Effect of Hand Rehabilitation on Hand Grip Strength and Manual Dexterity in Patients with Diabetic Hand Syndrome

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Abstract

Background- In patients with diabetes upper extremity impairments are common. Diabetes patient are more prone to diabetic hand. **Aim-** To study the effect of hand exercises on hand grip strength and manual dexterity in patients with Diabetic hand .**Objectives-** To study the effect of hand exercises on hand grip strength in patients with Diabetic hand using Modified sphygmomanometer test. To study the effect of hand exercises dexterity in patients with Diabetic hand using grip ability scale. To study the effect of hand function in patients with Diabetic hand using Michigan hand outcomes questionnaire (MHQ) and Duruoz Hand Index. **Setting and design** – In this study 15 individual participated having diabetic hand which was selected randomly. Modified sphygmomanometer test was performed on patient to check grip strength. Grip ability scale was performed on patient to check manual dexterity. Hand function was check using Michigan hand outcomes questionnaire (MHQ) and Duruoz Hand Index. The effect of hand exercise on hand grip strength and manual dexterity in patients with diabetic hand was analysied. **Result-** Total 15 individual participated with age mean 58±13.519 and duration of diabetes with mean 11±6.448. Modified sphygmomanometer test result improved from 28.13±3.044 to 32.47±2.875(p=0.001). Grip ability test result improved from 23.13±3.523 to 18.67±1.345(p=0.001). Michigan hand outcome questionnaire result improved from 53.29±10.19 to 71.34±5.036(p=0.001). Duruoz Hand Index result improved from 31.67±11.2 to13.47±4.596(0.001).**Conclusion-** There is significant effect of hand exercises on hand grip strength and manual dexterity in patient with diabetic hand.

Keywords*-Diabetic hand, Hand grip strength, dexterity, Duruoz Hand Index, Michigan hand outcomes questionnaire*

Introduction

Diabetes mellitus is a autoimmune systemic disorder in which there is increase in sugar level due to insulin deficiency. In type 1 and type 2 diabetes hyperglycemia that is poor sugar level causes micro- and macrovascular complications primary to pathophysiological and structural changes in musculoskeletal structures causing diabetic hand.(1) Diabetes mellitus is related with musculoskeletal disorders affecting hand, commonly called to as diabetic hand syndrome. These include limited joint mobility (LJM) (also known as diabetic cheiroarthropathy), Dupuytren's contracture, stenosing tenosynovitis (trigger finger), carpal tunnel syndrome (CTS), Charcot neuroarthropathy, reflex sympathetic dystrophy and a variety of hand infections.(2)

Dexterity means ability to use hand skilfully that is during a specific task fine, voluntary movement used to manipulate small objects. Dexterity can be categorized into manual dexterity that is the skill to handle objects with the hand. Grip strength means the measurable ability to apply pressure on objects or force applied by the hand and fingers.(3). Due to hyperglycemia there is adverse effect on connective and nervous tissue which affects hand functions in conditions of dexterity, grip and pinch strength, hand manipulation skills that can be impaired in patients with types 1 and type 2 diabetes. Due to structural changes in connective tissues, in approximately 50% of individuals with diabetes,

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musculoskeletal impairments in hand like limited range of motion, tenosynovitis, Dupuytren's contracture, and altered nerve function are noted which affect hand function in terms of strength, dexterity, fine motor skills, and hand performance.(1)

In diabetes, limited joint mobility is considered to be caused by non-inflammatory thickening and increased stiffness in the peri-articular structures. Limited joint mobility may lead severe upper extremity impairments related with pain and disability. The incidence of limited joint mobility and associated impairments at the shoulder and hand can have a important impact on upper extremity function in diabetic patient.(4) Dupuytren's contracture is also called as palmar fibromatosis is thickening of tissue in palmar skin most commonly involving the middle and ring fingers in diabetes.(2) **Carpal tunnel syndrome is a neuropathy that occurs frequently, when the median nerve that passes through the carpal tunnels of the flexor tendons is contracted by the transverse carpal ligament and carpal bones. Diabetes mellitus is the most common metabolic disease that causes Carpal tunnel syndrome.(4)**

Materials and Method

Ethical clearance was taken from institutional ethical committee of Tilak Maharashtra Vidyapeeth, department of physiotherapy. Permission Different centers was approached and permission was obtained prior to study. Explanation of the experiment was given to the patient. A Pre and Post Experimental study was conducted at various diabetic Clinics. Total 15 individual which were medically diagnosed cases of diabetic hand syndrome were selected. Modified sphygmomanometer test, Grip ability scale, Duruoz Hand Index, Michigan hand outcomes questionnaire (MHQ) was used pre and post intervention. Patient with diabetes mellitus both type I and type II, both male and female, patient willing to participate were included in study whereas patient with osteoarthritis, rheumatoid arthritis and fracture of hand were excluded from the study. Intervention protocol was given for 3 weeks 30 minutes 5 min flexor tendon gliding and blocking exercises, 5 min extension gliding exercises, 5 min rest, 10 min strengthening, 5 min rest. Intervention protocol include –Flexor Tendon Gliding Exercises, Flexor Tendon blocking exercises, Extension tendon Gliding exercise, Stretching technique for Intrinsic and multijoint muscles, Technique to strengthen muscles of wrist and hand.

Result

Study showed that out of 15 individual 6 were male and 9 were female (Table 1). Age with mean 58±13.519 and duration of diabetes with mean 11±6.448(Table 2). Modified sphygmomanometer test result improved from 28.13±3.044 to 32.47±2.875 with p value = 0.001(Table 3). Grip ability test result improved from 23.13±3.523 to 18.67±1.34 with p value = 0.001(Table 3). Michigan hand outcome questionnaire result improved from 53.29±10.19 to 71.34±5.036 with p value = 0.001(Table 3). Duruoz Hand Index result improved from 31.67±11.2 to13.47±4.596 with p value = 0.001(Table 3).

Table 1- Pre and post intervention

Outcome measues	**Pre Mean±SD**	**Post Mean±SD**	**p value**
Modified sphygmomanometer test	28.13±3.044	32.47±2.875	0.001
Grip ability test	23.13±3.523	18.67±1.345	0.001
Michigan hand outcome questionnaire	53.29±10.19	71.34±5.036	0.001
Duruoz Hand Index	31.67±11.2	13.47±4.596	0.001

Discussion

Study showed that out of 15 individual 6 were male and 9 were female. For age Mean= 58 SD=13.51 and median=53. For duration of diabetes Mean=11 SD=6.448 and median=10. Pre and post intervention performed noted that for Modified sphygmomanometer test p value= 0.001, Grip ability test p value= 0.001, Michigan hand outcome questionnaire p value= 0.001, Duruoz Hand Index p value= 0.001.

Diabetic hand syndrome is a common but less discussed. Pathologies that were examined in diabetic hand syndrome occur in general population as well. Moreover they are more common in patients with diabetes. These may differ in their Clinical presentation, course and response of treatment in diabetics compared to normal population. This condition has also been called to as diabetic pseudoscleroderma and the term shoulder-hand syndrome is often used when combined with adhesive capsulitis of the glenohumeral joint,.

Research conducted by De Carvalho e Silva et al. on the hand strength and functions in type 2 DM patients, found that hand functions and grip strength impairment are present in patient with type 2 DM . Similarly, Savas et al. And Cetinus et al. found that in patients with type 2 DM grip strength values were reduced than normal individuals. Lewko et al. investigated hand functions and dexirity in patients with DM and found out that poor hand functions are seen in patients with diabetes that leads to reduced quality of life as result of impaired hand function. Hence, it is important to assess hand function and treat it [6]

Muscle weakness is prominently seen in patients with diabetes and is mostly affected in Insulin resistance (Sayer et al, 2005) and, as a result patient exhibit reduce grip strength. researchers conducted by Rantanen et al (1999) an Leveille et al (2004) have reported that patients with type 2 diabetes mellitus showed that there is decreased handgrip strength.[7]

Strength training which employs principles of working at the level of motor neurons can benefit the hand dysfunction. Strength training improves glycemic control and improves grip strength and endurance and it leads to improvement in hand function in patient with diabetic neuropathy. Grip strength training exercises improved hand function in patient with diabetic neuropathy.[7]

Duruöz Hand Index (DHI) is a functional disability scale that can be used to assess the functional disability of hand. The hands are oftenly involved in diabetic patients. The DHI is a practical scale that is efficient in accurate assessment of hand dysfunction in diabetic patients.[8]

The recent study was done to study the effect of strength training on hand function in patient with diabetic neuropathy on 30 patients diagnosed with neuropathy .The patients were assessed and strengthening exercise were given. In Grip strength comparisons of post test values in group A are mean 34.80 and SD 12.23. Group B Mean 35.33 and SD 11.64. These values suggest they are statistically significant. These values suggest they are statistically significant. The study concluded that there was significant effect in giving strength training on hand function in patient with diabetic neuropathy.[9]

Active muscle contraction and specific motions of the digits are used to maintain or develop mobility between the multiple joint musculo-tendinous units and other connective tissue structures of hand. Tendon-gliding exercises and tendon-blocking exercises are used to develop or maintain mobility. These exercises used to develop neuromuscular control of hand musculature. The flexor tendon blocking exercises and extensor tendon-gliding exercise are used to strengthen the musculature by adding resistance manually or mechanically. [10]

Hand-specific exercises have also been emphasised as an efficient way of increasing handgrip

strength and functionality of RA individuals. Hand specific exercise improves hand grip strength and functionality of hand .Muscle strengthening exercises of hand improves functional performance, Quality of Life and muscle force gain. Strength training exercise improves lost function .During Hand movements, Balance between intrinsic and extrinsic muscle is quintessential for correct stabilization of joints in hand. [11]

Hence hand exercises like flexor tendon blocking exercises and extensor tendon-gliding exercise , intrinsic muscle strengthening exercise plays vital role in improving hand grip strength andmanual dexterity in patient with diabetic hand

Conclusion

There is significant effect of hand rehabilitation

exercise, flexor tendon blocking exercises and extensor tendon-gliding exercise , intrinsic muscle strengthening exercise on hand grip strength and manual dexterity in patient with diabetic hand. Hence rehabilitation plays an important role in management of hand dysfunction in patients with Diabetes

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