AN INSTRUMENT-APPLIED TOPICAL PRODUCT AFFECTS SKIN MICROVASCULATURE AND MAY THEREFORE BE BENEFICIAL FOR IMPROVING THE APPEARANCE OF CELLULITE

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INTRODUCTION

Cellulite is perceived as uneven bumpy skin texture seen especially with side lighting of the affected area. It has been described as an "orange peel" or "cottage cheese" skin appearance. This appearance is due to herniations of subcutaneous fat into the dermal and papillary dermis and can be documented via ultrasound as low-density regions among the denser dermal tissue (Figures 1 & 2). The complete etiology of cellulite is unclear but it is thought to involve genetic predisposition, changes in lipid metabolism, structural changes in the extracellular matrix of the skin and vascular insufficiency. Vasodilatation often accompanies the formation of cellulite but it is not known whether the results of this increased adipocyte size is causative. Nevertheless, reduced blood flow, measured as high as 10% may reduce nutrient supply to upper areas of the skin, weakening the skin's connective tissues and possibly contribute to the dimpling effect seen in persons with cellulite.

![Image 1](image1.png) Typical appearance of cellulite on the upper outer thigh.  
![Image 2](image2.png) 3D representation of skin showing a cellulite morphology.

OBJECTIVE

Evaluate the effects of a microcurrent instrument and topical products on the circulation of skin exhibiting a cellulite morphology.

METHODS

Ten Caucasian female subjects, Fitzpatrick types I and II, age 20–51, BMI 20–26 were enrolled in a pilot study to assess the ability of two proprietary electrically-conductive topical products (A, B), used in conjunction with a cosmetic instrument delivering a mild pulsating electrical current to improve microcirculation. Topical product A is formulated to provide an electrically conductive and contains active ingredients in an environment to control each of the two topical products was applied to 100 cm² on marked area of skin on the dorsal surface of the upper leg, one on each leg of each subject, randomized between left and right legs, and very gently massaged into the skin for 5 minutes using a microcurrent-delivering instrument. Immediately following the treatment, fluid movement was measured at three sites within the marked area by laser Doppler (Maso MBR), infrared imaging (CCD/200IP IR-NiK Thermal Imaging Software) and chromameter (X-radiance C3450).

RESULTS

By laser Doppler measurement, a statistically significant post-application increase in fluid movement (blood flow flux value) was seen with both instrument-applied topical products when compared to baseline. No significant differences were found between treatment with topical product A and topical product B (Table 1).

![Image 3](image3.png) Infrared photographs of the same skin area treated with topical product A taken immediately after application/treatment (0) and at 3 and 6 minutes post-treatment.

![Image 4](image4.png) Infrared photographs of the same skin area treated with topical product B taken immediately after application/treatment (0) and at 3, 4, 7, 12 and 15 minutes post-treatment.

![Table 1](table1.png)

<table>
<thead>
<tr>
<th>Topical Product</th>
<th>R_0-0</th>
<th>R_3-0</th>
<th>R_6-0</th>
<th>SD (Mean)</th>
<th>SD (Mean)</th>
<th>p</th>
<th>p</th>
<th>Response N of Subjects</th>
<th>N of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control, Placebo</td>
<td>A</td>
<td>7.16</td>
<td>6.51</td>
<td>6.27</td>
<td>0.45</td>
<td>2.12</td>
<td>0.0542</td>
<td>0.0485</td>
<td>40.00</td>
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<td></td>
<td>B</td>
<td>7.46</td>
<td>6.43</td>
<td>6.12</td>
<td>0.38</td>
<td>2.08</td>
<td>0.0542</td>
<td>0.0485</td>
<td>40.00</td>
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<tr>
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<td>4.42</td>
<td>3.64</td>
<td>3.57</td>
<td>0.25</td>
<td>2.84</td>
<td>0.0003</td>
<td>0.0003</td>
<td>19.00</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>4.42</td>
<td>3.64</td>
<td>3.57</td>
<td>0.25</td>
<td>2.84</td>
<td>0.0003</td>
<td>0.0003</td>
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</tr>
</tbody>
</table>

DISCUSSION

The theory that has received the most medical support contends that cellulite is an inflammatory process resulting from the breakdown of the collagen in the dermis, such that subcutaneous fat herniations into the dermis can be seen with ultrasound and skin texture is changed. With aging, enough collagen is destroyed to weaken the dermal and papillary dermis and allow subcutaneous fat to herniate between the structural fibrous septa found in female fat (more so than in males). Female subcutaneous fat is sequestered into discrete packets by the presence of septa. Obviously, if more subcutaneous fat is present, more pronounced herniation can occur, moving the skin upward while the septae hold areas of the skin in place. Deterioration of the dermal vasculature, particularly connective tissue or loss of the capillary network, also contributes to the process. As a result, excess fluid is retained within the dermal and subcutaneous tissues, limiting the removal of tissue-degrading enzymes and creating local edema and reducing the supply of oxygen supporting oxidative metabolism in favor of energy storage by additional lipid deposition. The compromising reduction of an efficient capillary network with inhibited venous return further enhances lipid deposition and ECM destruction. Changes in capillary blood flow can be reflected in skin temperature and can be seen as warmer regions of the skin. 

In this study, using a dermatoscope to assess skin color as an indicator of microcirculation did not show a statistically significant difference upon treatment with topical products A or B. However, laser Doppler measurement of microcirculation did detect a statistically significant difference following treatment with either topical A or B. We suggest that the skin surface cooling caused by the application of the anhydrous-based topical products reduced the utility of the dermatoscope to detect increased blood flow to the skin easier. This was confirmed by infrared photography where skin surface cooling was seen following topical product application.

In conclusion, although topical product B contained known cellulite active ingredients, caffeic analogs for example among others, no difference was seen when comparing topical A to topical B suggesting that the enhancement in circulation seen with both topical products may be due to the use of a cosmetic instrument delivering a mild pulsating electrical current for their application.

![Image 5](image5.png) Infrared photographs of the same skin area treated with topical product B taken immediately after application/treatment (0) and at 3, 4, 7, 12 and 15 minutes post-treatment.

CONCLUSION

Microcurrent-delivered cellulite-focused topical products may exhibit enhanced efficacy due to increases in microvascular circulation not attributable to product use or physically induced skin temperature changes.

REFERENCES