

Planar Waves Versus Radial Waves On Cellulite Post Liposuction

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Abstract

Background: Cellulite as changes in surface contour of the skin can lead to cosmetic and health problems. Liposuction actually worsens the dimpled skin appearance and cellulite. **Purpose of the study:** To differentiate between effect of planar waves and radial waves on cellulite post liposuction. **Subjects and methods:** Sixty female patients with cellulite grade 3 post-liposuction were randomly divided into two equal groups (planar group and radial group). The methods of assessment included cellulite grading scale and skin fold caliper. Planar group received planar waves, 2 times/week for 12 weeks while Radial group received radial waves, 2 times/week for 12 weeks. **Results:** The results of this study showed a significant improvement in cellulite grading scale and skin fold caliper in the radial group in comparing to planar group. **Conclusion:** It was concluded that radial waves were more effective than planar waves in controlling of cellulite in expression of decreasing degree of cellulite and improving the appearance.

Keywords: Cellulite, Acoustic Wave Therapy, Planar Waves, Radial Waves.

Introduction

Liposuction removes fat through very small skin incisions, with a traumatic, blunt-tipped cannulas. Simplicity, quality of results are but a few benefits that explain its success. Its main limitation is the minimal skin retraction achieved after the procedure [1].

Cellulite is a widespread problem involving females' buttocks and thighs based on the female specific anatomy. Given the higher number of fat cells stored in female fatty tissue in contrast to males, the gender specific dimorphism with subdermalseptae orientated orthogonally towards the skin, and the ageing process of connective tissue lead to an imbalance between lipogenesis and lipolysis with subsequent large fat cells bulging the skin [2].

The most frequent sequel of liposuction can worsen cellulite, by resulting in a new surface alteration [3].

Cellulite is defined as changes in the surface contour of the skin that result in orange peel or "mattress" appearance of the skin. Cellulite is not defined as a pathologic condition, but is a substantial cosmetic concern for many adult females [4].

Cellulite is not specific to overweight women, although increased adipogenicity will exacerbate the condition. It is a complex problem involving the microcirculatory system and lymphatics, the extracellular matrix, and the presence of excess subcutaneous fat that bulges into the dermis [5].

Unfortunately, there is little evidence to support dramatic cellulite reduction with the combination of diet and regular exercise. Diet and exercise cannot alter the histological structure of the perpendicular bands connecting the skin to the underlying fascia and thus cannot

eliminate cellulite in its entirety. However, these lifestyle modifications may assist in reducing the appearance of cellulite by decreasing adipocyte volume, thus placing less tension on surrounding connective tissue, resulting in decreased skin puckering [6].

The cosmetic problem of cellulite is caused by an increase in fat deposits on the buttocks and thighs on the one hand, and by skin aging due to thinning collagen layers on the other hand. Cellulite typically affects women owing to their genetic predisposition. Females have 21 to 22 billion fat cells, whereas males only have around 17 to 18 billion. Female fat tissue stores fat more easily and quickly than male tissue as the accumulated fat cells in females act as energy reserve during pregnancies. Acoustic wave therapy is able to stimulate the metabolic processes in the subcutaneous fatty tissue to such an extent that the connective tissue structure would be reinforced, the skin relief and therefore skin structure would be significantly increased and therefore that there would be a significant visible reduction in cellulite [7].

The term "acoustic wave" denotes a high-energy sound wave that terminates in a bursting of energy similar to a mini-explosion. Acoustic wave therapy utilizes a high peak pressure ranging from 5 to 130 Mpa, with a most common energy of 50 Mpa and a broad frequency of 14 Hz to 20 MHz [8].

Acoustic wave differs from ultrasound wave that is typically biphasic and has a peak pressure of 0.5 bar. The peak pressure of acoustic wave is approximately 1000 times that of ultrasound wave. Acoustic waves change their physical properties through attenuation and steeping when traveling through a medium and through

reflection and refraction at boundaries when subsequently moving into another medium[9].

Acoustic waves have two types of mechanical waves (radial waves and planar waves). Radial waves are produced by Pneumatic generators. The linear pressure, the low energy values, the relatively low velocity of propagation and the short duration of the rise time are characteristics of radial waves. In radial waves generators, the compressed air strikes a bullet contained in a cylinder. At the top of this cylinder is the applicator. The energy produced by the radial wave is highest at the skin surface, diverging and weakening as it penetrates deeper [10].

Planar or defocused (soft-focused) waves are produced by some electromagnetic and electrohydraulic generators. Planar waves have the same physical characteristics of radial waves but deliver the energy to a larger surface area. The depth of penetration will obviously be lower and, therefore, therapeutic use is limited [11].

Acoustic wave therapy is effective in treating cellulite through remodeling of skin collagen. This effect can be corroborated by measuring the microstructure of the skin using high frequency ultrasound (collagenoson) as well as by taking a histopathologic samples. On this sample, an amazing induction of neocollagenogenesis and neolastino-genesis is observed within the scaffolding fabric of dermis resulting in increased in the thickness of the dermis [12].

Enlarged fat cells push the skin up and compress the circulatory system reducing inflow of nutrients and outflow of waste products. Diminished exchange in circulatory processes leads

to gradual stiffening of the connective tissue, pulling down on the skin causing the push-pull effect that creates the appearance of Cellulite The mechanical action of acoustic waves disrupts the connective tissue to firm and smooth the skin; causes neovascularization, improving circulatory exchange (which is the root cause of the problem; initiates an inflammatory process in the skin, leading to thicker, more elastic skin through collagen production. The elasticity of the connective tissue is restored and the skin is smoother. The skin is thicker and more elastic with noticeable improvement in the skin's texture[13].

So, the purpose of this study was designed to differentiate between two types of acoustic mechanical waves radial and planar

Subjects, Instrumentations and Methods

Subjects:

Sixty female patients with cellulite Grade 3 according to cellulite grading scale post liposuction at their thighs participated in this study. Their ages ranged from 25 to 45 years. They were selected from the Outpatient Clinic of Plastic Surgery Department at Cairo University Hospitals. Patients were randomly subdivided into two equal groups, each group consisted of 30 patients, the first was planar group and the second group was radial group. Measurements were conducted before starting the treatment, after 6 weeks and at the end of treatment after 12 weeks.

The patients were selected with inclusion criteria including females who were non-pregnant and their ages ranged from 25 to 45 years. All patients were free from any pathological condition that might affect the

results. All patients were conscious and cooperative. The females who had one or more of the following criteria were excluded from the study: pregnant, breast feeding, diseases of the skin, thrombosis or post-thrombosis syndrome, known malignoma or chemotherapy, anti-coagulation therapy, cortisone-therapy, known metabolic disorders (ie, diabetes mellitus, hyper-cholesterolemia, etc.), inflammation within treatment area, other simultaneous treatment of cellulite, and morbid obesity (BMI>40). All patients received a good explanation of treatment and measurement devices.

The planar group composed of 30 female patients who had cellulite grade 3 at the thigh area post liposuction according to cellulite grading scale [14 and 15], and they were received planar acoustic wave therapy (1600 shots horizontal and 1600 shots vertical, 2 times per week for 12 weeks).

The radial group composed of 30 female patients who had cellulite grade 3 at the thigh area post liposuction according to cellulite grading scale [14 and 15], and they were received radial acoustic wave therapy (1500 shots horizontal and 1500 shots vertical, 2 times per week for 12 weeks).

3. Procedures

3.1. Evaluation

Cellulite was assessed by :

3.1.1. Cellulite grading scale: A simple grading-score of cellulite by inspection [14 and 15] (table 1)

Table(1): Cellulite Grading scale [14 and 15].

Grade	
0	<ul style="list-style-type: none"> ▪ Smooth surface of skin while lying down and standing. ▪ Wrinkles upon pinch-test
1	<ul style="list-style-type: none"> ▪ Smooth surface of skin while lying down and standing. ▪ Mattress phenomenon upon

	<ul style="list-style-type: none"> pinch-test ▪ Smooth surface of skin while lying down
2	<ul style="list-style-type: none"> ▪ Mattress-phenomenon spontaneously while standing
3	<ul style="list-style-type: none"> ▪ Mattress-phenomenon spontaneously while standing and lying down

3.1.2. Skin fold caliper to measure skin fold in Centimeter :

A device which measures the thickness of a fold of skin with its underlying layer of fat. By doing this at key locations, shown by research to be representative of the total amount of fat on the body, it is possible to estimate total percent fat of a person [16]. It is made in U.S.A. It is a small, simple and inexpensive plastic caliper that is surprisingly accurate and reliable. The caliper also has a unique feature that of a sliding marker that will remain after testing each site so that examiner can check your measurement before resting it. Purchase a skin fold caliper and then choose vertical fold midway between knee and top of thigh. Pinch the skin at your chosen site with your fingers, grasping skin and adipose tissue but not muscle (the muscle will be denser and more firm than skin and adipose tissue). Try it as many times as necessary to get a feel of the tissues. Apply the caliper on centimeter below your fingers and right angle to the skin surface. Take your measurement after waiting two seconds with the calipers engaged, then release and take another measurement, averaging two values.

3.2. Treatment

Both groups received different mechanical acoustic waves. Acoustic wave equipment developed by Swiss Company (storz medical AG) for generation of high energy sound waves (pressure waves or shock waves) in the fields of cosmetics. Acoustic wave

equipment composed of the following parts:

Touch screen: Press the button on posterior aspect of the equipment to open the screen then adjust energy level, applicators used, number of shots by touching the screen.

Manual Applicator C-Actor: Produces planar waves.

Manual Applicator D-Actor: Produces radial waves.

Planar group received planar acoustic wave therapy by C-Actor applicator (Planar waves. Each treatment region covered an area about 20x30 cm (Typically front or back of one thigh) which was scanned using C-actor applicator with dosage of 0.25 mJ/mm² (energy flux density), frequency 15 hz and 3200 shots in both horizontal (1600 shots) and vertical (1600 shots) directions for 20 min , 2 times per week for 12 weeks [17].

Radial group received radial acoustic wave therapy by D-Actor applicator (radial waves). Each treatment region covered an area about 20x30 cm (Typically front or back of one thigh) which was scanned using D-actor applicator with dosage of 2.6–3.6 bar that corresponds to an energy flux density of 0.16 mJ/mm² (energy flux

density), frequency 15 hz and 3000 shots in both horizontal (1500 shots) and vertical (1500 shots) directions for 20 min, 2 times per week for 12 weeks [18].

All measurements of each patient were taken before, after 6 weeks, and at the end of treatment after 12 weeks.

4. Statistical analysis:

The collected data of cellulite grading scale and skin fold caliper of both groups were statistically analyzed to differentiate between the effects of radial waves versus planar waves in female patients with cellulite on their thighs post liposuction. The mean, the standard deviation and the standard error will be calculated for each group in the study. The mean, the standard deviation and range were used as primary source of connecting facts about each parameter to measure central tendency. Paired T-test was used to compare within each group and to detect significance level between 2 groups (comparison). The statistical package for social science (SPSS) was utilized for data analysis and the level of significance will be set at the 0.05 level.

RESULTS

5. Results

5.1. Descriptive data of both groups (planar and radial):

The mean age (\pm SD) of the planar group were 37.86 \pm 5.47 years,

and that of the radial group were 38.8 \pm 4.93 years. There were no significance differences ($p > 0.05$) between both groups in age.

Table (2): Comparison between mean patient ages between both groups of the study:

Item	Planar group		Radial group			t-value	p-value	Sig	
	$\bar{X} \pm SD$	Range		$\bar{X} \pm SD$	Range				
		Min	Max		Min				Max

Age (years)	37.86±5.47	27	45	38.8±4.93	25	44	0.49	0.62	NS
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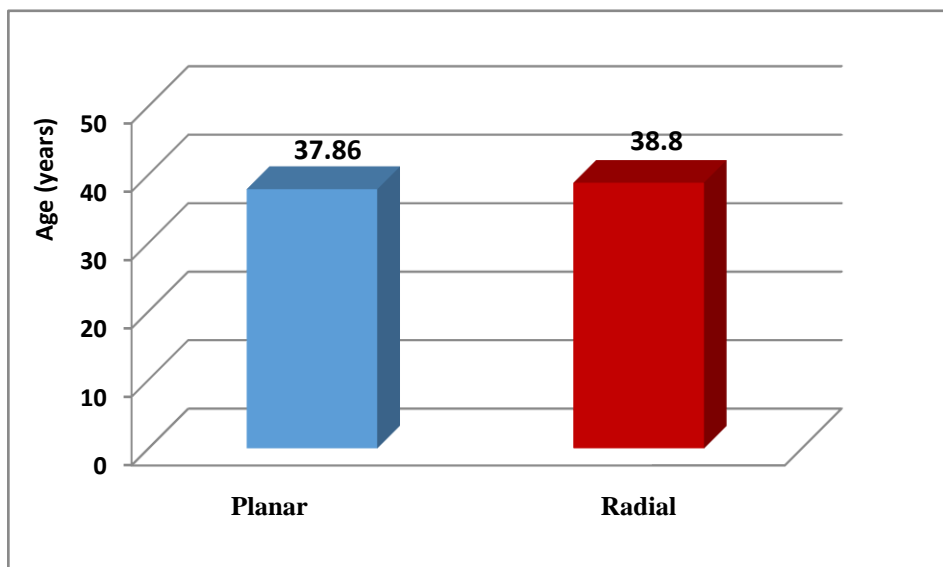


Fig (1): mean values of patient 's ages for both groups (planar and radial groups)

5.2. Comparison between groups pre treatment:

5.2.1. Pre treatment mean values of Cellulite grading scale for both groups (planar and radial):

Patients in both groups were selected with cellulite Grade 3 at their thighs. The mean value of cellulite grading scale ± SD for radial and planar groups was 3± 0. The mean difference between both groups was zero indicating no difference between radial and planar group in cellulite grading scale.

Table (3): Comparison between pre treatment mean values of cellulite grading scale of planar and radial group

Item	Cellulite grading scale	MD
	X ±SD	
Planar	3 ± 0	0
Radial	3 ± 0	

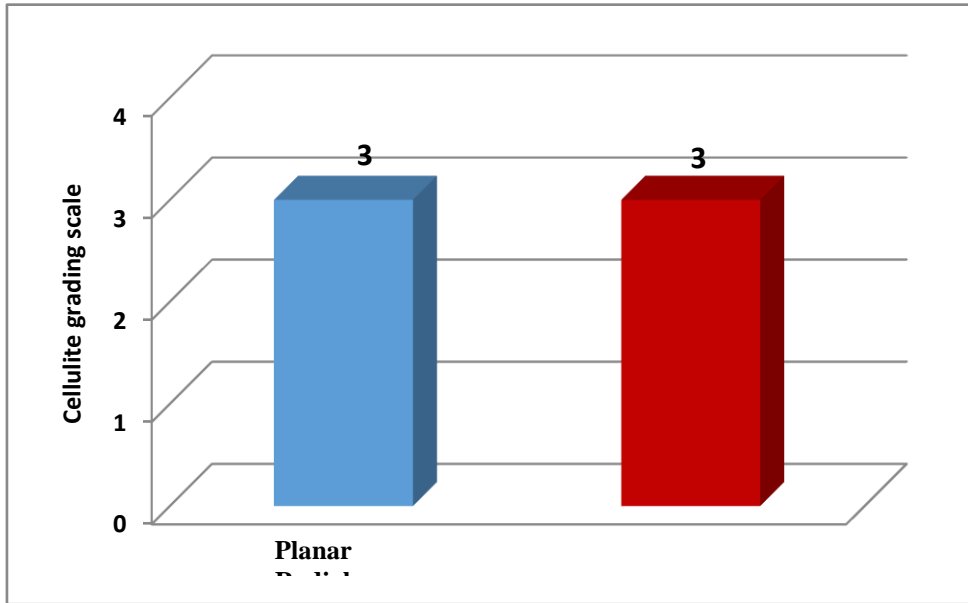


Fig (2): Pre treatment mean values of cellulite grading scale for Planar and radial groups.

5.2.2. Mean values of cellulite grading scale before and after treatment for planar group:

The mean values \pm SD of cellulite grading scale before application of planar acoustic waves was 3 ± 0 while after application of planar acoustic waves was 2.8 ± 0.4 . The

mean difference was 0.2 and the percent of improvement was 7.14 %. There was no significant difference ($P=0.08$) between pre and post treatment in cellulite grading scale. (Table 4, figure 3).

Table (4): Comparison between pre and post treatment mean values of cellulite grading scale for planar group:

Item	Cellulite grading scale	MD	% of improvement	t- value	p-value	sig
	X \pm SD					
Pre	3 \pm 0	0.2	7.14%	1.87	0.08	NS
Post	2.8 \pm 0.4					

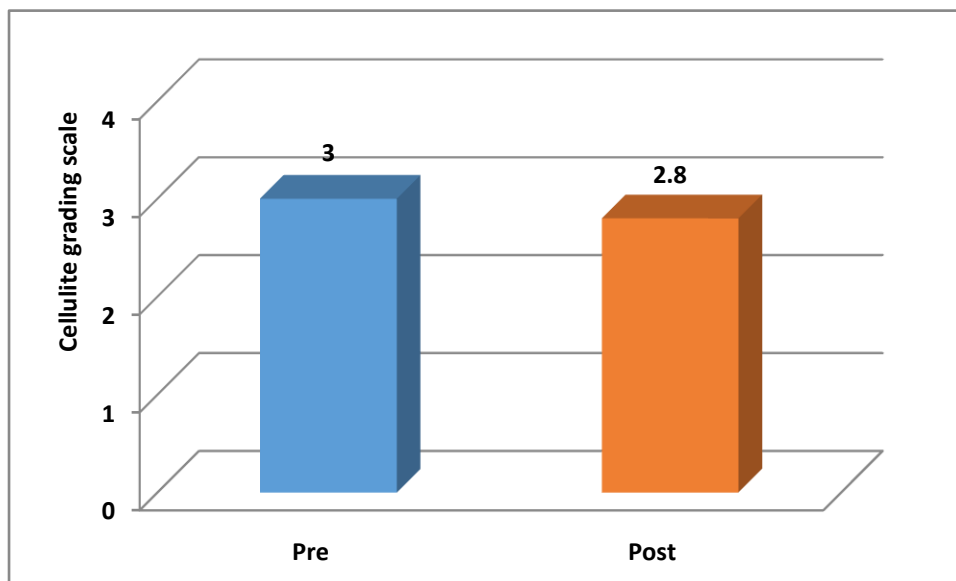


Fig (3): Pre and post treatment mean values of cellulite grading scale in planar group.

5.2.3 Mean values of cellulite grading scale before and after treatment for radial group:

The mean values \pm SD of cellulite grading scale before application of radial acoustic waves was 3 ± 0 while after application of radial acoustic waves wave was 0.86 ± 0.74 .

The mean difference was 2.14 and the percent of improvement was 71.33 %. There was significant difference ($P=0.0001$) between pre and post treatment in cellulite grading scale. (Table 5, figure 4).

Table (5): Comparison between pre and post treatment mean values of cellulite grading scale for radial group:

Item	Cellulite grading scale	MD	% of improvement	t- value	p-value	sig
	$\bar{X} \pm SD$					
Pre	3 ± 0	2.14	71.33%	11.11	0.0001	S
Post	0.86 ± 0.74					

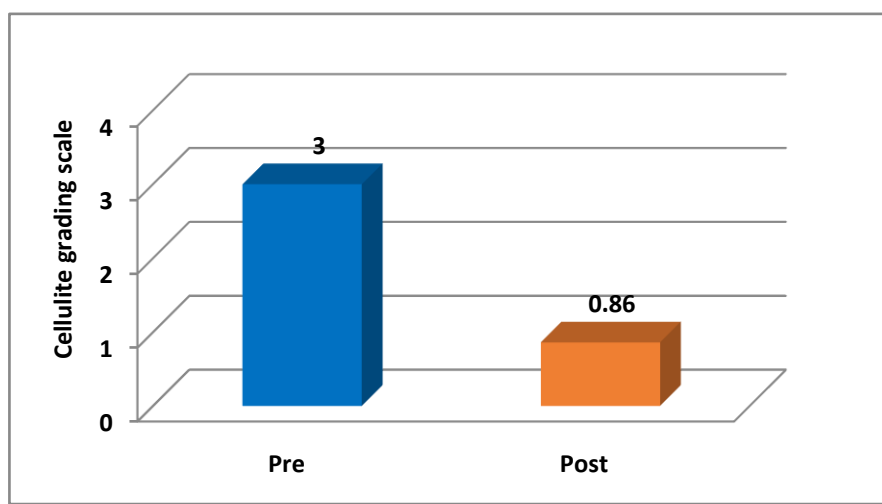


Fig (4): Pre and post treatment mean values of cellulite grading scale in radial group.

5.2.4. Post treatment mean values of Cellulite grading scale for both groups (planar and radial):

The mean value \pm SD of cellulite grading scale after treatment for planar group was 2.8 ± 0.4 and that for radial group was 0.86 ± 0.74 . The

Table (6): Comparison between post treatment mean values of cellulite grading scale for planar and radial groups:

Item	Cellulite grading scale	MD	% of improvement	t-value	p-value	sig
	$\bar{X} \pm SD$					
Planar	2.8 ± 0.4	1.94	69.28%	8.80	0.0001	S
Radial	0.86 ± 0.74					

mean difference between both groups was 1.49. There was significant difference ($p = 0.0001$) between radial and planar group in cellulite grading scale post treatment. (Table 6, figure 5).

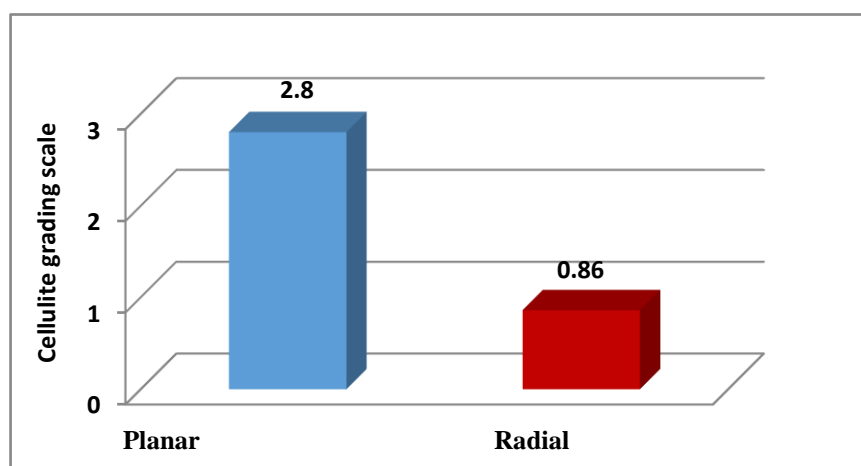


Fig (5): Post treatment mean values of cellulite grading scale in planar and radial groups.

5.3. Skin fold assessment

5.3.1. Pre treatment mean values of skin fold for both groups (planar and radial):

The mean value \pm SD of skin fold (cm) before treatment for planar group was 8.14 ± 0.45 (cm) and that for

radial group was 8.41 ± 0.41 (cm). The mean difference between both groups was -0.27 . There was no significant difference ($p = 0.11$) between planar and radial group in skin fold before treatment as assessed by skin fold calipers. (Table 7, figure 6).

Table (7): Comparison between pre treatment mean values of skin fold (cm) of planar and radial group:

Item	Skin Fold	MD	t- value	p-value	sig
	$\bar{X} \pm SD$				
Planar	8.14 ± 0.45	-0.27	-1.64	0.11	NS
Radial	8.41 ± 0.41				

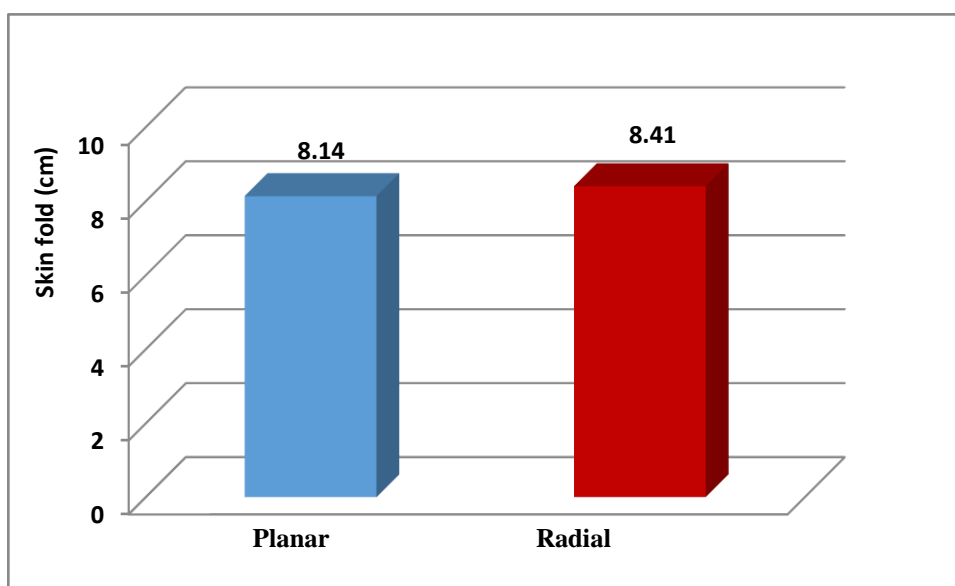


Fig (6): Pre treatment mean values of skin fold (cm) in planar and radial group.

5.3.2: Mean values of skin fold before and after treatment for planar group:

The mean values \pm SD of skin fold (cm) before application of planar acoustic wave was 8.14 ± 0.45 cm. while after application of planar acoustic waves was 8.05 ± 0.52 cm.. The mean

difference was 0.09 and the percent of improvement was 1.10% . There was no significant difference ($P = 0.09$) between pre and post treatment in skin fold (cm). (Table 8, figure 6).

Table (8): Comparison between pre and post treatment mean values of skin fold for planar group:

Item	Skin fold (cm)	MD	% of improvement	t- value	p-value	sig
	$\bar{X} \pm SD$					
Pre	8.14 \pm 0.45	0.09	1.10%	1.79	0.09	NS
Post	8.05 \pm 0. 52					

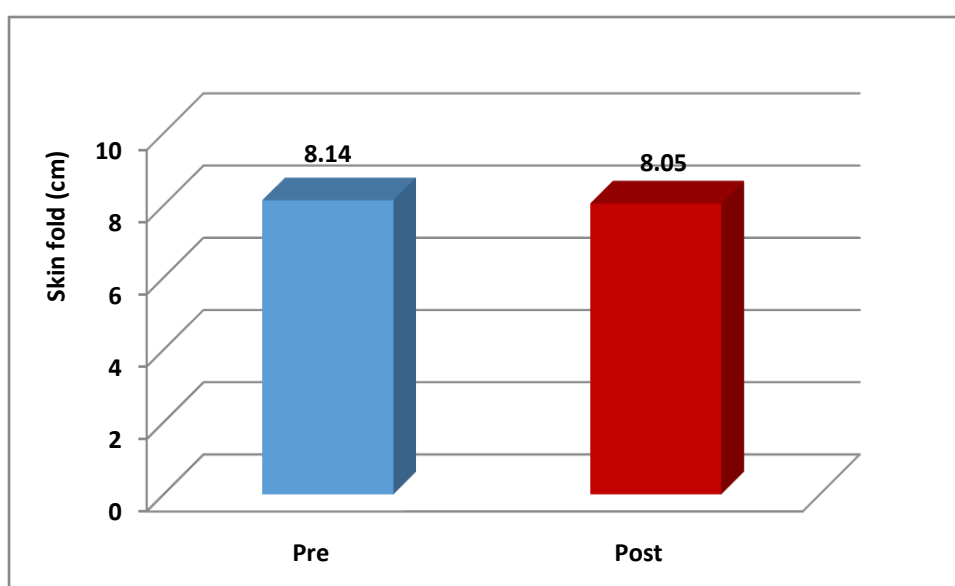


Fig (7): Pre and post treatment mean values of skin fold (cm) in planar group.

5.3.3: Mean values of skin fold before and after treatment for radial group:

The mean values \pm SD of skin fold (cm) before application of radial acoustic waves was 8.41 \pm 0.41 cm while after application of radial acoustic

waves was 6.38 \pm 0.40 cm. The mean difference was 2.03 and the percent of improvement was 24.13 %. There was significant difference (P=0.08) between pre and post treatment in skin fold (cm). (Table 9, figure 8).

Table (9): Comparison between pre and post treatment mean values of skin fold for radial group:

Item	Skin fold (cm)	MD	% of improvement	t- value	p-value	sig
	$\bar{X} \pm SD$					
Pre	8.41 \pm 0.41	2.03	24.13%	25.32	0.0001	S
Post	6.38 \pm 0. 41					

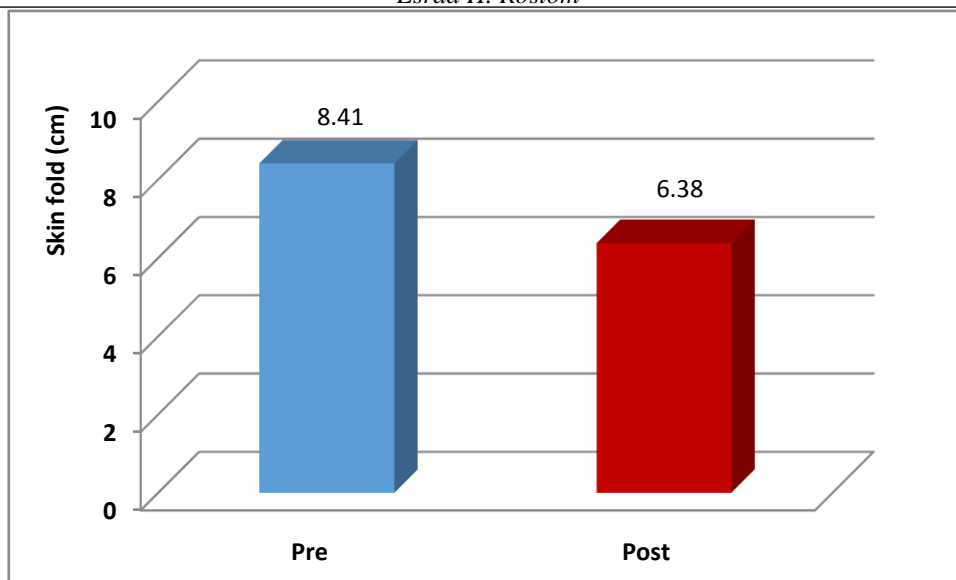


Fig (8): Pre and post treatment mean values of skin fold (cm) in radial group.

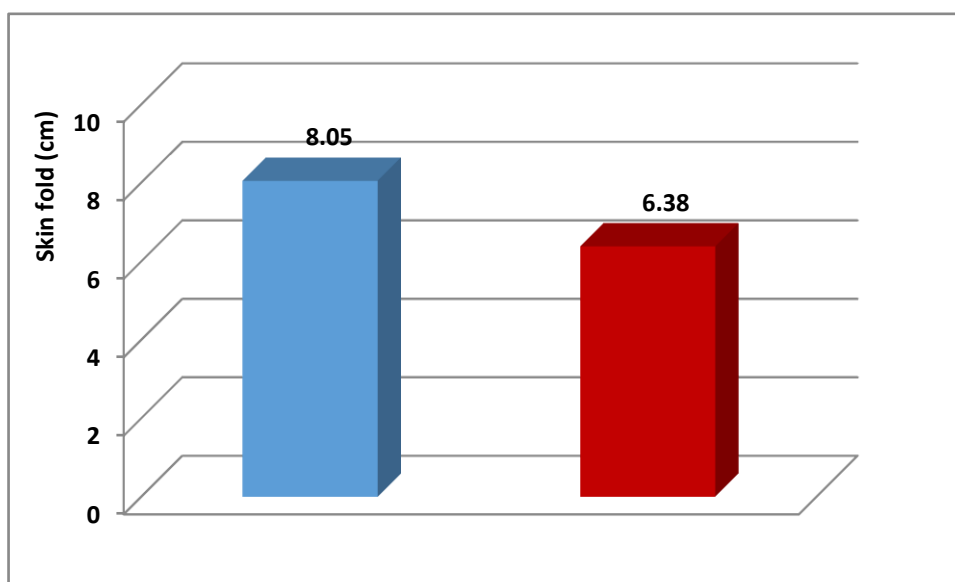
5.3.4. Post treatment mean values of skin fold for both groups (planar and radial):

The mean value \pm SD of skin fold (cm) after treatment for planar group was 8.05 ± 0.52 and that for radial group was 6.38 ± 0.41 . The mean

difference between both groups was 1.67. There was a significant difference ($p= 0.0001$) between radial and planar group in skin fold (cm) post treatment. (Table 10, figure 9).

Table (10): Comparison between post treatment mean values of skin fold (cm) of planar and radial groups:

Item	Cellulite grading scale	MD	% of improvement	t-value	p-value	sig
	X \pm SD					
Planar	8.05 ± 0.52	1.67	20.74%	9.43	0.0001	S
Radial	6.38 ± 0.41					



Planar

Radial

Fig (9): Post treatment mean values of skin fold in planar and radial groups.

DISCUSSION

Liposuction actually worsens the dimpled skin appearance. Thus, Avram and Van Vliet don't recommend liposuction as a cellulite treatment [2 and 19].

Cellulite the aesthetically disturbing dimpling of the skin commonly occurs in the thighs and buttocks affecting most post-adolescent woman of all races-Incipient. Cellulite is recognized by an "orange peel" aspect while full blown cellulite is characterized by a dimpled skin surface [20].

In addition to "exercise and weight loss" which require determined personal commitment there are currently no scientifically proven treatments for cellulite, except perhaps for two active substances ,caffeine and retinol, applied topically and endermology [21,22 and 23].

Acoustic waves application is a new approach for the treatment of lipidema and cellulite; it represents an easy to handle, non-invasive, side effects free, local therapy type with

short application periods. The original idea was to stimulate lipid mobilization and lipolysis in edematous regions [24]

Acoustic wave therapy is assumed to reduce significantly existing disorders of the skin by stimulating microcirculation in fat tissue. Acoustic waves tailored specifically for application to the subcutis have only minimal side effects such as minor pain during therapy or slight skin reddening [18].

Acoustic waves are effective in disrupting the sclerotic fibrous tissue septae responsible for much of uneven appearance of cellulite. Acoustic wave therapy has also been demonstrated to increase the thickness of the reticular dermis and decrease the protrusion of fat into the reticular dermis [25].

Radial acoustic waves were effective in disrupting the sclerotic fibrous tissue septa responsible for appearance of cellulite. Radial wave therapy has also been demonstrated to increase the thickness of the reticular dermis and decrease the protrusion of fat into the reticular dermis [26].

Planar acoustic waves were effective in improving skin elasticity. Planar waves have effects on biologic tissue including stimulation of microcirculation and improvement of cell permeability[18].

Kathrina et al., [27] applied a pilot study to assess the efficacy of radial acoustic wave treatment on cellulite. Eleven female patients with cellulite on thigh and buttocks were participated in this pilot study. One thigh and buttock are treated and then compared to the untreated side. Treatments were performed with radial acoustic wave module D-Actor (radial pulse). Six treatments were given every 7days, were used at 3 bar the maximal tolerated pressure, 10Hz, 2000 pulsed applied for the upper Leg and buttock. The Results proved that radial acoustic waves are effective and safe to treat cellulite. No side effects were seen. Patient's satisfaction and acceptance is high. The comparison of the circumference of upper leg treated versus untreated side showed significant decrease on treated side eventhough a general loss of body weight was seen.

Furthermore Sattler et al. [13] investigated 3 groups of 30 female patients with cellulite on their thighs. First group was treated with radial waves only, second group was treated with planar waves only, and third group was treated with combination of both radial and planar waves. Among the women of planar waves group, the results were perceived as being less convincing whereas majority of women who were treated with radial waves sensed a pronounced result. For the combination treatment, the results fell in the middle between the two treatments. This study concluded that radial waves therapy was the

preferable strategy for the treatment of cellulite because the results achieved from this method were the clearest in terms of both appearance and sensation. It was proved that radial acoustic waves improved microcirculation and increased lipolysis

Also Bill and Johnson [26] investigated using radial acoustic wave therapy in the treatment of cellulite by using a ballistic pressure head (D-Actor). The treated area was defined as 20× 30 cm area (typically the front or back of one thigh). Each area received 6 sessions (2/week for 3 weeks) Consisting of 1000 vertical pluses and 1000 horizontal pluses. The study confirmed that radial acoustic waves were effective in disrupting the sclerotic fibrous tissue septa responsible for appearance of cellulite. Acoustic wave therapy has also been demonstrated to increase the thickness of the reticular dermis and decrease the protrusion of fat into the reticular dermis.

In addition Brenke et al. [28] investigated Fifty-nine women with advanced cellulite and divided them into two groups; first group of 15 patients received planar waves for 6 therapy sessions within 3 weeks, and second group of 44 patients received planar waves for 8 therapy sessions within 4 weeks. Changes in connective tissue were evaluated using the Derma Scan ultrasound system. Skin elasticity measurements were performed using the Derma Lab system. Photographs of treated areas were taken at each therapy session and at follow-up sessions. The study showed that Skin elasticity values gradually improved over the course of planar waves therapy. Treatment was most effective in older patients with a long history of cellulite.

Furthermore Christ et al. [18] investigated effect of planar acoustic

waves on skin elasticity. The study included 59 women with pronounced cellulite (stage 2-3 in the pinch test). They were subdivided into 2 groups, first group of 15 patients received Planar acoustic waves for 6 sessions, second group of 44 patients received planar acoustic waves for 8 session. Skin elasticity measurements were performed derma lab system. Results showed improvement in skin elasticity. Planar acoustic wave therapy caused stimulation microcirculation and improvement of cell permeability.

Also Tagerwilen [29] applied a study of 69 women with pronounced cellulite (stage 2-3) as measured by pinch test. The aim of the study is to find out whether and how radial wave therapy mobilizes the metabolism activity in the subcutaneous fatty tissue which strengthens tissue structure while visibly reducing cellulite along with it. Radial acoustic waves were applied on the outer and inner thigh region and gluteal region using cellactorsc1. This study suggested that radial acoustic wave treatment worked by stimulating the microcirculation in fatty tissue and producing marked improvement in fat metabolism. Fibroblasts and fat protrusions in the lower dermis were dissolved by the radial waves and dislodged from the upper layer of skin. As a result, the upper layer became smoother in appearance. At the same time, the tissue became firmer and the elasticity of the skin was measurably improved. In addition, blood circulation as well as lymph flow was boosted by radial wave therapy, Which tightened skin and achieved a comprehensive reduction of the treated body region.

Meanwhile Anghern et al.[9] investigated the effects of radial acoustic waves on collagen structure of cellulite afflicted skin. Cellulite measurement using high-resolution ultrasound technology was performed before and after low-energy defocused radial wave therapy in 21 female subjects with cellulite. Skin of lateral left and right thigh treated with 40000 shots onto surface of 160 cm² per side (shots homogenously distributed by partitioning 160 cm² into 8 times 5 squares of 4 cm² with 100 shots per square). The Results of this study provided evidence that radial wave therapy caused remodeling of the collagen within the dermis of the tested region. Also lipid peroxidation products were released demonstrating the sclerosis-preventing effect of radial acoustic wave therapy that caused smoothening of dermis and hypodermis.

In addition Siems et al. [7] confirmed that the application of acoustic pulses leads to short term cell permeability increase. This cell permeability stimulates the exchange of substances of fat cells and activates fat-splitting enzyme (phospholipases) through the beta receptors on the fat cell membrane. These results were confirmed through the study applied on the gluteal and femoral regions of 69 female patients with cellulite grade 3. Some patients received planar waves through C-Actor (3200 pulses were applied for treated regions) and others received radial waves through D-Actor (4000 pulses were applied for treated regions). Each treated region had a size of approximately 20 by 30 cm. Treatment was performed by scanning the treated region with the applicator in both vertical and horizontal

directions to ensure uniform tissue treatment.

Acoustic waves are effective in disrupting the sclerotic fibrous tissue septae responsible for much of uneven appearance of cellulite. Acoustic wave therapy has also been demonstrated to increase the thickness of the reticular dermis and decrease the protrusion of fat into the reticular dermis [10]

Many articles have described potential mechanisms for acoustic wave to reduce cellulite. Research has suggested acoustic waves are effective in disrupting the sclerotic fibrous tissue septae responsible for much of the uneven appearance of cellulite[25]. However other effects have been postulated;.Angehrn et al. said acoustic wave therapy stimulated the metabolism of fat cells and increased expression of vascular endothelial growth factor, endothelial nitric oxide synthase, and proliferating cell nuclear antigen[12]. Christ et al. said reduced oxidative stress[18]. Kuhn et al. described induction of neocollagenogenesis and ne elastinogenesis[30]. Ferraro et al. thought increased angiogenesis and apoptosis of fat cells triggered by inflammation, and activation of C nerve fibers in the skin and release of substance P according to Schlaudraff et al. [31 and 32].

5. Conclusion

In this study, it can be concluded that radial waves have a significant improvement on cellulite post liposuction more than planar waves, measured by cellulite grading scale and skin fold caliper.

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المخلص

الموجات البلانارية مقابل الموجات الريديالية على السليولايت بعد شفت الدهون

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قسم العلاج الطبيعى للجراحة ، كلية العلاج الطبيعى ، جامعة القاهرة
الخلفية: السليولايت هو تغيير فى سطح الجلد يمكن أنيؤديالى مشاكل جمالية وصحية. شفت الدهون
يسبب تفاقم في مظهر الجلد المدمل والسليولايت.

الغرض من هذه الدراسة: المقارنة بين الموجات البلانارية مقابل الموجات الريديالية على
السليولايت بعد شفت الدهون

الوسائل : تم تقسيم ستين مريضة من النساء تعانى من السليولايت الدرجة الثالثة بعد شفت الدهون
عشوائيا إلى مجموعتين متساويتين فى العدد (المجموعة الأولى البلانارية و المجموعة الثانية
الريديالية). وتضمنت طريقة التقييم تحديد درجة السليولايت الموجودة وقياس سمك الجلد لكل
مريض. تلقت المجموعة الأولى الموجات البلانارية مرتين بالأسبوع لمدة 12 أسبوع ، بينما تلقت
المجموعة الثانية الموجات الريديالية مرتين بالأسبوع لمدة 12 أسبوع.

النتائج: أظهرت نتائج هذه الدراسة تحسن كبير في درجة السليولايت الموجودة وقياس سمك الجلد
في مجموعة الموجات الريديالية مقارنة بمجموعة الموجات البلانارية.

الاستنتاج: تم استنتاج أن الموجات الريديالية كانت اكثر فعالية علاجية من الموجات البلانارية في
السيطرة على السليولايت عن طريق خفض درجة السليولايت وتحسين مظهره.

كلمات البحث: السليولايت، العلاج بالموجات الصوتية، الموجات البلانارية، الموجات الريديالية.