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ORIGINAL RESEARCH

Autologous Serum and Non-Cultured Epidermal Cell Suspension for Stable Vitiligo: A 30-Patient Case Series

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Background: Stable vitiligo, characterized by irreversible melanocyte loss, often resists conventional therapies. Non-cultured epidermal cell suspension (NCES) transplantation are increasingly used, and adjunctive autologous serum may enhance efficacy via growth factor-mediated cell survival and proliferation. This study evaluates the clinical outcomes of combined autologous serum and NCES therapy for stable vitiligo.

Methods: This prospective case series enrolled 30 patients (61 sites) with stable vitiligo at the Guangzhou New Centre Institute of Vitiligo (2024–2025). Patients received autologous serum followed by NCES transplantation. Repigmentation was assessed using the Vitiligo Area Scoring Index (VASI) and color matching. Adverse events were monitored.

Results: After 3 to 6 months, excellent repigmentation (> 90%) was achieved in 83.6% of treated sites (51/61), with particularly high efficacy on facial (90% efficacy in 9/10 sites) and neck regions (92.3% efficacy in 12/13 sites). The trunk, upper limbs, and hands/fingers exhibited excellent repigmentation in 80.0%, 77.8%, and 78.6% of sites, respectively. Poor repigmentation (< 25%) was observed in only one trunk site (1/61). Excellent color matching was achieved in 82.0% of treated sites (50/61), and no treatment-related adverse effects were reported.

Conclusion: The combination of autologous serum and NCES transplantation is highly effective and safe for stable vitiligo. Autologous serum may synergize with NCES by supporting the microenvironment for melanocyte engraftment, offering a promising strategy for stable vitiligo.

Keywords: vitiligo, non-cultured epidermal cell suspension, autologous serum, melanocytes

Introduction

Vitiligo is a clinically distinct depigmentation disorder characterized by well-demarcated, milk-white macules or patches, resulting from the selective loss of melanocytes in the epidermis and hair follicles.[1] The pathogenesis of vitiligo is complex and multifactorial, involving genetic susceptibility, autoimmune, inflammation, oxidative stress-apoptosis cascade, and neurological factors. The interaction of these factors is believed to drive melanocyte destruction, yet the exact etiology remains unclear.[2] Given this complexity, combination therapies targeting multiple pathways have developed as a strategic approach to enhance therapeutic success.[2,3] Conventional therapies, such as topical corticosteroids, calcineurin inhibitors, and narrowband ultraviolet B (NB-UVB) phototherapy, aim to halt disease progression and induce repigmentation by immunomodulation or stimulating residual melanocytes. However, these approaches often exhibit inadequate efficacy in stable vitiligo, where follicular melanocyte reserves are depleted, thus necessitating surgical intervention through exogenous melanocyte transplantation. A recent meta-analysis of 117 studies involving 8,776

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patients reported thatthe pooled rates of repigmentation exceeding 50% and 90% following surgical intervention were 81.0% (95% CI, 78.2–83.8%) and 52.7% (95% CI, 46.9–58.5%), respectively. When stratified by these surgical techniques, repigmentation exceeding 90% was observed in 72.1% of treated sites for thin skin grafting, 61.7% for suction blister grafting, 56.8% for cultured epidermal cell suspension, 47.5% for non-cultured epidermal cell suspension (NCES), 45.8% for punch grafting, and 36.2% for non-cultured follicular cell suspension.[4]

In recent years, autologous NCES has emerged as the most widely used surgical approach for stable vitiligo, particularly when synergistically combined with adjuvant therapies such as NB-UVB, microneedling, 5-flurouracil, or platelet-rich plasma (PRP), significantly enhancing NCES efficacy.[5–7] Autologous serum, enriched with platelet-derived growth factors (PDGF), fibroblast growth factor (FGF), and insulin-like growth factor-1 (IGF-1), has been extensively investigated as a source that provide necessary growth factors and a supportive environment for cell survival, proliferation, migration, differentiation, and attachment in regenerative medicine.[8] Melanocyte cultures, like other cell systems, are typically supplemented with fetal bovine serum (FBS), which is well-known to provide a rich array of growth-promoting factors, essential nutrients, and protective components for these cells.[9] This study aimed to evaluate the repigmentation response and safety profile of autologous serum and NCES transplantation, thereby providing evidence to support their combined use as an effective treatment strategy for stable vitiligo.

Patients and Methods

This prospective study included patients with stable vitiligo who were unresponsive to conventional medical treatment and phototherapy. These patients were treated at the Guangzhou New Century Institute of Vitiligo (Guangzhou, China) between September 2024 and March 2025. Stability was defined by the following criteria: (1) no new lesions, (2) no enlargement or morphological changes in existing lesions, (3) no Koebner phenomenon for ≥1 year, and (4) Wood's lamp examination revealing sharply demarcated, bright white lesions with clear margins. Exclusion criteria included active vitiligo, a history of keloid formation, active infection, coagulation disorders, severe systemic diseases, or pregnancy. High-resolution photographs of target patches were obtained to assess repigmentation outcomes before and after treatment. The study was approved by the Research Ethics Committee of the Guangzhou New Centre Institute of Vitiligo (approval No. 2024A006). This study was conducted in accordance with the Declaration of Helsinki. All patients provided written informed consent for study participation and the use of photographic documentation for publication purposes. For patients under 18 years of age, consent was obtained from their parents or legal guardians.

The NCES and recipient site preparation were conducted as our previously described.[10] Peripheral blood (5–10 mL) was collected into sterile glass bottles and incubated at 37°C for 1 hour to ensure complete clotting. Subsequently, the serum was aseptically transferred to centrifuge tubes and centrifuged at 1000g for 10 minutes at 4°C to pellet cellular debris. Autologous serum was uniformly sprayed to the prepared recipient site at a volume of 0.1–0.3 mL per cm^2 of the vitiligo lesion. The NCES suspension was then carefully administered to ensure even cellular distribution across the dermabraded area, with a coverage ratio of 5–10 cm^2 of treated area per 1 cm^2 of donor biopsy. The site was covered with non-adhesive, sterilized wound dressings and contact dressings. All dressings were removed from the recipient sites after 1 week. Repigmentation was assessed at 1, 3, and 6 months post-transplantation using clinical and photographic evaluations. Repigmentation was evaluated and scored using the Vitiligo Area Scoring Index (VASI), and graded as excellent (> 90%), very good (76–90%), good (51–75%), fair (26–50%), or poor (< 25%) relative to treated regions.[7] Color matching was categorized as lighter, similar, or darker compared to surrounding skin. Adverse effects, including pain, erythema, infection, and scarring, were systematically recorded. Statistical analyses were performed using SPSS version 13.0 (SPSS Inc., Chicago, IL, USA). Demographic data were summarized with descriptive statistics: categorical variables are presented as frequencies (percentages), and continuous variables as mean ± standard deviation.

Results

A total of 30 patients (10 males and 20 females) with 61 vitiligo anatomical sites were included in the study. All patients received treatment with autologous serum and NCES and completed a follow-up duration exceeding 3 months. The mean age was 30.1 years (range:10–56 years), with 3 patients younger than 14 years. The mean duration of disease and disease stability were 10.4 ± 3.6 years (range: 3–16 years) and 3.2 ± 2.4 years (range: 1–9 years), respectively. Vitiligo types

Table 1 Demographic and Clinical Characteristics of 30 Patients with Vitiligo

Age (years), mean ± SD (range)	30.1 ± 11.8 (10–56)
Male (%): Female (%)	10 (33.3): 20 (66.7)
Duration of disease (years), mean ± SD (range)	10.4 ± 3.6 (3–16)
Duration of stability (years), mean ± SD (range)	3.2 ± 2.4 (1–9)
Subtype of vitiligo, n (%)	
Segmental/Non-segmental	5 (16.7)/25 (83.3)
Anatomic area, n (%)	
Face/Neck/Trunk/Upper limb/Hands and fingers	10 (16.4)/13(21.3)/15 (24.6)/9 (14.8)/14 (23.0)
Family history, n (%)	
Yes/No	3 (10)/27 (90)

Table 2 Repigmentation of Treated Sites After 3-to-6-Month Treatment (n, %)

	Face (n = 10)	Neck (n = 13)	Trunk (n = 15)	Upper Limb (n = 9)	Hands/Fingers (n = 14)	Total (n = 61)
VASI						
Poor (< 25%)	0 (0.0)	0 (0.0)	1 (6.7)	0 (0.0)	0 (0.0)	1 (1.6)
Fair (25–50%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Good (51–75%)	0 (0.0)	0 (0.0)	1(6.7)	0 (0.0)	1 (7.1)	2 (3.3)
Very good (76–90%)	1 (10.0)	1 (7.7)	1 (6.7)	2 (22.2)	2 (14.3)	7 (11.5)
Excellent (> 90%)	9 (90.0)	12 (92.3)	12 (80.0)	7 (77.8)	11 (78.6)	51 (83.6)
Color matching						
Lighter	0 (0.0)	1 (7.7)	1 (6.7)	0 (0.0)	1 (7.1)	3 (4.9)
Same	8 (80.0)	10 (76.9)	13 (86.7)	8 (88.9)	11 (78.6)	50 (82.0)
Darker	2 (20.0)	2 (15.4)	1 (6.7)	1 (11.1)	2 (14.2)	8 (13.1)
Complications						
Infection at recipient sites	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Scar at donor sites	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

included non-segmental (25 patients, 83.3%) and segmental (5 patients, 16.7%). Among the 61 anatomical sites, 10 (16.4%) were on the face, 13 (21.3%) on the neck, 15 (24.6%) on the trunk, 9 (14.8%) on upper limbs, and 14 (23.0%) on the hands/fingers. Three patients (10%) reported a family history of vitiligo (Table 1).

After 3 to 6 months post-treatment, VASI assessments demonstrated significant repigmentation across all anatomical sites (Table 2 and Figures 1–5). Excellent repigmentation (> 90%) was observed in 83.6% (51/61) of treated sites, with the face and neck achieving nearly complete repigmentation at 90.0% (9/10 sites) and 92.3% (12/13 sites), respectively. The trunk, upper limbs, and hands/fingers also demonstrated significant improvement, with excellent results in 80% (12/15), 77.8% (7/9), and 78.6% (11/14) of treated sites, respectively. Poor repigmentation (< 25%) was rare (1.6%, 1/61), occurring only on the trunk (6.7%, 1/15). Color matching was successful in most cases, with 82.0% (50/61) of sites achieving a perfect match to surrounding skin. Minor color discrepancies included darker pigmentation in 13.1% (8/61 sites) and lighter pigmentation in 4.9% (3/61 sites). No treatment-related complications, such as infections or scarring, were reported.

Discussion

NCES transplantation is a well-established surgical modality for stable or refractory vitiligo, demonstrating high repigmentation rates with a mean of 61.1% (95% CI: 56.1–66.1%) and minimal postoperative complications.[9] Several studies have found that different lesion sites (face and neck vs trunk and limbs),[11] vitiligo subtype (segmental vs non-segmental),[12] recipient site preparation method (dermabrasion and liquid nitrogen vs dermaroller; electrofulguration-assisted vs conventional dermabrasion),[13,14] NCES preparation method (cold vs warm trypsinization),[15] and donor-to-recipient cell ratio (low vs

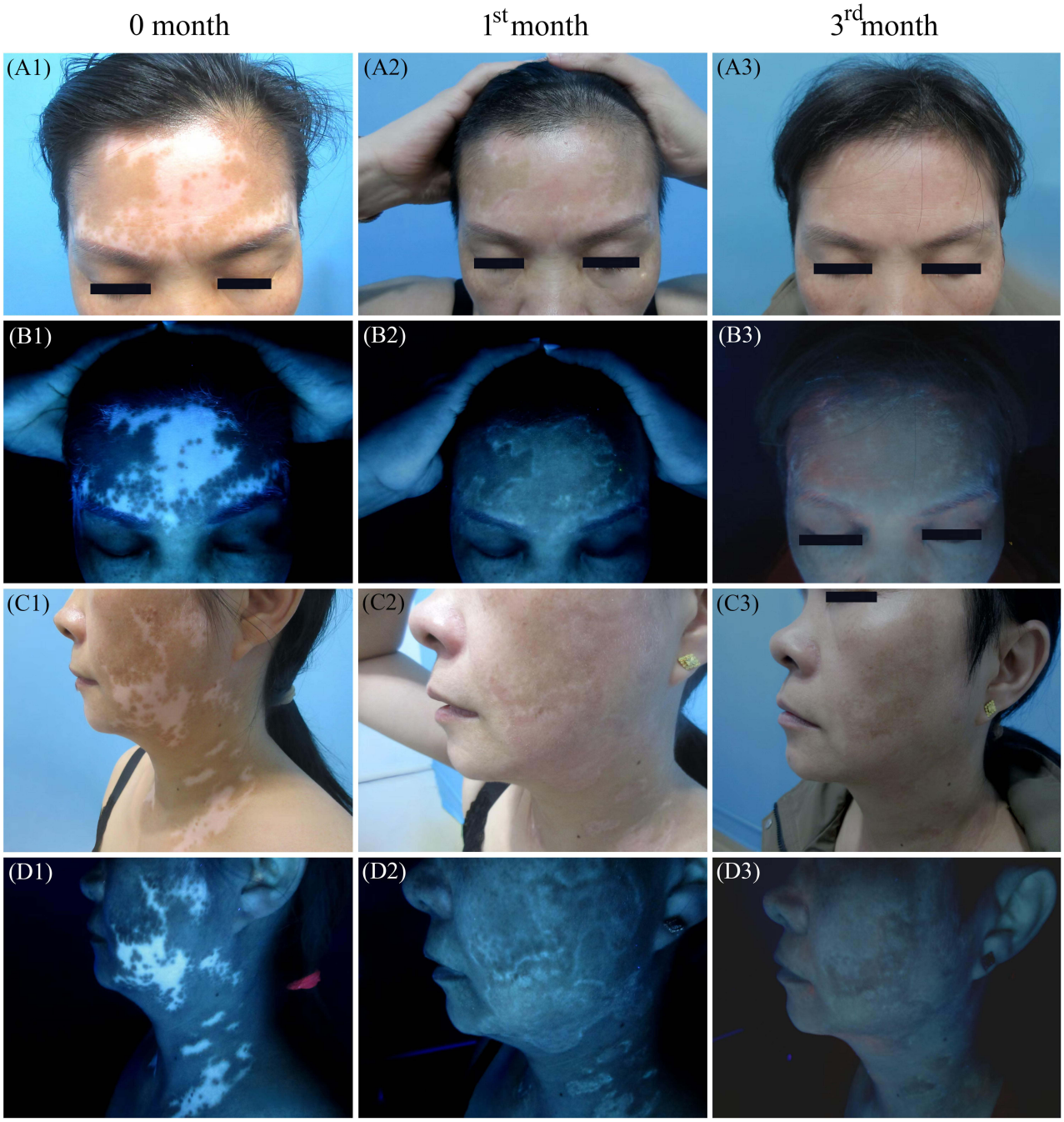

Figure 1 A 41-year-old female with 5-year history of non-segmental vitiligo on both face and neck before (A1-D1), and 1 month (A2-D2) and 3 months (A3-D3) after treatment with autologous serum and NCES.

high expansion)[16] may significantly influence repigmentation outcomes. NCES produces 8 times more cells, including a significantly higher percentage of melanocytes, and achieves faster repigmentation than hair follicle cell suspension (HFCS), although both NCES and HFCS show comparable safety and efficacy.[17] NCES was found to be significant superiority over the automated epidermal harvesting system in the repigmentation of stable vitiligo.[18] Compared to NCES monotherapy, the NCES-excimer lamp combination significantly stimulates the onset of repigmentation, increases the achievement of complete repigmentation, and reduces the incidence of the halo phenomenon.[19] The combination of NCES and noncultured dermal cell suspension (NDES) therapy showed superior efficacy in achieving repigmentation (100% vs 30%) in vitiligo patients with shorter disease stability duration compared to NCES monotherapy 3–6 months after treatment.[20]

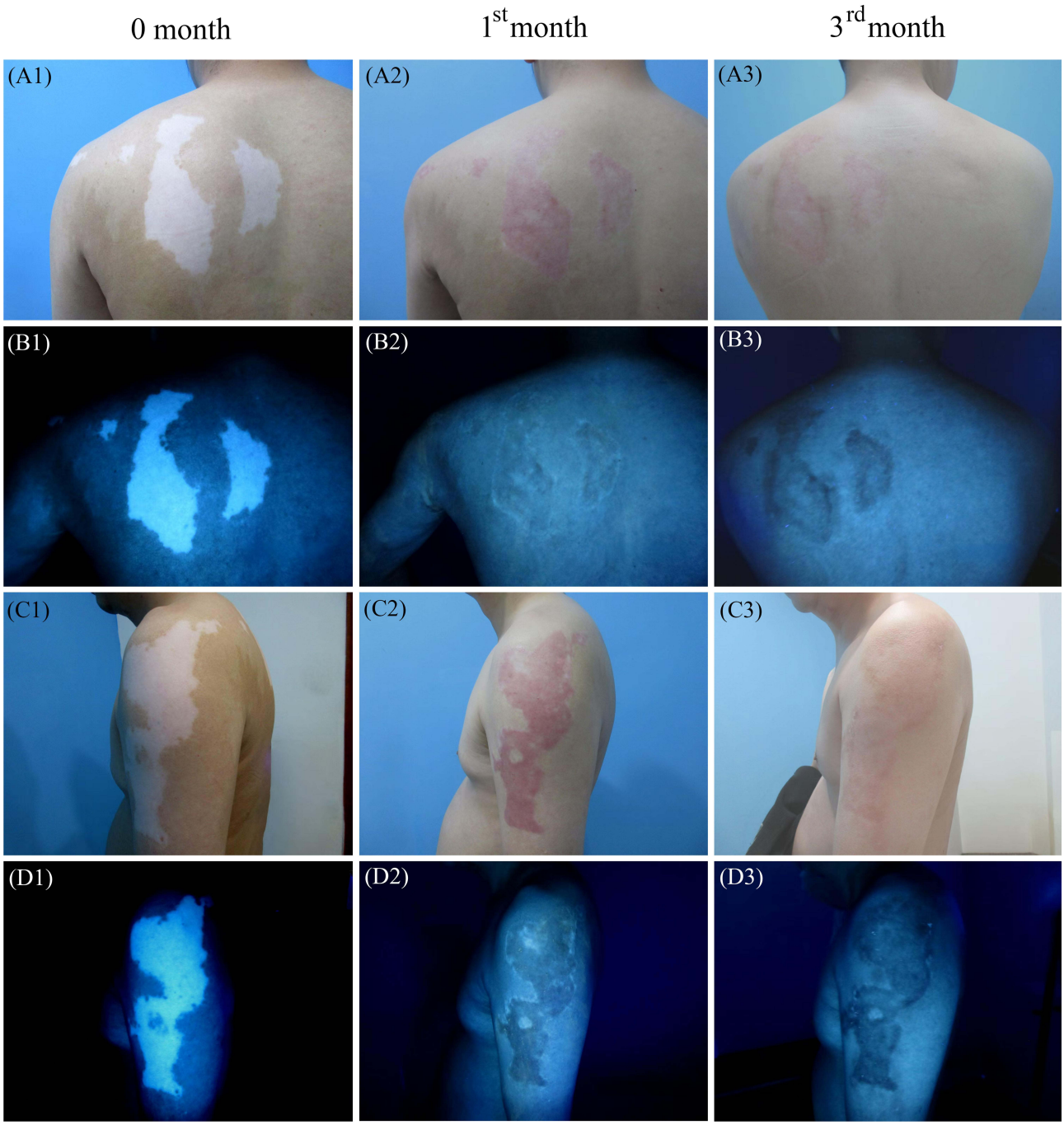

Figure 2 A 29-year-old male with 4-year history of non-segmental vitiligo on both trunk and upper limb before (**A1**–**D1**), and 1 month (**A2**–**D2**) and 3 months (**A3**–**D3**) after treatment with autologous serum and NCES.

Some studies have reported that PRP-suspended NCES showed a significantly higher repigmentation response compared to NCES suspended in ringer lactate (RL),[7] or phosphate buffered saline (PBS)[21] at 6 months after treatment.

In the present study, the combination of autologous serum and NCES resulted in excellent repigmentation (> 90%) in 83.6% (51/61) of treated sites, with ≥ 90% efficacy observed in facial and neck regions 3–6 months post-treatment. In line with our results, Kanika et al[9] reported a significantly higher repigmentation response (excellent (> 90%): 88.8% vs 44.4%) in 25 vitiligo patients with 36 lesions who were treated with serum-suspended NCES versus those treated with normal saline-suspended NCES at 4 months. Notably, our protocol involved spraying autologous serum onto the prepared recipient site

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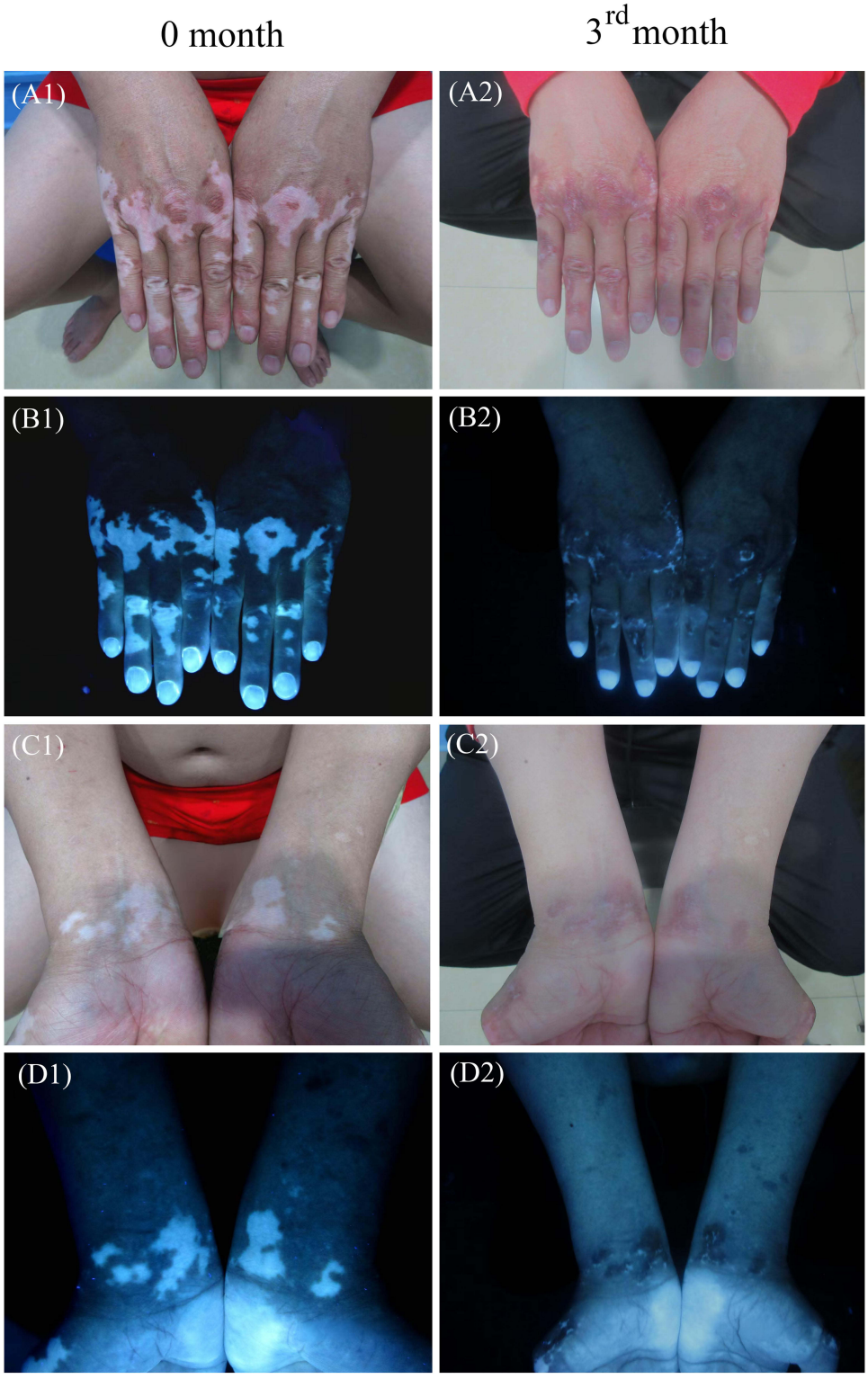

Figure 3 A 58-year-old male with 3-year history of non-segmental vitiligo on both hand, finger, and upper limb before (**A1**–**D1**), and 3 months (**A2**–**D2**) after treatment with autologous serum and NCES.

followed by NCES, rather than using serum-suspended NCES. When compared to the findings of our previous study, in which 41 stable vitiligo patients were treated with NCES monotherapy,[10] the present study demonstrated significantly higher rates of excellent (> 90%: 83.6% vs 34.1%) and very good (> 75%: 95.1% vs 65.8%) repigmentation than that using NCES

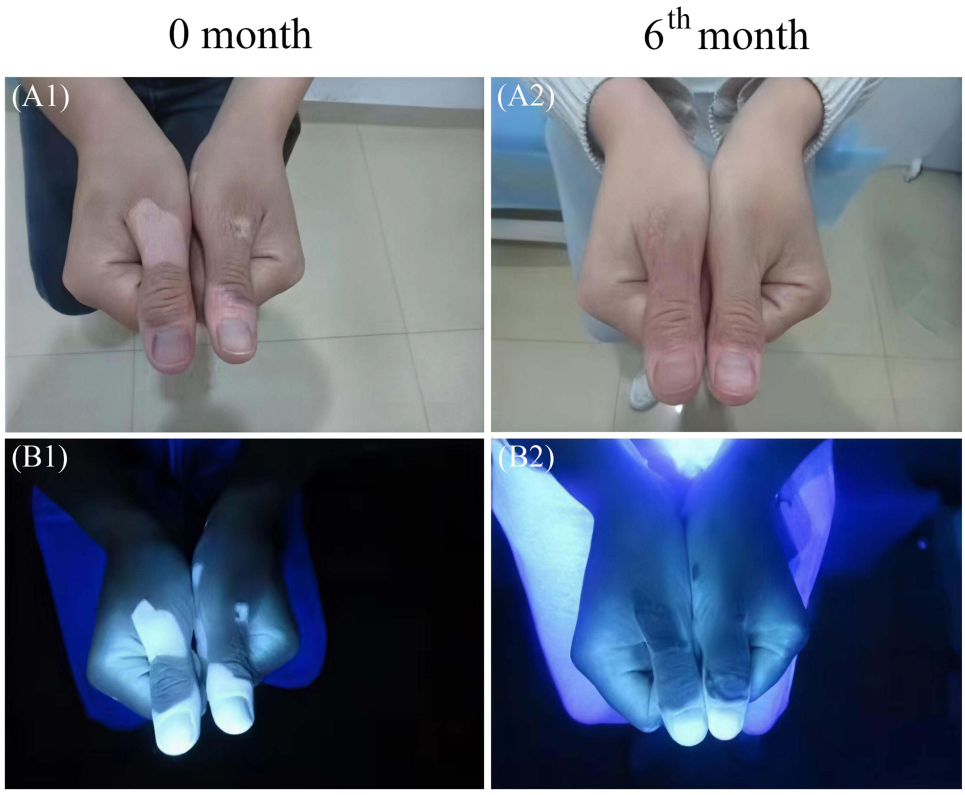

Figure 4 A 16-year-old male with 8-year history of non-segmental vitiligo on finger before (**A1** and **B1**), and 6 months (**A2** and **B2**) after treatment with autologous serum and NCES.

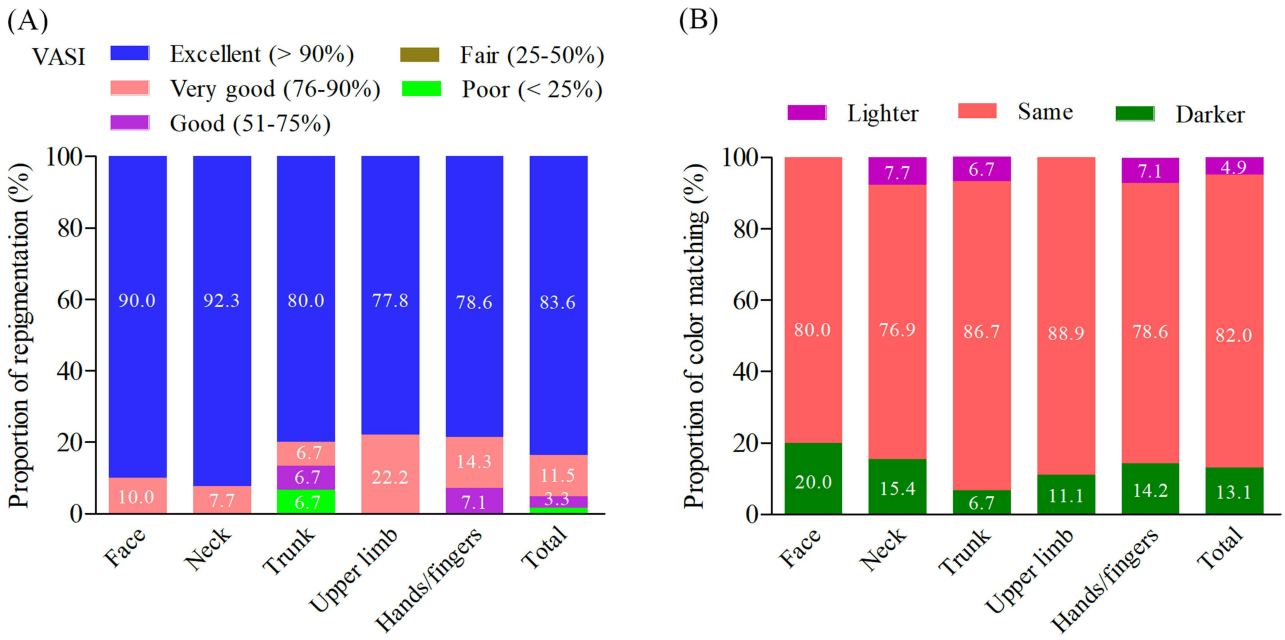

Figure 5 The proportion of repigmentation (**A**) and color matching (**B**) in different treated sites of the patients with non-segmental vitiligo after treatment with autologous serum and NCES.

monotherapy, with shorter durations to achieve these outcomes (3–6 months vs 6–9 months). Certain anatomical sites, such as the hands, fingers, wrists, and elbows, are regarded as challenging to treat. Several studies reported that 40% to 62.5% of acral lesions treated with NCES alone achieved a repigmentation response of > 75%.[6,22,23] Bertolotti et al[24] found that none

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of the lesions in these sites achieved more than 50% repigmentation when treated solely with NCES. In contrast, substantially higher success rates were noted in other anatomical regions, suggesting the limitations of NCES as montherapy for these difficult-to-treat sites. This site-specific discrepancy, rather than being a regional phenomenon, is likely attributable to the combined effects of local cytokine profiles, individual immune differences, anatomical micro-environments, lesion severity, and surgical factors.[25,26] Interestingly, 92.9% (13/14) hand/finger lesions in this study achieved a repigmentation response of > 75%, with 78.6% (11/14) exhibiting excellent repigmentation and 14.3% (2/14) showing very good repigmentation. These outcomes were significantly higher than those reported in previous studies using NCES monotherapy.[6,22–24] In this study of 61 lesions, imperfect color matching of the grafted area manifested as hyperpigmentation (darker) in 8 lesions (13.1%) and hypopigmentation (lighter) in 3 lesion (4.9%). Some authors had proposed that hyperpigmentation may result from a low expansion ratio of donor-to-recipient cells, overstimulation of melanocytes by growth factors or cytokines, or excessive post-inflammatory response; conversely, hypopigmentation may occur.[27–29]

Human autologous serum, like FBS, a commonly used cell culture supplement, contains a spectrum of bioactive substances, including growth factors, cytokines, proteins, adhesion molecules, hormones, lipids, vitamins, and essential trace elements, all of which are critical for cellular proliferation and survival.[30] Nevertheless, human autologous serum demonstrates superior efficacy in promoting chondrocyte proliferation and adherence, and enhancing long-term cellular viability compared to FBS.[31] Haque et al reported comparable findings, with higher expression of multiple regenerative paracrine factors in the secretomes of peripheral blood mononuclear cells (PBMC) than those cultured with FBS.[30] Moreover, autologous serum from vitiligo patients has proven more effective than FBS in promoting melanocyte in vitro growth.[9] Autologous serum also may be similar to PRP, as it is abundant in various growth factors, such as vascular endothelial growth factor, PDGF, FGF, IGF-1, and transforming growth factor-beta, as well as anti-apoptotic factors like bcl-2 and β-catenin.[8] These factors collectively stimulate cellular proliferation, increase extracellular matrix synthesis, enhance interaction of keratinocyte with melanocytes, and reduce apoptosis,[7,32] thus accelerating graft integration and augmenting the repigmentation efficacy in patients with stable vitiligo.

In conclusion, this study suggests that combining autologous serum and NCES transplantation is a highly effective treatment for stable vitiligo. Autologous serum may synergistically enhance NCES efficacy by supplying growth factors and promoting cell-cell interactions, which support melanocyte engraftment, proliferation, and survival. Notably, this combined approach possesses notable translational potential, primarily attributed to its cost-effectiveness and clinical feasibility. Autologous serum can be prepared in-house at minimal expense using standard laboratory equipment, obviating the need for costly commercial supplements. Similarly, NCES transplantation is a relatively straightforward procedure that requires only short-term specialized training, making it scalable for routine clinical practice. However, the study has several limitations that must be taken into account, including a small sample size of only 30 patients, a short follow-up period ranging from 3 to 6 months, the absence of a control group, and the lack of a functional study exploring how autologous serum could synergistically enhance the efficacy of NCES. Future research with larger sample sizes, extended follow-up periods, and randomized controlled trials is needed to validate these findings.

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Disclosure

All authors declare no competing interests.

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