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Aesthetic Procedures in Patients with Vitiligo: Evidence-Based Clinical Guidelines for Minimizing Koebner Phenomenon Risk

Roaa AlShams A Baroud*

Aesthetic and anti-aging doctor, American Academy of Anti-aging Medicine, Dubai, United Arab Emirates

***Corresponding author:**

Roaa AlShams A Baroud,
Aesthetic and anti-aging doctor, American Academy of Anti-aging Medicine, Dubai, United Arab Emirates

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1. Abstract

1.1. Background

Vitiligo is a chronic autoimmune disorder characterized by melanocyte destruction with variable progression, and significant psychological burden [1,2]. Patients increasingly seek cosmetic procedures; however, trauma may induce Koebner phenomenon, resulting in new depigmented lesions [3,4]. Despite rising demand, no formal guidelines exist for aesthetic interventions in this population.

1.2. Objective

To synthesize available evidence and propose structured, evidence-based recommendations to guide safe aesthetic practice in individuals with vitiligo.

1.3. Methods

A narrative review was conducted using PubMed, EMBASE, and the Cochrane Library. Literature addressing vitiligo pathophysiology, trauma-induced depigmentation, procedural safety, and aesthetic techniques was analyzed.

Recommendations were formulated based on peer-reviewed evidence and established dermatologic principles.

1.4. Results

Botulinum toxin and low-trauma procedures demonstrate favorable safety profiles when performed in stable vitiligo. Procedures involving significant epidermal or dermal injury including microneedling, ablative lasers, and thread lifting carry high risk of koebnerization [5,6]. Disease stability, history of koebnerization, and procedural trauma level are key determinants of safety.

1.5. Conclusion

Aesthetic procedures may be performed safely in selected patients with vitiligo when guided by structured assessment, risk stratification, and technique modification. These guidelines provide a practical framework for clinicians to minimize iatrogenic depigmentation.

2. Introduction

Vitiligo is a multifactorial pigmentary disorder affecting approximately 0.52% of individuals worldwide and is characterized by selective melanocyte destruction mediated through autoimmune, oxidative, and neurogenic pathways [1,7,8]. The psychosocial burden of vitiligo is substantial, with significant impacts on self-image and quality of life [2]. As aesthetic dermatology continues to expand, many individuals with vitiligo present seeking rejuvenation, contouring, resurfacing, or corrective cosmetic procedures.

A principal concern in this population is the Koebner phenomenon, defined as the appearance of new vitiligo lesions at sites of cutaneous trauma [3,4]. Mechanical, thermal, and inflammatory insults can trigger koebnerization, rendering many cosmetic procedures theoretically risky [4,12]. Despite increased demand, clinical guidance remains limited to anecdotal reports, small case series, and expert opinion [5,6,9].

The objective of this paper is to synthesize existing evidence and propose a structured guideline for the safe performance of aesthetic procedures in patients with vitiligo. These recommendations aim to assist clinicians in minimizing procedural risk and optimizing outcomes.

3. Methods

A narrative review was conducted due to limited high-quality data. Literature was searched using PubMed, EMBASE, and the Cochrane Library from inception to January 2026. Keywords included vitiligo, Koebner phenomenon, aesthetic procedures, lasers, microneedling, radiofrequency, fillers, botulinum toxin and micropigmentation.

3.1. Inclusion Criteria

- Peer-reviewed articles discussing vitiligo and trauma-related depigmentation
- Studies addressing procedural safety
- Mechanistic and pathophysiologic papers
- Case reports, reviews, and expert consensus documents

3.2. Exclusion Criteria

- Non-English publications
- Abstracts without full text

Results were synthesized thematically, and recommendations were formulated based on consistency of findings and established dermatologic principles.

4. Pathophysiology Relevant to Aesthetic Procedures

Vitiligo pathogenesis involves melanocyte destruction through autoimmune cytotoxicity, oxidative stress, and intrinsic melanocyte fragility [1,7,8,9]. Trauma mayntensify inflammatory pathways, producing cytokine upregulation including IL-1β, TNF-α, IL-6, and IFN-γ which are implicated in disease progression [8,9].

Melanocytes in vitiligo exhibit impaired antioxidant defenses, making them susceptible to apoptosis following minimal trauma [8,9].

The Koebner phenomenon, well-documented in vitiligo, describes the development of new lesions following mechanical, chemical, or thermal injury [3,4,13]. Its threshold varies among individuals, influenced by disease activity, local immune activation, anatomical location, and genetic susceptibility [5,18,19]. Procedures causing epidermal disruption, dermal inflammation, or thermal injury pose the greatest risk for iatrogenic depigmentation.

5. Pre-Procedure Assessment

5.1. Disease Stability

Stable vitiligo defined as no new lesions or enlargement for at least 6,12 months is essential before pursuing most aesthetic procedures [5,19]. Signs of instability include inflammatory borders, confetti depigmentation, and rapidly enlarging macules [14].

5.2. History of Koebner Phenomenon

A personal history of trauma-induced vitiligo strongly predicts future koebnerization [3,4].

5.3. Lesion Localization

Bony prominences, periorificial areas, and flexures carry increased risk due to local friction and micro-trauma [6,19].

5.4. Psychological Assessment

Vitiligo significantly affects self-esteem and emotional well-being [2]. Unrealistic expectations may lead to dissatisfaction if depigmentation occurs.

5.5. Medication Review

Concurrent topical or systemic therapies including corticosteroids, calcineurin inhibitors, JAK inhibitors, and phototherapy should be reviewed and adjusted as needed [10,20].

5.6. Informed Consent

Consent should specifically address risks of koebnerization, post-procedure monitoring, and possibility of permanent depigmentation.

6. Procedure-Specific Safety Recommendation

6.1. Injectables (Fillers and Botulinum Toxin)

Botulinum toxin produces minimal trauma and is considered safe [6]. Fillers require caution due to repeated needle entries. Trauma can be reduced by using microcannulas, minimizing injection points, and avoiding active lesions.

6.2. Microneedling and RF Microneedling

Microneedling generates controlled epidermal and dermal injury and has been associated with koebnerization [5]. RF adds thermal injury, increasing risk. These procedures should be avoided in unstable vitiligo and used conservatively in stable disease.

6.3. Platelet-Rich Plasma (PRP)

PRP has theoretical benefits but the needling trauma remains the main risk. Conservative injection patterns are recommended [6].

6.4. Laser and Light-Based Devices

- Ablative lasers (CO, Er: YAG) cause significant injury and carryhigh risk [16].
- Non-ablative lasers carry moderate risk and require conser- vative settings [10].
- Laser hair removal is generally safe when appropriate fluence is used [17]. Tattoo removal lasers carry unpredictable risk of depigmentation [18].

6.5. Thread Lifting

Threads induce mechanical trauma and should be avoided in unstable disease. Even in stable patients, minimal insertion points and gentle tissue handling are advised.

6.6. Tattooing and Micropigmentation

Tattooing carries significant risk of koebnerizations [18]. Camouflage micropigmentation may be considered only in long-standing stable lesions with strict precautions.

7. Post-Procedure Care

Immediate care should minimize inflammation and mechanical trauma. Recommendations include cold compresses, gentle emollients, and strict photoprotection. Early anti-inflammatory therapy with topical calcineurin inhibitors may reduce risk of new depigmentation [9,12]. Patients must monitor for new lesions, confetti depigmentation, or persistent erythema. Sequential procedures should be spaced adequately to allow full recovery [10].

7.1. Proposed Clinical Algorithm

1. Assess disease stability (stable vs unstable) [13,14].

2. Identify risk factors including koebnerization history [3].

3. Stratify procedures:

- Low risk: neuromodulators, conservative hair removal lasers
- Moderate risk: fillers, non-ablative fractional lasers
- High risk: microneedling, ablative lasers, thread lifting [5,16,19]

4.Modify technique to minimize trauma [6].

5. Post-procedure monitoring at 12 weeks and again at 412 weeks.

8. Discussion

Despite the rising popularity of aesthetic procedures, data guiding safe practice in vitiligo remain limited. The risk of koebnerization varies significantly depending on disease stability and pro- cedural trauma [3,4,13]. While low-trauma interventions such as botulinum toxin injections appear safe, high-trauma modalities particularly microneedling and ablative lasers have documented cases of inducing depigmentation [5,16,19].

Evidence gaps include the role of immunomodulatory pre-treatment, standardization of stability assessment, and long-term outcomes of repeated procedures [20]. Prospective Controlled Studies Are Needed.

These guidelines offer a structured, clinically applicable approach based on current evidence and dermatologic principles.

9. Conclusion

Aesthetic procedures can be performed safely in selected patients with vitiligo when guided by careful assessment, risk stratification, and technique modification.

Disease stability remains the strongest predictor of procedural safety. High-trauma procedures should be avoided in unstable disease. This guideline provides a practical framework to support safe and ethical aesthetic practice.

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