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Effect of Extracorporeal Shock Wave Therapy in Patients with Lymphedema-associated Breast Cancer

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Background

Complex decongestive therapy (CDT) is a proven lymphedema management method, but the effectiveness of the treatment may depend on the therapist's capabilities and the patient's education and compliance. Previous studies showed that extracorporeal shock wave therapy (ESWT) had been found effective in stimulating several endogenous growth factors. Furthermore, it was shown that ESWT regulates the activation of pro-fibrotic and anti-fibrotic proteins that are involved in fibrosis and finally improves lymphedema, upper-extremity functions and quality of life. The purpose of the present study is to show difference between the effect of CDT combined with ESWT and that of CDT alone in breast cancer-related lymphedema (BCRL) patients.

Methods

The present study enrolled stage 2 lymphedema patients who had hardness at their forearms and had circumference difference more than 2 centimeters between both arms, even though they had implemented phase 2 CDT (maintenance phase) by themselves. Subjects were randomly divided into two groups, ESWT group (EG) and conventional group (CG). In EG, ESWT was performed for three weeks (two sessions per week). In each session, a practitioner applied 1000 shocks to the most fibrotic lesion of the forearm and 1500 shocks to the cubital lymph nodes, the arm, the forearm, and the hand at an energy level of 0.056 to 0.068 mJ/mm2. During 3 weeks, phase 2 CDT including bandage and massage was maintained every night at home in both CG and EG. Before and after the three sessions, visual analogue scale, circumference and volume of the upper extremity were measured, and a shoulder and hand questionnaire (QuickDASH) was investigated to examine the functional status of both CG and EG patients' upper extremity. Body composition analyzer (InBody®, Seoul, Korea) was used to measure muscle mass and rate of water content in upper extremity as well as composition of total body water. In addition, skin thickness was measured at 10 centimeters below medial epicondyle. A skin fold caliper was used and measured values were compared with the unaffected side.

Results

Both groups had nine patients who completed 3 weeks therapy. No difference was identified in any of the demographics between the groups (Table 1). Statistically significant improvements were found in the below-elbow circumference, upper extremity volume,

rate of total body water, and skin thickness in EG (Table 2). A significant difference was found in the improvement of the upper extremity volume and skin thickness between CG and EG, but not in the other measurements (Table 3). No complications were found in either group during this study.

Conclusion

ESWT reduced edema and resulted in functional improvement of the upper extremity without a specific complication in BCRL patients. Therefore, ESWT may be used as an additional treatment with CDT. Future studies with a larger number of participants should be necessary.

Table 1. Baseline characteristics of both groups

	EG (n=9)	CG (n=9)	P-value
Age (years)	53.13±10.85	52.24±8.60	0.596
Days from breast cancer related surgery (month)	30.43±16.09	28.30±11.17	0.922
Duration of lymphedema (month)	12.83±8.21	14.40±10.63	0.142
Lymphedema stage 2	9	9	-
Received chemotherapy	7	8	-
Received radiotherapy	5	7	-
VAS	0.64±1.57	0.52±1.35	0.693
Initial circumference (cm)			
above elbow	28.17±3.01	26.813±4.28	0.492
elbow	25.94±2.08	24.44±2.37	0.401
below elbow	26.28±3.02	25.80±2.78	0.556
wrist	16.21±0.90	16.70±1.63	0.761
hand	18±0.57	17.90±1.28	0.492
Initial volume (ml)	840.42±181.33	822.00±144.68	0.726
Initial inbody			
muscle mass in upper Ex.	2.03±0.45	2.03±0.00	0.626
rate of water content in upper Ex.	0.39±0.00	0.38±0.00	0.078
rate of total body water content	1.58±0.35	1.61±0.37	0.845
Quick DASH score	4.75±5.72	2.52±3.77	0.426
Skin thickness	31.14±2.91	30.15±7.40	0.51

Values are presented as mean±standard deviation.

VAS, visual analogue scale; EG,extracorporeal shock wave therapy group; CG,complex decongestive therapy group; Ex., extremity.

Table2. Change of measurements between both groups after 3 weeks therapy

	EG (n=9)			CG (n=9)		
	Pre	Post	P-value	Pre	Post	P-value
VAS	0.64±1.57	0.43±0.78	0.180	0.52±1.35	0.40±0.84	0.655
Circumference(cm)						
above elbow	28.17±3.01	27.14±4.46	0.066	26.81±4.28	25.55±2.65	0.564
elbow	25.94±2.08	25.63±3.14	0.102	24.44±2.37	24.04±2.07	0.026
below elbow	26.28±3.02	25.50±3.12	**0.026***	25.80±2.78	25.40±2.19	0.286
wrist	16.21±0.90	16.00±0.76	0.083	16.70±1.63	16.55±1.53	0.593
hand	18±0.57	17.43±0.97	0.102	17.90±1.28	17.75±1.78	0.450
Volume (ml)	840.42± 81.33	802.8±149.7	**0.017***	822.00±144.68	810.0±156.9	0.496
InBody®						
muscle mass in upper Ex.	2.03±0.45	1.98±0.43	0.173	2.03±0.50	2.06±0.51	0.167
rate of watercontent in upper Ex.	0.39±0.00	0.39±0.00	0.355	0.38±0.00	0.38±0.00	0.355
rate of total body water content	1.58±0.35	1.53±0.36	**0.018***	1.61±0.37	1.69±0.45	0.167
Quick DASH score	4.75±5.72	3.89±4.41	0.317	2.52±3.77	2.52±3.77	1.000
Skin thickness	31.14±2.91	29.85±3.09	**0.026***	30.15±7.40	29.54±6.98	0.089

Values are presented as mean±standard deviation.

VAS, visual analogue scale; EG, extracorporeal shock wave therapy group; CG, complex decongestive therapy group; Ex., extremity.

*p<0.05 by Wilcoxon signed rank test.

Table3. Comparison of changes between both groups

	EG (n=9)	CG (n=9)	P-value
Δ VAS	0.21±0.78	0.12±1.47	0.294
Circumference(cm)			
Δ above elbow	1.02±1.07	1.26±0.28	0.255
Δ elbow	0.31±0.47	0.40±0.55	0.463
Δ below elbow	0.78±0.63	0.40±1.02	0.273
Δ wrist	0.21±0.26	0.15±0.74	0.328
Δ hand	0.57±0.78	0.15±0.58	0.322
Δ Volume (ml)	37.62±67.92	12.00±57.88	0.013*
InBody®			
Δmuscle mass in upper Ex.	0.04±0.06	0.03±0.15	0.057
Δrate of water content in upper Ex.	0.00±0.00	0.00±0.00	0.199
Δrate of total body water content	0.05±0.03	0.08±0.19	0.071
Δ Quick DASH score	0.85±2.26	0.00±0.00	0.669
Skin thickness	1.28±1.21	0.61±1.45	0.048*

Values are presented as mean±standard deviation.

VAS, visual analogue scale; EG, extracorporeal shock wave therapy group; CG, complex decongestive therapy group; Ex., extremity.

*$p<0.05$ by Mann-Whitney U-test.