

RESULTS OF SHOCKWAVE THERAPY FOR BODY CONTOURING IN CELLULITE COMPARISON OF LARGE VERSUS SMALL HEAD APPLICATORS

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Key words

Cellulite, Shockwave therapy, small / large applicator, Body Contouring

Abstracts

Background

Cellulite is a widespread problem for females. Shockwave therapy (SWT) is beneficial in terms of improved skin elasticity in published clinical data. The present study investigates the effects of shock waves on cellulite afflicted skin using two different size head applicators.

Methods

Cellulite classification were made according to Nürnberger-Müller scale, in 25 female subjects (Ages 25-50). Shockwave, with small head applicator (25 mm) and large head applicator (39 mm) were applied contra laterally and the results were compared. SWT was applied onto the skin at the lateral thigh 3 times a week for a period of 4 weeks. Frequency was 10 Hz / 16 Hz and number of pulses in area were 1500-2000. Before and after treatment; weight, circumference of upper legs, photographs were evaluated. 20 MHz diagnostic ultrasound was also used to be able to evaluate the treatment efficacy.

Results

Better results were obtained in reduction of circumference with 39 mm applicator. Diagnostic ultrasound with 20 MHz showed more homogenous tissue appearance and increase of tissue density with 39 mm applicator.

Discussion

The result of this study suggests that SWT is effective in treating cellulite through the remodeling of skin collagen. Large (39 mm) head applicator is more effective than small (25 mm) applicator. Shockwave therapy may effect by helping lymphatic drainage. It's massage effect causes revascularitation. SWT may become one of the noninvasive optimizing therapy for clinical management in females suffering cellulite.

Cellulite is aesthetically disturbing skin problem of thighs and buttocks that affects 85-98% post adolescent women. "Orange peel" aspect characterized by a dimpled skin surface. (1, 2, 3, 4)

Cellulite is uncommon in men, the majority of affected men also suffer androgen deficiency, cirrhosis. (5)

Cellulite also called as *liposclerosis*, *panniculopathy* and *gynoid lipodystrophy*. Nürnberger graded and formulated to evaluate of cellulite by inspection. (Table 1)

Surface of skin is smooth in normal healthy skin. The women skin is thinner than the skin of men. On the other hand, skin of women with cellulite, the septa of subcutaneous connective tissue is thin that results in formation of large fat cells chambers. The pathophysiology of cellulite related with the septa of the subcutaneous connective tissue. The fat cell chambers herniate into the surface and cause dimpling formation. In subjects with high body mass indexes have progressive fat accumulation.

Although, it is only a cosmetic concern, many affected patients have negative psycho social emotions and would like to have better appearance.

There are various cosmetic procedures and devices to reduce unwanted local subcutaneous fat. Exercise and weight loss are important factors. *Invasive* methods are surgically lipectomy or liposuction. *Semi-invasive* methods include cellulipolysis; injection lipolysis; laser lipolysis and cryolipolysis. *Non invasive* body contouring methods compose of creams (caffeine, retinol); mesotherapy; mechanical massage; vacuum or pressure; bipolar radiofrequency (RF); infrared (IR) heat; ultrasound or shock waves. (3,4,6)

Shock wave therapy (SWT) is a local painless therapy method for cellulite. High energetic sound pressure waves are transmitted through the surface of the skin and spread radially into the tissue effecting a large and deep treatment area.

Unfocused low pressure acoustic waves are created by an electromagnetic projectile mechanism.

The electromagnetic energy creates a ballistic motion of the applicator. Shockwaves have been used in medicine in urology in renal stone treatment aiming to destroy the targeted areas. (7,8)

Shock waves are used in orthopedic patients with tennis elbow, calcaneal spur and golf arm. (9,10)

It can be also used for wound healing and ulcer treatments. (11,12,13)

It has been demonstrated that SWT has biological effects and are caused to release of several mediators and increase local circulation. (14,15) The acoustic waves stimulate blood circulation as well as the production of collagen.

Increased concentrations of serum malandialdehyde and plasma proteins in cellulite patients are shown.

After SWT treatment, these serum concentrations decreased. SWT stimulates angiogenesis and promotes tissue revascularization. (15,16)

In our study we aimed to show the efficacy of SWT and compare the different head applicators in cellulite treatment. Effects of SWT on cellulite type were also investigated.

Methods

This study took place in Landau Dermatology and Laser Centrum in Germany in 2011.

25, non-pregnant female, of age between 20 and 50 years having cellulite parameters were selected to participate in the study. Cellulite classification was made according to Nürnberger-Müller scale. (1,2)

Each participants signed informed consent form. Before and after treatment; weight, circumference of upper legs, photographs were evaluated. 20 MHz diagnostic ultrasound was used to be able to evaluate and show the treatment effect.

We used "Z Wave" device. (Zimmer MedizinSysteme GmbH)

Two different applicator heads (small (25 mm) and large (39 mm)) were compared contralateral applications (**Figure 1 a, b**). Energy is chosen according to the sensitivity of patients (10 Hz-16 Hz). The ultrasound gel is used for transmission of the energy. Treatment was performed along the ways of lymphatic drainage (**Figure 2**). Number of pulses in area were between 1500-2000. The sessions were 3 times a week and 4 week period (**Table 2**).

Results

This treatment was very well tolerated without side effect and pain. There was only temporary erythema with 39 mm therapy head applicator in one case.

Circumference evaluation showed that with 39 mm applicator head had better results (**Figure 3**).

Clinical evaluation showed smoothening in threatening area with 39 mm applicator.

Tightening of skin were evaluated and cellulite scores were reduced (**Figures 4a, 4b, 5a, 5b, 6a, 6b**). Diagnostic 20 MHz ultrasound showed that after 12 session with 39 mm applicator of SWT, in increase in tissue density and there was more homogenous tissue appearance. (**Figure 7, 8**)

Discussion

Shockwaves are presented by a single, positive pressure pulse of large amplitude. High energy extra corporeal generated shockwaves is mechanical energy transformed by piezo effect. The pressure waves transmitted through the surface of the skin and spread radially into the tissue.

These waves were first used for kidney and uretral stone fragmentation (7, 8).

This noninvasive method is also used for musculoskeletal diseases such as tennis elbow, golf arm, tendinopathia and pseudoarthritis (9,10). Chronic skin ulcers and burnings respond positively to shockwave therapy as well (11).

Sparsa showed positive effects on *ulcus cururis* by increasing local blood circulation (13).

Gerdsmeyer focused on may have a antimicrobial effects (17).

Shockwaves are effective to increase local blood circulation and metabolism (**Table 3**).

The biologic action is reported as liberation of different agents such as vascular endothelial growth factors, endothelial nitric oxide syntahase or proliferating cell nuclear antigen.

Angehrn questioned the shockwave treatment in treating cellulite by remodeling collagen within the skin. In subjects with high body mass indexes have progressive fat accumulation.

In vivo measurements in 21 female patients with lipedema and cellulite parameters were carried out before and after therapy including manual lymph drainage and compression as main shock wave therapy (SWT). The results of this study suggest that low energy of SWT is effective in treating cellulite through the remodeling skin collagen (18).

Oxidative stress parameters of blood serum and biomechanic skin properties/smoothing of dermis and hypodermis surface were evaluated in *Siems* study (16). SWT improved significantly the biomechanic skin properties leading to smoothing of dermis and hypodermis surface. It is concluded as a release of lipid peroxidation (LPO) products from edematous dermis is an important sclerosis-preventing effect of SWT (11).

Christ used extracorporeal acoustic pulses in 59 female cases. Skin elasticity values gradually improved. This study confirmed the effects of acoustic wave therapy on biologic tissue, including stimulation of microcirculation. Ultrasound evaluation also confirmed density of collagen in the dermis and subcutis. In this study postmenopausal women between 40 and 65 years of ages were respond better. In this study is recommended a combination of healthier nutrition, sufficient intake of water, increase body activity (19). This therapy is a safe for body shaping.

Kuhn investigated effects of shockwaves in cellulite affected 50 year old woman. From untreated contralateral area and from treated area skin samples were taken for histopathological evaluation. Any damage to the treated skin area in particular no mechanical destruction could be demonstrated. However induction of neocollagen and elastin was observed. The dermis thickness increased (20).

Similarly, in our study an increase of tissue density is seen with 20 MHz ultrasound evaluation after 12 session with 39 mm head applicator. There was also more homogenous tissue appearance as well. SWT treated cellulite case was evaluated with high frequency high resolution ultrasound in *Kuhn* study as well. It is noticed that increased collagen content after treatment. This result supports our study. In this study increased thickness of the dermis particullarly collagen and elastin is confirmed by histologically. Amazing amount of neocollagen and neolastin supports the effects of shockwaves after 4 sessions.

Shockwave is a non invasive method. *Christ* evaluated skin appearance with photographs and ultrasound.

No clinical side effects were observed except minimal pain in 3 of 59 patients. This pain was related 2 days before menstrual period. During these days the applied energy was reduced. None of our cases pain observed. During the therapy only slight redness of skin were seen.

The effectiveness of massaging device has been showed by *Lucassen* (21) the result lasted only 1.5 months. However in *Christ* study with pulse activation in cellulite, improvement of skin elasticity was evaluated after 6 months follow up and the result lasted 6.5 months. They recommended this treatment for more older age group especially with a long history of cellulite.

On the other hand in our study cellulite level 1 and 2 responded better. The treatment had no sufficient effect in cellulite level 3-4. *Cutis laxa*; *adipositas* and *lymphodema* need more sessions.

Knobloch focused on their randomized shockwave trial importance of daily gluteal strength training in females suffering cellulite (22).

Negatively affected microcirculation may result in intracellular oedema and reduced lymphatic drainage in cellulite cases. *Adatto* investigated the effects of acoustic wave and extracorporeal pulse activation in controlled randomized study. Volume of depression and elevations and roughness parameters were evaluated with 3D images. At the 3 month follow up, while the treated legs maintained improvement, the unteated legs matched the improvement of treated legs, suggesting a systemic treatment effect. It is theorized that the acoustic wave stimulation may have resulted in improvement lymph drainage and microcirculation within the tissue (23).

Better lymphatic drainage resulted in less edema. Tissue tightening is related with increased tissue density. Initiation of new collagen causes more homogenous tissue appearance. Treatment should be performed along the ways of lymphatic drainage. Activation of lymph nodes before treatment might improve the drainage. The massage effect of device may stimulate fibroblast and initiate the lypolysis. Release of growth factors from tissue and increase of revascularization are the main effect (17, 23, 24).

Our study demonstrates that SWT is promoting in cellulite level 1-2, persisting fat deposits. It may be combined with endermology and lypolysis. It can be used pre and post liposuction or laserlipolysis.

Acknowledgements

The author have no conflicts of interest to report.
 This study supported by Zimmer MedizinSysteme GmbH, Germany in terms of using their device for the study.

Table 1: Cellulite Grading (Nürnberg - Müller scale)

<u>Definition</u>	<u>Grade</u>
No dimpling while standing and lying. pinch test reveals "folds and furrows", no mattress-like appearance	0
No dimpling while standing or lying, pinch test reveals the mattress-like appearance	1
Dimpling spontaneously when standing	2
Dimpling spontaneously positive standing and lying down	3

Table 2: Shock wave application adjustments

Wave	unfocused
Pressure	12 MPa
Rise time	1000 msec
Penetration depth	0-35 mm
No of pulses	2000/cm ²
Frequency	10 Hz
No of sessions	3/weeks
No of treatment	12 sessions
Group1/2	25 mm / 39 mm applicator heads

Table 3: Possible Mechanism of Action of Shock Waves

Shockwaves Effect	Decrease Cellulite Severity
Mechanical massage	Improvement in lymph circulation Decrease in fat cells oedema Increase in leakage of membrane
Increase local blood flow	Improvement of metabolism Anti-oxidative effect Less fibrosklerotic effect
Increased dermal connective tissue growth, release of growth hormones	Firmer skin and less bulging

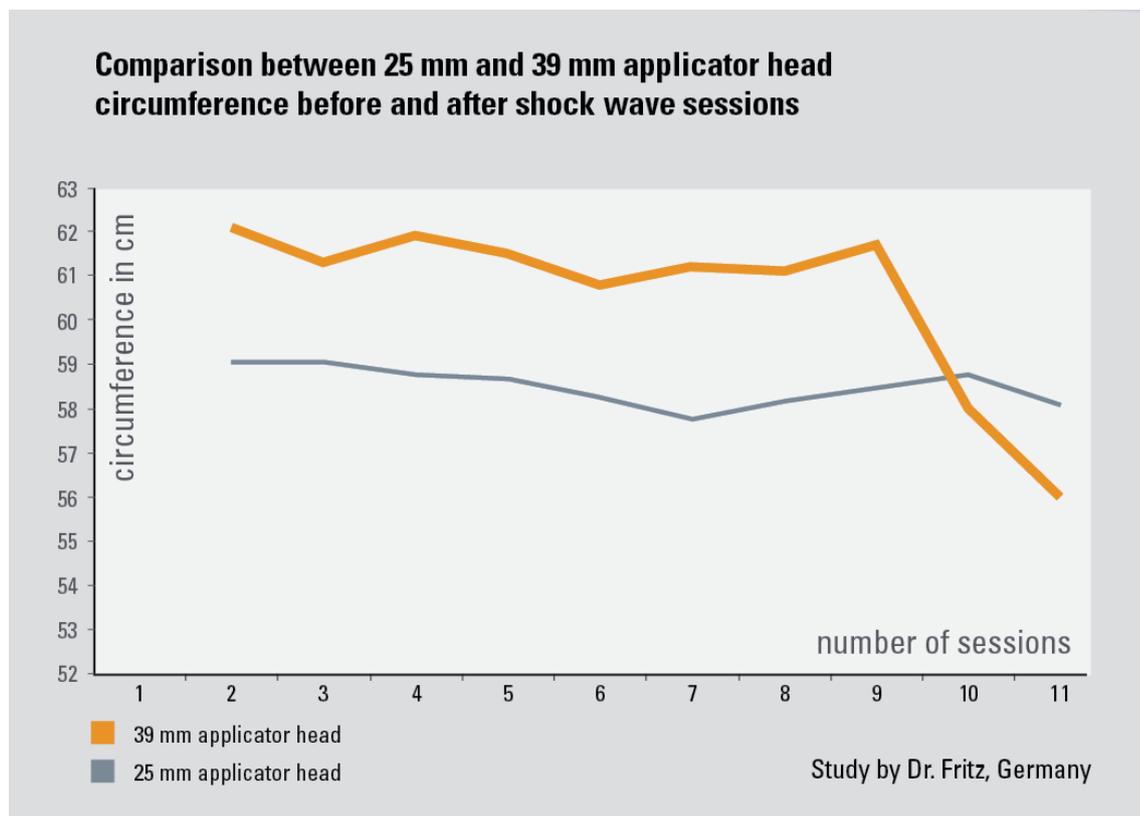
Figure 1a, 1b: Shockwave device and application heads

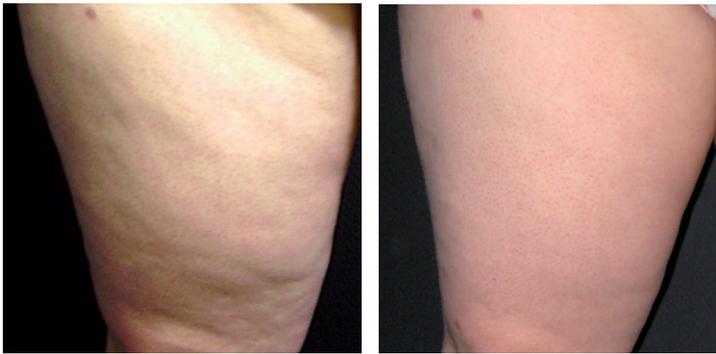


Figure 2: Application Method



Figure 3: Reduction of Circumference with 39 mm and 25 mm head applicators





before

after

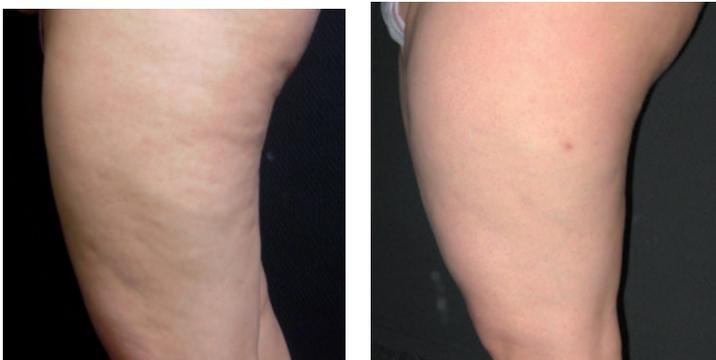
Figure 4a, 4b: Before and after Treatment



before

after

Figure 5a, 5b: Before and after Treatment

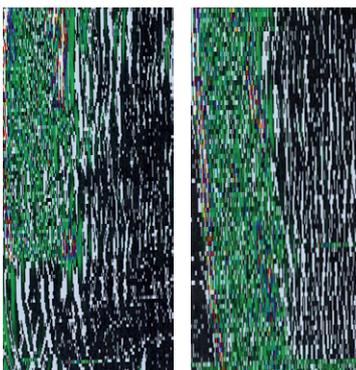


before

after

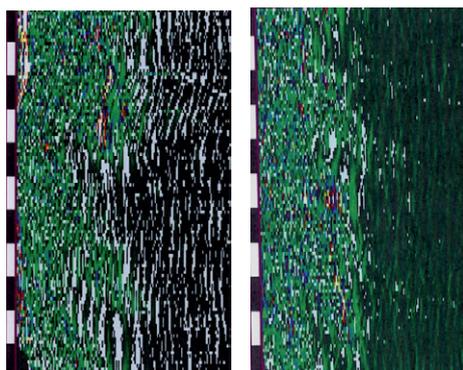
Figure 6a, 6b: Before and after Treatment

Figure 7, 8: 20 MHz Diagnostic



before

after



before

after

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