

Cellulite: no clear evidence that any type of treatment is effective

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Abstract The treatment of cellulite, a major cosmetic concern for many women, remains challenging. Although a number of studies have investigated the effects of a wide range of products/procedures on cellulite-related endpoints, most of these studies have important methodological flaws. At present, there is no clear clinical evidence that any evaluated treatments have good efficacy in reducing cellulite, with the most promising results shown with acoustic wave therapy.

Cellulite is not appealing

In women with cellulite, the surface of the skin (most commonly on the thighs, buttocks, and abdomen) has a dimpled or orange-peel appearance [1]. Cellulite is common in post-pubertal women and results from multiple factors associated with sex-related differences in the structure of skin and subcutaneous tissue [2]. Although it is more appropriate to consider cellulite as a secondary sex characteristic rather than as a disease, the condition remains a major cosmetic concern for many women [1].

A wide variety of treatments have been developed to improve the appearance of cellulite by achieving a smoother skin surface. This article briefly summarizes the clinical evidence of the efficacy of treatments for reducing cellulite, based on a systematic review conducted by Luebberding et al. [1].

Difficult to quantify/qualify improvement

The evaluation of the efficacy of anti-cellulite products/procedures is hampered by the lack of a precise and reproducible method for quantifying cellulite [1]. Surrogate markers that have been used to indirectly measure changes in cellulite include measurement of thigh circumference, skin elasticity, dermal thickness or density, blood flow or vascularization, and changes in magnetic resonance and X-ray images. However, the suitability of these methods in assessing changes in cellulite remains speculative, as there is no clear proof for a correlation between any indirect parameters and cellulite severity.

The standard classification system for the clinical evaluation of cellulite and its response to treatment is the Cellulite Severity Scale (CSS) [3]. This validated photometric scale grades the severity of five key morphological items (number of depressions, depth of depressions, clinical evidence of evident raised lesions, presence of flaccidity and grade of cellulite) on a scale from 0 to 3 (where higher scores indicate a more severe condition) [3]. However, many of the available studies did not use the CSS to evaluate the efficacy of treatment and, even when the CSS is used, the clinical rating of cellulite still remains somewhat subjective [1].

Evaluation of the evidence...

Luebberding et al. [1] analyzed 69 studies that met their inclusion criteria (i.e. original articles in English or German that reported data on the efficacy of cellulite treatment from in vivo human studies). According to an assessment of the level of evidence of each study [1]:

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- One study provided level 1a evidence [i.e. meta-analysis or systematic review (with homogeneity) of randomized, controlled trials (RCTs)];
- 34 studies provided level 2b evidence [i.e. individual cohort study (including low-quality RCTs)];
- 34 studies provided level 4 evidence [i.e. case-series (and poor-quality cohort and case-control studies)].

None of the evaluated studies met the criteria for level 2a [i.e. systematic review (with homogeneity) of cohort studies], level 1b [i.e. individual RCT (with narrow confidence interval)], level 3 [i.e. systematic review (with homogeneity) of case-control studies or individual case-control study] or level 5 evidence (i.e. expert opinion without explicit critical appraisal, or based on physiology or bench research).

Table 1 Overview of the efficacy of various therapies in the treatment of cellulite in randomized, controlled trials, as reviewed by Luebbing et al. []

Therapy and comparator (no. of pts)	Improvement in cellulite appearance with therapy
Topical monotherapy	
Retinol cream vs. placebo (19) [14]	++
Caffeine-based liposome-encapsulated cream vs. placebo (41) [15]	±
Topical combination therapy	
Cosmetic product containing <i>Furcellaria lumbricalis</i> / <i>Fucus vesiculosus</i> /retinoid/ conjugated linoleic acid/glaucine vs. vehicle (35) [16]	++
Cosmetic product containing retinol/caffeine/ruscogenine vs. placebo (46) [17]	+
Aminophylline cream ± endermologie vs. endermologie vs. untreated (52) [18]	–
Integral topical gel vs. placebo (40) [19]	++
Topical lipolytic agents vs. placebo (11) [20]	–
Commercial anti-cellulite cosmetic cream vs. placebo (61) [21]	++
Cosmetic product containing tetrahydroxypropyl ethylenediamine/caffeine/carnitine/forskolin/retinol vs. placebo (78) [22]	+
Phosphatidylcholine-based gel + LED exposure vs. placebo (9) [23]	–
Cosmetic product containing various botanical standardized extracts vs. placebo (23) [24]	++
Cosmetic product containing sulfocarrabiose ± caffeine vs. placebo or caffeine-containing product (50) [25]	++
Acoustic wave therapy	
Acoustic wave therapy vs. untreated (25) [5]	++
Acoustic wave therapy vs. placebo (53) [7]	++
Acoustic wave therapy vs. placebo (16) [6]	++
Laser-based therapies	
1064 nm Nd:YAG vs. untreated (12) [8]	–
1064 nm Nd:YAG vs. untreated (19) [9]	±
Low-level vs. placebo (68) [10]	+
Light-based therapies	
Infrared vs. untreated (25) [26]	–
Nutrition and weight loss	
Herbal product ^a vs. placebo (20) [12]	--
Herbal product ^a vs. placebo (190) [13]	++
Medically supervised weight loss programmes vs. untreated (51) [11]	++

Studies included are limited to those that provided results and statistical analyses relating to improvements in cellulite appearance, and included a placebo/vehicle or untreated control group. The level of evidence in all studies was 2b

LED light-emitting diode, pts patients, – no improvement relative to baseline, -- worsening relative to baseline, ± non-significant improvement, + significant improvement, ++ significant improvement and superiority over comparator

^a Plant complex containing *Ginkgo biloba*, sweet clover, sea-weed, grape seed oil, lecithins and evening primrose oil

...provided no clear indication of beneficial effects

Based on the available evidence, there is no clear proof that any of the evaluated cellulite treatments, including mechanical tissue stimulation, various tropical treatments, acoustic wave therapy, laser- and light-based devices, radiofrequency techniques and other modalities, are potentially effective in reducing cellulite [1]. Table 1 provides the overall findings of 22 RCTs of various treatments for cellulite that included a placebo/vehicle or untreated control group, had an evidence level of 2b, and provided results and statistical analyses relating to the endpoint of improvements in cellulite appearance.

Mechanical tissue stimulation, one of the oldest treatments for cellulite treatment, involves manual or assisted lymphatic drainage of the skin [1]. Its efficacy in the treatment of cellulite is not clear due to the lack of evidence from RCTs; however, some observational studies (i.e. level 4 evidence) have reported improvements in cellulite grading and/or reductions in thigh circumference with this intervention.

A number of cosmetic topical therapies have been evaluated in the treatment of cellulite, with little evidence from RCTs that specific therapies have significant effects on its appearance (Table 1) [1]. In a meta-analysis evaluating the efficacy of various cosmetic topical treatments on the appearance of cellulite in seven RCTs [4], cosmetic creams reduced mean thigh circumference by -0.46 cm (95 % CI -0.85 to -0.08) versus controls, but there was significant between-study heterogeneity [4].

Laser, light- and radiotherapy-based approaches have been used in the treatment of cellulite, but evidence of their effectiveness is also generally lacking [1]. Acoustic wave therapy may have beneficial effects on the appearance of cellulite, as it was the only treatment that exhibited clear superiority over control across all available RCTs (Table 1) [5–7]. The efficacy of laser- and light-based approaches to treating cellulite appears to depend on the device that is used. The minimally invasive 1440 nm laser has shown some beneficial effects in observational studies [1], whereas there is very little or conflicting evidence regarding the effectiveness of 1064 nm ND:YAG [8, 9] or low-level laser therapy [10] (Table 1). Likewise, there is little evidence to support the use of radiofrequency techniques in the treatment of cellulite. Further RCTs are necessary to clarify the position of these approaches in the treatment of cellulite.

Cellulite has been treated with a wide variety of other modalities, including nutritional supplements, weight loss programmes, minimally invasive subcision (connective tissue septa is cut through to elevate depressed and dimpled skin), occlusive compression stockings, carbon dioxide therapy, ultrasound in combination with topical

hyaluronidase, and collagenase injections [1]. In general, weight loss is associated with a decrease in cellulite severity, but it may increase cellulite severity in some women [11]. Two RCTs evaluating the use of the same nutritional supplement found conflicting results with regards to the cellulite appearance (Table 1) [12, 13], with one of the studies showing a significant increase in body weight [12]. As only very limited level 4 evidence is currently available regarding the effectiveness of these and other modalities, they cannot currently be considered viable options for the treatment of cellulite [1].

Compliance with ethical standards

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