

## Evaluation of the Efficacy of Ultrasound Therapy in the Treatment of Patients with Carpal Tunnel Syndrome

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### Abstract

**Conflict of Interest:** None

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*This randomized controlled trial was conducted in Department of Physical Medicine and Rehabilitation of Bangabandhu Sheikh Mujib Medical University, Dhaka during the period from March 2014 to August 2014 to evaluate the effect of ultrasound therapy (UST) on patients of carpal tunnel syndrome. Total 110 subjects were participated in this study and they were selected randomly divided in two groups by lottery. Group-A was treated with UST, Exercise, Wrist splint, non steroidal anti inflammatory drugs (NSAIDs) and group-B received Exercise, Wrist splint and NSAIDs. Treatment continued for a period of 6 weeks. Group-A were compared to group B by both Visual Analog Scale (VAS) and Levine Symptom severity scale(LSSS) after 3 weeks and 6weeks of treatment.*

*The result showed mean VAS at pretreatment (W0) in group-A was 6.42 ±1.23 and in group-B was 6.17±0.74. Group-A was 1.82±0.43 and in group-B was 3.1±0.23 in their follow up after 3 weeks (W3) In Group-A was 1.71(±0.52) and in group-B was 2.52(±0.49) at 2nd follow up (W6) after 6 weeks. Mean LSSSat pretreatment (W0), 1st follow up after 3 weeks (W3), 2nd follow up (W6) after 6 weeks in group-A was 31.64±1.55, 14.32 ± 2.29 and 14.31 ±1.12 respectively, and in group-B was 31.3±0.74, 18.51±0.92 and 18.31 ± 0.42 respectively. This study revealed that continuous mode of US therapy with exercise, wrist splint, NSAIDs have better outcome in case of Carpal tunnel syndrome patients.*

### Key Words:

Carpal tunnel syndrome, Visual analogue scale, Levine Symptom severity scale

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### Introduction

Carpal tunnel syndrome (CTS) is one of the most frequent entrapment neuropathies of the upper limb in medical practice. CTS is a condition where one of two main nerves in the wrist is compressed, which can lead to pain in the hand, wrist and sometimes forearm and numbness and tingling in the thumb, index or other fingers. In advanced cases some of the muscles of the hand can become weak.<sup>1</sup> The carpal tunnel is an anatomic passageway bounded dorsally and laterally by the hemicircular carpal bones and on the palmer surface by the transverse carpal ligament. CTS is due to compression of the median nerve as it passes from the forearm to the palm, beneath the transverse carpal ligament.<sup>2</sup> The prevalence of CTS in the general population is approximately 0.6-2.1% for men and 3.0-5.8% for women.<sup>3</sup> The rate increases with increasing age and years of employment and it affects women more than men. UST is the most widely used treatment modality in physical medicine in management of CTS. Other treatment modalities of CTS are NSAIDs, exercises, local steroid injection, Immobilization by splint, decompression of the median nerve by release of the transverse carpal ligament. Ultrasound is a physical therapy agent commonly used to increase temperature in deep tissue. The biologic effects

of ultrasound include changes in blood flow rates, tissue metabolism, the extensibility of connective tissue and the permeability of biologic membranes.<sup>4</sup> On nervous tissue it selectively heats peripheral nerves, may alter or block impulse conduction and may increase membrane permeability and tissue metabolism. The thermal effect of ultrasound may cause pain relief.<sup>5,6,7</sup> Ultrasound at therapeutic intensities ranging from 0.1 to 2.5 w/cm<sup>2</sup> (continuous) is used for its effects on soft tissue healing.<sup>8,9</sup>

VAS is a measurement instrument for subjective characteristics or attitudes that cannot be directly measured. VAS is usually a horizontal line, 100 mm in length, which is scored from 0 to 10. Zero means no pain at all and 10 means extreme pain as it is not tolerable by the patient. The Levine symptom severity is developed by considering six clinical areas such as ; pain, paresthesia, numbness, weakness, nocturnal symptoms and over all functional status. The scale consists of eleven questions with multiple choice responses, scored from 0 point (None or never) to 4 points (Very severe). The overall symptom severity score is calculated as the mean of the score for the eleven individual items.

CTS is one of the common problems encountered in industrialized populations. The risk of disability is so great that it is not only a costly burden to society but also loss of productivity. Among the treatment option in CTS ultrasound therapy is safe, simple and cheaper. The effect of ultrasound therapy in case of carpal tunnel syndrome has not been evaluated in Bangladeshi population. So, this systemic study evaluated the effect of ultrasound therapy for the CTS for relieving symptoms. The result may have implications for selecting appropriate treatment modalities and management plan for patients suffering from complications of carpal tunnel syndrome in Bangladesh.

## Methods

This randomized controlled trial was carried out from March 2014 to August 2014 in the department of Physical Medicine and Rehabilitation of Bangabandhu Sheikh Mujib Medical University, Dhaka. Total 110 present subjects were selected immediately after the examination; the patients were randomized by drawing lottery from outdoor referral patient irrespective of sexes in between 20 to 60 years of age and BMI < 25 kg/m<sup>2</sup> having CTS. Study subjects who fulfilled these following criteria were selected for this study i) Pain at palmar aspect of wrist more than 3 months ii) Tingling and numbness of lateral 3<sup>1/2</sup> fingers. After proper history taking, clinical examination and necessary investigations was done. Informed written consent has taken from all the patient. In this study, all participants were divided into 2 groups – group A (n=55) and group B (n= 55). Group-A participants were treated with Ultrasound therapy +

Exercise + Wrist splint+ NSAIDs and group-B participants were treated with Exercise, Wrist splint, NSAIDs. All medication was checked strictly and intervention was done aseptically. Data were collected by using a structured questionnaire. The participants were assessed at pretreatment, at 1st follow up after 3 weeks and 2nd follow up after 6 weeks. They are assessed by using Visual Analog Scale (VAS) and Levine Symptom severity scale (LSSS). Statistical analysis of the finding was done with the help of statistical package for social science version (SPSS) 19. The student t test used to analyze the level of significance, p < 0.05.

This study protocol was approved by two institutional review committee of Bangabandhu Sheikh Mujib Medical University and College of Physicians and surgeons Bangladesh. Data were analyzed by SPSS 19.0 version. The results were analyzed statistically and values were expressed as mean ± SD. The level of significance was determined by employing Student's unpaired t test. Only when the p value was less than 0.05; the differences between two groups were considered as statistically significant.

## Results

Table-I represents age distribution of the patient where maximum patient from age group 41-50 years. Table-II represents sex distribution of the patients where 49 male and 69 female. Table-III represents localization of pain which reveals 28 had localized pain and 82 patients had radiating pain. Table-IV shows severity of the pain. In which 49 were suffering from mild to moderate pain and 21 patients had severe pain. Table-V represents pre and post treatment VAS scale scoring. VAS scoring at pretreatment (W0) in group-A was 6.42 ± 1.23 and in group-B was 6.17 ± 0.74 p value was (p > 0.05) that was not statistically significant. Mean VAS in group-A after 3 weeks (W3) was 1.82 ± 0.43 and in group-B was 3.1 ± 0.23. p value was < 0.05 that was statistically significant. After 6 weeks was 1.71 (± 0.52) and in group-B was 2.52 (± 0.49). p value was (p < 0.05) that was statistically significant. Result shows group-A is significantly better than group-B in first follow up and 2nd follow up. Mean Levine Symptom Severity Scale (LSSS) at pretreatment (W0) in group-A was 31.64 ± 1.55 and in group-B was 31.3 ± 0.74, p > 0.05 that was not statistically significant. Mean LSSS in group-A after 3 weeks (W3) was 14.32 ± 2.29 and in group-B was 18.51 ± 0.92. p < 0.001 that was highly significant. Mean Levine Symptom severity scale (LSSS) in group-A at 2nd after 6 weeks (W6) was 14.31 ± 1.12 and in group-B was 18.31 ± 0.42. p < 0.001 that was highly statistically significant. That means group-A is significantly better than group-B in 1st follow up and 2nd follow up.

**Table-I**

<i>Age group distribution of the study population (N=110)</i>			
Age in years	Study group		Total
	Group-A (n %)	Group-B (n %)	
20-30 years	06(10.9)	05(9.1)	11
31-40 years	20(36.4)	10(18.2)	30
41-50 years	27(49.1)	32(58.2)	59
51-60 years	02(3.6)	08(14.5)	10
Total	55(100)	55(100)	110
Mean SD	49.87(±6.4)	51.72(±6.3)	

Table I shows age distribution of the study subjects

**Table II**

<i>Sex distribution of the study population</i>			
Sex	Study group		Total
	Group –A (n %)	Group-B (n %)	
Male	25(45.5)	24(43.6)	49
Female	30(54.5)	31(56.4)	61

Table 2 shows sex distribution of the study subjects

**Table III**

<i>Site of Pain</i>			
Site of Pain	Study group		Total
	Group –A (n %)	Group-B (n %)	
Localized	11(20)	17(31)	28
Radiating	44(80)	38(69)	82
Total	55(100)	55(100)	110

Table III shows site of pain distribution of the study subjects

**Table IV**

<i>Severity of Pain</i>			
Severity of Pain	Study group		Total
	Group –A (n %)	Group-B (n %)	
Mild to Moderate	44(80.0)	33(60.0)	49
Severe	11(20.0)	22(40.0)	21
Total	55(100)	55(100)	70

Table 4 shows severity of pain of the study subjects

**Table V**

<i>Mean Visual Analogue scale (VAS) at Pretreatment and after 3 wks and 6 wks follow up (n=110)</i>					
Visual Analogue scale (VAS)	Study group		95% CI		p value
	Group A Mean ±SD	Group B Mean (±SD)	Lower	Upper	
Pretreatment (W0)	6.42(±1.23)	6.17(±0.74)	-0.21	0.81	0.25
At 1st follow up (W3)	1.82(±0.43)	3.1(±0.23)	-1.34	-1.05	<0.001
At 2 <sup>nd</sup> follow up (W6)	1.71(±0.52)	2.52(±0.49)	-1.05	-0.54	<0.001

**Table VI**

<i>Mean Levine Symptom severity scale (LSSS) at Pretreatment and after 3wks and 6wks follow up (n=110)</i>					
Levine Symptom severity scale (LSSS)	Study group		95% CI		p value
	Group A Mean (±SD)	Group B Mean (±SD)	Lower	Upper	
Pretreatment (W0)	31.64± 1.55	31.3±0.74	-0.06	1.26	0.07
At 1st follow up (W3)	14.32± 2.29	18.51± 0.92	0.44	-5.18	<0.001
At 2 <sup>nd</sup> follow up (W6)	14.31± 1.12	18.31± 0.42	-4.30	0.20	<0.001

**Discussion**

In this study, US therapy, Exercise, Wrist splint and NSAIDs tends to be more effective than Exercise, Wrist splint and NSAIDs in treating CTS patients. Patients who

underwent US therapy and a wrist splint not only experienced improvements in their functional status scores compared to those receiving NSAIDs and a wrist splint but also showed statistically significant improvements in their

symptom severity scores and palmer pinch power. Different modes, frequencies and intensities have been used in US therapy for CTS patients.<sup>10,11,12,13</sup> Generally, in US therapy, continuous mode is chosen when the thermal effect is desired, while pulsed mode is applied when the nonthermal effect is preferred.<sup>14</sup> Dincer et al, in 2009 stated that continuous mode of UST in CTS showed improvement.<sup>15</sup> On the contrary, pulsed mode US therapy effectively enhanced peripheral nerve regeneration in an animal study, possibly through the mechanisms of local blood vessel dilatation, nerve sprouting stimulation, Schwann cell activation and chemotactic stimulator release. This study utilized pulsed mode US therapy on CTS patients and observed improvements in subjective symptoms and palmer pinch power, similar to previous studies. Levine et al; in 1993 used pulse mode of UST on CTS and showed improvement of functional status of patients in CTS.<sup>16</sup> Chang et al; in 2014, Viera et al; in 2001, Piazzini et al; in 2007 reported similar rate of improvement in CTS by using UST.<sup>17,18,19</sup> Ganvir et al; in 2009 used UST and laser therapy in CTS and stated that UST is more effective than laser on CTS.<sup>20</sup>

### Conclusion

To improve the functional status of CTS patients, a combination of Ultrasound therapy, Exercise, Wrist splint, NSAIDs may be more effective than a combination of Exercise, Wrist splint, NSAIDs. Since this was a trial, further confirmatory testing is suggested to justify the efficacy of these two treatments.

**Conflict of interest:** Nothing to declare.

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