

The Impact of Using Rehabilitation Exercises and Shiatsu on Carpal Tunnel Syndrome

¹Mohamed Salah El-Deen Mohamed and ²Hassan Hany Abd El-Aleem

¹Department of Health Science, Faculty of Physical Education, Port Said University, Egypt

²Department of Health Science, Faculty of Physical Education, Mansoura University, Egypt

Abstract: This research aims to identify the impact of using Rehabilitation Exercises (R.Ex) and pressure massage technique (Shiatsu) on nerves and working muscles of wrist when injured with Carpal Tunnel Syndrome (CTS) by measuring the rate of median nerve fibers conduction, grip strength and joint flexibility "range of motion" of wrist (flexion- extension- adduction- abduction), as well as the degree of pain sensation. Experimental method of one group of (pre-intra-post) measurement design was used. Research sample included ten women (25-30 aged) of (CTS) as result of practicing different sports. The load of (R.Ex) (amount-intensity-frequency) was standardized according to the extent of individual adaptation of the injured women and by using (Shiatsu) massage on specific points (Tsubo) alternately for a period of (2-3 minutes) for each point. The program continued for two months (8 weeks) of (24 sessions) equal to (3 sessions) per week and day by day alternately. Results showed that there was an improvement in degree of median nerve conduction, measured by electromyography, an increase of grip muscular strength of wrist joint, measured by dynamometer, increase of flexibility, "range of motion" to joint movements (flexion- extension-adduction-abduction), measured by geoniometer and decrease of pain sensation, measured by visual analogue scale. The researcher recommended using of (R.Ex) and pressure massage technique (Shiatsu) in an individual form leads to relieve of (CTS), which increases the functional efficiency of wrist joint, as well as quick recovery.

Key words: Rehabilitation exercises · Carpal Tunnel Syndrome · Shiatsu · Tsubo

INTRODUCTION

The (CTS) occurs as a result of imbalance of working muscles groups of wrist joint because of excessive using of the wrist joint and hand, in case of contraction state or bending for long periods of time that lead to pressing edema on the median nerve to wrist like using mobiles, computers and driving cars or as results of practicing some sports such as tennis, golf, cycling, racket ball and movable wheelchair sport and sometimes it associates with anatomical or disease structure. This injury occurs with rate of 3.46 cases per 1000 of people, where injury rate for females to males is about (3: 1) and frequently occurs to no workers people at age of fifty, meanwhile for workers at age of 20: 40 years old [1- 4]. Symptoms of (CTS) begins with suffering from sensation of pain burning in the hand, inability to grip on things, sense of numbness weakness in the fingers (thumb- Index- middle-ring) and inability to execute the activities of life as a

result of pressure on median nerve which is responsible for conduction of neural nutrition to fingers through carpal tunnel. Also many tendons pass through carpal tunnel and when edema of these tendons or increase of thickness of ligaments occur, the pressure within the carpal tunnel increases as well as blood flow and neural signals decrease. The (CTS) may be associated with some diseases such as diabetes, thyroid disorders and rheumatoid which must be treated early, Manual massage is considered one of the most important therapeutic means because of its advantages like its lack of need to facilities and its positive impact on quick recovery for athletes and their psychological state [5-9].

Shiatsu is considered a form of Japanese massage technique which is used as therapeutic remedy and depends on pressing by fingers on some specific points of the body to relieve pain, tension, stress and to keep the body's energy and vitality. Shiatsu is used on specific points either in epidermis of the skin, nervous system or

muscular one, where these points (positions) are known as (Tsubo). The pressure on these points leads to recycling of energy in the body to relieve pain, where the reaction of patient is normal at the beginning of the pressure and then his sense of pain is disappeared gradually. The success of this type of massage as physiotherapy depends on discovery of specific points (Tsubo), which is an area equal to the size and the form of fingers tips and when pressing them we could get best result for patient. The ideal period to use: "Shiatsu" for each point is 2-3 minutes, noting that the closed points to injured part requires more care and pressure than far ones with moving from one point to another after disappearing pain and sense of anesthesia (numbness) from the affected part.

The pressure points of (CTS) are specified on the neural pathways (with) (3 points of upper arm, 5 points in palm of hand, 4 points in the wrist, 3 points in forearm laterally) [10-13].

Hence and as result of this injury, it is necessary for patient to restore functional recovery and realize the concept of neuroplasticity depending on neural repairing does not occur automatically for a person and thus therapeutic exercises, like muscles as principle, should lead to improve the efficiency of median nerve [14,15]. The rehabilitation exercise (R. Ex) causes physiological and functional changes for nervous and muscular systems, where it helps to remove edema, debris, infiltration, an increases of blood circulation, regeneration of cells and damaged tissues, to improve the inhibition and stimulation process of nerves and muscles, to increase the efficiency of central nervous system, to make movement and responds more accurate, to increase attention and positive impact on neural conduction to increase the ability to distinguish different stimuli and ability of nerves to conduct motor signals. Hence, the therapeutic exercises should be practiced to support the neuro-muscular system health and to avoid weakness or inability to move taking in consideration the instruction of German sport therapists association which emphasizes on therapeutic exercises to nerves as therapeutic movements designed in specified dose lead to removal of injured part dysfunction [16-18].

Research Objective: This research aims to identify the impact of (R. Ex) and pressure massage technique (Shiatsu) on the nerves and working muscles in Carpal Tunnel Syndrome (CTS) through conduction proportion (rate) of neural fibers of median nerve, grip strength range

of motion (flexion- extension- adduction- abduction) of wrist joint and degree of pain sensation

Research Sample: Research sample consisted of one group included ten women (mean age = 28.9 years) of (CTS) resulting from practicing different sports, don't have any congenital abnormalities or organic diseases or taking any medication.

Research Procedures: The researcher applied experimental method by using (pre-intra-post) design of one experimental group. The study was conducted in physiotherapy centre of Suez Canal University in the period from 1/6/2010 to 30/7/2010 equal to two months (8 weeks), where (3 sessions per week) and day by day alternately. Total sessions were (24) ones and each session period of (25-45min.) Load of (R. Ex) (amount-intensity) was standardized according to individual state of patients, also applying the (R.Ex) program and pressure massage technique (Shiatsu) was executed individually, where points of pressure are specified as (3 points in the palm, 4 points in the wrist, 3 points in forearm from outside). The pressure is begun on specified points on forearm (outside), then move from a point to another alternately until ending and completion of the palm, where pressure of period on these specific points of (2- 3 min.) according to the response of patient and relief of pain sensation gradually, the proportion of improvement in the degree of median nerve conduction of the wrist is measured by using electromyography device, grip strength by dynamometer, flexibility "range of motion" of wrist (flexion-extension-adduction-abduction) movements by geoniometer and pain sensation degree by usual analyze scale before and after application of (R.Ex) program associated with (Shiatsu) massage. Height and weight were also measured and some assisted means used to perform the program (treadmill, stationary bicycle, resisting rubber, weights). Statistical coefficients were: mean (x), median (MD), standard deviation (S.D) skewness, analysis of variance (ANOVA), F-ratio test, "t" test and LSD test [19-23].

RESULTS

Data presented in Table 1 showed that skewness values ranged between (-0.7 to -0.132) to age, height and weight and between (-0.51 to -0.88) to nerve conduction variables and between (-0.40 to 0.05) to range of motion to wrist variables. It means that all values ranged

Table 1: Sample description of basic variables of research (Normal distribution data)

Variable	Unit	Arith mean (x)	Median (Md)	S.D.	Skewness
A-Growth Rate					
Age	year	28.90	28.50	3.28	-1.32
Height	cm.	170.10	170.00	3.44	-0.97
Weight	Kg	75.40	75.00	5.33	-0.70
B- Nerve conduction variables					
Nerve conduction	m/s	4.05	4.00	0.09	-0.51
Muscular strength	Kg	18.60	19.00	1.07	-0.88
C- Range of Motion of wrist variables					
Flexion	deg.	128.90	130.00	5.54	1.40
Extension	deg.	80.20	80.00	1.47	1.58
Adduction	deg.	40.50	40.60	1.77	-1.34
Adduction	deg.	25.90	26.00	1.19	0.04
Pain sensation	deg.	8.56	8.55	0.17	0.05

Table 2: ANOVA of (pre-intra-post) measurements of research variables

Variables	SOV	d.f	SS	MS	F
Nerve conduction m/s	Among	2	0.421	0.21	19.057*
	Within	27	0.298	0.11	
	Total	29	0.719	--	
Muscular strength (Kg)	Among	2	28.80	44.40	21.255*
	Within	27	56.40	2.086	
	Total	29	145.2	--	
Flexion (deg.)	Among	2	2739.467	1369.733	32.229*
	Within	27	1147.50	42.500	
	Total	29	3886.967	--	
Extension (deg.)	Among	2	110.867	55.433	35.134*
	Within	27	42.60	1.578	
	Total	29	153.467	--	
Adduction (deg.)	Among	2	72.20	36.100	18.391*
	Within	27	53.00	1.903	
	Total	29	125.20	--	
Abduction (deg.)	Among	2	156.80	78.400	46.523*
	Within	27	45.50	1.685	
	Total	29	202.30	--	
Pain sensation (deg.)	Among	2	195.685	97.842	195.54*
	Within	27	15.049	0.55	
	Total	29	210.734	--	

between (± 3) and subsequently homogeneity of sample. Data in Table 2 indicated that there are significant differences among three measurements of research variables; hence (LSD) should be computed. Data also in Table 3 showed that there are significant differences among means of three measurements of research variables and for post measurement to all variables.

DISCUSSION

Results showed that there are significant differences among the three measurements (pre-intra-post) of

research variables, where computed value of (F) to degree of freedom of (2, 27) and significant level to (0.5) = 3.35, which confirms that there are significant differences among measurements to all research variables (Table 2). Also, results show that there are significant differences among the three measurement (pre- intra- post) to all variables were for post measurements, where differences of nerve conduction between pre and post measurements was of (0.29) for post measurement. The differences of muscular strength between pre and post measurements was of (4.20) for post measurement. The improvement of range of motion to wrist joint was for post measurement,

Table 3: LSD of research measurement includes (pre-intra- post)

Variables	Measurements	Means (M)	Mean differences (MD)		LSD
Nerve conduction m/s	Pre	4.05	0.14 † *	0.29 † *	0.05
	Intra	3.91	--	0.15 † *	
	Post	3.76	--	--	
Muscular strength (Kg)	Pre	18.60	1.80 † *	4.20 † *	0.76
	Intra	20.40	--	2.40 † *	
	Post	22.80	--	--	
Flexion (deg.)	Pre	128.90	12.20 † *	23.40 † *	3.45
	Intra	116.70	--	11.20 † *	
	Post	105.50	--	--	
Extension(deg.)	Pre	80.20	2.10 † *	4.70 † *	0.66
	Intra	82.30	--	2.60 † *	
	Post	84.90	--	--	
Adduction(deg.)	Pre	40.50	1.80 † *	3.80 † *	0.74
	Intra	42.30	--	2.0 † *	
	Post	44.30	--	--	
Abduction(deg.)	Pre	25.90	2.70 † *	5.60 † *	0.68
	Intra	28.60	--	2.90 † *	
	Post	31.50	--	--	
Pain sensation(deg)	Pre	8.56	3.64 † *	6.37 † *	0.39
	Intra	4.92	--	2.73 † *	
	Post	2.19	--	--	

where for flexion movements was of (18.5%), for extension was of (5.86%), for adduction was of (9.13%), for abduction was of (21.62%) and all of these variables were for post measurement. Pain sensation was decreased of (74.41%) for post measurement after execution of (R. Ex) program and massage technique (shiatsu) (Table 3). The researchers refers to this improvement to pressure massage (Shiatsu) which is distinct from other methods of massage and which use devices, because of the increase of effective interaction between masseur and patient, where pressure massage is directed entirely to specified neural points of injured part leading to the speed of neural response as a result of reaction to this specified (located) pressure.

The increase in the improvement percentage of median nerve conduction degree, the researchers attribute that to pressure massage, which leads to increase concentrations of potassium, sodium and calcium in blood that improves the efficiency of central and peripheral nerves and speed of neural signals conduction leading to quick recovery and return to normal state. In terms of the increase of muscular strength of grip, range of motion to wrist and disappearance of pain sensation, it might attributed to that the pressure massage that leads to neural arousal due to the increase of neural salts concentration and decrease concentration level of creatine, cortisol and lactate dehydrogenase (LDH) which improves neural signals, leading to increase the activation

of muscle fibers, ligaments and tendons blood flow, nutrition of tissues and nerve and muscle fibers that occur to increase of sensation of theses fibers which lead to activation ability of muscles (strength of grip) excessive range of motion to wrist joint movements (flexion, extension, adduction, abduction) and subsequently, the increase of functional efficiency of hand and disappearance of pain sensation.

The pressure massage mechanism is due to its effect on nerve points of forearm, wrist and hand leads to reduce the transfer neural signals and the loss of pain sensation gradually and increase the concentration of salts, as well as, the increase of neural enzyme (acetylcholine) of muscular contraction, then the acetylcholine changes to active state, where it is changed to acetic acid and choline leading to increase of ion exchange of sodium and potassium salts in the muscle, where the electrical activity rises. Thus the muscular contraction is increased associated with the increase of adrenaline hormone in blood. Also, the blood flow to cells and wrist ligaments and muscular strength of grip and functional efficiency are improved, added to the patient could be able to move injured joint without pain sensation [24-28]. The use of the therapeutic (R.Ex) and pressure massage method are considered one of the best mean of safe physiotherapy that leads to relieve pain, to increase range of motion "flexibility" of joint, muscular strength and functional efficiency, as well as to avoid joint injury.

Also, (R.Ex) program is used for treatment of nerve, bones and joints because of its mechanical and biological impact on all organs of the body, where it removes dysfunction, edema and infiltration, as well as the increase of improvement degree of efficiency to injured joint. Moreover, (R.Ex) improves the of neuromuscular coordination and decreases period of recovery, noting that these exercises should be applied continuously, especially for joints according to the rule referred to the American foundation of pain, if you have not used it, you lose it.

The amount and intensity of exercises should be standardized according to the individual adaptation of patient within the limits of pain sensation taking in consideration angles of muscular work to injured part (R.Ex) program should include strength and flexibility exercises that support the neural activity which develop muscular strength and increases muscular mass, strengthens the connective tissues, ligaments and tendons, as well as, the increase of arterial blood pressure and efficiency of capillaries. Moreover, (R.Ex) program increases muscle fibers and mitochondria of muscles working on joints leading to the increase of energy production to muscles and delay the fatigue occurrence. The use of different angles of muscular work helps to balanced and integrated action to muscle fibers of wrist hand joint and causes changes in protein of muscles and increases the hemoglobin of muscles leading to increase the efficiency of muscles and removes neural inflammation. Hence, the use of (R.Ex) program with (Shiatsu) lead to relief from (CTS), improve nerve conduction, promote functional efficiency of joint and increase muscular strength of grip and its range of motion [29-33].

CONCLUSION

In the light of the research aims, results, sample properties, in addition to statistical analysis and the exercise program (R.Ex. and Shiatsu) and after result explanation the researchers found that:

- Improved median nerve conduction in the hand.
- Improved hand grip.
- Improved wrist joint range of motion.
- Improved pain sensation degree in the hand.
- Mixing Rehabilitative exercises and Shiatsu have an effective and rapid impact in the return of the normal function of the hand in the form of increased grip strength and the wrist joint range of motion.

Recommendations: The researchers recommended:

- The use of mixing rehabilitative exercises and Shiatsu in rehabilitation of Carpal Tunnel Syndrome patients.
- Perform the program continually to keep muscle power of the hand and range of motion and improved pain sensation.
- Perform the rehabilitative exercises even after the program ending.
- Taking care of the wrist joint injuries.
- Performing further studies in sport and injuries rehabilitation specially in the field of nerve diseases and its entrapment.

REFERENCES

1. Werner, B. and A. Robert, 2006. Evaluation of work-related Carpal Tunnel Syndrome. *Journal of Occupational Rehabilitation*, 16(2): 207-22.
2. Keir, P.J., J.M. Bach and D. Rempel, 2009. Effects of computer mouse design and task on carpal tunnel pressure. *Ergonomics*, 42(10): 1350-1360.
3. De Vera Barredo, R.M., 2007. The effects of exercise and rest breaks on musculoskeletal discomfort during computer tasks: an evidence-based perspective. *J. Phys. Ther. Sci.*, 19: 151-163.
4. Atroshi, I., C. Gummesson, R. Johnsson, E. Ornstein, J. Ranstam and N. Ros, 2009. Prevalence of Carpal Tunnel Syndrome in a general population. *JAMA.*, 282(2): 153-158.
5. Lazaro, R., 2005. Neuropathic symptoms and musculoskeletal pain in Carpal Tunnel Syndrome: Prognostic and therapeutic implications. *Surgical Neurology*, 47(2): 115-7, Discussion, 117-9.
6. Lozano-Calderón, S., S. Anthony and D. Ring, 2008. The quality and strength of evidence for etiology: example of Carpal Tunnel Syndrome. *The Journal of Hand Surgery*, 33(4): 525-38.
7. Gelberman, R.H., P.T. Hergenroeder, A.R. Hargens, G.N. Lundborg and W.H. Akeson, 2007. The Carpal Tunnel Syndrome. A study of carpal canal pressures. *The Journal of Bone and Joint Surgery*, 63(3): 380-383.
8. Tiong, W.H.C., T. Ismael and P.J. Regan, 2005. Two rare causes of Carpal Tunnel Syndrome. *Irish J. Med. Sci.*, 174(3): 70-8.
9. Muller, M., D. Tsui, R. Schnurr, L. Viddulph-Deisroth and J. Hard, 2004. Effectiveness of hand therapy interventions in primary management of Carpal Tunnel Syndrome: A systematic review. *J. Hand Ther.*, 17: 210-228.

10. Browne, S., 2006. Shiatsu and Carpal Tunnel Syndrome problems. *Journal of American Board of Family Practitioners*, 11: 193-199, USA.
11. Namikoshi, T., 2010. *Pressure Therapy, Shiatsu*, Japan Publications, 10th Ed.
12. Sasaki, P., 2006. *Shiatsu for Carpal Tunnel Syndrome, an Overview*, Tokyo, Japan, Publ.
13. Muller, M., D. Tsui, R. Schurr, L. Biddulph-Deisroth, J. Hard and J.C. MacDermid, 2004. Effectiveness of hand therapy interventions in primary management of Carpal Tunnel Syndrome: a systematic review. *Journal of Hand Therapy*, 17(2): 210-28.
14. Akuthota, V. and S. Herring, 2009. *Nerve and vascular injuries in sport medicine*. Springer.
15. Scangas, G., S. Lozano-Calderón and D. Ring, 2008. Disparity between popular (Internet) and scientific illness concepts of Carpal Tunnel Syndrome causation. *The Journal of Hand Surgery*, 33(7): 1076-80.
16. Huisstede, B.M., P. Hoogvliet, M.S. Randsdorp, S. Flerum, M. van Middelkoop and B.W. Koes, 2010. Carpal Tunnel Syndrome. part I: effectiveness of nonsurgical treatments-a systematic review. *Arch. Phys. Med. Rehabil.*, 91: 981-1004.
17. Cooper, C., M.V. Radomski and C.A. Trombly Latham, 2008. *Occupational therapy for physical dysfunction for Carpal Tunnel Syndrome*. 6th Ed. Philadelphia: Lippincott Williams and Wilkins.
18. Nigel L Ashworth, M.B., FRCPC, Professor and Chief, 2008. Division of physical exercise and rehabilitation, Glenrose Rehabilitation Hospital, University of Alberta contributor information and disclosures updated.
19. Eiaco, C., 2009. *Shiatsu massage*. Translated by Samia, A., Aml, W., Hala for Publication and Distribution, Giza, Egypt.
20. Londa, H., H. Kathryn and R. James, 2004. *How to use Shiatsu for Carpal Tunnel Syndrome*, Drake University, 158 :2304-2310, USA.
21. Marcus, B., 2009. Effects of Shiatsu in patients with Carpal Tunnel Syndrome: A randomized controlled trial. *The Journal of Pain*, 10: 601-608.
22. Ohasni, W., 2009. *Do it yourself Shiatsu*, New York.
23. Jennifer, I., D. Celina and Y. Surzanne, 2005. *The effect of Shiatsu on patients for Carpal Tunnel Syndrome*, Bristol. B., 52-LEG, UK.
24. Andrewf, L. and C. Hammah, 2003. The effect of Shiatusu: Findings from two-country exploratory, *Journal of alternative and complementary medicine*, 9: 539-547.
25. Michael, E., C. Stephane, G. Leonardo, W. Pamela and H. Fred, 2006. *Text book of neural repair and rehabilitation*. Cambridge University Press.
26. Nathan, P.A., A. Wilcox, P.S. Emerick, K.D. Meadows and M.C. Cormack, 2010. Effects of Shiatsu on median nerve conduction and symptoms associated with Carpal Tunnel Syndrome. *Portland Hand Surgery and Rehabilitation center*, Portland, OR, USA.
27. Van, M.J., F.H. Brakkee, P. Heders and W. Gispen, 2009. Shiatsu improve functional recovery and motor nerve conduction velocity after Sciatic nerve crush lesion in the rats. *Physical Medicine and Rehabilitation*, 78: 1.
28. Pinar, L., A. Enhos, S. Ada and N. Gungor, 2005. Can we use nerve gliding exercises in women with Carpal Tunnel Syndrome? *Gazi University Faculty of Medicine, Department of Physiology, Besvler-Ankara, Turkey*.
29. Riston, F., 2007. *Physical Exercises for Carpal Tunnel Syndrome Rehabilitation, Physical*, pp: 18-21.
30. Robert, C., 2011. *Carpal Tunnel Syndrome Byrd Health Sciences Center Department of Occupational Therapy*.
31. Scott, Kevin, R. and J. Kothari Milind, 2009. *Treatment of Carpal Tunnel Syndrome Faculty of Medicine, Chulalongkorn University, Bangkok, 10330, Thailand*.
32. Hui, A.C.F., S.M. Wong, A. Tang, V. Mok, L.K. Hung and K.S. Wong, 2004. Long-term outcome of Carpal Tunnel Syndrome after conservative treatment. *Intl. J. Clin. Practice*, 58(4): 337-9.
33. Trombly Latham, C.A., 2008. *Occupation as therapy: selection, gradation, analysis and adaptation*. In: Radomski, M.V., C.A. Trombly Latham, 6th Ed. Philadelphia: Lippincott Williams and Wilkins.