

Autologous Mini Punch Graft in Vitiligo: A Narrative Review

Gusti Nyoman Darmaputra^{1*}

¹Dermatology and Venereology, Faculty of Medicine, Udayana University - Prof IGNG Ngoerah Hospital, Denpasar, Bali, 80225, Indonesia

Abstract

Vitiligo is a disease characterized by clear white patches of various shapes and sizes due to fewer melanocytes. The prevalence of vitiligo varies widely worldwide, it was estimated to range from 0.004% to 2.28%. The purpose of vitiligo treatment is to minimize disease progression and re-pigmentation and to achieve cosmetically good results. Autologous mini-punch grafting is a surgical technique used in dermatology and plastic surgery to transplant small pieces of skin from one part of the body to another.

There are several indications for mini-punch grafting, namely in patients with stable vitiligo, facial vitiligo, minor vitiligo, and when non-surgical therapies have failed. So, there are several contraindications for this technique, such as patients with active or progressive vitiligo, patients with a tendency to keloids, patients with a tendency to have hypertrophic scars, vitiligo in large areas, and patients with unstable medical conditions. Cobblestone is the most common of all complications of this technique.

Graft rejection is another complication, especially seen in herpes labialis-induced lip leukoderma. The prognosis of mini-punch grafting results in up to 75% repigmentation in 78% of patients with mini-punch grafting therapy.

Keywords: *Autologous mini punch graft, surgical technique, vitiligo*

Introduction

The dermatological disorder known as vitiligo can be identified by abnormal skin and mucous membrane pigmentation. Clinically, the illness is marked by distinct white patches that vary in size and form because fewer melanocytes are present (Seneschal et al., 2021). The prevalence of vitiligo varies widely worldwide; it was estimated to range from 0.004% to 2.28%. There are no definite prevalence studies in the United States, but the few research undertaken in specific subpopulations have yielded estimates ranging from 0.05% to 1.55% (Gandhi et al., 2022).

The goal of vitiligo therapy is to reduce disease progression and re-pigmentation while still achieving cosmetically acceptable outcomes. There are several vitiligo treatments, including medication, phototherapy, and surgery. Surgery is used when phototherapy is not adequate. Surgery treatment aims to restore the normal color of the skin affected by vitiligo (Ahmed jan & Masood, 2024; Bergqvist & Ezzedine, 2020). Mini punch graft is one of the surgical therapies using a biopsy tool; this tool is small in size, less than 3 mm in the hole, and recommended for patients with hypopigmentation problems affecting the nipple area, lips, palms, or areas characterized by irregular shape and unsuccessful after drug or light therapy. The mini-punch graft method involves the removal of tissue, usually from the thigh or gluteal region, and is performed using a biopsy punch device equipped with a blade to obtain cylindrical core tissue (Chandrashekar et al., 2014).

Phototherapy is the last phase of treatment, and it helps with the repigmentation process. It takes tissue from healthy skin areas and transfers it to the affected skin. The transfer of normal skin is expected to improve the new normal skin color in the white skin area (Stiegler & Brickley,

* **Corresponding Author:** Gusti Nyoman Darmaputra; nyoman_darmaputra@unud.ac.id

2021). Some studies report success rates of 50-90% in vitiligo cases using mini-punch grafts as a therapy (Helalat et al., 2012). As a result, discussing autologous mini-punch grafts as a vitiligo treatment option in this literature review will provide new perspectives and therapeutic choices.

Autologous mini-punch grafts for vitiligo

Definition

A surgical procedure called autologous mini-punch grafting is performed in plastic and dermatological surgery to transfer tiny skin fragments from one body area to another. The procedure involves using a special tool, namely a mini-punch, which is a small round blade, to remove a small circular skin graft from a donor site on the patient's body. The donor site is usually a healthy skin area. After removal, the graft is carefully transferred to the recipient site, where the skin graft is required. Autologous means that the graft tissue comes from the patient's own body, ensuring compatibility and reducing the risk of rejection. The mini-punch graft technique is often preferred for smaller areas requiring precise graft size matching (Chandrashekar et al., 2014).

History of Autologous Mini Punch Graft

Baronio reported the first effective results of skin grafting experiments on sheep in 1804. But it took until almost 150 years later for Lewin and Peck to describe the first autograft reaction ever recorded—a dark-skinned autograft placed in a light-colored section of a spotted guinea pig—in 1941 (Rasagna et al., 2019).

The first human autograft re-pigmentation report was made by Norman Orentreich in 1972. He used a folk medicine of copper soaked in vinegar to treat a black lady with ancient leucoderma who had been burned chemically years before. She was being treated for a suspected tinea infection on her face. Norman Orentreich found the pigment-spreading phenomena after placing autografts of normal skin with a 1 and 2 mm diameter. From 1 and 2 mm grafts, he recorded a maximum pigment spreading of 1 mm. Similar findings were found by Labuono and Shatin in 1976 after hair transplantation using hair punch grafting into a leukodermic discoid lupus erythematosus (DLE) scar (Rasagna et al., 2019).

In 1978, Falabella reported on a novel approach to leucoderma repigmentation. Dental burrs were used with dermabrasion equipment to create abrasions that were 2-3 mm in diameter, less than 1 mm deep, and 5 mm apart. A curved needle was used to elevate the skin in the donor location, and minigrafts measuring 1-2 mm were taken close under the surface. He claimed that the pigment spread to 3 mm per graft using this method. This approach was used to treat three patients: one with chemical leucoderma, one with post-burn depigmentation, and one with piebaldism. He noted that compared to Labuono's full-thickness grafting, the superficial split-thickness grafting had much superior outcomes. Falabella repigmented three instances of segmental vitiligo in 1983 using tiny 1.5 mm diameter punch grafts. In response to Falabella's work with tiny grafts, Behl voiced doubts and asserted improved outcomes. Falabella clarified his support for tiny punch grafts and refuted his argument with several arguments and arguments in favour of punch grafts (Rasagna et al., 2019).

Falabella reported effective little punch grafts in the years that followed for focal and segmental vitiligo, post-abrasion leucoderma, and chemical leucoderma. Falabella made significant discoveries on the link between the donor graft area and the surgical re-pigmentation area while executing stable re-pigmentation of leucoderma using autologous micrografts. She discovered that a 1 mm donor graft may create a pigmented patch 25 times its size. Falabella combined minigrafts and epidermal grafts in 1995 to treat piebaldism and vitiligo. Westerhof noted a maximum pigment spread of 5 mm and reported effectiveness with punch grafts in stable vitiligo in 1994. Boersma underlined the need for careful case selection before micro grafting the following year (1995) (Rasagna et al., 2019).

Indications

Mini-punch grafting has several uses, including for individuals with face vitiligo, mild vitiligo, stable vitiligo, and non-surgical therapy failure. Mini-punch grafting is often advised for stable vitiligo if depigmented patches have not spread or developed after a year. Stable vitiligo indicates the condition is inactive, and grafts are more likely to succeed. This technique is also suitable for small to medium-sized patches of vitiligo. It is unsuitable for more significant or extensive areas of depigmentation, as rafting larger regions may lead to suboptimal results or complications. This technique is often used for facial vitiligo, where the condition's cosmetic appearance and emotional impact are significant. This technique allows precise grafting in delicate facial areas to achieve better cosmetic results. This technique is also suitable for patients who have failed medical therapies. Transplantation may be considered an alternate therapeutic option if prior medicinal therapies for vitiligo, such as topical corticosteroids, calcineurin inhibitors, or phototherapy, have not successfully re-pigment the afflicted regions (Bhingradia et al., 2023; Gamal et al., 2020).

Contraindication

There are several contraindications for the mini punch grafting technique, such as patients with active or progressive vitiligo, patients with a tendency to keloids, patients with a tendency to have hypertrophic scars, vitiligo in large areas, and patients with unstable medical conditions. This procedure is generally not recommended in patients with active or progressive vitiligo. Active vitiligo refers to the presence of spreading or new patches of depigmentation, indicating ongoing disease activity. Grafting in such cases may result in poor outcomes or further spread of the lesion. Individuals who tend to develop keloid or hypertrophic scars may not be suitable candidates for grafting. This procedure involves creating small wounds and skin grafting that potentially cause excessive scar formation in susceptible individuals (Gamal et al., 2020).

Mini punch grafting may not be the ideal treatment for individuals with extensive vitiligo, where large areas of the body are affected. In such cases, the procedure may not provide satisfactory repigmentation results or be impractical due to the large surface area requiring grafting. If the patient has an unstable or fluctuating underlying medical condition, such as uncontrolled diabetes, autoimmune disease, or a compromised immune system, a graft may not be recommended. This condition can affect the healing process and increase the risk of complications (Gamal et al., 2020).

Mini Punch Instruments

Dermatologists are the ones who use little punch grafting equipment nearly exclusively. It is fascinating to remember that it was first employed to cut skull bones with a trephine. As early as 1852, its use was recorded in the excision of a tibial abscess. Watson wrote about its application in 1878 for repairing unintentional gunpowder damage. However, Keyes was the one who initially demonstrated the value of punch devices in dermatology in 1887. Since then, dermatologists have employed Keyes punch for diagnostic purposes. Its strong handle and sharp, rounded cutting point benefit tiny skin biopsies. Less of the dermis is sliced (in diameter) than the surrounding epidermis when a puncture is formed because the tissue tends to be pushed by the thick wall with sloped sides above the cutting tip. The bevel on the outside of the Keyes punch's barrel also serves this purpose (Feng & Lu, 2022).

To get around this problem, researchers created another punch. Because of its narrower and less sloping walls than the Keyes punch, the Loo trephine is better suited for minor autotransplants or depressed scars (where a straight vertical incision is necessary). Using a Keyes punch to do this is challenging (Feng & Lu, 2022).

The more recent disposable punches are great for punch biopsies or excision procedures on cysts where sharp edges are advantageous. Punch is produced in several different sizes. For

vitiligo surgery, the general opinion is to utilize a micro punch with a smaller diameter for the cutting edge (Bhingradia et al., 2023; Lahiri, 2009).

Procedure

Several factors must be assessed before initiating surgical intervention in vitiligo, particularly the stability status of the patient. Clinically, patient stability can be evaluated through a patient history taking, the absence of progression in old lesions, and the lack of development of new lesions over a specific period (6 months to 2 years). Additionally, the Koebner phenomenon (Kp), the absence of recent Kp either historically (Kp-h) or experimentally induced (Kp-e), and grafting tests are considered (Bhingradia et al., 2023; Lahiri, 2009).

The recommended initial procedure involves placing several grafts (1.0–1.2 mm) in the centre of the depigmented lesion. The dressing is applied with Micropore adhesive tape and maintained for several weeks. After removing the tape, the area is exposed to sunlight for 15 minutes daily for 3 months. Maintenance is prohibited during this testing period (Khullar et al., 2015; Lahiri, 2009).

All test locations are visualized under a Wood's lamp during the 'test grafting' (TG) evaluation stage. The test is considered positive if there is unequivocal repigmentation extending beyond 1 mm from the border of the implanted graft. Conversely, the test is considered harmful if less than 1 mm of repigmentation or none is observed. 'Test grafting' (TG) has been recognized as a powerful tool for detecting stable vitiligo and anticipating successful repigmentation when surgery is a therapeutic option. If the assessment of stability status, routine physical examination, and investigations have been completed, informed consent is obtained from the patient, and the donor and recipient areas are surgically prepared (Bhingradia et al., 2023; Gamal et al., 2020; Lahiri, 2009).

Preoperative preparation

Preoperative preparation can include a complete blood count, platelet count, prothrombin time, partial thromboplastin time, liver function, HIV serology, hepatitis B and C, pregnancy check, and electrocardiogram if the patient is over 60. Two weeks before the procedure, stop using anticoagulant drugs and other drugs that interfere with lidocaine metabolism via cytochrome P450 (Lahiri, 2009).

Grafting and Transfer

In preparing the equipment, the instruments needed are a 1.5 or 1.2 mm mini punch graft, small clamps to hold the graft, small curved tipped scissors, a place to place the donor graft tissue, povidone iodine, sterile gauze, 0.9% NaCl, 10 cc syringe with Klein, tulle, gauze, and plaster solution. The receiving area is prepared in advance. Anesthesia for this procedure uses local anesthesia. Two per cent lidocaine with or without adrenaline is used as a local anaesthetic (Bae et al., 2017; Khullar et al., 2015).

The tumescent anesthesia can be used in skin surgery procedures such as liposuction and tissue transplantation. Combining these fluids can minimize bleeding and extend the analgesic effect. Minimal bleeding helps the grafting procedure because bleeding can block nutrients from the skin to the graft tissue in the recipient (Zhang et al., 2016). The Klein formula is made with 25 ml of 2% lidocaine, 1000 ml of 0.9% NaCl, 10 ml of 8.4% bicarbonate. Moreover, 1 ml of adrenaline 1:1000. The recommended dose of lidocaine for Tumescent is 35 – 55 mg/kgBW. The action of this anesthetic is initially a subcutaneous injection followed by an intradermal injection because the location of the afferent pain nerve fibers is in the pars papillary dermis (Bae et al., 2017).

For the mini punch grafting procedure, a punch tool is required, a disposable biopsy punch tool is a good choice of tool for this procedure, the size required varies from 1 mm to 3 mm, and the size used should be 1.5 mm or less, so that the graft can grow smoothly (Bae et al., 2017).

The depth of the tissue taken is 1 – 1.5 mm of the dermis layer (Khullar et al., 2015). Use the same size biopsy punch for the donor and recipient areas. The distance between the punch and recipient areas is 5 – 10 mm between punches. Taking the punch, the harvesting results can be placed on sterile wet gauze or transferred directly from the donor area to the recipient area. The quicker the harvesting and grafting action, the less risk of infection the tissue will have. Pay attention to the fact that the tissue should not be crushed or lie upside down to ensure the epidermis is on top. Placement of the tissue can be assisted with the tip of a needle or scissors (Gamal et al., 2020; Khullar et al., 2015).

During the grafting and transfer stage, there is a possibility of developing a perigraft halo. Therefore, it is necessary to create the initial recipient space close to the lesion margin (usually at a distance of 5-10 mm). The donor area is the upper lateral part of the thigh or the gluteal area. Punch graft impressions are made very close to each other to maximize the number of grafts taken from a small area. Punch grafts of the same size are used for donor and recipient areas. The grafts are transferred directly from the donor site (gluteal/upper thigh) to the recipient area. This approach can expedite the procedure and reduce the risk of infection. It is essential to ensure that the graft edges are not folded and that the tissue is not damaged or placed upside down (Gamal et al., 2020).

Wound care

Hemostasis can be achieved in the wound care stage by compressing the wound with sterile gauze soaked in 0.9% NaCl. Then, the post-procedure area is covered with tulle, gauze, and micropore. For the donor area, wound care is carried out using three layers of dressing from the inside out, consisting of paraffin-embedded nonadherent sterile gauze (jelonet), sterile surgical, and bio-occlusive micropore (Lahiri, 2009).

Special areas such as the lips are crucial, so patients are advised to consume a liquid diet for the first 24 hours, preferably using a straw to protect the recipient area. After this period, patients may resume a regular diet. Sometimes, the dressing may be opened within 24 hours to check for any changes in the graft's location and then closed again. The dressing can be removed for the recipient area after 7 to 14 days. Meanwhile, the dressing on the donor area can be removed after 8 to 10 days. Each location requires a different amount of time, depending on its size (Lahiri, 2009).

Pigmentation Mechanism of Mini Punch Graft Procedure

Following the graft extraction, the tissue is fully separated from the donor location and inserted into the recipient's orifice via a vascular bed. The blood supply for the graft comes from this vascular bed. Initially, fibrin helps the transplant stick to its new circulatory bed. This fibrinous coating allows nutrients to diffuse, initially maintaining the graft's viability. Graft vascularization results in capillary connections in two to three days. The superficial dermis's capillary network is denser with thinner grafts, which causes the vascularization process to proceed more quickly. Melanocyte migration and activation from the hair follicle reservoir will be enhanced by phototherapy. Centrifugally, melanocytes migrate from the infundibulum to the basal cell layer, proliferating and repopulating the epidermis with functioning melanocytes. As the melanocytes integrate into the recipient site and become functional, they start producing melanin, causing repigmentation of the previously depigmented areas. This process may take a few weeks to a few months, and multiple grafting may be required for larger areas of depigmentation (Gamal et al., 2020; Ju et al., 2021).

Post-procedure Monitoring

After surgery, patients are subjected to either NB-UVB or PUVA/PUVASOL (Psoralen with UVA from sunlight). Until full repigmentation is achieved, patients are monitored every two weeks for the first two months and then once a month after that. Minimal superficial scarring at the donor

site is expected and normal during secondary intention healing. The scab may separate from the recipient site in seven to fourteen days. Still, there is a good chance that no scab forms at all. In three to four weeks, perigraft repigmentation is anticipated to start. Depending on the grafted area and body part involved, the depigmented and grafted area should be fully pigmented in three to six months (Lahiri, 2009).

Complications

Most of these issues are entirely preventable with appropriate case selection and procedure. The most prevalent type is thought to be cobblestone. Most of the time, it is found to be remedied over time. Corrective electrofulguration might be necessary in resistant cases. This can be prevented by avoiding blows with a more than 1.5 mm diameter. Even tiny lips and a face (1.2 mm or 1 mm) are required. Another problem is graft rejection, particularly in lip leukoderma caused by herpes labialis (Gamal et al., 2020; Ju et al., 2021; Majid, 2013). The prognosis of mini-punch grafting results in up to 75% repigmentation in 78% of patients with mini-punch grafting therapy (Bhingradia et al., 2023; Majid, 2013).

Table 1. Table of Complications in Recipients and Donors (Lahiri, 2009).

Recipient	Donor
<ul style="list-style-type: none"> • Cobblestoning • Graft static/no pigment spreading • Depigmentation of the graft area • Perigraft halo (Figure 2.14) • The graft color does not match the surrounding area • Formation of hypertrophic scars or keloids 	<ul style="list-style-type: none"> • Keloid • Hypertrophic scar • Depigmentation/activation/expansion of disease • Plaster-induced contact dermatitis

Conclusion

A mini punch graft is a surgical technique commonly used to treat vitiligo. This procedure involves transplanting tiny skin grafts from unaffected to depigmented areas, aiming to restore the color and repigmentation of the affected skin. A mini punch graft is a practical therapeutic alternative when treating stable vitiligo with tiny to medium-sized patches, particularly on the face.

Conflict of Interest: There are no potential conflicts of interest to declare.

Funding: None

References

- Ahmed jan, N., & Masood, S. (2024). *Vitiligo*.
- Bae, J. M., Jung, H. M., Hong, B. Y., Lee, J. H., Choi, W. J., Lee, J. H., & Kim, G. M. (2017). Phototherapy for vitiligo: A systematic review and meta-analysis. In *JAMA Dermatology* (Vol. 153, Issue 7, pp. 666–674). American Medical Association. <https://doi.org/10.1001/jamadermatol.2017.0002>
- Bergqvist, C., & Ezzedine, K. (2020). Vitiligo: A Review. *Dermatology*, 236(6), 571–592. <https://doi.org/10.1159/000506103>
- Bhingradia, Y., Chaudhary, N., & Patel, N. (2023). Mini punch grafting involving angle of lip using cyanoacrylate glue. *Journal of Cutaneous and Aesthetic Surgery*, 16(1), 69. https://doi.org/10.4103/jcas.jcas_66_21

- Chandrashekar, B., Madura, C., & Varsha, D. (2014). Autologous mini punch grafting: An experience of using motorized power punch in 10 patients. *Journal of Cutaneous and Aesthetic Surgery*, 7(1), 42. <https://doi.org/10.4103/0974-2077.129977>
- Feng, Y., & Lu, Y. (2022). Advances in vitiligo: Update on therapeutic targets. In *Frontiers in Immunology* (Vol. 13). Frontiers Media S.A. <https://doi.org/10.3389/fimmu.2022.986918>
- Gamal, A., El-Barbary, R., & Mofteh, N. (2020). Updates in Surgical Treatment of Vitiligo. *Journal of Recent Advances in Medicine*, 0(0), 0–0. <https://doi.org/10.21608/jram.2020.44431.1086>
- Gandhi, K., Ezzedine, K., Anastassopoulos, K. P., Patel, R., Sikirica, V., Daniel, S. R., Napatalung, L., Yamaguchi, Y., Baik, R., & Pandya, A. G. (2022). Prevalence of Vitiligo Among Adults in the United States. *JAMA Dermatology*, 158(1), 43. <https://doi.org/10.1001/jamadermatol.2021.4724>
- Helalat, M., Rawashdeh, B., Odiebat, H., Smadi, R., & Zyod, I. (2012). Punch Minigrafting for Stable Vitiligo: Our Experience at the Jordanian Royal Medical Services. In *JRMS December* (Vol. 19, Issue 4).
- Ju, H. J., Bae, J. M., Lee, R. W., Kim, S. H., Parsad, D., Pourang, A., Hamzavi, I., Shourick, J., & Ezzedine, K. (2021). Surgical Interventions for Patients With Vitiligo: A Systematic Review and Meta-analysis. *JAMA Dermatology*, 157(3), 307–316. <https://doi.org/10.1001/jamadermatol.2020.5756>
- Khullar, G., Kanwar, A. J., Singh, S., & Parsad, D. (2015). Comparison of efficacy and safety profile of topical calcipotriol ointment in combination with NB-UVB vs. NB-UVB alone in the treatment of vitiligo: A 24-week prospective right-left comparative clinical trial. *Journal of the European Academy of Dermatology and Venereology*, 29(5), 925–932. <https://doi.org/10.1111/jdv.12726>
- Lahiri, K. (2009). Evolution and evaluation of autologous mini punch grafting in vitiligo. *Indian Journal of Dermatology*, 54(2), 159–167. <https://doi.org/10.4103/0019-5154.53195>
- Majid, I. (2013). Grafting in vitiligo: How to get better results and how to avoid complications. *Journal of Cutaneous and Aesthetic Surgery*, 6(2), 83. <https://doi.org/10.4103/0974-2077.112668>
- Rasagna, J., Vasundhara, T., Tejaswini, K., Rohith Kumar, K., Kumar Kadarla, R., & Professor, A. (2019). Vitiligo-An Overview. *Asian Journal of Pharmaceutical Research and Development*, 7(5), 113–123. <https://doi.org/10.22270/ajprd.v7i5.570>
- Seneschal, J., Boniface, K., D'Arino, A., & Picardo, M. (2021). An update on Vitiligo pathogenesis. *Pigment Cell & Melanoma Research*, 34(2), 236–243. <https://doi.org/10.1111/pcmr.12949>
- Stiegler, J., & Brickley, S. (2021). Vitiligo. *Journal of the Dermatology Nurses' Association*, 13(1), 18–27. <https://doi.org/10.1097/JDN.0000000000000589>
- Zhang, Y., Cai, Y., Shi, M., Jiang, S., Cui, S., Wu, Y., Gao, X. H., & Chen, H. D. (2016). The prevalence of vitiligo: A meta-analysis. *PLoS ONE*, 11(9), 1–17. <https://doi.org/10.1371/journal.pone.0163806>