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EFFICACY OF MOBILIZATION WITH MOVEMENT VERSUS EXERCISES IN LATERAL EPICONDYLITIS

THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE AWARD OF

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SUBMITTED BY

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Declaration by Student

CERTIFICATE

I Rachna Kocheta (Reg. No.: MVGU16B1PHY12), hereby certify that I had personally carried out the work depicted in the thesis entitled, "Efficacy Of Mobilization With Movement Versus Exercises In Lateral Epicondylitis", No part of the thesis has been submitted for the award of any other degree or diploma prior to this date.

Rachna Kocheta

Date:

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Certificate of Guide

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This is to certify that Rachna Kocheta (Reg. No.: MVGU16B1PHY12), in the department of Physiotherapy of this institute has fulfilled the requirements prescribed for the Ph.D. degree of the Maharaj Vinayak Global University, Jaipur. The thesis entitled; "Efficacy of Mobilization with Movement Versus Exercises in Lateral Epicondylitis" was carried out under my direct supervision.

Prof. (Dr.) Virendra Singh Rajpurohit

Date:

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Rachna Kocheta

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ABBREVIATIONS

δ	Delta
W/cm2	Watt per centimeter square
UST	Ultrasound Therapy
USD	United States Dollars
USA	United States of America
t	Paired t test Value
STD.	Standard
SPSS	Statistical Package for Social Sciences
SIG.	Significant
SE	Standard Error
SD	Standard Deviation
ROM	Range of Motion
RI	Reciprocal Inhibition
RCT	Randomized Control Trial
PRTEE	Patient Rated Tennis Elbow Evaluation
PRFEQ	Patient Related Forearm Evaluation Questionnaire
PNF	Proprioceptive Neuromuscular Facilitation
PIR	Post Isometric Relaxation
PIP	Proximal Interphalangeal
PIN	Posterior Interosseous Nerve
PEDro	Physiotherapy Evidence Database
PAG	Periaqueductal Grey
P	Probability Value
NSAIDs	Non-Steroidal Anti Inflammatory Drugs
NRS	Numerical Rating Scale
NPRS	Numerical Pain Rating Scale
N	Total number
MUP	Motor Unit Potential
ms	Milli Seconds
MRI	Magnetic Resonance Imaging
MIN	Minimum
MHz	Mega Hertz
MFR	Myofascial Release
MET	Muscle Energy Technique
MEDLINE	Medical Literature Analysis and Retrieval System Online
MAX	Maximum
LLLT	Low Level LASER Therapy
LIUS	Low Intensity Ultrasound
LE	Lateral Epicondylitis

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lb.	Pound
LASER	Light Amplification Stimulated Emission Radiation
KHz	Kilo Hertz
Kg	Kilograms
ISO	International Standards Organization
ICH-GCP	International Council for Harmonization Good Clinical Practice
ICD	International Classification of Disease
Hz	Hertz
HSD	Honesty Significant Difference
HOD	Head of the Department
HHD	Hydraulic Hand Dynamometer
GTO	Golgi Tendon Organ
F	F- Value (ANOVA)
Et al	And others
ESWT	Extra Corpeal Shockwave Therapy
ER	External Rotation
EMG	Electromyogram
ECU	Extensor Carpi Ulnaris
ECRB	Extensor Carpi Radialis Brevis
ECR	Extensor Carpi Radialis
DIP	Distal Interphalangeal
df	Degree of Freedom
DCGI	Drugs Control General of India
CTRI	Clinical Trial Registry of India
CST	Cross-Sectional Study
COX-2	Cyclooxygenase-2
CONSORT	Consolidated Standards of Reporting Trials
CLE	Chronic Lateral Epicondylitis
BMI	Body Mass Index
ASHT	American Society of Hand Therapists
ART	Active Release Technique
ANOVA	Analysis of Variance
ADL	Activities of Daily Living
ADJ.	Adjusted
µV	Micro Volt
%	Percentage

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INTRODUCTION

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Chapter-1

Introduction

1.1.Introduction

This chapter provides a comprehensive overview of Lateral Epicondylitis, encompassing its definition, characteristics, elbow joint anatomy, epidemiology, pathophysiology, and current management strategies for this condition.

This chapter provides a comprehensive overview of the background of the study, including a detailed explanation of the research problem, its significance, the need for the study, its scope, limitations, and the objectives that will be pursued.

1.2. Background of the study

Lateral epicondylitis (LE) was initially documented in 1873 by German physician F. Runge. Later on, in 1882, the condition was referred to as "Lawn Tennis Arm" by Henry Morris, who was writing in the Lancet at the time. Subsequently, this particular pathological state characterised by pain in the lateral aspect of the elbow has been assigned various designations, such as lateral epicondylitis, tennis elbow, lateral epicondylosis, tendinosis, enthesiopathy of the lateral epicondyle of the humeral bone, lateral epicondylalgia, and angiofibroblastic hyperplasia. (Cutts et al. 2020; Day et al. 2015; Fatyga et al. 2020) The pathogenesis of lateral epicondylitis (LE) was previously thought to involve an acute inflammatory response occurring at the site of origin of the wrist extensor muscles. Subsequent histological analysis indicated the absence of inflammatory cells and the presence of degeneration in the wrist extensor tendons. It is postulated that lateral epicondylitis arises from an inadequate healing response to repetitive micro trauma and reduced blood supply at the origin of the tendon. The root cause of lateral epicondylar pain, frequently attributed to the engagement of the typical wrist extensors, may involve the lateral radial nerve and collateral ligament. Due to an uncertain path anatomical cause, the current investigation employs the more prevalent terminology, lateral epicondylitis (Day et al. 2015; Lai et al. 2018). LE is a prevalent condition characterized by arm pain that is often associated with work or sports activities (L. M. Bisset and Vicenzino 2015). Lateral epicondylitis exhibits a prevalence that is sevenfold greater than that of medial epicondylitis, commonly referred to as golfer's elbow. It is commonly characterized as a condition involving pain localized in the region of the lateral epicondyle (L. M. Bisset and Vicenzino 2015). LE can manifest as either a degenerative condition or as a result of an inadequate healing response of the tendon (Coombes, Bisset, and Vicenzino 2015). Lateral epicondylitis (LE) is a distressing medical condition characterized by damage to The tendinous tissue located at the lateral epicondyle of the humerus, leading to a decrease in the functionality of the limb. Consequently, this condition significantly affects the social and personal aspects of the patient's life (Waseem et al. 2012).The upper extremity that is most frequently impacted is the dominant arm. The prevalence of LE reaches its highest point within the age range of 30 to 60 years (L. M. Bisset and Vicenzino 2015). The duration and severity of this

musculoskeletal condition are found to be more pronounced in women (Coombes, Bisset, and Vicenzino 2015; Waugh et al. 2004). it exhibits a significant recurrence rate, thus emphasizing the crucial role of rehabilitation in patients diagnosed with this condition (Day et al. 2015). Overuse or repetitive strain causes LE, and the most common form of this is the bending back action in which the wrist is extended against resistance. The extensor carpi radialis brevis, one of the extensor tendons originating near the lateral epicondyle, has frequently been identified as the primary structure involved in lateral epicondylitis. The atypical anatomical structure renders it susceptible to shearing forces during nearly all arm movements. According to Briggs' biomechanical research, there is evidence to suggest that tennis elbow is predominantly caused by mechanical factors.(Cutts et al. 2020) Tennis, badminton, and squash are frequently associated with a higher prevalence of lateral epicondylitis (LE). However, excessive wrist usage in daily activities is also a common contributing factor to the development of LE. In the realm of sports, the utilization of an inadequate backhand technique in tennis, a racket grip of insufficient size, excessively taut strings, and engagement in the sport with damp and weighty balls are all potential factors that contribute to an elevated susceptibility to the development of lateral epicondylitis (LE). Conversely, in the context of repetitive activities such as employing a screwdriver, engaging in painting endeavors, or performing typing tasks, these actions also pose a risk for the onset of LE (Waseem et al. 2012).Patients diagnosed with LE conditions report pain and a decline in functional abilities as their primary concerns (L. M. Bisset and Vicenzino 2015; Coombes, Bisset, and Vicenzino 2015).

1.3. Lateral Epicondylitis (LE)

1.3.1. Definition and characteristics

Lateral epicondylitis (LE) is a commonly observed musculoskeletal disorder that can be characterized based on the specific structure affected, the resulting impairment in task performance or activity, and the consequent limitations in social participation. According to the International Statistical Classification of Diseases and Related Health Problems (2016), the assigned code for Lateral Epicondylitis in the International Classification of Disease-10 (ICD-10) is M77.(Cutts et al. 2020). Lateral epicondylitis, colloquially referred to as tennis elbow, is a pathological condition characterized by the manifestation of symptoms resulting from repetitive strain on the extensor tendons located in the forearm. This chronic overuse results in damage to the tendons, characterized by collagen degeneration and micro-tears. Furthermore, this condition may impact the composition of muscle fiber types, neural drive, and the stiffness of the muscle-tendon complex (Kraushaar and Nirschl 1999; Sesto et al. 2006; Johnson et al. 2007). Lateral epicondylitis, as defined by (Trivedi et al. 2014; Evans-Laude, Brigden, and Bennett 2012), refers to the impaired ability to engage in excessive, rapid, repetitive manual activities encompassing the utilization of the hand, such as manipulating or grasping objects. This condition is characterized by the development of pain in the lateral humeral epicondyle, which may radiate to the forearm. It is a significant condition characterized by functional impairment resulting from pain, which hinders work performance and subsequently diminishes productivity (Kurppa et al. 1991; Verhaar 1994). The characterization of the disease's

progression lacks a discernible pattern due to its pronounced variability across individual cases. Several factors contribute to the prognosis of lateral epicondylitis, including occupational demands, work duration, muscle conditioning, and bone mineralization. Cases that are reported after duration of 4 weeks to up to 1 year are classified as resistant and diagnosed as chronic lateral epicondylitis. The patient exhibiting chronic symptoms presents with pain that persists even during periods of rest, in contrast to the acute phase where pain is only provoked by movement. There is expected to be a noticeable decrease in wrist extension, and in certain chronic cases, the extension of the elbow may also be limited due to the fact that wrist extensors are muscles that act on two joints (Haahr 2003). Figure 1a depicts the anatomical structure of the lateral elbow, while figure 1b illustrates the lateral epicondylitis.

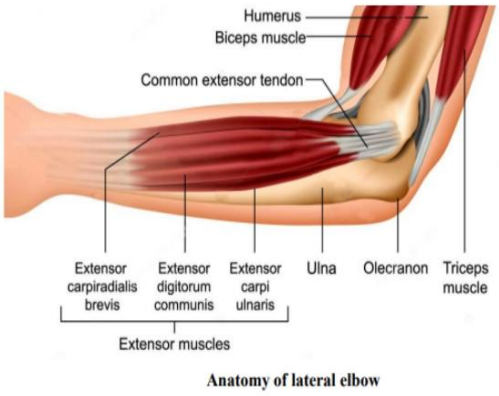

Figure 1. 1Anatomy of Lateral elbow

(Source: https://depositphotos.com/vector-images/tennis-elbow.html?qview=256174816)

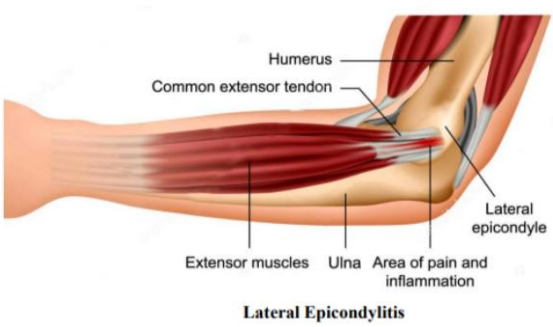

Figure 1. 2 Lateral Epicondylitis

(Source: https://depositphotos.com/vector-images/tennis-elbow.html?qview=253884532)

1.3.2. Anatomy

The elbow joint is classified as a synovial hinge joint, located between the upper arm and the forearm. The upper limb consists of the humerus bone in the arm, as well as the radius and ulna bones in the forearm. The articular cartilage of this joint is separated from each other by hyaline cartilage. The elbow joint facilitates the movement of the forearm in relation to the upper arm, enabling flexion and extension. Additionally, it permits rotation of the wrist and forearm. The distal extremity of the humerus, characterized by its rounded shape, forms a medial attachment to the trochlea and a lateral attachment to the capitulum. The trochlea, being pulley-shaped, establishes a secure articulation by connecting with the trochlear notch of the ulna. The lateral aspect of the radius's head, which exhibits a concave shape, articulates with the convex end of the capitulum, thereby forming the entirety of the elbow joint. The flexion and extension movement of the elbow is made possible by the capitulum of the humerus and the head of the radius, which together form a pivot joint. The rotational motion of the radius is additionally accountable for the supination

and pronation actions of the hand. According to (Chaurasia 2004), the blood circulation to the elbow joint is facilitated by the presence of the cubital anastomosis. This anastomosis is formed by the recurrent and collateral branches that originate from the brachial and deep brachial arteries. The innervation of the elbow joint is provided by the musculocutaneous, median, radial, and ulnar nerves. According to(Chaurasia 2004), Similar to other synovial joints, the elbow joint is also equipped with a robust and fibrous joint capsule, thereby enhancing its structural integrity. The capsule exhibits distinct characteristics, namely its lateral and medial thickening, which give rise to the formation of collateral ligaments.

In addition to the capsule, the elbow joint possesses three distinct types of bursae: intratendinous, subtendinous, and subcutaneous, also referred to as olecranon bursae (Chourasia et al. 2012).The static stability of the elbow joint is maintained by two primary ligaments: the medial collateral ligament, located on the medial side, and the lateral collateral ligament, situated on the lateral side of the elbow. In addition to its role in stabilizing the radius and ulna, the annular ligament plays a crucial role in maintaining stability between these two bones.

The origin site for the common extensors of the wrist is the lateral epicondyle of the humerus, while the common flexors of the wrist originate from the medial epicondyle of the humerus. A collection of muscles that originate or insert in close proximity to the elbow region represents the most frequently affected site for injury. In addition to supracondylar fractures of the humerus, elbow dislocations and student's elbow are also prevalent injuries that occur at the elbow joint.

1.3.2.1.The Elbow Joint's Flexibility and Stability

The joints and muscles of the elbow joint are often employed in day-to-day activities such as dressing, eating, carrying, and lifting among other similar tasks. The vast majority of movements need a combination of motions involving the elbow and the radioulnar joint.

The elbow joint is characterized by a high degree of congruity and stability. Both passive and active stabilizers of the joint contribute to the production of the joint's stability.

- Passive Stability: This is mostly attributable to the joint articulation and ligaments.
- Active Stability entails the production of compressive forces by the muscles.

1.3.2.2.Physiological Connection to the Wrist and Hand

The primary factor contributing to the hand's mobility is the anatomical structure of the radioulnar joint. The primary factor contributing to the hand's mobility is its inherent trade-off with stability, as the mobile forearm lacks the capacity to offer a stable connection for the muscles of the wrist and hand. The rationale behind the attachment of the muscles of the hand and wrist to the distal end of the humerus, as opposed to the forearm, is as follows. The muscles of the hand and wrist establish a close structural and functional connection with the elbow as they traverse it. The hand and wrist muscles play a crucial anatomical role in enhancing the integrity of the elbow joint by providing reinforcement to the joint capsule and promoting joint stability. During the process

of wrist muscle contraction, the muscles generate torque at the joint of the elbow. This leads to the compression of the articulating surfaces of the elbow.

According to (Levangie 2006), In the context of lateral epicondylitis, the extensor carpi radialis brevis and longus muscles, responsible for wrist extension, are enveloped by the brachioradialis muscle along the entirety of the forearm. The function of the extensor carpi radialis brevis muscle is primarily wrist extension, with some additional support in radial deviation. Lateral epicondylitis primarily arises from the excessive utilization and repetitive stress placed upon the extensor carpi radialis brevis muscle. The primary contributing factors to this issue are the suboptimal execution of the backhand stroke, inadequate racquet grip size, and excessively taut racquet strings among players engaged in racquet sports. In the general population, it has been observed that routine tasks such as laundering garments, engaging in painting activities, utilizing a screwdriver for fixing purposes, and typing on a regular basis can contribute to the development of lateral epicondylitis, as noted by Waseem et al. 2012.

1.3.3. Epidemiology

According to the epidemiology detailed in several papers on LE, 1%–3% of the general population is affected by LE (Lai et al. 2018; Testa et al. 2020; Vaquero-Picado, Barco, and Antuña 2016; L. M. Bisset and Vicenzino 2015; Pitzer, Seidenberg, and Bader 2014). Men and women are equally afflicted by LE, which most often strikes people in their fourth and fifth decades of life, notably between the ages of 30 and 70 (Lai et al. 2018; Dimitrios 2016; Vaquero-Picado, Barco, and Antuña 2016). The quality of the tendon tissue as well as mechanical abuse or overuse has an impact on their natural history (Testa et al. 2020). There is no proven treatment and a very significant probability of recurrence (Cardoso et al. 2019).

Overuse as a key contributing factor to LE is consistent with the fact that LE occurs more often in the dominant arm (Yao et al. 2020). (Samagh and Sudhakar 2016) investigated demographic factors and their impact on LE patients' physical and mental health. The author came to the conclusion that people in their fourth and fifth decades of life are most affected by lateral epicondylitis. Both the female gender and those who are more impacted by their dominant side are more prevalent. The domestic population, which included tennis players as well as working people, experienced the most severely diminished quality of life (QOL), both physically and cognitively. A recent assessment found that LE affects roughly 3% of the population annually. The condition got its name since it was initially seen among tennis players. Tennis players make up only 10% of all patients, despite the name (Fatyga et al. 2020). An epidemiological analysis regarding the health care burden of LE's 8.5% recurrence rate during a ten-year period was released in 2015. About 1 in 10 individuals had persisting symptoms that required surgery at 6 months, and the proportion of patients needing surgical therapy with a 2-year diagnosis increased over time (Sanders et al. 2015). 60% of garage employees in an Indian metropolis were found to have lateral and medial epicondylitis, according to (Dasari and Kumar 2018). Due to their work patterns, the lateral epicondyle was more often afflicted than the medial epicondyle (Coombes, Bisset, and Vicenzino 2015). Mani and Rajkumar 2017 conducted an epidemiologic study of tennis elbow patients

in a semi-urban tertiary facility in Tamilnadu. The bulk of the patients, according to the authors, were between the ages of 30 and 40. There were 60% more women than men. An analysis of the sides impacted revealed that 42.86% of left handed people and 81.4% of right handed people, respectively, experienced left sided affection. The gradual onset (84%) was found to be more frequent than the quick onset (16%). The smallest time a patient's symptoms persisted before going to the hospital was 10 days, and the longest was 36 months. They discovered that LE had an impact on 12 different professions. In their research, housewives made up the majority of tennis elbow patients (46%). They also discovered clerk and typewriter jobs, computer jobs, coolies, student jobs, chef jobs, carpenter jobs, mechanic jobs, lawyer jobs, artist jobs, engineer jobs, and teacher jobs. Up to 50% of tennis players may have lateral elbow symptoms at some point throughout their tennis careers, with recreational tennis players making up the majority of this demographic, according to a study on upper extremity injuries in tennis players.(Chung and Lark 2017)

From 1.1% in 2000 and 2002 to 24% in 2016, the percentage of patients referred for surgical intervention has gradually grown. The burden of the expense associated with treating lateral epicondylitis has increased as a consequence of the rise in the proportion of patients having surgery. Although there are a variety of variations in opinion among surgeons about the choice of surgical intervention for lateral epicondylitis, the incidence of patients choosing surgery is steadily rising. Hospital visits have risen along with the chronicity of lateral epicondylitis. Surgery is a more common alternative with a rate of 16%, indicating that it is a long-term treatment for Unfortunately, there is not enough evidence in the literature to support the long-term prognosis after surgery, which would enable us to determine whether or not surgical intervention was successful. According to Sanders et al. 2015, the average cost of lateral epicondylitis therapy in the USA is 4263 USD. Researchers have also discovered an increase in average yearly total reimbursement as well as per-patient reimbursement, which amply supports the notion that the cost of treating lateral epicondylitis will continue to rise in the years to come. The cost of a surgical procedure varies depending on the procedure's kind and the surgeon's goals (debridement is less expensive than a tenotomy). Even if surgical treatments are on the pricey side, individuals are thought to be motivated to choose surgery by the faster recuperation and return to work. According to research, individuals who have conservative treatment after 5 years of start spend more on controlling lateral epicondylitis than patients who receive surgical treatment. Thus, there is a pressing need to establish an appropriate conservative therapy plan before choosing surgical alternatives (Solheim et al. 2016).

1.3.4. Tendinosis in its pathological phases

The pathological stage of tendinosis encompasses a total of 4 distinct stages. Stage 1 is distinguished by inflammation surrounding the peritendinous area, and the presence of crepitus, which can be detected through palpation over the common extensor origin. The second stage of the inflammatory response concludes, while the onset of angiofibrotic changes initiates, resulting in the deterioration of the ECRB tendon's origin. Subsequently, the third stage involves pathological alterations that lead to a

structural breakdown and rupture, accompanied by a tear in the ECRB tendon. The ongoing deterioration of tendons and subsequent structural failure is accompanied by various additional alterations, including fibrosis, calcification of the soft matrix, and calcification of the hard osseous tissue in the fourth stage.

1.3.5. Mechanism of injury:

The cause of lateral epicondylitis is believed to be attributed to excessive and repetitive micro trauma experienced by the wrist extensor tendons. According to Pitzer, Seidenberg, and Bader (2014), the performance of repetitive movements involving eccentric contraction, which refers to the lengthening of the muscle-tendon unit while contracting, can heighten the likelihood of developing epicondylitis. According to a study conducted by Riek, Chapman, and Milner in 1999, an investigation was carried out to evaluate tennis strokes using computer analysis and magnetic resonance imaging. The study found that novice tennis players who exhibited improper backhand technique experienced eccentric contraction of significantly elongated extensor muscles. The researchers suggested that the micro trauma resulting from this technique may be responsible for the development of lateral epicondylitis.

Lateral epicondylitis is commonly observed in athletic activities that entail repetitive motions of the upper extremity. This condition is also acknowledged as an occupational disorder characterized by excessive utilization of the hand, wrist, and forearm (Pitzer, Seidenberg, & Bader, 2014). In a prospective cohort study conducted by Werner et al. 2005, a group of 45 auto assembly workers diagnosed with lateral epicondylitis were examined. The study revealed that older workers engaged in occupations involving higher levels of repetitive tasks and uncomfortable wrist positions exhibited a decreased likelihood of experiencing resolution in their elbow tendonitis.

1.3.6. Clinical appearance

The primary subjective manifestation of lateral epicondylitis is the presence of pain experienced on the outer lateral aspect of the elbow. Frequently, the sensation of pain extends to the region encompassing the forearm and wrist. The observed phenomenon typically exhibits an increase in magnitude when the patient engages in the action of clenching their fist or extending their wrist in a backward direction while encountering resistance. When palpated, there is soreness that can be felt all the way from where the tendons of the finger and wrist extensor muscles join to the humerus to where the lateral epicondyle of the humerus is located.

The primary concern expressed by the patient frequently revolves around challenges encountered when engaging in routine tasks, such as the act of lifting a glass or accessing a door. Determining the source of pain frequently presents challenges in terms of identification. The presence of soreness is commonly observed during hand activities that involve grasping or clenching, making it challenging to precisely identify the source of pain. The source of pain can be attributed to the extensor group, as the act of grasping with the hand necessitates the stabilization of the wrist through extension at an angle of 30°-50°. In order to achieve a stable position, it is necessary to engage in extended periods of variable or isotonic tension exercises targeting the tendons and extensor muscles

(Fatyga et al. 2020).

The primary manifestations of lateral epicondylitis (LE) encompass diminished grip and upper-extremity muscular power, accompanied by discomfort and inflammation originating from the lateral aspect of the elbow. The impairment of the elbow joint significantly impacts the daily activities and functional movements of patients, leading to pain and restricted function. In a study conducted by Lai et al. 2018 on lateral epicondylitis, it was found that a significant proportion of patients with this condition experience spontaneous resolution without the need for medical intervention. Approximately 80% of patients experience symptomatic improvement or complete resolution within one year. However, there exist specific factors that could potentially contribute to a less favorable prognosis in individuals with lateral epicondylitis (LE). These factors include engaging in manual labor, experiencing involvement of the dominant arm, enduring a longer duration of symptoms accompanied by high levels of baseline pain, and exhibiting inadequate coping mechanisms. In cases where symptoms persist despite treatment, a range of 3% to 11% of patients ultimately necessitate surgical intervention.

1.3.6.1.Pain, function, and QOL in patients with LE:

Patients diagnosed with LE conditions experience both physical pain and a reduction in functional abilities, thereby impacting their performance of essential daily activities. The reduction in function and resulting disability have a significant impact on the quality of life (QOL), encompassing various aspects such as self-care, usual activities, emotional well-being, and pain.

The primary concern revolves around the experience of pain and reduced functionality, which can potentially impact various daily activities such as gripping tools, handshakes, lifting objects like a cup of coffee, dressing oneself, engaging in household or desk work, and executing a backhand stroke in tennis, among others. The correlation between increased pain and decreased functioning is apparent, and in cases of chronic pain, there is a notable decrease in activity of the agonist muscle. Patients diagnosed with lateral epicondylitis (LE) commonly report experiencing pain in the area of the lateral humeral epicondyle. This pain may extend to the forearm and is typically observed during activities that involve repetitive and forceful movements of the hand, such as gripping or manipulating objects.

In a study conducted by Samagh and Sudhakar 2016, the researchers examined the impact of pain and functional disability on the QOL of patients with Lateral Epicondylitis (LE) conditions. The findings of the study revealed a noteworthy association between functional disability, pain and QOL. A positive correlation has been observed between functional disability and pain while a negative correlation has been found between QOL and functional disability. As the intensity of pain escalates, there is a corresponding rise in functional disability, leading to a subsequent decline in the patient's quality of life, encompassing both physical and mental aspects. The findings indicate that both the mental and physical component summary scores of the Short Form-36 health questionnaire were reduced, suggesting that LE has a detrimental effect on individuals' quality of life. However, the physical component summary score was significantly more impacted when compared to the mental component summary

scores. In the context of LE conditions, patients experience both pain and decreased functionality, leading to limitations in their ability to perform essential daily activities. Consequently, this adversely impacts the overall quality of life (QOL) for the patient. Consequently, it has been deduced that it is imperative for the patient to possess comprehensive knowledge regarding the benign characteristics of the ailment, as this underscores the significance of early detection and subsequent medical intervention. If left undiagnosed and untreated in its early stages, the condition has the potential to develop into a chronic state, which has been well-documented to have a detrimental effect on quality of life. The authors placed significant emphasis on the importance of providing moral support to patients, in addition to implementing physical therapy approaches, in the treatment of individuals with Lateral Epicondylitis (LE) conditions.

1.3.6.2.Deficiencies in grip strength:

During the performance of gripping activities, the wrist extensor muscles play a crucial role in providing stabilization. The clinical outcome measure recommended for patients with LE is pain-free grip, as it has been found to be more sensitive to change compared to maximum grip strength. The pain-free grip strength (PFGS) in individuals with Lateral Epicondylitis (LE) impairments is typically diminished by an average of 43-64% when compared to the unaffected side (Vicenzino et al. 2001; Abbott, Patla, and Jensen 2001; Chourasia et al. 2012; Sran et al. 2001; L. Bisset 2005). According to its definition, this measure quantifies the level of force necessary to elicit initial pain sensation. Consequently, it serves as an indirect indicator of the pain system, rather than a direct measure of strength. The assessment of maximal grip strength in Lateral Epicondylitis participants has yielded varying outcomes, including instances of unilateral weakness, bilateral weakness, and no weakness being observed
(Alizadehkhaiyat et al. 2007)

1.3.6.3. The presence of distinct deficiencies in muscle strength.

In individuals with LE impairments, there are observed deficiencies in the strength of the flexor and extensor muscles of the wrist and hand, as compared to individuals without impairments. However, it is worth noting that the extension of the metacarpophalangeal joint does not exhibit the same strength deficits. The potential rationale behind the maintenance or enhancement of finger extensor strength may involve compensating for any potential weakness in the wrist extensors. The assessment of shoulder rotator muscles reveals a decrease in strength among individuals with LE issues in comparison to healthy individuals. This finding suggests a potential influence from a distant source or implies the presence of a contributing factor that is not directly related to the affected area. Alizadehkhaiyat and colleagues (Alizadehkhaiyat et al. 2009) conducted a study to investigate the muscle function of individuals with a history of lateral epicondylitis (LE) who had remained asymptomatic for a minimum of six months. With the exception of finger extensor muscle strength, all measures of upper limb strength remained diminished in patients who had recovered from LE conditions, when compared to healthy individuals. This suggests that despite the alleviation of pain, there is an incomplete restoration of functional ability. Several studies have demonstrated the presence of weakness in the scapular muscles, particularly the lower

trapezius (LT) and serratus anterior (SA), in individuals with LE when compared to those who are healthy (Day et al. 2015; Lucado et al. 2012).

1.3.6.4. Deficits in motor control:

A research investigation was undertaken to evaluate the EMG activity exhibited by the muscles of the forearm in individuals who engage in tennis, specifically during the execution of the backhand stroke in playing tennis. The findings revealed that tennis players with lateral epicondylitis (LE) exhibited significantly reduced activity in the Extensor carpi radialis brevis (ECRB) muscle during the initial acceleration phase. However, these individuals demonstrated greater ECRB muscle activity at the point of ball impact compared to uninjured tennis players. A study observed a decrease in extensor carpi radialis (ECR) muscle activity in individuals with lateral epicondylitis (LE) during tasks involving isometric wrist extension and gripping. In a research study, individuals diagnosed with LE conditions who experienced symptomatic improvement demonstrated enhanced extensor carpi radialis (ECR) activity. This finding indicates a potential association between neuromuscular activity and the manifestation of symptoms. The potential explanation for this association may involve pain-related inhibition or the fear of experiencing pain and subsequent injury. In patients with lateral epicondylitis (LE), it has been observed that pain is mediated through central processing, which may be associated with a motor system impairment. This is supported by bilateral wrist position abnormalities during gripping and bilateral impairments in reaction time and movement speed during reaching tasks, as reported in studies involving unilateral LE patients. In addition, it has been observed that there is a higher degree of error in detecting movement in the affected elbows of patients with lateral epicondylitis (LE) compared to healthy individuals. This finding suggests that impaired proprioception may play a role in the compromised motor function observed in these patients. According to research findings, it has been determined that a slight extension of the wrist is the most advantageous posture for generating maximum grip force. Based on the proposed models of length-tension relationships at the wrist, it can be inferred that there is a decrease in maximal grip force generation associated with wrist flexion. This reduction in grip strength may explain the deficits observed in patients with LE conditions.

1.3.7. Diagnosis:

The diagnosis of lateral epicondylitis is typically established based on physical signs and tests. There exist a range of physical examinations that can be employed for the purpose of diagnosing Lateral Epicondylitis (LE) conditions. The Cozen test, Mill's test, and Maudsley's test are commonly employed assessments (Magee and Manske 2014). In cases where the diagnosis is uncertain, the utilization of ultrasound imaging and MRI can serve to validate and strategize treatment approaches. Nonetheless, it is generally the case that clinical tests and physical examination alone are adequate for establishing a diagnosis. Approximately two-thirds of patients will exhibit an aberrant signal in the vicinity of the lateral epicondyle during Magnetic Resonance Imaging (MRI) scanning. Furthermore, this phenomenon has the potential to persist for an extended period of time even after the symptoms have subsided. Various diagnostic techniques, such as infra-red thermography, isotope bone scan, and Laser Doppler flowmetry, have been

employed to examine and explore this particular medical condition. (Cutts et al. 2020)

1.3.8. Treatment of lateral epicondylitis:

Numerous treatment modalities have been documented for the management of lateral epicondylitis, indicating a lack of consensus on a universally optimal approach. The clinical review article published in 2020 supports the notion that the utilization of well-established treatments for tennis elbow is frequently substantiated by level five evidence, which primarily consists of expert opinion (Cutts et al. 2020). The conservative management approach is selected by approximately 90% of patients with lateral epicondylitis (LE). Numerous physiotherapy interventions have been suggested for the purpose of managing Lateral Epicondylitis (LE) conditions. A variety of physiotherapeutic approaches are used together with an exercise programme to treat LE (Smidt et al. 2003; L. M. Bisset et al. 2006; Trudel et al. 2004; Labelle et al. 1992; Wright and Vicenzino 1997). These approaches include soft tissue techniques, external support/taping/bracing, acupuncture, manual therapy, and electrotherapy (pulsed electromagnetic field therapy therapeutic, low level laser, extracorporeal shockwave therapy (ESWT), transcutaneous electrical nerve stimulation (TENS), iontophoresis, and ultrasound). These treatments exhibit distinct theoretical mechanisms of action, yet their shared objective is to alleviate pain and enhance local functionality. The diverse range of treatment techniques employed implies a lack of consensus regarding the optimal treatment approach. Several systematic reviews and clinical reviews have identified variations among different cohorts when examining research papers on the treatment of lateral epicondylitis (LE). As an illustration, a limited number of surgeons would opt for surgery as their primary therapeutic approach, and the majority of patients participating in a study involving surgical intervention have already exhibited inadequate response to conventional treatments, including the passage of time, steroid injection, and physiotherapy.(Cutts et al. 2020)

1.4.Statement of the Problem

Although several therapy alternatives are available, such as traditional exercise-based therapies, it is still unclear how beneficial these treatments are in easing pain and improving functionality on the whole. Several studies have documented favorable outcomes associated with exercise interventions, whereas others have revealed restricted or incongruous findings. Consequently, healthcare practitioners and patients find themselves in a state of uncertainty regarding the optimal approach to exercise. Furthermore, the introduction of alternative therapies, such as Mobilization with Movement (MWM), adds further complexity to the treatment landscape. The primary objective of this research is to conduct a comparative analysis between the effectiveness of MWM (Mobilization with Movement) and traditional exercise-based interventions in individuals diagnosed with lateral epicondylitis. The study seeks to address the research question of which approach, between MWM and traditional exercise-based interventions, yields superior outcomes in terms of pain reduction and improvement in functional outcomes. The results obtained from this study have the potential to offer valuable perspectives on the most effective treatment approach for lateral

epicondylitis, which could result in better patient outcomes and improved management of this prevalent musculoskeletal disorder.

1.5.Objectives of the study

The primary objective of this study is to assess the effectiveness of mobilisation with movement as a therapeutic intervention for individuals diagnosed with tennis elbow. Additionally, this research aims to investigate the impact of both mobilisation with movement and exercise on pain reduction and improvement in grip strength among patients with lateral epicondylitis. The study delineates the specific objectives as follows:

1. to assess the efficacy of mobilisation with movement techniques in individuals diagnosed with lateral epicondylitis.
2. To assess the efficacy of exercise interventions in individuals diagnosed with lateral epicondylitis.
3. to assess the efficacy of mobilisation with movement in comparison to exercise interventions for individuals diagnosed with lateral epicondylitis.

1.6.Hypothesis of the study

Experimental (H_1)

Mobilization with movement will be effective than exercise on subjects with lateral epicondylitis.

Alternate Experimental Hypothesis

There will not be significant difference between mobilization with movement and exercises in subjects with lateral epicondylitis.

1.7.Measuring Outcomes

The Visual Analogue Scale (VAS)

The commonly employed outcome measure for evaluating pain in lateral epicondylitis is the VAS, which quantifies the intensity of pain. The defining feature of lateral epicondylitis (LE) is the presence of pain in the lateral epicondylar region, particularly during activities that involve gripping. In order to assess the level of pain experienced. VAS and NPRS are frequently employed in the assessment of patients with Lateral Epicondylitis (LE) pain (Scott and Huskisson 1976). These tools are considered to be valid and reliable. (Coombes, Bisset, and Vicenzino 2015; Macdermid and Silbernagel 2015)

Grip Strength

Griping is an essential element of daily life tasks. The wrist extensor muscles play a significant role in stabilizing grip-related activities. In individuals with lateral epicondyle overuse syndrome, a condition characterized by excessive strain on the common wrist extensor attachment at the lateral epicondyle, the primary complaint reported by patients is pain during various gripping activities in their daily lives. These activities include lifting objects such as a mug of coffee or tea, rinsing clothes, kneading dough, and carrying grocery bags. Furthermore, individuals whose occupations require significant or prolonged gripping efforts also experience pain, which can contribute to work absenteeism (Macdermid and Silbernagel 2015). The measure of maximum grip strength is indicative of the contractile capacity of the wrist finger flexors, which are engaged when the wrist extensors contract to provide stability to the wrist. This metric is widely recognized as a measure of an individual's strength. Pain-free grip strength refers to the highest level of force that an individual can generate through gripping before experiencing any pain. The

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PFGS assessment is characterized by its ease of implementation, requiring only a short duration and basic equipment. This evaluation serves to measure the degree of grip strength impairment in the lower extremities, making it applicable in both clinical and research settings. The test is valid and accurate for measuring grip strength deficiency in LE. (Wyn Lim 2013)

1.8.Need and Significance of the study

There exist multiple interventions that have been validated as treatment strategies for lateral epicondylitis. The timing of surgical consideration and the long-term outcomes of surgical intervention are subjects of controversy, with biases present in the existing research. Therefore, it is imperative to implement a clearly delineated conservative treatment protocol, taking into account multiple factors such as clinical presentation and prognosis. At present, there is a lack of consensus regarding the optimal management approach for Chronic Lateral Epicondylitis, despite the existence of multiple systematic reviews on the topic. A diverse range of physiotherapy interventions have been suggested for the management of Chronic Lateral Epicondylitis. These treatments exhibit distinct theoretical mechanisms of action with regards to pain and functional outcomes. There is limited evidence supporting the efficacy of soft-tissue release techniques such as muscle energy technique (MET) and myofascial release (MFR) in the treatment of chronic lateral epicondylitis. Furthermore, existing research has demonstrated the efficacy of incorporating stretching and strengthening exercises for the wrist extensor muscles in the treatment of chronic lateral epicondylitis. However, it is important to note that the current body of research primarily emphasizes the utilization of plyometric exercises, specifically eccentric exercises, in the rehabilitation process for chronic lateral epicondylitis. Upon thorough examination of the existing body of evidence, it is evident that no study has been conducted to directly compare the effects of Muscle Energy Technique in conjunction with Plyometric exercises and Myofascial Release Technique in conjunction with Plyometric exercises in patients diagnosed with Chronic Lateral Epicondylitis.

1.9.Scope of the study

The focus of this study pertains to individuals who have been diagnosed with lateral epicondylitis, a medical condition commonly known as tennis elbow. The objective of this study is to evaluate and compare the effectiveness of two different interventions, Mobilisation with Movement (MWM) and traditional exercise-based interventions, in terms of their capacity to reduce pain and improve functional outcomes among the targeted population. The main aim of this study is to assess the effectiveness of pain reduction and functional parameters, such as grip strength, VAS, and patient-reported outcomes, as the primary measures of outcome. The research will be conducted within a specifically designated clinical or research setting, and its timeframe will be limited to a predetermined follow-up period. While the findings of this study are pertinent to individuals who satisfy the specified inclusion criteria, their direct applicability to individuals with varying elbow conditions or musculoskeletal disorders may be constrained. The study will also acknowledge potential limitations, such as limitations in sample size and potential biases, which may impact the generalizability of the findings.

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By defining the parameters of the study, the research can focus on specific aspects related to the management of lateral epicondylitis, thus providing valuable insights into the efficacy of Mulligan's Mobilisation with Movement (MWM) compared to exercise interventions for this common musculoskeletal condition.

1.10. Organization of the study

This thesis is organized into 7 chapters.

Chapter 1: Introduction
Chapter 2: Review of literature
Chapter 3: Research Methodology
Chapter 4: Results
Chapter 5: Discussions
Chapter 6: Conclusion
Chapter 7: Summary
Bibliography
List of Publications
Appendices

The initial chapter, entitled "Introduction," will present a comprehensive examination of Lateral epicondylitis, encompassing its background, significance, and the primary objective of the study. The subsequent section is designated as "Review of Literature" and it presents critical assessments of prior studies pertaining to treatments for Lateral Epicondylitis, outcome measures, and other relevant research. The subsequent chapter, titled Methodology, elucidates the various steps undertaken by the researcher in conducting the research. This includes the selection of subjects, the design of the study, the instruments employed, the grouping of participants, as well as the tools and methods employed for data analysis. The findings of the conducted study are presented in Chapter 4. The findings are also presented in the form of graphs and tables. The report encompasses findings related to demographic characteristics, as well as intra-group and inter-group outcomes, which are subsequently subjected to a comparative analysis. Discussions, a conclusion, and a summary are provided in the next chapters. Limitations and recommendation for further research have been included in chapter 5 of discussions. The researcher has made diligent efforts to ensure that the suggestions or summary provided are devoid of any personal biases or limitations. The bibliography comprises both acknowledgements and references that were consulted and served as the underpinning for this study. The researcher has made every effort to include the names of all contributors. The list of publications, curriculum vitae, and appendices are typically located at the end of the thesis. The appendices contain various documents, including a consent form, assessment form, questionnaire, data collection form, master chart, and data collection sample.

Concluding Remarks

This introductory chapter provides a summary of the study's context. It discusses the history, symptoms, diagnosis, clinical presentation, and possible treatments for lateral epicondylitis. This section includes any additional details that are important to our investigation.

The chapter also includes the study's purpose and hypothesis, as well as an explanation of the problem, necessity, scope, and importance of the research. In this part, we also discuss how we evaluate results. The organization of the study is covered in the final section of this chapter.

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REVIEW OF LITERATURE

Chapter-2

Review of Literature

2.1 Introduction

Chapter 2 focuses on the comprehensive examination of existing literature pertaining to lateral epicondylitis and its various treatment modalities. Lateral epicondylitis also referred to as tennis elbow, is a widely observed and incapacitating musculoskeletal disorder that impacts the tendons located at the lateral epicondyle of the humerus. The objective of this section is to conduct a comprehensive analysis and synthesis of existing literature regarding the effectiveness of various interventions for lateral epicondylitis. Specifically, the focus will be on comparing the efficacy of mobilization with movement (MWM) with traditional exercised based approaches. Through a critical analysis of existing body of evidence, this literature review aims to enhance comprehension of most efficacious and empirically supported therapeutic approaches for the management of lateral epicondylitis. This chapter establishes the foundation for the forthcoming examination and exploration of the comparative efficacy of MWM versus exercises in Chapter 3 by identifying gaps and inconsistencies in the existing literature.

This chapter provides a comprehensive overview of the literature pertaining to lateral epicondylitis, encompassing various study outcome measures such as the NPRS, Handheld Dynamometer (HHD), PRTEE, Electromyography (EMG), as well as interventions including Manual Therapy (MET), Myofascial Release (MFR), Plyometric Exercises, Strengthening and Stretching exercises and Ultrasound therapy.

The databases utilized for conducting this literature review include PEDro, Medline, the Cochrane Library and NCBI.

2.2 Review of related studies

Alizadehkhiyat et al. 2015 demonstrated the presence of muscle imbalance in the wrist and elbow regions among individuals with lateral epicondylitis (LE). This elucidates the necessity of engaging in physical exercise to rectify the muscular imbalance that contributes to Lateral Epicondylitis (LE) issues.

Stretching has been found to be effective in addressing limitations in joint mobility across a wide range of musculoskeletal conditions. When dealing with lateral epicondylitis (LE), the act of flexing the wrist and fingers results in the extension of the wrist extensor muscles.

Abbott (2001) conducted a study investigating the impact of Mobilisation with Movement (MWM) on shoulder range of motion in individuals diagnosed with lateral epicondylalgia. A study was conducted on a sample of 23 individuals, leading to the conclusion that patients diagnosed with lateral epicondylagia exhibit a restricted range of motion in shoulder rotation. This limitation is likely attributed to an increased level of muscle tone in the shoulder rotator muscles. The range of motion for shoulder internal and

external rotation experiences an increase subsequent to mobilisation with movement applied to the elbow in individuals diagnosed with unilateral lateral epicondylalgia. Ahmed et al. 2021 undertook a research to compare the efficacy of Mulligan mobilisation with the Cyriax method in treating individuals with subacute lateral epicondylitis. The clinical trial was conducted at the District Headquarter Hospital in Bahawalnagar, Pakistan, between September and December 2018. The participants in the trial were individuals diagnosed with lateral epicondylitis who had been experiencing symptoms for a duration exceeding two weeks. The diagnosis was established through the utilization of physical examinations and musculoskeletal ultrasound imaging. The participants were assigned to two equivalent groups, A and B, using a random allocation method. Group A was administered deep transverse friction and Mill's manipulation based on the Cyriax approach, whereas group B underwent Mulligan mobilisation with movement techniques. The data collection for this study utilized the Patient-Related Tennis Elbow Evaluation Index, and subsequent analysis was conducted using SPSS version 20. Out of the total sample size of 60 patients, an equal distribution of 30 individuals (50%) was observed in both groups. The average age of the participants was 35.27±7.30 years, with 38 individuals (63.3%) identifying as male. Following a 4-week period of treatment sessions, it was observed that both groups exhibited notable enhancements ($p<0.05$) in pain and functional disability scores. Group A demonstrated a statistically significant increase in pain subscale scores ($p<0.05$) in comparison to group B. Conversely, group B exhibited a significant improvement ($p<0.05$) in functional disability subscale scores when compared to group A. There was no statistically significant difference ($p>0.05$) observed between the groups in terms of the total score of the patient-related tennis elbow evaluation index. Both Mulligan mobilisation with movement and the Cyriax approach were found to be effective in reducing pain and improving functional status in patients with lateral epicondylitis.

Abbott et al. 2001 investigated the initial impact of an elbow mobilisation with movement technique on grip strength in individuals diagnosed with lateral epicondylagia. A study was conducted on a sample of 25 participants, wherein it was observed that the intervention led to a significant increase in both pain-free grip strength and maximum grip strength of the affected limb. The magnitude of the increase in pain-free grip strength exceeded that of maximum grip strength..**Aatit**

Bisset L,et al,2005 conducted a study . A systematic review and meta-analysis This systematic review and meta-analysis assessed the effectiveness of various therapy, including eccentric exercises, showed the most consistent evidence for pain reduction and functional improvement.

Bateman 2018 conducted service evaluation within the Department of Physical Therapy at Derbyshire revealed a lack of uniformity in the selection of modalities among physiotherapists. The selection and prescription of exercise lacked consistency. The individual emphasized the situation of

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offering modalities lacking empirical support and raised concerns regarding the premature use of corticosteroid injections.

According to Barratt (2018), it is imperative that the core of treatment for individuals with LE (executive dysfunction) focuses on strengthening. The author emphasized the importance of accurately determining the load required for strengthening as a critical component of Lateral Epicondylitis rehabilitation. Research has demonstrated that incorporating wrist extension exercises and shoulder stabilization exercises can effectively alleviate pain and improve upper extremity performance in individuals with Lateral Epicondylitis (LE) conditions.

In a recent study conducted by Lee J in 2018, it was demonstrated that non-athletic individuals were able to validate this assertion.

Bansal 2008 conducted a study that examined the young adult population in India, which aligns with the aforementioned study. The primary objective of this study was to determine the normative values for dominant and non-dominant hand strength in young adults aged 18-25 years, encompassing both genders. The study determined that the average grip strength for the non-dominant hand was 29.30 kg with a standard deviation of 9.7 kg, while the average grip strength for the dominant hand was 27.88 kg with a standard deviation of 10.01 kg. The results of the gender analysis indicated that males exhibited a grip strength that was 7.2% higher than females when using their non-dominant hand, and 6.8% higher when using their do Bisset et al. 2006, the researchers investigated the effects of Mobilisation with Movement (MWM) and exercise, corticosteroid injection, and a wait-and-see approach on individuals with tennis elbow in a randomized trial. A study was conducted on a sample of 198 participants, wherein it was determined that an intervention involving a combination of elbow manipulation and exercise yielded greater advantages compared to a "wait and see" approach within the initial six-week period, as well as in the long term when compared to the administration of steroid injections. Consequently, it is plausible to consider recommending this combined approach as a preferable alternative to corticosteroid injections.

minant hand.

Bhargava et al. 2010 conducted a study in which they utilized hand-held dynamometry (HHD) to analyze the grip strength of the wrist extensors. The study focused on individuals with unilateral chronic Lateral Epicondylitis (LE) conditions and compared the grip strength of the affected side with that of the unaffected side.

The research was conducted on both individuals from an athletic population and individuals from a non-athletic population. The measurement of grip strength was conducted using the JAMAR Handheld Dynamometer (HHD) at two different angles of wrist extension, specifically 150 and 350 degrees. To ensure consistency, a involving athletes.

The utilization of uniaxial handheld dynamometers (HHDs) led to the development of sophisticated dynamometers by interdisciplinary researchers, thereby establishing their reliability and validity. Irwin C, hailing from the state of Wisconsin in the United

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States played a pioneering role in the development of a multiaxial dynamometer. This device was designed not only to assess grip strength but also to measure the angular grip force. In the year 2010, the researcher conducted an analysis on the reliability and validity of the multiaxial dynamometer in two distinct age groups, namely the younger and older populations. The findings of this study provided evidence to support the presence of a strong concurrent validity between younger and older adults. In a subsequent development in 2013, Irwin successfully created a multi-axial dynamometer and subsequently demonstrated its efficacy in quantifying the magnitude of grip force. The device was specifically engineered to accurately measure both the magnitude and direction of force in the extension and flexion planes of individual fingers. The study also assessed the potential confounding effect of the thumb. The study's findings demonstrated that multiaxial dynamometers exhibit greater accuracy in measuring grip force when compared to conventional handheld dynamometers (HHD). This improvement in accuracy can be attributed to the enhanced ergonomic design of the multiaxial dynamometers, which are shaped like joysticks. (Irwin and Sesto 2010; Irwin et al.

Bunata et al. 2007 carried out an investigation to examine the anatomical factors contributing to the development of tennis elbow. A total of 85 cadaveric elbows were subjected to examination, revealing that the extensor carpi radialis brevis (ECRB) possesses a distinctive anatomical position that renders its undersurface susceptible to contact and abrasion with the lateral edge of the capitulum during movements of the elbow joint.

Bisset L,et al ,2010 demonstrated Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial.

This randomized trial compared the effectiveness of MWM and exercise, corticosteroid injection, and a wait-and-see approach in the treatment of lateral epicondylitis. The study found that MWM and exercise resulted in significant improvements in pain and function compared to corticosteroid injection or the wait-and-see approach at 6 and 12 weeks.

These additional studies provide further support for the effectiveness of physiotherapy treatments, including MWM techniques, in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to consult with a healthcare professional to determine the most appropriate treatment approach for each individual case.

Coonrad R et al ,2004 conducted an analysis on tennis elbow, examining its progression and nature. The findings of the study indicated that the occurrence of tennis elbow is not exclusively linked to the sport of tennis, but rather has a correlation with work-related activities.

Coombes et al, 2010 conducted a study on the Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomized controlled trials.

This systematic review examined the efficacy and safety of corticosteroid injections and other injections for the management of tendinopathy, including lateral epicondylitis. The study found that corticosteroid injections

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provided short-term pain relief but did not improve long-term outcomes. Additionally, other injections, such as platelet-rich plasma (PRP) and autologous blood, showed promising results but further research is needed.

Cleland et al 2005 conducted a study in which Manual physical therapy, cervical traction, and strengthening exercises in patients with cervical radiculopathy:
Although this study focuses on cervical radiculopathy, it includes a subgroup analysis of patients with lateral epicondylitis. The study found that manual physical therapy techniques, including MWM, combined with cervical traction and strengthening exercises, resulted in significant improvements in pain and function in patients with lateral epicondylitis.

Coombes B et al 2004, conducted astudy on Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomized controlled trials.
This systematic review evaluated the efficacy and safety of corticosteroid injections on lateralepicondylitis. The study found that corticosteroid injections provided short-term pain relief but did not show long-term benefits and had a higher risk of adverse effects compared to other interventions.

Dingemanse et al. 2013 conducted a systematic review to investigate the efficacy of different electrophysiological modalities in the treatment of Lateral and Medial Epicondylitis. The researcher discovered potential evidence supporting the effectiveness of ultrasound and laser therapies in the treatment of Lateral Epicondylitis (LE) conditions. Additionally, the researcher arrived at the conclusion that there exists a necessity for conducting high-quality randomized controlled trials (RCTs) to substantiate the findings of this study, as well as for conducting long-term follow-up investigations to assess the lasting effects. In their study, Eapen et al. (2023) conducted a systematic review with the aim of assessing the efficacy of wrist joint manipulations in improving pain, grip strength, range of motion (ROM), and functional outcomes among adult individuals diagnosed with lateral epicondylitis. A systematic search was conducted across six databases in order to identify pertinent clinical trials. Data extraction and methodological quality assessment were performed by three independent reviewers using the PEDro scale. The extraction and summarization of data followed established protocols. Four studies were found to meet the inclusion criteria. The results were summarized using a best-evidence synthesis. The studies included in the analysis demonstrated that wrist manipulations administered for a minimum duration of three weeks were effective in reducing pain associated with lateral epicondylitis. These findings were observed when comparing the outcomes of the wrist manipulation group to those of other groups receiving treatments such as ultrasound, laser therapy, friction massage, and exercises. There was significant variation in functional outcomes across the studies. The results of grip strength exhibited heterogeneity, while no significant impact was observed on the range of motion (ROM) of the wrist. There is compelling evidence to suggest that wrist joint manipulations have a beneficial impact on short-term pain reduction in individuals with lateral epicondylitis, when compared to control groups in the context of management strategies. It is advisable to conduct future studies of superior quality.

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Fairbank et al. 2002 conducted a study investigating the involvement of the extensor digitorum communis muscle in lateral epicondylitis. The findings of their study provided confirmation regarding the high occurrence rate of a positive Maudsley test in cases of lateral epicondylitis. Additionally, they observed that patients who experienced maximum tenderness at the origin of the extensor digitorum communis slip to the middle finger exhibited the most intense pain when extending the middle finger.

Gabel et al, 2001 conducted a study aiming to establish a prevalence ratio between lateral epicondylitis and medial epicondylitis. According to his report, the ratio varies between 4:1 and 7:1, with a higher prevalence of LE. The aforementioned phenomenon was observed in a sample size of 814 individuals who sought treatment at a pain management center.

Green S et al, 2002,conducted a study aiming to examined the effectiveness of acupuncture in the treatment of lateral elbow pain. The study found that acupuncture provided short-term pain relief compared to sham acupuncture or no treatment. However, the long-term effects were uncertain due to limited evidence.

Howitt et al. 2006 examined the effectiveness of conservative care, specifically Active Release Technique (ART) and rehabilitation, in treating lateral epicondylosis. The research findings suggest that a treatment protocol involving a combination of rehabilitation, therapeutic modalities and soft tissue therapy can be utilized by both allopathic and chiropractic practitioners. This approach aims to facilitate the speedy return to play for athletic patients

Kund et al. 2008 found that patients suffering from lateral epicondylitis exhibit diminished elbow proprioception compared to individuals without the condition. A sample consisting of 15 female individuals diagnosed with lateral epicondylitis and 21 healthy control participants was examined. The findings indicate that individuals with lateral epicondylitis exhibit inferior proprioception in the affected elbows compared to the control group's elbows.

Kubot et al. 2017 conducted a comparative investigation which examined the impacts of radial extracorporeal shockwave therapy and ultrasound therapy (UST) in the management of Lateral Epicondylitis (LE) conditions. It was determined that both treatments exhibited efficacy in mitigating the frequency and intensity of pain for a minimum duration of 8 weeks. Additionally, it was noted that UST exhibited lower efficacy in comparison to radial shockwave therapy.

The aforementioned findings align with the findings of Lizis P (2015), which discussed the significant impact of extracorporeal shock wave therapy both immediately following treatment and during the analysis conducted three months after treatment.

Krogh TP et al., 2013 Comparative effectiveness of injection therapies in lateral epicondylitis: a systematic review and network meta-analysis of randomized controlled trials. individuals with patellofem.

This network meta-analysis compared the effectiveness of different injection therapies for lateral epicondylitis, including corticosteroids, platelet-rich plasma (PRP), and autologous whole blood. The study found that PRP injections

were more effective in reducing pain and improving function compared to corticosteroid injections.

Kay et al.2004 conducted a study that focused on the analysis of outcome measures for individuals diagnosed with

patellofemoral pain. A total of 71 individuals were recruited to participate in a randomized controlled trial (RCT) that examined the effectiveness of a conservative intervention for patellofemoral pain. The data collected for outcome measures were subsequently assessed for both validity and responsiveness. The study employed several outcome measures, including three 10-cm VASs to assess usual pain (VAS-U), pain experienced during six aggravating activities (running, walking, sitting, squatting, descending and ascending stairs) and worst pain (VAS-W). Additionally, the Anterior Knee Pain Scale (AKPS), a global rating of change and the Functional Index Questionnaire (FIQ) were utilized. The author's conclusion suggests that the Visual Analogue Scale (VAS) for usual or worst pain and the Anterior Knee Pain Scale demonstrate reliability, validity, and responsiveness. These measures are recommended for use in future clinical trials or clinical practice to assess treatment outcomes in

Struijs PA et al, 2004, demonstrated Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial.

This randomized clinical trial compared the effectiveness of a physiotherapy program, including MWM techniques, with a brace and a combination of both in the treatment of lateral epicondylitis. The study found that the physiotherapy program, including MWM, resulted in significant improvements in pain, grip strength, and functional outcomes compared to the brace or the combination group.

Koch et al. 2012 conducted a study to assess the vertical ground reaction force in a sample of 22 healthy male participants through the implementation of plyometric push-ups. A notable disparity was noted in the peak vertical ground reaction force when comparing the limb that is dominant to the limb that is non-dominant.

Lee et al. 2018 conducted a study aimed at investigating the impact of eccentric control exercise for wrist and shoulder stabilization on pain and functional outcomes in individuals with tennis elbow.

The participants were divided into two groups: one group performed eccentric control exercises for the wrist extensor muscles, while the other group performed shoulder stabilization exercises. A total of nine patients were enrolled in the study, with each group consisting of five males and four females. The researchers discovered that both experimental groups exhibited a notable reduction in pain intensity and a substantial improvement in the measurement of tenderness thresholds in the lateral epicondyle, grip strength and upper trapezius muscle when comparing pre- and post-intervention data within each group. In the comparison between groups, it was observed that the shoulder stabilization exercise group exhibited a statistically significant increase in the measurement of tenderness thresholds in the grip strength and upper trapezius muscle. However, no significant differences were found in the tenderness threshold of the lateral epicondyle and pain level. The researchers reached the conclusion that incorporating wrist eccentric control exercises and shoulder stabilization exercises can serve as effective intervention strategies for alleviating pain associated with lateral epicondylitis and enhancing the restoration of impaired functions caused by tennis elbow.

Loturco et al. 2015 conducted research with the intention of determining whether or not vertical and horizontal plyometric training

had an influence on the jumping and sprinting abilities of football players. The implementation of vertical plyometrics resulted in a 20-meter increase in velocity when compared to the use of horizontal plyometrics.

Murtezani Ardiana et al, 2015 conducted a study in which the impact of exercise and therapeutic ultrasound was examined in relation to corticosteroidal injection as a treatment for lateral epicondylitis. Based on her research findings, she reached the conclusion that the utilization of exercises and ultrasound therapy in the rehabilitation of lower extremities (LE) yields notable advantages when compared to the administration of corticosteroidal injections.

conducted a study on. Long-term clinical benefits of shockwave therapy for chronic recalcitrant plantar fasciitis.

Although this study focuses on plantar fasciitis, it also includes a subgroup analysis of patients with lateral epicondylitis. The study found that shockwave therapy, which involves the application of high-energy sound waves, combined with MWM techniques resulted in significant improvements in pain and function in patients with lateral epicondylitis.

Martinez-Silverstini et al. 2005 conducted a study investigating the comparative effectiveness of a home exercise programme for chronic lateral epicondylitis. The study compared the outcomes of a stretching-only programme with those of a programme that included both stretching and either eccentric or concentric strengthening exercises. A study was conducted on a sample size of 94 participants, wherein it was observed that no statistically significant disparities in outcome measures were observed across the three groups. Despite the absence of any notable differences in outcomes across the groups, it was observed that eccentric strengthening did not result in a deterioration of the subjects.

Mohseni et al 2008 conducted a study in which. the effect of three different exercise programs on the treatment of patients with chronic lateral epicondylitis. .

This study compared the effects of three different exercise programs (eccentric exercise, concentric exercise, and stretching exercise) in the treatment of chronic lateral epicondylitis. The study found that all three exercise programs resulted in significant improvements in pain and function, with eccentric exercise showing the greatest improvements.

These additional studies provide further evidence for the effectiveness of physiotherapy treatments, including manual therapy, exercise, and other interventions, in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to consult with a healthcare professional to determine the most appropriate treatment approach or each individual case.

Martinez Questionnaire. J Hand Ther.2007 Conducted a study

This study aimed to validate the Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire, which is commonly used to assess outcomes in lateral epicondylitis. The study found that the PRTEE questionnaire had good reliability, validity, and responsiveness, making it a useful tool for evaluating treatment outcomes in lateral epicondylitis Manandhar et al, 2021 conducts a research to determine the impact of eccentric exercise and Mulligan's MWM on grip strength and functional impairment in recreational tennis players with lateral epicondylitis. A total of thirty participants

who met the specified inclusion criteria were recruited through the process of referrals. The experimental group participated in Mulligan's Mobilisation with Movement (MWM) in addition to eccentric exercise, while the control group received an intervention consisting exclusively of an eccentric exercise programme. Both groups engaged in three sessions per week for a duration of four weeks. The measurement of grip strength was conducted using a Hand Held Dynamometer, while the assessment of functional abilities was performed using the PRTEE. The data underwent analysis using SPSS 16.0, employing both descriptive and inferential statistics at a significance level of 5%. The analysis revealed statistically significant improvements in both outcomes for both the experimental group and the control group. The experimental group exhibited greater improvements for both dependent variables. The combination of Mulligan's MWM administration and eccentric exercise was determined to be more efficacious than eccentric exercise alone in enhancing grip strength and functional capabilities among recreational tennis players diagnosed with lateral epicondylitis.

McCormick et al. 2016 conducted a study involving a group of 14 adolescent female basketball players. The purpose of the research was to investigate the impact of plyometric exercises in the frontal and sagittal planes on measures of power and change of direction speed. A notable enhancement in performance was observed when implementing a sagittal plane plyometric training programme in comparison to a frontal plane plyometric training programme. The study findings demonstrated enhancements in counter movement of vertical jump when participants engaged in sagittal plane plyometrics training. Similarly, improvements were observed in lateral hop and lateral shuffle test performance when participants underwent frontal plane plyometrics training. The author additionally proposed that the integration of plyometric exercises across all planes of movement in basketball players would enhance their power, as well as their ability to rapidly change speed and direction.

Murtezani et al. 2015 conducted a study that demonstrated the enhanced efficacy of ultrasound therapy when combined with exercise, as compared to the sole utilization of exercise as a treatment method. This discovery was made through a 12-week randomized controlled trial involving a sample of 49 participants.

Nagrale AVet al, 2016, . Cyriax physiotherapy versus phonophoresis with supervised exercise in subjects with lateral epicondylalgia: a randomized clinical trial.

This randomized clinical trial compared the effectiveness of Cyriax physiotherapy, which includes MWM techniques, with phonophoresis (the use of ultrasound to enhance the absorption of topical medication) and supervised exercise in patients with lateral epicondylalgia. The study found that both treatments resulted in significant improvements in pain and function, with no significant differences between the two groups.

These additional studies support the effectiveness of physiotherapy treatments, including MWM techniques, in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to consult with a healthcare professional to determine the most appropriate treatment approach for each individual case.

Nirschl et al , 2004 conducted an analysis on

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tennis players who experienced lateral epicondylitis (LE) and made a contentious assertion that approximately 50% of all tennis players will inevitably develop this condition at some point in their careers, regardless of their playing style or platform. The author substantiated this claim through histopathological analysis, wherein non-inflammatory tissues were observed and classified as angiofibroblastic tendinosis. The individual provided an explanation stating that Tennis elbow is caused by insufficient vascularization, rather than

inflammation of the wrist extensor tissue at its typical point of origin. Additionally, the author suggested that the objectives of non-surgical intervention encompass the restoration of compromised vasculature and the repair of collagen, both of which are adversely affected by inadequate nourishment. The study additionally proposed that surgical intervention should be considered when rehabilitation efforts prove unsuccessful, with the primary objective of removing pathological tissues being the surgeon's foremost concern.

Paungmali et al. 2003 conducted research to investigate the Hpoalgesic and svmpathoexcitatory effects of mobilisation with movement for lateral epicondylgia. A study was conducted on a sample of 24 participants, and the findings indicated that the mobilisation with movement treatment technique yielded physiological effects comparable to those reported for certain spinal manipulations

Peterson et al 2003, conducted a study. A randomized controlled trial of exercise versus wait-list in chronic tennis elbow (lateral epicondylosis).

This randomized controlled trial compared the effectiveness of exercise versus a wait-list control group in the treatment of chronic tennis elbow (lateral epicondylosis). The study found that exercise resulted in significant improvements in pain, grip strength, and function compared to the wait-list control group after 12 weeks of intervention.

These additional studies provide further evidence for the effectiveness of various physiotherapy treatments, including acupuncture, mobilization with movement and exercise, corticosteroid injections, and other interventions, in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to consult with a healthcare professional to determine the most appropriate treatment approach for each individual case.

Paungmali et al .2003 conducted a study examined the hypoalgesic effects of elbow manipulation, which included mobilization with movement techniques, in individuals with lateral epicondylalgia. The study found that the treatment produced significant pain reduction, and importantly, the effects did not exhibit tolerance over repeated treatment sessions. This suggests that the pain-relieving effects of elbow manipulation are maintained .

Pienimäki et al, 2019 conducted a study investigated the effects of progressive strengthening and stretching exercises, combined with ultrasound therapy, in the treatment of chronic lateral epicondylitis. The study found that this combination of treatments resulted in significant improvements in pain, grip strength, and functional outcome

Rama Krishna 2013 proposed a research inquiry regarding the potential similarity in grip strength differences between individuals

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with left-handed and right-handed dominance in their respective non-dominant and dominant hands. The findings of this study indicate that individuals with right dominance exhibited a 10% disparity in grip strength between their upper limbs. In contrast, individuals with left dominance did not demonstrate a comparable difference, as their grip strength was nearly equal.

Among the commercially available dynamometers in the Indian market, the JAMAR HHD has been identified as a widely utilized and dependable tool within the research community.

Riek et al 2002examined the backhanded tennis strokes of the players. He monitored the extensor carpi radialis brevis throughout this investigation and demonstrated that it contracts eccentrically during backhanded strokes more than any other muscle. The experienced tennis player, on the other hand, developed a much superior fluidic style with less eccentric contraction and was less likely to sustain an injury. He noticed analogous occurrences in beginner and amateur tennis players. This was established by Bernhang in 1974, who claimed that professional tennis players retained their wrists in a steady posture during the backhand stroke compared to rookie players, and Fairbank & Corlett 2002, who examined the function of the extensor digitorum communis in tennis elbow. (Bernhang 1974; Riek et al.1999; Fairbank & Corlett 2002)

Rompe et al. 2017 conducted a study focused on the validation of the patient-rated tennis elbow evaluation questionnaire. A study was conducted on a sample size of 78 participants, and the researchers determined that the patient-rated tennis elbow evaluation questionnaire exhibited qualities of reliability, reproducibility, and sensitivity as an assessment tool for chronic lateral elbow tendinopathy

Shiri R et al. did a research in 2006 where they examined the factors of LE in addition to its prevalence. This research included home interviews and clinical examinations on 8028 samples of participants aged 30-64. The frequency of potential LE was 2.8%, according to the study's findings, and it was greatest among patients between the ages of 45 and 64. The likelihood of LE was similarly greater in women than in males. There was no gender difference in the prevalence of definite LE, which was 1.3% in participants between the ages of 45 and 54. Body mass index, hip waist ratio, and hip circumference were all shown to be strongly associated with medial epicondylitis but not lateral epicondylitis. According to Shiri R. et al. 2006 LE was linked to any job that required repeated hand and wrist motions, strong hand grip forces, or the manual handling of heavy instruments with weights more than 5 kg or 20 kg. Carrying weights manually and repeated actions involving the hands or wrist were shown to be associated with a dose response relationship, with the risk being larger for longer exposure times. LE was discovered to happen when there was a combination of strong exercise and repeated arm motion. When participants engaged in a mix of forceful and repeated behaviors, the risk was 5.6 times greater than it was for those who did not engage in any of these activities. Additionally, this research showed that there is no danger when patients just engage in vigorous or repeated motions.

Smidt et al. 2003 conducted a systematic review to analyze the impact of physical therapy intervention for lower extremities. The author reached the conclusion that despite the extensive body of

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research on physical therapy interventions in lower extremities, there is a lack of sufficient evidence to support their effectiveness. With the exception of Ultrasound, which has limited supporting evidence, there is a lack of adequate research studies available to substantiate the effectiveness of other modalities. However, this assertion does not hold true when considering exercise and stretching. The existing body of literature provides ample evidence supporting the efficacy of exercise.

Smidt et al ,2002 conducted a study with Corticosteroid injections, physiotherapy, or a wait-and-see policy for lateral epicondylitis: a randomised controlled trial.

This randomized controlled trial compared the effectiveness of corticosteroid injections, physiotherapy, or a wait-and-see policy in the treatment of lateral epicondylitis. The study found that corticosteroid injections and physiotherapy were both effective in reducing pain and improving function compared to the wait-and-see policy at 6 and 12 weeks. However, the effects of corticosteroid injections diminished.

-Silvestrini et al. 2005 conducted an analysis on the effectiveness of a home-based exercise programme that focused on stretching and incorporating concentric and eccentric strengthening exercises. The researcher discovered that there was no statistically significant disparity observed between two home-based exercise programmes. Additionally, it was determined that the implementation of eccentric exercises did not result in a significant exacerbation of pain.

Rompe JD, Overend TJ, MacDermid JC. Validation of the Patient-Rated Tennis Elbow Evaluation

Stasinopoulos et al. 2009 conducted a study involving a sample of 70 patients to examine the comparative effectiveness of a home-based exercise programme versus a supervised exercise programme. The study focused on the rehabilitation of lateral epicondylitis and aimed to determine which programme was more beneficial in terms of pain reduction and improvement in functional outcome. The findings of the study indicated that the supervised exercise programme was superior to the home exercise programme in achieving these outcomes.

Shimose R in 2011,conducted a study, the objective was to investigate the impact of submaximal isometric wrist extension training on grip strength. The findings of the study indicated a significant increase in gripping force and electromyographic (EMG) activation in both the flexor and extensor muscles during gripping force, following the completion of the wrist extension training. Therefore, it can be concluded that submaximal isometric wrist extension training is an effective method for enha

Struijset al 2004, conducted a studyon Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial.

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Although mentioned earlier, this study is worth mentioning again as it compared the effectiveness of a brace, physical therapy, or a combination of both in the conservative treatment of lateral epicondylitis. The physical therapy intervention included MWM techniques. The study found that the combination of brace and physical therapy, including MWM, resulted in the fastest recovery and significant improvements in pain and function.

These studies provide evidence for the effectiveness of mobilization with movement techniques in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to note that treatment outcomes can vary among individuals, and it is recommended to consult with a healthcare professional to determine the most appropriate treatment approach for each individual case.

,**Struijs et al,2003** conducted a study on. Manipulation of the wrist for management of lateral epicondylitis: a randomized pilot study.

This randomized pilot study investigated the effects of wrist manipulation, which included mobilization with movement techniques, in the treatment of lateral epicondylitis. The study found that wrist manipulation resulted in significant improvements in pain, grip strength, and function compared to a control group at 12 weeks..ncing grip strength.

Sayegh and Strauch 2015 conducted a meta-analysis with the aim of investigating the impact of nonsurgical interventions on lateral epicondylitis (LE) and its long-term prognosis. The researcher reached the conclusion that, based on an extensive analysis of randomized controlled trials (RCTs), the primary approach for managing lateral epicondylitis (LE) without surgery was predominantly through the utilization of ultrasound therapy (UST) and exercise therapy. These interventions were found to yield intermediate to long-term benefits

Stergioulas 2007 conducted a study to assess the effectiveness of Low-Level Laser therapy in comparison to Plyometric Exercises for the treatment of Lateral Epicondylitis. The findings of the study indicated that patients with lateral epicondylitis (LE) who underwent treatment with low-level laser therapy in conjunction with plyometric exercises experienced notable enhancements in wrist range of motion (ROM) and a decrease in pain.

In a study conducted by **Trivedi et al. (2019),** a case report was conducted to investigate the effectiveness of plyometric exercises in the treatment of individuals with chronic lateral epicondylitis. The duration of the treatment was four weeks, during which the subject received a carefully designed protocol consisting of plyometric exercises and pulsed ultrasound therapy. The study's findings indicated that the implementation of a protocol involving plyometric exercises combined with pulsed ultrasound therapy yielded promising outcomes in the rehabilitation of individuals

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with chronic lateral epicondylitis.

Shiri R et al 2006, demonstrated prevalence and determinants of lateral and medial epicondylitis: a population study.

This population study aimed to determine the prevalence and risk factors for lateral and medial epicondylitis. The study found that repetitive forceful exertions, high physical workload, and older age were associated with an increased risk of lateral epicondylitis.

Shirato et al,2017 made a recommendation for the use of wrist traction, followed by finger traction and wrist varus force, as a means to stretch the extensor muscles. This approach was suggested as an alternative to the conventional practice of performing finger and wrist flexion exercises. The recommendation was made on the basis of an examination conducted on eight recently deceased bodies.

Sethi K et al. **2018** conducted a study to investigate the impact of strengthening the scapular muscles on muscle activity, functional outcomes, and pain in individuals with chronic Lateral Epicondylitis (LE) conditions.

A total of 26 individuals with chronic Lateral Epicondylitis (LE) conditions were recruited for this study. These participants were then divided into two groups: one group received scapular strengthening exercises in addition to conventional physiotherapy treatment, while the second group only received conventional physiotherapy treatment. Both groups underwent their respective treatments for a duration of 6 weeks. The outcome measures utilized in this investigation included the VAS for pain assessment, pain-free grip strength evaluation, functional outcome assessment using the PRTEE, as well as evaluation of scapular muscle strength, scapular positioning using the LSST, and electromyography (EMG) activity before and after the intervention. The findings of the study indicate that there were statistically significant differences observed in all outcome measures for the time effect. Additionally, a significant difference was observed for the group effect in the electromyography (EMG) activity of the lateral triceps (LT) and extensor carpi radialis brevis (ECRB) muscles. Furthermore, a significant difference was found in the interaction between time and group for all outcome measures, except for the LSST. The researchers reached the conclusion that incorporating scapular muscle strengthening exercises into conventional physiotherapy treatments is recommended for individuals with chronic Lateral Epicondylitis pain in order to enhance pain management and functional outcomes.

Schulte-Edelmann et al. 2005 conducted a study aimed at investigating the impact of plyometric training on the posterior shoulder and elbow regions among a sample of 28 healthy college students.

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The research findings indicated that plyometric training resulted in enhanced power and force generation in the elbow extensor muscles.

In a study conducted by Carter et al. (2007), it was found that there was a statistically significant augmentation in concentric internal rotation and eccentric external rotation isokinetic strength. The researcher reached the conclusion that the implementation of plyometric exercises is likely to enhance the strength of the rotator cuff muscles and subsequently improve the functional performance of basketball players.

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Tonks et al. (2007) utilized high-definition ultrasound (HHD) to examine the efficacy of steroid injection therapy as a conservative approach in the management of lateral epicondylitis (LE). The findings of his prospective randomized controlled trial (RCT) indicated that steroid injection therapy demonstrated superior efficacy as the initial treatment for tennis elbow. This intervention resulted in a significant improvement in grip strength and facilitated a prompt resumption of daily activities

Testa et al. 2020 conducted a systematic review that examined the efficacy of extracorporeal shockwave therapy (ESWT) for the treatment of upper limb diseases. The studies conducted to assess the efficacy of Extracorporeal Shockwave Therapy (ESWT) in the management of lateral epicondylitis yielded conflicting outcomes.

taping, with a total of 48 patients. The results of the trial indicated that there were no significant differences observed between the two groups in terms of their outcomes.

In a review article conducted by **Tarpada et al. 2018**, an analysis was performed on innovative therapeutic approaches, such as Bone Marrow Aspirate Concentrate (BMAC), Platelet Rich Plasma (PRP) injections, stem cell injections and collagen-producing cell injections, with the aim of tendon regeneration and functional recovery in patients with epicondylitis. The researchers reached the conclusion that these innovative therapies are currently in the early stages of investigation, and preliminary studies support the ongoing efforts to refine PRP 24 variables, collagen-producing cell treatments, and stem cell treatments. The primary constraint in endorsing the safety and efficacy of PRP protocols at present is the dearth of evidence in the literature. The potential efficacy of collagen-producing cell treatments and stem cell treatments in the context of conservative and surgical interventions for LE conditions is being explored in preliminary clinical trials. These treatments hold promise for enhancing tendon healing, as well as improving pain management and functional outcomes.

In a randomized controlled trial conducted by **Nowotny et al. 2018**, the researchers examined the impact of incorporating a dynamic wrist orthosis into the treatment of lateral epicondylitis (LE) conditions. The results indicated a noteworthy enhancement in both pain reduction and functional improvement after 12

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weeks of treatment in the group receiving both physiotherapy treatment and the orthosis, in comparison to the group solely receiving physiotherapy treatment. However, after duration of 12 months, no discernible distinctions were observed between the various cohorts.

In a review article conducted by **Lai et al. 2018** an examination of chronic lateral epicondylitis (LE) was undertaken, encompassing various conservative treatment modalities such as nonsteroidal anti-inflammatory drugs (NSAIDs), physiotherapy, shockwave therapy, corticosteroid injections, biologics, as well as surgical interventions including open, arthroscopic, and percutaneous techniques. The article provided an overview of the current evidence supporting these treatment approaches for refractory patients. The findings from this dataset indicate that nonsteroidal anti-inflammatory drugs (NSAIDs), physiotherapy (PT), bracing, and shockwave therapy offer only modest advantages in the management of lateral epicondylitis (LE). Platelet rich plasma (PRP) and autologous whole-blood injections have been suggested to exhibit greater efficacy than steroid injections over an extended duration. Although the preliminary findings of stem cell injections show promise, it is imperative to conduct larger comparative studies in order to further evaluate their efficacy. In the context of refractory LE cases, it has been observed that various surgical techniques, including open, arthroscopic, and percutaneous approaches, exhibit a high degree of efficacy. However, no single technique has demonstrated superior outcomes compared to the others. Arthroscopic and percutaneous techniques have been found to potentially lead to expedited recovery and earlier resumption of work when compared to open surgery.

In a review conducted by **Dimitrios 2016**, an examination was conducted on the evidence pertaining to physiotherapy management in the context of LE conditions. The review concluded that the most promising treatment approach for LE is an exercise programme. However, it also highlighted the necessity for further research to establish an optimal protocol for this treatment modality. In several patients, a sole exercise programme may not yield satisfactory improvements, necessitating further investigation into the optimal combination of additional physiotherapy techniques, such as manual therapy, electrotherapy, taping/bracing, and acupuncture, to achieve the most favorable outcomes in the treatment of LE conditions. A 2015 epidemiological study examined the healthcare burden of LE conditions in the United States population from 2000 to 2012. The study reported an incidence rate of 4.5 cases per 1000 individuals in the year 2000, which decreased to 2.4 cases per 1000 individuals in the year 2012. The recurrence rate of 8.5% remained consistent. The proportion of patients receiving surgical treatment within

two years of diagnosis exhibited a threefold increase over time. Specifically, approximately one out of every ten patients experiencing persistent symptoms necessitated surgical intervention within six months.

Vicenzino B,in 2007 conducted a study on the initial effects of a cervical spine manipulative physiotherapy treatment on the pain and dysfunction of lateral epicondylalgia.

This study investigated the effects of cervical spine manipulative physiotherapy, including MWM techniques, on pain and dysfunction in patients with lateral epicondylalgia. The study found that this treatment approach resulted in immediate pain reduction and improved grip strength

In their study, **Reyhan et al. 2020** conducted research with the objective of examining the effects of MWM in the lower extremities (LE). The study consisted of a total of forty participants who were randomly divided into two groups. Group 1, comprising of twenty individuals, received a combination of MWM therapy, cold therapy and exercise. Group 2, also consisting of twenty participants, received only exercise and cold therapy. The sessions were administered on a frequency of five times per week over a duration of two weeks. All measurements were performed at the initial assessment, post-treatment, and during the 1-month and 3-month follow-up periods. The Mann-Whitney U test was utilized to assess the statistical significance of the data. Pain intensity was measured using a VAS, while the PRTEE Questionnaire was employed to evaluate both pain intensity and functional disability. Hand grip strength was measured using a dynamometer. The Visual Analogue Scale (VAS) activity pain exhibited a significant decrease in group 1 following the treatment ($p= 0.001$), both at the 1st ($p< 0.001$) and 3rd months ($p= 0.040$). Group 1 exhibited a notable reduction in VAS night pain ($p= 0.024$), alongside a significant improvement in pain-free grip strength ($p= 0.002$) following the intervention. The pain scores in group 1 exhibited a significant decrease following treatment, as indicated by a p-value of less than 0.001. This decrease was observed at both the first and third months, with p-values of less than 0.001 and 0.001, respectively. The combination of manual therapy, exercise, and cold therapy has been found to be a viable and efficacious alternative for managing elbow pain. This approach has demonstrated positive outcomes in terms of improving functional capacity, reducing pain, and enhancing pain-free maximum grip strength.

Rompe et al. conducted a study to validate the Patient-Rated Tennis Elbow Evaluation Questionnaire (PRTEE). The study involved the enrollment of 78 tennis players who were diagnosed with chronic, unilateral, lateral elbow tendinopathy through MRI confirmation. The objective of the study was to evaluate the reliability, validity, and sensitivity of the PRTEE Questionnaire. The researchers conducted a comparative analysis between the outcomes of the PRTEE and several other assessment tools, namely the VAS, DASH Questionnaire, the Upper Extremity Function AND the Roles and Maudsley score Scale. Outcome

measures were assessed at the initial time point and after a period of 12 weeks. The findings indicated a high level of reliability and internal consistency for the PRTEE specific activities subscale (0.93), PRTEE usual activities (0.85) and PRTEE pain subscale (0.94). Significant correlations were observed between the subscales and total scale of the Patient-Rated Tennis Elbow Evaluation (PRTEE), as well as between the VAS and the DASH questionnaire. Based on the findings, the authors have determined that the PRTEE demonstrated reliability, reproducibility, and sensitivity as an assessment tool for chronic lateral elbow tendinopathy in a cohort of individuals who play tennis. The study determined that PRTEE exhibited a level of sensitivity to change that was equal to or greater than the other outcome tools that were assessed. The PRTEE has the potential to emerge as the predominant primary outcome measure in the investigation of tennis elbow.

In their study, Raja et al. (2022**)** conducted research to assess the efficacy of ultrasound in conjunction with strengthening exercises for individuals diagnosed with lateral epicondylitis. Additionally, they aimed to evaluate the effectiveness of a progressive strengthening exercise programme for subjects with lateral epicondylitis. The study comprised a sample size of 50 subjects. Participants who satisfied the predetermined criteria for inclusion and exclusion were selected and enrolled in the study. The participants were allocated randomly into two groups, labelled as Group A and Group B, with each group consisting of 25 individuals. Group A was assigned as the experimental group, while Group B served as the control group. The study examined the efficacy of two interventions, namely strengthening exercises and ultrasound therapy, in reducing pain and improving muscle strength. The results indicated that strength training alone was more effective in reducing pain and improving muscle strength compared to the combination of both interventions. However, it is worth noting that the association between the two interventions did show a statistically significant reduction in pain, but no significant change was observed in muscle strength in the control group.

Stasinopoulos et al. 2005 conducted an investigation on the efficacy of an exercise plan formulated for the treatment of lateral elbow tendinopathy. The researchers came to the conclusion that exercise routines are effective in the treatment of lateral elbow tendinopathy.

Struijs PA et al.,2003 demonstrated Manipulation of the wrist for management of lateral epicondylitis: a randomized pilot study.

This pilot study investigated the effects of wrist manipulation combined with MWM techniques in the treatment of lateral epicondylitis. The study found that the combination of wrist manipulation and MWM resulted in significant improvements in pain, grip strength, and functional outcomes compared to a control group.

These studies suggest that physiotherapy treatments, including mobilization with movement techniques, can be effective in reducing pain and improving function in individuals with lateral epicondylitis. However, it is important to

note that individual responses to treatment may vary, and further research is needed to establish the long-term effectiveness and optimal protocols for MWM in the management of lateral epicondylitis

Smidt et al. 2002 investigated the efficacy of corticosteroid injections, physiotherapy, and a wait-and-see policy for the treatment of lateral epicondylitis. A study was conducted on a sample size of 185 participants, leading to the conclusion that corticosteroid injections are the most effective short-term treatment option for patients diagnosed with lateral epicondylitis. The disparities between physiotherapy and a wait and see approach were substantial, clinically significant, and consistent across all outcome measures.

Slater et al, 2006 conducted study to investigate the impact of manual therapy technique on experimental lateral epicondylalgia. A study was conducted on a sample of 24 participants, wherein it was determined that the lateral glide Mulligan mobilisation with movement (MWM) technique does not elicit the activation of mechanisms associated with analgesia or force augmentation in individuals exhibiting experimentally induced characteristics resembling lateral epicondylalgia.

Srinivas et al. 2022 conducted a research with the goal of determining the efficiency of ultrasonography with strengthening in individuals with lateral epicondylitis and to determine the effectiveness of a progressive strengthening exercise programme in persons with lateral epicondylitis. The study involved the selection of a sample size consisting of 50 subjects. Participants who met the specified inclusion and exclusion criteria were selected and enrolled in the study. The participants were allocated into two groups, A and B, using random assignment. The experimental group consisted of 25 subjects, while the control group also comprised 25 subjects. The interventions utilized in this study involved the implementation of both strengthening exercises and ultrasound therapy. The results indicated that strength training alone was more effective in reducing pain and improving muscle strength, as compared to the control group. However, when the two interventions were combined, there was a statistically significant association observed in pain reduction. It is important to note that no changes in muscle strength were observed in the control group.

Singh et al. 2022 conducted a study with the aim of comparing the impact of Cyriax physiotherapy and mobilisation with movement technique on pain reduction and grip strength improvement in patients diagnosed with tennis elbow. The study comprised a sample size of 30 individuals diagnosed with lateral epicondylitis, all falling within the age range of 30 to 50 years. The participants were allocated into two groups, Group A and Group B, using a random assignment method. Fifteen participants were assigned to Group A and received cyriax physiotherapy, while another fifteen participants were assigned to Group B and received treatment involving movement with mobilisation. The patients received treatment three times per week over a duration of four weeks. The outcome measures utilized in this study include the NPRS and DASH assessment tool. The findings of the study indicated a statistically significant enhancement in the NPRS and the DASH scores within Group A (Experimental group) as compared to Group B. The comparison between Group A and Group B

was conducted using an independent t-test. Group A demonstrated a statistically significant improvement in the Numeric Pain Rating Scale (NPRS) with a p-value of 0.024, as well as in the DASH questionnaire with a p-value of 0.002. Based on the findings, it can be inferred that cyriax physiotherapy demonstrates greater efficacy in alleviating pain, enhancing functional disability, and improving pain-free grip strength compared to mobilisation with movement in individuals diagnosed with lateral epicondylitis.

Vicenzjno et al, 2003 conducted a study on the topic of lateral epicondylagia from a musculoskeletal physiotherapy standpoint. The researcher discovered that the utilization of manipulative therapy and taping treatments yields the most favorable outcomes in the clinical management of lateral epicondylalgia21.

Vicenzino et al, 2001 examined the effects of specific manipulative therapy treatment on chronic lateral epicondylegia, resulting in distinct hypoalgesia. The study was conducted on a sample size of 24 participants, and the findings revealed a statistically significant and substantial improvement in pain-free grip strength by 58% during the treatment phase, as compared to the placebo and control phases. On the other hand, the observed increase of 10% in pressure threshold following treatment, while significantly higher than that of the placebo and control groups, was considerably smaller compared to the change exhibited in pain-free grip strength. The observed effect was limited to the affected limb.

, **Vissing et al. 2008** conducted a study aimed at assessing the impact of plyometric exercises and resistance training on muscular adaptations in untrained young men. The researchers concluded that both conventional resistances training and plyometric training yielded comparable outcomes in terms of maximal strength gains. However, they observed that plyometric exercises resulted in more rapid improvements in muscle power when compared to conventional resistance training.

Vicenzino et al,2001 conducted a studyin which a. Specific manipulative therapy treatment for chronic lateral epicondylalgia produces uniquely characteristic hypoalgesia.

Walker Bone et al. 2004 conducted an investigation to determine the prevalence and assess the impact of musculoskeletal disorders specifically affecting the upper limb in a sample of 1152 individuals who were not involved in athletic activities. According to the report, a total of 2.4% of the participants were diagnosed with tennis elbow. Among these cases, 1.3% was male and 1.1% was female.

Walker-Bone et al. 2004 conducted research to examine the prevalence and impact of musculoskeletal disorders specifically related to the upper limb within the general population. The researchers reached the conclusion that upper limb pain is prevalent among the general population and frequently exhibits physical indications that imply the presence of distinct upper limb disorders.

This study examined the immediate effects of cervical spine manipulative physiotherapy, including MWM techniques, on pain and dysfunction in patients with lateral epicondylalgia. The study found that this treatment approach resulted in significant reductions in pain and improvements in grip strength and functional outcomes.

In a study conducted by **Zami et al. 2023**, the researchers investigated the

efficacy of administering mulligan mobilisation with movement as a treatment approach for lateral epicondylitis. The findings of the literature review, which involved the evaluation of five articles based on predetermined inclusion criteria, indicate that a range of modalities were employed, either individually or in conjunction with one another. The implementation of Mulligan mobilisation with movement has been shown to have the potential to alleviate pain and enhance functional capacity in the elbow joint. The utilization of Mulligan mobilisation with movement has demonstrated efficacy and may serve as a viable alternative in the therapeutic management of lateral epicondylitis. The integration of mobilisation with movement techniques in conjunction with various therapeutic interventions, including conventional treatments and exercise, has been found to yield optimal outcomes.

Zhou et al. 2020 conducted a meta-analysis on the effects of acupuncture treatment for LE, and their research included a review and analysis of ten randomized controlled trials (RCTs) that matched the following inclusion criteria: The chosen study design for this research is randomized controlled trials (RCTs). The population under consideration for this study consists of individuals who have been diagnosed with Lateral Epicondylitis (LE) conditions. The intervention implemented in the observation group was restricted to acupuncture therapy, specifically manual acupuncture or electro-acupuncture. The comparison in the control group involved sham acupuncture, drug administration, or blocking therapy. The researchers reached the conclusion that acupuncture demonstrates a higher level of effectiveness compared to blocking therapy, sham acupuncture therapy and drug therapy for LE conditions. However, it is important to note that these findings lack analysis of long-term follow-ups, and the randomized controlled trials (RCTs) that were identified were not adequately designed and had small sample sizes.

In a review conducted by Fatyga et al. 2020, an examination of contemporary treatment options for lateral epicondylitis (LE) was presented, highlighting the prevailing and efficacious treatment approaches for this condition. The least intrusive modalities utilized in physiotherapy and rehabilitation encompass ultrasound and phonophoresis, home exercise, cryotherapy, Light amplification by stimulated emission of radiation (LASER) therapy, radial shock wave therapy and light therapy. The researchers conducted a comparative analysis of the effectiveness of various pharmacological interventions, including steroid injections combined with lidocaine, non-steroidal anti-inflammatory drugs, hyaluronic acid, platelet-rich plasma, collagen, and botulinum toxin. Additionally, they discussed the indications for surgical approaches in the treatment of lateral epicondylitis. The authors have reached the conclusion that the presence of a wide range of treatment options, coupled with the uncertainty surrounding their effectiveness, indicates the absence of a universally accepted treatment approach for lateral epicondylitis (LE). No large prospective clinical trials with long-term objective follow-up were identified. The majority of studies have documented treatment outcomes in the short and medium term, using various criteria that were subjectively chosen.

. static splint was utilized to maintain the desired wrist extension on both the

affected and unaffected sides. As anticipated, the grip strength of the involved side was notably lower compared to the uninvolved side in both wrist positions. Additionally, the athletic population demonstrated significantly higher grip strength compared to

the non-athletic population. However, the most notable discovery of the research was the observation that grip strength was significantly higher at a 15-degree

angle compared to a 35-degree angle. As a result, it is suggested that the 15-degree angle be utilized as the preferred position for analysing grip strength in future studies

2.3 Research Gap

The study has identified a research gap that pertains to the necessity of determining the most influential technique for treating subjects with lateral epicondylitis. Although there are multiple treatment approaches available for this particular condition, there is a notable dearth of comprehensive research that directly compares and evaluates the efficacy of these techniques in a systematic manner. The primary objective of this study is to fill the existing research gap by undertaking a comparative analysis of two distinct treatment modalities, namely mobilisation with movement and exercises.

At present, the existing body of literature is deficient in providing substantial evidence favouring one technique over another, resulting in a state of uncertainty among healthcare practitioners when it comes to choosing the most suitable treatment strategy for patients with lateral epicondylitis. The lack of adequately designed studies that directly compare the outcomes of these interventions adds to the ambiguity surrounding their effectiveness.

This study aims to address a gap in the existing research by employing a rigorous research design and utilizing an experimental approach. The objective is to generate strong empirical evidence regarding the comparative efficacy of mobilisation with movement and exercises in terms of pain reduction and improvement in grip strength among patients diagnosed with lateral epicondylitis.

Concluding Remarks

In conclusion, the examination of the relevant literature has offered a holistic and penetrating comprehension of the present state of knowledge for the treatment of lateral epicondylitis. The comprehensive review of previous studies, research papers, and academic publications has shed light on the many different therapy methods, treatments, and management strategies that are utilized in the treatment and management of this ailment.

The review makes it abundantly clear that lateral epicondylitis is a common and difficult musculoskeletal illness that affects a sizable number of people, in particular those who participate in activities that are performed in a manner that is same time and time again. The current body of research emphasizes the significance of making an accurate diagnosis as early as possible and beginning suitable treatment as soon as possible in order to reduce discomfort, restore function, and improve the affected people' overall quality of life.

Several therapeutic strategies, such as physical therapy techniques, exercises, manual treatments, and other supplementary

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interventions, have been investigated. There is currently a lack of consensus on the best effective technique for the care of lateral epicondylitis, despite the fact that several treatment modalities have been found to have beneficial effects in certain trials.

In addition, the evaluation has thrown light on the necessity of conducting more research in this field. Many studies have shown evidence that various therapies may be effective; however, conclusive conclusions cannot be drawn due to methodological constraints and discrepancies in the existing research. As a result, there is a gap in the research that requires well-designed, randomized controlled trials and comparative studies to directly examine the efficacy of various treatment methods.

In conclusion, the assessment of the relevant literature shows the significance of evidence-based practice as well as the requirement for more in-depth study in order to determine the most effective treatment techniques for lateral epicondylitis.

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Research Methodology

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Chapter-3

Research Methodology

3.1 Introduction

The methodology section holds paramount significance in any research study as it allows the researcher to establish a comprehensive framework for the undertaken study. The research methodology encompasses a systematic procedure in which the researcher commences from the initial identification of problems and progresses towards the ultimate conclusion.

The primary objective of this study is to assess the effectiveness of mobilization with movement as a therapeutic intervention for individuals diagnosed with tennis elbow. Additionally, this research aims to investigate the impact of both mobilizations with movement and exercise on pain reduction and improvement in grip strength among patients suffering from lateral epicondylitis.

The following chapter outlines the methodology employed by the researcher in conducting the study. The components encompassed in this study consist of the research methodology employed, the specific context in which the study is conducted, the technique utilized for sampling the population, the selection of appropriate tools for data collection, the procedure implemented for intervention, as well as the plan devised for data analysis.

3.2 Research Approach

The research approach is a crucial component of any research endeavour. The selection of the research approach is contingent upon the specific objectives of the research investigation being conducted.

Due to the fact that the majority of studies in the field of physical medicine require the highest degree of accuracy, an experimental strategy that is true yet comparative in character has been decided to be the most appropriate method for carrying out the current research.

3.3 Population

The population in this study is defined as the group of individuals to whom the research findings can be applied. In this particular study, all patients experiencing lateral epicondylitis were considered as the universal population.

3.4 Accessible Population

Among the respondents, there were individuals who were amenable to the researcher and were part of the accessible population from which the sample was selected. The study's population consisted of patients who sought medical care at the Pacific Institute of Medical Sciences.

3.5 Research Setting

The research was carried out in the physiotherapy department of Pacific Medical College & Hospital, which is located in Bhilo ka Bedla , Udaipur India.

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3.6 Sample and Sampling Technique

3.6.1 Sample

In the first stage of the study, individuals presenting with complaints of elbow pain underwent an assessment using an evaluation form to diagnose cases of lateral epicondylitis, adhering to the necessary inclusion criteria. Following the aforementioned process, a comprehensive compilation of subjects was generated, from which a subset of 180 subjects was selected utilizing the systematic random sampling technique.

3.7 Research Design

The study employed an experimental design with a comparative approach.

3.8 Inclusion Criteria

- Positive mill's test
- Positive cozen's test
- Both genders are included
- Age 20 - 40 years

3.9 Exclusion Criteria

- Surgery of the elbow
- Redial tunnel syndrome
- Intra - articular pathology
- Injuries of the elbow with or without any deformities
- Cervical radiculopathy

3.10 Equipment Used

1. Ultrasound Machine

   Company name: - International Electromedical Company

2. Gel: - Ultrasound gel
3. Frequency: - 1 MHz
4. Hand Held Dynamometer

   Company name Baseline

3.11 Tools Used

1. Thera band

3.12 Procedure of Data Collection

The participants in the study were provided with a comprehensive explanation of the study's procedure and objectives. Subsequently, consent forms were obtained from each participant. The levels of pain, function, and grip strength were assessed using the Visual Analogue Scale (VAS), Hand Dynamometer, and an epicondylitis questionnaire for all participants in groups A, B, and C.

The participants assigned to experimental group A received treatment consisting of mobilisation with movement and ultrasound for a total of four sessions, with a frequency of two sessions per week over a period of two weeks. Following the completion of the treatment, the levels of pain experienced by the participants as well as their grip strength were evaluated. The participants were requested to subjectively assess their pain levels using a 10-point visual analogue scale. Additionally, a questionnaire for lateral epicondylitis was administered, and grip strength was measured using a hand-held dynamometer. The participants' measurements were taken on the first day prior to the commencement of the intervention, and subsequently on the final day of the intervention, which occurred two weeks later.

3.12.1 VAS measurement

Participants were instructed to assess

their pain intensity using a 10-point visual analogue scale at the commencement of the treatment and on the final day following a two-week period.

3.12.2 Grip strength Measurement

The participants were positioned in a seated posture, with their elbows flexed at a 90-degree angle and their forearms in a neutral rotation. Participants were instructed to grasp the Hydraulic Hand Held Dynamometer. The measurements were obtained at the commencement of the intervention and subsequently after a duration of 14 days, as per the established protocol, using the unit of pounds.

3.12.3 Patient rated Tennis Elbow evaluation Questioner -

The participants were requested to complete a questionnaire regarding lateral epicondylitis at the commencement of treatment and upon completion of the treatment protocol, specifically after a duration of two weeks.

3.12.4 Procedure

The evaluation Performa was utilized to assess all 180 subjects who met the inclusion criteria. These subjects were then divided into three groups: experimental group A (mobilisation group) consisting of 60 subjects, experimental group B (exercise group) consisting of 60 subjects, and group C (control group) consisting of 60 subjects. The patient provided consent through the completion of a consent form.

The subjects underwent evaluation through the administration of two tests.

1. **COZEN'S TEST**

The examiner's thumb is placed on the patient's lateral epicondyle to stabilize the subject's elbow. Subsequently, the patient is instructed to execute a fist-clenching action, followed by forearm pronation and radial deviation, as well as wrist extension, while the examiner applies resistance to impede the movement. A positive test is characterized by the abrupt onset of intense pain in the region of the lateral epicondyle of the humerus.

2. **MILL'S TEST**

While conducting manual examination of the lateral epicondyle. The examiner proceeds to pronate the patient's forearm, achieving full flexion of the wrist and extension of the elbow. A positive test is characterized by the presence of pain localized to the lateral epicondyle of the humerus.

3.13 Treatment Received by Experimental Group A

3.13.1 Ultrasonic Therapy

The individual assumes a seated position with their elbows flexed at a 90-degree angle and in a state of full pronation. This results in the lateral epicondyle becoming more prominent. The physiotherapist assumes a seated position in close proximity to the patient, subsequently administering ultrasound therapy at the prescribed dosage.

No. of days 2 weeks (2 times a week)

Mode: - pulsed (1: 4)

Frequency: 1 MHz

Duration 10 minutes (2 minutes / cm^2 area)

Dosage: - 0.5 W

No. of days: - 2 weeks (2 times a week)

Mode: -pulsed (l :4)

Frequency: - 1 MHz

Duration: - 10 minutes (2 minutes / cm^2 area)

Dosage: - 0.5 W

3.13.2 Mobilization with movement

The patient carries a supine position with the elbow in an extended and fully pronated state. The belt is positioned in close proximity to the medial epicondyle and is wrapped around the shoulder of the therapist on the opposite side. For example, when applying the glide to the right elbow, the belt is wrapped around the left shoulder of the therapist. The therapist assumes a position in which their face is directed towards the patient's feet. The therapist employs a bimanual technique, wherein one hand is used to stabilize the distal humerus, while the other hand is utilized to provide resistance against extension. In order to provide a lateral glide to the radius, it is important to ensure that the belt is positioned perpendicular to the patient's elbow while maintaining the glide. The duration of the glide is sustained for a period ranging from 5 to 10 seconds, with a rest interval not exceeding 1 minute. The patient is administered six repetitions.

3.14 Treatment Received by Experimental Group B

3.14.1 Ultrasonic Therapy plus Exercises (conventional therapy)

The patient assumes a seated position with his elbows flexed at a 90-degree angle and his forearms in a pronated position. This results in the lateral epicondyle becoming more prominent. The physiotherapist assumes a seated position in close proximity to the patient, subsequently administering ultrasound therapy at the prescribed dosage.

Subsequently, the patient was administered the subsequent exercise protocol, which commenced with a preliminary phase of general shoulder stretching. The patient is instructed to perform warm-up exercises involving the elbow and wrist for a duration of five minutes while in a standing position.

Afterwards, the patient is positioned in a seated posture, with the elbow joint flexed at a 90-degree angle.

1) wrist flexion: - Three sets of ten repetitions using a yellow-colored Thera band
2) wrist extension: - Three sets of ten repetitions using a yellow-colored Thera band.
3) elbow flexion: - Three sets of ten repetitions using a yellow-colored Thera band.
4) elbow extension: - Three sets of ten repetitions using a yellow-colored Thera band.
5) finger flexion / extension: - For a duration of one minute, utilizing a rubber band.
6) forearm pronation / supination: - Three sets of ten repetitions using a yellow-colored Thera band.

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3.15 Treatment Received by Control Group C

3.15.1 Ultrasonic Therapy

The patient is seated with his elbows completely extended at a 90-degree angle and his palms facing front. As a result, the prominence of the lateral epicondyle is increased. The physiotherapist will first take a seat in front of the patient before beginning the ultrasound treatment, which will have the following dosage:

No. of days: - 2 weeks (2 times a week)

Mode: -pulsed (1 :4)

Frequency: - 1 MHz

Duration: - 10 minutes (2 minutes / cm^2 area)

Dosage: - 0.5 W

3.16 Plan for Data Analysis

The data for intergroup analysis is analyzed using statistical tests such as the paired t-test, Wilcoxon signed rank test, Kruskal-Wallis test, and ANOVA. The concept of mean variation is employed in the analysis of data for the purpose of intra-group analysis. The p-value is employed to ascertain the level of statistical significance at a 5% threshold.

Fig3.1 Subject receiving MWM while patient is in Supine lying with shoulder adducted and elbow fully extended and forearm pronated. The Mobilization belt lies at the level of epicondyle of Humerus.

Fig3.2 Subject doing elbow flexon with forearm fully supported on a pillow.

Fig3.3 Subject doing wist forearm pronation while seated on a chair with elbow flexed to 90 degrees and forearm supported on a pillow.

Fig3.4 Subject doing wist forearm pronation while seated on a chair with elbow

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flexed to 90 degrees and forearm supported on a pillow.

Fig3.5 Subject doing wist flexion while seated on a chair with elbow flexed to 90 degrees and forearm supinated and rested on a pillow.

Fig3.6 Subject receiving ultrasound on lateral Epicondyle of humerus with elbow flexed to 90 degrees and forearm supported on a pillow.

Hydraulic Hand Dynamometer

Fig3.7 subject with shoulder adducted with no rotation elbow flexed for grip strength measurement

Fig3.8 Subject doing elbow extension while seated on a chair with shoulder flexed to 90 degrees and elbow flexed to 90 degrees.

Concluding Remarks

The methodology chapter plays a crucial role in laying the groundwork for the entirety of the research study. The comprehensive framework includes multiple components, including the chosen research methodology, the target population, the sampling methodology, the research design, the criteria for inclusion and exclusion, the equipment and tools utilized, the procedure for data collection, and the proposed plan for data analysis.

The selection of an experimental methodology was deemed appropriate, considering the imperative for precision in the realm of physical medicine investigation. The utilization of inclusion and exclusion criteria effectively ensured the study's concentration on the intended population, while the research setting was clearly delineated. In addition, the researchers took great care in selecting an appropriate sample size and employing a rigorous sampling technique in order to bolster the study's

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reliability.

The study's methodology is enhanced by the incorporation of dependable tools and equipment for data collection, including the Visual Analogue Scale (VAS), Handheld Dynamometer, and questionnaire for lateral epicondylitis. The treatment protocols for each group, namely mobilization with movement, exercise, and control group, were explicitly delineated.

In its entirety, the comprehensive methodology chapter establishes a sturdy framework for the research study. Through the implementation of this methodology, our objective is to acquire significant insights regarding the effectiveness of treatment approaches. These insights have the potential to make a valuable contribution to the progression of lateral epicondylitis management within the realm of physical medicine. The forthcoming chapters will provide an exposition of the findings and subsequent discussions, thereby enhancing our understanding of the efficacy of the interventions.

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Results

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Chapter-4

Results

4.1 Observation and Data Analysis

The statistical analysis was conducted using SPSS 11. The results were computed utilizing a significance level of 0.05.

The statistical formula for calculating the mean was utilized to determine the mean values of various variables across a specified number of subjects:

$$\bar{X} = \frac{\sum X}{N}$$

Where, N = Number of subjects

X = each subjects value

STANDARD DEVIATION

$$S = \sqrt{\frac{\sum X^2}{N}}$$

x = deviation of score from mean

N = Number of subjects

ANOVA – ONE FACTOR (F)

$$F = \frac{MS}{MS_e}$$

Where,

MS = Number of subjects

MS = each subjects value

t-test of dependent means

$$r = \frac{M_1 - M_2}{SD_M}$$

$$SDM = \sqrt{\{\frac{(N_1-1)S_1^2+(N_2-1)S_2^2}{N_1+N_2-2} \dashv][\frac{1}{N_1} + \frac{1}{N_2}]\}}$$

SDM = Standard Deviation of Mean Difference

D = Difference between pair of means

M = Mean

It is a significant piece of research work. The data has been subjected to analysis across three distinct groups.

Comprehension has been achieved across various domains.

1. Analysis within a specific group
2. Analysis of Intergroup Dynamics

4.2. Demographic Results

4.2.1. Gender

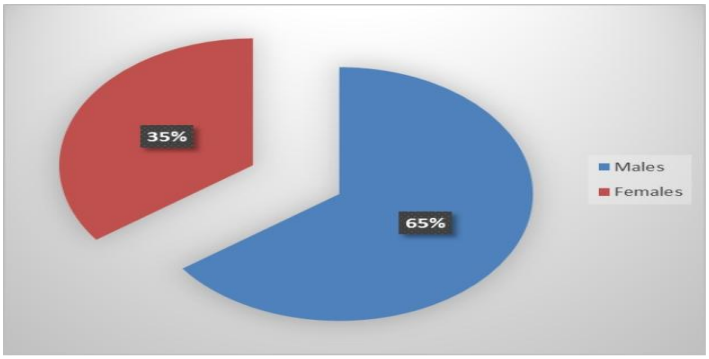

Figure 4. 1 Distribution of Males and Females among Total Study Subjects

Figure 4.1 presents a pie chart illustrating the distribution of male and female subjects included in the study, with proportions of 65% and 35% respectively.

4.2.2. Age wise distribution of the subjects

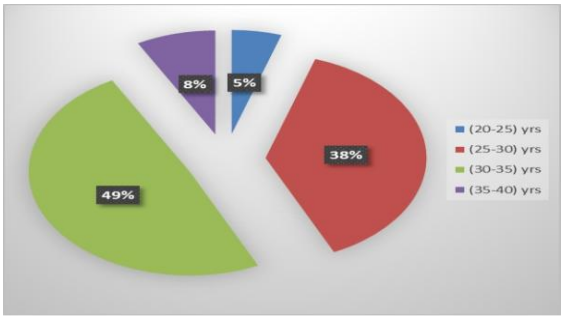

Figure 4. 2 Age wise distribution of the

subjects included in the study as a percentage

Figure 4.2 presents a pie chart illustrating the distribution of subjects included in the study according to age groups. The findings indicate that 5% of the subjects were aged between 20-25 years, 38% were aged between 25-30 years, 49% were aged between 30-35 years, and 8% were aged between 35-40 years.

4.3. Intra-group Analysis

4.3.1. Age for the Subjects of Group A, Group B and Group C

Table 4. 1mean and standard deviation of age for the subjects of group A, group B and group C

Groups	Age (Mean ± SD)
Group A	34.65 ± 7.05
Group B	35.5 ± 3.95
Group C	36.75 ± 3.38

The table provided presents the mean and standard deviation of age for the participants in group A, group B, and group C. Specifically, the mean age for group A is 34.65 with a standard deviation of 7.05. For group B, the mean age is 35.5 with a standard deviation of 3.95. Lastly, group C has a mean age of 36.75 with a standard deviation of 3.38.

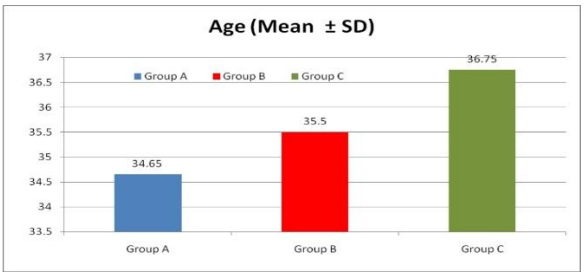

Figure 4. 3Comparison of mean value for Age between Group A, Group B and Group

The graph presented above illustrates the mean and standard deviation of age for the participants in groups A, B, and C. The mean age for group A is 34.65 years with a standard deviation of 7.05 years. Group B has a mean age of 35.5 years with a standard deviation of 3.95 years. Lastly, group C has a mean age of 36.75 years with a standard deviation of 3.38 years.

4.3.2. Grip Strength at Pre and Post Interval

Table 4. 2 mean and standard deviation of grip strength at pre and post interval

Groups	Grip Strength	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	35.95 ± 19.65	58.55 ± 18.94
Group B	34.85 ± 11.11	44.55 ± 11.87
Group C	34.00 ± 5.19	38.5 ± 4.41

The table presented above provides information regarding the mean and standard deviation of grip strength during the pre and post intervals. The mean and standard deviation for group A are 35.95 ± 19.65 and 58.55 ± 18.94, respectively. The mean and standard deviation for group B are calculated to be 34.85 ± 11.11 and 44.55 ± 11.87, respectively. The mean value for group C is 34.00 ± 5.19, while the mean value for group C is 38.5 ± 4.41.

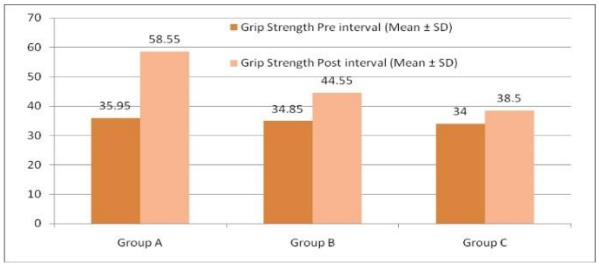

Figure 4. 4 Comparison of mean value of

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Grip Strength at Pre and Post interval between Groups A, B and C

The provided graph illustrates the average and standard deviation of grip strength during the pre and post intervals. The mean value for group A is 35.95 ± 19.65(pre) and 58.55 ± 18.94 (post). In group B, the values are reported as 34.85 ± 11.11 and 44.55 ± 11.87, respectively. The values for group C are 34.00 ± 5.19 and 38.5 ± 4.41, respectively.

Table 4. 3 Paired t – test done between pre and post interval of grip strength for group A group B and group C

(Pre Vs Post) Interval	t value	P value
Group A	-15.30	P < 0.05
Group B	-9.159	P < 0.05
Group C	-7.18	P < 0.05

It summarizes the paired t-test performed on the grip strength of groups A, B, and C before and after the interval. The t values are -15.30, -9.159, and -7.18 (P 0.05).

4.3.3. VAS at Pre and Post Interval

The table presented above provides information regarding the average and variability of the Visual Analogue Scale (VAS) scores during the pre and post intervals. The values for group A are 8.2 ± 0.75 and 0.98 ± 0.38. In the case of group B, the values are 8.19 ± 0.78 and 1.86 ± 0.85, respectively. In the case of group C, the values are 8.17 ± 0.64 and 2.86 ± 1.55, respectively

Table 4. 4 mean and standard deviation of VAS at pre and post interval

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	8.2 ± 0.75	0.98 ± 0.38
Group B	8.19 ± 0.78	1.86 ± 0.85
Group C	8.17 ± 0.64	2.86 ± 1.55

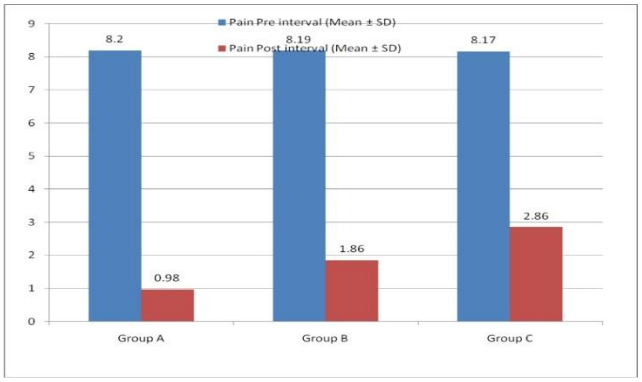

Figure 4. 5Comparison of mean value of VAS at Pre and Post interval between Groups A, B and C

The graph presented above illustrates the average and standard deviation of the Visual Analogue Scale (VAS) measurements during the pre and post intervals. The values for group A are 8.2 ± 0.75 and 0.98 ± 0.38. In the case of group B, the values are reported as 8.19 ± 0.78 and 1.86 ± 0.85, respectively. The values for group C are 8.17 ± 0.64 and 2.86 ± 1.55, respectively.

Table 4. 5Paired t – test done between pre and post interval of VAS between for group a, group B and group C

(Pre Vs Post) Interval	t value	P value
Group A	33.92	P < 0.05
Group B	23.50	P < 0.05

Group C	12.89	P < 0.05

This table provides a description of the Paired t-test conducted to compare the pre and post intervals of the Visual Analogue Scale (VAS) scores for groups A, B, and C. The t-values reported in the study are 33.92 (P < 0.05), 23.50 (P < 0.05), and 12.89 (P < 0.05), respectively.

4.3.4. Pain at Pre and Post Interval

Table 4. 6 mean and standard deviation of pain at pre and post interval

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	30.80 ± 6.90	7.20 ± 1.64
Group B	30.25 ± 3.98	10.75 ± 3.53
Group C	30.65 ± 4.00	13.30 ± 2.43

The table presented above provides information regarding the average and standard deviation of pain levels during the pre and post intervals. In group A, the values are reported as 30.80 ± 6.90 and 7.20 ± 1.64, respectively. In the case of group B, the values are 30.25 ± 3.98 and 10.75 ± 3.53, respectively. The values for group C are 30.65 ± 4.00 and 13.30 ± 2.43, respectively.

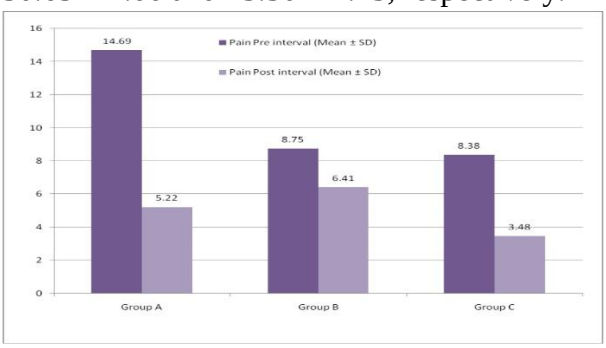

Figure 4. 6Comparison of mean value of Pain and Pre and Post interval between Groups A, B and C

The graph provided illustrates the average and standard deviation of pain levels before and after a specific time interval. In the case of group A, the values are 30.80 ± 6.90 and 7.20 ± 1.64, respectively. In the case of group B, the values are 30.25 ± 3.98 and 10.75 ± 3.53, respectively. The values for group C are 30.65 ± 4.00 and 13.30 ± 2.43, respectively.

Table 4. 7Paired t – test done between pre and post for pain for group A, group B and group C.

(Pre Vs Post) Interval	t value	P value
Group A	-3.93	P < 0.05
Group B	-3.928	P < 0.05
Group C	-3.929	P < 0.05

This table provides a description of the Paired t-test conducted to compare pre- and post-pain levels among Group A, Group B, and Group C. The t-values reported in the study were -3.93 (p < 0.05), -3.928 (p < 0.05), and -3.929 (p < 0.05) respectively.

4.3.5. Function at Pre and Post Interval

Table 4. 8 mean and standard deviation of function at pre and post interval

Groups	Pain	
	Pre interval (Mean ± SD)	Post interval (Mean ± SD)
Group A	58.60 ± 14.69	14.1 ± 5.22
Group	57.90 ± 8.75	18.45 ± 6.41

B		
Group C	58.5 ± 8.38	23.95 ± 3.48

The table presented above provides information regarding the average and standard deviation of pain levels during the pre and post intervals. In group A, the values are reported as 58.60 ± 14.69 and 14.1 ± 5.22, respectively. In the case of group B, the values are 57.90 ± 8.75 and 18.45 ± 6.41, respectively. The values for group C are 58.5 ± 8.38 and 23.95 ± 3.48, respectively.

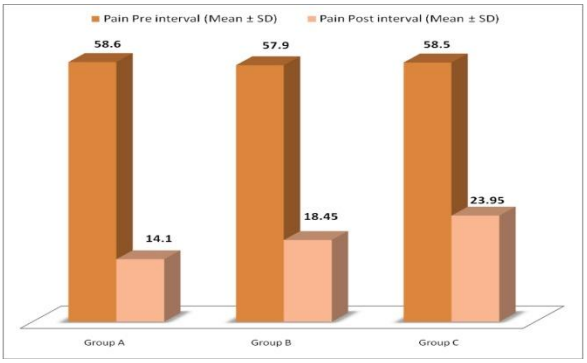

Figure 4. 7 Comparison of the value of the function at pre and interval between Group A, B, and C

The graph presented above illustrates the average and standard deviation of pain levels before and after a specific time interval. In group A, the values are reported as 58.60 ± 14.69 and 14.1 ± 5.22, respectively. In the case of group B, the values are 57.90 ± 8.75 and 18.45 ± 6.41, respectively. The values for group C are 58.5 ± 8.38 and 23.95 ± 3.48, respectively.

Table 4. 9 Paired t-test results comparing pre and post intervals for function in groups A, B, and C.

(Pre Vs Post) Interval	t value	P value
Group A	-3.92	P < 0.05
Group B	-3.92	P < 0.05
Group C	-3.923	P < 0.05

This table provides a description of the Paired t-test conducted to compare the pre and post intervals for the function in groups A, B, and C. The t-values reported in the study were -3.92 (P < 0.05), -3.921 (P < 0.05), and -3.923 (P < 0.05), respectively.

4.4. Intergroup Analysis

Table 4. 10 Comparison of means using ANOVA for grip strength and VAS during the pre-interval

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	0.107	P > 0.05
VAS	0.006	P > 0.05

This study employs analysis of variance (ANOVA) to examine mean values of grip strength and visual analogue scale (VAS) scores during the pre-interval period, with the aim of assessing potential changes across three groups: group A, group B, and group C. The observed values were 0.107 (P > 0.005) and 0.006 (P > 0.05) correspondingly.

Table 4. 11 Analysis of variance for mean of pain and function scores throughout the pre

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interval period

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	2.90	P > 0.05
Function	0.67	P > 0.05

The table presents an analysis of variance (ANOVA) for the mean values during the pre-interval period, specifically focusing on pain and function, in order to assess any potential changes across three groups: group A, group B, and group C. The observed values were 2.90 (P > 0.005) and 0.67 (P > 0.05), respectively.

Table 4. 12 ANOVA on pre-interval means for grip strength and VAS

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	12.21	P < 0.05
VAS	16.01	P < 0.05

The table presents an analysis of variance (ANOVA) for the mean values of grip strength and Visual Analogue Scale (VAS) at the pre-interval, with the purpose of examining potential changes among Group A, Group B, and Group C. The observed values are 12.21 (P < 0.005) and 16.01 (P < 0.05), respectively.

Table 4. 13 Comparison of mean pain and function scores across the baseline period using ANOVA

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	31.91	P < 0.05
Function	22.64	P < 0.05

The table presents the analysis of variance (ANOVA) results for the mean values during the pre-interval period, specifically focusing on pain and function, in order to assess any potential differences among group A, group B, and group C. The observed values for the variables are 31.91 (P < 0.05) and 22.64 (P < 0.05), respectively.

Table 4. 14 Pre-interval ANOVA for Mean Grip Strength and Visual Analogue Scale Values

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Grip Strength	70.51	P < 0.05
VAS	9.432	P < 0.05

The table presents an analysis of variance (ANOVA) for the mean values of grip strength and visual analogue scale (VAS) at the pre-interval, aiming to examine any potential changes across group A, group B, and group C. The observed values were 70.51 (P < 0.05) and 9.432 (P < 0.05), respectively.

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Table 4. 15 Analysis of Pre-Interval Means for Pain and Function Using ANOVA

Variables	Group A Vs Group B Vs Group C	
	F value	P value
Pain	16.18	P < 0.05
Function	8.58	P < 0.05

The table presents an analysis of variance (ANOVA) for the mean values during the pre-interval period, specifically focusing on pain and function, in order to assess any potential changes across three groups: Group A, Group B, and Group C. The observed values for the variables are 16.18 (P < 0.05) and 8.58 (P < 0.05) respectively.

Table 4.16 provides a comprehensive analysis of the comparison between Group A and Group B, Group A and Group C, and Group B and Group C in terms of Grip Strength, Visual Analogue Scale (VAS), Pain, and Function at the Pre-interval, Post-interval, and (Pre-Post) interval. The values for t and P are provided in the preceding section.

The aforementioned findings indicate the presence of substantial alterations in groups A, B, and C. The findings indicate that group A exhibits a superior response compared to both group B and group C. This finding demonstrates that the treatment protocol administered in group A exhibits superior efficacy compared to those in group B and group C. Therefore, the null hypothesis is rejected, and the experimental hypothesis is accepted. The findings of the study indicate that mobilisation with movement is a more efficacious approach.

Table 4. 16 Comparison of values for Grip Strength, VAS, Pain, and Function between Group A, Group B, and Group C

Variables	Group A Vs B		Group A Vs C		Group B Vs C	
	t value	P value	t value	P value	t value	P value
Pre Grip Strength	0.218	P > 0.05	0.429	P > 0.05	0.310	P > 0.05
Post Grip Strength	2.800	P < 0.05	4.609	P < 0.05	2.136	P < 0.05
(Pre – Post) GS	7.098	P < 0.05	11.284	P < 0.05	4.227	P < 0.05
Pre VAS	0.041	P > 0.05	0.113	P > 0.05	0.066	P > 0.05
Post VAS	-4.171	P < 0.05	-5.242	P < 0.05	-2.508	P < 0.05
(Pre – Post) VAS	2.595	P < 0.05	4.097	P < 0.05	2.052	P < 0.05
Pre Pain	0.308	P > 0.05	0.084	P > 0.05	-0.317	P > 0.05
Post Pain	-4.071	P < 0.05	-9.302	P < 0.05	-2.657	P < 0.05
(Pre – Post) Pain	2.525	P < 0.05	3.917	P < 0.05	1.673	P > 0.05
Pre Function	0.183	P > 0.05	0.145	P > 0.05	-0.055	P > 0.05

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Post Function	-2.330	P < 0.05	-7.017	P < 0.05	-3.328	P < 0.05
(Pre – Post) Function	1.416	P > 0.05	3.053	P < 0.05	1.875	P < 0.05

According to the findings, people who had lateral epicondylitis benefited more from a combination of mobilization and movement than they did from exercises on their own in terms of having less pain and having increased grip strength and function. This is due to the repair of positioning defects that have developed as a result of injuries that have happened.

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DISCUSSIONS

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Chapter-5

Discussions

5.1. Introduction

The discussion chapter plays a pivotal role in any research, offering a thorough analysis and interpretation of the study's findings.

This chapter delves into the findings obtained through observation and data analysis, with a specific emphasis on comparing the effectiveness of Mobilization with Movement (MWM) and traditional exercises in the management of lateral epicondylitis. By conducting comparative analysis of the outcomes observed within each group as well as between the groups, we can assess the efficacy of the interventions in terms of their impact on grip strength, pain reduction and improvement in functional outcomes. Acknowledging the inherent constrains of the present study, we propose suggestions for forthcoming investigations in order to enhance our comprehension of therapeutic interventions for lateral epicondylitis.

The present investigation employed an experimental methodology, as it was deemed necessary to ensure a high level of precision in the field of physical medicine research. The objective of the study was to evaluate the effectiveness of mobilisation with movement in individuals diagnosed with tennis elbow, as well as to examine the impact of both mobilizations with movement and exercises on pain reduction and improvement of grip strength in patients with lateral epicondylitis.

The study's population encompassed all individuals afflicted with lateral epicondylitis. The present study focused on a specific subset of the overall population, namely patients who sought medical care at the Pacific Institute of Medical Sciences. A sample of 180 subjects was selected from the accessible population using a systematic random sampling method.

The inclusion criteria for this study encompassed individuals of both genders, ranging in age from 20 to 40 years, who exhibited positive results on the Cozen's and Mill's tests. The exclusion criteria encompassed various conditions, including cervical radiculopathy, elbow surgery, elbow injuries with or without deformities, radial tunnel syndrome, and intra-articular pathology.

The research was carried out at the Department of Physiotherapy located at Pacific Medical College & Hospital in Udaipur. Experimental group A was administered a treatment regimen comprising ultrasonic therapy and mobilization with movement, whereas experimental group B received ultrasonic therapy along with a designated exercise protocol. The control group was exclusively administered ultrasonic therapy.

The data collection process encompassed the utilization of three assessment tools: The Visual Analogue Scale (VAS), Handheld Dynamometer, and a questionnaire specifically designed for evaluating lateral epicondylitis. These tools were employed to measure and evaluate the variables of pain, grip strength, and overall functionality. The measurements were obtained at the initiation of the treatment and subsequently after a duration of 2 weeks.

In the context of data analysis, a range

of statistical tests were employed to conduct both intergroup and intragroup analyses. Specifically, the paired t-test, Wilcoxon Signed Rank test, Kruskal-Wallis Test, and ANOVA were utilized for intergroup analysis, while mean variation was employed for intragroup analysis. The predetermined level of statistical significance was established at 5% ($P < 0.05$).

5.2. Discussion on Demographic Data of this Study

The study includes a distribution of subjects based on gender, with males comprising 35% and females comprising 65% of the total sample. The study examined the distribution of subjects across different age groups. The results indicate that 5% of the subjects were between 20-25 years old, 38% were between 25-30 years old, 49% were between 30-35 years old, and 8% were between 35-40 years old. The mean and standard deviation of age for the subjects in group A, group B, and group C are calculated to be 34.65 ± 7.05, 35.5 ± 3.95, and 36.75 ± 3.38, respectively.

5.3. Discussion on outcome measures of this Study

5.3.1. Discussion based on Intragroup

The examination of the outcomes derived from the intragroup analysis provides significant insights into the efficacy of Mobilization with Movement (MWM) and conventional exercises for the management of lateral epicondylitis. The mean and standard deviation of grip strength were computed for each group during the pre and post intervals. Notably, all three groups exhibited significant improvements.

Group A demonstrated a significant improvement in grip strength, with the pre-interval mean of 35.95 ± 19.65 increasing to a post-interval mean of 58.55 ± 18.94. Group B demonstrated a lesser degree of improvement, as evidenced by a pre-interval mean of 34.85 ± 11.11 and a post-interval mean of 44.55 ± 11.87. Group C exhibited the smallest degree of improvement, as evidenced by their pre-interval mean of 34.00 ± 5.19 and post-interval mean of 38.5 ± 4.41. The results of the paired t-test indicate that there were statistically significant differences in grip strength measurements between the pre and post-interval for each group. The t-values obtained were -15.30 ($P < 0.05$) for Group A, -9.159 ($P < 0.05$) for Group B, and -7.18 ($P < 0.05$) for Group C.

In relation to the Visual Analogue Scale (VAS) scores, it is noteworthy that all three groups exhibited a statistically significant decrease in pain levels from the pre-intervention to the post-intervention period. Group A exhibited the most notable reduction in pain, as evidenced by a pre-interval mean Visual Analogue Scale (VAS) score of 8.2 ± 0.75 and a post-interval mean of 0.98 ± 0.38. Group B exhibited a pre-interval mean visual analogue scale (VAS) score of 8.19 ± 0.78, which subsequently decreased to a post-interval mean of 1.86 ± 0.85. Group C demonstrated a pre-interval mean Visual Analogue Scale (VAS) score of 8.17 ± 0.64, which subsequently decreased to a post-interval mean of 2.86 ± 1.55. The results of the paired t-test revealed statistically significant differences in the pre and post-interval VAS scores for each group. Specifically, Group A exhibited a t-value of 33.92 ($P < 0.05$), Group B exhibited a t-value of 23.50 ($P < 0.05$), and Group C exhibited a t-value of 12.89 ($P < 0.05$).

In relation to the assessment of pain intensity, the conducted study revealed a noteworthy reduction in pain levels across all

three groups, as observed from the pre-intervention to post-intervention measurements. The results indicate that Group A exhibited the greatest decrease in pain levels, as evidenced by a pre-interval mean of 30.80 ± 6.90 and a post-interval mean of 7.20 ± 1.64. Group B exhibited a pre-interval mean of 30.25 ± 3.98, which subsequently decreased to a post-interval mean of 10.75 ± 3.53. Group C demonstrated a pre-interval mean of 30.65 ± 4.00, which decreased to a post-interval mean of 13.30 ± 2.43. The results of the paired t-test revealed statistically significant differences in pain levels between the pre and post-interval assessments for each group. The t-values were -3.93 ($P < 0.05$) for Group A, -3.928 ($P < 0.05$) for Group B, and -3.929 ($P < 0.05$) for Group C.

5.3.2. Discussion based on intergroup

The purpose of conducting an intergroup analysis utilizing ANOVA was to assess and compare the average values of grip strength, visual analogue scale (VAS) scores, pain levels, and functional abilities at various time intervals across Group A, Group B, and Group C. The findings revealed varying degrees of statistical significance across the different outcome measures.

During the pre-interval stage, the analysis of variance (ANOVA) results indicated that there were no statistically significant disparities in grip strength and visual analogue scale (VAS) scores across the various groups. The grip strength value of 0.107 ($P > 0.005$) and the VAS value of 0.006 ($P > 0.05$) suggest that the baseline values of grip strength and VAS were similar among the three groups.

However, statistically significant differences were observed in terms of pain and function during the pre-interval stage. The observed values of 2.90 ($P > 0.005$) and 0.67 ($P > 0.05$) for pain and function, respectively, indicate that there were differences in the initial pain levels and functional capacities across the groups prior to the implementation of the intervention.

Upon transitioning to the post-interval stage, the analysis of variance (ANOVA) outcomes demonstrated noteworthy alterations in grip strength and visual analogue scale (VAS) scores among the different groups. The grip strength value of 12.21 ($P < 0.005$) and the VAS value of 16.01 ($P < 0.05$) suggest that the interventions had a significant effect on these measures, resulting in discernible differences between the groups following the treatment.

In a similar way, statistically significant differences were observed between the groups in terms of pain and function during the post-interval stage. The results indicate that the interventions had a statistically significant impact on reducing pain levels (31.91, $P < 0.05$) and improving functional outcomes (22.64, $P < 0.05$) within the groups.

Subsequent examination during the pre-post interval phase revealed more pronounced impacts of the interventions on grip strength and VAS scores. The grip strength value of 70.51 ($P < 0.05$) and the VAS value of 9.432 ($P < 0.05$) both suggest that the combination of treatments in each group resulted in significant enhancements in grip strength and VAS scores, respectively, when compared to their respective baseline values.

In a similar direction, notable alterations were observed in both pain and functional outcomes during the pre-post interval stage. The statistical analysis

revealed that the values of 16.18 ($P < 0.05$) and 8.58 ($P < 0.05$) for pain and function, respectively, provided evidence that the combined interventions had a statistically significant and beneficial effect on reducing pain levels and improving functional outcomes when compared to the pre-intervention levels.

5.4. Discussion on Efficacy of Groups

The effectiveness of the treatment protocols in Group A, Group B, and Group C was evaluated through the comparison of the average values of Grip Strength, Visual Analogue Scale (VAS), Pain, and Function at various intervals across the groups.

During the pre-interval stage, the analysis of variance (ANOVA) results indicated that there were no statistically significant differences observed between Group A and Group B in terms of Grip Strength ($t = 0.218$, $P > 0.05$) and VAS ($t = 0.041$, $P > 0.05$). Similarly, no significant differences were found between Group A and Group C ($t = 0.429$, $P > 0.05$; $t = 0.113$, $P > 0.05$), as well as between Group B and Group C ($t = 0.310$, $P > 0.05$; $t = 0.066$, $P > 0.05$) in relation to Grip Strength and VAS, respectively. Likewise, in terms of Pain and Function, there were no statistically significant disparities observed between the groups during the initial period ($P > 0.05$).

However, notable disparities were observed during the post-interval stage. Significant improvements in grip strength were observed in Group A when compared to both Group B ($t = 2.800$, $P < 0.05$) and Group C ($t = 4.609$, $P < 0.05$). Regarding the Visual Analogue Scale (VAS), Group A demonstrated a statistically significant decrease in comparison to both Group B ($t = -4.171$, $P < 0.05$) and Group C ($t = -5.242$, $P < 0.05$). Furthermore, it was observed that Group A exhibited a notable decrease in pain levels in comparison to Group B ($t = -4.071$, $P < 0.05$) and Group C ($t = -9.302$, $P < 0.05$). In terms of function, Group A exhibited noteworthy enhancements in comparison to both Group B ($t = -2.330$, $P < 0.05$) and Group C ($t = -7.017$, $P < 0.05$).

Moreover, significant differences were observed when comparing the changes from the pre-interval to the post-interval (Pre-Post) within each group. In Group A, there was a statistically significant improvement in Grip Strength ($t = 7.098$, $P < 0.05$), a significant reduction in VAS scores ($t = 2.595$, $P < 0.05$), and a significant alleviation of Pain ($t = 2.525$, $P < 0.05$). Nevertheless, the Function variable did not exhibit any statistically significant changes ($t = 1.416$, $P > 0.05$).

Significant improvements were observed in Grip Strength ($t = 11.284$, $P < 0.05$), reduction in Visual Analogue Scale (VAS) scores ($t = 4.097$, $P < 0.05$), and alleviation of pain ($t = 3.917$, $P < 0.05$) within Group B during the (Pre-Post) interval comparisons. There were no statistically significant changes observed in the function variable ($t = 3.053$, $P < 0.05$).

The findings from the interval comparisons within Group C indicate that there were significant improvements in Grip Strength ($t = 4.227$, $P < 0.05$) and reduction in VAS scores ($t = 2.052$, $P < 0.05$). Nonetheless, the study did not observe any noteworthy alterations in Pain ($t = 1.673$, $P > 0.05$) or Function ($t = 1.875$, $P < 0.05$).

In summary, the findings of this study suggest that Group A exhibited more favorable outcomes in relation to improvements in Grip Strength, reductions in Visual Analogue Scale (VAS) scores, alleviation of pain, and enhancements in overall function when compared to both

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Group B and Group C. The efficacy of treatments incorporating mobilization with movement in Group A was observed to be superior in the management of lateral epicondylitis compared to exercises alone in the remaining groups. The findings provide evidence to reject the null hypothesis and accept the experimental hypothesis, indicating that personalized treatment strategies, specifically those involving mobilization with movement, lead to improved outcomes for individuals with lateral epicondylitis by addressing postural abnormalities resulting from injury.

5.5. Limitations of the study

The study has certain limitations that should be acknowledged.

- The study was conducted within a limited timeframe.
- The sample size utilized in the study was limited.
- The allocation of subjects among groups is done in a manner that ensures equal distribution with respect to age.
- The presence and accessibility of patients.

5.6. Future Recommendations for the study

- Future research could investigate the efficacy of the intervention on individuals with acute or sub-acute or chronic lateral epicondylitis separately to ascertain whether the duration of the condition influences its effectiveness.
- In order to enhance the robustness and generalizability of future research, it is recommended that forthcoming studies incorporate diverse samples drawn from larger population sizes and encompassing various regions across the country.
- Further research can be conducted on the professional athletic population in order to determine the effectiveness of the intervention in individuals with well-developed musculoskeletal systems.
- A study with a duration exceeding one year can be conducted to demonstrate the comparative effectiveness of different intervention approaches in the long term.

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CONCLUSION

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Chapter-6

Conclusion

Based on the available evidence, it can be inferred that mobilization with movement (MWM) yields superior outcomes in terms of pain alleviation, as well as enhancements in grip strength and functional abilities. Nevertheless, the efficacy of the practitioner plays a pivotal role in achieving the intended outcome. The current investigation has determined that the use of Mulligan's Mobilization with Movement (MWM) demonstrates efficacy in the treatment of individuals diagnosed with lateral epicondylitis.

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SUMMARY

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Chapter-7

Summary

Epicondylitis is a medical condition characterized by the inflammation of the epicondyle. Tennis elbow is a pathological condition that affects the wrist extensor muscles at their point of origin on the lateral humeral epicondyle. Pain is exacerbated by activities involving extension of the wrist. The objective of this study is to assess the effectiveness of mobilization with movement in individuals diagnosed with tennis elbow, as well as to evaluate the efficacy of a newer technique in order to determine its potential benefits for the broader population. Several authors, including Bisset L, B. Vicenzino, and Abbott JH, have conducted research indicating that mobilization with movement shows promise as an intervention for lateral epicondylitis.

However, Adolfsson and Gay have discovered that eccentric exercises demonstrate greater efficacy in the treatment of lateral epicondylitis. The subjects underwent a screening process based on inclusion criteria. Out of the total number of subjects, 180 were chosen for the study and were then randomly assigned to three separate groups. Participants in Group A were administered mobilization with movement and ultrasound therapy. Group B received eccentric and stretching exercises in addition to ultrasound, while Group C, serving as the control group, received ultrasound alone. The findings indicated that there was a statistically significant improvement in pain reduction across all groups. The study examined the grip strength and function of three groups: group A, group B, and group C. The results indicated that group A demonstrated superior outcomes compared to both group B and group C. Based on the available evidence, it can be inferred that mobilization with movement demonstrates superior efficacy in pain reduction, as well as in enhancing grip strength and overall functional outcomes, when compared to exercises and ultrasound therapy.

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RESEARCH EDGE AND PUBLICATION

APPENDIX

RESEARCH EDGE AND PUBLICATION

APPENDIX – 1

CONSENT FORM

APPENDIX – 1

CONSENT FORM

I, ……. Willing and voluntarily agree to participate in the research study under the direction of the ……

I, understand that the purpose of the study is to see the "To compare the Efficacy of mobilization with movement versus exercises in subjects with lateral epicondylitis."

I understand that there is no risk involvement to my health and if any, it is being explained to me. I understand that I have the right to seek information regarding the study and can contact ……I understand that my confidentiality and anonymity is protected and further I have to terminate my participation at any time. I have read and received a copy of this consent form.

…….

Signature of patient

Name :-

Address :-

contact

Date :-

RESEARCH EDGE AND PUBLICATION

APPENDIX – 2

ASSESSMENT FORM

APPENDIX – 2

ASSESSMENT FORM

IDENTIFICATION ADTA
Name
Age
Gender
Occupation
Dominance
CHIEF COMPLAINTS
HISTORY
A) History of present illness
B) History of past illness
C) Occupational history
D) Medical history
E) Surgical history
F) Personal history
G) Drug history

VITAL SIGNS
Pulse
Blood pressure
Temperature
Weight
Height

PAIN ASSESSMENT
Site
Onset
Nature
Character
Type
Aggravating factor
Relieving factor

Irritability

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OBSERVATION

Colour of skin
Skin condition
Any scar
Deformity
Bon and soft tissue contour
Built
Attitude
Posture

PALPATION

Tenderness
Swelling
Odema
Warmth
Crepitus

EXAM INATION

Sensation
Reflexes
Manual muscle testing :- Flexors
Extensors
Supination
Pronation
Wrist flexion
Wrist extension

Range of motio

Movement	Active	Passive
Elbow flexion		
Elbow extension		
Forearm pronation		
Forearm supination		
Wrist flexion		
Wrist extension		

SPECIAL TESTS

Special test	Positive	Negative
Cozen's test		
Mill's test		

Provisional diagnosis
Investigations

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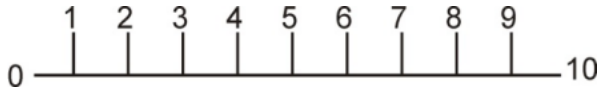
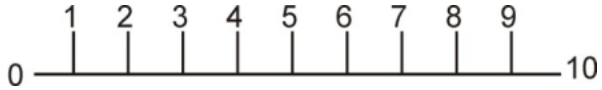
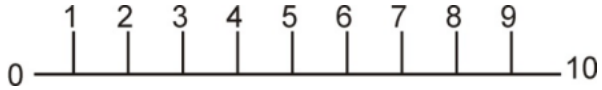
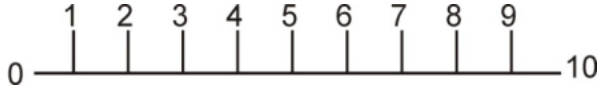
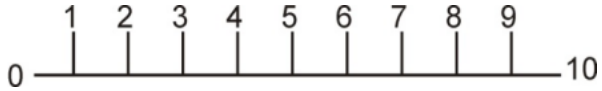
APPENDIX – 3

QUESTIONAIRE FOR LATERAL EPICONDYLITIS

QUESTIONAIRE FOR LATERAL EPICONDYLITIS

Please provide an answer for all questions. If you do not perform an activity, please provide an estimate of the pain or difficulty you would expect if you perform the activity. Please note the average amount of pain in your arm over the past week by writing a number between 0-10 where '0' means did not have any pain and '10' means you had worst pain imaginable.

1. Pain with affected arm

Question	
When you are at rest	
When doing a task with repeated arm movement	
When carrying a plastic bag of groceries	
When your pair was at least	
When your pain was at its worst	

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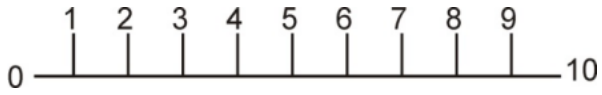
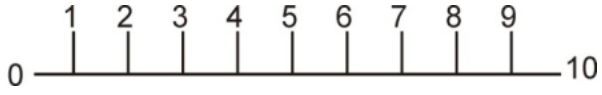
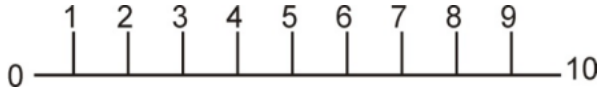
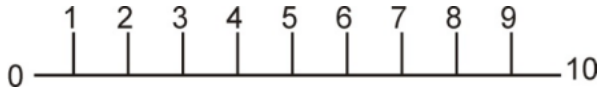
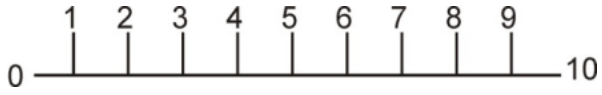
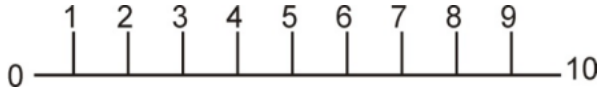
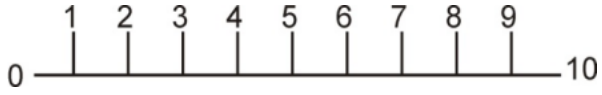
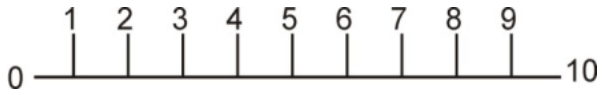
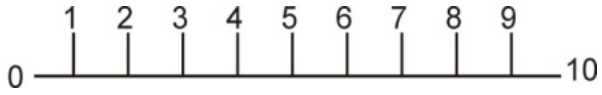
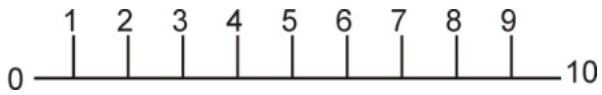
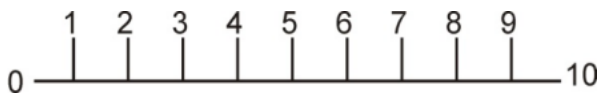
2. Function with affected arm

Specific activities	
Turning a door knob	
Carrying a Plastic bag of groceries	
Lifting a full coffee cup or glass to your mouth	
Opening a Jar	
Pulling up pants	
Wringing out a facecloth or dishrag	
Usual activities	
Personal care activity (i.e. dressing, washing)	
Household Work (maintenance, cleaning)	
Work (your usual job) or main activity if not employed	
Recreation or sporting activities	

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APPENDIX – 4

DATA COLLECTION FORM

NAME OF PATIENT :…….
AGE :- …….
SEX :- ……..

VISUAL ANALOGUE SCALE MEASUREMENTS
PRETREATMENT :- ……..
POST TREATMENT :- ……

GRIP STRENGTH MEASUREMENTS

AT THE START OF TREATMENT
1ST READING :-…….
2ND READING :-……
3RD READING :-…….
MEAN :…….

AFTER 2 WEEKS
1ST READING :-…….
2ND READING :-……
3RD READING :-…….
MEAN :…….

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APPENDIX – 5

MASTER CHART

GROUP – A

S. No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Rashmi	F	38	33	56	7.8	1.9	35	8	46	11
2	Navin	M	40	18	57	6.6	0.9	36	6	66	10
3	Sushila	F	40	33	52	9.5	1	38	8	81	11
4	Sarita	F	40	10	40	9.5	1	32	7	64	8
5	Tikam	M	40	32	64	8.9	0.5	38	8	57	14
6	Indra	F	31	22	50	8.1	0.9	36	9	43	12
7	Mona	F	20	16	39	8.8	0.5	32	7	80	15
8	Madhu	F	40	17	26	7	1.7	35	9	66	21
9	Usha	F	20	39	66	7.7	1.5	19	8	38	11
10	Asha	F	30	40	60	8.5	0.8	20	6	49	13
11	Mangla	F	30	65	80	7.4	1	33	7	54	20
12	Pukraj	M	40	17	40	7.9	1	31	8	60	17
13	Deepak	M	40	50	70	7.7	1.1	34	8	65	16
14	Raj Kumar	M	40	80	103	8	1.1	31	8	68	13
15	Shabana	F	34	30	53	8.8	1.2	33	9	62	15
16	Indu	F	40	35	50	8.7	1	10	2	24	4
17	Mohan	M	40	80	100	8.1	0.6	30	5	40	8
18	Sohan	M	25	35	55	7.9	0.3	30	8	68	21
19	Neha	F	33	32	50	8.5	0.9	32	7	72	26
20	Deepa	F	34	35	60	8.6	0.8	31	6	69	16

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21		F	30	40	60	8.5	0.8	20	6	49	13
22		F	31	22	50	8.1	0.9	36	9	43	12
23		F	40	17	26	7	1.7	35	9	66	21
24		F	20	16	39	8.8	0.5	32	7	80	15
25		M	40	18	57	6.6	0.9	36	6	66	10
26		F	39	33	56	7.8	1.9	35	8	46	11
27		F	40	10	40	9.5	1	32	7	64	8
28		F	39	33	52	9.5	1	38	8	81	11
29		M	40	32	64	8.9	0.5	38	8	57	14
30		F	20	39	66	7.7	1.5	19	8	38	11
31		M	25	35	55	7.9	0.3	30	8	68	21
32		M	40	80	103	8	1.1	31	8	68	13
33		F	33	30	53	8.8	1.2	33	9	62	15
34		M	40	17	40	7.9	1	31	8	60	17
35		F	32	32	50	8.5	0.9	32	7	72	26
36		M	40	80	100	8.1	0.6	30	5	40	8
37		F	30	65	80	7.4	1	33	7	54	20
38		F	40	35	50	8.7	1	10	2	24	4
39		M	40	50	70	7.7	1.1	34	8	65	16
40		F	35	35	60	8.6	0.8	31	6	69	16
41		M	40	32	64	8.9	0.5	38	8	57	14
42		F	40	33	52	9.5	1	38	8	81	11
43		F	40	10	40	9.5	1	32	7	64	8
44		M	40	18	57	6.6	0.9	36	6	66	10
45		F	38	33	56	7.8	1.9	35	8	46	11
46		F	20	16	39	8.8	0.5	32	7	80	15
47		F	32	22	50	8.1	0.9	36	9	43	12
48		F	40	17	26	7	1.7	35	9	66	21

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49		F	30	40	60	8.5	0.8	20	6	49	13
50		F	20	39	66	7.7	1.5	19	8	38	11
51		M	40	50	70	7.7	1.1	34	8	65	16
52		F	34	30	53	8.8	1.2	33	9	62	15
53		M	40	80	103	8	1.1	31	8	68	13
54		M	40	17	40	7.9	1	31	8	60	17
55		F	30	65	80	7.4	1	33	7	54	20
56		F	34	35	60	8.6	0.8	31	6	69	16
57		F	33	32	50	8.5	0.9	32	7	72	26
58		M	40	80	100	8.1	0.6	30	5	40	8
59		M	26	35	55	7.9	0.3	30	8	68	21
60		F	40	35	50	8.7	1	10	2	24	4

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GROUP – B

S. No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Anju	F	37	26	45	8.3	2.5	27	13	56	14
2	Anita	F	32	26	39	8.2	1.8	30	15	57	25
3	Surbhi	F	40	24	38	8.4	1.6	27	6	48	11
4	Mohini	F	30	21	31	8.5	1.8	32	14	69	27
5	Kanta	F	32	44	53	9.8	1	29	2	56	31
6	Ranjana	F	39	68	74	8	1.3	28	6	58	20
7	Rakhi	F	30	33	39	8	1.9	29	11	60	21
8	Anjana	F	40	32	38	8.1	2	32	13	63	19
9	Mahesh	M	32	37	39	8.7	2.5	34	15	68	15
10	Sumitra	F	37	50	63	8.3	1.7	32	10	52	23
11	Sushma	F	34	50	72	9	1.4	33	9	49	28
12	Pramod	M	39	35	42	7.5	2	28	10	55	19
13	Hiramani	F	32	37	43	9.5	1.7	27	8	52	11
14	Sushil	M	39	28	36	8.4	1.5	27	12	76	20
15	Deepak	M	40	28	40	8	5	23	8	55	9
16	Gaurav	M	38	30	38	7.9	2.3	26	13	48	18
17	Laxmi	F	36	27	37	6.9	1.5	30	11	50	15
18	Radha	F	40	35	42	6.5	1	39	10	56	9
19	Rahul	M	28	29	36	7.2	1.8	35	13	52	11
20	Rajeev	M	35	37	46	8.6	1	37	16	78	13
21		F	33	26	39	8.2	1.8	30	15	57	25
22		F	39	32	38	8.1	2	32	13	63	19
23		F	38	26	45	8.3	2.5	27	13	56	14

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24		M	40	28	40	8	5	23	8	55	9
25		M	38	30	38	7.9	2.3	26	13	48	18
26		F	31	37	43	9.5	1.7	27	8	52	11
27		F	32	44	53	9.8	1	29	2	56	31
28		F	37	27	37	6.9	1.5	30	11	50	15
29		M	32	37	39	8.7	2.5	34	15	68	15
30		F	29	21	31	8.5	1.8	32	14	69	27
31		M	38	35	42	7.5	2	28	10	55	19
32		F	40	35	42	6.5	1	39	10	56	9
33		M	29	29	36	7.2	1.8	35	13	52	11
34		M	35	37	46	8.6	1	37	16	78	13
35		F	30	33	39	8	1.9	29	11	60	21
36		F	38	68	74	8	1.3	28	6	58	20
37		F	38	50	63	8.3	1.7	32	10	52	23
38		F	40	24	38	8.4	1.6	27	6	48	11
39		M	39	28	36	8.4	1.5	27	12	76	20
40		F	33	50	72	9	1.4	33	9	49	28
41		F	40	24	38	8.4	1.6	27	6	48	11
42		F	37	50	63	8.3	1.7	32	10	52	23
43		F	39	68	74	8	1.3	28	6	58	20
44		F	30	33	39	8	1.9	29	11	60	21
45		F	30	21	31	8.5	1.8	32	14	69	27
46		M	33	37	39	8.7	2.5	34	15	68	15
47		F	31	44	53	9.8	1	29	2	56	31
48		F	37	26	45	8.3	2.5	27	13	56	14
49		F	40	32	38	8.1	2	32	13	63	19
50		F	33	26	39	8.2	1.8	30	15	57	25
51		M	40	28	40	8	5	23	8	55	9

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52		M	38	30	38	7.9	2.3	26	13	48	18
53		F	32	37	43	9.5	1.7	27	8	52	11
54		F	36	27	37	6.9	1.5	30	11	50	15
55		M	39	35	42	7.5	2	28	10	55	19
56		F	40	35	42	6.5	1	39	10	56	9
57		M	39	28	36	8.4	1.5	27	12	76	20
58		F	34	50	72	9	1.4	33	9	49	28
59		M	28	29	36	7.2	1.8	35	13	52	11
60		M	35	37	46	8.6	1	37	16	78	13

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GROUP – C

S. No.	Name	Sex	Age	Pre Grip Strength	Post Grip Strength	Pre VAS	Post VAS	Pre Pain	Post Pain	Pre Function	Post Function
1	Asha	F	30	35	40	8.5	3	30	11	46	20
2	Sampat	M	34	37	40	7.5	2.7	34	15	62	26
3	Rajendra	M	34	30	35	9.2	0.9	26	11	51	20
4	Vimla	F	40	33	40	8	5.5	32	10	54	25
5	Sushila	F	37	33	35	8	2.2	30	15	58	28
6	Sarita	F	40	36	39	8.5	1.1	36	18	52	27
7	Malti	F	40	25	31	8.5	1.1	39	14	68	21
8	Rita	F	38	27	30	10	1.9	29	15	74	21
9	Jai	M	40	33	38	8	2.5	36	12	64	20
10	Nirmal	M	30	40	42	7.5	2.3	38	15	65	22
11	Ashok	M	40	44	45	7.6	3.7	28	10	49	24
12	Prabhas	M	35	26	33	7.5	2.2	32	14	57	20
13	Nisha	F	40	30	40	7.7	4.4	29	13	40	18
14	Manisha	F	40	37	43	7.5	4.2	28	15	58	28
15	Usha	F	38	30	40	8.5	6.5	30	12	68	25
16	Sarita	F	35	30	32	8	5	27	14	63	28
17	Somnath	M	33	38	45	7.9	1.4	25	11	50	25
18	Rukmani	F	36	36	40	8	1.8	28	13	60	24
19	Syara	F	40	40	40	8.2	2.6	28	10	58	27
20	Vikram	M	35	40	42	8.9	2.2	28	18	64	30
21		F	30	35	40	8.5	3	30	11	46	20
22		M	40	44	45	7.6	3.7	28	10	49	24

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23		M	40	33	38	8	2.5	36	12	64	20
24		F	40	25	31	8.5	1.1	39	14	68	21
25		F	40	37	43	7.5	4.2	28	15	58	28
26		M	30	40	42	7.5	2.3	38	15	65	22
27		F	40	30	40	7.7	4.4	29	13	40	18
28		M	35	26	33	7.5	2.2	32	14	57	20
29		M	34	30	35	9.2	0.9	26	11	51	20
30		F	38	27	30	10	1.9	29	15	74	21
31		F	36	36	40	8	1.8	28	13	60	24
32		M	35	37	40	7.5	2.7	34	15	62	26
33		F	40	36	39	8.5	1.1	36	18	52	27
34		F	35	30	32	8	5	27	14	63	28
35		M	33	38	45	7.9	1.4	25	11	50	25
36		F	38	33	35	8	2.2	30	15	58	28
37		F	39	40	40	8.2	2.6	28	10	58	27
38		F	38	30	40	8.5	6.5	30	12	68	25
39		M	35	40	42	8.9	2.2	28	18	64	30
40		F	40	33	40	8	5.5	32	10	54	25
41		F	40	33	40	8	5.5	32	10	54	25
42		F	36	33	35	8	2.2	30	15	58	28
43		F	40	36	39	8.5	1.1	36	18	52	27
44		M	33	37	40	7.5	2.7	34	15	62	26
45		F	39	27	30	10	1.9	29	15	74	21
46		M	34	30	35	9.2	0.9	26	11	51	20
47		M	35	26	33	7.5	2.2	32	14	57	20
48		F	40	30	40	7.7	4.4	29	13	40	18

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49		M	30	40	42	7.5	2.3	38	15	65	22
50		F	40	25	31	8.5	1.1	39	14	68	21
51		M	40	33	38	8	2.5	36	12	64	20
52		M	40	44	45	7.6	3.7	28	10	49	24
53		F	30	35	40	8.5	3	30	11	46	20
54		M	36	40	42	8.9	2.2	28	18	64	30
55		F	37	30	40	8.5	6.5	30	12	68	25
56		F	40	40	40	8.2	2.6	28	10	58	27
57		M	34	38	45	7.9	1.4	25	11	50	25
58		F	34	30	32	8	5	27	14	63	28
59		F	37	36	40	8	1.8	28	13	60	24
60		F	39	37	43	7.5	4.2	28	15	58	28

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APPENDIX – 6

DATA ANALYSIS SAMPLE

Descriptive

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	60	18.00	52.00	35.6000	8.28696
Pre Grip Strength	60	10.00	80.00	35.9500	19.65619
Post Grip Strength	60	26.00	103.00	58.5500	18.94445
MD (Pre-Post) Grip Strength	60	9.00	39.00	22.6000	6.60462
Pre VAS	60	6.60	9.50	8.2000	.75114
Post VAS	60	.30	1.90	.9850	.38835
MD (Pre-Post) VAS	60	5.30	8.50	7.2150	.95105
Pre Pain	60	2.00	9.00	30.8000	6.90995
Post Pain	60	2.00	9.00	7.2000	1.64157
MD (Pre-Post) Pain	60	8.00	30.00	23.6000	5.94182
Pre Function	60	24.00	81.00	58.6000	14.69479
Post Function	60	4.00	26.00	14.1000	5.22041
MD (Pre-Post) Function	60	20.00	70.00	44.5000	12.72172
Valid N (listwise)	60				

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T-Test

Paired Samples Test

	Paired Differences					t	df	Sig. (2 – talled)
	Mean	Std. Deviation	Std. Error Mean	95% confidence interval of the difference		t	df	
				Lower	Upper	t	df	
Pair 1 Pre post Strength – Post Grip Strength	22.6000	6.60462	1.47684	-25.6911	-19.5089	-15.303	59	.000
Pair 2 Pre Vas – Post Vas	7.2150	.95105	.21266	6.7699	7.6601	33.927	59	.000

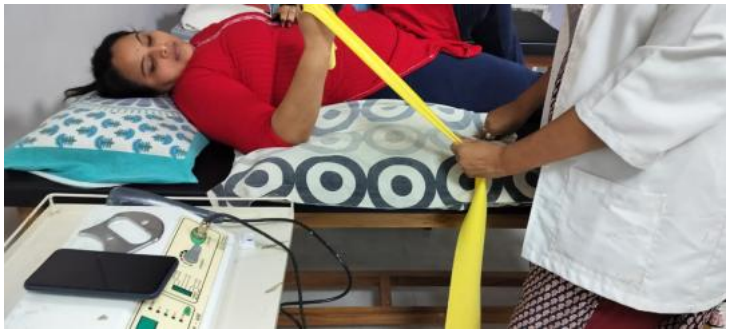
NPar Tests

Wilcoxon Signed Ranks Test

Test Statistics

	Post Pain – Pre Pain	Post Function – Pre Function
Z	-3.930	-3.921
Asymp. Sig. (2-tailed)	.000	.000

a. Based on positive ranks
b. Wilcoxon Signed Ranks Test



RESEARCH EDGE AND PUBLICATION

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A Review of Therapeutic Management for Lateral Epicondylitis

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ABSTRACT

This paper examines studies that assess different therapeutic interventions for treating lateral epicondylitis. Various medical treatments, including drug therapies, surgical interventions and physical therapies are examined and evaluated based on the available evidence supporting their effectiveness. Various treatments have been studied for the management of lateral epicondylitis, but no specific therapy has been identified as the definitive best option with clearly superior long-term effectiveness. The existing research has some methodological flaws despite its commendable studies. Some limitations observed in the study are the absence of non-treatment and placebo controls, lack of objective outcome measures, inadequate follow-up and insufficient subject numbers. The paper addresses the constraints of existing research and proposes suggestions for future investigations. The paper discusses the need for further research on various therapies and encourages researchers to evaluate its effectiveness to determine the best treatment method for lateral epicondylitis.

INTRODUCTION

In 1873, German physician F. Runge was the first to define lateral epicondylitis (LE). Henry Morris, who was writing in the Lancet at the time, referred to the condition as "Lawn Tennis Arm" in 1882. Subsequently, this pathological condition characterised by pain in the lateral aspect of the elbow has been given a variety of names, including lateral epicondylitis, tennis elbow, lateral epicondylosis, tendinosis, enthesiopathy of the lateral epicondyle of the humerus, lateral epicondylalgia, and angiofibroblastic hyperplasia. (Cutts et al. 2020; Day et al. 2015; Fatyga et al. 2020) Previously, it was believed that lateral epicondylitis

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(LE) was caused by a transient inflammatory response at the origin of the wrist extensor muscles. The subsequent histological examination of the wrist extensor tendons revealed the absence of inflammatory cells and the presence of degeneration. It is hypothesised that lateral epicondylitis is caused by an inadequate healing response to repetitive micro trauma and diminished blood supply at the tendon's origin. The lateral radial nerve and collateral ligament may be the underlying cause of lateral epicondylar discomfort, which is commonly attributed to the activation of typical wrist extensors. Due to an ambiguous path anatomical cause, the term lateral epicondylitis is used in the current investigation (Day et al. 2015; Lai et al. 2018). LE is a common condition characterised by arm discomfort that is frequently related to work or athletic activities (Bisset and Vicenzino, 2015). The incidence of lateral epicondylitis is seven times higher than that of medial epicondylitis, also known as golfer's elbow. It is typically described as a condition characterised by discomfort in the region of the lateral epicondyle (Bisset and Vicenzino, 2015). LE can manifest either as a degenerative condition or an inadequate tendon healing response (Coombes, Bisset, and Vicenzino, 2015). Lateral epicondylitis (LE) is a distressing medical condition characterised by injury to the tendinous tissue at the lateral epicondyle of the humerus, resulting in a loss of limb function. Consequently, this condition has a significant impact on the patient's social and intimate life (Waseem et al., 2012). The dominant arm is the upper extremity that is most frequently affected. The peak incidence of LE occurs between 30 and 60 years of age (Bisset and Vicenzino, 2015). The duration and severity of this musculoskeletal disorder are greater in females (Coombes, Bisset, and Vicenzino 2015; Waugh et al. 2004). It has a high rate of recurrence, highlighting the importance of rehabilitation for patients diagnosed with this condition (Day et al., 2015). The most prevalent form of LE is the bending back motion in which the wrist is extended against resistance due to overuse or repetitive strain. Frequently, the extensor carpi radialis brevis, one of the extensor tendons originating near the lateral epicondyle, has been identified as the primary structure implicated in lateral epicondylitis. It is susceptible to shearing forces during almost all arm movements due to its atypical anatomical structure. There is evidence, according to Briggs' biomechanical research, that tennis elbow is primarily caused by mechanical factors. (Cutts et al. 2020) Tennis, badminton, and squash are frequently linked to an increased incidence of lateral epicondylitis (LE). Nonetheless, extensive wrist use during daily activities is a common factor in the development of LE. In the realm of sports, the use of an improper backhand technique in tennis, an insufficiently sized racket grip, excessively taut strings, and participation in the sport with damp and heavy balls are all potential risk factors for the development of lateral epicondylitis (LE). In the context of repetitive activities, such as using a screwdriver, painting, or typing, these actions also increase the risk of developing LE (Waseem et al., 2012). The primary concerns of patients diagnosed with LE are pain and a decline in functional abilities (L.
M. Bisset and Vicenzino 2015; Coombes, Bisset, and Vicenzino 2015).
Numerous treatment modalities for the management of lateral epicondylitis have been documented. Since the body of data supporting therapeutic treatment is always expanding, it is crucial to perform a comprehensive review of the current literature. This review aims to synthesise and appraise the current evidence on treatment therapies for lateral epicondylitis, with a focus on Mobilisation using movement and

exercise-based strategies.

Therapeutic Management

1. Drug Therapy

Drug therapies are a prominent form of therapeutic interventions utilised in the conservative management of LE conditions. The treatments that are currently accessible encompass corticosteroid and local anaesthetic injections, oral non-steroidal anti-inflammatory drugs (NSAIDs), and transdermal NSAIDs.

In their study, Smidt et al. (2002) examined the effectiveness of physiotherapy, a wait- and-see approach and corticosteroid injections in managing lateral epicondylitis. In a recent study involving 185 participants, researchers investigated the efficacy of different treatment options for individuals diagnosed with lateral epicondylitis. The findings of this study suggest that corticosteroid injections emerge as the most effective short-term treatment option for managing this condition. The existing literature demonstrates significant and consistent disparities between the use of physiotherapy and a wait and sees approach. These disparities are clinically significant and evident across various outcome measures.

In their study, Tonks et al. (2007) conducted a comprehensive investigation using high- definition ultrasound (HHD) to evaluate the effectiveness of steroid injection therapy as a conservative treatment option for lateral epicondylitis (LE). In his prospective randomised controlled trial (RCT), the author's findings revealed that teroid injection therapy exhibited a higher level of effectiveness when employed as the primary treatment for tennis elbow. The implemented intervention yielded a notable enhancement in grip strength and effectively expedited the resumption of daily activities. Fatyga et al. (2020) conducted a comprehensive review that examined the comparative efficacy of different pharmacological interventions. The interventions under investigation included a combination of steroid injections with lidocaine, non-steroidal anti-inflammatory drugs, hyaluronic acid, platelet-rich plasma, collagen, and botulinum toxin. Furthermore, the authors examined the various indications for surgical interventions in managing lateral epicondylitis. The authors' analysis highlights the lack of consensus in the medical community regarding the optimal treatment approach for lateral epicondylitis (LE). They emphasise the existence of numerous treatment options available for this condition, but also note the prevailing uncertainty surrounding their efficacy. This finding underscores the absence of a universally accepted treatment strategy for LE.

Lai et al. (2018) conducted a comprehensive review article on chronic lateral epicondylitis (LE). The study explored different conservative treatment options, including NSAIDs, physiotherapy, shockwave therapy, corticosteroid injections, and biologics. Additionally, the review examined various surgical interventions such as arthroscopic, percutaneous and open techniques for managing LE. The article presented a comprehensive review of the existing literature, examining the available evidence that supports the use of these treatment approaches in patients who have not responded to conventional therapies. The literature review reveals that the use of NSAIDs, physiotherapy, shockwave therapy, and bracing in the treatment of lateral epicondylitis only provides limited benefits. Previous studies have proposed that autologous whole-blood injections and platelet rich plasma (PRP) may demonstrate superior effectiveness compared to steroid

injections, particularly over a longer period of time. The current literature suggests that stem cell injections hold potential based on preliminary findings. However, to comprehensively assess their effectiveness, it is crucial to undertake larger comparative studies. Numerous studies have been conducted to evaluate the effectiveness of various techniques, yet none have exhibited a clear advantage over the others in terms of outcomes. Several studies have reported that arthroscopic and percutaneous techniques may offer advantages in terms of earlier return and faster recovery to work compared to open surgery.

2. Surgical Management

The percentage of patients referred for surgical intervention has shown a significant increase over the years. Starting at 1.1% in 2000 and 2002, the percentage has steadily grown to reach 24% in 2016. The escalation in the number of patients undergoing surgery has resulted in a significant increase in the financial burden associated with the management of LE. The selection of surgical intervention for lateral epicondylitis remains a topic of debate among surgeons, with differing opinions on the most appropriate approach. However, it is worth noting that there has been a consistent increase in the number of patients opting for surgical treatment. The increase in hospital visits has been observed in parallel with the growing prevalence of chronic lateral epicondylitis. Surgery has emerged as a prevalent alternative, with a substantial rate of 16%, suggesting its efficacy as a viable long-term treatment option. Regrettably, the existing literature lacks sufficient evidence to substantiate the long-term prognosis following surgery, thereby hindering our ability to ascertain the success of surgical intervention.

Sanders et al. (2015) conducted a study on the average cost of therapy for lateral epicondylitis in the United States. The average cost was found to be $4263. Multiple studies have shown an increase in average yearly total reimbursement and per- patient reimbursement for treating LE, indicating a significant rise in future expenses for this condition. Surgical procedure costs can vary based on the type of procedure and surgeon's objectives. Debridement, the removal of dead or damaged tissue, is generally a more cost- effective option than tenotomy, a surgical procedure that involves cutting a tendon. The high cost of surgical treatments can discourage some people, but the desire for a speedy recovery and a prompt return to work often drives them to choose surgery. Patients who choose conservative treatment for lateral epicondylitis for 5 years may experience higher costs compared to those who have surgery, according to existing literature. Solheim et al. (2016) emphasise the importance of creating an appropriate conservative treatment plan before exploring surgical alternatives.

Lai et al. (2018) conducted a literature review on surgical techniques used for refractory lateral epicondylitis (LE) cases. The study highlights the effectiveness of various approaches, such as open, arthroscopic, and percutaneous methods, in treating this condition.

In their review article, Tarpada et al. (2018) explored different therapeutic approaches used to promote tendon regeneration and improve functional recovery in individuals with epicondylitis. The study examined various innovative techniques such as PRP injections, Bone Marrow Aspirate Concentrate (BMAC), stem cell injections, and collagen-producing cell injections. The review aimed to assess the effectiveness of different approaches for treating epicondylitis. This study summarises the current research on innovative therapies, including PRP 24 variables, collagen-

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producing cell treatments, and stem cell treatments. Preliminary studies indicate promising results for these therapies, suggesting they are still in the early stages of investigation. Efforts are currently underway to improve and investigate the potential benefits of these treatments. The lack of evidence in existing literature is a current limitation in determining the safety and effectiveness of PRP protocols. Preliminary clinical trials are exploring the potential of collagen-producing cell treatments and stem cell treatments for managing LE conditions, including both conservative and surgical approaches. The literature widely acknowledges the potential of these treatments in improving tendon healing, pain management, and functional outcomes.

3. Physical therapy

Ultrasound Therapy

Murtezani Ardiana 2015 conducted a study in which the impact of exercise and therapeutic ultrasound was examined in relation to corticosteroidal injection as a treatment for lateral epicondylitis. Based on her research findings, she reached the conclusion that the utilization of exercises and ultrasound therapy in the rehabilitation of LE yields notable advantages when compared to the administration of corticosteroidal injections.

Sayegh and Strauch 2015 conducted a meta- analysis and reached the conclusion that, based on an extensive analysis of randomized controlled trials (RCTs), the primary approach for managing lateral epicondylitis (LE) without surgery was predominantly through the utilization of ultrasound therapy (UST) and exercise therapy. These interventions were found to yield intermediate to long-term benefits

Electrophysical Therapy

Dingemanse et al. (2013) conducted a systematic review on the effectiveness of various electrophysiological modalities for treating Lateral and Medial Epicondylitis. The researcher found evidence suggesting that ultrasound and laser therapies may be effective in treating Lateral Epicondylitis (LE) conditions.

In a study conducted by Kubot et al. in 2017, the researchers compared the effects of radial extracorporeal shockwave therapy and ultrasound therapy in treating Lateral Epicondylitis. UST was found to be less effective than radial shockwave therapy. The findings mentioned are similar to those of Lizis P (2015), who also found that extracorporeal shock wave therapy had a significant impact immediately after treatment and during the three-month analysis.

In a systematic review by Testa et al. (2020), the effectiveness of extracorporeal shockwave therapy (ESWT) for upper limb diseases was investigated. The review found conflicting results regarding its efficacy.

Manual Therapy

Vicenzjno 2003 conducted a study on the topic of lateral epicondylagia from a musculoskeletal physiotherapy standpoint. The researcher discovered that the utilization of manipulative therapy and taping treatments yields the most favorable outcomes in the clinical management of lateral epicondylalgia.

Slater 2006 conducted study to investigate the impact of manual therapy technique on experimental lateral epicondylalgia. A study was conducted on a sample of 24 participants, wherein it was determined that the lateral glide Mulligan mobilisation with movement (MWM) technique does not elicit the

activation of mechanisms associated with analgesia or force augmentation in individuals exhibiting experimentally induced characteristics resembling lateral epicondylalgia.

Vicenzino et al. 2001 examined the effects of specific manipulative therapy treatment on chronic lateral epicondylegia, resulting in distinct hypoalgesia. The study was conducted on a sample size of 24 participants, and the findings revealed a statistically significant and substantial improvement in pain-free grip strength by 58% during the treatment phase, as compared to the placebo and control phases. On the other hand, the observed increase of 10% in pressure threshold following treatment, while significantly higher than that of the placebo and control groups, was considerably smaller compared to the change exhibited in pain-free grip strength. The observed effect was limited to the affected limb.

Exercises

Trivedi et al. (2019) conducted a study focusing on the efficacy of combining plyometric exercises with pulsed ultrasound therapy in individuals suffering from chronic lateral epicondylitis. The findings of this study revealed promising outcomes in terms of treatment effectiveness. The study examined the effects of a four-week treatment protocol on pain reduction and rehabilitation of lateral epicondylitis. The results indicated significant improvements in these areas following the treatment. The available literature indicates that the combination of plyometric exercises and pulsed ultrasound therapy may have potential as an effective strategy for the management of chronic lateral epicondylitis. In recent studies, Srinivas et al. (2022) and Raja et al. (2022) independently investigated the effectiveness of combining ultrasound therapy with strengthening exercises for the treatment of lateral epicondylitis in individuals. The two studies examined in this review both utilised a sample size of 50 participants. The findings from both studies indicated that when comparing the effectiveness of strengthening exercises alone to a combination of ultrasound therapy and strengthening exercises, the former was more successful in reducing pain and enhancing muscle strength. Nevertheless, it is important to acknowledge that the amalgamation of interventions demonstrated a statistically significant decrease in pain.

Furthermore, Stasinopoulos et al. (2005) conducted a study that provides further evidence for the efficacy of exercise therapy in the management of lateral elbow tendinopathy. The effectiveness of exercise routines in managing lateral epicondylitis has been concluded by researchers, emphasising the significance of including exercise in the treatment plan for this condition.

The inclusion of plyometric exercises in rehabilitation protocols has been suggested to offer potential advantages that extend beyond the treatment of lateral epicondylitis. Several studies have been conducted to investigate the effects of plyometric exercises on muscle power and performance in different sports and activities. Notably, Vissing et al. (2008), Loturco et al. (2015), and McCormick et al. (2016) have contributed to this body of literature. Their findings consistently demonstrate that plyometric exercises have the potential to enhance muscle power and improve overall performance. The literature suggests that incorporating plyometrics into training regimens can have positive effects on overall athletic performance. This is particularly relevant for individuals who are looking to enhance their physical capabilities beyond just injury rehabilitation.

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Laser

Stergioulas 2007 conducted a study to assess the effectiveness of Low-Level Laser therapy in comparison to Plyometric Exercises for the treatment of Lateral Epicondylitis. The findings of the study indicated that patients with lateral epicondylitis (LE) who underwent treatment with low-level laser therapy in conjunction with plyometric exercises experienced notable enhancements in wrist range of motion (ROM) and a reduction in pain.

Mobilisation with movement (MWM) therapy

It is a conservative treatment strategy for musculoskeletal diseases such lateral epicondylitis (tennis elbow). Managing lateral epicondylitis with MWM has been the subject of several scientific investigations.

In their study, Abbott et al. (2001) examined the preliminary effects of an elbow mobilisation with movement technique on grip strength among individuals suffering from lateral epicondylalgia. In a recent study, a sample of 25 participants was examined to investigate the effects of an intervention on pain-free grip strength and maximum grip strength in the affected limb. The findings of this study revealed a noteworthy increase in both maximum grip strength and pain-free grip strength following the intervention. The observed augmentation in pain-free grip strength surpassed that of maximum grip strength, as reported in the literature.

Aatit Paungmali et al. 2003 conducted research to investigate the Hpoalgesic and svmpathoexcitatory effects of mobilisation with movement for lateral epicondylgia. A study was conducted on a sample of 24 participants, and the findings indicated that the mobilisation with movement treatment technique yielded physiological effects comparable to those reported for certain spinal manipulations.

Clinical research by Ahmed et al. (2021) compared the effectiveness of Mulligan mobilisation with the Cyriax technique in the treatment of subacute lateral epicondylitis. Both deep transverse friction and Mill's manipulation (both based on the Cyriax method) and Mulligan mobilisation (with movement techniques) were administered to one group, while the other group just moved. After 4 weeks of therapy, both groups saw substantial reductions in pain and functional impairment ratings. Pain subscale ratings increased significantly in Group A (Cyriax method) but functional disability subscale scores decreased significantly in Group B (Mulligan mobilisation). Patients with lateral epicondylitis reported significant improvements in both pain and function after using either treatment approach.

In order to determine whether or not wrist joint manipulations are helpful for lateral epicondylitis, Eapen et al. (2023) performed a systematic review. The discomfort from lateral epicondylitis may be alleviated with regular wrist manipulations for at least three weeks, according to the review. Although studies found varying degrees of functional improvement after wrist joint manipulation, the evidence was strong that it was more effective than other therapies for relieving pain in the short term.

Researchers Singh et al. (2022) looked examined the effectiveness of Cyriax physiotherapy vs mobilisation with movement method for treating tennis elbow. Cyriax physiotherapy was shown to be more effective than mobilisation with movement in reducing pain, reducing functional impairment, and increasing pain-free grip strength in people with lateral epicondylitis. Manandhar (2021) compared the effects of eccentric exercise and Mulligan's MWM on grip

strength and functional impairment in a group of recreational tennis players with lateral epicondylitis. When compared to eccentric exercise alone, the combination of Mulligan's MWM administration plus eccentric exercise improved grip strength and functional skills in this population of patient's more than eccentric exercise alone. The effectiveness of Mulligan mobilisation with movement as a therapy for lateral epicondylitis was investigated in a literature review by Zami et al. (2023). Based on the findings of this systematic review, Mulligan mobilisation with movement should be considered as a treatment option for the therapy of lateral epicondylitis since it has the ability to reduce discomfort and increase functional capacity in the elbow joint.

In addition, the integration of mobilisation with movement techniques in conjunction with various therapeutic interventions, including conventional treatments and exercise, has been found to yield optimal outcomes (Raja et al 2022; Eapen et al. 2022; Singh et al. 2022; Reyhan et al 2022; Zami et al. 2023 and Mandhaar 2021).

Studies show that MWM treatment, or Mulligan mobilisation with movement, may help those with lateral epicondylitis by lowering discomfort and increasing their functional level. Considered an alternative to intrusive treatments like corticosteroid injections, it shows promise as a method of controlling tennis elbow.

CONCLUSION

In conclusion, drug therapy, surgical management, and physical therapy are available therapeutic management options for lateral epicondylitis (tennis elbow). Patients with lateral epicondylitis have found temporary relief from drug therapy such corticosteroid injections and nonsteroidal anti-inflammatory drugs (NSAIDs). There is no agreement on the best course of action, and it is unclear whether or not these therapies will be beneficial in the long run. More and more patients are choosing surgical treatments as part of their treatment plans in recent years. While surgical options exist for treating lateral epicondylitis, the long-term prognosis and cost-effectiveness of these procedures are still up for dispute and need further research. Ultrasound, electrophysical therapy, and manual treatment are just a few of the physical therapy methods that have shown potential in treating lateral epicondylitis. Plyometric exercises in particular have been shown to help individuals with lateral epicondylitis have less discomfort and better functional benefits from their exercise treatment. Both laser treatment and mobilisation with movement (MWM) have shown promise in alleviating elbow pain and restoring function. The existing research has some methodological flaws despite its commendable studies. Some limitations observed in the study are the insufficient subject numbers, absence of non-treatment and placebo controls, inadequate follow-up, and lack of objective outcome measures. Clearly, further study and development are needed to determine the best treatment method for lateral epicondylitis. While there is evidence that certain therapies are beneficial, additional research is required to determine whether or not they are superior than alternatives in the long run. In addition, individuals with lateral epicondylitis may benefit most from a customised and comprehensive treatment strategy that makes use of a variety of treatments. Overall, pharmacological treatment, physical therapy, and surgical alternatives should be explored while treating lateral epicondylitis due to the complexity of the condition and the wide variety of patients who suffer from it.

Declaration by Authors

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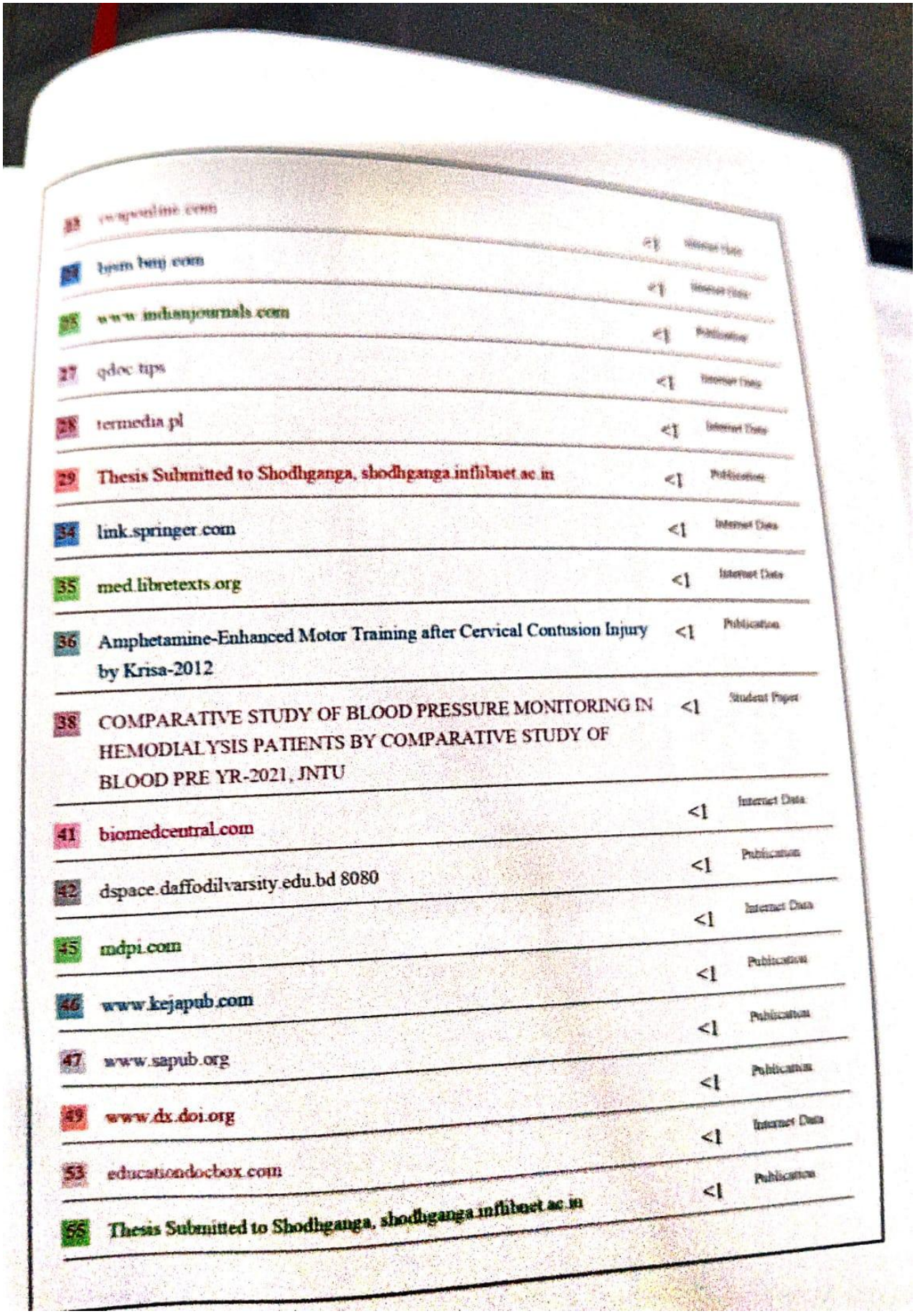

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ANNEXURE - D

ETHIC COMMITTEE APPROVAL LETTER

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Ref. No. MVGU/PHD/2018/258(D)

Date: 30.05.2018

ETHICAL COMMITTEE APPROVAL

To,
Dr. Rachna Singhvi,
D/o Mr. Jaswant Singh
Faculty of Physiotherapy
Registration No. MVGU16B1PHY12

Subject: Approval of Research & Topic from Ethical Committee of MVGU.

Dear,
Dr. Rachna Singhvi,

The University Ethical Committee has reviewed and approved your application on conduct of research on **"Efficacy of Mobilization with Movement Versus Exercises in Lateral Epicondylitis"** in the Faculty of Physiotherapy under the supervision of Dr. Virendra Singh Rajpurohit.

Chairman
Ethical Committee

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2590103, 2590104, 4801798

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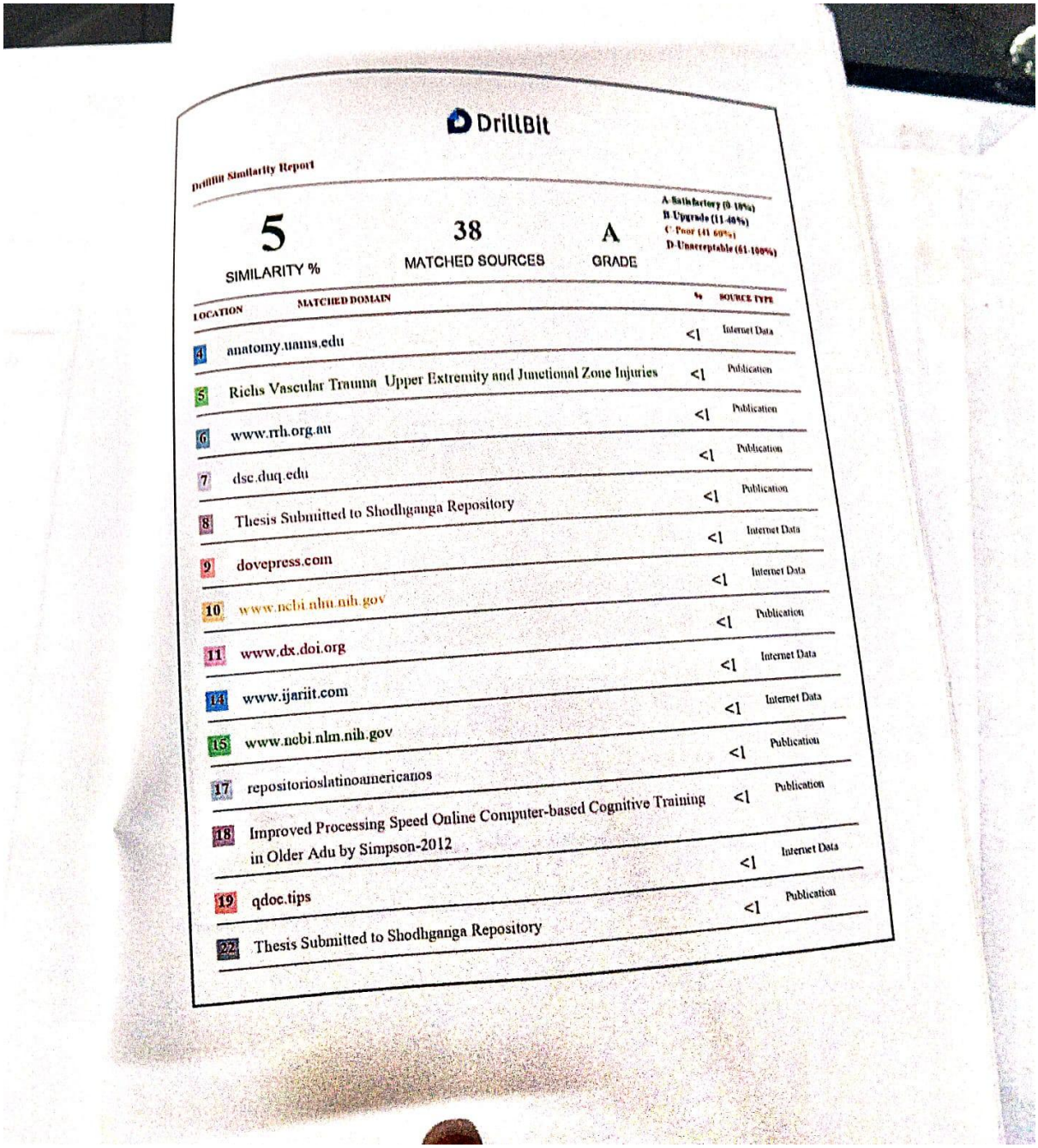

DrillBit

Drillbit Similarity Report

5	38	A	A-Satisfactory (0-10%) B-Upgrade (11-40%) C-Poor (41-60%) D-Unacceptable (61-100%)
SIMILARITY %	MATCHED SOURCES	GRADE	

LOCATION	MATCHED DOMAIN	%	SOURCE TYPE
4	anatomy.uams.edu	<1	Internet Data
5	Richs Vascular Trauma Upper Extremity and Junctional Zone Injuries	<1	Publication
6	www.rrh.org.au	<1	Publication
7	dsc.duq.edu	<1	Publication
8	Thesis Submitted to Shodhganga Repository	<1	Publication
9	dovepress.com	<1	Internet Data
10	www.ncbi.nlm.nih.gov	<1	Internet Data
11	www.dx.doi.org	<1	Publication
14	www.ijariit.com	<1	Internet Data
15	www.ncbi.nlm.nih.gov	<1	Internet Data
17	repositorioslatinoamericanos	<1	Publication
18	Improved Processing Speed Online Computer-based Cognitive Training in Older Adu by Simpson-2012	<1	Publication
19	qdoc.tips	<1	Internet Data
22	Thesis Submitted to Shodhganga Repository	<1	Publication

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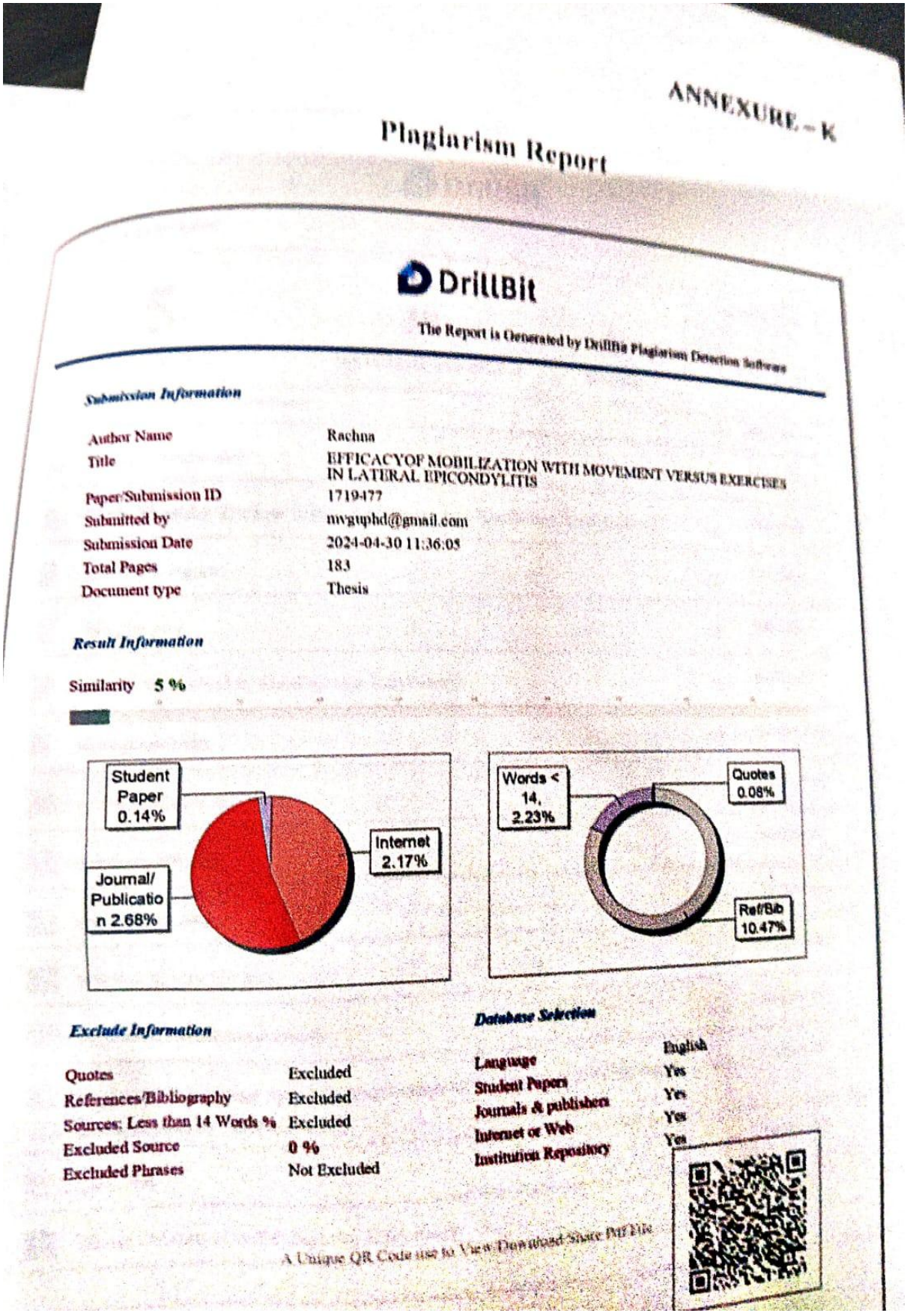

ANNEXURE – K

Plagiarism Report

DrillBit

The Report is Generated by Drillbit Plagiarism Detection Software

Submission Information

Author Name	Rachna
Title	EFFICACYOF MOBILIZATION WITH MOVEMENT VERSUS EXERCISES IN LATERAL EPICONDYLITIS
Paper/Submission ID	1719477
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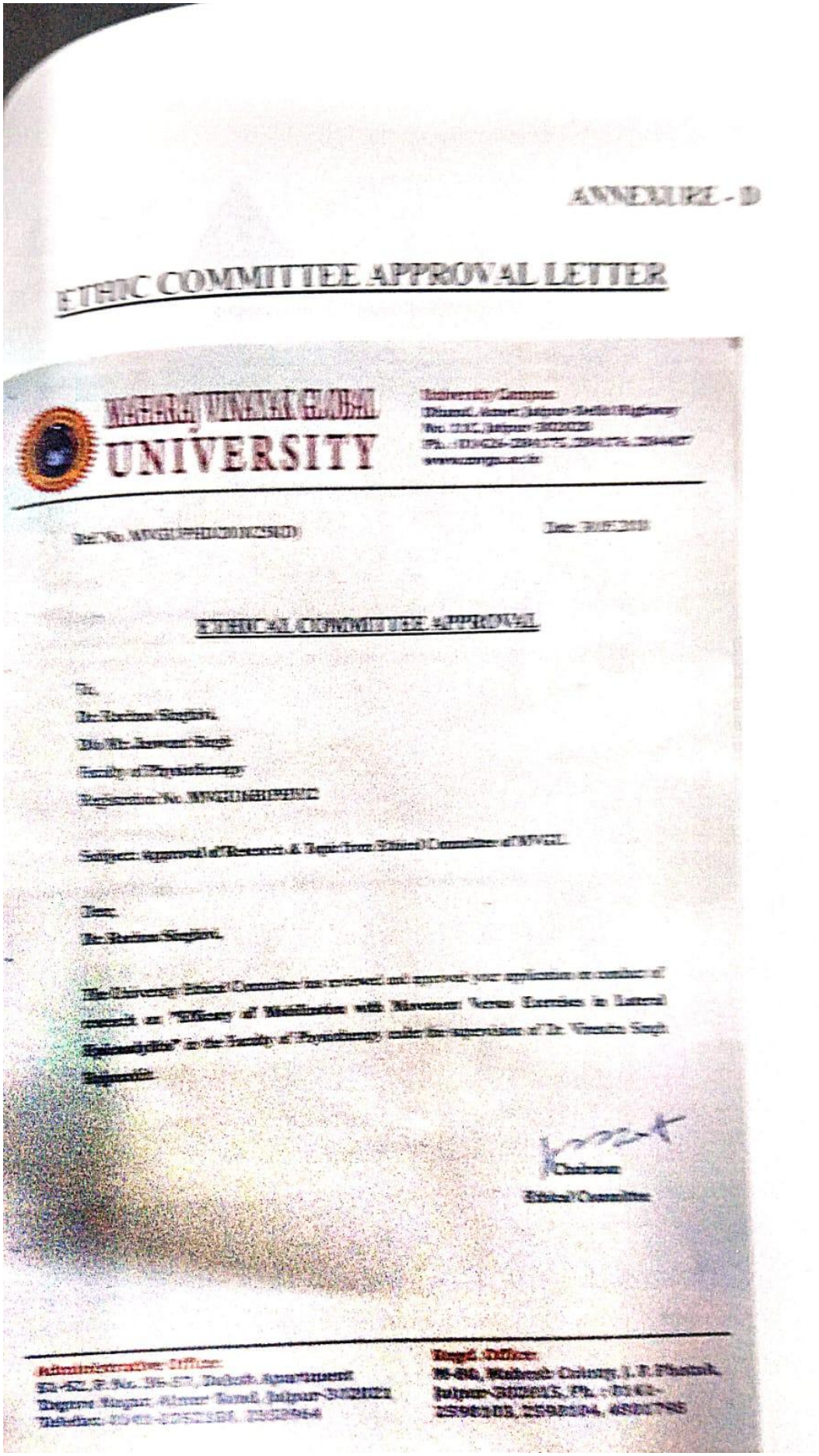


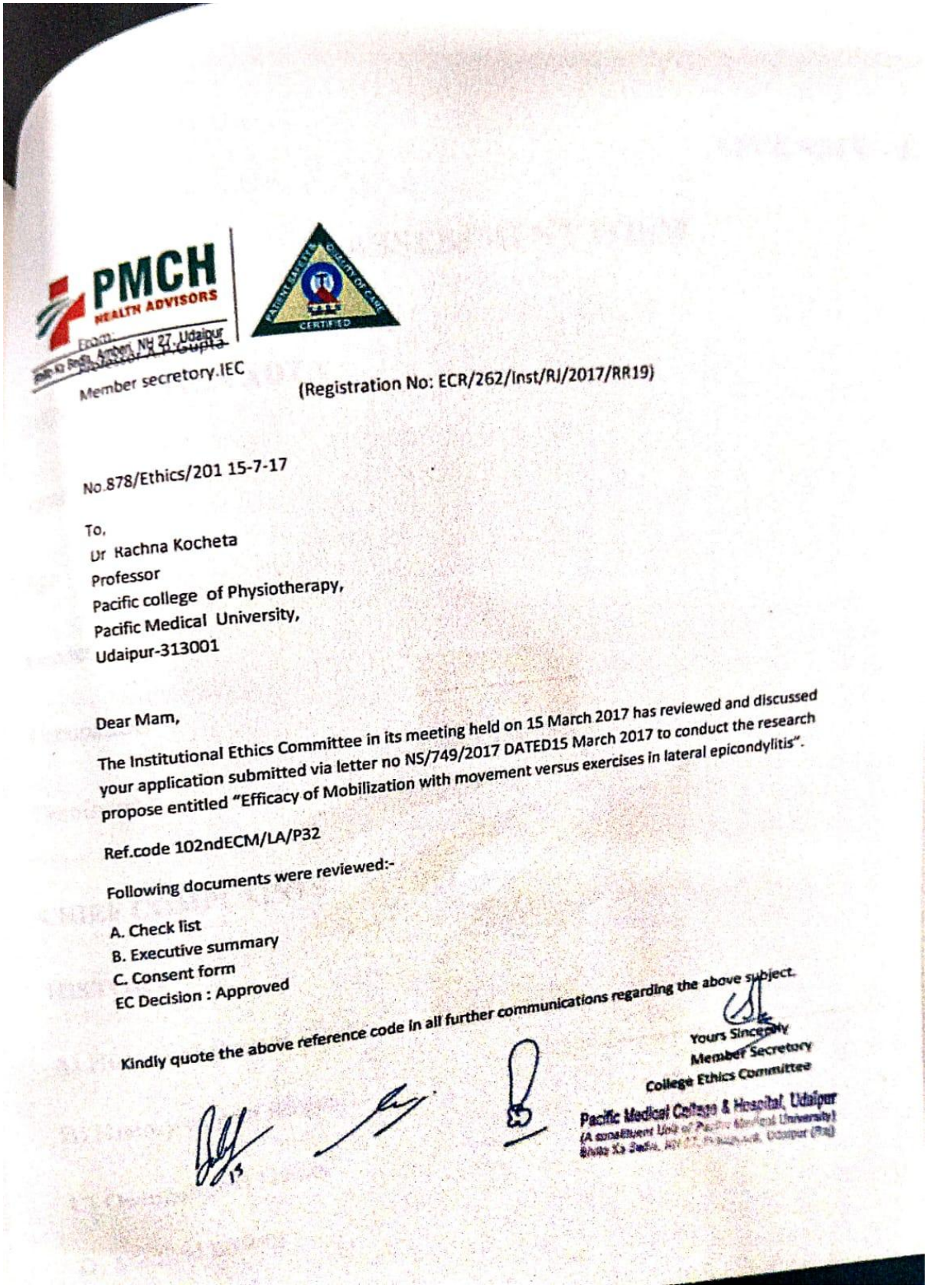
ANNEXURE - D

ETHIC COMMITTEE APPROVAL LETTER

VINAYAK GLOBAL UNIVERSITY

ETHICAL COMMITTEE APPROVAL

RESEARCH EDGE AND PUBLICATION



PMCH HEALTH ADVISORS
From: Ambavi, NH 27, Udaipur
Member secretory.IEC

(Registration No: ECR/262/Inst/RJ/2017/RR19)

No.878/Ethics/201 15-7-17

To,
Dr Rachna Kocheta
Professor
Pacific college of Physiotherapy,
Pacific Medical University,
Udaipur-313001

Dear Mam,

The Institutional Ethics Committee in its meeting held on 15 March 2017 has reviewed and discussed your application submitted via letter no NS/749/2017 DATED15 March 2017 to conduct the research propose entitled "Efficacy of Mobilization with movement versus exercises in lateral epicondylitis".

Ref.code 102ndECM/LA/P32

Following documents were reviewed:-

A. Check list
B. Executive summary
C. Consent form
EC Decision : Approved

Kindly quote the above reference code in all further communications regarding the above subject.

Yours Sincerely
Member Secretory
College Ethics Committee

Pacific Medical College & Hospital, Udaipur