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Pigmentary Disorders

A Comprehensive Compendium



2nd Edition

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Foreword
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JAYPEE

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CHAPTER 25

Autologous Mini Punch Grafting in Vitiligo

Koushik Lahiri

JAYPEE BROTHERS

KEY FEATURES

- Minigrafting in vitiligo remains the easiest, fastest, and cheapest of all surgical options in vitiligo.
- If deployed properly, it can produce excellent result.
- Stability must be assured before opting for surgical options in vitiligo.
- Optimal punch sizes are 1, 1.2, and 1.5 mm. Punch sizes >1.5 mm are to be avoided.
- Cobblestoning and polka dotting remain the main complication if larger punches are used.
- Phototherapy, after minigrafting evokes encouraging results.

INTRODUCTION

Historical Perspective

Vitiligo is the most significant form of cutaneous achromia which is an illusive, if not enigmatic problem down the ages. In all the ancient civilizations and religions, there is some reference to vitiligo. In the *Rigveda,* it was referred to as "*Kilas*" meaning a white spotted deer. It is interesting to note that as per a Vedic myth the anthropomorphic adoration of the sun, Bhagavantam, developed vitiligo after being gazed upon by his illegitimate son.[1] The disease was mentioned in "*Tarkh-e-Tibbl-e-Iran*" in the period of the *Aushooriyan*, as early as 2200 BC. In 1550 BC, information regarding vitiligo was noted in the Ebers Papyrus.[2] Unfortunately in some of the prominent ancient texts, the disease was confused with leprosy and also other skin diseases like psoriasis. This was referred to as *Swethakushtha* (white leprosy) in the *Atharva Veda* (1400 BC).[3] An accurate description also exists in a collection of Japanese Shinto prayers, Amarakosa, dating from 1200 BC.[4] In the Old Testament, the white spots were also described in Verse 2 of Chapter 13 of Leviticus under the Hebrew word *Zora at* or *Tzaraat/Tzoraath*. *Tsoraath* was translated using the Greek word "Lepros," which means a scale or scales. Along with this the phonetic resemblance of the word *Tsoraath* (which in Ashkenazi pronunciation would read *tsoraas*) led to the belief that "leprosy" was psoriasis. In truth, in all likelihood, most cases of biblical "leprosy" were achromic or hypochromic disorders that would include vitiligo, some cases of psoriasis, cases of pityriasis alba, probably albinism, and also leprosy. The word got translated as "lepra" in the Greek and English translations of the Bible. Also the theory of vitiligo as a dirty/polluted/contaminated disease was initiated, as the word *Tzaraat* refers to a group of skin diseases, which according to the Old Testament, renders one ritually unclean.[5] The exact word "Vitiligo" may have been derived from the Latin word *vitium* meaning "blemish," or possibly *vitulum* meaning "small blemish".[5] Another theory is that the Latin derivation is from the white, glistening flesh of calves (vitelius). Others believe that the actual word was first used by Celsus in his tome De Medicina in the first century AD.[4,6,7] References to this disease can also be found in the ancient Koran and Buddhist scripts.[7] The treatment has undergone an enormous evolutionary change from the Vedic days of *Vasuchika* to the most modern transplantation techniques. However, the ultimate goal remains the same, which is, replenishment of lost pigment. Among all the techniques described for surgical management of vitiligo, mini punch grafting (MPG) is the easiest, fastest, least aggressive, and minimal expensive technique. Since the dermatologist is

familiar with the punch, this technique is easily learnt and is usually the first technique performed by a beginner.[8-22]

PUNCH INSTRUMENT

The skin punch or surgical punch is an instrument which is used almost exclusively by dermatologists. It is interesting to note that originally, it was used as a trephine to cut through the skull bone. Its use was documented in abscess removal from tibia as early as in 1852.[23] In 1878, Watson described its use in the correction of accidental gunpowder disfigurement.[24]

But it was EL Keyes in 1887, who first established the importance of punch instrument in dermatology.[25]

The Keyes punch **(Fig. 1)** has been used in dermatology since then for diagnostic purpose. Its rounded sharp cutting end and thick handle make it very much appropriate for small skin biopsies. Because of the thick walls with angled sides above the cutting edge, tissue tends to be pushed away as the punch is made, causing less dermis (in diameter) to be cut through than overlying epidermis. This is also a function of the bevel, which is outside the barrel of the Keyes punch.[26]

To overcome these difficulties, other punches have been developed.[27]

The walls of the Loo trephine **(Fig. 2)** are thinner and less slanted than those of the Keyes punch, making it advantageous to use on depressed scars or minor autotransplants (where a straight vertical incision is needed). This is difficult to do with Keyes punch.

The newer disposable punches **(Fig. 3)** are excellent for punch biopsies or excisional work on cysts. The razor-sharp edge is a great benefit. The punch is available in different dimensions.

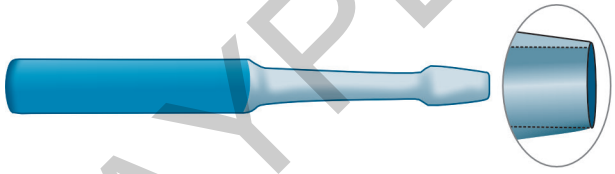


Fig. 1: Keyes punch.

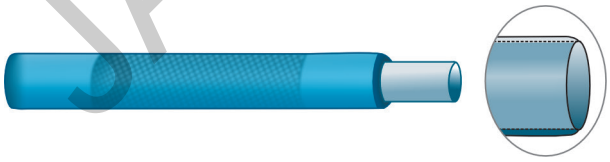


Fig. 2: Loo trephine.

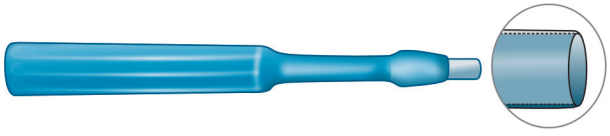


Fig. 3: Disposable punch.

For vitiligo surgery, now the consensus favors using miniature punches with smaller diameter of the cutting edge.

EVOLUTION OF MINI PUNCH GRAFTING

In the history of skin grafting, few observations can be mentioned as a preamble to further discussion on punch grafting (PG).

The first documented successful result of experimental skin grafting was described in sheep by Baronio in 1804.[28]

But it took almost another one and half century for the first autograft response of dark-skinned autografts transplanted to fair skin in spotted guinea pigs to be published by Lewin and Peck in 1941.[29]

In 1972, Norman Orentriech first reported autograft repigmentation in humans. He treated a black woman with long-standing leukoderma that occurred after a chemical burn resulting from application of a home remedy, which included a copper penny dipped in vinegar for presumptive tinea infection on her cheek. Orentriech deployed nine 1 mm and 2 mm diameter normal skin autografts and observed the "pigment spread phenomenon". He reported a maximum of 1 mm pigment spread from both 1 and 2 mm grafts.[11]

In 1976, Labuono and Shatin made a similar observation after transplanting hair bulbs with hair PG within the leukodermic scars of discoid lupus erythematosus (DLE).[30]

Falabella in 1978 reported a novel method of repigmenting leukoderma. With the help of a power-driven dermabrasion unit, he used dental burs to create abrasion 2–3 mm in diameter and <1 mm in depth and 5 mm apart. In the donor area, skin was raised by means of a curved needle and was sniffed off just below it to harvest 1–2 mm size minigrafts. He reported about 3 mm perigraft pigment spread by this technique. Three patients, one with piebaldism, another with chemical leukoderma and a third with postburn depigmentation were treated by this method.[12] He observed that this superficial split thickness grafts evoked a much better outcome than the full thickness hair PG by Labuono.

In the same article, interestingly, it was concluded that "true vitiligo is not treatable by transplantation of grafts of normally pigmented, autologous skin".[12]

Miniature punches on 1.5 mm diameter were used by Falabella while repigmenting three cases of segmental vitiligo in 1983.[13]

Behl (1995) expressed some reservation while commenting on Falabella's work on minigrafting and claimed better results with thin Thiersch grafting. In a rejoinder Falabella reiterated his faith on miniature PG and countered with his sets of reasons and logics in favor of PG.[31,32]

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In the following years Falabella reported success with MPG in chemical leukoderma, postdermabrasion leukoderma, and focal and segmental vitiligo.[33-35]

While repigmenting stable leukoderma with autologous minigrafting, Falabella made an important observation regarding the relationship between the donor graft area and the area of surgical repigmentation and found that a 1 mm donor graft can originate a pigmented spot 25 times larger than its size.[33]

In 1995, it was Falabella again who combined epidermal grafting and minigrafting in treating vitiligo and piebaldism.[36]

Westerhof in 1994 reported success with PG in stable vitiligo and observed a maximum of 5 mm of pigment spread.[37] In the subsequent year (1995), Boersma stressed on the importance of proper selection of cases before minigrafting.[38]

Various studies point toward the high effectiveness of the procedure.[39-42] An assortment of different evaluation parameters of MPG has also evolved over the years.[43-45]

It has now been documented that MPG can be combined with narrowband ultraviolet B (NB-UVB) (311 nm) with encouraging results.[22]

TEST GRAFTING

Punch grafting is also used for determining stability.[46] The objectives of this test are:

- Establishing the stability of the depigmenting process
- Identifying patients who may respond to pigment cell transplantation.

In the original suggested procedure,[46] a few grafts (1.0–1.2 mm) were placed in the center of the depigmented lesion to be tested. Dressing was done by Micropore® adhesive tape and kept for a couple of weeks. After removal of the tape, the area was exposed to sunlight for 15 minutes daily for a period of 3 months. No treatment was permitted during this test period. All test sites are visualized under Wood's light. The test was considered positive if unequivocal repigmentation takes place beyond 1 mm from the border of the implanted grafts. On the other hand, if <1 mm or no repigmentation was observed, the test was considered as negative.

Test grafting (TG) has been found to be a more reliable exercise than the unreliable dependence on period of stability alone.[22,42,47]

PROCEDURE OF MINIGRAFTING[13,40-42] (FIG. 4)

After proper assessment of the stability status, routine physical examination, and investigations, an informed consent is taken from the patient. The donor and recipient areas are surgically prepared.

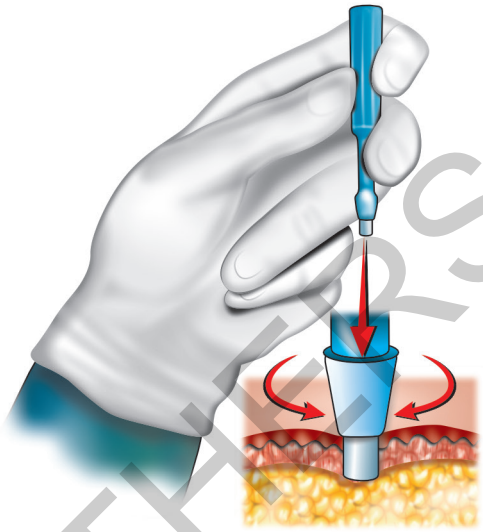


Fig. 4: Correct positioning of the hand while taking grafts with a miniature punch.



Fig. 5: Instrument required for minigrafting.

- The instruments required are 1.5 mm or 1.2 mm punches, small jeweler's or graft holding forceps and small curved tip scissors **(Fig. 5)**.
- Recipient area is prepared first. 2% lignocaine with or without adrenaline is infiltrated as local anesthetic.
- To minimize the chance of developing any perigraft halo, the initial recipient chambers are made on or very close to the border of the lesion. The punched-out chambers are spaced according to the result of TG or at a gap of 5–10 mm from each other.
- The donor area is either upper lateral portion of thigh or gluteal area. Punch impressions are made very close to each other so that from a small area maximum number of grafts can be taken.

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- Same-sized punches are used for both donor and recipient area.
- The grafts were placed directly from donor (buttock or upper thigh) to the recipient areas. This speeds up the procedure and lessens the chance of infection. Care is taken so that the graft edges are not folded, the tissue is not crushed or placed upside down. The needle of the syringe or the tip of the scissors is used for proper placement of grafts in the recipient chambers.
- Hemostasis is achieved by pressing a saline-soaked gauze piece over the area.
- For the recipient area three layers of dressing from inside out—paraffin-embedded nonadherent sterile gauze (Jelonet®), sterile Surgipad® and bio-occlusive Micropore® **(Figs. 6A to E)**.
- For the donor area only Surgipad® and Micropore® are used.



Figs. 6A to E: Three layers of dressing from inside out: Paraffin-embedded nonadherent sterile gauze (Jelonet®), sterile Surgipad®, and bio-occlusive Micropore®.

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- The recipient area may be immobilized if necessary. Proper instructions for special areas like lips are necessary. To secure the recipient area, these patients are advised to take liquid diet for first 24 hours, preferably with a straw. Patients are allowed normal diet after this period.
- Sometimes dressings are opened after 24 hours to look for any dislodgment of grafts, if found any, they are replaced.
- Finally, after 4–7 days the dressings are removed.

FOLLOW-UP AND COURSE OF EVENTS

Postsurgically the patients are exposed to psoralen plus ultraviolet A (PUVA)[17,18] or psoralen plus ultraviolet A from solar radiation (PUVASOL)[41,42] or NB-UVB[22] or even kept as such in some studies.[42] The patients are followed up fortnightly for initial 2 months and then monthly up to complete repigmentation is achieved.

In the donor site, after healing with secondary intention, minimal superficial scarring is expected and acceptable.

Scabs may fall off from the recipient site within 7–14 days. Though in many instances there may not be any scab formation. Perigraft repigmentation is expected to start around 3–4 weeks.[22,41-43]

The entire depigmented and grafted area is expected to be completely repigmented within 3–6 months, based on the area of grafting and body part involved.

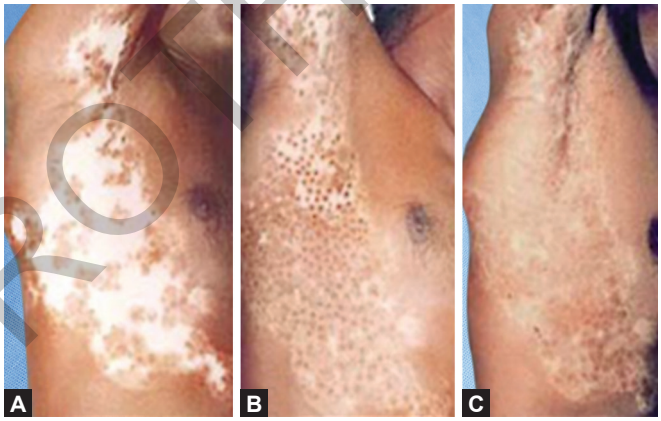
Minigrafting can be deployed on any parts of the body **(Figs. 7A to C to 11A and B)**.

COMPLICATIONS[22,40-42]

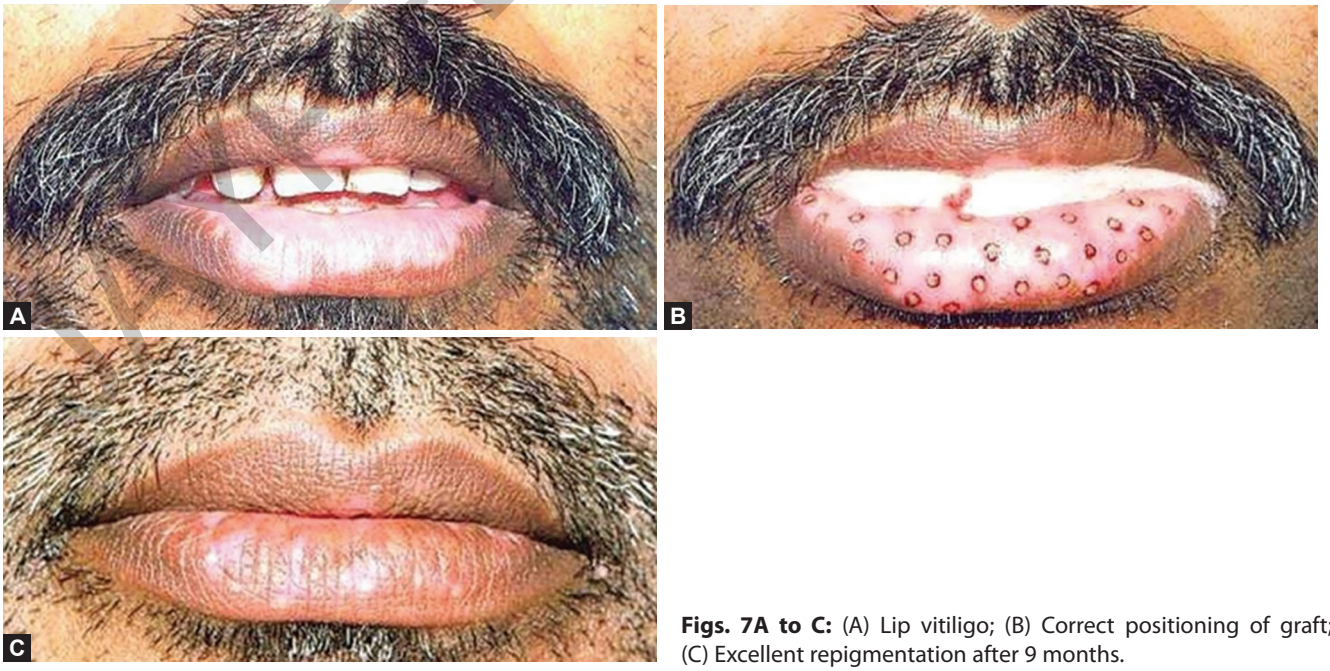
Complications are seen in PG frequently and are enumerated in **Table 1**. By proper selection of cases and with proper technique, most of these complications are entirely avoidable. Cobblestoning is regarded as the most common of them all.[22,41,42,47] It was observed that with time it got corrected in most of the cases.[41] In resistant cases, corrective electrofulguration may be needed.[48]

It can be avoided by avoiding punches >1.5 mm in diameter. On face and lips, it should be even smaller (1.2 or 1 mm).[22]

Rejection of grafts is another complication, particularly seen in herpes labialis-induced lip leukoderma.[49-52]



Figs. 8A to C: (A) Large segmental vitiligo; (B) After second session of minigrafting; (C) Complete repigmentation after 6 months.

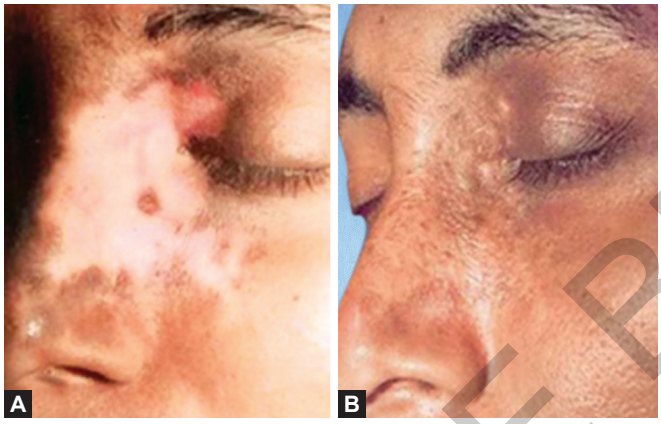


Figs. 7A to C: (A) Lip vitiligo; (B) Correct positioning of graft; (C) Excellent repigmentation after 9 months.

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Figs. 9A to C: (A) Depigmented right nipple and areola with two test grafts on nipple; (B) More grafts are placed on areola and nipple; (C) Almost complete repigmentation.



Figs. 10A and B: (A) Segmental vitiligo on side of the nose; (B) Complete repigmentation after 5 months.

TABLE 1: Complications of minigrafting.

Recipient site	Donor site
• Cobblestoning **(Fig. 12)** • Polkadot • Variegated appearance and color mismatch • Static graft (no pigment spread) • Depigmentation of graft **(Fig. 12)** • Perigraft halo • Graft dislodgment/rejection • Hypertrophic scar and keloid formation	• Keloid • Hypertrophic scar • Superficial scar **(Fig. 13)** • Depigmentation/spread/ activation of disease • Contact dermatitis to adhesive tapes



Figs. 11A and B: (A) Segmental vitiligo on neck; (B) Complete repigmentation after 7 months.



Fig. 12: Cobblestoning on lips and depigmentation of grafts on moustache area.

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Fig. 13: Variegated appearance.

ANALYSIS OF SPECIAL FEATURES

Among all surgical methods, autologous miniature PG has established its place as the easiest means of vitiligo surgery. When the graft is taken off, the piece of tissue is completely detached from the donor site and then it is placed on the vascular bed in the recipient holes. From this vascular bed it derives its blood supply. Initially the graft adheres to its new bed by fibrin. There is diffusion of nutrients through this fibrinous layer which keeps the graft alive initially. Within 2–3 days, capillary linkage occurs with vascularization of the graft. The thinner the graft the denser the capillary network in the superficial dermis and thus earlier is the process of vascularization.[53] Several aspects of PG need special consideration:

- *Mechanism of pigmentation of grafting procedures*: The mechanism of pigmentation of grafting procedures has been studied in several studies. Melanocytes have been shown to spread centrifugally from the infundibulum of hair follicle to the basal cell layer and recolonize the epidermis with active and functional melanocytes.[54,55] The presence of pilosebaceous apparatus within the grafts is not at all necessary for the repigmentation process; suction blister grafts possess only epithelial cells and still achieve repigmentation.[56] Billingham and Silvers demonstrated the phenomenon of melanocytes migration from graft's edge within the achromic skin to recolonize and replenish the area with functional and active melanocytes.[57]
- *Relapse after grafting*: The major limitation of all grafting techniques is lack of specific criteria for defining stability.[58-60] It is often hard to predict how long the disease will remain stable. Similarly, it is difficult to envisage when it will start to become unstable.[61,62] This fact has made assessment of results difficult. Treatment of relapsed cases is considered difficult. However, repigmentation has been successfully induced in previous graft failure cases under NB-UVB (311 nm) phototherapy.[63]
- The author has reported curious phenomenon reverse Koebner's phenomenon after PG; spontaneous repigmentation of distant non-grafted vitiligo patches after PG.[64-66] It was attributed to possible release of cytokines from grafts.
- Size of the grafted lesion varied between 15 and 144 cm^2 in different studies **(Table 2)**. Likewise, the size of the punch instrument differed in different studies **(Table 3)**. But now the consensus is toward using smaller punches such as 1.2 mm or 1.5 mm. Falabella even recommends 1 mm grafts for facial region and 1.2 mm for other body parts.[51,67]
- Treatment of leukotrichia is difficult and is not generally corrected by grafting. However, recently repigmentation of leukotrichia with PG and NB-UVB[22] and PUVASOL[68] was reported **(Figs. 14A and B)**.[68]
- *Appearance of repigmentation time*: Another important parameter is the postgraft appearance of repigmentation (AOR) time. It was found to be between 2 and 6 weeks in different studies **(Table 4)**. After PG and PUVASOL, AOR time in different regions varied between 14 and 39 days, with an overall average being

TABLE 2: Maximum grafted area in different studies.

Author (reference)	Year	Maximum grafted area (cm^2)
Jha AK, et al.[59]	1992	15
Das SS, et al.[58]	1992	80
Boersma BR, et al.[38]	1995	96
Malakar S, et al.[42]	1999	>100
Falabella R[35]	1988	110
Lahiri K, et al.[41]	1997	144

TABLE 3: Size of graft in different studies.

Author (reference)	Year	Size of punch (diameter in mm)
Das SS, et al.[58]	1992	4
Jha AK, et al.[59]	1992	3 and 4
Boersma BR, et al.[38]	1995	2
Lahiri K, et al.[41]	1997	2
Malakar S, et al.[42]	1999	2
Malakar S, et al.[47]	2004	1.5
Falabella R[35]	1988	1.2
Orentriech N, et al.[11]	1972	1 and 2

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Figs. 14A and B: (A) Segmental vitiligo with leukotrichia; (B) Complete repigmentation with resolving cobblestoning and repigmentation of leukotrichia.

TABLE 4: Appearance of repigmentation (AOR) time in different studies.

Author (Reference)	Year	Earliest AOR (in days)
Lahiri K, et al.[22]	2006	14
Lahiri K, et al.[41]	1997	14
Malakar S, et al.[42]	1999	16
Savant SS[39]	1992	30

approximately 21.6 days as shown in one study.[41] With the deployment of NB-UVB along with PG AOR time in different regions varied between 14 and 32 days, with an overall average being approximately 20.6 days.[22] Falabella found that a 1 mm donor graft can repigment an area 25 times larger than the graft itself.[33] In a recent study with 1.5 mm grafts and NB-UVB in type IV and V skin type subjects, this value was found to be more than double of that (56.21 times).[22] Previously in one study with PUVASOL, this relationship was found to be 42 times.[45]

CONCLUSION

Considering all the indicators and parameters, it can be concluded that minigrafting is an easy, inexpensive, effective method of treating stable and recalcitrant vitiligo.[69] The advantages and disadvantages are summarized in **Box 1**.

BOX 1 Advantages and disadvantages of minigrafting.

Advantages:

- Easiest, fastest, and least expensive method
- Can be performed anywhere on any site (except angle of the mouth)
- Particularly suitable for areola
- It is perhaps the only suitable method for palm, though results may not be fully satisfactory

Disadvantages:

- Side effects are common, particularly cobblestoning
- Phototherapy is always necessary after grafting
- Perfect match does not occur

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- Lahiri K, Malakar S, Sarma N, Banerjee U. Repigmentation of vitiligo with punch grafting and narrow-band UV-B (311 nm)—a prospective study. Int J Dermatol. 2006;45(6):649-55.
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