GAVIN PUBLISHERS

Clinical & Experimental Dermatology and Therapies

Firooz A, et al. Clin Exp Dermatol Ther (2016) : G113.

DOI: 10.29011/2575-8268/100013

Research Article

Treatment of Cellulite and Local Obesity by a Treatment of Cellulite and Local Obesity by Acoustic Waves (Awt): Presentation of Three Cases and the Protocol Used

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Citation: Fanian F, Zartab H, Taraneh Yazdanparast T, Variji Z, Estarabad AR, et al. (2016) "Treatment of Cellulite and Local Obesity by a Treatment of Cellulite and Local Obesity by acoustic Waves (Awt): Presentation of Three Cases and the Protocol Used" Dermatology Research and Therapy GDRT -113. DOI: 10.29011/2575-8268/100013

Received Date: 20 October, 2016; **Accepted Date:** 30 November, 2016; **Published Date:** 5 December, 2016.

Abstract

There are different ways to treat local obesity and cellulite including invasive and noninvasive methods. Due to the fact that non-invasive methods have significantly lower rates of adverse effects, they have been becoming more popular. One of these methods is Acoustic Wave Therapy (AWT) or Shock Wave Therapy (SWT). In addition to treating cellulite, SWT has been found useful for some other conditions. In this paper, we briefly introduce SWT and describe the protocol and results of treating cellulite and local obesity using Cellactor® SC1 device (Storz Medical, Switzerland) in three females with normal body mass indices.

Keywords: Obesity; Cellulite; Acoustic wave; Body mass index; Non invasive liposuction; Body contouring.

Introduction

Available treatments for body contouring (body-sculpting) are divided in two groups: invasive and non-invasive. Invasive treatments potentially have some risks [1]. Despite this; invasive Lipoplasty is the most common method that is used for body-sculpting in the U.S.A yet. Due to potential complications of invasive methods, tendency for use of non-invasive methods is enhancing increasingly. There are different non-invasive methods for body-sculpting such as treatment by radio frequency waves, cryolipolysis, treatment by low power laser, injection lypolysis, low intensity non thermal ultrasound, high intensity focal ultrasound. Non-invasive treatments have fewer complications and don't need local and general anaesthesia or need less. Non-invasive methods are ideal for patients with moderate to severe overweight and done with the aim of reducing fat tissue in moderate amount. [2] One of the non-invasive treatments is acoustic wave therapy (AWT) or shock wave therapy (SWT). AWT consists of producing pulses that are applied on skin surface mechanically and penetrate subcutaneous tissue. Both low and high amplitude microwaves have treatment effects. SWT have been used in different fields such as: orthopaedics (plantar Fasciitis, shoulder tendinosis calcarea, aseptic necrosis …).

Rehabilitation and pain management, treatment of chronic ulcerative Cutaneous lesions, scars (such as burning scars), cardiology (myocardial ischemia) and infectious diseases (with antibacterial role) [3-7].

Case presentation and protocol

Results of three outpatients cases treatment by Cellactor®

SC1 system manufactured by Storz Medical company from Switzerland in a specialist dermatology clinic are presented in this article. This device has three probes with the names of C-Actor®, D-Actor® and V-Actor® that any of them apply the waves to the surfaces under treatment in a different method. D-Actor® has radial pulses and C-Actor® has planar pulses. V-Actor® is actually a local vibrator. Treatment protocol is the adjusted version of the protocol proposed by Storz Medical Company which has been designed by physicians of that clinic according to their clinical experiment and any patient's treatment response and possible complications. Considering the Physician's clinical judgment, patients' treatment response, complications of any probe and three factors of frequency, energy and number of pulses of the waves for any region under treatment, Flexibility in the implementation of the Protocol should set by the Physician. All patients were between 30 and 45 years of age, their BMIs were normal and all of them attended in any treatment sessions.

First case

The first case was a 38 year old female with the weight of 56 kg and the height of 159 cm (BMI=22.15) who was treated twice a week and totally nine sessions. Areas under treatment were love handles. Frequency, energy and number of pulses for any area, treatment session and probe have been shown in [Tables 1-3].

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	3	3	3	3	3	3	3	3	3
Energy	0.76	0.88	1.02	1.02	1.24	1.24	1.24	1.24	1.24
Number of pulses for any region under treatment	1000	1000	1000	2000	1000	1000	1000	1000	1000

Table 1: probe C-Actor® Treatment protocol of probe C-Actor® in any visit for first patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	16	16	16	16	14	14	15	15	15
Energy	4	4.2	4.4	4.6	4.8	4.8	5	5	5
Number of pulses for any region under treatment	1500	1500	1500	2000	2000	2000	2000	2000	2000

Table 2: Treatment protocol of probe D-Actor® in any visit for first patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	35	35	35	35	35	35	35	35	35
Energy	4	4	4	4	4	4	4	4	4
Number of pulses for any region under treatment	2500	2500	2500	2500	2500	2500	2500	2500	2500

Table 3: Treatment protocol of probe V-Actor® in any visit for first patient.

The patient lost weight 1.8 kg by 32 days after beginning the treatment (from 56 kg to 54.2 kg). Measurements of the abdominal circumference were done in three levels according to the (Figure 1).

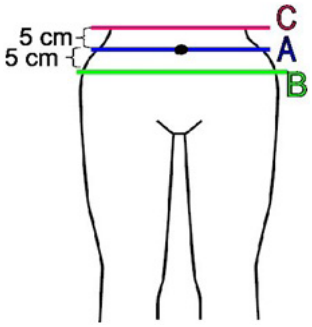

Figure 1: Measured regions to assess response to the treatment in first patient.

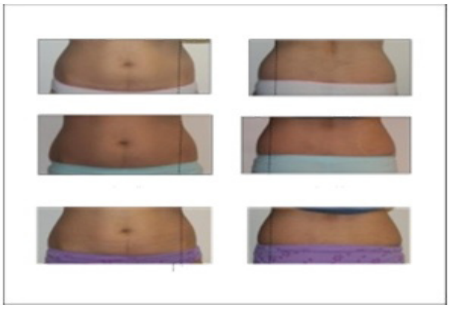

Figure 2: Anterior and posterior view of region under treatment in first patient by 0 (upper photos), (15 middle photos) and 30 (Bottom photos) days after beginning the treatment.

Measures of abdominal circumference in level A by 0, 11 and 32 days after beginning the treatment were 84, 81 and 78.5 cm

cm respectively (totally 5.5 cm reduction of the circumference). Measures of abdominal circumference in level B by 0, 11 and 32 days after beginning the treatment were 87, 86 and 85 cm respectively (totally 2 cm reduction of the circumference). Measures of abdominal circumference in level C by 0, 11 and 32 days after beginning the treatment were 74, 71 and 70 cm respectively (totally 4 cm reduction of the circumference). Total results after completion the treatment are shown in (Figure 2).

Second case:

The second case was a 45 year old female with the weight of 66 kg and the height of 167.5 cm (BMI=23.52) who was treated twice a week and totally nine sessions. Areas under treatment were anterior and posterior parts of both thighs. Frequency, energy and number of pulses for any area, treatment session and probe have been shown in [Tables 4-6].

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	3	3	3	3	3	3	3	3	3
Energy	1.02	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Number of pulses for any region under treatment	1500	1500	1500	1500	1500	1500	1500	1500	1500

Table 4: Treatment protocol of probe C- Actor® in any visit for second patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	14	14	14	14	14	14	14	14	14
Energy	5	5	5	5	5	5	5	5	5
Number of pulses for any region under treatment	5000	5000	5000	5000	5000	5000	5000	5000	5000

Table 5: Treatment protocol of probe D- Actor ® in any visit for second patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	35	35	35	35	35	35	35	35	35
Energy	4	5	5	5	5	5	5	5	5
Number of pulses for any region under treatment	5000	5000	5000	5000	5000	5000	5000	5000	5000

Table 6: Treatment protocol of probe V- Actor ® in any visit for second patient.

The patient lost weight 4 kg by 32 days after beginning the treatment (from 66 kg to 62 kg). Measurements of the right and left thighs were done in three levels according to the (Figure 3).

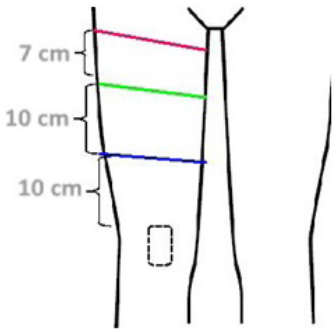

Figure 3: Measured regions to assess response to the treatment in second patient.

Measures of right thigh circumference in level A by 0, 15 and 36 days after beginning the treatment were 51, 48.5 and 48 cm respectively (totally 3 cm reduction of the circumference). Measures of right thigh circumference in level B by 0, 15 and 36 days after beginning the treatment were 58, 55.5 and 54 cm respectively (totally 4 cm reduction of the circumference). Measures of the circumference in level C by 0, 15 and 36 days after beginning the treatment were 62, 59 and 57 cm respectively (totally 5 cm reduction of the circumference). Total results after completion the treatment are shown in (Figure 4).

Figure 4: Anterior and posterior view of region under treatment in second patient by 0 (upper photos) and 36 (Bottom photos) days after beginning the treatment.

Third case:

The third case was a 42 year old female with the weight of 57 kg and the height of 160 cm (BMI=22.26) that was treated twice a week and totally ten sessions. Areas under treatment were anterior and posterior parts of both thighs. Frequency, energy and number of pulses for any area, treatment session and probe have been shown in [Tables 7-9].

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	3	3	3	3	3	3	3	3	3
Energy	0.88	1.02	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Number of pulses for any region under treatment	1500	1500	1500	1500	1500	1500	1500	1500	1500

Table 7: Treatment protocol of probe C- Actor® in any visit for third patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	35	35	35	35	35	35	35	35	35
Energy	4	5	5	5	5	5	5	5	5
Number of pulses for any region under treatment	5000	5000	5000	5000	5000	5000	5000	5000	5000

Table 8: Treatment protocol of probe D-Actor® in any visit for third patient.

Parameter/visit	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7	Visit 8	Visit 9
Frequency	35	35	35	35	35	35	35	35	35
Energy	5	5	5	5	5	5	5	5	5
Number of pulses for any region under treatment	4	5	5	5	5	5	5	5	5

Table 9: Treatment protocol of probe V-Actor® in any visit for third patient.

The patient lost weight 3 kg by 32 days after beginning the treatment (from 57 kg to 54 kg). Measurements of the right and left thighs were done in three levels according to the (Figure 5).

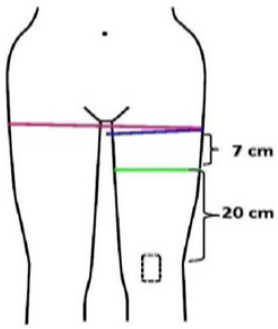

Figure 5: Measured regions to assess response to the treatment in third patient.

Measures of the right thigh circumference in level A by 0, 8, 22 and 47 days after beginning the treatment were 60, 60, 58 and 57 cm respectively (totally 3 cm reduction of the circumference). Measures of right thigh circumference in level B by 0, 8, 22 and 47 days after beginning the treatment were 57, 58, 56 and 54 cm respectively (totally 3 cm reduction of the circumference). Measures of the circumference in level C by 0, 8, 22 and 47 days after beginning the treatment were 101, 99, 97 and 95 cm respectively (totally 6 cm reduction of the circumference). Total results after completion the treatment are shown in (Figure 6).

Figure 6: Posterior and lateral view of region under treatment in third patient by 0 (upper photos) and 47 (Bottom photos) days after beginning the treatment.

Discussion:

Cellulite is much more prevalent in women than men because of Greater number of fat cells in women and different ways of fat storage in two sexes [8]. Several factors are involved in the

development of Cellulite and lipedema. These factors include the following. increase and accumulation of fat in dermal tissue of the thigh and buttock, thinning of collagen layers because of aging (this process is accelerated by menopause and makes epidermis loose and subcutaneous tissue tighter) [8-10], free radicals, sun rays, inadequate diet, stress, smoking, obesity, Impaired lymphatic flow due to a sedentary life style, Fibrosis due to the accumulation of plasma proteins in the interstitial tissue [8].

Cellulite has 4 stages:

Stage 0: when the skin is pinched there is no dimpling.

Stage 1: there is no dimpling by itself; some cellulite is visible when the skin is pinched.

Stage 2: there is dimpling when standing but there is not when lying down.

Stage 3: dimpling is seen when both standing and lying down [12].

Treatment response is usually significant in 0th and 1th stage, partial in 2th stage and stage 3 is refractory to the treatment.

Known or proposed effects of AWT consist of the following items:

Improvement of the perfusion, increase of cell proliferation and regeneration and improvement of tissue quality [3-5], [13-14] , increase of fat mobilization and lipolysis in edematous area [15], increase in serum concentration of malondialdehyde (MDA) and plasma protein carbonyls which shows reduction of oxidative stress [16], rise of cell membrane permeability [17-18], increase of mitochondrial endoplasmic reticulum cytoskeleton waste permeability [19], stem cells stimulation [20], Increased release of growth factors such as TGF- ß1 and VEGF, stimulation of enzymes such as endothelial nitric oxide synthetase and Proliferation of cell nuclear antigen [16, 21-23]. Induction of intra and extra cellular signals transmission and production of Nitroxide radicals and heat shock proteins [24], collagen rearrangement [25], cavitation effect [26], Stimulation of microcirculation in blood and lymphatic vessels [27], release of substance P [28], anti-bacterial effect [6], improved biomechanical properties of the skin and as a result softening and improving the appearance of the skin [16], Improving skin elasticity and patients' satisfaction with treatment that can continue even longer than 6 months [29-30].

In addition to being non-invasive, AWT cellulite treatment has some other advantages such as: Easy to use, very low complications and short courses.

In a study of 18 to 65 year old females with varying degrees of cellulite six different criteria were used to evaluate the results of treatment with AWT that were consisted of: photonomeric severity scale, Nürnberger scale, measuring the circumference, capillary blood flow, Tissue oxygen saturation and after capillary venous blood flow. In this triple-blind controlled clinical trial, a placebo or sham? AWT was performed (by a special hand piece designed for this purpose) for the control group in the gluteal region and thigh at six sessions. In addition, a special strengthening exercise for the gluteal muscles was recommended. For the case group AWT was performed in the gluteal region and thigh at six sessions. In addition, a special strengthening exercise for the gluteal muscles was recommended.

The participants were followed for 12 weeks. AWT was much more effective to treat cellulite in comparison with "strengthening the gluteus muscles program" method alone [31]. A study which used combination technology of cryolipolysis and AWT for non-invasive body contouring showed that AWT and cryolipolysis had synergistic effect. The mean reduction in fat thickness in this study was 3.02 cm, circumference of treated area had decreased an average of 4.45 cm and cellulite and blood flow to the area were improved significantly too [32].

Both planar and radial AWT were used in another investigation. Saddle bag areas of 14 females were treated twice a week for 4 weeks and results of treatment were assessed 1, 4 and 12 weeks after end of the treatment. Ultrasound evaluation of treated area showed significant reduction in the thickness of the subcutaneous fat layer. Mean circumference of treated thighs reduced too [33].

In another study [30], patients were divided in three groups: first group got only radial treatment (11 patients), second group got only planar treatment (9 patients) and third group got both radial and planar treatment (7 patients). Results were evaluated by scale of 0-10 (0-3.9 meant no change, 4-5.9 Satisfactory change and 6-10 ideal change). The means of recovery scores were 5.5, 3.3 and 4.3 in first, second and third group respectively. In first group, 5 patients showed ideal and 3 ones showed satisfactory results and patients reported cellulite improvement after an average of 2.5 sessions. In second group, 1 patient showed ideal and 5 ones showed satisfactory results. 50% of patients in this group reported cellulite improvement after an average of 3.8 sessions. In third group, 2 patients showed ideal and 4 ones showed satisfactory results and 7 patients in this group reported cellulite improvement after an average of 3.6 sessions. There were no adverse effects in these three groups and there were no obvious and significant change in skin elasticity either.

In treatment of cellulite, it should be considered that collagen regeneration and synthesis is a time taking process and due to that while treating by AWT, significant recovery shouldn't be expected immediately after any treatment session. Improvement process will continue even until a few months after treatment sessions (that are often between 8 to 10 sessions) [34].

There are different ways to evaluate response to the treatment after performing AWT that include: photonomeric scale, Nürnberger scale, measurement of area circumference, amount of area capillary blood flow, tissue oxygen saturation and amount of after capillary blood flow [31].

Conclusion:

Treatment of cellulite and local obesity by AWT can be an effective method in decreasing size and grade of cellulite if an appropriate patient is chosen based on age and BMI and regular follow up is performed.

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