Microneedling and Hyperpigmentation

The question as to whether hyperpigmentation occurs due to microneedling is brought up repeatedly. The obvious question is that if “post-inflammatory hyperpigmentation” (PIH) is common in darker skin types, why would needling not be considered “high risk” in these patients, given that inflammation results with needling? The answer hinges around the degree and duration of inflammation. This response is typically not prolonged, nor is it as intense after needling when compared to other treatment modalities. Microneedling stimulates production of TGF-B3 which has anti-inflammatory effects. It also stimulates TGF-B1 which restricts pigment formation through downregulation of tyrosinase via decreased gene expression as well as decreasing its intracellular half-life. [i] Also, anti-inflammatory skincare ingredients, such as phosphatidylcholine, typically used in conjunction with needling, limit the inflammatory response. There are other mechanisms due to microneedling that normalize pigment formation as well which I won’t discuss here.

The problem with hyperpigmentation is that there are so many variables and it is almost impossible to determine underlying cause with complete certainty. It usually involves multiple factors. Yes, there are the typical causes which we tend to focus on, such as sun exposure, PIH, smoking, genetics, hormones, photosensitizing meds and skin care products, etc., but the list is too extensive to include here, though some lesser known causes are discussed below.

Microneedling is touted as being colorblind, though it is the microneedling PLUS.....and you can fill in the blanks with chemical peels, photosensitizers, sun exposure, etc. that results in hyperpigmentation. Microneedling is never done in isolation. Life happens. Avoiding sun exposure is virtually impossible in the weeks following treatment. Women have hormones that influence melanogenesis. Many people are on medications which cannot be discontinued that are photosensitizers. Higher Fitz patients are exceptionally capable of producing pigment, and once we have awakened the sleeping giant with rejuvenation treatments, all the traditional treatments for pigmentation, such as IPL, Laser, and Chemical Peels, provoke a perturbed cell even more.

In summary, Microneedling in isolation regulates and normalizes pigment formation, both at a melanocyte and keratinocyte level. It does not cause hyperpigmentation without other influencing factors.
Here are some additional lesser-known things to ponder:

A lesser-known cause of hyperpigmentation pertains to temperature. If you were to treat someone who lived in a hot climate, but hypothetically lived in the dark (a vampire for instance), they could still develop hyperpigmentation. This mechanism is poorly understood. One theory is that increased perfusion drives the melanogenesis equation to production via an abundance of precursors for melanin, though I have not found any studies to verify this. However, increased temperature does accelerate the tyrosinase reaction and is thought to explain hyperpigmentation found in skin chronically exposed to heat sources and body folds. [ii]

There is also a condition called “erythema ab igne”, where pigmentation results due to angiogenesis caused by heat exposure, e.g. hot water bottle, laptop, ovens, etc. It is thought that chronic vasodilatation from heat leads to leaking of inflammatory cells into the tissue with ensuing post-inflammatory hyperpigmentation.

As a side note, pH also affects melanogenesis. One study showed that melanin synthesis is maximal at a pH of 6.8 and melanin production is suppressed by lowering melanosome pH. [iii] Conventional wisdom maintains that the chief mechanism of action with most chemical peels is through exfoliation, but there may well be other mechanisms that play a greater role than we think. Not that I want to encourage you to rush to this treatment modality as a first choice in treating hyperpigmentation because exfoliating the natural barrier, along with the bilayers, has its own drawbacks that complicate the cascades of wound healing triggered by microneedling. Chemical peels, by definition, cause inflammation. This adds fuel to the fire in patients at high risk for post-inflammatory hyperpigmentation. Due to the power of Microneedling pens compared with rollers, it is easier to over-treat the skin with electronic devices, especially when some recommend bleeding and maceration as the endpoint. This inevitably also creates significant inflammation, and thus combining chemical peels with microneedling increases the risk of PIH considerably in high Fitz patients.

In essence, microneedling is a proven treatment for optimizing skin health that is superior in many ways to other treatment modalities, but, like most things in life, it has its limitations. In our quest for maximizing results beyond these limitations we often try to amplify the positive effects by adding other treatment modalities, forgetting that microneedling may also amplify the negative effects of these treatments through increased absorption or inflammation.
Frequently these problems arise when pushing the envelope while trying to compete with practitioners that have greater scope of practice in an attempt to equal their results.

A good example of this is when aestheticians use a cosmetic roller and occlusion to enhance penetration of topical anesthetic, thus converting an OTC product into a “drug” that would normally require a prescription to attain those levels of effectiveness. This defeats the purpose of imposing dose level restrictions and removes the very protection it was supposed to afford the practitioner (and client/patient) according to their level of ability and responsibility should an emergency occur, such as cardiac arrest.

Again, I urge practitioners to stay within their scope of practice. Less is best. Accept that microneedling has limitations. Accept your own limitations (scope), and rest in the knowledge that pigmentation disorders are extremely complex and we cannot always fix everything that comes through our doors. Keep it simple and keep it safe.