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Review Article

Current Physical Therapies Available for the Rehabilitation of Tennis Elbow: A Review Article

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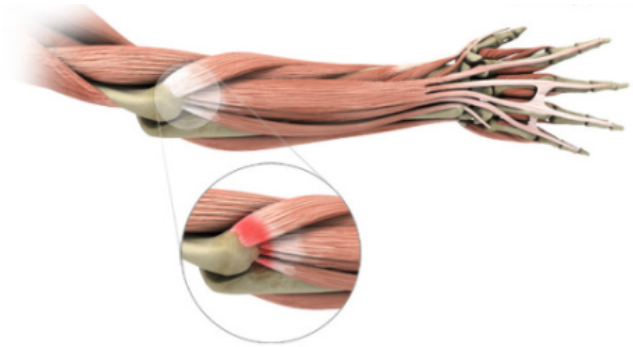
ABSTRACT

This literature review article has drawn attention to the current available physical therapies which can be applied in managing Tennis Elbow or lateral epicondylitis (LET) whose prevalence is about 3% in general population and about 20% in elderly population. This condition is characterised by lesions in Extensor Carpi Radialis Brevis muscle leading to painful and debilitating musculoskeletal condition and affecting the overall quality of life of a patient. The review has also discussed the updated pathophysiological findings in this condition. The study has discussed that tennis elbow is degenerative disorder and initially caused by inflammation. The typical pathology found is presence of disorderly arrangement of immature collagen fibers consisting of fibroblastic and vascular components. Finally, the review has discussed several methods of physical therapies to manage tennis elbow. This includes counterforce bracing, Soft tissue techniques, various modalities , various exercises including Wrist extensor eccentric exercise, stabilization exercise, Stretching exercises, Eccentric strengthening exercise and. Overall, the review brings updated guidelines of the exercises and physical rehabilitation therapy points for managing LET or Tennis Elbow.

Keywords: tennis elbow; musculoskeletal condition; elbow pain; physical therapy

INTRODUCTION

Tennis elbow is characterised by constant disabling pain in elbow region, particularly involving the radio humeral joint which is also known as lateral epicondylitis, or lateral epicondylalgia[1–5]. It is abbreviated as LET. Any definite causative agent/means still lies blanketed. While it stubbornly survives as a painful and debilitating musculoskeletal condition and affecting the overall quality of life of a patient[6]. It's familiar occurrence is seen in individuals having profession/jobs requiring recurrent 'rotary motion of the forearm (e.g., tennis players and carpenters')[7]. It happens because of rapid, repetitive, 'cyclic eccentric contractions and activities that require wrist gripping[8]. The dominant arm is generally "work-struck", meaning, the hand is unable to move to carry out any task. It's prevalence rate in a general populace is 1–3%, but it sharply elevates to up to 19% when the study subjects addressed are 30–60 years of age. For females the condition is more severe and long-lasting[9,10]. The average period for an occurrence to last is 6 -24 months[11]. This disease can be characterized, by presence of 'microscopic and macroscopic lesions in Extensor Carpi Radialis Brevis' (ECRB)[6]. A review was carried out from February 2022 in the databases of PubMed, Cinahl, Scopus, Medline and Web of Science using the search terms: Physical therapy modalities, Physical and rehabilitation medicine in Tennis elbow or Elbow tendinopathy to collate more details towards the recent trends in the management of tennis elbow.



Despite of many ambiguities rehabilitation methods are the first line of treatments been favored over medications, steroid injections or surgery[12,13]. After thoroughly assessing wide range of avaliable literature, it can be concluded that best rehabilitation practice consist of combination of therapeutic exercise and manual therapy that renders instant relief and improves functioning for short-terms[14]. Though, scientists are still unable to exactly define and describe what all parameters should be included in a 'multimodal treatment program for LET'[15] particularly when the concern is also the future prevention of relapse of condition[16,17]. Atop, all this only petite guidance is accessible about the dosage (incorporating the 'intensity, duration, frequency, and progression') that ought to be followed in any exercise prescription.

Few recent studies have established a linkage amid weakness of shoulder girdle and LET[18–20]. This makes it, justifiable that if cases of LET are accompanied by weakness then scapular muscle exercises must be necessarily incorporated in the rehabilitation program. One possible explanation to this strategy lies in Kinetic Chain Theory (KCT). According to KCT at times of 'functional arm motions kinetic energy is transferred from proximal to more distal segments of the arm', delivering an effectual and competent mode for distal function[21,22] when this happens, proximal weakness augments the demand on the distal segment thus distal segment gets overloaded[23] in absence of appropriate proximal scapular strength, the distal tissues are under increased load at two points- the elbow and wrist[24].

PATHOPHYSIOLOGY OF TENNIS ELBOW

There can be two types of Tennis Elbow, namely, acute and chronic. Acute form is caused due to tendonitis, this is not generally found; chronic type is more frequently found and the possible reasons behind it are a degenerative tendon changes, collagen bundles getting disorganized, scar tissue, and hypervascularity[25] are two mechanisms that lead to tendinopathy : related to load (biomechanical) and systemic. Generally found systemic risk factors consist of 'hypercholesterolemia, diabetes', disturbance in normal hormonal functions, hereditary and age related elements[26,27] the systemic factors are responsible in reduction of 'tendon capacity to manage load' to such an extent that even the daily living activities may become a stimulus for a pathological cycle[26].

ECRB is the main tendon affected in TE. It has a role of stabilizing the wrist statically. This supports the use of isometric exercises in TE management. Isometric exercises were found to have hypoalgesic effect both locally and in remote sites from exercised part during and after contraction[28].

TE is a kind of degenerative disorder and its initial stages come under inflammation thus recovery and success of treatment will very much depend on normal body well-being. Life –style hazards like smoking, ingestion of calorie-rich processed foods and obesity may hamper in early recovery[29].

ECRB is the commonly encountered anatomic site of origin, yet other factors that lead to Tennis elbow are 'annular ligament, lateral capsule, radial nerve, and extensor digitorum communis'[30]. When the cause of tendinopathy is of degenerative nature it is normally due to happening of micro-trauma at the origin of the extensor tendon which is caused due to 'repetitive wrist extension and alternating forearm rotation' occurring due to stress & excessive use. Tendon injuries that are generally encountered in Tennis elbow have common histologic findings, featured by 'angiofibroblastic hyperplasia', displaying a disorderly mix of immature collagen fibers comprising of fibroblastic and vascular components[31]. According to some microscopic studies that focused on tissues of Tennis elbow it has been concluded that histologic features appears when there occurs a failure of healing responses in ECRB, and that the inflammatory processes are not the sole etiology[32].

COMMON TECHNIQUES IN PARA FORM

Wrist Orthosis

During the early rehabilitation strategies of conquering TE using counterforce braces is highly recommended as it drastically improves threshold of pain pressure[33] (Figure 1). The possible explanation behind its efficacy is that these brace place 'tension on a more distal segment of the tendon/muscle' thereby giving time to heal 'to the injured proximal insertion of the common wrist extensors'. Many times when it is not possible for the patient to avoid the aggravating activity (to let the healing process set in) in such cases these straps are especially beneficial. Like for example, tennis players or individuals doing manual labor jobs have no option to hold the activity; here counterforce brace can be a very supporting alternative[34].

It is advised to the patients that they should use the strap while at work or sports activities but not during their resistant time. The best position to place the strap is 'two finger widths below the painful area' and they are told to that

Fig. 1: Wrist orthosis

tension should be adjusted according to their comfort while the muscles were still relaxed, and that it should never be too tighten [33,34].

Soft Tissue Mobilization

Soft tissue techniques can cause lowering of local pain, and aggravate the flow of blood in the concerned area bringing about tissue healing and also lead to enhance tissue extensibility. the treating therapist is given the option of performing a variety of soft tissue techniques. A kind of soft tissue method is Deep Friction Massage (DFM). It is provided in small circular movements along the common wrist extensor tendon. DFM tends to reduce scar tissue [35] by promoting healing process of an already degenerating tendon during its remodeling phase. Also, this kind of soft tissue massage when done throughout common wrist extensor muscle helps to relax and augments tissue extensibility. Again, myofascial techniques that target the common wrist extensors help in pain reduction and recuperate extensibility of soft tissues. [36] Despite of all these evidence available in support of use of soft tissue techniques as treatment of tendinopathies is limited [37].

CRYOTHERAPY

Cryotherapy is based on gate control theory [38] and is an effective means to diminish local pain in TE. It can also cause vasoconstriction of superficial blood thereby reducing any chemical pain if present [39]. The authors (study itself) want to suggest to the clinicians that ice massage should be there first choice (until otherwise contradicted) as it is well known to be an integral part of any multimodal program meant for treating tendinopathies [40]. But involvement of ice as a direct massage tool and its direct skin contact may not be readily acceptable for all individuals. This condition can be patched up if the clinician is able to provide a slightly improved version of (either homemade or commercial) ice pack that has a thin outer covering (typically a pillow case) at the clinic [41]. It would be more effective for the patient if they tried to do this therapy at their home also by application of ice for at least 5 minutes on the affected area particularly after an aggravating activity and hence the clinicians should suggest the same to the patient. Another alternative way is to do ice therapy at the elbow region, 3-4 times daily for 10 minutes each time. It will help in pain reduction [40,41].

Different types of exercises

According to 'Achilles and Patellar Tendinopathies [12] Eccentric exercises are the gold standard to recupurate from tendon overuse injuries and in prevention of further re-injuries [42]. They also have an upper hand (when contrasted with concentric exercises) in cases where patients/athletes are planning to resume their normal functioning/ athletic activities [43]. In Achilles tendinopathy tendons responded to eccentric exercises after three months of training [44]. But there are other studies too according to which tendons do not respond differently depending on concentric and eccentric exercises [45]. But we need to mention that under the exercise regime its type, frequency of doing it, speed and duration of contraction are still dubious [45].

TE is a deteriorating process where thickness of common extensor tendon [46], increases. It is also featured by improper wrist functioning predominantly while try to grip something (probably due to varied neuromuscular strategies) [47] Pain while gripping an object is thus the most common feature of it. Thus load reduction should be included in effective management strategy accompanied by ways to build tissue resilience. An effective and simple way to alter load is suggesting the 'patient to work under their pain threshold' and allowing them to do those 'exercises that load the tendon below the level of exaggerated pain' [48].

Vishwas et al [49] performed an comparative study highlighting the instant outcomes of isometric exercises that were undertaken different intensities (crossing over the maximum and minimum pain threshold limits) on perception of pain in people suffering from chronic TE. Their results revealed that when exercises of upper pain limit were done it considerably reduced the resting pain intensity immediately as the exercise session ended, in comparison to the other group. They also concluded that those patients who feared this greater fear of movement (while exercising above upper pain limit) experienced higher intensity of pain. [49]

Exercising should be maintained at a regular process moving steadily to increase tendon tolerance to loads. Exercises can be carried out in following ways given in Table 1.

Wrist extensor eccentric exercise

A special type of band, known as thera band, is used to perform 'wrist extensor eccentric strengthening exercise'. This is performed by moving the affected side of the forearm 'in the state of internal version and the forearm is placed on the edge of the bed but hand is placed outside the bed. This is a more subtle type of exercise where affected side hand

Table 1: Some of the exercises and their descriptions are given below

Exercise/Positions	Description
Elbow and forearm position	initially starting with 'flexed elbow and forearm in supination', then slowing raising the elbow extension angle
Fingers flexion vs extension	it starts with fingers in flexion then moves towards extension to load the long extensors
Adding weights	it can be achieved by usage of exercise band or dumbbells
Bilateral movement	bilateral symptoms were reported by many individuals, which supports that TE is associated with central sensitization
Weight bearing exercises	Exercises that target the entire upper limb along with functional training exercises

is slowly extended with the help of hand that is not under TE pain (while doing eccentric control exercise). This helps to carry out the eccentric control exercise within the no-pain range. This whole exercise is to be performed 15 times which is counted as one set. This type of five sets have to be performed; between each set a one minute break should be taken[50].

The shoulder stabilization exercise

They comprise of usage of slings for doing push-up plus exercise using slings[14]. The sling that is to be used is at a height of 10 cm from the floor. The position in which it is started is a crawling position and the doer holds the handle of the sling. A right angle (90°) is maintained between the shoulder and knee joint. The alignment of head, spine, and pelvis should be a straight line. A steady eye contact should be ensured with the floor. Placement of hands and knees should be in accordance with shoulder width. Complete extension of the elbows and plantar flexion of ankle joints is to be maintained. While doing the push-up plus exercise, it is made sure that 'unciform bones of the middle fingers got aligned with the acromions', while the scapulae getting maximally protracted enabling head and the trunk joints to form straight line. This posture has to be maintained for 5 seconds. This entire process when performed five times constituted one set. Five such sets have to be performed with a 1 minute break in between each set. This is recommended 3 times in a week for 3 consecutive weeks.[50]

Stretching exercises (combination of static and eccentric)

This exercise program has two components. Primarily, it is a stretching exercise of the Extensor Carpi Radialis Brevis standing at a fixed position. This static stretching is done while the patient remains seated position but elbow is extended, forearm is in 'pronation, and wrist flexion with ulnar deviation'. Stretch force is applied depending on the tolerable capacity of the patient. Patient has to stay in this stretch position for about 30–45 seconds. A total of 6 such sets are to be done but there is protocol for it which is followed in a specified manner. It has to be done 3-3 times (total 6) before and after eccentric exercise portion[50,51]. Each time of stretching should be accompanied by a 30 seconds interval of rest.

Eccentric strengthening exercise

In this exercise, the patient remains sitting while his or her elbow should be fully extended, 'forearm pronation, and maximum wrist extension' is there. At this position, the patient has to lower the wrist slowly 'into flexion for a count of 30'. He/she uses the contra lateral hand to enable him/her to return the wrist to maximum extension. Then the patients have to continue the exercise even in case of mild discomfort. But they need to stop if the pain got unbearable. Those patients who were able to do eccentric exercise without minor discomfort/pain, for them the load is can be increased 'using free weights based on the patients 10 RM (Repetition Maximum)'. This process is to be repeated ten times and three such sets are to be performed. There is a resistant of 60 seconds between each set. An education manual is also made available to the patients which guided them about 'ergonomics and activity modification technique' so that they get informed about how to not aggravate their symptoms[52].

Cyriax physiotherapy

It comprises of deep transverse friction massage for a duration of 10 min. and instantly after that a single application of Mill's manipulation is done. The hand placement is shown in Figure 2. The patient should be seated in a comfortable position and the elbow is fully supinated and in 90° of flexion. The next step is mapping the area of tenderness done on the basis of palpation of 'anterolateral aspect of the lateral epicondyle of humerus'. Then with the help of a thumb deep transverse friction is rendered. This pressure is applied on tenoosseous junction in a posterior direction. It is continued for at least ten minutes to achieve the numbing effect so that the tendon get receptive for Mill's manipulation[52].

In Mills manipulation, patients are made to sit with ease and it is made sure that 'affected extremity in 90° of abduction' and enough internal rotation brings the olecranon faced up situation is achieved. After this the therapist tries to stabilize 'patient's wrist in full flexion and pronation with one hand', simultaneously placing the other hand over the olecranon[4,51,52]. Refer to Figure 2 for Mill's Manipulation.

Fig. 2: The method of deep transverse friction massage

The therapist is supposed to assume full wrist flexion and pronation position, and thus 'apply a high-velocity, low-amplitude thrust at the end range of elbow extension'. However a comparative study on tennis elbow showed that that group which underwent a one month supervised exercise program reported significantly better functioning and pain-reduction status as compared to Cyriax physiotherapy treatment[53,54].

Fig. 3: The method showing Mill's manipulation

Laser

Laser has been a choice of management in tennis elbow over time and found to have varying degree of success in minimizing pain, disability and promoting range of motion and functionality based on varying therapeutic factors. Its advised to administer low level laser therapy with dose ranging from 904nm and 632nm wavelength and the effect is better felt when combined with exercise.[53] It is also noted that LASER can be a second line option in pain relief and alternative for surgical intervention in chronic cases of pain.[54].

Pulsed electromagnetic therapy & shockwave therapy

PEMF reduces the pain intensity and lot of studies have reported higher degree of positive effect specific to tennis elbow. Along with the list of advanced therapies like PEMF, Shockwave therapy have been an added second range of choice with additional cost.[55,56]

Ultrasound

The tennis elbow and ultrasound as a method of its management is a conventional approach and well documented as well is a subject of controversy. The varying concerns is more related to the procedural methods, choice of dosage and supportive exercise regimen.[57,58]

DISCUSSION

This review focuses on the current physiotherapy trends prevailing in the management of Tennis elbow. There have been notions suggesting either modality or only exercise as a medium of treatment and evidences through scientific publications depicting the negative aspect of the efficacy of the unbalanced choice of management strategies. It is to be noted that management of tennis elbow, be it chronic or acute, goes well with combined effect of exercise and modality.

In chronic pain, a systematic review reports use of exercise along with modalities are effective in control of pain and long-term relief.[59,60]

The pain relief and better functionality is achieved through orthosis[61], HILT[61], DF[60] and US, TENS and stretching exercises[62], since they can all affect hypercellularity, the collagen matrix, the proteoglycan content and neovascularisation, which is generated by the accumulation of microinjuries, due to the repetitive overload that exceeds the healing capacity of the tendon[63].

The review helps understand the individual effects of different approaches towards management of tennis elbow and also strengthens the combination therapy inclusive of exercise program as an effective management medium, however individualized randomized control studies with consideration to factors such as procedure, dosage, adherence to exercise and ergonomics would yield better scientific evidence.

CONCLUSION

Current review has clearly showed some updated physical methods for rehabilitation of Tennis Elbow. Acute Tennis elbow is caused due to the inflammation of the tendons while the chronic form occurs due to the degenerative changes in the tendons, collagen bundles leading to hypervascularity and scar formation. The common physiotherapeutic techniques are discussed in detail methods. Cryotherapy has been discussed to manage the local pain in tennis elbow. Different types of exercises like are discussed for the improvement of the pain and degree of movement. The exercises are discussed with methodical approach from the recent papers. Finally this review has brought forward Mill's Manipulation which is a deep transverse friction massage. The review is very significant as the present guidelines of the tennis elbow management is discussed in practical approach. The pathophysiology of tennis elbow has also been

discussed to understand the mechanism of the condition. The review is useful for the students for further study about tennis elbow and for the clinicians to implement the clinical physiotherapeutical techniques in their practice.

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