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Comparison of microneedling and full surface erbium laser dermabrasion for autologous cell suspension grafting in non-segmental vitiligo: a randomized controlled trial

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Dear Editor, Autologous cell suspension is a well-demonstrated effective approach for treating segmental or stable and localized forms of vitiligo[1]. Full surface dermabrasion is considered as the gold standard technique for preparing the skin before grafting. Fractional ablative laser or microneedling have been shown to enhance the penetration into the skin of topical agents[2]. We demonstrated, using an *ex-vivo* skin model, that microneedling allows to successfully graft a melanocyte suspension into the skin and that this procedure was as effective as fractional ablative lasers in this setting[3]. In the same study, we showed that a 200uM depth of microneedles was optimal for delivering the melanocytes in the epidermis. The interest of using microneedling before a graft of epidermal suspension was further suggested by a pilot open study reporting excellent repigmentation in 3 and mild repigmentation in 2 of the 5 treated patients[4]. These interesting results needed to be confirmed as the treated lesions were located on the face in a sunny country and spontaneous repigmentation cannot be ruled out since the study was not controlled.

We thus conducted a randomized controlled prospective study to compare the efficacy of microneedling to the full surface Erbium:YAG-assisted dermabrasion (IRB Sud-Méditerranée V15.075; NCT02660320). Patients with non-segmental vitiligo, stable for more than 3 months were included. The lesions had to be resistant to at least one medical procedure including topical tacrolimus or topical steroids or UVB for 6 months. In each patient, three separate test areas ranging from 2 to 50cm² were selected in the same part of the body. For

each patient a scheme with the 3 areas, named A, B and C clockwise, was sent to the department of Research and Innovation of our hospital. In return, for each patient, they used a random number table and send back to us which type of procedure had to be done for every location. One area was pre-treated with dermaroller and received hyaluronic acid suspension and the two others received epidermal cell suspension in hyaluronic acid after pre-treatment either with dermaroller or laser-assisted dermabrasion, each patient being his own control. The dermaroller had 540 microneedles of 200µm depth. Twelve passages were performed on the treated area to achieve 60% of coverage. Laser-assisted dermabrasion was performed using a 2940nm Erbium:YAG laser (spot size 5mm, 13J/cm², 5Hz, repeated passages until pinpoint bleeding was noticed) (Burane, Alma lasers, Liege, Belgium). The epidermal suspension was prepared by using the VITICELL® kit (Genevrier, Sophia-Antipolis, France) with a 1 to 5 ratio. Targeted phototherapy with 308nm excimer lamp (Exciplex, Clarteis, Sophia-Antipolis, France) was applied on all treated areas 2 weeks after cell grafting and performed twice a week for 3 months. The primary efficacy endpoint was the rate of repigmentation lesions at 3 months. The rate of repigmentation was graded as 0%, 1-25%, 26-50%, 51-75%, 76-100% by two physicians (HM, TP) blinded to the treatment received on standardized direct and UV pictures. An intention to treat analysis was performed.

A total of six patients were included (4 women and 2 men) with skin type I to V. None was lost during follow-up. The mean age was 44.5 years (extremes 29-63). Treated lesions were localized on the lower limbs in 3 cases, on the arms for 2 patients and on the axillae for the last one. None of the 6 patients treated with microneedling followed or not by the suspension graft had any repigmentation. Two patients had 90% repigmentation of the area treated with Er:YAG dermabrasion followed by epidermal suspension. One patient achieved 75% of repigmentation with the same procedureand the three remaining patients did not have any repigmentation. A Cochran's Q test was used to compare the rate of repigmentation ≥75%

between Er:YAG dermabrasion followed by epidermal suspension and microneedling alone or followed by epidermal suspension. In both case the dermabrasion performed statistically better (p=0.018 for the two comparisons). Pain was graded 1.2 (extremes 0-2) with microneedling and 4.7 (extremes 2-7) with the Er:YAG dermabrasion. No infection or scars were noted for all groups.

With minimal pain, easy procedure and limited cost, the microneedling is appealing but our results suggest the ineffectiveness of such a procedure for preparing the grafting bed. The small sample size is the main limitation of our study. Moreover, we can't exclude that other protocols using different depth or density of microneedles, or adding cells before performed the microneedling as Benzekri et al did[4], might provide better results. Interestingly, fractional CO2 laser was also initially reported to be effective in the same indication[5]. However, a prospective randomized controlled trial performed in segmental vitiligo and piebaldism showed that the full surface dermabrasion is superior to the fractional CO2 laser[6]. In accordance to our results, they did not observe any repigmentation when using the fractional CO2 laser. We can hypothesize that the ineffectiveness of fractional CO2 or microneedling could be explained by the fact that the melanocytes account for only a minor proportion of the cells grafted when using epidermal suspension and that the limited number of cells allowed to penetrate the epidermis using fractional procedures is not enough to induce repigmentation.

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Figure

Figure 1. A. Vitiligo lesions before treatment. **B.** Vitiligo patch 3 months after laser-assisted dermabrasion and autologous epidermal cell suspension. **C.** UV picture of vitiligo patch 3 months after laser-assisted dermabrasion and autologous epidermal cell suspension. **D.** Vitiligo patches 3 months after dermaroller followed by autologous epidermal cell suspension (upper lesion) or by hyaluronic acid only (lower lesions). **E.** UV pictures of vitiligo patches 3 months after dermaroller followed by autologous epidermal cell suspension (upper lesion) or by hyaluronic acid only (lower lesions).