

Manual Lymphatic Drainage Versus Pneumatic Compression Pump on Cellulite Post Liposuction

AMANY R. SHAFIK, M.Sc.*; HAIDY N. ASHAM, Ph.D.*; SAMEH M. EL-TAHER, Ph.D.** and
ESRAA H. ROSTOM, Ph.D.*

The Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University and
The Department of Plastic Surgery, Faculty of Medicine, Ain Shams University***

Abstract

Background: The presence of cellulite is an aesthetically unacceptable cosmetic problem for most post-adolescent women that can appear post liposuction, it is characterized by dimpled or puckered skin. Manual lymphatic drainage and pneumatic compression pump may be effective in improving cellulite after liposuction.

Aim of Study: This study is conducted to compare the effect of manual lymphatic and pneumatic compression pump on cellulite in females post liposuction.

Subjects and Methods: Thirty female patients with cellulite grade 3 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 and were divided into two equal groups, each group consisted of 15 patients. Group (A) received manual lymphatic drainage and walking on treadmill three times per week for 8 weeks. Group (B) received pneumatic compression pump and walking on treadmill three times per week for 8 weeks. Methods of evaluation are cellulite grading scale and thigh circumference.

Results: There was a significant decrease in severity of cellulite in manual lymphatic drainage group when compared with pneumatic compression group.

Conclusion: Manual lymphatic drainage is superior to pneumatic compression pump in the treatment of cellulite.

Key Words: Liposuction – Cellulite – Manual lymphatic drainage – Pneumatic compression pump – Aerobic exercises.

Introduction

CELLULITE is a structural, inflammatory, and biochemical disorder of the subcutaneous tissue that causes alterations in skin topography. Such

changes derive in skin protrusions and depressions, mainly localized in the buttocks, lower limbs, pelvic region, and abdomen this problem concerns 85-98% of women, and for them it is one of the most intolerable aesthetic imperfections [1].

As well as Liposuction is a cosmetic procedure that uses suction to remove exercise and diet resistant fat. It is also used to contour specific areas of the body like the hips, buttocks and thighs [2].

Liposuction is one of the more common causes of cutaneous surface alterations that are clinically similar to depressed lesions of cellulite, depressed lesions of liposuction cause secondary cellulite or aggravate cellulite [3]. Also the reasons for the formation of cellulite include genetic factors, hormonal disturbances, and disturbances of lymph and blood circulation, dietary habits, psychological factors, pregnancy, sedentary lifestyle and alcohol [4].

Upon clinical examination of cellulite the following symptoms can be noticed presence of the typical orange peel skin upon normal visual examination and after pinching of the skin, dimpled or puckered skin can be seen on the buttocks and posterior and lateral thighs. Deep palpation of the skin reveals differences in the mobility of fat tissue and presence of micro and macro nodules and fibrosclerosis irregularities, in skin surface temperature: Touching the skin reveals the presence of cold spots sometimes presence of painful subcutaneous nodules through deep palpation [5].

Cellulite affects most women's psychosocial sphere because it is directly and inexorably related to the physical appearance, self-esteem, and, consequently to the well-being perception and social

Correspondence to: Dr. Amany R. Shafik, The Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University

acceptance. Thus, the main reason to look for a treatment for Cellulite is its esthetic appearance [1].

Manual lymphatic drainage is a technique that aim to stimulate the lymphatic system, reducing fluid excess, and eliminating metabolic waste. The cellulite seems to be related to metabolic changes and fluid accumulation in dermal connective tissue leading to the worsening of anatomical characteristics, manual lymphatic drainage may be beneficial in the control of this condition. Manual lymphatic drainage is a safe massage technique that does not cause discomfort [6].

While pneumatic compression represents a recognized therapeutic procedure that its periodic compression exerted on tissues of affected extremity facilitates lymph flow to collecting lymphatic vessels so it contributes to decrease cellulite problem [7].

Subjects and Methods

The study was conducted for four months from August 2018 to November 2018. Post liposuction thirty female patients with Grade 3 cellulite at their thighs participated in this study. Patients were selected from the outpatient clinic of Plastic Surgery Department at Cairo University Hospitals. Their ages ranged from 25 to 45 years. Patients were randomly subdivided into two equal groups, each group consisted of 15 patients.

Group A: This group composed of 15 females with cellulite grade 3 at thigh area and they received manual lymphatic drainage and aerobic exercises in form of walking on treadmill.

The treatment was conducted for 8 weeks (3 times per week).

Group B: Fifteen females patients with cellulite grade 3 at the thigh area and they received pneumatic compression pump and aerobic exercises.

The treatment was conducted for 8 weeks (3 times per week).

The potential participants were excluded if they were pregnant, breast feeding. Diseases of the skin, inflammation within treatment area, thrombosis or post-thrombosis syndrome, known malignoma, known metabolic disorders (i.e, diabetes mellitus hyper-cholesterinemiaetc.), morbid obesity (BMI >40) or received chemotherapy, anti-coagulation therapy, cortisone-therapy and other simultaneous treatment of cellulite.

Equipments used: The main equipment's used in this study were classified into two types:

1- *Measurement tools:* Cellulite was assessed by:

Cellulite grading scale: A simple grading-score of cellulite was used by inspection. It consists of 4 grades for assessment of cellulite [8,9].

- *Thigh circumference:* Flexible ruler that was wrapped around the predetermined sites of the subject thigh to determine thigh circumference [10].

2- *Therapeutic equipment:*

- *Manual lymphatic drainage:* It consists of hand motions that made by the therapist on the skin and subcutaneous tissue of the patient. Applied pressure was very soft from distal to proximal [11].
- *Pneumatic compression pump:* (Made in Japan. 220V, 50/60HZ, 25/23 W. Rated 30min. No 60200357).

Pneumatic compression device consists of two inflatable garments for the arms or the legs and an electrical pneumatic pump that fills the garment with compressed air, the garment is intermittently inflated and deflated with cycle times and pressures [12].

- *Treadmill:* Treadmill was used for aerobic exercises for both groups. It is made in china, 220V, 150HZ, input power is 2.6HP, No:6662 [13].

Procedures of the study:

A verbal explanation about the importance of this study procedure, main aims and conceptual approach were explained to every patient.

The procedures of this study was divided into two main procedures:

1- *Measurement procedures:*

- *Cellulite grading scale:* It is used to assess the grade of cellulite, it consists of 4 grades [8,9].

Table (1):

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

- *Thigh circumference measurement:* At the first, the distance between the hip and knee was measured. Then at the midway of the distance between them a point was taken by a marker then sterilized tap was used to measure horizontal circumference of the thigh at this level. This measurement is taken pre-treatment and post-treatment to make comparison between them and to assess degree of improvement after treatment in Group A and Group B [10].

Measurements were taken before the treatment (pre-treatment) and after 8 weeks (post-treatment).

2- *Therapeutic procedures:*

Before treatment, all patients received full explanation to the purpose of the treatment, the therapeutic and physiological benefits of this method of treatment. Before starting the treatment, each patient was placed into comfortable position that allowed the vision of the treated area (supine lying position for treating the anterior thigh and prone lying position for treating the posterior thigh).

Manual lymphatic drainage was applied for Group (A). The treated limb wasn't covered with cloths and soft pressure of fingers and hands were used with movement from distal to proximal for 1 hour.

Pneumatic compression pump was applied to patients of Group (B) for 1 hour. The treated limb wasn't covered with cloths and was entered in specific sleeve, the device was switched on, then time (1 hour), pressure (the lowest pressure program 1), and mode (sequential) were detected then the start button was switched on. After the end of the session the device was switched off. Then the patients of both groups applied treadmill aerobic exercises for 30min this program applied three times per week for 8 weeks [11-13].

Statistical procedures:

Various statistical procedures were used: Descriptive statistics and *t*-test were used for comparison of the mean age, between both groups, mann-Whitney U-test was conducted to compare median values of cellulite grading scale between both groups, wilcoxon Signed Ranks Test was conducted for comparison between pre and post-treatment median values of cellulite grading scale in each group, *t*-test was conducted for comparison of thigh circumference between both groups and paired *t*-test was conducted for comparison of thigh circumference between pre and post-treatment in each group. The level of significance for all statistical tests was set at $p < 0.05$. All statistical measures

were performed through the Statistical Package for Social Studies (SPSS) Version 19 for windows [14].

Results

I- *Pre-treatment median values of cellulite grading scale of both Groups (A and B):*

The results of the pre-treatment showed that there was no significant difference in the median values of cellulite grading scale pre-treatment between Group A and B ($p=1$) (Table 2), Fig. (1).

Table (2): Comparison between pre-treatment median values of cellulite grading scale of Group A and B.

	Cellulite grading scale Median	U-value	p-value	Sig.
Group A	3	112.5	1	NS
Group B	3			

U-value : Mann-Whitney test value.
 p-value : Probability level.
 NS : Non Significant.

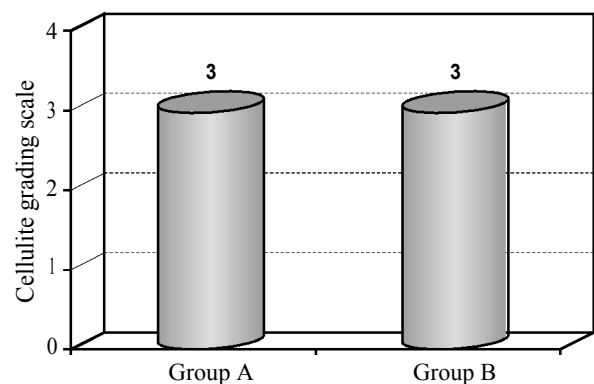


Fig. (1): Pre-treatment median values of cellulite grading scale of Group A and B.

II- *Pre and post-treatment median values of cellulite grading scale of Group A:*

The median value of cellulite grading scale pre treatment and post-treatment for the Group A showed that there was a significant decrease in the median values of cellulite grading scale post-treatment compared with pre-treatment ($p=0.0001$) (Table 3), Fig. (2).

Table (3): Comparison between pre and post-treatment median values of cellulite grading scale of Group A.

	Cellulite grading scale Median	Z-value	p-value	Sig.
Pre	3	3.57	0.0001	S
Post	1			

Z-value : Wilcoxon signed ranks test value.
 p-value : Probability level.
 S : Significant.

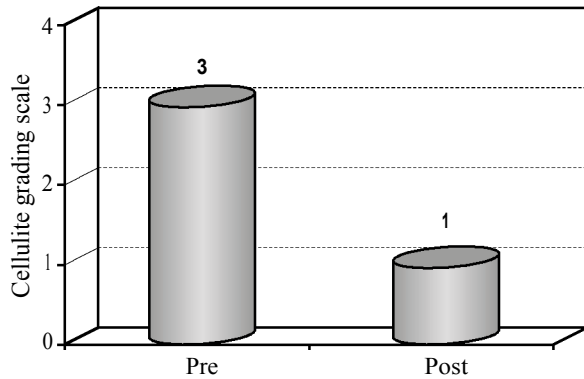


Fig. (2): Pre and post-treatment median values of cellulite grading scale of Group A.

III- Pre and post-treatment median values of cellulite grading scale of Group B:

The median value of cellulite grading scale pre-treatment and post-treatment for the Group B showed that there was a significant decrease in the median values of cellulite grading scale post-treatment compared with pre-treatment ($p=0.001$) (Table 4), Fig. (3).

Table (4): Comparison between pre and post-treatment median values of cellulite grading scale of Group B.

	Cellulite grading scale Median	Z-value	p-value	Sig.
Pre	3	3.41	0.001	S
Post	2			

Z-value : Wilcoxon signed ranks test value.
 p-value : Probability level.
 S : Significant.

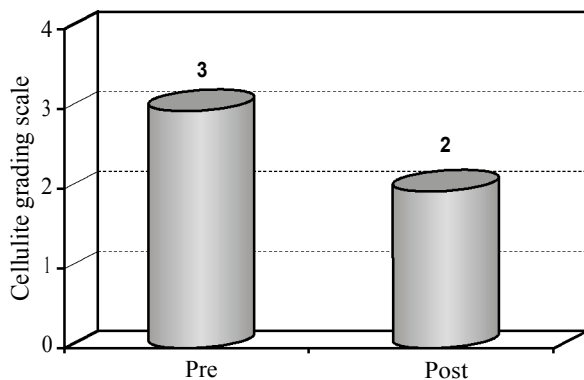


Fig. (3): Pre and post-treatment median values of cellulite grading scale of Group B.

IV- Post-treatment median values of cellulite grading scale of both Groups (A and B):

The median value of cellulite grading scale post-treatment showed that there was a significant decrease in the median values of cellulite grading scale of Group A compared with Group B post-treatment ($p=0.02$) (Table 5), Fig. (4).

Table (5): Comparison between post-treatment median values of cellulite grading scale of Group A and B.

	Cellulite grading scale Median	U-value	p-value	Sig.
Group A	1	65.5	0.02	S
Group B	2			

U-value : Mann-Whitney test value.
 p-value : Probability level.
 S : Significant.

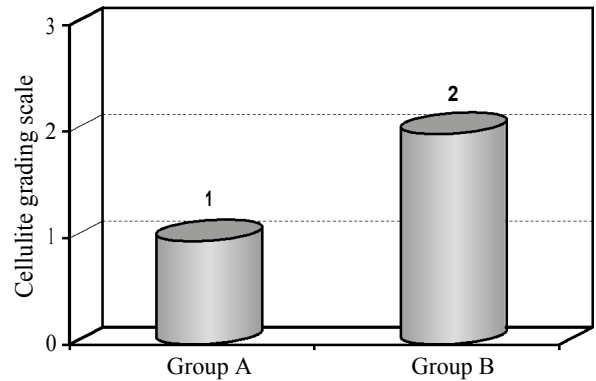


Fig. (4): Post-treatment median values of cellulite grading scale of Group A and B.

Results of thigh circumference:

I- Pre-treatment mean values of thigh circumference of both Groups (A and B):

Table (6) and Fig. (5) demonstrated that there was no significant difference in the thigh circumference between the Group A and B pre-treatment ($p=0.78$).

Table (6): Comparison between pre-treatment mean values of thigh circumference of Group A and B.

	Thigh circumference (cm) X ± SD	MD	t-value	p-value	Sig.
Group A	39.13 ± 4.8	-0.4	-0.27	0.78	NS
Group B	39.53 ± 3.04				

X : Mean. SD : Standard Deviation.
 MD : Mean Difference. t-value : Unpaired t-value.
 p-value : Probability value. NS : Non Significant.

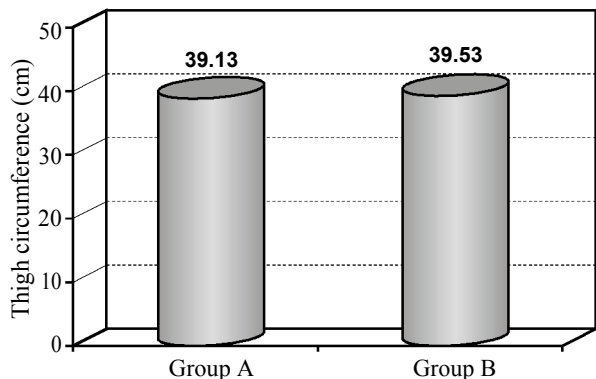


Fig. (5): Treatment mean values of thigh circumference of Group A and B.

II- Pre and post-treatment mean values of thigh circumference of Group A:

Table (7) and Fig. (6) demonstrated that there was a significant decrease in the thigh circumference post-treatment compared with pre-treatment ($p=0.0001$).

Table (7): Comparison between pre and post-treatment mean values of thigh circumference of Group A.

	Thigh circumference (cm) $\bar{X} \pm SD$	MD	% of Change	t-value	p-value	Sig.
Pre	39.13±4.8					
Post	33.86±4.4	5.27	13.46	19.75	0.0001	S

\bar{X} : Mean. SD : Standard Deviation.
MD : Mean Difference. t-value : Paired t-value.
p-value : Probability value. S : Significant.

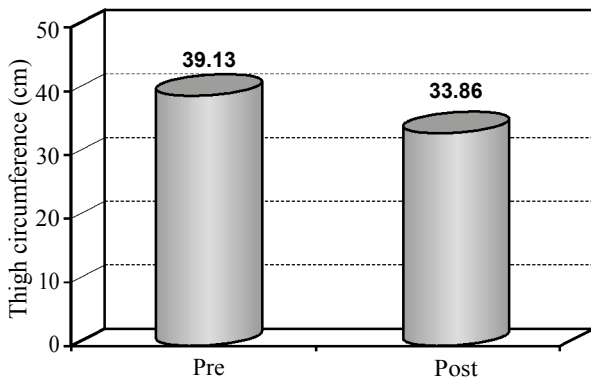


Fig. (6): Pre and post-treatment mean values of thigh circumference of Group A.

III- Pre and post-treatment mean values of thigh circumference of Group B:

Table (8) and Fig. (7) demonstrated that there was a significant decrease in the thigh circumference post-treatment compared with pre-treatment ($p=0.0001$).

Table (8): Comparison between pre and post-treatment mean values of thigh circumference of Group B.

	Thigh circumference (cm) $\bar{X} \pm SD$	MD	% of Change	t-value	p-value	Sig.
Pre	39.53±3.04					
Post	37.13±3.5	2.4	6.07	11.22	0.0001	S

\bar{X} : Mean. SD : Standard Deviation.
MD : Mean Difference. t-value : Paired t-value.
p-value : Probability value. S : Significant.

IV- Post-treatment mean values of thigh circumference of both Groups (A and B):

Table (9) and Fig. (8) showed that there was a significant decrease in the thigh circumference in the Group A compared with Group B post-treatment ($p=0.03$).

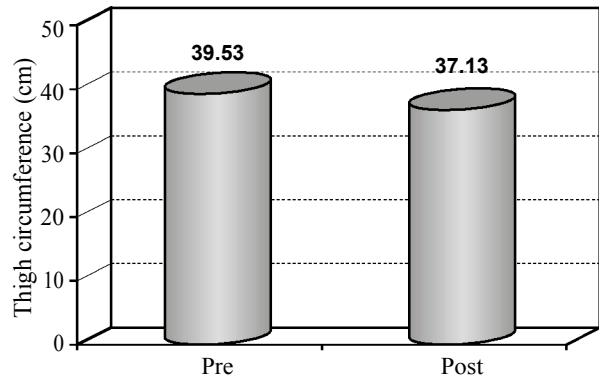


Fig. (7): Pre and post-treatment mean values of thigh circumference of Group B.

Table (9): Comparison between post-treatment mean values of thigh circumference of Group A and B.

	Thigh circumference (cm) $\bar{X} \pm SD$	MD	t-value	p-value	Sig.
Group A	33.86±4.4				
Group B	37.13±3.5	-3.27	-2.24	0.03	S

\bar{X} : Mean. SD : Standard Deviation.
MD : Mean Difference. t-value : Paired t-value.
p-value : Probability value. S : Significant.

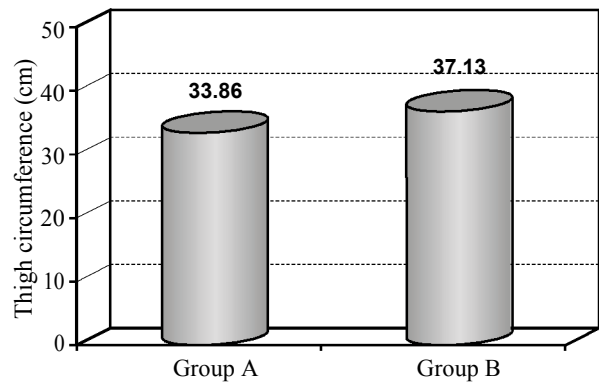


Fig. (8): Post-treatment mean values of thigh circumference of Group A and B.

Discussion

The present study was designed to investigate the effect of manual lymphatic drainage versus pneumatic compression pump on cellulite post liposuction in female's thigh.

Cellulite (gynoid lipodystrophy) is the non-inflammatory pathology of subcutaneous cells affecting over 80% of post-pubertal females. It is localized frequently on the thigh and buttock regions characterized by the 'orange peel' appearance. In this condition, the venous and lymphatic stimulation will be decreased along the macromolecules which embrace the lymphatic transport. As a result, fluid is accumulated within the dermal and subcutaneous tissues [4].

Lymphatic system simulation technique is an approach to the treatment of cellulite, involving stimulation of the physiological processes of the body, and so it is the body itself that re-establishes its equilibrium. This lymphatic system simulation technique is efficacious in the treatment of cellulite [15].

Manual lymphatic drainage is a technique of gentle massage, which stimulates the lymphangi-motoric activity. It opens and dilates the uninvolved lymph routes and then directs the lymph away from the edematous parts and reduces the volume of the limb by diminishing the persistent lymph. Besides lymph flow improvement, manual lymphatic drainage reduces lymph stasis, increases protein resorption, and softens fibrosis [16].

While pneumatic compression is a modality for controlling lymphatic drainage. The extremity is inserted into a sleeve that is then inflated by a pump. This exerts pressure on the extremity which shifts edema into the root of the limb and into the adjacent trunk quadrant [17].

Results of this study reveals that there was significant differences between first and second group in both cellulite grading scale and thigh circumference measurements post-treatment in favoring to first group.

Results of this study concerning the effect of manual lymphatic drainage versus pneumatic compression pump in controlling cellulite confirmed the observations of studies done by: (Melissa et al., Hossein et al., Bianca et al., Muluk et al., Adriana et al., Godoy and Godoy, Bayrakci et al., Gluec, Godoy and Godoy).

Melissa et al., [18] applied a study to evaluate the benefit of pneumatic compression pump in improving lymphatic drainage. Near-infrared fluorescence lymphatic imaging was used to assess patients who treated by pneumatic compression pump. Assessment revealed significant extravascular and lymphatic movement and better lymphatic contractile activity in lymphatic vessels.

In addition Hossein et al., [19] applied a study to evaluate the efficacy of pneumatic compression pump in addition to complex decongestive physical therapy in improving lymphatic drainage. Twenty female patients were randomly divided into two groups. First group was treated with compression pump in addition to complex decongestive therapy techniques and second group was treated by complex decongestive therapy techniques only. Patients were treated 5 days/week for 2 weeks. The study

showed that adding of pneumatic compression pump to complex decongestive therapy techniques is useful for improving lymphatic drainage and improving quality of life.

As well as Bianca et al., [6] applied a study that aimed to investigate the efficacy and safety of manual lymphatic drainage in improving the appearance of the skin with cellulite and the influence of this technique on quality of life. Twenty women were participated in this study with cellulite on the upper third of thigh and buttocks. All women presented with cellulite grade II or III on the buttocks. Manual lymphatic drainage sessions were carried out once a week for 14 weeks using Magnetic Resonance Imaging (MRI) for assessment. MRI scans showed that this technique promoted the removal of excessive interstitial fluid and improved the general appearance of the skin. The study concluded that manual lymphatic drainage was ineffective when performed in isolation. But it is a safe massage technique that does not cause discomfort.

Furthermore Muluk et al., [20] applied a study using an pneumatic compression device to improve lymphatic drainage and reduce limb volume. The treated patients experienced a significant reduction in limb volume. The study concluded that pneumatic compression was effective in improving lymphatic drainage.

In addition Adriana F. et al., [21] conducted a study to analyze the effect of Manual Lymphatic Drainage (MLD) associated with ultrasound for treating women with Cellulite, the study was conducted with 10 women with Cellulite. MLD was applied for 60 minutes and the US was used in buttocks and upper thigh in the frequency of 3MHz with an intensity of $0.6\text{W}/\text{cm}^2$, continuous mode and duration of 12 minutes. It was found a significant difference in the degree of Cellulite on the buttocks and in the patient's satisfaction with Cellulite compared before and after treatment. The study concluded that manual lymphatic drainage is effective in treating cellulite and ultrasound adds to its effect resulting in high patient satisfaction.

Also Godoy and Godoy, [22] performed a study to report a new form of treatment for cellulite based on a novel physiological hypothesis. Fourteen patients participated in this study with. Perimetry was performed at the gluteal fold and below the navel. Additionally, standard photographs were taken. The patient were submitted to a treatment regimen of 1.5 hours per day adapted for the treatment of cellulite, consisting of manual and mechanical lymph drainage and cervical stimulation

for 10 sessions over two weeks. Reductions were observed below the navel and at the gluteal fold. This study confirmed that lymphatic system stimulation is efficacious in the treatment of cellulite.

Furthermore Bayrakci et al., [4] investigated and compared the effectiveness of mechanical massage, manual lymphatic drainage and connective tissue manipulation techniques on fat mass in women with cellulite. Sixty subjects were participated in this study. Patients were randomized into three groups. Group (1) treated with mechanical massage, Group (2) treated with manual lymphatic drainage and Group (3) treated with connective tissue manipulation techniques. Results in all groups had an improvement in thinning of the subcutaneous fat after the treatment. All the treatment techniques were effective in decreasing the regional fat values of the patients with cellulite and so improving appearance of cellulite.

Also Gluec [23] performed a study to evaluate the efficacy LPG endermologie with or without pneumatic compression in the treatment of cellulite. The study included 33 women seeking cellulite treatment. Twenty six women were treated with the LPG endermologie only for 35-40min. Seven women were treated with LPG endermologie for 35-40min and pneumatic compression pump for 20min. Treatments were performed twice weekly for a total of 15 sessions. This study concluded that pneumatic compression pump does not seem to provide any additional benefit to LPG endermologie and no significant differences were found when pneumatic compression pump was used.

In addition Godoy and Godoy, [15] investigated the improvement of cellulite utilizing a novel technique of lymph drainage. This therapeutic technique was used in patients with cellulite and it was found that it was effective to reduce cellulite completely. Several treatment regimens were evaluated and they found that it is possible to reduce the greatest abdomen or thigh perimetric variation by 10cm utilizing intensive treatment for 4 hours daily over a period of 10 days. Even with these significant reductions, weight loss does not occur. The maintenance of the results can last for at least 8 years as long as the patient is not overweight or suffer from edema.

Conclusion:

1- Manual lymphatic drainage and pneumatic compression pump are useful approach in controlling cellulite, in expression of reducing dimpling of skin, improving circulation, and improving the appearance.

- 2- The manual lymphatic drainage and pneumatic compression pump are safe, effective, and available ways of treatment to control skin dimpling in females with cellulite.
- 3- Measurement of cellulite severity by cellulite grading scale and thigh circumference are accurate and useful methods used to measure the rate of improvement.
- 4- Manual lymphatic drainage is superior on pneumatic compression pump in the treatment of cellulite.

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التصريف اللمفاوي اليدوي مقابل الإنضغاط الهوائي على السليولايت بعد شفط الدهون

الهدف من البحث: أجرى هذا البحث لمقارنة الصرف اللمفاوي اليدوي ومضخة الضغط الهوائي في علاج السليولايت.

مواد وأساليب البحث: أجريت هذه الدراسة على ثلاثين سيدة ممن يعانون من السليولايت بعد شفط الدهون وقد تراوحت أعمارهم ٢٥-٤٥ سنة وقد تم تقسيمهم عشوائياً إلى مجموعتين متساويتين في العدد:

(١) المجموعة الأولى (أ): وتضم ١٥ مريض ممن يخضعون إلى العلاج باستخدام الصرف اللمفاوي اليدوي والتمريينات الهوائية وإستمر العلاج لمدة ٨ أسابيع بواقع ثلاث مرات إسبوعياً.

(٢) المجموعة الثانية (ب): وتتكون من ١٥ مريض ممن يتلقون مضخة الضغط الهوائي والتمريينات الهوائية وإستمر العلاج لمدة ٨ أسابيع بواقع ثلاث مرات إسبوعياً.

تم التقييم باستخدام طريقتين قبل بدء التجربة وبعد نهايتها (أى بعد ٨ أسابيع من العلاج): تحديد درجة السليولايت الموجودة في الجلد - قياس محيط الفخذ .

النتائج: لقد أظهرت النتائج الآتية:

١- أن هناك تحسن ملحوظ في مظهر المنطقة المصابة ومحيط الفخذ بعد ثمانى أسابيع من العلاج لكل المرضى في المجموعتين.

٢- أن هناك نقص ذو دلالة إحصائية في درجة السليولايت الموجودة في الجلد في المنطقة المصابة ومحيط الفخذ بعد ثمانى أسابيع من بداية العلاج في مجموعة الأولى.

٣- أن هناك فروق ذات دلالة إحصائية بين المجموعتين (المجموعة الأولى والمجموعة الثانية). وكانت أفضل النتائج بالنسبة لدرجة السليولايت في الجلد ومحيط الفخذ وتحسن المظهر بالمجموعة الأولى.