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 reticular and papillary dermis and can be documented via ultrasound as low-density regions among the denser dermal tissue. (Figures 1 & 2)[1] The complete etiology of cellulite is unclear but is thought to revolve around genetic predisposition, changes in lipid metabolism, structural changes in the extracellular matrix of the skin and vascular insufficiency.[2,3,4,5] Vasoconstriction often accompanies the formation of cellulite but it is not known whether this results from the increasing adipocyte size or is causative. Nevertheless, reduced blood flow, reportedly as high as 35%[6] 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.

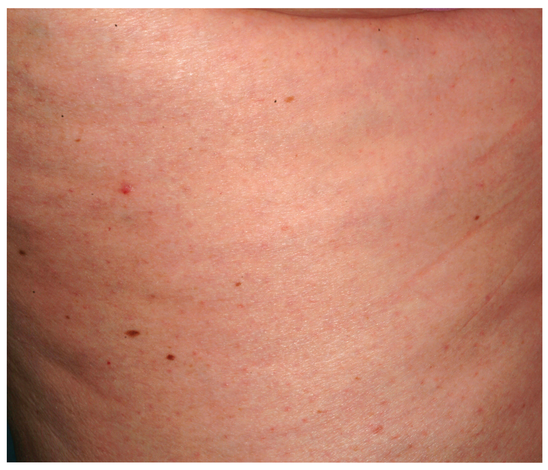

FIGURE 1. Typical appearance of cellulite on the upper outer thigh.

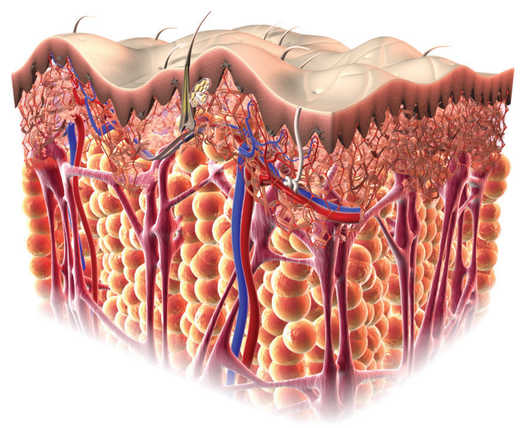

FIGURE 2. 3D representation of skin exhibiting a cellulite morphology.

OBJECTIVE

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

METHODS

Ten Caucasian female subjects, Fitzpatrick type I and II, age 20–35, BMI 20–30 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 electrical conductivity and topical product B was formulated to be electrically conductive and contain cellulite-active ingredients. In an environmentally-controlled area each of the two topical products was applied to 100 cm^2 marked area of skin on the dorsal surface of the upper legs, 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 (Moor MB3), infrared imaging (ICI 7320P, IR Flash Thermal Imaging Software) and chromameter (Minolta CR-400).

RESULTS

By laser Doppler measurement, a statistically-significant post-application increase in fluid movement (blood flow flux values) 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).

0 3 6

FIGURE 3. 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.

Chromameter data showed non-statistically significant but directional increases in post-application chromameter a* (red-green) values for both instrument-applied topical products. No significant differences were found between treatments (Table 1).

Infrared imaging showed patterns of hyperthermic regions against a non-homogenous background. A significant cooling effect on the skin from both instrument-applied topical products was seen, reaching a maximum reduction in skin surface temperature by 6 minutes post-treatment followed by rewarming of the skin. Figure 3 shows a reduction in skin surface temperature (reduction of white/bright blue areas) over the 6 minutes following application/treatment with topical product A. Figure 4 shows a similar pattern following application/treatment with topical product B with maximum surface cooling (blue areas) occurring at 6 minutes post application/treatment and a gradual re-warming of the skin surface thereafter.

	Topical Product	BL $\bar{\chi}$	V $\bar{\chi}$	Δ	%Δ	SDΔ	95% CIΔ	pΔ	pT	Response: % of Subjects w/ +	Response: % of Subjects w/ –
Chroma Meter a*	A	8.14	8.51	0.37	4.58	2.02	(-1.07, 1.82)	0.5742	0.9625	40.00	60.00
	B	7.79	8.14	0.35	4.43	0.88	(-0.28, 0.97)	0.2466		60.00	40.00
Laser Doppler	A	373.92	513.64	139.72	37.37	62.81	(94.79, 184.65)	<.0001	0.2312	100.00	0.00
	B	368.16	538.21	170.05	46.19	68.37	(121.14, 218.95)	<.0001		100.00	0.00

TABLE 1.

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 reticular 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 pockets 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 constriction of 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 catabolic signals and choking the supply of oxygen supporting oxidative respiration 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[7] and can be seen as warmer regions of the skin.[8,9] Thermal imaging has been proposed as useful in the evaluation of cellulite.[10]

In this study, using a chromameter 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 aqueous-based topical products reduced the utility of the chromameter to detect increased blood flow by skin color. This was confirmed by infrared photography where skin surface cooling was seen following topical product application.

Further, 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.

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.

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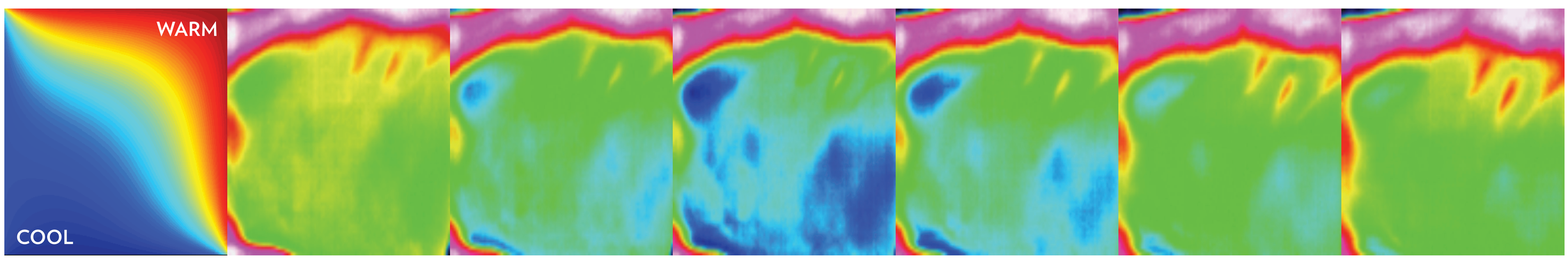

COOL/WARM 0 3 6 9 12 15

FIGURE 4. Infrared photographs of the same skin area treated with topical product B taken immediately after application/treatment (0) and at 3, 6, 9,12 and 15 minutes post treatment.