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Effect of dry needling on quality of life in patients with trigger finger: a randomized controlled trial

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Abstract

Background An inflammatory disorder known as trigger finger (TF) results in pain inthe proximal and distal palm and digit, as well as restricted movement and diminished function. Physiotherapists use a specific treatment called dry needling (DN) to reduce musculoskeletal pain and assist patients with mobility restriction.

Objectives This study aimed to examine the effectiveness of DN on quality of life in patients suffering from trigger finger.

Methods Forty patients, ranging in age from 45 to 75, were randomized into one of two groups in this Prospective pre and post-test, single-blind parallel group randomized controlled trial. Twenty patients were assigned to the intervention group, which included traditional physiotherapy splinting and ultrasound (ultrasonic dosage was 3MHz, the intensity of 0.5 W/cm2, and the duty cycle 50%. Duration: 5 minutes) as well as to DN upon a nodule at the proximal end of the 1st annular (A1) pulley as well as the discrepancy that existed between the flexor tendon's diameter along with its sheath at the metacarpal head. Twenty patients were assigned to the control group, which consisted of traditional treatment alone, twice weekly, for a total of ten sessions over five weeks. The trial evaluated the quality of life, severity of pain, and hand grip strength using the World Health Organization Quality-of-Life Scale (WHOQOL-BREF), visual analogue scale, and Camry dynamometer respectively two times, beforetreatment and after 10 treatment sessions.

Results Within-group analysis using MANOVA demonstrated a significant decline in VAS (p = 0.001) and a significant improvement in quality of life ($p = 0.001$) and hand grip strength ($p = 0.001$). Regarding between group comparison using MANOVA there was significant improvement in favor of the DN intervention ($p = 0.001$) for all measured variables.

Conclusions A 5-week dry needling approach with a traditional physiotherapy program was effective in improving in quality of life, pain intensity, and hand grip strength in patients with trigger finger, emphasizing it as the better option.

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Keywords trigger finger, dry needling, quality of life, dynamometer

Introduction

A frequent hand condition with a prevalence of 2 to 20% worldwide is trigger finger, also known as stenosing tenovaginitis or tenosynovitis. This condition develops when the tendons of the flexor digitorum superficialis as well as flexor digitorum profundus become trapped in the fibro-osseous tunnels that run through the palm, wrist, and fingers. Nodule formation, an enlargement of the tendon brought on by overuse, is causing the patient to experience a locking and popping feeling [22].

The discrepancy among the flexor tendon's diameter as well as its sheath at the metacarpal head, in addition to the excessive pressure at the proximal border of the 1st annular (A1) pulley, is believed to be the root causes of this condition. An essential component of the hand, the 1st annular (A1) pulley, stabilizes the metacarpophalangeal joint and keeps the flexor tendon in its proper position [20]. Factors that increase the likelihood of developing trigger fingers include diabetes, carpal tunnel syndrome, and overuse injuries. The most common affected fingers are the ring as well as thumb of the dominant hand. The problem manifests over time as a result of excessive use and fades away on its own after 6 months [22].

A person's capacity to carry out their everyday tasks and perform their job responsibilities independently depends on the hand's normal function. Hand dysfunction and impaired ability to participate in daily activities can result from damage to any one of these components [14]. Although the trigger finger is not an irreversible condition, it significantly decreases the patient's quality of life and makes performing manual tasks challenging. The trigger finger has numerous effects on daily activities, hand function, and quality of life, even though it is classified as a mild hand pathology. Trigger fingers not only hurt, but they can also make it hard for a patient to cut, drive, or type [13].

There are two main approaches to treating trigger fingers: conservative and surgical procedures. Physical therapy techniques like shock wave therapy [7], ultrasound therapy [9], mobilization [9], stretching exercises [9], and splinting [1], injections of local corticosteroids (CI), and nonsteroidal anti-inflammatory drugs (NSAIDs) taken orally were the currently approved conservative therapies. Another developing method that physiotherapists are using for relieving a variety of pain syndromes as well as myofascial trigger points (MTrPs) is DN. According to the definition, DN is "a skilled treatment utilizing a thin filiform needle that penetrates the skin to triggers myofascial TrPs, muscles, as well as connective tissue for the management of musculoskeletal pain problems" [19].

No sufficient studies have been done on the impact of DN on the quality of life in patients suffering from trigger fingers. Previous studies have been done by Azizian et al. (2019) [2], who evaluated the effects of trigger finger DN. According to the findings of this study, individuals suffering with trigger finger reported less pain after just one session of DN, which also improved their pinch strength and overall functional capacity. Furthermore, Sahoo et al. (2023) [22] discovered that traditional physiotherapy, in conjunction with two advanced techniques—the A1 pulley stretch and DN—is superior to any treatment alone in alleviating pain and activity limitation caused by chronic trigger finger.

A lack of sufficient and high-quality evidence for the treatment of trigger finger (TF) persists in the literature, despite the disease's prevalence, functional impairment, and economic effects on sufferers. Consequently, the purpose of this study was to examine the impact of DN on the quality of life of individuals suffering from trigger finger.

Methods

Ethical considerations

Proposal number: P.T.REC/012/003924 was approved by the Faculty of Physical Therapy's ethical research committee in 2022. The ClinicalTrial.gov database has this trial documented with the identifier (NCT05671523). The participants were informed that they might withdraw from the study at any moment and gave their written consent accordingly. The guidelines provided by the Declaration of Helsinki were followed in this study.

Design

Prospective pre- and post-test, single-blind parallel randomized controlled trial.

Setting

This study was carried out in the physiotherapy clinic of Damanhour Teaching Hospital, Egypt.

Sample size estimation

The sample size calculation was done utilizing the comparison of pinch grip between subjects having trigger finger treated with dry needle and the control group. As reported in Azizian (2019) [2], with 80% power at $\alpha = 0.05$ level, the results of the two-group, *F*-test MANOVA with

within-as well as between-interaction effects revealed an effect size of 0.469. A minimum of 38 participants, with 17 in each group, was considered an adequate sample size. Software version 3.0.10 of G*Power was used to determine the sample size. Forty patients were enrolled, with 20 assigned to each group, to assess the probability of dropout. Figure 1 shows the flow chart for this research trial. Fifty-two participants were enrolled, but 9 participants were excluded because they do not meet the inclusion criteria, and 3 declined to participate. Forty participants were allocated randomly to 2 groups with 20 participants within each group.

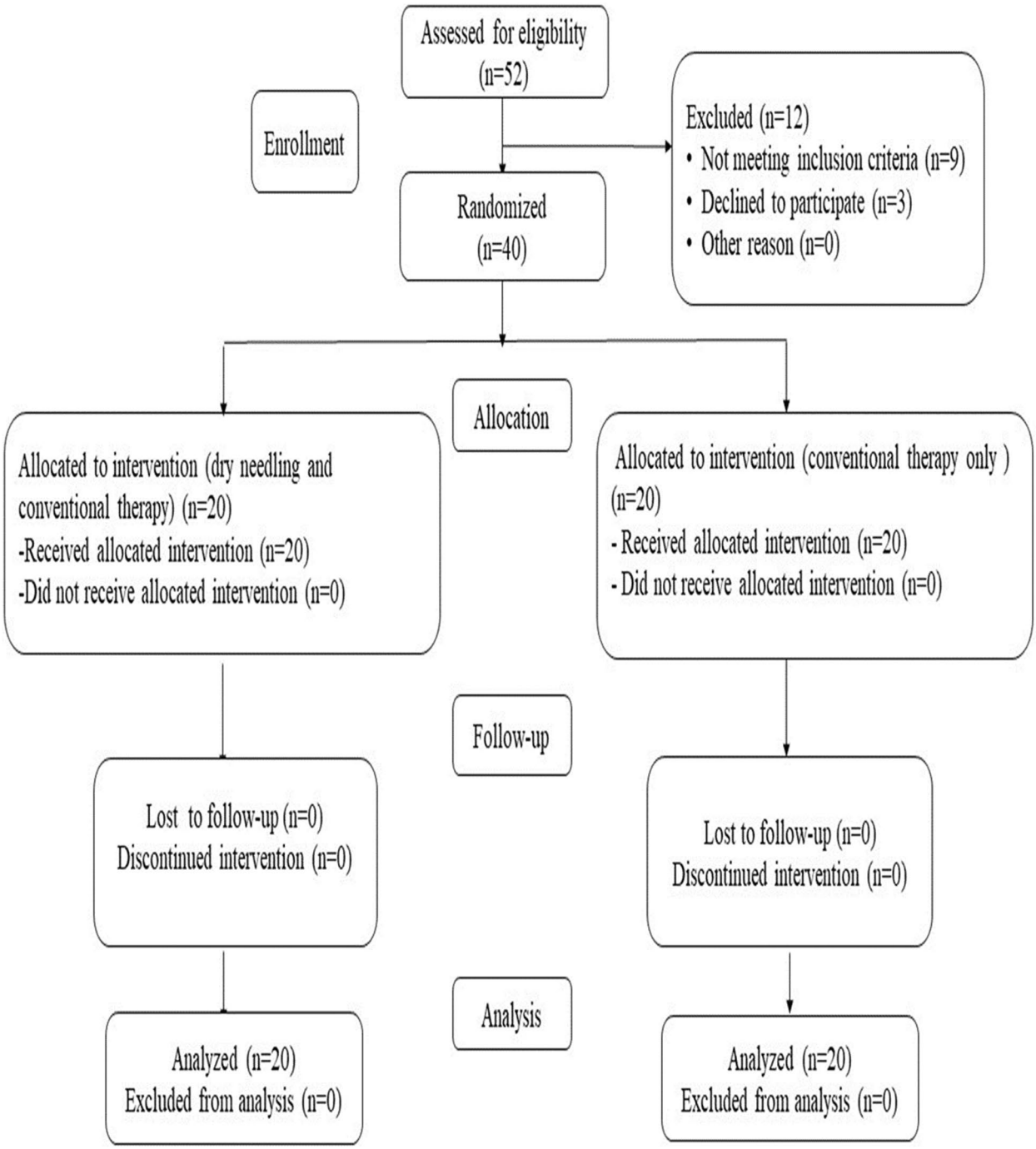

Fig. 1 Flow chart of the study

Patient recruitment and allocation

Fifty-two patients of both genders aged 45–75 years were recruited by referral from the orthopedist in the orthopedic outpatient clinic of Damanhour Teaching Hospital, Egypt, and were randomly recruited from January 1, 2023, to June 10, 2023.

The inclusion criteria were as follows: 40 patients all had trigger fingers, 23 patients with thumb trigger fingers, 17 patients with middle trigger fingers lasting at least 4 weeks, and patients with grades I, II, and III according to Green's classification [12]. Both genders were included. Patients ranged in age from 45 to 75 years old [2]. The area around the A1 pulley is painful and tender. No analgesics were administered to the patients. Feeling pain or discomfort during flexion or extension of the finger, hearing for a clicking sound whenever the finger is flexed or extended, or experiencing locking or snapping of the finger are all symptoms of a nodule. Everyone involved in the study was fully conscious, cooperative, and capable of finishing all tasks.

The exclusion criteria were individuals suffering from rheumatoid arthritis, diabetes mellitus, or have a history of trauma. Fingers that have a history of local gouty or pyogenic diseases are currently receiving dialysis. A severe phobia of needles and severe hand trauma. We did not include patients who had any of the following conditions: anticoagulants, infections, hemorrhage psychotic disorders, malignancies, deposits of calcium, or severe osteoarthritis in our deep DN protocol.

A total of 20 patients who fulfilled the study's inclusion and exclusion criteria were assigned to group A, the intervention group, who were given traditional physiotherapy as well as DN (splinting and ultrasonic therapy). As a control, group B was given the traditional physiotherapy of splinting and ultrasonic treatment.

Randomization

One member of the outside staff was responsible for creating the 1:1 ratio randomization schedule utilizing computer-generated block randomization. Then, the concealed allocation was carried out by opening sealed envelopes that were numbered consecutively; a card inside would show the group assignment. Using a simple random assignment method, each subject was assigned into one of two treatment groups. To make sure the blinded assessors did not know the schedule, this external individual maintained it. Also, throughout the evaluation, participants were instructed not to show the type of intervention they had been assigned to.

Outcome measures

Both groups performed the same battery of tests prior to and following the 5-week intervention. The characteristics that were analyzed included quality of life as measured by the WHOQOL-BREF, pain intensity as measured by the VAS, and hand grip strength as measured by the Camry dynamometer.

Assessments

Quality of life

The World Health Organization Quality-of-Life Scale—Arabic Version (WHOQOL-BREF)—was utilized to measure quality of life. This tool is based on the WHOQOL-100. Two questions relate to general health as well as overall quality of life, while the WHOQOL-BREF assesses 24 different aspects of satisfaction across four domains: physical health (DOM1), psychological health (DOM2), and social relationships (DOM3), in addition to environmental health (DOM4). Using a 5-point Likert scale, every item was evaluated. On a response scale ranging from 1 to 5, every aspect of the WHOQOL-BREF was evaluated. We followed the criteria to convert the raw domain scores of the WHOQOL to a score between 4 and 20. The domain scores were measured on a positive scale, meaning that higher values indicate a higher quality of life. To determine the domain score, we take the average of all the item scores inside each domain. After calculating the scores, they converted them linearly to a scale from 0 to 100 [10].

Both the reliability as well as validity indices for the Arabic version of the WHOQOL-BREF are excellent. The four domains of WHOQOL-BREF showed a good level of internal consistency ($\alpha = 0.92$) [5].

Pain intensity

The visual analog scale (VAS), which measures the level of pain, was used. The self-reported symptom measures used to calculate scores are documented by placing a single handwritten mark across a 10-cm line. This line reflects a continuum ranging from "no pain" at the left side (0 cm) to "most severe pain" on the right side (10 cm). The patient was instructed to indicate their present state of pain using the line [6]. According to the intraclass correlation (ICC), the VAS for pain measurement has a high level of reliability. A total of 90% of pain assessments were reproducible within 9 mm. These findings indicate that the VAS is reliable and can be utilized to evaluate pain with reasonable accuracy. VAS scores had an ICC of 0.97 [95% $CI = 0.96$ to 0.98] [3].

Hand grip strength

Hand grip strength was measured by Camry dynamometer. It is a simple method that is recommended for

evaluating muscular function in a clinical setting. The Camry dynamometer is commonly utilized in the most of healthcare settings as well as physical training. The ICC was found to be 0.95 which is considered to be excellent [17].

As a simple, low-cost, and reliable tool, this device can measure grip strength [11]. For adults in the hospital, the Camry dynamometer is a reliable instrument for evaluating grip strength [16].

Blinding

By using a standardized methodology to assure consistency in participant positions, instructions, and overall test techniques, all evaluations were conducted by the same physiotherapist who was uninformed of the patient's treatment group. This was done in a single blind manner.

Intervention

All the patients in the intervention and control group were given 10 separate treatment sessions, two times a week, within a 5-week period. The same physiotherapist, who has 3 years of experience in dry needling, is responsible for treating all patients.

Control group

Patients in the control group were given traditional treatment only (splinting and ultrasound therapy).

Experimental group

Patients in the experimental group were given DN as well as their traditional physiotherapy program (splinting and ultrasound therapy).

Dry needling

The nodule in the A1 pulley anatomic region was punctured using disposable stainless-steel needles measuring 0.25 mm × 30 mm [25]. We employed a DN technique called fast in, fast out, where the needle was placed at an angle of 45° at the nodule level, creating the illusion of a cone shape. Each needle was left in for 1 min.

There were some precautions before using dry needling. The first step was to use a 70% alcohol swab to clean the area. The DN procedure made use of a disposable, pre-sterilized solid filament needle. Wearing disposable gloves, the therapist prepared to apply DN. There was no evidence of blood or outflow from the needling locations, and the sterility of the needle shaft was preserved throughout the therapy [25]. Following the session, the patient was instructed to utilize either ice or heat whenever necessary to control their pain [25]. Disposal was carried out in a suitable needles container to prevent needle stick injuries. It was carefully inserted onto the trigger finger nodule rather than the joint [22].

Therapeutic ultrasound

One effective method for preventing TF symptoms from returning is ultrasound therapy [9]. Therapeutic ultrasound parameters were adjusted to the following: the dosage was 3 MHz, the intensity of 0.5 W/cm^2, and the duty cycle 50%. Duration is as follows: 5 min [26]. The ultrasonic gel was put between the applicator and the skin over the flexor tendon on the A1 pulley nodule of the trigger thumb and the trigger middle finger. Then, the applicator was moved at a constant speed and in a circular movement at the involved area for 5 min [26].

Finger splint

Injured fingers might be fully supported and protected with the Digitec Finger Splint. A strong nylon shell provides firm stabilization and support, while an EVA foam inner makes the splint comfortable to wear for long periods of time. To keep the splint in place and promote optimal healing, adjustable side straps provide a secure but comfortable fit. Helped the finger heal by positioning it in a practical way.

The thumb spica splint was utilized to treat the trigger thumb. Superior neoprene thumb spica splint has a cotton as well as stretch nylon covering for maximum skin comfort. The patient may place it on either their left or right hand; it comes in one size that fits wrists up to 10 inch in circumference. Nightly, the built-in aluminum bar splint will give your thumb joint the support it needs for up to 5 weeks. The recommended length of treatment during splinting ranged from 3 to 12 weeks [12]. At every session, the therapist documented and recorded whether the patient was wearing the finger immobilizer night splint upon meeting the patient at the outpatient clinic. The patient was not wearing the finger immobilizer as instructed this was recorded as a non-compliant event.

The control group received traditional therapy only (splinting and ultrasound therapy) as the intervention group, two sessions a week for 10 sessions over 5 weeks.

Statistical analysis

Data analysis and statistical design

We presented the data as the mean ± standard deviation. Subject characteristics of the two groups were compared using chi-square and an unpaired *t*-test. The normality of the data distribution was tested using the Shapiro–Wilk test. MANOVA was conducted to compare within as well as between groups' effects for parametric variables (the quality of life and hand grip strength) and Wilcoxon and Mann–Whitney tests for nonparametric variables (pain intensity). The data was analyzed using the statistical tool for the social sciences, version 20 for Windows,

developed by SPSS Inc. of Chicago, IL, USA. For statistical significance, a p-value of less than 0.05 was used.

Results

Demographic data of subjects

As revealed in Table 1, there were no significant difference among the mean value of age, weight, height, BMI, and gender distribution of both groups ($p > 0.05$).

Assumption of normality, homogeneity of variance, and existence of outlying scores were all checked in the data. Shapiro–Wilk test for normality revealed that quality of life and hand grip strength variables were normally distributed, while pain intensity variable was not normally distributed ($p > 0.05$).

Quality of life

Regarding within-group comparison of QoL, there was a statistically significant increase by 100% in group A and 58% in group B post-treatment ($p = 0.001$).

Statistical analysis revealed that group A had significantly higher mean values of quality of life (QoL) after therapy compared to group B ($p = 0.001$), as shown in Table 2.

Hand grip strength

Regarding within-group comparison of hand grip strength, there was a statistically significant increase by 95% in group A and 36% in group B post-treatment ($p = 0.001$).

When comparing the two groups, group A showed significantly higher mean values of hand grip strength after treatment ($p = 0.001$), as shown in Table 2.

Pain intensity

Regarding within-group comparison of pain intensity, a statistically significant decline by 75% in group A and 49% in group B post-treatment was detected ($p = 0.001$).

Table 1 Demographic data of subjects of both groups

Demographic data	Group A	Group B	*t*-value	*p*-value
Age (years)	55.6 ± 7.2	56.8 ± 9	−0.445	0.659
Weight (kg)	84.3 ± 7.1	82 ± 7.6	0.986	0.330
Height (cm)	164.7 ± 6.3	165.7 ± 5.6	−0.530	0.559
BMI (kg/m^2)	31.2 ± 3.2	29.9 ± 2.9	1.3	0.198
Sex Males Females	*N* (%) 7 (35%) 13 (65%)	*N* (%) 8 (40%) 12 (60%)	$\chi^2 = 0.107$	0.744

Data was expressed as mean ± standard deviation, χ^2 chi-square, *p*-value significance

When comparing the two groups, group A showed significantly higher mean values of pain intensity after treatment ($p = 0.001$), as shown in Table 2.

The overall effect of treatment on quality of life and hand grip strength variables

The impact of therapy on the assessed variables was examined through the use of MANOVA. Both the time and treatment had significant main effects, and the interaction effect of treatment and time was also statistically significant ($p = 0.001$).

Discussion

Around the world, 2 to 20% of people suffer from trigger finger, also recognized as tenosynovitis. The flexor digitorum profundus and superficialis tendon become trapped in fibro-osseous tunnels in the hand, wrist, and fingers, causing this condition [22]. Trigger finger is not an incurable illness, but it significantly lowers the quality of life and makes it difficult to perform manual tasks. Despite being categorized as a mild hand pathology, the trigger finger affects hand function, daily activities, and quality of life in many ways [13]. Pain and tenderness are correlated with low level of quality of life and affect hand grip strength. The purpose of this study was to inspect how DN affected patients with trigger fingers' quality of life, level of pain, and strength of hand grip by WHOQOL-BREF questionnaire, VAS, and CAMRY dynamometer, respectively.

Following the 5 weeks of intervention in relation to the baseline, significant changes in the two groups regarding QoL, pain, and hand grip strength were obtained. The findings of this study showed that there was a statistically significant increase in quality of life by 100%, a decrease in pain by 75%, and an increase in hand grip strength by 95% in the experimental group. Moreover, there was a statistically significant improvement in quality of life by 58%, a decrease in pain by 49%, and an improvement in hand grip strength by 36% in the control group.

The administration of DN produced an improvement in pain intensity and as a result improved the hand grip strength, hand function, and quality of life. According to the previous study of Sahoo et al. (2023) [22] and according to our findings, the fundamental impact of dry needling—the activation of different sensory pathways as well as the noxious inhibit control system—leading to neuromodulator in pain signaling—was responsible for a significant decline in pain. Additionally, it stimulates the pathways that regulate descending pain as well as spinal segmental pain inhibitory pathways. A further mechanism for peripheral and spinal cord level pain reduction

Table 2 Mean ± SD of measured variables pre- and post-treatment of both groups

Measured variables	Group A Mean ± SD	Group B Mean ± SD	*f*-value	*p*-value (between group)
QoL				
Pre-treatment	38.4 ± 5	39.9 ± 5.3	0.871	0.356
Post-treatment	78.5 ± 4.2	63.1 ± 4.4	125.5	0.001*
% of change	100%	58%		
p-value (within group)	0.001*	0.001*		
Hand grip strength (Newton)				
Pre-treatment	10.5 ± 3.3	10.2 ± 2.5	0.069	0.795
Post-treatment	20.5 ± 4.8	13.9 ± 2.9	27.7	0.001*
% of change	95%	36%		
p-value (within group)	0.001*	0.001*		
Pain intensity (cm)			*z*-value	*p*-value of Mann–Whitney test
Pre-treatment	7.3 ± 1.2	7.6 ± 1.1	−0.739	0.460
Post-treatment	1.8 ± 0.7	3.9 ± 0.8	−5.2	0.001*
% of change	75%	49%		
p-value (Wilcoxon test)	0.001*	0.001*		

QoL quality of life, *SD* standard deviation

* significant

that occurs as a result of needling treatment is the stimulation of endogenous opioid production during needle manipulation. Research has also demonstrated that DN can decrease the thickness of the flexor tendon. The pain level, as assessed by the Nottingham Pain Rating Scale (NPRS), decreased from 6 to 0.

Also, these results agreed with the study of Azizian et al. (2019) [2] whose findings a single DN session was successful in decreasing pain in the VAS, enhancing hand function as evaluated by the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, and strengthening pinch grip strength as measured by a digital dynamometer. Our study is different from Azizian et al. (2019) [2], as patients in the experimental group of this study were given DN along with traditional physiotherapy program (splinting and ultrasonic therapy) for long treatment sessions of 5 weeks. The impact of DN on quality of life was evaluated by the Arabic version of (WHOQOL-BREF) which reflects the total states of patients such as physical state, psychological state, social relationships, and environmental health not only the hand function.

In addition, poor quality of life, anxiety, and depression are linked to severe hand injuries, chronic pain, and discomfort [21]. That is why dry needling was included in the treatment program for musculoskeletal disorders of the forearm, wrist, and hand. The old investigation by Ziaeifar et al. (2014) [27] found that DN produces an improvement in pain intensity, pressure pain threshold, and the DASH in patients with a MTrPs in the upper fiber of trapezius muscle particularly when pain reduction is the aim of the treatment. Also, Tekin et al. (2013) [24] investigated the impact of DN on quality of life in the management of myofascial pain syndrome by using short form-36 (SF-36). Patients showed a significant improvement in life quality. Voss et al. (2021) found that the patients had no pain during functional grasping as well as pinching after DN in thumb fracture [25].

Patients in the control groups achieved a statistically significant decline in pain and improvement in quality of life. Splinting prevents the tendon and tendon sheath from coming into repeated contact with one another, as shown in the study's findings of Johnson et al. (2021) [12]. The goal is for the inflammation or cartilaginous metaplasia to be eliminated so that the symptoms can be reduced. Previous research has shown that nighttime usage of a metacarpophalangeal (MCP) splint can alleviate triggering symptoms and reduce disability [8].

Also, according to the previous study, ultrasound therapy caused tissue vibration, generating heat in the tissue that increases blood flow and removes inflammatory exudations which helped to reduce pain, increase the extensibility of collagen fibers, and reduce the viscosity of fluid elements in the tissue [18].

In contrast, Chys et al. (2023) [4] examined the impact of DN versus sham needling on local as well as distant pressure pain thresholds in addition to conditioned pain modulation in individuals suffering from chronic idiopathic neck pain. The study compared the two treatments immediately after the procedure. Their results showed that in patients suffering from chronic idiopathic neck pain, neither DN nor SN had a more beneficial impact on local or distant PPTs and CPM.

Also, our result was contraindicated with the aim of the study carried out by Stieven et al. (2020) [23] in which patients were assigned into two groups to obtain either guideline-based physiotherapy or guideline-based physiotherapy in addition to DN. Only 1 month after randomization did DN produce a minor enhancement of pain when used in conjunction with physiotherapy based on guidelines for treating neck pain. Disability was unaffected.

The goal was to assess the effectiveness of radial extracorporeal shock wave therapy and DN in treating myofascial trigger points in the upper trapezius muscle, which contradicts our findings (Luan et al., 2019) [15]. Following three sessions, patients suffering from myofascial trigger points reported pain relief, improved function, and a decrease in shear modulus; the extracorporeal shock wave therapy had the same effect of DN.

Limitation

There are a few limitations to this study. First, convenience sampling was used to select patients, but it was not able to accurately reflect the entire population. It would be helpful for future research to address the lack of follow-up information on the individuals' health state, which would allow for better tracking of the long-term impacts of DN.

Conclusion

In patients with trigger finger, a 5-week dry needling, finger splint, and ultrasound therapy led to significant enhancement in QOL, pain intensity, and hand grip strength recommending it as a better choice.

Abbreviations

A1	First annular
CI	Corticosteroid injection
DN	Dry needling
MTRP	Myofascial trigger points
TF	Trigger finger
QoL	Quality of life
VAS	Visual analog scale
HGS	Hand grip strength
MCP	Metacarpophalangeal
PPTS	Pressure pain thresholds
CPM	Conditioned pain modulation
SD	Standard deviation

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Authors' contributions

EFE contributed to the concept or design of the article. EFE, AAY, SAG, and HKA contributed to the acquisition, analysis, or interpretation of the data for the article. EFE, AAY, SAG, and HKA drafted the article or revised it critically for important intellectual content. The authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This was approved by the Ethics Committee of the Faculty of Physical Therapy at Cairo University (P.T.REC/012/003924). Another distinct number is derived from the Clinical Trials Registry, specifically identified as the Registry ID: NCT05671523.

Consent for publication

Consent for the publication of pictures is obtained from the participants.

Competing interests

The authors declare that they have no competing interests.

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