

Cellulite

PATHOPHYSIOLOGY AND TREATMENT Second edition

edited by

Mitchel P Goldman, MD

*Volunteer Clinical Professor of Medicine/Dermatology
University of California
San Diego, California
USA*

Doris Hexsel, MD

*Preceptor and Coordinator, Cosmetic Dermatology
Department of Dermatology
Pontificia Universidade Católica do Rio Grande do Sul
Porto Alegre, Rio Grande do Sul
Brazil*

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13 Endermologie – LPG Systems® after 15 years

Pier Antonio Bacci, MD

The treatment Endermologie®, patented by LPG-Systems (Valence, France) constitutes a true revolution in the field of the physical therapy both for clinical applications and aesthetics [1].

After 15 years of experience, we can certainly affirm this methodology as the most important basic treatment for cellulite. Associated to the mesotherapy, it allows us to treat different forms of cellulite offering various solutions, in the area of the aesthetic and functional physiotherapy. It is the basic treatment around which we can rotate other necessary methodologies according to the cases.

This technique represents a revolution both in the principle and practical application of massage by maximizing the traditional techniques of the physiotherapist. Endermologie® is performed with unique equipment and various protocols for different pathologies.

The equipment consists of a patented tool, first instrument was named “Cellu M6®” and its use provides various clinical and aesthetic solutions, but it requires training.

After many experiences and studies, LPG company produced different versions and today we have the most recent version named “Keymodule 2i®” that allows stretching the skin in the various directions (Fig. 1). Endermologie® shows a clinical efficacy in cellulite linked with well documented circulatory, anti-edematous, dermatrophic and lipolytic properties [2–9].

The modern instrument changes the use and the methodology because we have a sophisticated control of the different actions, an easy application of treatments and the possibility to choose the best probe for different areas and indications (Fig. 2).

New Keymodule 2i® maintains the same first idea using only compressed air, it aids the performance of various physiotherapeutic maneuvers such as pumping, draining and stimulating the vascular system.

The first maneuver is directed to muscles and tendons, the second is mostly directed to lipodermal tissues. These maneuvers favor emptying of the venous and lymphatic systems with the manual techniques described by Casley –Smith, Foldi and Leduc [10–12].

The fingers of the physiotherapist can perform maneuvers of grazing, pinching, slurring, compression and rotation of the tissues, in addition to the classical “paper-roller” characterized by movements of compression and rotation exploiting the elastic return of the tissue which also stimulates fibroblastic function.

Endermologie® treatment enhances the execution of the same maneuvers and operations performed with the fingers. It's therefore possible to perform stretching and traction at the same time.

The aspiration system of the machine lifts the skin and subcutaneous tissue inside the motorized handpiece as the operator works rolling up and moving the handpiece in the desired directions. The equipment software allows the operator to perform “compression-rotation” or “rhythmic compression-rotation”

maneuvers. This allows the therapist an endless range of therapeutic maneuvers to treat various pathologies or different phases of a complex pathology. Such characteristics increase the indications and fields of application.

To understand the concept and role of this complete and complex medical methodology it is necessary to describe the scientific principles and practical basis of some methods such as massage and lymphatic drainage, focusing on some fundamental principles of anatomy and physiology of the dermo-epidermal tissues.

Anatomy and Physiology

The interstitial matrix

This constitutes and represents the true inside “sea” where all the exchanges and all the vital cellular regulations happen, where life begins and chronic illnesses and degenerative changes such as the processes of aging occur. This is a substance that permeates every space and is found as a solution or gel. The principal cells that constitute it are the fibroblasts and the macrophages because they provide continuous recovering of the tissue and to anti-inflammatory action.

Adipose tissue

Adipose tissue is, very probably, the most important tissue in the body. It is a form of connective tissue with energetic formation regulatory functions [13–17]. The representative cell of this tissue is the adipocyte whose principal role is to maintain a reserve of fat, in addition to acting as mechanical protection and assisting with thermoregulation.

The quantity of adipocytes varies between individuals and also varies between regions of the body. The variability is based on genetics [18,19]. Above the muscular fascia is a pillow of fat “*parallel fat*”, whose principal characteristic is reactivity to the food/caloric intake, constituting an important cause of obesity. Some regions of the body possess subfacial fat that is referred to as “*steatomery*.” It is slightly sensitive to caloric intake and insulin. To be able to lose 1 kg of steatomeic fat one must lose 6 kg of systemic fat. Inside the abdomen another type of fat, “*intravisceral fat*” also responds quickly to caloric intake.

Adipose tissue is connected to the endocrine system through hormones that act on the metabolism of the fats. They are divided into two groups:

1. lipoclastic hormones (catecholamine, adrenaline, glucagons, ACTH, TSH, thyroid hormones)
2. lipogenetic hormones (insulin, sex hormones, in particular estrogens)

Endermologie acts on the skin and subcutaneous tissue, connective tissue, fat tissue and the microcirculation both arteriolar, venous and lymphatics [20,21].

The new instrument “Key Module”



Using this methodology
we can have active action for:

- CONNECTIVE TISSUE
- VASCULAR SYSTEM
- METABOLIC FUNCTION
- ADIPOSE TISSUE
- STATUS OF THE SKIN
- COLLAGEN PRODUCTION
- LYMPHATIC DRAINAGE

Figure 1 Endermologie facilitates different activities.

The Superficial Muscular Fascia

Treatment of this fascia is very important to have the best results using endermologie.

Surgeons and anatomists have often ignored or denied the importance of the superficial fascia of the body. For example, the anatomical layer on which liposuction or liposculpture occurs is really the superficial fascia, considered sometimes as a systemic bandage: S.F.S. (*Superficial Fascial System*). An interesting anatomical and histological examination of the inferior limbs has shown the presence of the “Superficial Fascia” as responsible for numerous aesthetic alterations of the skin surface [22].

The depressions and elevations of the contour of the body are explained from the anatomy of the superficial fascia and from its relationships with the skin, the fat and the musculo-skeletal system. The study of anatomy and the understanding of physiopathological exchanges of the superficial bandage system are not only the basis for surgical correction of the silhouette, but above all the basis for recovery in osteopathic therapies.

The Argentineans, Moretti, Schapira and Kaplan have studied 20 patients, 10 males and 10 females withdrawing one “lozenge” of 20 cm of length for four of width in the zone along the side and the knee. Their anatomical study found the presence of a net of connective tissue that extends from the subdermal plane to the muscular aponeurosis [23]. It is really this net that constitutes the true superficial band and it is formed from various horizontal septa of collagen and elastic fibers separated by fat lobules and always crossed vertically by septa type fibers. At the subdermal level, the presence of the superficial fascia also constitutes a connection with the deep dermis with bigger fibrous septa woven among them in such way to provoke the separation of adipose tissue in small compartments that organize the superficial adipose tissue with the classical structure of a honeycomb of bees.

This structural configuration constitutes the “*bundle-dermal system*”, of great functional importance.

Even if anatomically a real plane of separation is not observed among the superficial muscular fascia and the connective

Different treatments



Figure 2 New instruments have different probes for different pathologies.

fibers of the deep dermis we can deduce that, functionally and histologically, the continuous imbrications of fibers collectively constitute this “*hypodermic superficial fascia*”.

In thin patients the superficial band is well delineated and of whitish color. In obese patients the great quantity of adipose tissue stretches the superficial fascia and attenuates the end making it difficult to recognize. The connective and elastic fibers are diluted in the fat fabric and this can explain the error of some studies, ones that put doubts on the existence of this superficial band.

Without doubt, in the facial zone in men over the iliac crest appears as a deep band that is not found in the female sex. In the women, instead, the fibrous band appears with the muscular aponeurosis at a level of the subgluteous that constitutes the base for the adipose tissue situated in this zone. This difference explains the difference in the contour of the gluteus among the two sexes.

The skin, the superficial fascia and the superficial fat must to be considered as a system of protection and functional support. This functional unity constitutes the support of the adipose fabric and helps to prevent the abnormal location of this fabric in other anatomical regions. The traction and stretching of the superficial facial band and the superficial muscular fascia with Endermologie is essential in the treatment.

Massage

Massage is an art, more than a therapeutic action that comprises a feeling between the hand of the operator and the tissues of the patient that must not be traumatized, but instead revascularized, stimulated and cleansed. A well done massage has to relax the body and the mind to increase the skin temperature with stimulation of the microcirculation which favors intercellular exchange. A global massage of the body can have a sedative action and, at the same time, stimulate the nervous system. But massage doesn't have to be violent or prolonged to avoid provoking lymphatic congestion.

Manual Lymphatic Drainage

Lymphatic drainage is a physical method to reduce the stasis of the lymphatic fluid and the toxic substances in the tissues. Lymphatic drainage is not traumatic but a gentle massage technique.



Figure 3 Endermologie allows a traction of the skin and connective fibers.

Manual lymphatic drainage has its scientific basis in the study and teachings of Foldi and Leduc [24,25].

It deals with a series of grazing and compressions on the lymphatic system to improve lymphatic flow. In the technique of Vodder lymphatic drainage becomes less physician and more aesthetic in nature. Periodic cycles of manual lymphatic drainage are recommended according to Vodder, particularly to maintain the tissues from free from lymphatic congestion. We believe that manual lymphatic drainage performed with the hands is the only one that can give acceptable results.

The Technique “Endermologie®”

History and principles

Our experience with the LPG-System began in 1993. The French engineer, Louis Paul Guitay (LPG), developed a system to help care of fibrosis he developed as a result of violent trauma that resembled the movement performed by his therapist’s fingers, including additional effects.

Sophisticated software allows for possible phases of continuous and sequential aspiration with mobilization of the tissues, offering the therapist an endless range of possibility of interventions appropriate for various pathologies. So began a true revolution in physiotherapy. Today scientific research has confirmed the effectiveness of this method [2–9]. This revolution has also given birth to an important professional team formed by doctor/surgeon and physiotherapist, a union that is important in the fields of the phlebolympology.

What is endermologie

It is patented equipment that works with two motorized rollers between a vacuum suction with varying programs that lifts the skin reaching the deepest structures (Figs 3–4).

The hands of the therapist can be helped by the integrated action of this equipment allowing one to make the same physiotherapy maneuvers enriched by stretching the cutaneous fabrics to be able to work more deeply. The effect is mainly the stimulation of cellular metabolism (fibroblasts, adipocytes) and the vascularisation with lymphatic drain and a purification through manual lymphatic drainage.

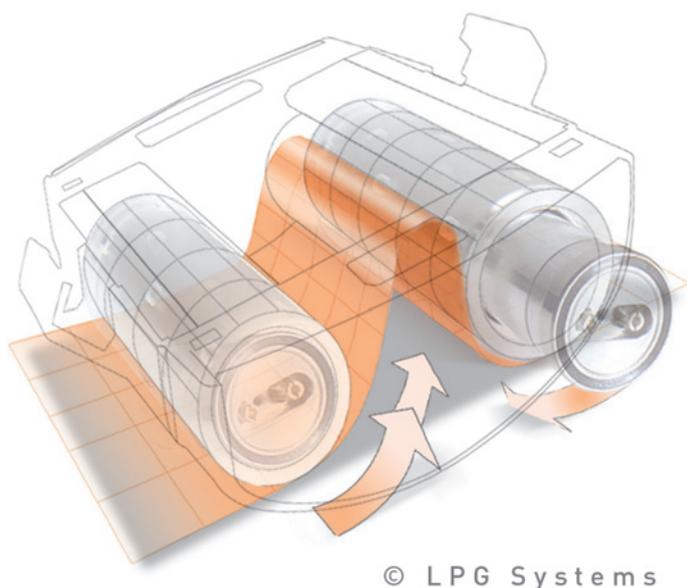
To ensure proper treatment one must have:

1. Correct diagnosis to be able to apply the therapy or the fittest program
2. Qualified Personnel

Mechanism of action

Endermologie® possesses five complementary actions that allow treatment of different types of tissue:

1. Mobilization of the tissues that characterize the different structures with consequent activation of the arteriolar micro-circulation
2. Traction of the connective tissue with exercise of the skin
3. Activation of the reflected arcs and stimulation of fibrous banding
4. Neurometabolic regulation with metabolic activation
5. Rhythmic compression of the tissues with lymph drainage



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Figure 4 Different directions of the rotation facilitates different activities.

Together the stretching and the rhythmic compression of connective tissue activate fat lobules to cause their shrinkage with stretching of the fibrous septae.

The mechanical stimulations act on the mechanoreceptors such as:

1. *corpuscles of Meissner*, sensitive to the light stimulations with activation of the fibroblasts
2. *corpuscles of Water-Pacini*, that are found in the deep dermis and in the lipoderma are sensitive to deep pressure of the skin and vibration. They stimulate the activity of the fibroblasts
3. *corpuscles of the Golgi*, sensitive to the light pressures, they stimulate fibroblasts and the regeneration of the collagen and connective tissue
4. *corpuscles of Merkel*, situated in the epidermis, are sensitive to the vibrations and the light pressure. They act on cellular metabolic activity

The hyperdistension of the subcutaneous tissue will activate the specific receptors to free substances such as the bradychinen, histamine, serotonin and catecholamines. These have action on beta adrenergic receptors activating the adenocyclase with an increase of the AMP to increase of tissue AMP which in turn stimulates protein kinase that activates intra-adipocytic lipase with hydrolytic action on the triglycerides of the fat cells.

To conclude, different methodologies can have different results (Fig. 5).

You could hypothesize two principal actions.

The lightest treatment stimulates Golgi complexes to provoke:

1. *Vascularisation*
2. *Stimulation of the receptors = Lipoclasis*
3. *Stimulation of the fibroblasts = Restructuring connective tissue*

Thus stimulation of the beta adrenergic receptors occurs with

1. *Lipolytic action*
2. *Increase tissue AMP*
3. *Hydrolytic intra-fat action*
4. *Restructuring of connective tissue*

The strongest and deepest treatment, with stimulation of the Pacini corpuscles provokes liberation of bradichinen, histamine, serotonin and catecholamine with:

1. *Increase free radicals*
2. *Alteration matrix*

3. *Flogosis*
4. *Fibrosis*

Then we have a direct action on cicatrisation rather than toward a restructuring.

Treatment phase

The physician and operator act as a team. The actual procedure can be performed by the physiotherapist or osteopath after the diagnosis is pointed out by the physician specialized in Phlebology, in the case of pathologies of the venolymphatic system or from the Dermatologist or Cosmetic Surgeon, in the case of burns or scars that introduce fibrous retractions.

Various phases of application are:

1. Vascularising phase, to reactivate the cutaneous micro-circulation
2. Drainage phase, to drain the lymphatic stagnation
3. Stimulation phase, to stimulate the fibroblasts and the interstitial neurophysiologic systems
4. Invigorating phase, to stimulate the skin
5. Exercise phase, in which the patient actively collaborates with isometric contractions pointed out by the operator to produce tissue and muscle tonification
6. Visceral phase, always with the collaboration of the patient along with specific maneuvers to stimulate abdominal visceral activities
7. Lipomassage phase, to increase the metabolism of the fat tissue

Indications

a) Phebolymphology

This treatment enhances the possibilities offered by traditional manual lymphatic drainage overcoming the traditional concept of “emptying of the lymphatic vessels” with the concept of metabolic stimulation.

Unlike the traditional therapies, performing the lymphatic drainage with Endermologie®, allows one to possibly reduce the necessity for high compression stockings or elastic bandages. This means that the mechanism of action of treatment includes activation of the autonomous nervous system and the interstitial connective tissue [26–29].

b) Plastic and aesthetic surgery

The method here is a natural complement of liposculpture recovering and remodeling the fat tissue decreasing complications (irregularities). In addition, Endermologie will decrease the



Figure 5 Any type of the skin can have his best treatment.

incidence of seromas, edemas, alterations of the skin (fibrosis and asymmetries) [30–34].

c) Cellulitic syndromes

As discussed in previous chapters, cellulite is a condition comprised of various pathological expressions of vascular and/or degenerative alterations of the connective tissue or interstitial matrix, often in partnership with lipotrophy of the muscular tissue. Cellulite should not be confused with obesity.

Obesity is when the fat tissue is above 30% of the quantity that can normally be present, while cellulite is a transformation and an alteration of subcutaneous interstitial tissues [35–45].

Endermologie provide us the basic treatment around which many methodologies may be associated for a complete and studied integrated protocol of treatment.

In addition to aesthetic alterations, various subjective symptoms exist including cramps, pain to the touch, heaviness, livedo reticularis, edemas and tiredness. Such symptoms represent important diagnostic signs for the various cellulitic pathologies that are classified in five fundamental groups [46–48].

1) Edematous cellulite

Characterized by orange peel skin provoked by the stretching of the connective fibers due to an excess of liquid. The principal symptoms are: pain, edematous plasticity, sense of periodic swelling and edema of the ankle.

2) Adipose cellulite

Characterized by the skin stretched by an excess of adipose tissue, with particular increase of the fat “steatomery”. There are no imbibitions of interstitial liquid, it is associated with being overweight. Orange-peel skin is caused by the stretching of connective tissue due to an excess of fat tissue. The principal symptoms are no pain, no edema and no sense of periodic swelling.

3) Interstitial cellulite

Characteristic of young subjects is the typical lipoedema which is characterized by the superficial tissue of the thigh imbibed with fluid and superficial adipose tissue. Orange peel skin is caused by the stretching of connective tissue from edema and fat tissue.

The principal symptoms are pain and edema to the thigh, but not the leg or foot. There is often a sense of swelling to the hands [49–53].

4) Fibrous cellulite

The pathophysiologic point of view is characterized by dehydration of the cutaneous and fibrous connective tissue and fat with the development of nodules of adipose tissue surrounded by a sclerotic capsule. The orange peel appearance of the skin is coarse and caused by the retraction of connective tissue fibers. The principal symptoms are pain without edema.

5) Localized adiposity

They are lipomatosis and localized adiposity in subcutaneous tissue or in the splitting of the superficial fascia. Their anatomic, physiologic and pathologic evidence are completely different from



Figure 6 Endermologie treatment may be useful for care or maintenance.

the cellulite. The surgeon will proceed to eliminate the localized adiposity through excision or liposculpture.

Today we use frequently a lipolaser with microfibras of 100–200 micron connected by the Eufoton™ laser 940 nanometers, using this methodology we can reduce the traumatic action of cannulas and improve the retraction avoiding the irregularities of the skin.

After surgical treatment of liposculpture or mini invasive treatment by lipolaser we can add six to eight sessions of Endermologie to complete the treatment and to have the best results in short time. The therapist will begin treatments with lymphatic drainage that aids in recovery.

Endermologie can offer the possibility of good results without surgical treatment in selected patients because we can reduce a fat layer using a particular treatment named Lipomassage. In fact, new Keymodule stimulates fat tissue increasing its metabolic activity and reducing its quantity with a good aesthetic result.

The method

Endermologie® is ideal in the treatment of the different forms of cellulite but precise protocols of technique are necessary [54,55]. Three fundamental rules to provide correct treatment: are no pain, no persistent vascularisation and a fluidity of the massage technique from the operator. The therapist doesn't have to provide a strong traction with the rollers, on the contrary, the technique should be like a fluid sliding on the *Body garment*. Another important rule is to position the machinery at the foot of the table on the left.

Positioning Keymodule in this manner allows the operator to use both hands to massage the patient in a superior – inferior direction (Fig. 6).

All the necessary maneuvers are performed, with slow movements in the descending phase, respecting the tissues and favoring the lifting and tonification. The manipulation of the head must be compared to a painter's brush that has to cover the whole surface of the body within every treatment session.

In patients with predominant veno-lymphatic stasis, it is necessary to begin the treatment from the abdomen, treating it



Figure 7 We can have good result in local adiposity too.

in such way as to prepare the lymphatic vessels to drain from the whole body as well as stimulate the muscular fascia, perivisceral fascia (kidney and peritoneum) and the suspensor ligaments of the colon and liver.

The standard time of treatment, applicable to most cases is of 35 minutes. More time may be devoted to subjects notably

overweight where it is necessary to work on a single part of the body. Whatever the constitution and problem it is always best to treat the whole body (Fig. 7).

If we suggest a good nutrition with a reduction of carbohydrates to low stimulation of insulin, our results will be fast and increased (Fig. 8).



Figure 8 The association with prothetic nutrition is very interesting.

Endermologie treatment aims to bring plasticity, elasticity and compactness to the skin and subcutaneous tissue, thanks to the stimulation of connective tissue. The variations of technique follow the clinical indications.

Conclusions

Endermologie - LPG System certainly is not a panacea for all the pathologies but it is a real revolution in the field of the physical medicine, of physiotherapy and aesthetical physiotherapy [56,57].

The method one doesn't consist of a massage but a real treatment. To massage means to perform a local stimulation with a local result. To make a treatment means to perform a systemic and local stimulation with systemic and local results.

The use of Endermologie® never foresees the execution of a massage or a lymphatic drainage but the execution of a treatment finalized to the metabolic recovery and the stimulation of connective tissue. This aspect represents the revolution and the great difference is in comparison to the manual lymphatic drainage. This is appropriate for cellulitic syndromes.

Endermologie is a natural complement to cosmetic and plastic surgery in the treatment of lipodistrophy and cellulite as well as various forms of edema and lipolymphedema [58,59]. Endermologie, for the first time, offers a particularly active treatment in the activation of fibroblasts and the metabolism of the interstitial matrix and, actually, it represents the more important basic treatment for different forms of cellulite.

Particular biopsy shows the possibility to have a new activity of the dermis and subcutaneous layer demonstrated by an improved reticular dermis layer.

All other methodologies can be integrated with Endermologie to have best results and few complications [60–63].

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