Advanced Surgical Techniques for Effective Wound Management

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Abstract

Skin graft applications are surgeries that are often performed by veterinarian experts in plastic surgeries and are performed by transplanting skin from one part of the body to another area with a lack of skin. It is a very useful method for closing open wounds the skin loss. If enough blood flow and tissue have developed in the wound to hold the patch of skin, a skin graft can be applied on top of it. Skin grafts are generally classified as thin, thick or full-thickness according to their thickness. The wound in the area where the skin is removed heals on its own. If a full-thickness skin is taken, a thinner skin patch should be placed here from elsewhere or the full-thickness skin area should be sutured and closed. The areas where skin patches are applied are in the form of accidents, burns, and open wounds caused by the removal of tumors. Some wounds cannot be closed with a patch of skin alone, more complex surgical interventions may be required for them. In some cases, it may be necessary to use dressing changes and alternative methods for a while to make the wound hold the skin patch. Although there is a possibility that the wound will heal on its own in some cases, it may be considered applying a skin graft to that area, considering that this will take a very long time and the scar that will occur in this area will be unhealthy and bad.

Keywords: Skin graft, Flap, Full-thickness, Composite, Meshed Skin Graft.

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Introduction

A break in the continuity of the skin is called a wound and if the wound has an open contact with the environment, then it is supposed an open wound. In addition to it, if the open wound surpasses 6 hours and no precautionary measures have been taken, it will be termed as an open and infected wound. While different traumatic injuries, most the animals like humans' face skin loss, and such loss of skin can only be treated either by some coverage of the wound surface by bandaging the surface area if it is small or if the surface area is large than by using a skin graft. Skin grafting is a surgical procedure that has been done proper veterinary surgeon with expertise and experience in reconstructive surgery. The skin, the largest organ of the body, protects the external parts of the body and holds body fluids, organs, muscles, nerves and all body tissues together (McKnight et al., 2022). Breaks or gaps in the skin tissue are called wounds. Wound healing is a natural response to tissue damage. Wound healing is a complex system that involves many systems. In spite of having different compositions and properties, animal and human skin share a few similarities. A brief comparison of human and animal skin has been described below.

Objective

The main objective of this chapter is to review the basic concept of normal skin and its structure. The process of wound healing, its stages and type of latest surgical innovations that can help in wound healing. Primary, secondary and delayed primary or tertiary wound healing and the role of skin flap or skin grafts (Full thickness skin grafts, partial thickness skin grafts, meshed skin grafts, pedicle skin grafts, composite skin graft, composite culture skin graft and pinch graft) in wound healing in animals.

Human skin vs Animal Skin

It is made up of three principal layers: the foremost epidermis, then dermis, and the last subcutaneous tissue or hypodermis (Madawi et al., 2023). The epidermis provides protection and is the waterproof outermost layer which advances towards the dermis that is also called as middle layer, which concludes sweat glands, blood vessels, nerve endings, and hair follicles. Later on, skin advances towards subcutaneous tissue, which is an innermost layer of cells that includes energy and insulation sources in the form of fat and commonly named fat cells. In contrast to it, the skin of animals also has layers that vary among species. In wide-ranging considerations, animal skin contains an epidermis that may vary in composition as well as in thickness. Next is the dermis, which also contains sweat glands, blood vessels, nerve endings and hair follicles. The last layer, which is the subcutaneous layer, may or may not be present, as a source of energy and insulation like whales, big cats, various primates, etc. The Human skin majorly includes water, fat, different cells, various proteins, elastin fibers, and collagen fibers. The

epidermis is usually composed of melanocytes that produce melanin pigment, which gives color to the skin while keratinocytes that used to produce the protein named keratin (Hussain et al., 2020).

Structure and Layers

As discussed earlier, the dermis has collagen as well as elastin fibers that gives elasticity and strength to the skin while animal skin can vary as per specie. Moreover, cells are composed of collagen and elastin fibers, some fats, and proteins. Though, the exact arrangement, type of fibers, and their density can vary in different species. Besides, animals have some unique adaptations in their skin as per environment like feathers, specialized glands or scales in different animals. Human skin used to serve numerous significant functions. It behaves as a barrier to chemicals or external pathogens and also to physical damage. Skin also regulates the temperature of the body by monitoring sweat production as well as the flow of blood (Rehman et al., 2020). It also entertains various sensory receptors for the sensations of temperature, pain and touch. The human skin is also tangled in the synthesis of the vitamin D and has been also involved in the immune defense of the body. While, the animal skin also performs almost similar functions as human skin like temperature regulation, sensory perception, and protection as well (Rawling A. V. 2006). Nevertheless, the exact adaptations of the animal skin can vary as per the needs of species like animals have a skin for protection against predators or camouflage. Some others have the skin versions for efficient swimming, or flying and heat regulation. The human skin differentiates in color and texture and thickness among people and also for different body parts (Taylor S. C. 2002). Skin on the ventral hand and feet is usually thicker, but skin over the eyelids used to be sensitive and thinner. The human skin may also depict variation in pigmentation that can be influenced by sun exposure, genetics, and various other factors. The animal skin also shows a wider range of variations and specialties depending on the type of species some animals have adapted scales over the skin in fishes and reptiles, feathers in birds, thick fur or thick hair in mammals, or exoskeletons in insects and crustaceans. These adaptations provide insulation, camouflage, and protection or can also help with some other specific functions as well (Zhang et al., 2022). It is important to note that while human skin has been extensively studied and understood, there can be significant differences in the composition and structure of animal skin. These differences require special knowledge and approaches when conducting skin-related treatments or research in veterinary medicine (Madawi et al., 2023).

Types of Wound Healing

Wound healing, in its simplest definition, is the response given by the organism to repair the damage caused by the factors that cause the wound. Wound healing can be summarized by the infiltration of inflammatory cells at the site of damage, then their proliferation and matrix storage, and then scar formation. Wound healing can be grouped as primary, secondary, and tertiary (delayed primary) healing (Stroncek et al., 2008).

Primary Wound Healing

The healing seen when the wound openings are combined with surgical sutures in a clean incision is the least complicated example of wound healing and is called primary wound healing. In incision-type wounds, some epithelial and connective tissue cells are destroyed. The incision area is narrow and immediately fills with a clot containing fibrin and blood cells. When the clot on the surface becomes dehydrated, a crust is formed that covers the wound and isolates it from the external environment (Wynn, M. O. 2021).

Secondary Wound Healing

The healing process is more complicated in cases of inflammatory ulceration, abscess formation, surface injuries with large tissue defects, and high amounts of cell and tissue loss. If the losses in the parenchymal cells in the injured organ do not heal with regeneration, secondary healing is observed. The resulting tissue defect areas are filled with excessive granulation tissue in the early period and scar tissue in the later period, and healing occurs.

Normally, collagen forms the tensile force in wound healing, while epithelialization creates the tensile force of the scar tissue in secondary healing. In secondary healing, the process is slow and it may take 4-8 weeks for epithelialization to develop.

Fig. 1: Secondary Wound Healing in a dog

Although the main events in the healing process are similar to those that develop in primary wound healing, the differences are that the inflammatory reaction is more severe, the granulation tissue is more abundant, and the wound is contraction as shown in figure 1. Wound contraction occurs when fibroblasts turn into myofibroblasts. The wound area becomes smaller. The developing scar tissue is initially pink. It gradually fades with the decrease in vascular structures (Lux, C. N. 2022).

Tertiary (Delayed Primary) wound Healing

These are wounds with extensive tissue damage and severe bacterial contamination. In this type of wound, the wound area is not closed immediately. The inflammatory process in the wound bed is given time to minimize the concentration of bacteria. Then, by applying primary closure, normal biological processes of wound healing are experienced. Delayed primary wound healing has been shown in a cat in Figure 2.

Fig. 2: Delayed Primary Wound Healing in a Cat (Day 42 without granulation tissue)

Skin Flap and Skin Graft

Skin Flap

The flap is the removal of the piece of tissue fed by the blood vessels that are named or unnamed in the body and used to provide the missing tissue in another near or distant area. The flap tissue is either moved to another point without interrupting the blood circulation, or the vessel is repaired where it is taken and fed through the veins in that area Skin grafts are commonly used in veterinary medicine to aid wound healing in animals.

Flaps are used to close larger, deeper, and complicated wounds because they are thicker, and larger and many tissues can be used for transplantation at the same time (Adigbli et al., 2016). Skin, muscle, bone, and fascia tissues can be used individually or together. The most important difference between flaps and grafts is that there are also feeder vessels and/or nerves in the flaps.

One or more of the tissues such as skin, subcutaneous tissue, muscle, bone, cartilage, nerve, vessel, tendon, and fascia can be found together in the flap tissue. In addition, internal organs such as the intestine can also be used as flaps.

Flaps can be used in many places for open wound closure and the creation of a region:

- For skin wound closure after trauma or cancer surgeries.
-Graft (skin patch) to close wounds that are not suitable for use.
-To close wounds such as diabetes-related wounds, bedsores, and leg wounds due to vascular insufficiency.
- To close bone deficiencies after trauma or cancer surgery with bone tissue.
- To open adhesions and contractions of the pelvic or pectoral region caused by burns.

Local Skin Flap

In order to close an open wound or correct a skin problem, the application of a flap in an area immediately close to the problem is called a 'local flap' or regional flap application (Pavletic et al., 1997; Berry et al., 2024). They are flaps that are very commonly used in the field of reconstructive surgery. For example, after the removal of a skin cancer on the nose, the open area is closed with nearby tissues with various tissue turning techniques, or the skin contraction that occurs in a finger after a burn is opened with the 'Z-plasty' method.

Free Skin Flap

The process of breaking all connections of tissue (skin, bone, muscle, etc.) in the body together with its vessel and/or nerve, moving it to another place, and connecting it to the existing vessels and/or nerves in that place is a 'free flap' surgical procedure. In these methods, which require special training, a microscope is used.

-When there is a serious opening in the area of a wound on the body.
- When skin grafts or local flaps are insufficient to close the wound.
-When a better result is desired when closing the open wound.
- When it is necessary to close or reconstruct the missing tissue in the open area with a tissue of the same consistency (such as recreating the bone deficiency after jaw bone cancer surgery with bone tissue etc.) free flap use may be required (king et al., 2014).

Skin Graft

A skin graft is a surgical procedure that involves transplanting healthy skin from one area of the body, known as the donor area, to another area with damaged or missing skin, called the recipient site (Iqbal et al., 2020). The purpose of a skin graft is to replace or cover damaged or lost skin, promote wound healing, and restore the function and appearance of the recipient area.

History of all Skin Grafts

Skin grafting is a surgical technique with thousands of years of history (Davison et al., 1986). The evolution of skin grafts has been shaped by advances in surgical knowledge, techniques, and understanding of skin biology (Ozhathil et al., 2021). India (c. 800 BC): The Sushruta Samhita, an ancient Indian medical text, describes reconstructive surgery techniques, including the use of skin grafts made from the cheek or inner arm to repair nasal defects. In ancient Egypt (around 2500 BC), Egyptian papyrus recommends the use of skin grafts for reconstructive purposes, especially in repairing nasal deformities. 16.-17. Century: European surgeons, such as Ambroise Paré and Gaspare Tagliacozzi, developed techniques for nasal reconstruction using a variety of methods, including the use of local flaps and pedicle flaps. In the 19th century, the introduction of anesthesia and advances in surgical techniques further expanded the possibilities of skin grafting. Reverdin, a Swiss surgeon, introduced the concept of partial-thickness skin grafts (Siddiqui et al., 2010). He described the technique of taking small skin grafts from the donor area using a special knife. In 1869, German surgeon Carl Thiersch developed a technique for full-thickness skin grafts (Chick., 1988). He introduced the concept of meshing the graft by creating holes to allow for expansion and easier healing (Scholttmann et al., 2021).

In 1939, Sir Harold Delf Gillies, a British plastic surgeon, pioneered a scuba pedicle graft technique that includes a flap of the skin with the intact blood supply returning to the wound. Advances in microsurgical techniques in the 1940s-1950s led to the development of free flaps, in which a section of tissue with its own blood supply was completely separated from the donor area and transferred to the recipient area. The bioengineered substitutes of the skin discuss the limited availability of the donor sites and also improve outcomes from the graft (Hauben et al., 1982). Substitutions include cell-free dermal matrices, dermal matrices, and cultured epithelial autografts, as well. Modern skin grafting also includes a selection of the appropriate graft type, meticulous surgical technique for graft collection, careful evaluation of the wound, preparation, and placement of the graft (Swaim., 1990). Advances in wound care, like negative pressure wound therapy and the use of special kinds of dressings, have also improved graft survival as well as outcomes of wound healing. If we go through history, skin grafting has evolved from a simple technique to composite reconstructive trials (Stanley et al., 2013). While considering an understanding of skin biology, stages of wound healing, and various surgical techniques that have continuously expanded not only lead to better outcomes but also advances in various grafting procedures.

Nowadays, skin grafts remain one of the important tools during the treatment of burns, various wounds and also reconstructive surgeries, they can help animals to restore almost original shape and function to all damaged areas of the body (Hermeto et al., 2012). A skin graft usually involves taking a healthy piece of skin from one area of the body, called as the donor area, and transplantation of it to cover the wound or the defect in another area, also known as recipient area (Schlottmann et al., 2021; Lee et al., 2022). That procedure is only performed when the own skin of the animal is unable to heal the wound adequately, whenever there will be a significant loss of the skin due to the burns, injuries, surgical excision or any other trauma. There are various types of the skin grafts in veterinary sciences, counting autografts, then allografts, and later on xenografts (Johnson et al., 1992).

Autografts

Autographs involve the skin of the same animal as a rotary tissue. Such type of grafts is preferred because of their high success rate as well as less risk of immune rejection. Autograft have been performed by surgeons in those humans who do not have any recipient or any autoimmunity disorder. In case of severe emergency and for early manipulation, autograft can be the best choice for smaller portion of skin loss.

Allografts

Allografts use the skin of another animal of the same species as the donor tissue. These grafts are useful when not enough of the animal's own skin is available. However, allografts carry a higher risk of immune rejection compared to autografts.

Xenografts

Xenografts involve using skin from a different species, typically pigs, as donor tissue. These grafts are used as temporary coverings until a more suitable graft is obtained. Xenografts are eventually rejected by the animal's immune system.

Allograft vs. Xenograft

Allografts are skin grafts obtained from another individual of the same species (human) but not from the animal. Xenografts are grafts derived from animals, usually pig (pig) skin. Allografts and xenografts are used as temporary dressings for wounds with large areas of skin loss, providing protection and promoting wound healing until the animal's own grafts or skin can be used (Bristol., 2005; Aisa and Vernon., 2016). These grafts are eventually rejected by the body and need to be replaced. It is important to note that advances in regenerative medicine and tissue engineering have also led to the development of artificial and bioengineered skin substitutes that can be used as an alternative or in combination with traditional skin grafts (Harari, 2004).

After the graft is collected, the donor area will also require wound care and healing. The recipient area is prepared by removing any non-viable tissue and creating a suitable bed for graft placement. The graft is carefully fixed to the recipient area using sutures, staples, or adhesive dressings to ensure proper adhesion and integration (Willenborg et al., 2022).

Proper monitoring as well as suitable postoperative care have been needed after this procedure. To avoid damage and deterioration of the graft site, the animal must be allowed to rest and not move as much as was supposed before the injury. As per Pope., 1990, proper wound care, pain management and prevention from infection plays important roles in healing. Successful skin grafting means survival and proper integration of transplanted skin tissue with the recipient site, which allows for proper wound healing, its closure as well as restoration of appearance and function. (Bystryn, 1997).

Principles of Skin Grafting

The principles of skin graft contain numerous key factors that contribute towards successful procedure and healing of the recipient area as said by (BC, 1998). These principles are:

Graft Selection

It is critical to select the appropriate and authentic type of skin as per the characteristics of wound and the desired result. Partial-thickness skin grafts or split-thickness skin grafts (STSG) are mostly used in cases of large affected areas having partial thickness skin loss, while full-thickness skin grafts (FTSG) are favored for the areas that need some better cosmetic results along with limited vascular supply (Claeys, 2016).

Graft Collection

The donor site selection must be done carefully to ensure healthy as well as a suitable skin for skin grafting. The graft collecting technique

should be précised and planned for minimal trauma to the donor skin site and to confirm proper graft thickness. The choice of the donor site also depends on factors like animal-specific considerations, availability, and skin quality (Taylor et al., 2021).

Adequate Blood Supply

The recipient area of the animal must have an adequate and complete blood supply throughout its circumference to support and ease the survival as well as integration of the skin graft. While preparation of the wound bed, removal of necrotic tissue, and underlying vascular supply are vital in maintaining a healthy and comfortable environment for graft healing.

Graft Bed Preparation

The grafts must be reinforced with the adhesion as well as integration in the recipient skin area, which has to be considered very crucial in the context of a clean and properly vascularized wound bed. Treatment of infection or other systemic conditions, debridement and wound cleansing is among the preparations for attaining of an optimal and comfortable environment for the healing of the graft (Gierek et al., 2022).

Graft Fixation and Immobilization

Proper fixation as well as immobilization of graft in the recipient skin area is very crucial for successful skin grafting. For the securing of skin graft at its original place, sutures or staples and adhesive tape dressings can be used so that it sticks to the wound bed and also integrates with surrounding skin tissue. This fixation can also help in preventing movement and shear forces that can impair skin graft survival (Garutti et al., 2024).

Post-Operative Care

Post-operative care and close monitoring play's crucial role in the success of skin grafts. Post-operative care involves careful management of the wound after application of the graft, regular change in dressing, monitoring for the signs of infection if any or other graft complications, proper pain management and also wound care along with education on activity restrictions of the owner of animal.

Prevention of Complications

Proper Precautionary measures should be taken to avoid complications like hematoma, infection, excessive scar formation, graft failure, or seroma formation. Proper control of infection, along with managing wound drainage and maintaining a moist environment, plays an important role in minimizing the risks (Hosgood, 1992).

Rehabilitation and Follow-up

Rehabilitation and follow-up care are also important to improve the proper functional as well as cosmetic results of skin grafts. Activity restrictions, scar management, physical therapy, wound care, and education of the owner regarding graft depict vital roles and as a component of the rehabilitation process.

By observing such principles, healthcare professionals can also enhance the chances of the successful retrieval of the graft, its integration, and long-term healing as well, which can also lead towards better wound closure along with functional affected part with cosmetic outcomes (Eldad, 1987). The choice of the type of skin graft depends upon the proper requirements of the wound, the availability of the donor site, and the expertise of the surgeon as well. A valid and experienced healthcare professional will also evaluate wounds and also determine the most appropriate type of skin graft to optimize proper wound healing and functional and aesthetic outcomes (Andreassi et al., 2005; Mojallal et al., 2009).

Wound treatment with Skin Grafts

Skin grafts are reconstructive surgical manipulations used to treat and manage wounds that are considered either difficult to heal or have some kind of extensive tissue loss (Bacchetta et al., 1975). The skin grafts involve the transplantation of healthy skin from one of the body parts towards the wound. Some information about the usage and handling of skin grafts during wound treatment, and the associated science behind their effectiveness, has been described here as previously elaborated by Lewin and Peck (1941) and Lindenblatt et al. (2008). The chief purpose of the skin graft is to cover the wound that is unable to heal. This graft works as either a temporary or permanent substitute for the damaged or lost skin along with promoting wound closure as well as facilitating the wound healing process. For a successful skin graft, it must have survived and also integrated properly into the recipient skin area. During the process of healing, the blood vessels (capillaries) from the recipient skin area will also grow inside the grafted skin and provide it with oxygen and also with nutrients, which are necessary for its survival. Graft also forms some new blood vessels that will allow it to integrate with the surrounding skin tissue (Hu et al., 2022).

There are various different types of skin grafts in veterinary sciences, including FTSG and STSG. Full-thickness grafts usually involve the shifting of both the epidermis and dermis, while split-thickness grafts mostly consist of some portion of the dermis and the whole of the epidermis. The choice of skin graft type usually depends upon the characteristics of the wound and also on the availability of donor skin sites. The donor skin site for a skin graft is characteristically selected on basic factors like quality and availability of the skin, the location and size of the wound, and the overall health condition of the animal as well. The donor skin site also needs some wound care, in addition to healing. For the sake of promotion of successful skin graft retrieval as well as integration, a graft is usually immobilized and stayed in its position by using staples, sutures, or adhesive tape wraps. Dressing is usually done to protect the graft and to provide a moist environment for healing purposes. These dressings may also include some absorbent materials, non-adhesive layers, or even silicone layers. After the proper vaccination procedure of the animal, close monitoring and suitable postoperative care are also crucial in such cases (Lux, C. N. 2022).

To prevent deterioration or damage, the animal may also need to limit the movement as well as weight bearing in the grafted skin area, as discussed earlier. The care of wounds, pain management, and prevention of diseases are very important points in the healing process of a

skin graft. With the passage of time, the grafted skin area may also show some narrowing as it heals, which is called wound contraction (Stadler et al., 2001). That contraction can cause some changes in the appearance and also the overall texture of the graft and the surrounding available skin. For the concern of scar management techniques like a massage of the affected area, pressure bandage, or silicone gel sheets can also be used depending upon the wound to minimize scar formation and also to optimize better cosmetic outcomes than before (Edwards J. 2022).

Skin grafts are a valuable kind of treatment options for wounds that may not heal on their own. Success of skin graft also depends on several factors' survival of the graft, its integration, and proper postoperative care after a skin graft (Schultz et al., 2003). A veterinary surgeon or healthcare professional with expertise and practice in wound management and also in surgical procedures that will evaluate wound condition and determine the best appropriate approach for skin grafting if required. Regular and precise follow-up visits of the animal are necessary to monitor the progress of the skin graft and ensure optimal healing outcomes after skin grafting (Bacchetta et al., 1975).

Types of Skin Grafts

There are different types of the skin grafts that will be discussed here,

Full-Thickness Skin Graft (FTSG)

A full-thickness skin graft includes transplantation of epidermis and the complete thickness of dermis from donor skin to recipient skin. Such grafts provide a much thicker in addition to a durable coverage when compared with STSG. FTSG are most commonly used for the areas that may need some better and aesthetic results or for some areas having less vascularization towards recipient skin. A FTSG has the entire thickness of the skin makeup including wholesome of epidermis and dermis. The skin graft is attained by the removal of full thickness of skin from donor skin, mostly by using a scalpel or by using surgical scissors. They provide a thicker and more durable skin coating when compared with STSG. They also have some better cosmetic appearance because of the availability of the sweat glands, hair follicles, and some other dermal structures as well. Some most common donor skin sites for FTSG include areas such as the groin region, upper eyelid region, retro-auricular region, or pre-auricular region (Pavletic., 1997).

Split-Thickness Skin Graft (STSG)

A split-thickness skin graft includes transplantation a part only from the epidermis and dermis of the donor skin to the recipient skin area. Donor skin site is supposed to be finalized on the basis of location and size of wound, the quality along with use of the skin. Furthermore, overall health of animal must be utmost priority while considering skin grafting. Most common donor skin sites are thigh, upper fore and hind limb region and hip or lumbar region. Skin graft is either mesh or expanded over the skin to cover a larger skin surface area and also promotes healing of the wound. A STSG includes transplantation of epidermis and some portion of the dermis from donor skin towards recipient skin (Johnson et al., 1992).

A graft is mostly obtained by using a surgical instrument called a dermatome that helps in the removal of a thin layer of the skin from the donor skin in a control manner. While, the depth of the graft may vary and majorly have epidermis and a flexible portion of dermis (Dogan et al., 2024). STSG are thin as well as flexible in nature that allow them to be available for irregular wound surfaces. They also have better chances of survival as compared to the FTSG due to presence of the live dermal elements which promote revascularization of the skin.

Composite Graft

Composite grafting involves transplanting skin and other tissues, such as cartilage or subcutaneous fat, from the donor area to the recipient area. The graft is obtained by excising a section of skin along with associated tissues from the donor area Composite grafts are typically used for special cases where specific tissues, such as cartilage, are required for nasal reconstruction. They have limited blood circulation and are often used for wounds limited to a smaller area (Fossum, T. W. 2012).

Pedicle Graft

A pedicle graft involves transferring a flap of skin from the donor area to the recipient area without disturbing the blood supply. The flap partially remains attached to the donor area and ensures a constant supply of blood. The flap is then tunneled or rotated into the recipient area, thus maintaining blood flow until it makes new connections in the recipient area (Kim et al., 2022).

Meshed Skin Graft

A mesh skin graft is created by using a dermatome to create multiple small holes or crevices in the graft. This technique allows the graft to expand and cover a larger area. Meshing helps to increase the surface area of the graft, which can be especially useful when there is a shortage of donor skin or when covering large wounds. The braided pattern allows for the drainage of fluids and provides space for tissue expansion and growth (Fossum, T. W. 2012).

Pinch Graft

A pinch graft involves collecting small split-thickness skin grafts (usually less than 1 cm in diameter) from the donor area. The grafts are then placed in the recipient area, spaced apart. Pinch grafts are often used for small or irregularly shaped wounds or in areas where the availability of donor skin is limited. They are particularly suitable for wounds that do not require large grafts (Probst, 1990).

Composite Cultured Skin Graft

Composite cultured skin grafts are bio-engineered skin substitutes created in the laboratory using the animal's own cells. They are made up of both epidermal and dermal layers. These grafts are used in cases where the animal has extensive burns or large wounds that cannot be

adequately covered with traditional grafts. Cultured grafts promote wound healing and improve the function and appearance of the treated area (Fossum, T. W. 2012).

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