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Hand function and its determinants in patients with lateral epicondylitis – A cross sectional study

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***Abstract*---**Background: Hand function is an important aspect of most of the activities of daily living. There are many conditions that cause direct impact on hand function but few of musculoskeletal conations indirectly influence the hand function but often ignored in rehabilitation. Objective: The aims of this study were to analyse the hand function among lateral epicondylitis (LE) patients and identify the influence of various parameters (Age, dominance, pain, range of motion (ROM), and chronicity) that may influence the hand function. Methods: Eighty six LE patients participated in this cross sectional study. The hand function was assessed using Perdue peg board along with various other parameters like age, dominance, pain, range of motion, and chronicity. Results: There was a significant difference between the hand function of affected and unaffected extremity ($p<0.001$, effect size of 0.425). Pain severity, chronicity of LE and wrist

extension was strongly related to hand function with R value of -0.910, -0.788 and 0.698 respectively. Conclusions: The results highlight the possible hand function compromise among patients with LE. Out of all the assessed parameters pain severity, wrist extension ROM and chronicity of condition were associated with hand function compromise. From this study we strongly recommend assessment and treatment of dexterity issues among LE patients.

***Keywords*---**Lateral epicondylitis, tennis elbow, hand function, elbow pain, Purdue peg board.

1. Introduction

Lateral epicondylitis (LE) is one of the important overuse syndromes of the upper extremity often called as tennis elbow, yet only 5% of the affected people are involved in the sport. [1] LE commonly affects the people who are involved in repetitive one sided movements like plumbers, carpenters, gardener, drivers, electricians and even people with desk bound job. This condition causes limitation in work and reduces the performance and productivity of the employees. [2] Epicondylitis is more prevalent in the lateral side compared to the medial and affects 1-3 % of the population in the age group of 35 to 50 years. [3] This is because of the fact that LE is a common extensor origin, and the muscles are involved more in functional activities than the flexor muscles of the forearm. Adding to this, the flexion muscles are stronger than the extensor muscles, produce steady muscle contraction particularly in isometric muscle action and have a broader origin from the medial epicondyle. The common extensor origin is more tendinous than the flexors. [4] The working population is the one which is most affected with epicondylitis and that is why the condition is more prevalent in the active life of human and declines after the age of 50 years. A systematic review isolated 3 risk factors for LE: handling equipment or tools heavier than one kilogram, handling loads more than 20 kg at least ten times a day, and performing repetitive movement for more than two hours a day. There were other minor contributing factors like overuse, training errors, misalignments, lack of flexibility, ageing, lack of proper circulation, poor muscle strength or muscle imbalance and even psychological problems. [5]

LE affects not only the elbow function but also some of the hand function. Gripping is one component that is often affected and that significantly affects the activities of daily living reducing the functional freedom of patients like lifting a mug of water to bath, holding on to heavier objects and so on [6]This is why clinical examination of LE patients includes quantification of grip strength. [7] There are various aspects that determine the functional performances like hand eye coordination and hand function. There are very few studies which have studied these two components. However the hand eye coordination and reactive force production have been studied already and found to affect the upper limb functionality. [8] Thus it's obvious from the literature that the hand function among the lateral epicondylitis has not been studied before. As we felt if the condition (LE) can influence the grip strength and hand eye coordination, it can also affect the hand function. The aims of this study were to analyse the hand

function among lateral epicondylitis (LE) patients and identify the influence of various parameters (Age, dominance, pain, range of motion, and chronicity) that may influence the hand function.

2. Methods

2.1Participants

Eighty six LE patients from Kempegowda Institute of Medical Sciences Hospital participated in this cross sectional study. The selection criteria were patients who were diagnosed with lateral epicondylitis by physicians and referred to physiotherapy department. Only unilateral LE of both sides and of both gender in the age group of 30 to 60 were selected for the study. Subjects who had compromised sensation of any of the upper limb, radiculopathy, and muscle weakness due to other musculoskeletal conditions of upper limb or cervical spine, any history of neurological deficits that may interfere with perception, memory, motor function, and any history of previous surgery to the upper limb were excluded from the study.

2.2 Data collection

The subjects who were referred by physicians with LE, attended the physiotherapy department were assessed with Cozen's test [9] and Mill's test [10] to confirm the presence of LE. Basic details about the patient like the age, sex and basic physiotherapy assessment was performed. From these information various parameters like age, dominance, pain severity, range of motion of elbow and wrist joint, and chronicity of condition were collected. Following these tests the hand function was assessed using Perdue peg board (PPB). PPB task was administered to find the hand dexterity. A blinded assessor was used in the assessment of two tasks performed by every subject three times with a gap of 60 seconds between each attempt. [11] The first subtask required the subject to place as many pegs as possible in 30 seconds in the target holes provided in the pegboard using the affected limb. This task was performed with both hands consecutively. The second task required the subject to place the peg, then the washer and followed by the collar in a sequence prescribed by the guidelines. [12]

2.3 Statistical analyses

Statistical analyses for the study were calculated using SPSS 23.0 (SPSS Inc.). The study used 95% confidence intervals (CIs) and P values <0.05 was considered as statistically significant. Independent t-test was used to analyse the difference in PPB hand function scores of affected hand and unaffected hand and effect size was also calculated. The correlation between the affected side hand function score with pain and hand dominance was performed using Spearman's rank correlation and all others were assessed using Pearson's correlation.

3. Results

The study screened 94 patients and selected 86 samples and all of them accounted for the study results. The basic characteristics of the subjects are

presented in table 1. There were more female subjects (57%) and dominant side (67%) was most affected. Majority of the cases were acute, 72% having chronicity less than 2 months. The mean (SD) of the affected hand and normal hand function score on PPB was 71.34 (6.1) and 76.25(3.9) respectively which showed a significant difference between them with p value < 0.001 and an effect size of 0.425. The correlation values of age, dominance, pain severity, range of motion of elbow and wrist joint, and chronicity of condition are presented in table 2. It is oobserved from the results that the pain severity, chronicity of LE and wrist extension was strongly related to hand function with R value of -0.910, -0.788 and 0.698 respectively.

Table 1 Demographic characteristics of the study population (*n*=86)

Criteria	Numbers
Age	
30-40 years	44
40-50 years	22
50-60 years	20
Sex	
Male	37
Female	49
Involved side	
Dominant hand	58
Non dominant hand	28
Chronicity of LE	
Less than a month	41
1-2 months	21
2-3 months	22
More than 3 months	02
Work hours (mean/SD)	8.1 (1.45)

LE – lateral epicondylitis. SD – standard deviation

Table 2 – Correlation between the variables

Variable 1	Variable 2	Mean (SD) Variable 1	Mean (SD) Variable 2	P value
AHF	Age	71.34 (6.2)	41.84 (6.9)	0.069
AHF	Dominance	71.30 (6.2)	Median – 1 Variance – 0.22	0.440#
AHF	Chronicity	71.30(6.2)	16.82 (20.6)	0.001*
AHF	Pain severity	71.34 (6.2)	Median – 5 Variance – 2.35	0.001*#
AHF	Wrist extension	71.34 (6.2)	67.17(1.9)	0.031*
AHF	Wrist Flexion	71.34 (6.2)	68(1.9)	0.342
AHF	Elbow flexion	71.34 (6.2)	128.58(1.6)	0.120
AHF	Elbow extension	71.34 (6.2)	5.32(0.6)	0.362

AHF – affected hand function, SD – standard deviation. *significant, # Spearman's Rank correlation.

4. Discussion

This cross sectional study was conducted to find how patients with LE faired in hand function and what can determine it. In this study, as we found not all patients referred from physician were not specifically LE, the researcher did a differential diagnosis and specifically identified LE and recruited them for the study. We did not consider traumatic cases which mimicked LE, because there were many confounding variables and the patients won't behave similar to the target population. In the past, rehabilitation of LE has always centred on pain reduction. Even strengthening exercises were found effective in terms of pain reduction predominantly and the other supportive manipulation techniques were suggested only because they could bring about a momentary pain reduction that may help the patient is doing vigorous strengthening. [13] Many electrotherapy modalities were found moderately effective yet not conclusive in terms of reducing pain [14] It is observed that pain, range of motion and grip strength had always been the common outcome measures evaluated to designate a intervention effective in LE. [13-16]

Hand function among the previous studies specified only the grip strength [15] however in our day today life not all activity requires grip strength. Majority of the skill based activity are done with hand dexterity. It is well known that for the distal segment of the upper limb to perform better the proximal segments need to contribute. [17] Electromyography studies have illustrated that the proximal muscles contract on an anticipatory basis even before the hand muscles contracted. This is to provide stability and translate the hand to the work area. [18] While attempting to grasp any object with hand, there was a prior and simultaneous muscle contraction at the elbow and shoulder [19]. These studies clearly explain the role of proximal muscles in the hand function. When this is true we perceived that there is every chance of the hand function being affected in tennis elbow which is a condition that affected the wrist extensors. Hand dexterity was measured using PPB in our study as it is commonly used in rehabilitation set up to train hand function and also in selection of employees in factories and industries which involve assembling, packing, machine manipulation, and jobs of similar nature. [20] The study considered the unaffected arm as the reference for normal value to which the affected limb was compared. This was the main reason why we selected unilateral LE. Any condition that was perceived to influence the hand function of the unaffected arm was also excluded from the study. We included both male and female as there were no significant difference between them in terms of prognosis and incidence. [21] The PPB score used in the study was calculated using an average score of three attempts made for the two tasks. The same score was used compare between the affected side and unaffected side, and also for comparing the affected side score with other determinants. We have not considered hand function as a determinant because it's already been established that hand function can be influenced by hand grip or grip strength. [22]

The results of our study proved that there was compromised hand function performed by the limb that was affected with LE as they were not able to display a in par hand dexterity task in the PPB. This can be justified by the fact that finger flexors, which are very vital in dexterity function, are dependent on the wrist

posturing particularly wrist extensors. It is also documented that the index finger in particular is more dependent on the wrist position while performing dexterity tasks. [23] Thus in case of LE when the patient had pain in extension of the wrist, naturally the wrist presentation would be affected and that may in turn affect the finger flexors and extensors and compromise the dexterity. This claim was supported by the fact that the wrist extension had a significant positive correlation with the PPB scores in our study. Similarly, pain also was influenced the hand function in our study, as it may be due to the apprehension to move, that might have limited the wrist and finger movements. The chronicity of the ailment also affected the hand function, where patients who were suffering with LE for more than a month displayed poor dexterity.

The main clinical implication and strength of our study is that the emphasise we place on training dexterity function among the LE patients to improve their productivity in work place. Rather than training individual muscles we recommend training meaningful functional task for improving hand skills. For executing this initial examination of the hand function along with grip strength is vital. The main limitation of this study is the lack of sensitive outcome tools like EMG to analyse the muscle activity. We are not very sure how far these results can be generalised to all population as this is a single centre based results and hence there is a strong need for conducting the study on a larger and heterogeneous sample.

5. Conclusion

The results highlight the possible hand function compromise among patients with LE. Out of all the assessed parameters pain severity, wrist extension ROM and chronicity of condition were associated with hand function compromise. These findings can help to develop guidelines regarding prioritizing hand function training among chronic LE patients and patients with severe pain. From this study we strongly recommend assessment and treatment of dexterity issues among LE patients.

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