history of diabetes. Based on the clinical presentation and physical examination of the patient, an orthopedic sports physician diagnosed it as a trigger thumb. Analgesics were initially administered, and the patient was then referred to physiotherapy for rehabilitation. All outcomes improved substantially during the follow-up after six sessions of physical therapy, which included shock-wave therapy and an exercise program.

Conclusion: This study concluded that the protocol developed specifically for the treatment of the trigger thumb is efficacious. Therefore, future research with a larger number of participants is required to validate this approach.

Keywords: Trigger finger disorder, Thumb, High-energy shock waves, Hand strength, Pain

Introduction

Trigger thumb is caused by thickening of the tendon sheath at the A1 annular pulley as a result of the "cause and effect" of non-infective inflammation, which results in constriction of the tendon and nodule formation, preventing it from sliding through the pulley [1]. Symptoms of trigger thumb include catching while extending from a flexion position, pain while moving, morning stiffness, and impairment. In people aged 50 to 60 years, the tendon demonstrates mucoid degeneration, chondral metaplasia, and fibrocartilaginous metaplasia at the A1 pulley of the thumb, with the ring and middle fingers being the most affected and thumb involvement being negligible. The reported lifetime prevalence in the general population ranges from 2.5 to 3% [2]. The prevalence of the trigger thumb is modest in the general adult population, ranging from 3.3% per 1000 live births in the pediatric population [3].

A wide range of conservative treatment options is available, including nonsteroidal anti-inflammatory drugs, stretching exercises, steroid injections, splinting, and ultrasound [4, 5]. However, the evidence for these forms of treatment is not scientifically proven to be very effective, even though they may provide some relief to patients suffering from pain and disability. All of these therapeutic options are highly unclear and lack strong supporting evidence [6].

Extracorporeal shock wave therapy (ESWT) is a new, scientifically validated method for treating chronic soft tissue injuries. Radial (r) and focused probes are utilized to treat soft tissue injuries or diseases (f). rESWT is

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frequently used to treat subacromial calcific tendonitis, plantar fasciitis, Achilles tendinopathy, myofascial pain syndromes, and nonunion of the long bones [7]. The difference in energy between two probes for a particular treatment varies by a factor of 100. fESWT released greater acoustic energy on a target tissue, with a changeable variation in focal volume and penetration level, whereas rESWT emits high-pressure waves primarily at the skin's surface. There is no evidence supporting the rESWT and fESWT in terms of therapy efficacy. Studies recommend abandoning "low-energy ESWT" and "high-energy EWST" for rESWT and fESWT, respectively [1, 6, 8].

According to existing evidence, the ESWT is a useful method for treating tendon-related deficits. It has also been shown to be as effective as corticosteroids in treating chronic soft tissue diseases [4, 6]. As a result, this study used rESWT to explore the role of a conservative management regimen and its effectiveness in a trigger-thumb patient.

Case presentation

A 53-year-old housewife presented to the outpatient clinic complaining of right thumb pain, especially at the base, and recurring locking episodes that had been present for 1 month. The patient experienced pain gradually while clutching, writing, and squeezing.

The doctor initially recommended analgesics for 15 days, but they were ineffective in controlling the pain and disability, and the discomfort became severe. It eventually resulted in the inability of the individual to perform basic duties.

It took around 2–3 min with the other hand to unlock the thumb. This issue started a year prior, with no history of locking and only mild pain that was neglected. There had been no history of trauma, injury, unhealthy habits, etc. The patient had a history of diabetes and hypothyroidism, but no hypertension, and had been taking medications for all of the aforementioned issues for 10 years.

Examination and differential diagnostic findings

On examination, the palmar fascia was found to be tight, and a nodule was identified at the base of the thumb. Profound tenderness grade 4 was reported near the base, with a pain scale of 7–8 on the NPRS. Trigger points developed at the transverse head of the adductor longus and the base of the third ray as a result of forearm fascial tightness. Palpation exhibited mild discomfort at the extensor pollicis brevis and abductor pollicis longus, but the Finkelstein test was negative. The patient was assessed for Dupuytren's contracture, RA, and tendon damage. The patient's four-digit range of motion was normal, with the exception of a hard tightness at the terminal range. A significant reduction in range of motion (ROM) in the first interphalangeal joint (25–5°) and the metacarpophalangeal (MCP) joint (40–5°).

Intervention and outcome measures

The intervention was started after explaining the potential benefits and risks associated with shockwave therapy to the patient.

The primary outcome measure, grip strength, was assessed using a hand dynamometer. Similarly, the secondary outcome measures, the pain intensity, thumb disability, trigger point sensitivity, and range of motion (ROM), were assessed using NPRS, modified Quinnell scale, algometer, and the hand goniometer, respectively.

A verbal and written consent was obtained from the patient before the intervention. The NPRS is an 11-point scale representing along the line from "0" to "10". "0" represents no pain, and "10" indicates the worst pain. The patient was instructed to choose a number along the line which best indicates their pain levels including none, mild, moderate, and severe. Patient NPRS Score scale between 7 and 8 comes under the severe category [9].

Disability of the thumb was evaluated by a modified Quinnell thumb disability scale based on a system that helps to determine the severity of triggering and stages of stenosing tenosynovitis ranging from "0" to "6". Zero signifies no triggering episodes whereas "6" indicates full locking and flexion deformity of the thumb. The grades include stage 1= normal; stage 2= uneven motion of tendon; stage 3= triggering, clicking, and catching; stage 4= locking of thumb in extension and flexion unlock by active motion; stage 5= locking of thumb in extension and flexion unlock by passive motion; and stage 6= thumb locked in flexion and extension. As per, the Quinnell scale patient falls between stage 4 and stage 5, the patient sometimes unlocks the thumb by active extension through flexion position, and few incidences need the assistance of another hand for extension of the thumb from flexion position [10].

Algometer is a device used to measure pain pressure threshold (PPT) which is defined as the sensitivity felt on the tissue by applying mechanical pressure with equipment results from a change of pressure feeling into a feeling of pressure and pain. The pressure was applied to the patient's tender areas at the base of the thumb, and the midpoint of the adductor longus was gradually increased with a pressure of 1kg/cm^2 until the patient was instructed to "stop." The pressure increased at the first spot at the base of the thumb was found to be sensitive at 0.3kg/cm^2 and mid-point at 2nd spot adductor longus sensitive at 0.8k/cm^2 [11]. A digital ABS hand dynamometer device was used to assess the grip strength

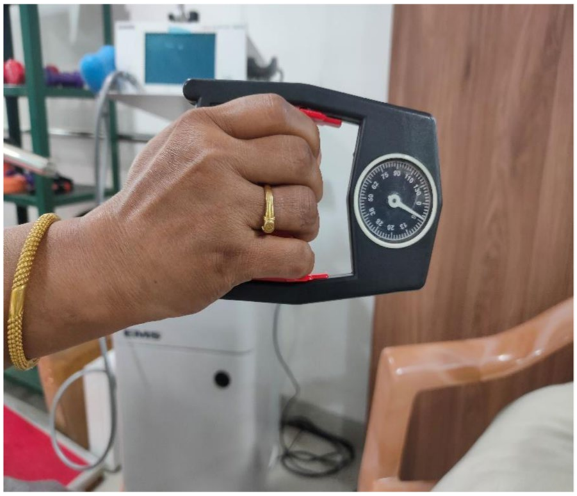

Fig. 1 Pre-grip strength before the shockwave right hand

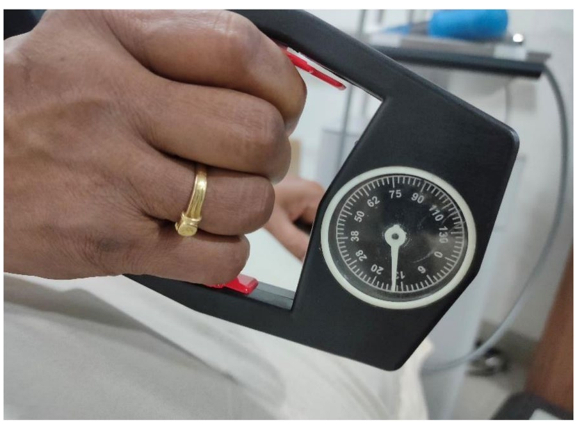

Fig. 2 Post-grip strength after the shockwave right hand

Fig. 3 Dosage used for rESWT

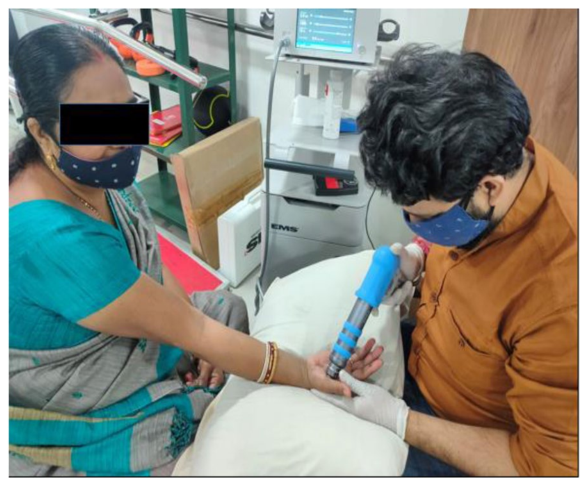

Fig. 4 Patient during treatment session

of the patient bilaterally to compare the difference in strength (Figs. 1 and 2).

On observation, the grip strength of the right hand (dominant) and left hand (non-dominant) was 4 and 14 kg, respectively [12]. The range of motion which was severely restricted at the interphalangeal (IP) joint varies (25-5°), and the metacarpophalangeal (MCP) joint 40-5° was measured with a hand goniometer [13]. Roles and Maudsley scores were used to determine the functional outcomes of the trigger thumb. It has 4 functional scales varying from points 1 to 4. “1” indicates the excellent recovery with no pain, full movement, and activity, and “4” indicates poor recovery with a pain-limiting activity. “Fair” with a score of 3 and “poor” score 4 results are considered as “failure” of treatment.

The patient was treated with an electro-medical system (EMS) device, the Swiss dolocast master version (Figs. 3 and 4). In order to carry out the rESWT procedure, the patient was instructed to assume a position that would allow them to be as relaxed as is humanly possible. Since the participant felt more at ease sitting with their elbows extended, the experiment was carried out while the participant was in this position.

A total of 6 sessions for 6 days were administered to a patient in a week kept 1000 impulses with baric pressure of 2 bar and frequency of 15–10HZ for less painful areas and 300–500 impulses kept 1.5 bar pressure with a frequency of 5–7HZ directly over the nodule with the more painful area was administered.

Aside from extracorporeal shock therapy (ESWT), a patient was instructed to perform stretching, eccentric, and range of motion exercises at home twice a day for the bilateral hands to maintain the soft tissue properties and ROM attained with the use of rESWT. Furthermore, the patient did not report any adverse therapeutic effects following the session. The whole time spent on therapy was 30–40 min. The patient was followed up on 2 months following the treatment.

Treatment outcomes

Table 1 depicts the features of all the symptoms that were significantly reduced after the first three sessions. NPRS came down from 8 to 3 and 0 at the end of the 6th session of treatment. Modified Quinnell scale assessment shows a significant improvement from stage=4 to stage=3 on the 3rd day of treatment and stage=1 at the end of treatment on the 6th day [9]. Pain pressure holds improved significantly from 0.5 to 1 kg/cm^2 on site of nodule at the base of the thumb, whereas PPT of the adductor pollicis and along the 3rd ray was improved from 0.8 to 2kg/cm^2. Hand strength showed a significant improvement in terms of grip force from 4 to 13.2kg on the affected side. The range of motion at the interphalangeal joint and metacarpophalangeal joint improved at the end of the 6th session. Maudsley functional score showed improvement in pain, movement, and activity. During the follow-up session 2 months later, the patient shows consistent improvement and recorded the same as on the last session of treatment.

Discussion

In our patient's case study, we found that in only 1 week, they saw a considerable reduction in discomfort, an increase in grip strength, and an overall improvement in their functional ability. After a period of 2 months, we inspected and analyzed the patient, and throughout this process, we came to the conclusion that the patient's progression was being maintained with scheduled home workouts. The patient was not followed up on because there were no difficulties with the patient's trigger thumb that could prevent them from engaging in their routine physical activities.

The patient had shock wave therapy in order to hasten the recovery of myofascial structures, most notably the tendinous region. This was done so that the patient could resume normal activities sooner. We used 1000 impulses with 2 baric pressure and a set frequency range of 15–10 HZ on less painful locations and 300–500 impulses with 1.5 baric pressure and a set frequency range of 5–7 HZ on more painful sites because there was no convincing evidence regarding rESWT dosimetry. The more painful sites experienced 300–500 impulses with 1.5 baric pressure and a set frequency range of 5–7 HZ [10].

The release of ATP aids in the activation of the inhibited tissues and reduces the load on overworked tissues, which the researcher hypothesizes may be the cause of these alterations. There may be an increase in tissue permeability as well. Second, the influx of calcium ions into the tissues has an anti-inflammatory effect on the bones and soft tissues by alleviating pain and improving thumb function [12].

In addition to reducing inflammation, we hypothesized that rESWT also promotes the synthesis of angiotensin growth factor (AGF), which aids in neovascularization at the site of chronic damage and increases blood flow to the region by increasing the production of nitrous oxide by newly formed blood vessels [5]. Furthermore, rESWT exerts its effects via mechanotransducing mechanical pressures through the cytoskeleton into the nucleus, causing the expression of multiple genes that enhance the body's natural ability to repair the muscle, tendons, ligaments, and other surrounding tissues. It stimulates nociceptors, preventing the pain gate mechanism, and inhibits the production of enzymes that break down collagen protein [5, 13].

In addition to rESWT, the patient had a total of 12 eccentric exercise sessions over the therapy time, as well as the same guidance for at-home wrist and hand exercises to aid in continued healing. As a result, the underlying processes for the alterations may include the central adaptation of both agonist and antagonist

Table 1 Outcome measures

Outcome measures		Baseline	3rd session	6th session	2 months of follow up
Grip strength		4 kg	8.6 kg	13.2 kg	15.7 kg
PPT	**At tshumb**	0.5 kg/cm^2	0.6 kg/cm^2	1 kg/cm^2	3 kg/cm^2
	At 3rd ray	0.8 kg/cm^2	1 kg/cm^2	2 kg/cm^2	5 kg/cm^2
NPRS		8	3	0	0
Quinnell scale		Stage 4	Stage 3	Stage 1	Stage 0
Frequency of locking/day		8–10	7–8	3–4	0

muscles, increased tendon stiffness as a result of pain familiarization following repeated pain-inducing eccentric exercise sessions, and neuromuscular benefits. In addition to these adjustments, the author suggests some biochemical explanations for these enhancements, such as how they may stimulate tendon metabolism and, as a result, tissue hypoxia. Similarly, there is a correlation between increased type I collagen production and reduced pain [14, 15].

As this report is based on the outcome of a single case, the study results could not be generalized, so the author advises future studies to test the efficacy of this customized approach on larger samples.

Conclusion

This case study lays the foundation for the trigger thumb care in physical therapy. We find that rESWT is very effective and safe in reducing pain and improving disability, grip strength, and function in patients with the trigger thumb, but only when used with certain impulses, baric pressure, and frequency. We recommend that rESWT be used with the eccentric thumb exercises to sustain progression throughout treatment for accelerated healing.

Abbreviations

ESWT: Extracorporeal shock wave therapy; rESWT: Radial extracorporeal shock wave therapy; fESWT: Focus extracorporeal shock wave therapy; NPRS: Numeric pain rating scale; ROM: Range of motion; MCP: Metacarpophalangeal joint; IP: Interphalangeal joint; PPT: Pain pressure threshold; EMS: Electromedical system.

Acknowledgements

I would like to acknowledge the patient for giving consent to participate and publish the data.

Authors' contributions

Pankaj Verma. Contributions: 40%, Work: Primary investigator. Data collection, Deepak Kumar Pradhan. Contributions: 40%, Work: Proposal writing. Statistical analysis, Sandeep Singh. Contributions: 20%, Work: Diagnosis and screening. The author(s) read and approved the final manuscript.

Funding

Nil

Availability of data and materials

Available

Declarations

Ethics approval and consent to participate

Both verbal and written consent were obtained from the participant in relation with the measurements and images taken.

Consent for publication

The patient was well aware of the medical publication, and a signed written consent was attained for the publication.

Competing interests

The authors declare that they have no competing interests.

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Received: 20 June 2022 Accepted: 30 August 2022
Published online: 09 November 2022

References

1. Malliaropoulos N, Pyne D, Padhiar N, Turner J, Korakakis V, Lohrer H. Radial extracorporeal shockwave therapy for the treatment of finger tenosynovitis (trigger digit). Open Access J Sport Med. 2016;7:143–51.
2. Shen PC, Chou SH, Lu CC, Fu YC, Lu CK, Liu WC, et al. Comparative effectiveness of various treatment strategies for trigger finger by pairwise meta-analysis. Clin Rehabil. 2020;34(9):1217–29.
3. Kikuchi N, Ogino T. Incidence and development of trigger thumb in children. J Hand Surg Am. 2006;31(4):541–3. https://doi.org/10.1016/j.jhsa.2005.12.024 PMID: 16632044.
4. Yildirim P, Gultekin A, Yildirim A, Karahan AY, Tok F. Extracorporeal shock wave therapy versus corticosteroid injection in the treatment of trigger finger: a randomized controlled study. J Hand Surg Eur. 2016;41(9):977–83.
5. Dogru M, ERDURAN M, Narin S. The effect of radial extracorporeal shock wave therapy in the treatment of trigger finger. Cureus. 2020;12(6):1–15.
6. Chen YP, Lin CY, Kuo YJ, Lee OKS. Extracorporeal shockwave therapy in the treatment of trigger finger: a randomized controlled study. Arch Phys Med Rehabil. 2021;102(11):2083–2090.e1. Available from. https://doi.org/10.1016/j.apmr.2021.04.015.
7. Mohamed DAA, Kamal RM, Gaber MM, Aneis YM. Combined effects of extracorporeal shockwave therapy and integrated neuromuscular inhibition on myofascial trigger points of upper trapezius: a randomized controlled trial. Ann Rehabil Med. 2021;45(4):284–93.
8. Suputtitada A. Update of extracorporeal shockwave therapy in myofascial pain syndrome. Int Phys Med Rehabil J. 2017;1(4):82–6. https://doi.org/10.15406/ipmrj.2017.01.00019.
9. Moradi A, Ebrahimzadeh MH, Jupiter JB. Radial tunnel syndrome, diagnostic and treatment dilemma. Arch Bone Jt Surg. 2015;3(3):156–62.
10. Ferrara PE, Codazza S, Maccauro G, Zirio G, Ferriero G, Ronconi G. Physical therapies for the conservative treatment of the trigger finger: a narrative review. Orthop Rev (Pavia). 2020;12(1S):90–4.
11. Zyluk A, Mosiejczuk H. Outcomes of the treatment of trigger digits by extracorporal shock wave therapy (ESWT). Handchirurgie Mikrochirurgie Plast Chir. 2020;52(1):25–8.
12. Ioppolo F, Saracino F, Rizzo RS, Monacelli G, Lanni D, Di SL, et al. Comparison between extracorporeal shock wave therapy and intra-articular hyaluronic acid injections in the treatment of first carpometacarpal joint osteoarthritis. Ann Rehabil Med. 2018;42(1):92–100.
13. Crevenna R, Mickel M, Schuhfried O, Gesslbauer C, Zdravkovic A, Keilani M. Focused extracorporeal shockwave therapy in physical medicine and rehabilitation. Curr Phys Med Rehabil Reports. 2021;9(1):1–10.
14. Couppé C, Svensson RB, Silbernagel KG, Langberg H, Magnusson SP. Eccentric or concentric exercises for the treatment of tendinopathies? J Orthop Sports Phys Ther. 2015;45(11):853–63.
15. Murtaugh B, Ihm JM. Eccentric training for the treatment of tendinopathies. Curr Sports Med Rep. 2013;12(3):175–82.