Acute Tissue Injury Following Tattooing: A Confocal Microscopy Analysis
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Abstract

Introduction

Tattooing has increased exponentially in recent years, being embraced as a form of art, where approximately 30% of current Americans aged 18-25 and 40% of Americans aged 26-40 are presently tattooed. Interestingly, in a lethargic era of increased scrutiny and regulation, tattooing is largely unregulated and is regarded as some as an ongoing human experiment on the injection of chemicals into the human skin, where reactions are not uncommon.

Decorative tattoos have the potential for a variety of complications including bacterial, viral, fungal infections, and allergic reactions, and even localized skin disease such as porioid and lichen planus, and tumors have been documented. A majority of these complications are probably due to the implantation of unstable pigments in anesthile conditions. The onset of each complication varies, often occurring within days, months, or even years later. These adverse events can be seen in medical uses of tattoos as well, which have rapidly increased in the cosmetic and reconstructive medical arena.

Purpose

To define progressive cytoarchitectural changes after acute tissue injury days to weeks after acquiring a tattoo, using in vivo reflection confocal microscopy (RCM)

Method and Design

We report the use of in vivo RCM in the investigation of acute tissue injury days to weeks after acquiring a tattoo, and examine changes in the stratum corneum, the strato-granular (SG) layer, and at the dermo-epidermal junction (DEJ). Patients were examined in a clinic setting using the CellceID VivaScope 1500 multi-layer reflection confocal microscope. Encounters were carried out as follows:

- Site
- Imaging
- Post tattoo day 10
- Post tattoo day 3, 7, 10, 13, 17, 24
- Patient 1: abdomen
- Patient 2: shoulder
- Patient 3: abdomen

Case Report

RCM imaging revealed a disruption in the architecture of the stratum corneum as well as an infiltration of inflammatory cells due to the trauma of the tattoo in the SG layer. There was significant deposition of tattoo pigment in the SG layer and down to the DEJ. On the other hand, a lymphocytic response is evidenced by a dramatic increase in Langherans cell counts due to the trauma of the tattoo in the SG layer. There was no evidence of adverse events or reported during the study.

Discussion

Histopathology of acute tissue injury

In the first 24 hours, neutrophils phagocytose the pigment, later followed by evidence of pigment aggregates in keratinocytes, macrophages, mast cells, and fibroblasts. Eventually a lymphocytic response may emerge as Langerhans cells recognize and transport foreign antigens to lymph nodes.

A new tattoo will show disruption of the epidermal basement membrane with necrosis of epidermal and dermal cells. The disruption of the basement membrane allows pigment to travel back to the epidermis from the dermis. This is termed "transdermal elimination" and can be seen over a month later with pigment in keratinocytes, macrophages, and fibroblasts. Transdermal elimination occurs once the basement membrane returns. Pigment however may still be evident in corresponding lymph nodes.

Older tattoos show pigment in mononuclear cells, fibroblasts, and extracellular tissue. Larger particles remain in the dermis, too large to be transported. Later these particles are found within dermal fibroblasts as a noninflammatory response of foreign nonmetal substances. As tattoos continue to age, the pigment absorbs further into the dermis, eventually draining to lymph nodes.

Results

Patient 1 was imaged on only one occasion, post-tattoo day 10. On this day they had similar results to patients 2 & 3 on their corresponding post-tattoo day 17 & 24. Patients 2 & 3 had similar results on every examination from their baseline pre-treatment to the last imaging. Patients 2 and 3 were tattooed by the same person using similar equipment. However, patient 1 was tattooed elsewhere, likely with different pigment and technique.

- Disrupted architecture in the stratum corneum in locations of needle entry, shown as hyporeflective areas. An infiltration of small bright inflammatory cells is present around areas of trauma, which continue into the SG layer. Tattoo pigment appears as bright polymorphic granularities with a haphazard deposition in this layer and down to the DEJ junction.

- Disrupted architecture in the stratum corneum in locations of needle entry, shown as hyporeflective areas. Hyporeflective areas with an inflammatory cell infiltrate. SG layer has multiple spindle-shaped cells consistent with Langerhans cells. These dendritic cells appear grouped together in increased density around areas of increased trauma due to multiple needle entry from tattoo design.

References

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