Stoßwellentherapie bei Lymphödem

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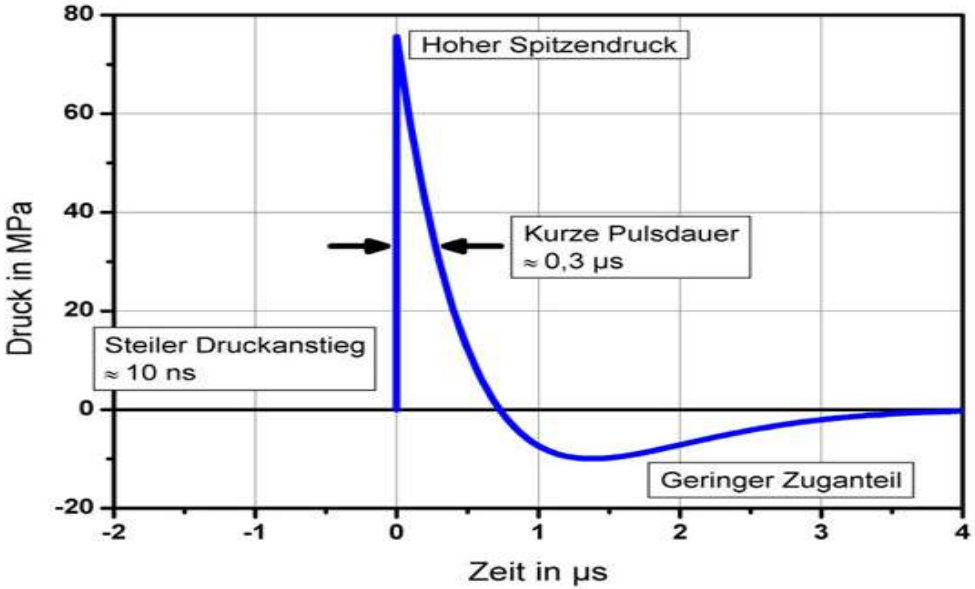
[3] Klinikum am Kurpark, Baden

MEDIZINISCHE UNIVERSITÄT WIEN

Stoßwelle - Physik



Quelle: www.digest-ev.de

Quelle: Wikipedia

Wirkprinzipien

TABLE I Overview of Effects and Functional Proteins After ESWT*

	Upregulation Factors	Downregulation Factors
Chondroprotective effect[2,14,16,29-40]	BMP-2, 3, 4, 7; IGF-1; TGFβ-1; VEGF; Wnt3; RUNX2; osteocalcin; alkaline phosphatase; osteopontin; FAK; ERK1/2; c-Fos; c-Jun; p38 MAPK; P2X7 receptor; SOX9; PDGF; b-FGF; FGF-2; Ras; substance P; prostaglandin E(2); Hsp70	DKK1, Wnt5a, calcitonin gene-related peptide, miR-138
Neovascularization[25,43-45]	VEGF, Flt1, Flt2, CD31, vWF, FGF, PIGF, KDR, PCNA	
Anti-inflammation[12,13,22,25,46]	TGFβ-1, TLR3, eNOS, nNOS, IL-10, IL-6, IL-8, cyclophilin B, cyclophilin A, EGF-like domains 2, IFN-β1	sICAM, sVCAM, iNOS, IL-18, TNFα, NF-kB
Anti-apoptosis[25,47]	Bcl2, heme oxygenase (HO)-1, NAD(P)H quinone oxidoreductase-1	Bax, cleaved caspase 3, cleaved PARP, γ-H2AX, NOX1, NOX2, TUNEL activity
Tissue and nerve regeneration[35,48-52]	COL1A1, COL2A1, MMP2, MMP9, glycosaminoglycan, collagen type III, S100b, p75, c-Jun, GFAP, activating transcription factor 3 (ATF3), growth-associated phosphoprotein (GAP-43)	MMP-1, MMP-13, myelin marker P0

*BMP = bone morphogenetic protein, IGF = insulin-like growth factor, TGF = transforming growth factor, VEGF = vascular endothelial growth factor, RUNX2 = runt-related transcription factor 2, FAK = focal adhesion kinase, ERK = extracellular signal-regulated kinase, MAPK = mitogen-activated protein kinase, PDGF = platelet-derived growth factor, FGF = fibroblast growth factor, Hsp = heat-shock protein, DKK = dickkopf-related protein, miR = microRNA, Flt = FMS-like tyrosine kinase, vWF = von Willebrand factor, PIGF = phosphatidylinositol-glycan biosynthesis class-F protein, KDR = kinase insert domain receptor, PCNA = proliferating cell nuclear antigen, TLR = Toll-like receptor, NOS = nitric oxide synthase, eNOS = endothelial NOS, nNOS = neuronal NOS, IL = interleukin, EGF = epidermal growth factor, IFN = interferon, sICAM = soluble intercellular adhesion molecule, sVCAM = soluble vascular cell adhesion molecule, iNOS = inducible NOS, TNFα = tumor necrosis factor alpha, NF-kB = nuclear factor kappa B, Bcl = B-cell lymphoma, NAD = nicotinamide adenine dinucleotide, PARP = poly(ADP-ribose) polymerase, H2AX = H2A histone family member X, TUNEL = terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling, COL1A1 = collagen type-1 alpha 1, COL2A1 = collagen type-2 alpha 1, MMP = matrix metalloproteinase, and GFAP = glial fibrillary acidic protein.

The Role of Extracorporeal Shockwave Treatment in Musculoskeletal Disorders
Moya, Daniel MD[1,a]; Ramón, Silvia MD, PhD[2]; Schaden, Wolfgang MD[3]; Wang, Ching-Jen MD[4]; Guiloff, Leonardo MD[5]; Cheng, Jai-Hong MD[4]
JBJS: February 7, 2018 – Volume 100 – Issue 3 – p 251–263

ESWT Indikationen, ISMST The International Society for Medical Shockwave Treatment

46 Indikationen

für Stoßwellentherapie

1. **Approved standard indications**
2. **Common empirically-tested clinical uses**
3. **Exceptional indications – expert indications**
4. **Experimental Indications**

Quelle: www.shockwavetherapy.org

ESWT Indikationen, ISMST The International Society for Medical Shockwave Treatment

3. Exceptional indications – expert indications

3.1. Musculoskeletal pathologies
3.1.1. Osteoarthritis
3.1.2. Dupuytren disease
3.1.3. Plantar fibromatosis (Ledderhose disease)
3.1.4. De Quervain disease
3.1.5. Trigger finger
3.2. Neurological pathologies
3.2.1. Spasticity
3.2.2. Polyneuropathy
3.2.3. Carpal Tunnel Syndrome
3.3. Urologic pathologies
3.3.1. Pelvic chronic pain syndrome (abacterial prostatitis)
3.3.2. Erectile dysfunction
3.3.3. Peyronie disease
3.4. Others
3.4.1. Lymphedema

Quelle: www.shockwavetherapy.org

Experimentelle Untersuchungen

Extracorporeal shock wave therapy ameliorates secondary lymphedema by promoting lymphangiogenesis

Masayuki Kubo, PhD, Tao-Sheng Li, MD, PhD, Takahiro Kamota, MD, Mako Ohshima, PhD, Bungo Shirasawa, MD, PhD, and Kimikazu Hamano, MD, PhD, *Ube, Yamaguchi, Japan*

Objective: Although secondary lymphedema is a common complication after surgical and radiation therapy for cancer, the treatment options for lymphedema remain limited and largely ineffective. We thus studied the effect of extracorporeal shock wave therapy on promoting lymphangiogenesis and improving secondary lymphedema.
Methods: A rabbit ear model of lymphedema was created by disruption of lymphatic vessels. Two weeks after surgery, the lymphedematous ear was treated with or without low-energy shock waves (0.09 mJ/mm^2, 200 shots), three times per week for 4 weeks.
Results: Western blot analysis showed that the expression of vascular endothelial growth factor (VEGF)-C (1.23-fold, $P < .05$) and VEGF receptor 3 (VEGFR3; 1.53-fold, $P < .05$) was significantly increased in the ears treated with shock wave than in the untreated lymphedematous ears. Compared with the control group, shock wave treatment led to a significant decrease in the thickness of lymphedematous ears (3.80 ± 0.25 mm vs 4.54 ± 0.18 mm, $P < .05$). Immunohistochemistry for VEGFR3 showed the density of lymphatic vessels was significantly increased by shock wave treatment ($P < .05$).

Journal of Vascular Research

Research Paper

J Vasc Res 2013;50:124–133
DOI: 10.1159/000343699

Received: November 23, 2011
Accepted after revision: September 7, 2012
Published online: November 27, 2012

Extracorporeal Shock Wave Therapy Combined with Vascular Endothelial Growth Factor-C Hydrogel for Lymphangiogenesis

In Gul Kim[a] Ji Youl Lee[a] David S. Lee[b] Jeong Yi Kwon[c] Ji Hye Hwang[c]

[a]Department of Urology, Seoul St. Mary's Hospital, The Catholic University of Korea, [b]Yongsan International School, and [c]Department of Physical and Rehabilitation Medicine, Sungkyunkwan University School of Medicine, Samsung Medical Center, Seoul, Korea

Eur J Vasc Endovasc Surg. 2011 Aug;42(2):254-60. doi: 10.1016/j.ejvs.2011.02.029. Epub 2011 Mar 31.

Extracorporeal shock wave therapy induces therapeutic lymphangiogenesis in a rat model of secondary lymphoedema.

Serizawa F[1], Ito K, Matsubara M, Sato A, Shimokawa H, Satomi S.

Author information

Abstract

OBJECTIVE: Lymphoedema is a common complication after cancer treatment. We have reported that low-energy extracorporeal shock wave (SW) therapy up-regulates vascular endothelial growth factor (VEGF) in ischaemic myocardium. As VEGF plays an important role in lymphangiogenesis, we investigated whether our low-energy SW therapy enhances lymphangiogenesis in rats.

METHODS: We created a tail model of lymphoedema in rats. The tail was treated with or without low-energy SW therapy (0.25 mJ mm(-2), 500 impulses) four times (days 3, 5, 7, and 9). The tail volume and the fluorescence intensity of indocyanine green (ICG) were measured. The expression of VEGF-C and basic fibroblast growth factor (bFGF) were evaluated by RT-PCR, and the lymphatic vessel density was assessed histochemically.

RESULTS: The tail volume increased significantly in the control group and was significantly improved in the SW group. The lymphatic system function (evaluated with fluorescence intensity of ICG), the lymphatic vessel density, and the expression of VEGF-C and bFGF were all enhanced by the SW therapy (all $P < 0.05$).

CONCLUSIONS: The low-energy SW therapy induces therapeutic lymphangiogenesis by up-regulating VEGF-C and bFGF, and improves lymphoedema in a rat-tail model, suggesting that low-energy SW therapy could be a non-invasive and effective strategy for lymphoedema in humans.

PMID: 21454105 DOI: 10.1016/j.ejvs.2011.02.029

[Indexed for MEDLINE] Free full text

Klinische Studienlage

Studie 1

Michelini *et al. BMC Geriatrics* 2010, **10**(Suppl 1):A105
http://www.biomedcentral.com/1471-2318/10/51/A105

BMC Geriatrics

MEETING ABSTRACT Open Access

Treatment of geriatrics lymphedema with shockwave therapy

S Michelini*, M Cardone, A Failla, G Moneta, A Fiorentino, F Cappellino

From de Senectute: Age and Health Forum
Catanzaro, Italy. 5-7 December 2009

72 Patienten eingeschlossen
(25 prim. LÖ, 47 sek. LÖ)

Alter: 70–85

Prozedere:

10 Einheiten rESWT
2500–3500 Impulse (abh.von Größe der fibrotischen Areale)

Studie 1

Michelini *et al. BMC Geriatrics* 2010, **10**(Suppl 1):A105
http://www.biomedcentral.com/1471-2318/10/51/A105

BMC Geriatrics

MEETING ABSTRACT Open Access

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Evaluierung:

Baseline und 4 Wochen nach ESWT

Ergebnis:

- Durchschn. Reduktion Extremitätenumfang von 26%
- Durchschn. Reduktion Hautdicke von 32% (hochauflöslicher US)
- Klinische Verbesserung der sklerosierten Hautareale

Studie 2

Original Article
Ann Rehabil Med 2013;37(2):229-234
pISSN: 2234-0645 • eISSN: 2234-0653
http://dx.doi.org/10.5535/arm.2013.37.2.229
arm
Annals of Rehabilitation Medicine

Clinical Outcomes of Extracorporeal Shock Wave Therapy in Patients With Secondary Lymphedema: A Pilot Study

Hasuk Bae, MD, Ho Jeong Kim, MD
Department of Rehabilitation Medicine, Ewha Womans University School of Medicine, Seoul, Korea

7 Patientinnen

- mit fortgeschrittenen dermatofibrotischen Veränderungen
- kein Ansprechen auf KPE

Prozedere:

4x rESWT (2 Wochen), je 2000 Impulse

1000 Impulse „fibröseste“ Läsion
1000 Impulse andere Läsionen

(2 Gruppen: 3 Pat. ESWT, 4 ESWT+KPE)

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Evaluierung:

Baseline und unmittelbar nach Therapieende

- Umfangmessungen
- Volumetrie
- Hautdicke, Hauthärte, Sensible Defizite (VAS)

Studie 2


Original Article

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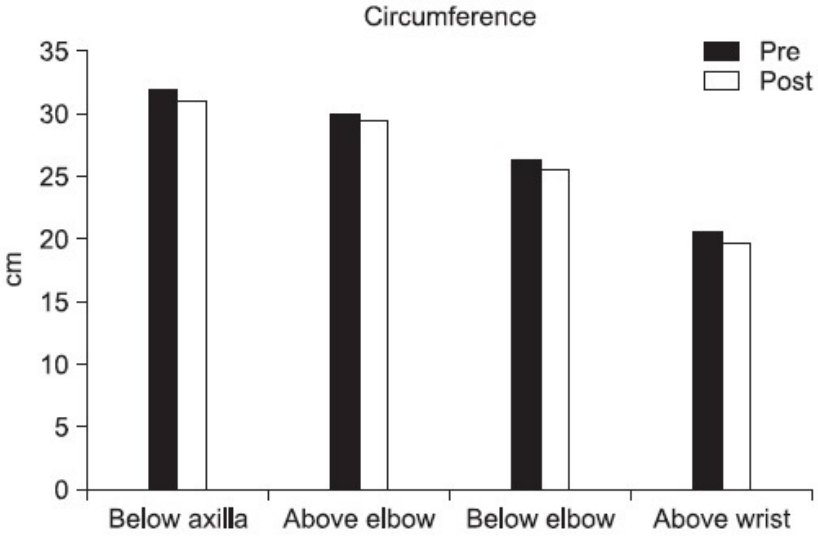

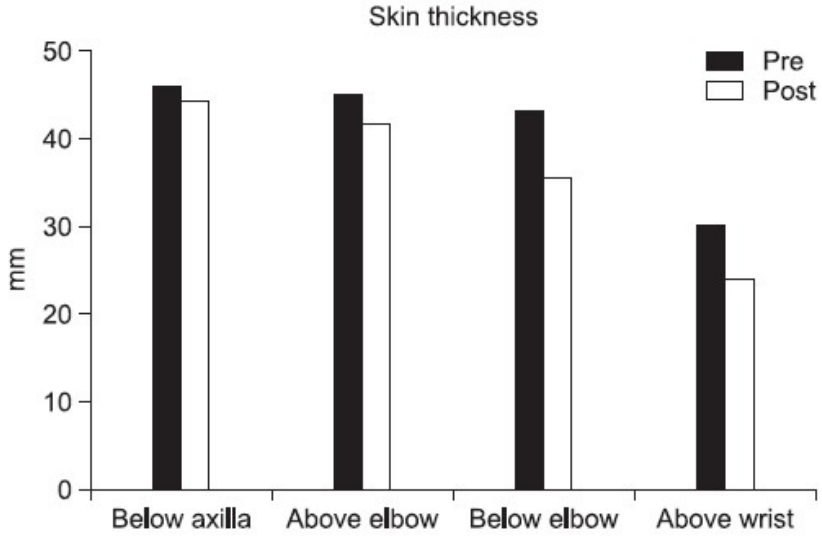

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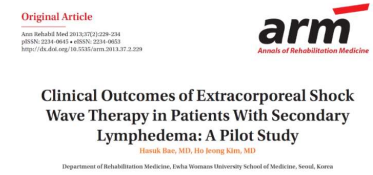
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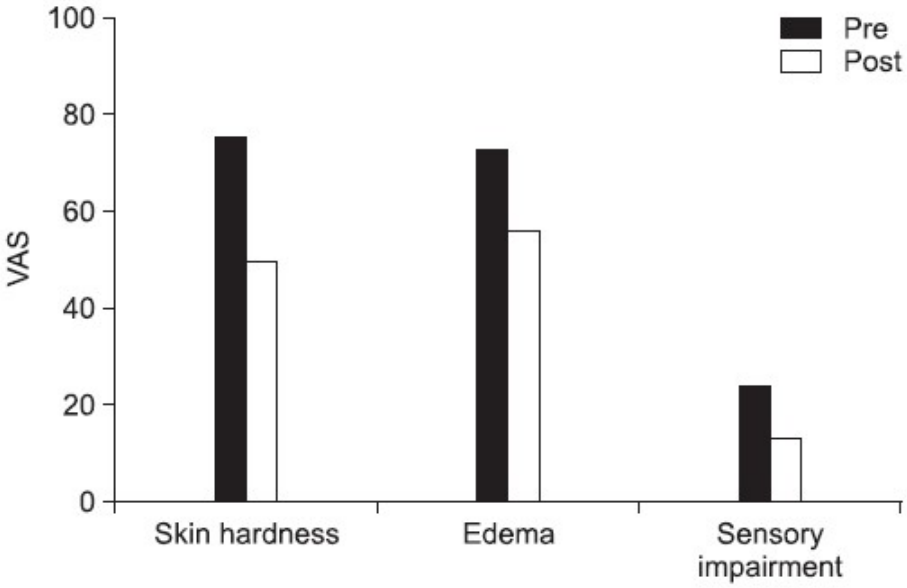


Gruppe ESWT+KPE:

+5% Volumenreduktion

Studie 3

11 PatientInnen mit sek.LÖ nach Brustkrebsbehandlung

Procedere:

12 (3x/wo.) rESWT-Einheiten

(2500 Impulse, 2 bar, 4 Hz)

Axilla 750 Impulse
Cubita 250 Impulse
Arm/Unterarm/Hand 1500 Impulse

ACRM AMERICAN CONGRESS OF REHABILITATION MEDICINE
Archives of Physical Medicine and Rehabilitation
journal homepage: www.archives-pmr.org
Archives of Physical Medicine and Rehabilitation 2016;97:1520-5
http://dx.doi.org/10.1016/j.apmr.2016.02.019

ORIGINAL RESEARCH

Extracorporeal Shock Wave Therapy for Breast Cancer—Related Lymphedema: A Pilot Study

Mehtap Aykac Cebicci, MD,[a] Serap Tomruk Sutbeyaz, MD,[a] Sema Sezgin Goksu, MD,[b] Sehriban Hocaoglu, MD,[a] Arzu Oguz, MD,[b] Ayse Atilabey, MD[a]

From the [a]Departments of Physical Therapy and Rehabilitation and [b]Medical Oncology, Kayseri Training and Research Hospital, Kayseri, Turkey.

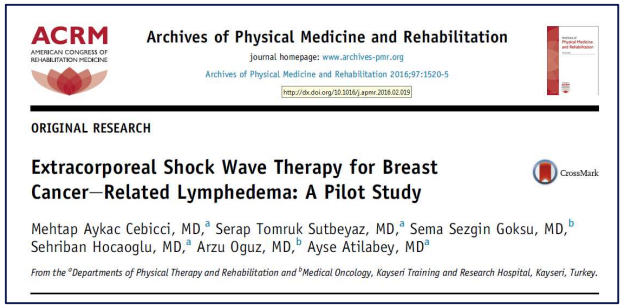
Table 1 General characteristics of the subjects (N=11)

Characteristics	Value
Age (y)	50.63±7.03
Female	11
Lymphedema duration (mo)	12 (6—84)
Received chemotherapy	11
Received radiotherapy	8
Lymphedema severity at baseline	
Mild	1
Moderate	2
Severe	8
Lymphedema severity at 6mo after treatment	
Mild	3
Moderate	5
Severe	3

NOTE. Values are mean ± SD, median (minimum—maximum), or n.

Archives of Physical Medicine and Rehabilitation 2016;97:1520-5

Studie 3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From the [a]Departments of Physical Therapy and Rehabilitation and [b]Medical Oncology, Kayseri Training and Research Hospital, Kayseri, Turkey.

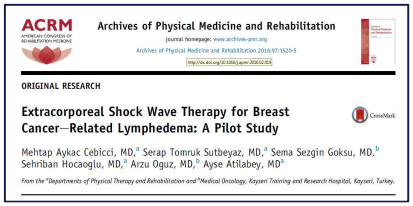
Evaluierung:

baseline, posttherap., 1, 3 und 6 Mo.

- Volumetrische Vermessung
- QuickDASH

Archives of Physical Medicine and Rehabilitation 2016;97:1520-5

Studie 3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ORIGINAL RESEARCH

Extracorporeal Shock Wave Therapy for Breast Cancer—Related Lymphedema: A Pilot Study

CrossMark

Mehtap Aykac Cebicci, MD,[a] Serap Tomruk Sutbeyaz, MD,[a] Sema Sezgin Goksu, MD,[b] Sehriban Hocaoglu, MD,[a] Arzu Oguz, MD,[b] Ayse Atilabey, MD[a]

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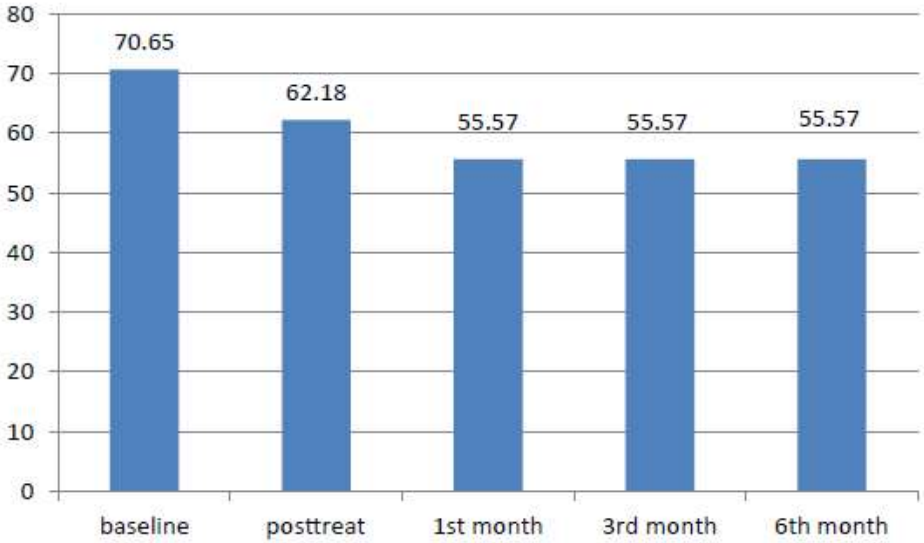
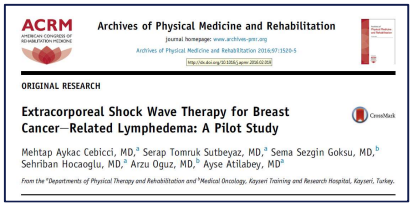


Fig 3 QuickDASH scores at baseline, posttreatment, and 1, 3, and 6 months after treatment.

Archives of Physical Medicine and Rehabilitation 2016;97:1520-5

Studie 3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ORIGINAL RESEARCH

Extracorporeal Shock Wave Therapy for Breast Cancer—Related Lymphedema: A Pilot Study

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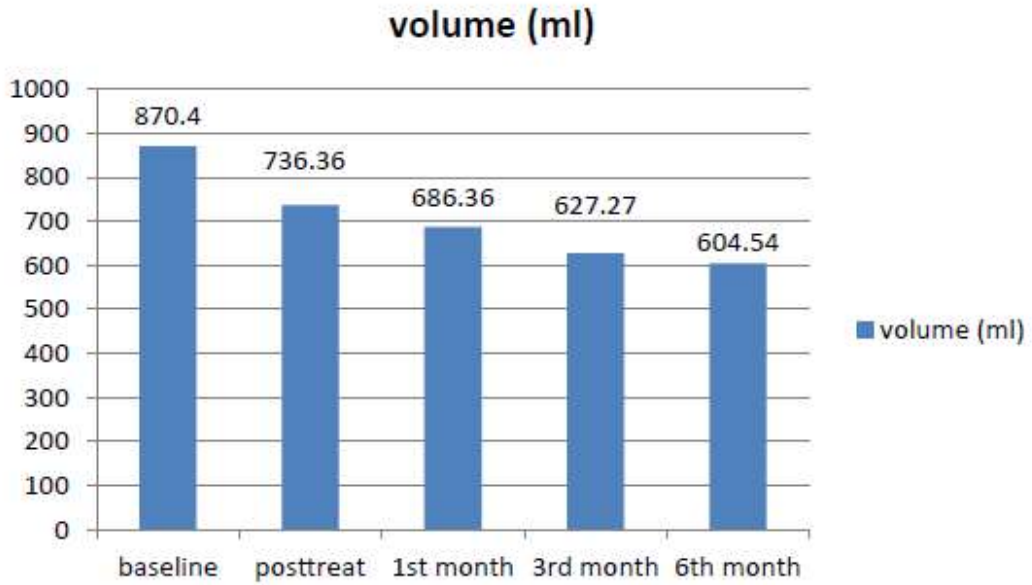

Fig 2 Mean volume displacement of the affected upper extremity at baseline, posttreatment, and 1, 3, and 6 months after treatment.

Archives of Physical Medicine and Rehabilitation 2016;97:1520-5

Conclusio

- Stoßwellentherapie hat positive Effekte auf LÖ
- Technische Parameter sind zu klären
- Untersuchungen zum Wirkmechanismus notwendig
- Weiterführende Studien sind notwendig (höhere Fallzahl, kontrolliert, rand.)

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