Frostbite following cryolipolysis: a case report

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Background

Cryolipolysis is a non-invasive body contouring procedure that aims to achieve focal clearance of subcutaneous fat by means of confined areas of cold exposure. The observation that adipose tissue is preferentially susceptible to cold injury compared to skin was first recognised by Hochinsinger in 1902.1 A review article in 2013 identified further cases reported by several authors since the 1940s.2

It was not until 2008 that the idea of applying this concept for aesthetic purposes was reported in the porcine model.2,3 It was shown that the precise application of cold temperatures selectively triggered apoptosis in adipocytes with sparing of the overlying skin. Two days post-treatment, a neutrophil and monocyte infiltrate was noted in the subcutaneous fat, which intensified with time as the adipocytes reduced in size in association with an increase in lipid-laden mononuclear inflammatory cells.3–5

Sasaki et al6 studied the skin and subdermal temperature changes in subjects during and after cryolypolysis. By completion of a one-hour treatment, skin and subdermal temperatures fell to between 9.5 and 13.9°C. Experimentally, at temperatures of approximately 10°C intracellular ‘lipid ice’ forms, which may contribute to immediate cell death or delayed apoptosis.3 Many other additional mechanisms of injury of the fat cells have been postulated, including alterations in cell osmoregulation, reduced Na+/K+-ATPase activity and adenosine levels, intracellular lactic acidosis, free radicals and ischaemic reperfusion type injury.6 When skin is exposed to cold, the degree of damage is related to the thermal properties of the material it is exposed to, the
temperature of that material, the duration of that exposure and the force applied. The estimated freezing point of human finger skin is -0.6°C. As the skin surface temperature falls from -4.8 to -7.8°C, the risk of frostbite increases from 5 to 95 per cent.7 These skin temperatures are well below the skin temperatures detected by Sasaki during correctly functioning and performed cryolipolysis.

Cryolipolysis is currently gaining popularity as an alternative to traditional liposuction due to its high efficacy and low incidence and duration of side effects.8,9 Common side effects include erythema, bruising, oedema, pain and diminished sensation, all of which are usually transient.7 Frostbite injuries following cryolipolysis are exceedingly rare.10,11 We report a case of severe frostbite following a cryolipolysis session that required surgical intervention with resultant permanent scarring.

Keywords: body contouring, frostbite, cryolipolysis

Case

A 40-year-old female presented to plastic surgery outpatients with two large, tense blisters on her left medial knee. She reported undergoing simultaneous cryolipolysis to both medial knees with an unknown brand device at a private clinic two days previously. On examination, there were adjacent bullae, each approximately 15×6 cm in diameter, on her left medial knee (Figure 1). On deroofing the blisters, there was a pink peripheral zone with preserved capillary return and a pale, insensate central area, suggestive of a full-thickness burn.

The lesions were initially treated conservatively with Acticoat™ (Smith & Nephew, London, United Kingdom) and IntraSite Conformable™ (Smith & Nephew, London, United Kingdom) dressings while awaiting demarcation. A week later, the central areas remained pale and insensitive and the patient underwent debridement of the burns with split-thickness skin grafting. At the time of operation the main concern was the status of the underlying fat and whether it would be sufficiently viable to support a skin graft—fortunately, in this case, it was (Figure 2).

The fat was discoloured but punctate bleeding was visible from the septae. Pathology of the debrided tissue was reported as congested viable fat with superficial organizing fat necrosis and focal thrombosis.

The patient experienced good graft take and the wounds were completely healed by six weeks. The incident, however, left the patient with two oval scars with a slight contour deformity on the medial aspect of the left knee (Figure 3), as well as significant psychological trauma.

Discussion

Frostbite injuries following treatment with cryolipolysis devices are very rare, with only two cases reported in the literature.10,11 Choong and colleagues10 described a burn injury occurring in the left flank after a visit to an unregulated beauty salon. It resulted in necrosis of the skin and underlying fat, which healed by secondary intention. Nseir and colleagues11 treated a patient...
with skin necrosis following routine cryolipolysis by a dermatologist. They did not report on the viability of the underlying fat. The burns were excised and directly closed. In both cases, initial treatment involved a conservative approach with dressings to allow for evolution of the injury. Subsequent management differed based on the anatomical site, size and severity of lesions. In our case, the underlying fat remained viable, supporting the use of a split-thickness skin graft to restore the integrity of the large area of skin deficit. Unfortunately, many imitation devices with unknown safety and effectiveness have now emerged in the market for cryolipolysis treatment. In this case there is uncertainty surrounding the make of device but the simultaneous treatment of two areas appears inconsistent with the approved and reputable Coolsculpting® (Zeltiq Aesthetics, Pleasanton, California, USA) branded device because it has only a single applicator per unit.

In our patient we were unable to determine the exact mechanism of the frostbite. In Nseir’s case, the handpiece was found to be lacking gel, resulting in direct skin contact with the cooling plates. We can only speculate that a similar error may have occurred during our patient’s procedure, as the gel sheets that are positioned beneath the applicator can tear or move, thereby inadvertently exposing skin directly to the applicator. Alternatively, the vacuum pressure may not have been applied correctly or there was a fault with the machine. The Coolsculpting® device has a built-in freeze-detection sensor and software to monitor changes in the skin and will automatically shut the unit down if a freeze is detected. This should minimise the risk of frostbite injury but these features may not be present on other-branded or generic units.

**Conclusion**

Frostbite injuries are an extremely rare and potentially avoidable complication of cryolipolysis. Clinicians should raise the awareness of their patients to this possible adverse effect and advise them to seek cosmetic procedures only from certified reputable providers that use approved devices.

**Disclosure**

The authors have no financial or commercial conflicts of interest to disclose.

**References**

