INTRODUCTION

Burns are among the most severe kind of harm that may ever affect a human being. In all societies, burns continue to constitute a medical, psychological and economic problem. The physical and psychological consequences increase markedly with increased burn extent. Thus, it is obvious that survivors from extensive burns are more prone to develop long-term physical and psychological sequelae with devastating consequences, not only to them, but also to their family and society in general ***(Hemeda et al., 2003).***

Skin grafts are a common method of closing skin defects and have been used since the early 1500s by the Germans and Hindus ***(Achora et al., 2014).***

Split-thickness skin grafts (STSGs) may be used for primary closure of a wound, as adjunctive treatment for wounds that have closed partially in response to other therapies, or to promote healing of donor sites created by other plastic surgery procedures.

There is increasing use of STSGs for diabetic foot and leg ulcers, because grafting has been found to shorten healing time and reduce complications. Split-thickness skin grafts are the preferred approach in situations where there are large surface areas to be covered, and in burn wound care ***(Achora et al., 2014).***

The success of skin graft depends on haemostasis and adhesion of skin graft to wound bed on the other, on local vascularity and wound microbiology ***(Achora et al., 2014).***

Autologous platelet-rich plasma (PRP) has become increasingly popular as a clinical treatment in a wide variety of soft and hard tissue applications in almost all fields of surgery, particularly in problematic wounds, maxillofacial bone defects, and the fields of cosmetic, and spinal surgery.The usefulness of PRP in plastic and reconstructive surgery has also attracted attention ***(Waiker and Shivalingappa, 2015).***

Platelet-rich plasma (PRP) is a fraction of blood plasma with a platelet concentration above baseline, PRP typically contains 3-8 times the concentration of normal platelet levels. The α-granules of platelets contain molecules such as platelet-derived growth factor (PDGF) and transforming growth factor-β (TGF-β), which stimulate cell proliferation and cell differentiation for tissue regeneration. These factors are released from α-granules in response to platelet activation by inducers of platelet aggregation the application of PRP has shown good results in wound care, however, up to date no substantial research has been performed on the effect of PRP in burn treatment ***(Kakudo et al., 2010).***

PRP has a significant effect on graft take, instant adhesion which are approved in many studies ***(Waiker and Shivalingappa, 2015).***

Aim of the Work

To detect the effect of lyophilized platelet growth factors on split thickness skin graft (S.T.S.G) take in the treatment of post burn raw area compared with non-treated graft take as regard percentage, time of take.

SPLIT THICKNESS SKIN GRAFT

Skin is the largest human organ, covering 1.7 m2 in the average adult. It serves as an essential barrier with mechanical, immunological, and aesthetic functions. Approximately 95% of the skin is dermis and the other 5% is epidermis. The dermis contains sebaceous glands and the subcutaneous fat beneath the dermis contains sweat glands and hair follicles. The skin vasculature is superficial to the superficial fascia and parallels the skin surface. The cutaneous vessels branch at right angles to penetrate subcutaneous tissue and arborize in the dermis. The final destination of these blood vessels is a capillary tuft that terminates between the dermal papillae ***(Allen et al., 1994).***

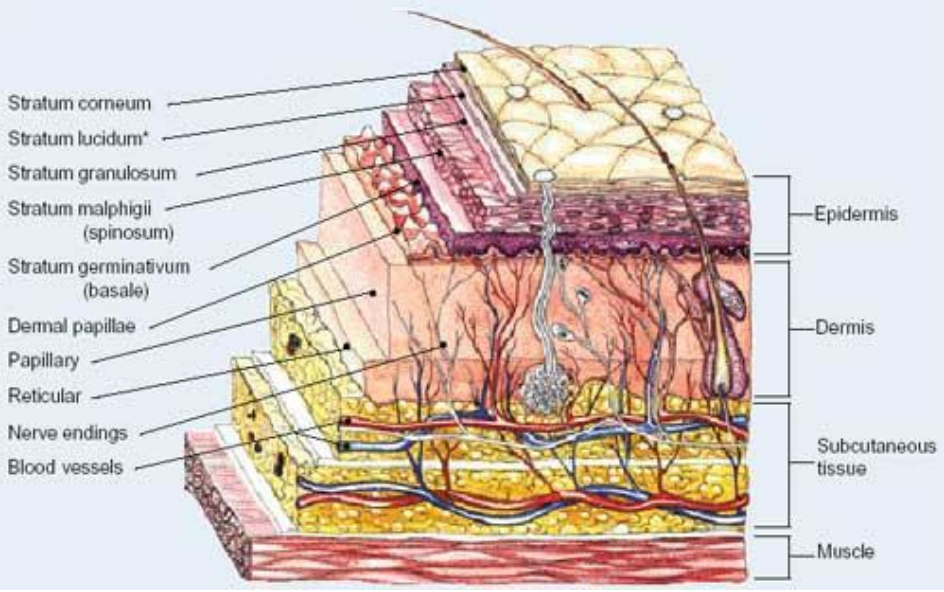

Figure (1): Showing the histological anatomy of the skin ***(Miller-Keane, 2003).***

Skin transplantation has long fascinated humans and there is evidence that skin grafts were performed in India as early as 1500 BC for traumatic nasal amputation. Modern science has taught us much about the anatomy and physiology of skin ***(Neligan, 2012).***

Gaspare Tagliacozzi, one of the first reconstructive surgeons (1545–1599), described pedicled skin flaps from the arm for nasal reconstruction in patients while at the same time research was conducted by Giuseppe Baronio (1750–1811), who performed and published for the first time skin grafts in a lamb ***(Neligan, 2012).***

With the development of skin harvest techniques the number of publications reporting clinical results of skin grafts increased exponentially. Later, James Carlton Tanner (1921–1996) revolutionized burn surgery by the introduction of meshing to expand skin grafts in order to cover larger wounds with minimal donor site morbidity ***(Tanner et al., 1964).***

In 1920 Ricardo Finochietto (1888–1962) developed a knife to elevate larger skin areas manually by controlling the thickness of the skin graft. Ten years later, the invention of the shave blade by Humby further facilitated skin harvest. The introduction of the mechanical dermatome of Padgett-Hood and Reese in 1940 and 8 years later the development of the electric dermatome by Harry Brown significantly facilitated skin harvest of large surfaces in a controlled manner ***(Neligan, 2012).***

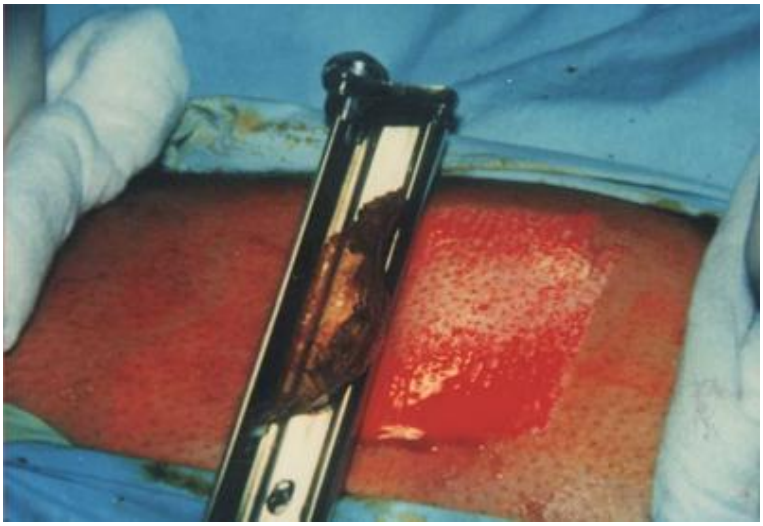

Figure (2): Showing the harvesting of the graft by Humpy Knife.

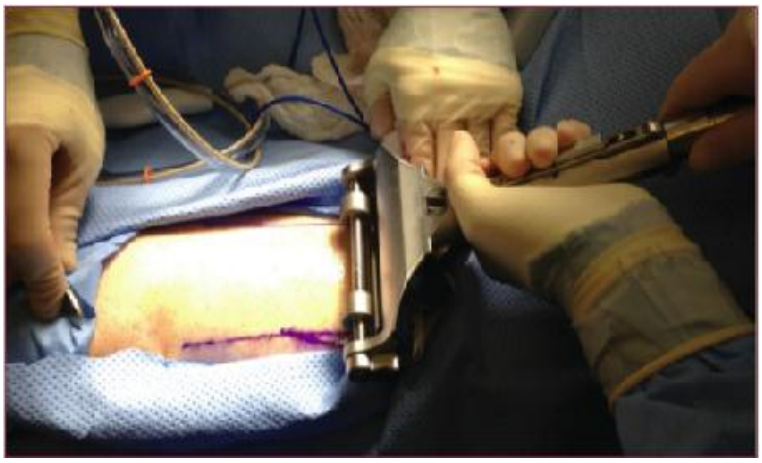

Figure (3): Showing the harvesting of the graft by a Dermatome.

Types of skin grafts:

The term "graft" by itself commonly refers to either an allograft or an auto graft. An autograft is a type of graft that uses skin from another area of the body but there has to be enough undamaged skin available and the patient has to be healthy enough to undergo surgery. An allograft uses skin

obtained from another human being, Donor skin from cadavers is frozen, stored, and available for use as an allograft. Skin taken from an animal (usually a pig) is called a xenograft because it comes from a nonhuman species. Allograft and xenograft provide only a temporary covering because of rejection by the patient's immune system within seven days. The allograft or xenograft must then be replaced with an auto graft ***(Spear, 2011).***

Skin grafts are generally classified as split-thickness or full-thickness grafts. When a graft includes only a portion of the dermis, it is called a split-thickness skin graft. When a graft contains the entire dermis, it is called a full-thickness skin graft. Split-thickness skin grafts are further classified into mesh skin grafts, stamp skin grafts, and chip skin grafts, based on their shape ***(Lee et al., 2000).***

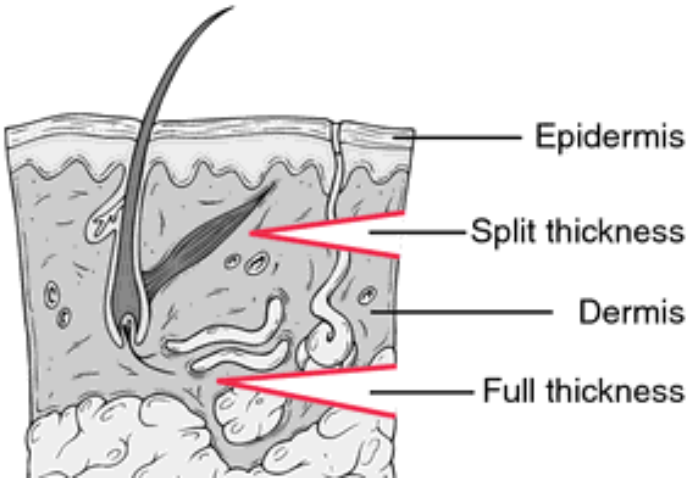

Figure (4): Showing the anatomical difference between the split and full thickness skin graft ***(Miller-Keane, 2003).***

The amount of dermis included with the graft determines both the likelihood of survival and the level of contracture. That is to say, split-thickness grafts can survive in conditions with less vascularity, but they have a greater likelihood of contracture. In contrast, full-thickness grafts require a better vascular bed for survival but undergo less contracture ***(Ragnell, 1952).***

Composite skin graft is sometimes used. A composite skin graft consists of combinations of skin and fat, skin and cartilage, or dermis and fat. Composite grafts are used in patients whose injuries require three-dimensional reconstruction. For example, a wedge of ear skin and cartilage can be used to repair the nose ***(Spear, 2011).***

Donor Sites:

With consideration of aesthetic results, the donor site should be similar to the recipient site in terms of consistency, thickness, color, and texture. To cover a facial defect, in which maximum care must be taken, full-thickness skin grafts are often needed. Common donor sites for full-thickness skin grafts of the head and neck include the postauricular region, anterior auricular region, nasolabial crease, supraclavicular region, eyelids, and neck. Even on the same face, skin characteristics may vary widely by location. For example, while eyelid skin is thin and has few glandular structures, nasal skin is thick and has a relatively large number of glandular elements. Though full-thickness skin from the postauricular region is often used to cover defects of the lower eyelid, aesthetic results may be much better if it is possible to use a surplus of upper eyelid skin. In the other sites of the body, groin region or lower abdomen is frequently used as a donor site because the enough skin can be obtained and the donor site can be primarily sutured. Also, the scar of the donor site can be hidden in the under wear ***(Ruka et al., 2012).***

Split-thickness skin grafts may be taken from any area of the body, including the scalp. Despite its ability to heal spontaneously, the donor site of a split-thickness skin graft is frequently scarred or discolored. If the patient agrees with hair shaving, it is effective to take grafts from a hair-bearing region, because the scarring after skin harvesting can be hidden in the hair. In addition, re-epithelialization is faster, because of the remaining rich hair follicles. When taking a graft from a hair-

bearing region, it is important to take a thin graft, because thicker split-thickness grafts will contain undesired hair follicles and eventually lead to hair in the graft and hair loss in the donor site. We usually harvest split-thickness skin from the scalp less than 350μ min thickness. For men, the donor site should be chosen with care based on the potential for hair regression by male pattern baldness ***(Ruka et al., 2012).***

Graft take

The large array of physiologic events usually seen in a healing skin wound are altered and modified by placement of a graft. The graft becomes incorporated in the host bed through the process of graft "take". The success of a graft depends primarily on the extent and speed at which vascular perfusion is restored to this parasitic, ischemic tissue.Given equal clinical and technical conditions, two qualities of a skin graft influence its fate. The first determinant is the blood supply of the skin from which the graft was obtained ***(Kimura et al., 1996).***

A graft harvested from a highly vascular donor site will predictably heal better than a graft taken from a poorly perfused area. The second factor in graft take is the metabolic activity of the skin graft at the time of application, which will dictate its tolerance to the inevitable period of ischemia. Skin graft take occurs in three phases. The first phase consists of plasmatic imbibition and lasts 24–48 hours. This is followed by an inosculatory phase and a process of capillary ingrowth that occur essentially simultaneously until generalized blood flow

has been established by the fifth or sixth postgraft day ***(Kimura et al., 1996).***

Plasmatic Imbibition The exact significance of plasmatic imbibition to the healing of a skin graft is not clear. Hinshaw and Miller ***(Kimura et al., 1996)*** and Pepper ***(Inoue et al., 1996)*** believed that plasmatic imbibition is nutritionally important, while Clemmesen Converse and Peer thought that it merely prevents the graft from drying out and keeps the graft vessels patent in the early postgraft period ***(Nakajima et al., 1998; Taylor et al., 1990)***.

Regardless of whose theory is correct, all concur in the following:

- The graft is ischemic for an undetermined period of time that varies according to the wound bed: 24 hours for a graft placed on a bed that is already proliferative; 48 hours for a graft covering a fresh wound ***(Taylor et al., 1990)***.

- Grafts placed on poorly vascularized beds will be ischemic for a longer time than those placed on wounds with good blood supply. Exactly how long a graft will tolerate this ischemic interval is unclear, but thick FTSGs seem to tolerate ischemia for up to 3 days while thin FTSGs survive for up to 5 days ***(Taylor et al., 1990)***.

Split-thickness grafts take well even after 4 days of ischemia ***(Taylor et al., 1990).***

- Plasmatic imbibition allows a graft to survive this immediate postgraft ischemic period until such time as graft vasculature is reestablished.

- Grafts gain weight during the phase of plasmatic imbibition, ***(Houseman et al., 2000; Nakajima et al., 1986)*** adding as much as 40% to their pre graft weight through fluid movement from bed to graft ***(Nakajima et al., 1986).*** The origin of graft edema is believed to be the same as that of inflammatory edema—ie, from disaggregation and depolymerization of proteoglycans, accumulation of osmotically active metabolites, and increased vascular permeability ***(Zhong et al., 1994; Imanishi et al., 2002)***.

Inosculation and Capillary Ingrowth

At the end of 48 hours, a fine vascular network is established in the fibrin layer between the graft and its recipient bed. Capillary buds from the blood vessels in the recipient bed make contact with the graft vessels and open channels are formed. Blood flow is established and the skin graft becomes pink ***(Nakajima et al., 1986).***

Revascularization

Three theories have been put forth to explain how a skin graft is revascularized. Connection of graft and host vessels. The first theory holds that after the inosculatory event, the definitive vasculature of a graft consists of the blood vessels

originally present within the graft. According to this theory, circulation is restored in a graft via the original skin graft vessels by anastomoses formed between the recipient bed and the skin graft through inosculation ***(Zhong et al., 1994; Imanishi et al., 2002)***.

Among others, this line of thinking. Clemmesen, ***(Houseman et al., 2000)*** working on a porcine model, injected India ink into the host vessels of the autograft. No ink was seen within the graft on the first postgraft day, but on day 2 a number of graft vessels contained India ink, suggesting communication between the host and graft vessels. After the second day many graft vessels contained Indiaink, indicating patent connections between vessels of the graft and its bed. Initially a fine fibrin mesh linked the graft to the bed, but over the first 4 days this meshwork became lined with endothelial cells and linked up with the vessels of the graft.

Haller and Billingham ***(Imanishi et al., 1999)*** reached a similar conclusion in a study involving the hamster cheek pouch model. They too noted that the pattern of vessels in the healed graft was the same as the pattern before grafting. Formation of new vascular channels. The second theory of graft revascularization holds that the graft is perfused through new vessels going from the recipient bed into the transplanted graft.

Converse, ***(Nakajima et al., 1999)*** Ljungvist and Wolff and Schellander 48 espouse this theory. Converse and Rapaport

(Pinal et al., 1993) studied skin grafts in humans and noted an early connection of graft and host vessels—the inosculatory event—after which there was active invasion of the graft by host vessels to produce the definitive vasculature of the graft. On the basis of a later study in a rat model involving diaphorase, ***(Koshima et al., 1991)*** Converse concluded that the final vasculature of a graft stemmed from ingrown vessels from the host bed. Degenerative changes in the original graft vasculature were apparent in the first 4 days post graft, as evidenced by progressive loss of diaphorase activity during this time. With subsequent vessel in growth there was return of diaphorase activity. Wolff and Schellander 48 measured cellular enzymes to evaluate return of circulation in porcine skin grafts. ATP activity correlated well with the pattern of new vessel ingrowth, leading the authors to conclude that the new graft vasculature consisted entirely of ingrown vessels.

Working on mice, ***Zarem et al. (Nakajima et al., 1999)*** theorized that preexisting graft vessels served only as nonviable conduits through which the endothelium of the ingrowing vessels progressed. The rate of vessel ingrowth was measured at approximately 5 microns per hour. The original graft vessels degenerated concomitantly and at the same rate, leaving only those vessels growing from the recipient bed as the graft's definitive vasculature.

Combined old and new vessels. Smahel ***(Levy et al., 2007)*** and Tsukada ***(Suzuki et al., 1996)*** proposed a third (and

much less popular) hypothesis of graft revascularization: a compromise between the two above theories. The authors speculated that circulation in a graft is reestablished in various ways; that is, in any graft old vessels may be recycled and new ones may grow to variable degrees. These two pathways to restore circulation to ischemic tissue may occur simultaneously or as consecutive stages in the interaction between the graft and its bed.

There are two methods of skin graft revascularization:

Primary and secondary.

Primary revascularization.

Under the scanning electron microscope it can be seen that no real circulation to the graft exists for the first 6 to 7 days postgrafting. Whatever flow there is within the graft is sluggish, shifting direction, and with attendant pooling and pendulum-like movement ***(Rohrich et al., 1999).*** Clinically this manifests as cyanotic discoloration and is particularly noticeable in full-thickness skin grafts ***(Koshima et al., 1991; Zhong et al., 1994; Pinal et al., 1993).***

In the normal course of events circulation in a skin graft is reestablished through vascular anastomoses between budding neovessels from the bed and those already present in the graft (inosculation). Blood enters the graft via these newly formed vascular connections and the graft turns pink. A pink color is generally considered a sign of probable graft survival, although the intensity of coloration does not allow any conclusions regarding