Article published online: 2022-08-04

Effect of TheraBand Flex Bar versus Strengthening Exercise in Patients with Lateral Epicondylitis

Biva Rani Kalai[1] Sudhakar Subramanian[1]

[1] Department of Physiotherapy, Krupanidhi College of Physiotherapy, Bengaluru, Karnataka, India

J Health Allied Sci[NU] 2023;13:241–246.

Address for correspondence Sudhakar Subramanian, MPT (Sports), PhD, Krupanidhi College of Physiotherapy, Bengaluru 560035, Karnataka, India (e-mail: sudhakar.sports@gmail.com; physio.kric@krupanidhi.edu.in).

Abstract

Background Lateral epicondylitis (LE) is an exertion or sporting-connected aching condition of the extensor muscles of the forearm. The core warning signs are pain and soreness of the outside on the elbow and grip strength weakness. The investigation aims to differentiate the effect of TheraBand flex bar versus strengthening exercise on pain, grip strength, range of motion, and functional status.

Objectives To find the effects of TheraBand flex bar, strengthening exercise, and compare the effects of Thera band flex bar versus strengthening exercise on the elbow pain, handgrip strength, elbow and wrist range of motion, and functional disability status in lateral epicondylitis.

Design Quasi-experimental study.

Methods Thirty (30) patients with lateral epicondylitis were enrolled, both male and female, randomly assigned to control or 6-week training groups. They were subdivided into two groups. Subjects were pre-tested and post-tested using a hand-held dynamometer, the VAS, PRTEE Questionnaire Functional status, and goniometer.

Results The results showed a statistically significant difference between pre and post-treatment in the study batch. The results show that Batch-1 and Batch-2 were significantly improved with *p*-values of 0.000, 0.004, 0.000, 0.001, 0.001, 0.004 at $p < 0.05$.

Conclusion In this study, the TheraBand flex bar and the strengthening exercise for lateral epicondylitis effectively reduced pain, enlarged the functional status, and improved the range of function within 30 subjects with lateral epicondylitis. The study concluded that TheraBand flex bar in Batch-1 and strengthening exercise in Batch-2 significantly improved VAS, PRTEE, handgrip strength, and ROM. The study's outcome suggests that TheraBand flex bar and strengthening exercise of extensors muscles of the wrist can be productive for the treatment among lateral epicondylitis (LE) sufferers.

Keywords
- lateral epicondylitis
- pain
- Theraband flex bar
- strengthening exercise
- grip strength
- phonophoresis
- range of motion
- dumbbell

Introduction

Lateral epicondylitis (LE) is an inflammation of the lateral epicondyle, also commonly known as tennis elbow,[1] which is associated with work or sports-related pain disorder of the extensor muscles of the forearm. The inflammation is caused by the unrestrained, rapid, repeated motion of the forearm and wrist, which raptures proximal attachment of long extensor muscles of the forearm, which cause constant pain and local inflammation.[2–4] LE is a deteriorating or

article published online
August 4, 2022

DOI https://doi.org/10.1055/s-0042-1753509.
ISSN 2582-4287.

© 2022. The Author(s).
This is an open access article published by Thieme under the terms of the Creative Commons Attribution License, permitting unrestricted use, distribution, and reproduction so long as the original work is properly cited. (https://creativecommons.org/licenses/by/4.0/)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

disastrous curing tendon response, which is characterized by the developed fibroblasts, proteoglycans, glycosaminoglycans, and immature collagen.[5,6] It typically affects nearly 1.0 to 4.0% of females and 1.0 to 1.3% of males and occurs in all age groups; the peak frequency is between 30 and 60 years of age groups.[7]

Therefore, progressive slow, repetitive strengthening exercises improve the strength of the muscles and the ability to tolerate repeated motion, increasing the load and stress acting on the muscle.[3] Lateral epicondylitis is a disease that affects persons who perform repeated upper body tasks. Examples are instrumentalists, tennis players, carpenters, and computer programmer coders.[7,8] The maximum area of tendinosis is one to two centimeters distal to its attachment at the lateral epicondyle in the Extensor carpi radialis brevis (ECRB) tendon.[7] Interpretation is easy and can be dedicated to the test of reconstructing the discomfort, such as palpation above the facet of the lateral epicondyle and limitation of the wrist and middle finger extension.[9,10]

In a recent study on LE, Walf et al reported that the management has been designed by a shift in the perception of the illness course from an experience of inflammation to one of deterioration of a section of the extensor tendon of the forearm cause.[11] Anatomically, the muscle includes the extensors carpi radialis brevis and not the pronator teres, as was counseled. ECRB originates from the lateral epicondyle, fleeting distally with ECRL. While the brevis essentially inserts into the base of the third or primary metacarpal, the longus goes into the bottom of the second metacarpal.[12]

The works, games, and local tasks claim wrist extensions are myriad. Some examples are drains, drawing, plaiting, scraping, using screwdrivers, pliers, and sledgehammers, cutting meat; turning doorknobs, trawling, racket sports, and other deform motions; and raising objects with a wrist extended.[13]

Whatever the cause of the injury, LE usually presents as a little pain in the lateral part of the elbow. The variant warning signs are pain when the wrist is in extension, pain when trembling hands, and regularly a debilitated grip while enlivening a cup or a glass carrying a bag by a holder can precipitate pain.

The handgrip has been an indicator of resolve strength. Grip strength has been corresponding to function in hand dominance and overall physical fitness.[13] Dynamometer measurement for grip strength is highly reliable. It is a well-known outcome measure in the research field in the management of LE.[14] Different physiotherapy treatment options include rest, electrical stimulation, ultrasound, soft tissue massage, stretching, acupuncture, drugs, LASER, and even surgery in severe cases. Eccentric exercise efficiently elongates the muscle–tendon complex.[7,8,15,16]

Resistance exercise is performed by the tool called Theraband flex bar. It is inexpensive and portable equipment. Once patients learn the exercise, they can lightly perform it. Thus, it helps to maintain muscle performance and reduce functional activities.[17] Recently, resistance exercise was reported to be productive in LE.[18] The main intention of LE management is to relieve pain, protect the movement, and intensify flexibility, muscle strength, and muscle endurance. The conception of this exercise training program is based on increasing the strength of the tendon by progressively overcharging it to promote a rise in tensile strength. As a result, soreness is decreased.

Materials and Methods

Subjects

This training included 30 patients, male and female. The patients were interpretative with LE at Krupanidhi outpatient department in Bengaluru. Patients were in anguish from discomfort, with limited wrist flexion range, extension, and weak handgrip. They were divided into two batches. The first batch-1 observed a physiotherapy program concentrating on TheraBand flex bar with phonophoresis ($n = 15$, 5 females, 10 males). The physiotherapy program of the second batch-2 focused on strengthening exercise with phonophoresis ($n = 15$, 7 females, 8 males). They received treatment for 6 weeks. Patients who qualified for this training were 30 to 60 years old. All patients were non-athletic, including both male and female. The inclusion criteria for the study were patients who were clinically diagnosed with LE, tenderness present on palpation under the lateral epicondyle and discomfort while griping, history of pain under the lateral epicondyle for a minimum of 1 month, pain on Vas score 7 or more than 7. The exclusion criteria were previously any surgical procedure to the elbow area, any history of fracture of radius/ulna, RA, and corticosteroid injection on elbow within 6 months.

Outcome Measures

Goniometer to measure the range of wrist flexion, wrist extension, and elbow flexion.
VAS to measure the severity of pain.
Hand-held dynamometer to measure the power of the handgrip.
PRTEE scale to test the functional status.

Methodology

The patients hired learned consent forms, and patients learned about the entire management measures earlier before training and testing (►**Fig.1**).

Management Procedure

Subjects were selected and divided into two batches, five teens in each batch. Batch-1 received TheraBand flex bar and phonophoresis, and Batch-2 received strengthening exercise and phonophoresis. The management for each group was continued for 6 weeks. The questionnaires (PRTEE), clinical test, and painless grip testing were done before and after the end of 6 weeks, and Vas scores were taken after 7 days of treatment and after 6 weeks.

Theraband Flex Bar Exercise Program

TheraBand flex bar exercise was given for 6 weeks 5 times a week. The Flex Bar exercise was carried out for three sets of

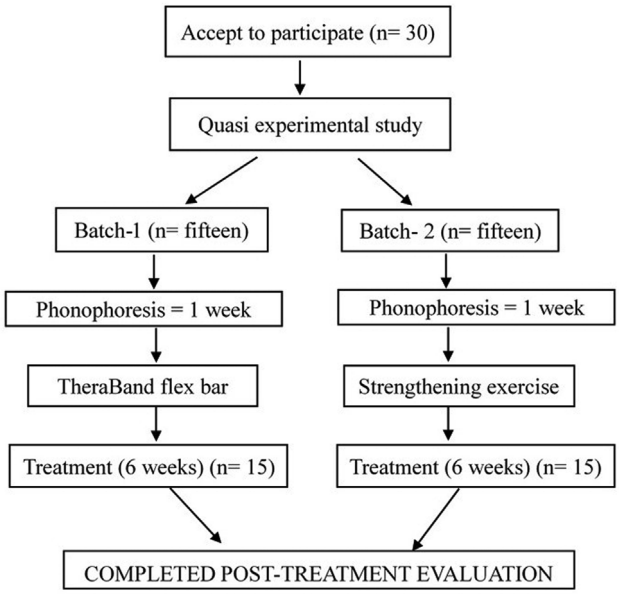

Fig. 1 Design of the study (STROBE flow diagram).

fifteen repetitions. Every recurrence took 4 seconds to complete the exercise, and there was a 30-second rest among each set of recurrences of the exercise. This exercise program was carried out in a seated or standing position. There were five steps of the exercise, the patients were to hold the flex bar in the involved hand in a maximum extension of the wrist, and the patients would grab another end of the flex bar with a non-involved hand. Then, the patient would twist the flex bar with the uninvolved hand while holding the involved wrist in extension. The patients would bring the arms in the forefront of the body and elbows extension while controlling the twist in the flex bar by holding fully with the uninvolved wrist and the involved wrist fully in the extension. Then, the patients would gradually allow the flex bar to untwist by granting the wrist to transfer into flexion. TheraBand flex bar level-1 yellow color, extra light (6 lbs) was used.

Strengthening Exercise Program

Batch-2 were experienced in four sets of strength training programmes with a dumbbell. Every exercise program consists of 10 repetitions of strengthening exercises, performed for 6 weeks. Begin each step with no weight and increase the repetitions until the patients can complete it progressively. When the patients can perform 10 repetitions without accelerating pain, we move to advance the training using 1 kg weight. The same procedure and weight until reach 3 kg are followed (Dumbbell hand weight starts at 1 kg, progresses to 2 kg, ends at 3 kg). In wrist flexion performed by the dumbbell, the patient will be sitting on a comfortable chair holding a dumbbell. The palm faces upward, and the elbow rests securely on the knee and shoulder to be stabilized. Keeping palm facing up, the patient is asked to flex the wrist by cycling it toward the body. The patient is asked to return to the starting position and repeat it 10 times. The patient is asked to try to set a part of the motion to the wrist, keeping the rest of the arm still. For wrist extension, the patient is asked to sit on a chair holding a dumbbell in hand with the palm facing downward, the elbow resting comfortably on the knee, and the shoulder stabilized, keeping the palm facing downward, the patient is asked to extend the wrist by cycling it toward the body, the patient is instructed to come back to the starting position and reiterate 10 times. The patient is asked to try to set apart the movement to the wrist, keeping the rest of the arm still. In supination, the patient is asked to sit on a comfortable chair holding the dumbbell precipitously in the hand with the elbow resting on the knee and the shoulder stabilized. The patient is asked to allow the bulk of the dumbbell to help whirl the arm externally, whirling the palm up. The patient would whirl the head back in the outer direction until the palm faces downward. The patient is asked to try to set apart the motion to the lower arm, keeping the upper arm and elbow still.

Phonophoresis

Patients of both groups received phonophoresis. Phonophoresis is used to exploit the effects of topical drugs. It uses acoustic energy to drive whole molecules into the deeper tissues via the skin and enhance the absorption of analgesics. The thermal effect of phonophoresis increases tissue permeability. An ultrasound device was used to apply phonophoresis. An analgesic gel was combined with aqua sonic ultrasound gel to better transference the medication over the body. Phonophoresis with analgesic gel is an efficient coupling agent. When it is mixed with an aqua sonic ultrasound gel, it enhances ultrasound by providing fast relief. It also produces a cooling sensation. It was given for 7 days. The detailed treatment protocol was that the patient would be comfortable in the sitting position. The arm would be supported on a table with the elbow flexed to 90 degrees, the forearm is in pronation, and a pillow supports the wrist with the pulsed mode of ultrasound. Dosage-1 watt/cm^2, frequency-1 MHz over the area, pulse-1:4 for 1 minute per session, analgesic gel-2 g/day.

Assessment Measures

The LE sufferers were evaluated before management and reassessed after 6 weeks.

A manual goniometer was used to measure the range of motion of wrist flexion, extension, and elbow flexion. The secure part of the goniometer was positioned in parallel to the forearm and the mobile part in parallel to the ulnar side of the hand. The patient was instructed to flex and extend their wrist while the little finger was in the zero position. Every motion was noted for three periods to get the final range.

Using VAS to rating pain, characterized from 0 to 10, with 0 being no discomfort and 10 being severe discomfort.

A hand-held dynamometer was used to test the grip strength with a fixed elbow. The variation in hand-held dynamometer pressure was noted earlier and later by the management. Patients with LE were instructed to squeeze the hand-held dynamometer as hard as possible, and

three grip strength measurements were calculated (kilogram-force).

The level of function was determined using the PRTEE questionnaire, which is a valid and reliable form of evaluation of pain and function. The questionnaire comprises two subscales for function and pain. The first 5 queries examine the pain status, and the following 10 queries examine the level of function (six things for a specific activity and four things for usual activity).

Statistical Examination

Least and supreme values, standard deviation (SD), and mean were used for descriptive statistics. The difference between batch-1 and batch-2 was compared using paired *t*-test at a self-assurance level of 0.05.

Results

According to the data shown in ►**Table 1**, the pre-test and post-test VAS score mean in batch-1 was 2.733 with a *p*-value of 0.000, and in batch-2, the mean was 2.733 with a *p*-value of 0.000, which was significant. The pre-test and post-test PRTEE score in batch-1 mean was 0.467 with a *p*-value of 0.004, and in batch-2 mean were 0.467 with a *p*-value of 0.004, which was significant. The pre-test and post-test ROM elbow flexion score in batch-1 mean was −5.467 with a *p*-value of 0.000, and the pre-test and post-test ROM elbow flexion score in batch-2 the mean was −7.067 with a *p*-value of 0.000, which is significant. The pre-test and post-test ROM wrist flexion score in batch-1 was −7.533 with a *p*-value of 0.000, and for the pre-test and post-test ROM wrist flexion score in batch-2, the mean was −3.133 with mean *p*-value of 0.001, which was significant. The pre-test and post-test ROM wrist extension score in the batch-1 mean was −7.333 with a *p*-value of 0.000, and the pre-test and post-test ROM wrist extension score in the batch-2 the mean was −4.133 with a *p*-value of 0.001, which was significant. The pre-test and post-test pain-free grip strength score in the batch-1 mean was −3.800 with a *p*-value of 0.000 and the pre-test and post-test pain-free grip strength score mean in the batch-2 was −6.733 with a *p*-value of 0.004, which was significant. The results showed that pain, PRTEE, grip strength, and range of motion showed significant improvement in patients with LE in the experimental group.

Discussion

LE produces a substantial burden of workdays and resulting in lingering impairment. Patients were diagnosed according to their history and physical examination. The study was undertaken to a comparative study on the effects of TheraBand flex bar versus strengthening exercise in a patient with LE. According to statistical analysis, among the study population, 15 were batch-1 and 15 were batch-2.

The outcomes of this study showed a significant improvement in discomfort, range of motion in the wrist, elbow, and elbow flexion in batches 1 and 2, functional status, and grip strength, with TheraBand Flex Bar and Phonophoresis receiving the most attention in physical therapy, respectively.

The TheraBand flex bar program was introduced in the study; the results showed diminished pain, improvement in handgrip strength, and enlargement in functional status and ROM among LE patients. The results for LE were better with the addition of a TheraBand flex bar than strengthening exercise. Analysis of the results showed significant improvement in the pain rating on the VAS, the grip strength by hand-held dynamometer, PRTEE scale, and range of motion by a manual goniometer.

Analysis of pain rating was done by VAS, functional status by PRTEE, hand grip strength by hand-held dynamometer, and range of motion by manual goniometer in batch-1 and batch-2. The comparison of age, sex, VAS, PRTEE, grip strength, and range of motion of samples is shown in the

Table 1 Pre and post scores of pain, range of motion of wrist flexion, extension, elbow flexion, PRTEE questionnaire, and handgrip strength for both the batches

Variable	Batch	Mean	SD	*t*	DF	Sig. (2-tailed)
VAS	Batch-1	2.733	0.961	11.014	14	.000
	Batch-2	2.733	.704	15.043	14	.000
PRTEE	Batch-1	.467	.516	3.500	14	.004
	Batch-2	.467	.516	3.500	14	.004
Rom for elbow flexion	Batch-1	-5.467	2.696	-7.854	14	.000
	Batch-2	-7.067	3.634	-7.530	14	.000
Rom for wrist flexion	Batch-1	-7.533	5.222	-5.587	14	.000
	Batch-2	-3.133	2.875	-4.221	14	.001
Rom for wrist extension	Batch-1	-7.333	2.582	-11.000	14	.000
	Batch-2	-4.133	3.739	-4.281	14	.001
Grip strength	Batch-1	-3.800	1.082	-13.598	14	.000
	Batch-2	-6.733	7.713	-3.381	14	.004

tables and concluded that batch-1 and batch-2 were significantly improved.

Lateral epicondylitis is the greatest common limiting condition of the elbow region, which is settled after strong and fast concentric and eccentric contractions of the wrist extensors. Habitually defined as misuse damage were the capability of the tendon to restore itself converts overpower and this may lead to hampering the activities of daily living (ADL).

The given electrical instrument was phonophoresis. Relief pain by phonophoresis that happens by straight prompting the transmission of aching impulses by provoking variations within the fibers. Unintended discomfort reduction results in increased blood circulation and capillary penetrability. A decrease in VAS replicated this result.

Majeedkutty et al (2016) studied the effect of eccentric exercise on grip strength and discomfort among LE patients. The study exposed that eccentric exercise is extra effective in diminishing discomfort and refining grip strength among LE patients than standard physiotherapy. This study also shows that the TheraBand flex bar affects pain and functional status among LE patients.[7]

The theory behind the TheraBand flex bar is to charge the musculotendinous part, which encourages hypertrophy and cumulative tensile strength. This tries to decrease the strain on the tendon throughout the tasks. Eccentric contraction creates a larger provocation for the cells of the tendon.

Viswas et al illustrated the frequent session result. Afterward, the whole recuperation was attained following the first eccentric excess session. A frequent program results in minimal warning signs of muscle injury, permitting eccentric excess to become a viable program, especially when measured that the frequent session result can last for only 30 weeks.[19]

Baskurt et al compared the results of iontophoresis and phonophoresis of naproxen in the management of LE. This study was carried out with 61 patients who have LE, and the results suggested that iontophoresis and phonophoresis of naproxen are the effectual electrical healing techniques in the management of LE.[20]

Upadhyay et al studied the results of strengthening exercises in chronic LE, they had found that the strengthening exercise combined with conservative therapy was additional effective in diminished discomfort, refining functional disability, and refining grip strength than conservative physiotherapy alone among the patients with long-lasting LE.[3]

McDermid, PRTEE questionnaire is the primary customer rated by the patient's sense of aching and Functional Scale that is valid and reliable. The primary complaint is palpable soreness over the lateral epicondyle (LE), which is expressed by waning grip power and difficulty moving. People's functionality is affected by squeezing, booming objects with an extended elbow, and dragging chores with a flexion of the elbow. VAS is the most common scale used to observe the pain intensity.[21]

In this research, a pain-free grip strength verified a better magnitude of change in the affected hand. The TheraBand flex bar and strengthening exercise results showed a substantial result in aching, functional status, and pain-free grip strength in the affected hand and ROM. Eccentric exercise programs seem to be tense to myotendinous elements. Hence, developing step-by-step training can endorse healing without traumatization. A programme of strengthening exercises that heightens tendon collagen orientation and stimulates end point linkage.

Limitations of the Study

The study was limited to an age group of 30 to 60 years. The study was limited to only LE patients. This study could not be generalized to everyone as the sample size was small. No continuing follow-up data were saved in the study. The study was mostly dependent on modalities and exercises. Patients were selected based on clinical diagnosis.

Recommendations for Further Studies

It is advised to monitor the ongoing effectiveness of the treatment strategies employed in this study and encourage the physiotherapist to implement the TheraBand flex bar programme for an ideal reduction in warning symptoms among LE patients. Big sample size and ongoing monitoring. Determined the interventions utilised in this study's interventions' long-term effects.

Conclusion

In this study, the TheraBand flex bar and strengthening exercise for LE were productive in diminished pain, enlarging functional status, and improving range in 30 patients with LE. The study can be concluded by stating that TheraBand flex bar in batch-1 and strengthening exercise in batch-2 showed statistically significant improvements in VAS, PRTEE, grip strength, and ROM, and the TheraBand flex bar and strengthening exercises help improve the grip strength and functionality of the hand between pre and post-training. Batches 1 and 2 were equally effective. After 6 weeks of the training program, both were equally effective in treating lateral epicondylitis ($p < 0.05$). This study proposes that TheraBand flex bar and strengthening exercise of extensors muscles of the wrist can be effective for the management among LE sufferers.

Conflict of Interest
None declared.

Acknowledgment
The authors are grateful for the support provided by the Management of Krupanidhi College of Physiotherapy and the Krupanidhi-Research Incubation Center (K-RIC) in the successful completion of this work.

References

1 Lee JH, Kim TH, Lim KB. Effects of eccentric control exercise for wrist extensor and shoulder stabilization exercise on the pain and functions of tennis elbow. J Phys Ther Sci 2018;30(04): 590–594

2 Pienimäki TT, Tarvainen TK, Siira PT, Vanharanta H. Progressive strengthening and stretching exercises and ultrasound for chronic lateral epicondylitis. Physiotherapy 1996;82(09):522–530
3 Upadhyay S, Shukla Y, Patel KK. Effects of progressive strengthening exercise in chronic lateral epicondylitis. International Journal of Health Sciences & Research 2017;7(04):244–257
4 Vasseljen O. Low-level laser versus traditional physiotherapy in the treatment of tennis elbow. Physiotherapy 1992;78(05):329–334
5 Stasinopoulos D. The effectiveness of isometric contractions combined with eccentric contractions and stretching exercises on pain and disability in lateral elbow tendinopathy. A case report. J Nov Physiother 2015;5(238):2
6 Kraushaar BS, Nirschl RP. Tendinosis of the elbow (tennis elbow). Clinical features and findings of histological, immunohistochemical, and electron microscopy studies. J Bone Joint Surg Am 1999; 81(02):259–278
7 Nizar Abdul M. Effects of therapeutic Exercise on pain and grip strength in persons with lateral epicondylitis: a randomized controlled trial. J Nursing Health Sci 2016;5(04):66–71
8 Stasinopoulos D, Stasinopoulou K, Johnson MI. An exercise programme for the management of lateral elbow tendinopathy. Br J Sports Med 2005;39(12):944–947
9 Page P. A new exercise for tennis elbow that works!. N Am J Sports Phys Ther 2010;5(03):189–193
10 Haker E. Lateral epicondylalgia: diagnosis, treatment and evaluation. Crit Rev Phys Rehabil Med 1993;5:129–154
11 Faro F, Wolf JM. Lateral epicondylitis: review and current concepts. The Journal of hand surgery. 2007;32(08):1271–19
12 Flatt AE. Tennis elbow. Proceedings (Baylor University. Medical Center) 2008;21(04):400–402
13 Maureen Salter, Lynn Chesire. Hand Therapy Principles and Practice, 1st ed,. Butterworth-Heinemann publishersOxford2000;40:53
14 Bohannon RW. Intertester reliability of hand-held dynamometry: a concise summary of published research. Percept Mot Skills 1999;88(3 Pt 1):899–902
15 Geoffroy P, Yaffe MJ, Rohan I. Diagnosing and treating lateral epicondylitis. Can Fam Physician 1994;40(40):73–78
16 Baktir S, Ozdincler AR, Mutlu EK, Bilsel K. The short-term effectiveness of low level laser, phonophoresis, and iontophoresis in patients with lateral epicondylosis. J Hand Ther 2019;32(04): 417–425
17 Tyler TF, Thomas GC, Nicholas SJ, McHugh MP. Addition of isolated wrist extensor eccentric exercise to standard treatment for chronic lateral epicondylosis: a prospective randomized trial. J Shoulder Elbow Surg 2010;19(06):917–922
18 Croisier JL, Foidart-Dessalle M, Tinant F, Crielaard JM, Forthomme B. An isokinetic eccentric programme for the management of chronic lateral epicondylar tendinopathy. Br J Sports Med 2007; 41(04):269–275
19 Viswas R, Ramachandran R, Korde Anantkumar P. Comparison of effectiveness of supervised exercise program and Cyriax physiotherapy in patients with tennis elbow (lateral epicondylitis): a randomized clinical trial. The scientific world journal. 2012;2012
20 Başkurt F, Özcan A, Algun C. Comparison of effects of phonophoresis and iontophoresis of naproxen in the treatment of lateral epicondylitis. Clin Rehabil 2003;17(01):96–100
21 MacDermid JC. The Patient-Rated Tennis Elbow Evaluation (PRTEE) User Manual. Hamilton, CanadaSchool of Rehabilitation Science, McMaster University. 2007