cellulite .....

what is it
where does it come from,
and how do i make it go away?

by Diana L. Howard Ph.D., The International Dermal Institue

Few subjects have elicited more debate and controversy amongst the scientific community and professional skin care and body therapists than that of cellulite. For years, many in the medical community have argued that cellulite is merely fat and can only be treated with diet and exercise. Yet, non-overweight, physically active women have also been known to show up at the spa or skin care center with pleas for treatments or products to address their dimpled thigh skin. The unfortunate truth is that 80-90% of women will get cellulite sometime after they reach puberty and not all of these women are considered to be overweight. So what is this thing we call cellulite that coexists with our fat cells in our bodies?

Since the word, cellulite, was first coined in Europe over 150 years ago, studies have focused on the structure of cellulite tissue. As a result of more recent studies, it is safe to conclude that indeed cellulite is more than just ordinary fat and that in order to treat this condition one must truly understand its unique aspects. To better understand this condition we need to look at the structure of fat as well as the causes of cellulite.

what is cellulite?

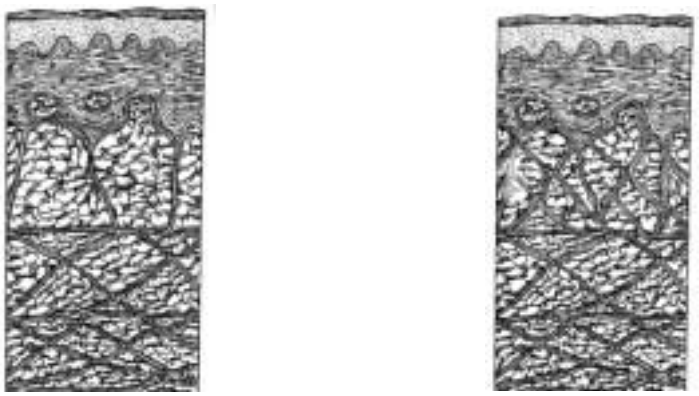
Like it or not, man is a fatty animal. Our skin's surface is covered in a coating of oil, and with the exception of the eyelids and male genitalia, a layer of fat occurs over most of the body. The primary functions of this fat layer are to provide thermoregulation, cushioning against mechanical trauma, body contour, filling of body space and most importantly, as a source of energy.

In this latter process, lipids accumulate in the fat cells (or adipocytes) as fatty acids that are combined with glycerol and stored as larger triglyceride molecules; when energy reserves are needed, these in turn are broken down into glycerol and fatty acids that are metabolized as an energy source. Hence, the fat cell functions as an energy reservoir for our body.

The adipocytes or fat cells, store body fat, which collectively form adipose tissue. Fat is a form of loose connective tissue that is found beneath the skin (dermis) around muscles, organs and joints in our body.

In the late 1970s, Drs. Nurnberger and Muller (Reference: 1), in their effort to better understand cellulite and fat, examined the structure of skin and the component fat cells. They found that in the female body, the uppermost layer of the subcutaneous tissue (or hypodermis) consisted of free standing fat cell chambers, (filled with fat cells) which were separated by vertical walls of connective tissue called septa. The apex of these upright fat chambers is in the form of an arc-like dome, which was weak and prone to collapse when undue pressure was applied. This pressure could be the result of excess weight, fluid retention or lack of strength due to little or no exercise. These larger chambers generated smaller compartments of fat cells (known as papillae adiposae) that clustered tightly under the skin. This combination of free standing fat cell chambers and compartmentalized clusters of fat cells are the very elements that create the change in appearance in the skin s surface that we know as cellulite.

Interestingly, when they compared the structure of the hypodermis in female vs. male patients they found that the men had smaller fat cell chambers with oblique septa; this latter structural difference affords more strength to the



female hypodermis vs. male hypodermis

septa and enables them to withstand collapsing under pressure. They also noted that the smaller compartments of fat cells (papillae adiposae) had the same structure in men and women. (Reference: 3) It is hypothesized that this difference in structure of fat cell chambers may predispose women to cellulite more so than men. Interestingly, men with more feminine characteristics tend to have fat cell chambers similar to women, thus inferring that hormones may control this aspect of our structural diversity.

how does cellulite form?

Now that we understand some of the structural differences associated with the cellulite condition, lets look at the four progressive stages that occur during cellulite formation.

In stage one, several phenomena occur which are invisible to the naked eye. These changes involve a deterioration of the skin s dermis whereby, the integrity of the blood vessels and capillaries that create a complex transport network throughout the skin, slowly begins to break down. Similarly, the upper region of the dermis begins to lose some of its capillary network. Fat cells, housed within the free standing fat cell chambers, begin to engorge with lipids often swelling two to three times their original size. Fat cell clumping may commence at this stage as well. Fluid begins to accumulate in the tissue, most likely due to a breakdown in the capillary system. Projections of fat begin to occur in the dermis and there is an increase in glycosaminoglycans (GAGS), which may account for the enhanced ability for tissues to retain excess water. (Reference 5)

In stage two, dermal deterioration continues and the microcirculatory system continues to decline. Fat cells engorge further and clumping is more pronounced pushing the much-needed blood vessels further away. It is not uncommon for gaps to appear in the dermis which may be the result of the normal inflammatory process which activates specific enzymes such as collagenase and elastase, creating an available path for immune cells to migrate to the site of inflammation (Reference: 4). Fluids continue to accumulate. At this stage, orange peel skin is now evident.

In stages three and four, the microcirculatory system continues to deteriorate, slowing metabolism in cells of the dermis. Both protein synthesis and the repair process are reduced drastically which may contribute to a thinning of the dermal layer. Protein deposits begin to form around fat cell clusters. Pinching the skin between finger and thumb at this stage demonstrates a definite "orange peel" effect. By stage four, hard nodules are evident in the dermal region. These are comprised of fat cell clumps encased in a hardened protein shell. This is the final stage in cellulite formation.

what causes cellulite?

The precise cause of cellulite is most likely a combination of factors. We have already looked at the structure of the hypodermis layer and explored the differences that are inherent in women. We now know from numerous studies that each of the four stages in cellulite formation is distinguished by changes in the molecular and structural level. Now we must examine what is the trigger mechanism and what is orchestrating this condition known as cellulite.

According to Drs. Sherwitz and Braun Falco (Reference 4) one of the causes of the rippling effect of cellulite is fluid retention in adipose tissue. They noted that along with an engorgement of fat cells, cellulite tissue showed clear evidence of fluid invasion in the connective tissue fibers of the upper layers of skin. They concluded that not only do the retained fluids cause visible swelling of thighs, hips and abdomen, but that the toxic wastes they contain break down collagen and elastin fibers that help to keep the skin smooth and firm.

Further studies by Drs. Nurmberger and Muller confirm this finding and indicate that there is a definite decrease in the number of elastin and collagen fibers in cellulite tissue. It is believed that as we age, these structural proteins generally begin to stiffen and lose their flexibility. The loss of firmness can be exacerbated by engorging fat cells, accumulated fluids and toxins as well as, poor circulation. All of these factors are believed to contribute to the formation of cellulite.

While the actual cause of cellulite is the result of a breakdown in the connective fibers, one must remember that the reason for this breakdown was most likely, a decline in the circulatory system. Although toxic accumulation and fluid retention certainly are major contributing factors to cellulite formation, it is poor circulation (blood and lymphatic flow) that ultimately creates the right environment for cellulite formation. Loss of circulation to an area - whether caused by lack of exercise, too much sitting, clogged arteries or nutrient deficiency - can have a serious impact and accelerate cellulite formation. That is why cellulite generally appears in areas that have poor circulation; unfortunately, once it

forms, it slows circulation in an area even more.

what can be done to treat cellulite?

Aside from weight loss, exercise, and liposuction, the number of spa or skin care center treatments that are effective in treating cellulite are limited. Even massage, once touted as being effective in treating cellulite, probably does more harm than good. If one is performing a firm, kneading type of massage on cellulite areas, you may actually stimulate additional fluids into the tissues. Unless you have accompanied this with a means of improving blood and lymph flow out of the tissues you will only exacerbate the problem.

On the other hand, a lighter form of massage, known as Manual Lymph Drainage (MLD), stimulates lymph flow and may in fact be one of the most effective means of treating the causes of cellulite. MLD is a light, rhythmic pumping massage pioneered by Dr. Emil Vodder. This technique has the unique result of aiding in the elimination of lymph fluids without increasing blood flow. It is recommended that it be done twice a week or daily for best results. I must caution you however, that this is a technique that requires proper training in order to do this form of therapy effectively. (Certified Vodder Institute instructors teach the Vodder Method of MLD at The International Dermal Institute)

Aromatherapy oils are used in many spa body treatments and are effective if the oil selected stimulates elimination, improves circulation and lymphatic movement. Some of the essential oils that we recommend at The International Dermal Institute include: lavender, eucalyptus, lemon, black pepper, rosemary, sage, cypress, atlas cedar, juniper, geranium and lemon grass. Use of essential oils in conjunction with MLD is an especially effective technique.

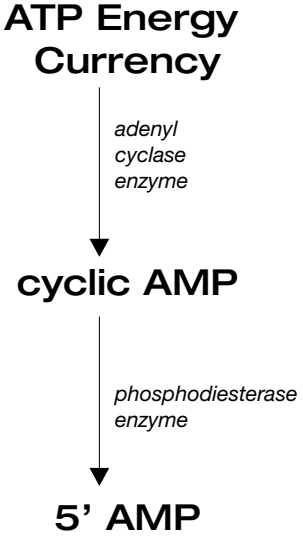
Cellulite creams on the market generally contain one or more of the following class of compounds in their formulation: (1) retinoids, such as vitamin A (retinol); (2) hydroxy acids, such as lactic acid, salicylic acid or glycolic acid; (3) botanical extracts, such as green tea, kola nut, fennel, algae, ivy, verbena, lemon, strawberry, seaweed, barley, butchers broom, or marjoram; or (4) xanthines, such as caffeine, theophylline or theobromine (or a derivatized form of these compounds).

The retinoids are generally used for their ability to effect the lack of firmness and elasticity associated with cellulite. Based on their history in effecting the appearance of the stratum corneum, hydroxy acids have been incorporated into cellulite products, however, there have been no known published reports demonstrating the effectiveness of this class of compounds in treatment of cellulite.

Likewise, the botanicals cited above are also used to tone and tighten skin and may even be included for their stimulating properties. Many botanicals noted for their ability to improve venous and lymphatic capillaries could help accelerate the elimination of cellular toxins while promoting resorption of local edema or swelling.

More recently, the xanthine compounds, caffeine, theophylline and theobromine, have been reported to effect fat lipolysis at the cellular level. Remember from our earlier discussion of fat cells that their key function is to provide an energy source for the body. The triglycerides stored in the fat cells are constantly renewed by a highly dynamic process of fat hydrolysis *(triglycerides --- > glycerol + fatty acids), and re-esterification (glycerol + fatty acids ---- > triglycerides);* this process is regulated not only by the supply of fatty acids, lipoproteins, and glycerol, but is controlled by several enzymes including lipase. When lipase activity is stimulated, so is fat hydrolysis (breakdown).

In order to understand how this process works one needs to look at how the body uses ATP, the energy currency of the cells. ATP is constantly providing energy for cellular processes and is always being regenerated to keep our bodies going. When ATP has provided energy to the cells it is converted into a form known as cyclic AMP; this is in turn converted to even a lower energy form called 5'AMP. Each of these steps is regulated by a different enzyme, which controls the reaction.



The xantinine derivatives, caffeine, theobromine and theophylline, inhibit the phosphodiesterase enzyme causing a pool of cyclic AMP to build. This in turn stimulates through a series of chemical reactions, lipase activity, which is responsible for triglyceride hydrolysis. The long chain fatty acids are then utilized for energy and oxidized further to C02and H20. Extensive studies demonstrating the efficacy of these compounds have been conducted on human subjects and in laboratory studies (Reference: 2).

Xanthines Used to Treat Cellulite:(ref.2)

Caffeine	an alkaloid* from the leaves and beans of the coffee tree, tea, guarana and kola nuts; inhibits phosphodiesterase
Theopylline	an alkaloid* obtained from tea leaves and prepared synthetically inhibits phosphodiesterase
Theobromine	an alkaloid* resembling caffeine, derived from cocao beans, kola nuts, tea; obtained as a byproduct in the manufacture of chocolate and cocao; inhibits phosphodiesterase
Theophyllineacetic Acid Alginate or Carboxymethyltheophylline	made from theophylline and chloroacetic acid; stimulates cyclase activity (increasing cyclic AMP) and triglyceride hydrolysis; 7X more effective than theophylline in stimulating lipolysis

*nitrogen containing, basic (positively charged) compounds naturally occurring in plants

While our knowledge of cellulite has progressed considerably in the past two decades there is still more investigative work that needs to be completed. As new ingredients are introduced, the scientific community must undertake the responsibility to determine that these ingredients are not only efficacious but safe and effective.

References

1. F. Nurnberger, G. Muller, *So-called Cellulite: AN invented Disease*, J. Dermatology, Surg., Oncol. March 1978, vol. 4, No. 3, p.221

2. Ronald DiSaivo, *Controlling the Appearance of Cellulite*, C& T Ingredient Resource Series, AHAs and Cellulite Products, 1995, page 21

3. M. Rosenbaum, V. Prieto, J. Helimer, M. Boschman. J. Krueger, R. Leibel, A. Shiop, *An Exploration and Investigation of the Morphology and Biochemistry of Cellulite*, Plastic and Reconstructive Surgery, June 1998, vol. 101, No.7, p. 1934

4. K. Marenus, *Cellulite Etiology*, Dermatol. Surg. 1997, vol. 23, p.1 177

5. W. Smith, *Cellulite Treatments: Snake Oils or Skin Science*, C& T Ingredient Resource Series, AHAs and Cellulite Products, 1995, 29 I

Diana L. Howard, PhD, is the vice president of technical development for The International Dermal Institute. She earned her doctorate degree from the University of California, Los Angeles, where she specialized in plant biochemistry. Howard has worked in research and development, as well as marketing, for major cosmetic companies. She has lectured extensively on the topics of therapeutic body spa trends and skills for achieving full business potential.