



A Comparative Study to Evaluate the Efficacy of Supervised Exercise Program and Cyriax Physiotherapy on Pain and Function in Lateral Epicondylitis

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Authors' contributions

This work was carried out in collaboration between both authors. Authors GK and PP contributed in designing of the study, statistical analysis, writing the protocol and writing the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: To see the effectiveness of supervised exercises and cyriax physiotherapy both including therapeutic ultrasound for improving pain and function in adults with lateral epicondylitis.

Study Design: Comparative study- to find out the efficacy of effectiveness of two different interventions for reducing pain and improving function in patients with lateral epicondylitis

Place and Duration of Study: Department of Musculoskeletal Physiotherapy Sciences, Ravi Nair Physiotherapy College, Sawangi (Meghe), Wardha, for 12 months.

Methodology: A total of 30 people with lateral epicondylitis (tennis elbow) were selected to take part in a comparative research. Subjects were randomized 1:1 to either (1) supervised exercise programme group, or (2) cyriax physiotherapy group. Over just a 4-week period, three times each week for a sum of 12 sessions, promptly after baseline evaluation and randomization, subjects received static stretching of Extensor Carpi Radialis Brevis followed by eccentric strengthening of

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the wrist extensors and Therapeutic Ultrasound in supervised exercise programme group. While those in cyriax physiotherapy group received deep transverse friction massage for 10 min immediately followed by Mill's manipulation and Ultrasound. The study concluded at the 4 weeks.

Results: Out of 30 patients half were placed in each group, where $p=.0001$. Significant increase in mean in the group I and II in pre ad post-test VAS score (4.20 ± 0.77 and 5.20 ± 0.67) and TEFS score pre and post-test (17.33 ± 1.44 and 19.80 ± 1.42). analysis showed significant improvement in both the groups.

Conclusion: From the observations and results, the conclusion drawn that there is significant improvement in both the groups but effect of cyriax physiotherapy in the form of deep friction massage and mills manipulation combined with therapeutic ultrasound for improving pain on VAS and function on TEF scale.

Keywords: Supervised exercise program; cyriax physiotherapy; lateral epicondylitis; TEFS; VAS; therapeutic ultrasound.

1. INTRODUCTION

Lateral epicondylitis occurs at the lateral humeral epicondyle, which is an extensor muscle origin that degenerate musculotendinous junction [1]. The elbow is a robust complex joint, which consists of three different articulations, which are humaroulnar articulation, humeroradial articulation, and proximal radioulnar articulation [2]. It can endure large loads during certain activities, particularly in racquet and sports throwing. In the pathoanatomy of throwing athletes or in the elbow dislodging and instability, the ligamentous complexes of the elbow are involved. Population studies have demonstrated a frequency of 1 to 3 percent among 30 to 64-year-olds of incidence with worldwide population peaks between 45 and 54. In Indian population the incidence and prevalence of lateral epicondylitis is insignificant for male and female genders while 1 to 4 percent of the population gets affected to this degenerative disease [3]. The humero-ulnar articulation is formed by the trochlea of the humerus distally and trochlear notch of the ulna. Joint is sturdy and compatible. The olecranon and coronoid processes are, accommodated by fossae in the humeral shaft axis [4]. Lateral epicondylitis (LE) is a common musculoskeletal condition that develops as a result of recurrent microtoroid to the upper extremity, affecting the lateral epicondyle of the elbow in particular [5]. In 1873, the German doctor Runge described lateral epicondylosis (LE) as writer's cramp or tennis elbow. While the cause is unknown, Cyriax defined 26 potential mechanisms and divided them into three categories: neuro-irritation process, repetitive pain, and tendon injury [6] Mechanical tension at the insertion of the extensor carpi radialis brevis muscle is the primary cause of LE. LE is frequently seen in those who engage in

repeated, resistance-based, and wrist extension exercises [7,8]. If neglected, it can result in chronic pain syndrome, sensitivity, and discomfort in the lateral epicondyle, especially with resistive wrist and middle-finger extension. Grip strength may deteriorate, and everyday activities (ADL) may be severely restricted [9]. It occurs more often in the dominant arm, indicating that overuse is a major contributor [10].

LE is, often treated conservatively, with education and occupational ergonomic advice and physiotherapeutic modalities being the most common treatments. The treatment methods used in medicinal orthopaedic are largely dependent over the kind of condition, cyriax includes manipulations and deep friction massage. Techniques of manipulation (small-amplitude, rapid and passive movement with thrust, also called "C grade mobilisation") are accustomed to reduce tiny gristly displaced particles in the spine in joints of periphery (slack objects). Manipulation are often requisite to reinstate usual movability in a joint that has been limited by ligamentous adhesion or when bones have become subluxed. Deep friction is an effective treatment for soft tissue lesions caused by trauma or overuse. The logic for incorporating deep friction (a type of soft tissue mobilisation) is backed up by decades of research that confirms and explains the positive effect of movement on muscle and skeletal tissues healing [11].

Static stretching is described as slowly placing the muscle tendon unit in a maximum stretch and keeping it there for an expanded period of time. The optimum position of stretching is evaluated by the patient's mild discomfort and/or pain. It is difficult to activate the stretch reflex, which induces contraction of the muscle tendons rather than relaxation [12]. Furthermore, since the

viscoelastic structure of muscle tendon unit that elongates, the muscle tendon unit's resistance is low in slow static stretching than in fast static stretching. Only the harmed tendon, not every tendons around the skeletal field, should be stretched with static stretching exercises, according to therapists [13].

2. METHODOLOGY

A comparative study performed during year 2020 and 2021 in the Department of Musculoskeletal Sciences, Ravi Nair Physiotherapy College, Sawangi (Meghe), Wardha. Patients in the study were, referred from orthopaedicians, tertiary health care providers and self-referred subjects. Patients were included who has been diagnosed with lateral epicondylitis since 6 weeks to 10 weeks and were aged between 20-50 years.

2.1 Inclusion Criteria

- Patients with positive Cozen's test
- All genders
- Age between 20-50 years.
- Patients with pain on passive wrist flexion with the elbow extension
- Patients with wrist pain with resisted extension
- Patients having tenderness over lateral epicondyle of humerus on palpation

2.2 Exclusion Criteria

- Cervical radiculopathy
- Neurological impairments
- Any trauma to the area of Elbow before
- Every procedure for elbow and elbow pain that has been developed from any disease other than lateral epicondylitis
- The subjects who having neuromuscular diseases
- Peripheral nervous disorder and
- Injection of corticosteroids 6 months prior to the start of research

In advance of participating in the study, all participants signed a written consent as part of the recruitment process, patients were, asked to fill out a standard health questionnaire that included information on their demographics, symptoms duration, past treatments, and employment status.

2.3 Treatment

Group A patients were given a supervised therapeutic exercise programme that comprised

static stretching of the Extensor Carpi Radialis Brevis followed by eccentric strengthening of the wrist extensors. In the sitting posture static stretching was, achieved with elbow is in extension, supination of forearm and wrist flexion with ulnar deviation. The stretch force was, administered based on patient's forbearance. This stretch position was, sustained for 30–45 seconds and was, repeated three times previous and three times succeeding the eccentric exercise part of the therapy for a total of six repetitions. (Fig. 1) Each round of stretching was, preceded by a 30-second rest period [14]. In the sitting position, eccentric strengthening exercises were, done with full elbow in extension, pronation of forearm, and in maximum wrist extension. From this pose, the patient gently descended the wrist into flexion for a number of 30 counts and, then returned wrist to maximal extension with the opposite hand. Patients were, told to carry on with exercising even though they felt slight discomfort, and to cease exercising if the pain worsened and became debilitating. The freight was raised using free weights depending on the patient's 10RM (Repetition Maximum) for those who could perform the eccentric exercise with little or no discomfort or suffering. During each treatment, three sets of ten repetitions were, done, with a one-minute rest break for every repetition [15].

Group II patients got Cyriax physiotherapy, which consists of 10 minutes of deep transverse friction massage followed by a one application of Mill's manipulation. The placement of the hand shown in figure. The patient was, comfortably positioned in sitting with completely supinated elbow and kept it in 90 degrees of flexion. The soreness was located by palpating the anterolateral portion of the lateral epicondyle of the humerus. The side of the thumb tip is, used to apply deep transverse friction. (Fig. 2) Pressure was, applied from the posterior side to the tenoosseous junction. Before the numbing effect was, achieved, it was, administered for ten minutes to make ready the tendon for Mill's manipulation [16] Mills manipulation was, performed on patient who was, comfortably sitting in chair, with the afflicted limb in ninety degrees of abduction and adequate internal rotation such that the olecranon process look out on above side. The therapist used one hand to support the patient's pronated and wrist fully flexed, while the other hand was, put on the olecranon. The therapist administered a thrust of low-amplitude and high velocity at the end range of elbow extension at

the same time maintaining complete wrist flexion and pronation [17,18] (Fig. 3)

Participants assigned to both the groups received conventional treatment in the form of therapeutic ultrasound. After the manual treatment, there was 5 min application of therapeutic ultrasound with, parameters of 1 MHz frequency, 1:4 ratio of pulsed mode with 0.8

W/cm² intensity [19]. A piezoelectric action induced by crystal vibration within the head of the wand/probe generates ultrasound waves. Sound waves that travel through the skin cause local tissue to vibrate. This vibration or cavitation can create a profound warmth locally, however the patient generally does not feel any heat. The frequency of therapeutic ultrasound varies from 0.5-3.0 MHZ.



Fig. 1. The eccentric exercise



Fig. 2. deep transverse friction



Fig. 3. Complete wrist flexion and pronation

2.4 Outcome Measures

Pain intensity and functional status were collected at the start of the trial (pretest) and at the end of four weeks as outcome measures. The outcome measures were evaluated by an impartial observer who was not aware of the patient group allocation. VAS will evaluate the pain, in which is a horizontal bar of 10 cm with two ends zero cm is a 'minimum imaginable pain' and ten cm "worst pain imaginable". The patient must draw an upright line on a horizontal scale based on their current level of discomfort. During the 24 hours before each assessment, the pain VAS was used to assess the worst pain amount of the subject and this strategy proved valid and responsive for VAS. For both groups, the VAS pain scale was used, and contrasted. Testing-the reliability of the test has been demonstrated to be good and has designed validity for VAS pain [20].

The functional activity of the elbow was examined using the Tennis Elbow function scale, which has 10 groups of activities with ratings depending on discomfort or pain, i.e. 'No discomfort' to 'Extreme discomfort'. This measure is used to assess pain-related function in conjunction with scale's score. The individuals was told to execute a series of tasks that may be challenging owing to the underlying issue and to assess the degree of their discomfort appropriately. Maximum scores imply a higher degree of impairment. TEFS is valid, reliable and responsive measure in evaluating function based on activities in Lateral Epicondylitis which, had ICC 1 where 1 was 0.92 that is 95% [21].

2.5 Data Analysis

The patients those willingly volunteered for the study were included and purpose was, explained. Total 37 Lateral Epicondylitis participants were assessed for the exclusion and inclusion criteria of the research, from which, 3 participants were not meeting the inclusion criterion and 4 discontinued the treatment due to pandemic. Therefore, this research comprised 30 participants. The method was thoroughly explained to all eligible individuals, and their informed consent was obtained (n=30) before allocating them into two groups. (Fig. 4)After randomization they were divided into two groups- Group I (n=15) and Group II (n=15) The pre assessment were taken on (0 Day) and post assessment were taken at the end of 4th week

for all outcome measures such as Visual Analog Scale (VAS) for pain, TEF Scale for functional activities.

The software used in the analysis were SPSS 24.0 and Graph Pad Prism 7.0 version and P=.001 is consider as level of significance. Before and after the therapy, the mean differences with standard deviation for outcome measures of pain intensity and function scale were computed. Chi square test, student paired and unpaired t-test were used in this study.

3. RESULTS

Distribution of patients in two groups according to their age in years, where range of year distribution is 25-49 for both Group I and Group II. Mean±SD in Group I is 34.73±6.87 and Group II is 38.20±8.35. By using chi square test, statistically no significant difference was found in age of participants of both the groups. About gender distribution of patients in two groups, male participants were 7 (46.67%) and 8 (53.33%) in group I and Group II while female participants were 8 (53.33%) and 7 (46.67%) in Group I and Group II respectively. (Table 1)

Statistical analysis revealed no significant changes in any of the variables i.e. TEFS and VAS between Group I (supervised exercise programme) and Group II (Cyriax physiotherapy) at the time of first evaluation. At baseline, scores of VAS were discovered to be comparable (similar) between groups (Pre-test). At the 0.0001% level of significance, there is no significant difference between the two groups' pre-VAS scores. At baseline, TEFS scores were found to be comparable (similar) between groups (Pretest). At the 0.0001% level of significance, there is no significant difference between the two groups' pre-TEFS scores. For both the variables, statistical test used is the paired student t-test.

The intragroup comparison of pain intensity as evaluated by VAS at the conclusion of treatment intervention in both Groups I and II reveals that there was a significant reduction in pain intensity after 4 weeks of supervised exercise and Cyriax physiotherapy. The statistical test used was student's paired t-test. The post-test intergroup comparison of pain intensity results measured on VAS shown in Table. Since both groups represents a substantial reduction in pain when contrasted to the pre-test score, the intergroup comparison of VAS scores revealed a statistically

significant reduction in VAS scores in Group II over Group I.

The intra group comparison of functional status as evaluated by TEFS at the conclusion of treatment intervention in both Groups I and II reveals that there was a significant reduction in pain intensity after 4 weeks of supervised exercise and Cyriax physiotherapy. The

statistical test used was student's paired t-test. The post-test intergroup comparison of pain intensity results measured on TEFS shown in Table 2. Since both groups represents a substantial improvement in functional status when contrasted to the pre-test score, the intergroup comparison of TEFS scores revealed a statistically significant reduction in VAS scores in Group II over Group I.

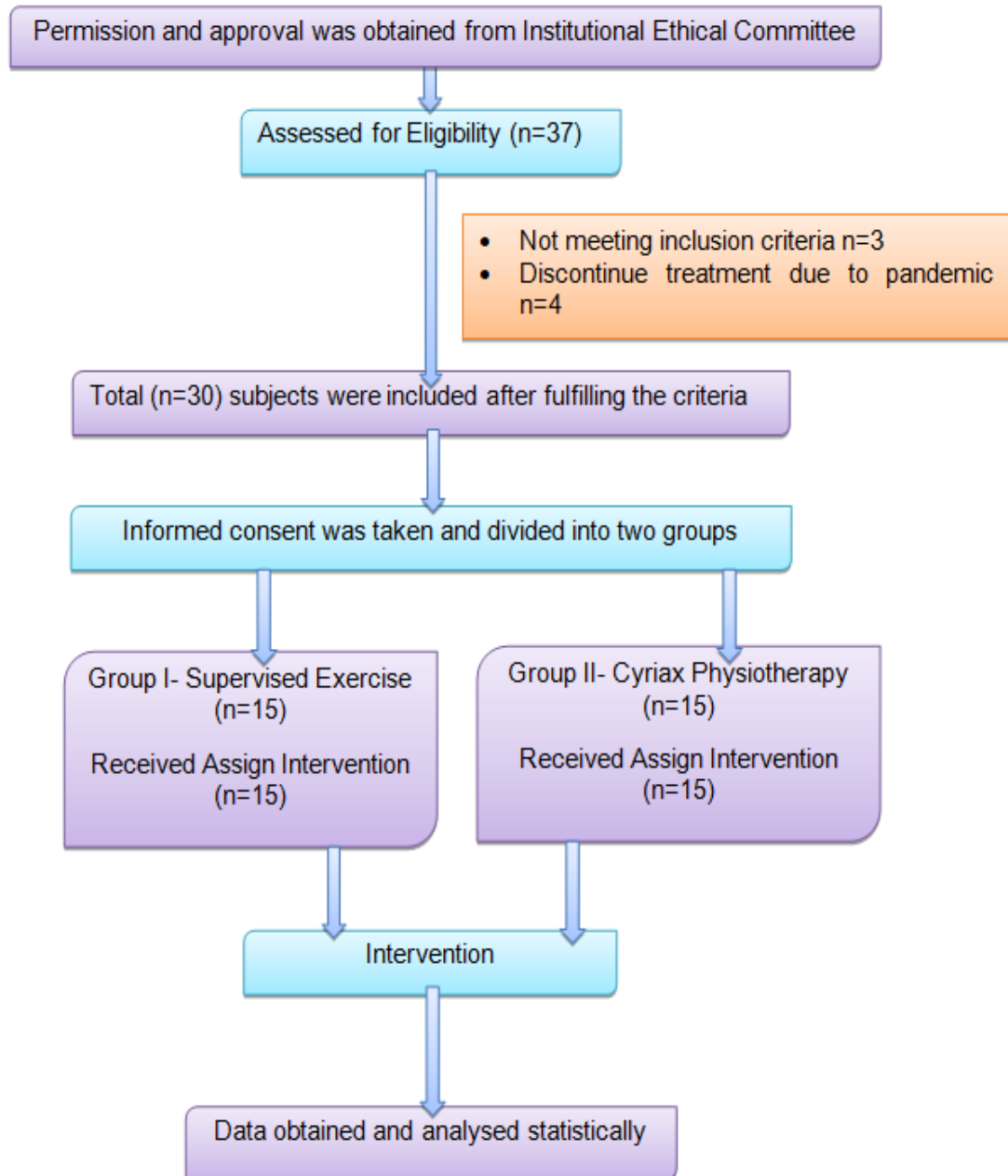


Fig. 4. Schematic design of data analysis

Table 1. Distribution of patients in two groups according to their age and gender

DOMAIN	Group I	Group II	χ ² -value
Age in years			
21-30 yrs	4(26.67%)	3(20%)	4.06
31-40 yrs	9(60%)	5(33.33%)	p=0.13,NS
41-50 yrs	2(13.33%)	7(46.67%)	
Total	15(100%)	15(100%)	
Mean±SD	34.73±6.87	38.20±8.35	
Range	25-49 yrs	22-49 yrs	
Gender			
Male	7(46.67%)	8(53.33%)	0.13
Female	8(53.33%)	7(46.67%)	p=0.71,NS
Total	15(100%)	15(100%)	

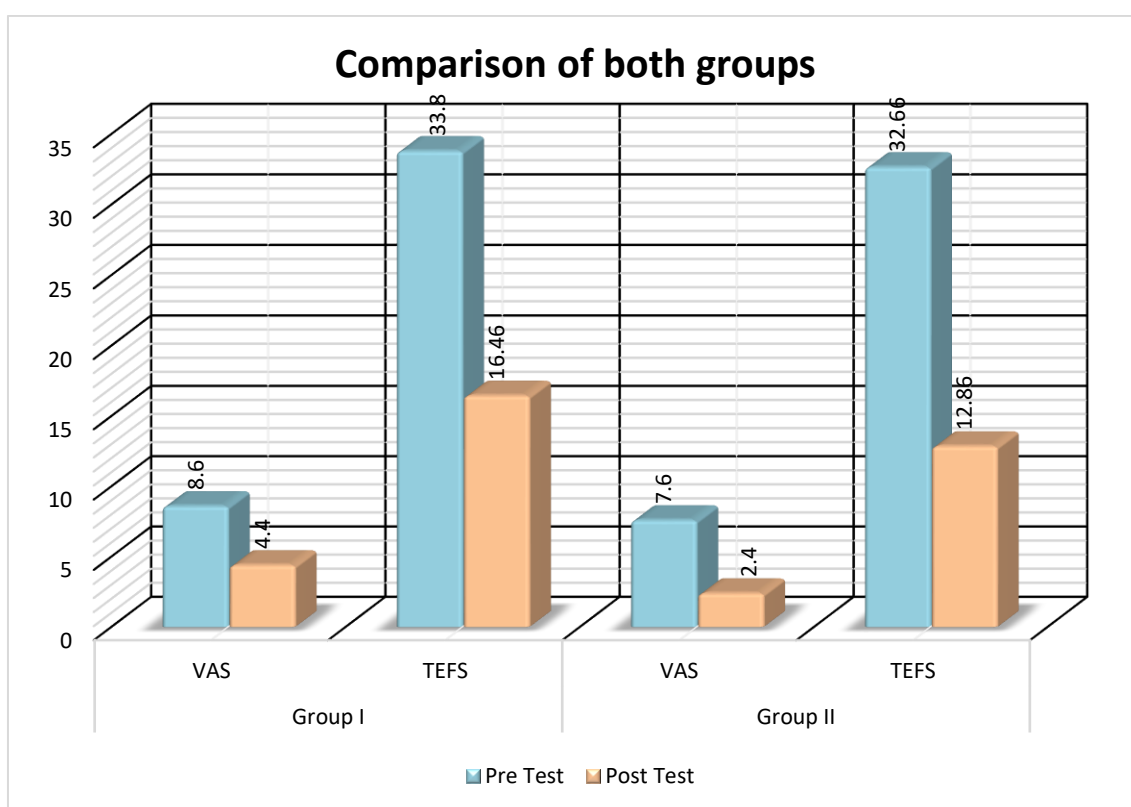


Fig. 5. Comparison of both groups

Table 2. Comparison of VAS for pain and TEFS for function in two group at pre and post-test

			Mean	N	Std. Deviation	Std. Error Mean	Mean Difference	t-value
Group I	VAS	Pre Test	8.60	15	0.50	0.13	4.20±0.77	21 p=0.0001,S
		Post Test	4.40	15	0.50	0.13		
	TEFS	Pre Test	33.80	15	1.52	0.39		
		Post Test	16.46	15	1.12	0.29		
Group II	VAS	Pre Test	7.60	15	0.50	0.13	5.20±0.67	26.78 p=0.0001,S
		Post Test	2.40	15	0.63	0.16		
	TEFS	Pre Test	32.66	15	1.49	0.38		
		Post Test	12.86	15	0.91	0.23		

4. DISCUSSION

The outcome of this research shows that both Group I and Group II including therapeutic ultrasound were significant in improving pain and elbow function on VAS and TEFS respectively however Cyriax Physiotherapy along with Therapeutic Ultrasound are more efficient in Lateral Epicondylitis. This study's claimed success of supervised exercise program is commensurate with other published research studies.

The early recovery of functional status is highly beneficial for a sportsperson since it allows him or her to resumption to sports in a shorter time. This increase in functional ability will also avoid disuse atrophy or muscular weakening produced by little or no exercise owing to lateral epicondylitis discomfort and impairment. Authors noted that lateral epicondylitis is usually a self-limiting condition and has the usual course of about 12 to 18 months. Non-operative treatments, modification in activity and physiotherapy can help to recover from the symptoms [22,23]. The underlying mechanism of pain alleviation subsequent to friction massage is thought to be related to regulation of pain signals at the spinal cord level [24]. There is currently no published data to support the suggested mechanism for what happens during and after manual treatment with Cyriax physiotherapy. Mill's manipulation's theorised mechanism is scar tissue lengthening succeeding adhesion rupture caused by the manipulation [25]. Lateral epicondylitis results in significant pain and functional disability [26]. Many meta-analysis and systematic reviews were published and concluded that eccentric exercises though they are varied in nature helps in improving pain, grip strength and overall functional ability [27,28]. Lucado A. M. et. al. stated in their systematic reviewed that compared to control groups improvement in functional grip score and pain score can be seen over the period of time by joint mobilizations directed at the elbow. Regional joint mobilizations can also be helpful, according to preliminary evidence [29]. Nagarale et. al. compared a 4 week long cyriax physiotherapy and phonophoresis with supervised exercise program observed to be superior in terms of discomfort, pain-free grip, and functional ability however, after 8 weeks of cessation of treatment there was decline and was gradual return to

baseline [30]. Combining wrist manipulation with incremental exercises was successful in reducing elbow pain and functional impairment caused by Tennis Elbow. DFM techniques was helpful in reducing pain, function, intensity, and behaviour in tennis elbow patients [31,32]. In comparing the results of this study, to those experienced by supervised exercise program and cyriax physiotherapy treatment group in the presented study some points must be considered. First, none of the trials listed above employed a genuine control group, thus they did not control for the disorder's normal course or spontaneous recovery. Second, the present study did assign both the treatment plans isolated and including therapeutic ultrasound. Therefore, till now no such study has been done and proposed good results although, it is impossible to say which action contributed the most to the therapeutic outcome.

5. CONCLUSION

We rejected the null hypothesis the, there is no significant difference between the effect of Supervised exercise and Cyriax physiotherapy both including therapeutic ultrasound on pain and function in patients with Lateral Epicondylitis after four weeks of treatment. Both groups who received therapy for four weeks improved considerably in terms of pain severity and functional capacity but, more in cyriax physiotherapy group including ultrasound. Future studies can be done by using both techniques together that is supervised exercises and cyriax physiotherapy.

6. LIMITATIONS OF THE STUDY

1. Long term follow up was not taken.
2. It was tiresome to convince participants to continue treatment session.


CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical clearance from the Datta Meghe Institute of Medical Sciences' Institutional Ethics Committee (DU)

LETTER OF INSTITUTIONAL ETHICS COMMITTEE APPROVAL

**DATTA MEGHE INSTITUTE OF MEDICAL SCIENCES**
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NAAC Accredited Grade 'A'

Ref.No. DMIMS(DU)/IEC/2020-21/ 8972 Date: 20/07/2020

Certificate of Approval

The Institutional Ethics Committee in its meeting held on 03.07.2020 has approved the following research work proposed to be carried out at **Ravi Nair Physiotherapy College, Sawangi (Meghe), Wardha.**


This approval has been granted on the assumption that the proposed research work will be carried out in accordance with the ethical guidelines prescribed by Central Ethics Committee on Human Research (C.E.C.H.R.)

Following research project for post-graduate course of Master Degree in Physiotherapy [MPT] approved by the committee and given approval.

The details of the proposed research dissertation/thesis work discussed and approved by Institutional Ethics Committee, DMIMS (DU) is as under:-

Sr. No.	Name of the Student (Name of Guide)	Category (Specialization)	Title of the Proposed Research
1	Gouri Kalaskar (Dr. R.K. Sinha)	Postgraduate Thesis MPT in Musculoskeletal Physiotherapy	A Comparative study to evaluate the efficacy of Supervised Exercise Programme and Cyriax Physiotherapy on pain and function in Lateral Epicondylitis.

(Dr. Vidya Baliga)
Member Secretary
Institutional Ethics Committee
D.M.I.M.S. (D.U.)



Copy to :-

1. Dr. Gouri Sanjay Kalaskar, First year MPT student, Dept. of Musculoskeletal Physiotherapy
2. Dr. R.K. Sinha, Guide & Professor, Dept. of Musculoskeletal Physiotherapy, RNPC
3. Principal, Ravi Nair Physiotherapy College

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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