Dissertation

"COMPARITIVE STUDY OF SPLIT SKIN GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON TUMESCENT TECHNIQUE"

Dissertation submitted to

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

in partial fulfilment of the regulations for the Award of the degree of

M.S. (General Surgery)

Branch – I

THE TAMILNADU Dr. MGR MEDICAL UNIVERSITY

CHENNAI

May 2019

CERTIFICATE

This is to certify that, the dissertation entitled "**COMPARITIVE STUDY OF SPLIT SKIN GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON TUMESCENT TECHNIQUE"**

Is the bonafide work done by **DR. VAISHNAVI.V** during her **M.S. (General Surgery)** course **2016-2019**, done under my supervision and is submitted in partial fulfilment of the requirement for the M.S.(BRANCH-I)- General Surgery of The Tamilnadu Dr.MGR Medical University, May 2019 examination.

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DECLARATION

I, certainly declare that this dissertation titled "**COMPARITIVE STUDY OF SPLIT SKIN GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON TUMESCENT TECHNIQUE"** represents a genuine work of mine. The contributions of any supervisors to the research are consistent with normal supervisory practice, and are acknowledged.

I also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other University board, either in India or abroad. This is submitted to The TamilNadu Dr. M.G.R Medical University, Chennai in partial fulfilment of the rules and regulations for the award of Master of Surgery Degree Branch I (General Surgery).

DATE: DR VAISHNAVI.V

PLACE: (POST GRADUATE)

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"A teacher affects eternity., he can never tell where his influence stop"

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CERTIFICATE OF APPROVAL

To

Dr.Vaishnavi.V.
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Dear Dr.Vaishnavi.V.,

The Institutional Ethics Committee has considered your request and approved your study titled **"COMPARITIVE STUDY OF SKIN GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON-TUMESCENT TECHNIQUE" - NO.05062017(A)**

The following members of Ethics Committee were present in the meeting hold on **20.06.2017** conducted at Madras Medical College, Chennai 3

1. Prof.Dr.C.Rajendran, MD., :Chairperson
2. Prof.R.Narayana Babu,MD.,DCH., MMC,Ch-3 : Deputy Chairperson
3. Prof.Sudha Seshayyan,MD., Vice Principal,MMC,Ch-3 :Member Secretary
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6. Prof.Rema Chandramohan,Prof.of Paediatrics,ICH,Chennai : Member
7. Prof. Susila, Director, Inst. of Pharmacology,MMC,Ch-3 : Member
8. Thiru S.Govindasamy, BA.,BL,High Court,Chennai : Lawyer
9. Tmt.Arnold Saulina, MA.,MSW., :Social Scientist
10. Tmt.J.Rajalakshmi, JAO,MMC, Ch-3 : Lay Person

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary – Ethics Committee

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-600 003

CONTENTS

LIST OF ABBREVIATIONS

STSG	**split thickness skin graft**
FTSG	**full thickness skin graft**
TLA	**tumescent local anesthesia**
LA	**local anesthesia**
TT	**tumescent technique**
NTT	**non tumescent technique**
TTD5	**tumescent technique on day 5**
TTD10	**tumescent technique on day 10**
TT3W	**tumescent technique after 3 weeks**
NTTD5	**non tumescent technique on day 5**
NTTD10	**non tumescent technique on day 5**
NTT3W	**non tumescent technique after 3 weeks**

ABSTRACT

Tumescent technique has been practiced for over twenty years especially in liposuction. Using tumescent local anaesthesia for harvesting a split thickness skin graft is not in much practise. Tumescent anaesthesia is a combination of crystalloid, lignocaine, adrenaline and sodium bicarbonate. Adrenaline is used to harvest skin grafts due to its vasoconstriction effect which limits blood loss. Although adrenaline is widely used, its local and systemic effects vary from patient to patient. Lignocaine with its bacteriostatic property aids in efficient graft uptake on the recipient site. .. Aim of our study was to determine skin graft take after tumescent technique compared to non-tumescent technique for harvesting.

OBJECTIVE

1. To compare the efficacy of tumescent and non-tumescent technique in split skin graft.
2. To assess age/gender differences in the two groups.
3. To assess the percentage healing of donor sites on day 10 in both groups.
4. To assess the percentage graft take on day 5 for patients who had harvesting done by tumescent technique and those who had non-tumescent technique.

5. To assess the final outcome of non-healed donor and recipient sites after short term follow up of 3 weeks.

STUDY CENTRE

Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai

DURATION OF STUDY

July 2017 to June 2018

STUDY DESIGN

Observational study (prospective)

SAMPLE SIZE

50

ETHICAL CLEARANCE - approved

INTRODUCTION

INTRODUCTION

Ulcers that are formed post wound debridement of cellulitis, necrotizing fascitis, burns and trauma with a healthy granulation tissue are treated by split thickness skin graft harvested from a normal anatomical site preferably thigh and grafted on the ulcer or recipient site. The success of skin graft depends on 3 factors – donor site, recipient bed and general condition of the patient. Graft uptake depends on graft nutrient uptake, vascular ingrowth from recipient bed, and postoperative immobility. Factors affecting graft take include seroma/ hematoma formation, shearing of graft, contaminated or poorly vascularized bed, comorbid conditions and smoking. Graft take is decreased in structures with decreased blood supply such as bone, cartilage and tendon. Wound bed should be vascular, free of pus and streptococcal infection. In this study we evaluate the use of adrenaline and lignocaine, and study its effect on graft take as used in tumescent technique. Tumescent technique is the subdermal injection of fluid containing vasoconstrictor and local anesthetic for harvesting a graft to reduce blood loss and improve graft take.

Tumescent local anesthesia (TLA) is a combination of crystalloid, local anesthetic, vasoconstrictor like adrenaline and sodium bicarbonate. Crystalloid is used for hydrating the donor site and creating a plane for

harvestment. Local anesthetic has an antimicrobial activity that prevents infection of graft and improves recipient take. Tumescent technique has been evolved over the years but not used much for harvesting graft. This study is done to evaluate the effectiveness of graft uptake and better healing of donor site following tumescent application.

AIM AND OBJECTIVE

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REVIEW OF LITERATURE

REVIEW OF LITERATURE

SKIN ANATOMY

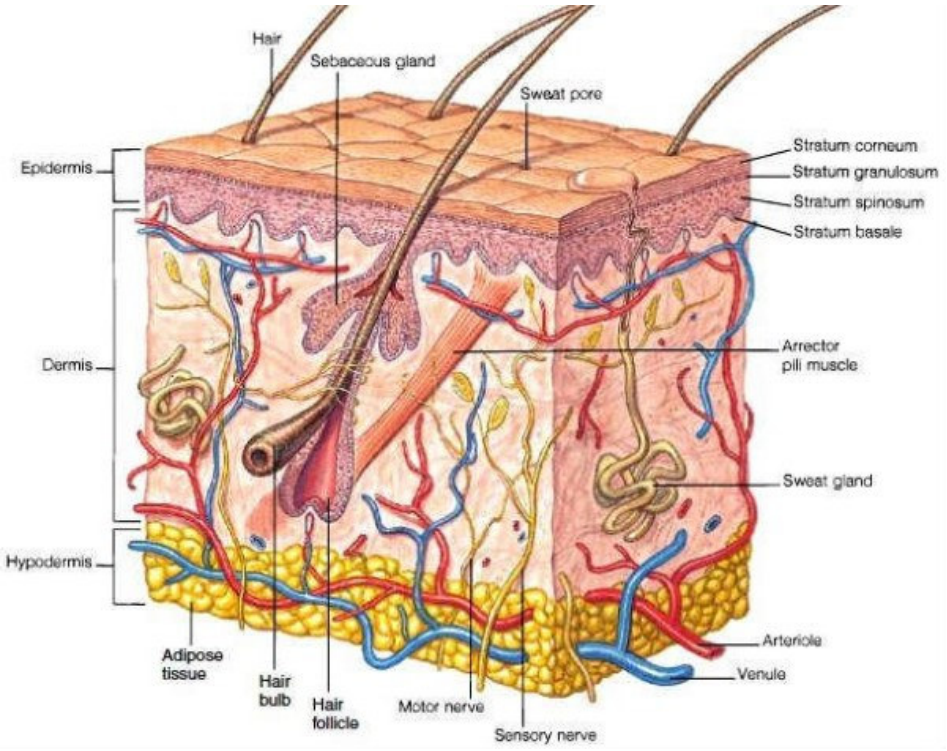
Skin is the body's largest organ, consists of epidermis, dermis and deeper connective tissue layer. The epidermis is a keratinized epithelium that is a tough horny superficial layer that provides protection to its underlying layers. The epidermis has no blood vessels and no lymphatics. The epidermis is an avascular structure and is nourished by its underlying vascularized dermis.

It is made of four layers- stratum corneum, stratum granulosum, stratum spinosum, stratum basale. An extra fifth layer stratum lucidum is a condensation of lower part of stratum corneum and is present only in palms and soles. Most nerve terminals are in dermis but a few penetrate the epidermis and hence the skin is sensitive to touch, irritation (pain) and temperature.

The dermis is made of papillary and reticular dermis. The dermis is supplied by arteries that enter its deep surface to form a cutaneous plexus of anastomosing arteries. Below the papillary dermis lies the superficial vascular plexus and below the reticular dermis lies the deep vascular plexus. The dermis is a dense layer of interlacing collagen and elastic

fibers, the fibers provide skin tone and account for the strength and toughness of skin. The predominant pattern of collagen fibers determine the characteristic tension and wrinkle line in the skin. The deeper layer of dermis contains hair follicle with associated smooth arrector muscle and sebaceous gland.

Located between the dermis and underlying deep fascia the subcutaneous tissue is composed of loose connective tissue and stored fat and contains sweat glands, superficial blood vessels and cutaneous nerves. The cutaneous vessels branch at right angles to penetrate subcutaneous tissue and arborize in the dermis, finally forming capillary tufts between dermal papillae.[1]



A VIEW OF SKIN ANATOMY

EPIDERMIS

STRATUM CORNEUM

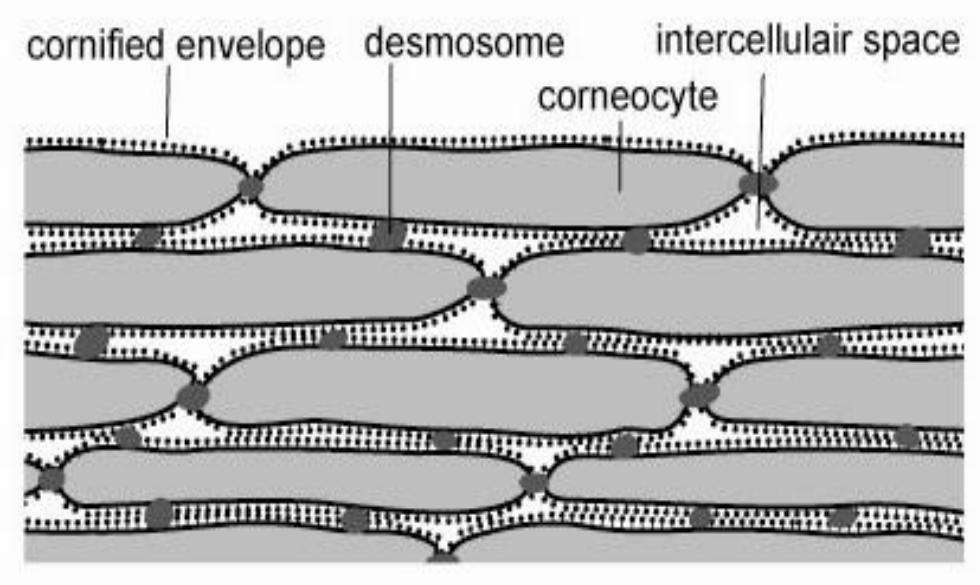
The stratum corneum is composed of corneocytes, which are hexagonal flat cells without a nucleus, held together by lipids and desmosomes in what is commonly referred to as a brick-and-mortar structure. The diameter and thickness range from 25 to 45 μm and approximately 0.3-0.7 μm, respectively[2][3].

The stratum corneum consists of 15-25 layers of corneocytes,[4] resulting in a total layer thickness of about 10-25 μm. The lipids are arranged in lamellar sheets, which consist of membrane-like bilayers of ceramides, cholesterol, and fatty acids together with small amounts of phospholipids and glucosylceramides. Desmosomes, also called corneosomes, are specialized inter-corneocyte linkages formed by proteins and, together with the lipids, they maintain the integrity of the stratum corneum. The lipids form the major permeability barrier to the loss of water from the underlying epidermis.

The stratum corneum, and viable epidermis, is continuously renewed within 6 to 30 days. Cells are shed from the outside and replaced by new ones. Changes in structure, composition and function of the corneocytes occur as they move toward the outer skin surface. Cells of the deeper layers of the stratum corneum are thicker and have more densely packed arrays of keratins, a more fragile cornified cell envelope and a greater variety of modifications for cell attachment. Consequently, the deeper part of the stratum corneum has a major influence on its overall mechanical behavior. The outer stratum corneum cells have less capacity to bind water. The cells in the outermost stratum corneum have a rigid cornified envelope and in the same area, the desmosomes undergo proteolytic degradation.

Although the corneocytes are non-viable, the stratum corneum is considered to be fully functional, particularly in terms of barrier properties, and retains metabolic functions[5]. The mechanical properties of both stratum corneum and viable epidermis are influenced by environmental conditions such as relative humidity (RH) and temperature. In addition, topical applications of either pure water, moisturizers or emollients alters the hydration state of the stratum corneum, significantly modifying some of its mechanical properties.

Under normal conditions, the hydration in the stratum corneum conditions varies from 5-10% near the surface up to 30% near to the transition with the viable epidermis. Bound water associated with proteins and lipids accounts for 20-30% of the total water volume. The total water content varies little between 30% and 60% RH, although it increases considerably at higher values. When fully hydrated, the stratum corneum swells to twice its normal thickness.



MORPHOLOGY OF STRATUM CORNEUM

STRATUM GRANULOSUM

The most superficial layer of the epidermis containing living cells, the granular layer or stratum granulosum is composed of flattened cells

holding abundant keratohyaline granules in cytoplasm. The granules contain lipids, which along with the desmosomal connections help to form a waterproof barrier that functions to prevent fluid loss from the body. These cells are responsible for protein synthesis involved in keratinisation. Lysosomal enzymes are present in high levels because the granular layer is a keratogenous zone of epidermis.

STRATUM SPINOSUM

Overlying basal cell layer is a layer of epidermis that is 5-10 cells thick and known as the squamous cell layer or stratum spinosum. This layer has a variety of cells with varying properties. Suprabasal spinous cells are polyhedral in shape and have rounded nucleus whereas the upper spinous cells are larger in size containing lamellar granules and are pushed to the surface of skin. Lamellar granules are membrane bound organelles containing glycoprotein, glycolipids, phospholipids, free sterols and a number of acid hydrolases including lipases, proteases, acid phosphatases and glycosidases. Hence these cells are a type of lysosomes.

Intercellular spaces between spinous cells are bridged by abundant desmosomes that promote mechanical coupling between cells of epidermis and provide resistance to physical stresses. Gap junctions are another type of connection between epidermal cells. These for pores that

allow physiological communication via chemical signals that is essential in the regulation of cell metabolism, growth and differentiation.

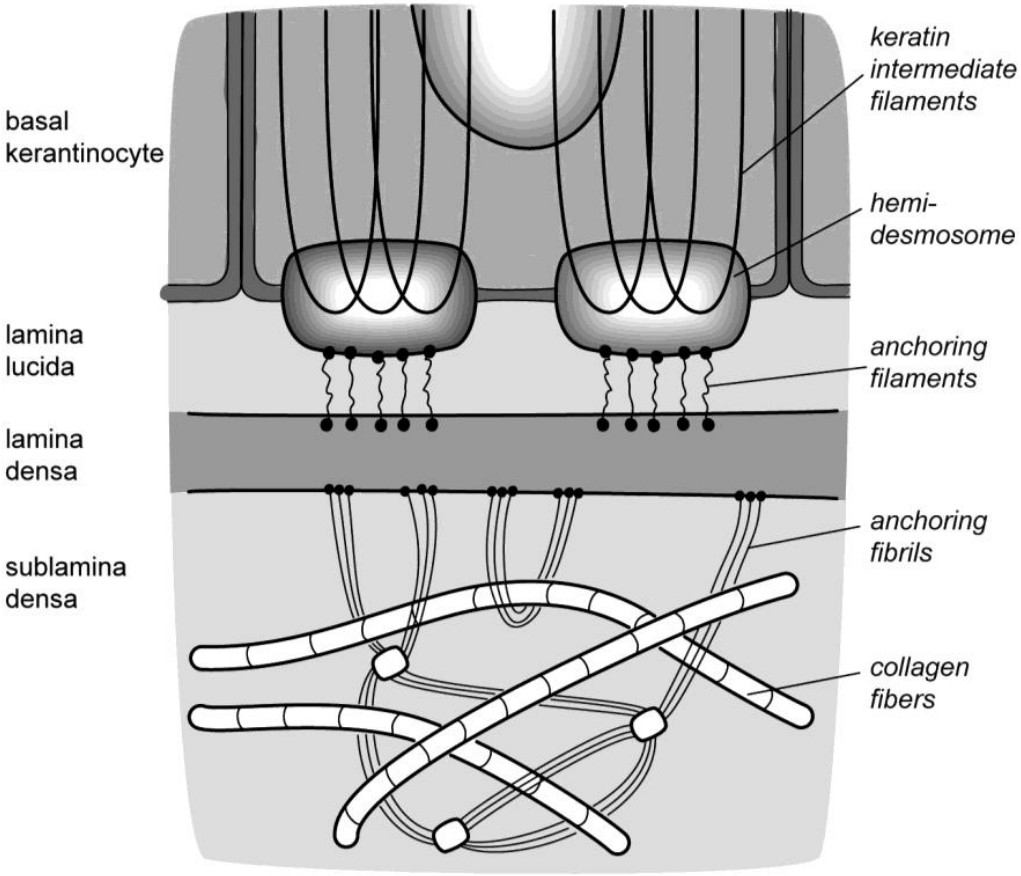
STRATUM BASALE

Basal cell layer also known as stratum germinativum contains column shaped keratinocytes that attach to the basement membrane zone. Most distinguishing feature of basal cell layer is the presence of melanocytes that produce melanin. The basal cell layer is the primary location of mitotically active cells in the epidermis that give rise to cells of outer epidermal layers. Hyperplastic conditions such as wounding can increase the number of cycling cells in the epidermis by stimulating the division of stem cells. Carcinogenic agents damage the cells of this layer. Migration of basal cells from basal cell layer to corneum takes 14 days and from corneum to outer most epidermal layer another 14 days .

DERMOEPIDERMAL JUNCTION

The interface between the epidermis and dermis is formed by a porous basement membrane zone that allows the exchange of cells and fluid and holds the two layers together. Basal keratinocytes are the most important components of structures of the dermal-epidermal junction. The basal lamina is a layer synthesized by basal cells of the epidermis

consisting mainly of type IV collagen as well as anchoring fibrils and dermal microfibrils. The plasma membranes of basal cells are attached to the basal lamina hemidesmosomes that distribute tensile or shearing forces through the epithelium. The dermal- epidermal junction acts as support for the epidermis, establishes cell polarity and direction of growth, directs the organization of the cytoskeleton in basal cells, provides developmental signals, and functions as a semipermeable barrier between layers.



DERMIS

Dermis is an integrated system of fibrous, filamentous and amorphous connective tissue composed of nerves, vessels, fibroblasts, macrophages and mast cells. Blood borne cells like lymphocytes, plasma cells and leucocytes enter the dermis via vasculature.

Its functions include

a) Protect body from mechanical injury
b) Bind water
c) Aids in thermoregulation
d) Respond to stimuli via sensory receptors Dermis interacts with epidermis in repairing and remodelling the skin as wounds are healed. They do not follow a differentiation pattern like epidermis. The collagen and elastic connective tissue vary in a depth dependent manner and undergo turnover and remodelling in normal skin in pathological process and in response to stimuli.

Dermis is mesodermal in origin. During 6^{th} week of fetal life dendritic cells with mucopolysaccharide form precursors of fibroblast. During 12^{th} week the fibroblasts are in an active state and synthesise collagen and elastin. By the end of 24^{th} week fat starts to accumulate

below the dermis.The principle component of dermis is collagen which is a major stress resistant component of skin. Elastic fibres maintain elasticity but to a very little extent resist deformity and tearing of the skin. Collagen fibres are constantly degraded by proteolytic enzymes and replaced by new fibres.

Fibroblasts integrate with procollagen molecules and assemble into collagen fibrils. Amino acids like glycine, hydroxyproline and hydroxylysine highly enrich collagen. Fibrillar collagen are the most abundant protein of the body and form a major constituent of skin. The major constituent of dermis is type I collagen. Loose collagen fibres are located in the superficial or papillary dermis and the hefty collagen fibrils are located in the reticular dermis.

Elastic fibres produce elastin. The fibroblasts fuse the elastic fibres to extracellular matrix of dermis.

VASCULATURE

The dermal vasculature is made up of two intercommunicating plexuses: the subpapillary or superficial plexus composed of postcapillary venules found at the junction of the papillary and reticular dermis and the lower plexus at the dermal-subcutaneous interface. The

dermal papillae are supplied by capillaries, end arterioles, and venules of the superficial plexus. The deeper plexus is supplied by larger blood vessels and is more complex surrounding adnexal structures.

MUSCLES

The muscle fibers of the arrectores pilorum are located in the connective tissue of the upper dermis and are attached to the hair follicle below the sebaceous glands. They are situated at such an angle to the hair follicle that when contracted, the hair follicle is pulled into a vertical position, deforming the skin and causing “gooseflesh” .

NERVES

Nerves are found in large quantities in the neurovascular bundles. Meissner corpuscles that mediate touch and Pacinian corpuscles that mediate pressure are located in the deeper portion of dermis. Pain and temperature are mediated by unmyelinated nerve fibres that are around hair follicles and papillary dermis.

HYPODERMIS

The hypodermis is defined as the adipose tissue layer found between the dermis and the aponeurosis and fascia of the muscles. Its thickness varies with anatomical site, age, sex, race, endocrine and

nutritional status of the individual. The subcutaneous adipose tissue is integrated structurally with the dermis through nerve and vascular networks and the continuity of epidermal appendages, such as hairs and nerve endings.

The bulk of subcutaneous adipose tissue is a loose association of lipid-filled cells, the white adipocytes, which are held in a framework of collagen fibers. However, only one third of adipose tissue contains mature adipocytes [6], with the remainder being stromal-vascular cells including fibroblasts, leukocytes, macrophages, and pre-adipocytes [7]. Adipose tissue has little extracellular matrix compared to other connective tissues.

Stored fat is the predominant component of the adipocytes; where the lipid droplet can exceed 50 μm. The cytoplasm and nucleus appears as a thin rim at the periphery of the cell The diameter of the entire white adipocyte is variable, ranging between 30 and 70 μm. Collections of white adipocytes comprise fat lobules, each of which is supplied by an arteriole and surrounded by connective tissue septae. One or more capillary comes in contact with an adipocyte, which provides the exchange of metabolites and allows the adipocytes to function effectively. More importantly the subcutaneous adipose tissue of the lower trunk and the gluteal thigh region has a thin fascial plane dividing it into superficial and deep portions.

SKIN GRAFTS

Skin grafting techniques date back >3000 years to India, where forms of the technique were used to resurface nasal defects in thieves who were punished for their crimes with nose amputation. Modern skin grafting methods include split- thickness grafts, full-thickness grafts, and composite tissue grafts. Each technique has advantages and disadvantages .Selection of a particular technique depends on the requirements of the defect to be reconstructed, the quality of the recipient bed, and the availability of donor site tissue. 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 [8],[9]. The amount of dermis included with the graft determines both the likelihood of survival and the level of contracture[10].

SPLIT THICKNESS SKIN GRAFT

When a graft includes epidermis and a portion of the dermis it is called split thickness skin graft. Primary contracture is the degree to

which a graft shrinks following harvesting and before grafting. Primary contraction is the immediate recoil of freshly harvested grafts as a result of the elastin in the dermis. The more dermis the graft has, the more primary the contraction that will be experienced. Secondary contracture, involves contraction of a healed graft and is probably a result of myofibroblast activity. Secondary contracture is the degree to which graft shrinks during healing. Amount of dermis determines the chances of contracture. So split thickness skin graft has less primary contracture, more secondary contracture and more chances of healing. They have a high graft take even in poorly vascularized bed. Thin grafts, however, tend to heal with abnormal pigmentation and poor durability compared with thick split grafts and full-thickness grafts. Grafts are meshed in order to increase surface area and useful especially when a large area has to be resurfed. Meshed grafts have better survival because the fenestrations allow for egress of wound fluid and excellent contour matching of the wound bed by the graft. The fenestrations in meshed grafts reepithelialize by secondary intention from the surrounding graft skin. The major drawbacks of meshed grafts are poor cosmetic appearance and high secondary contraction. Meshing ratios used usually range from 1:1.5 to 1:6

FULL THICKNESS SKIN GRAFT

When a graft contains epidermis and the entire dermis it is full thickness skin graft. It is associated with less secondary contracture, better cosmetic appearance and higher durability. Full thickness grafts are used in areas that are highly vascularized like face and palms. They are used in reconstructing superficial wounds of the face and the hands.

COMPOSITE GRAFT

Composite tissue grafts are donor tissue containing more than just epidermis and dermis. They commonly include subcutaneous fat, cartilage and perichondrium, and muscle. These grafts are used for nasal reconstruction as the nasal lobule skin is thick and following its excision, reconstruction with a full thickness skin graft may not be sufficient. The ear lobe composite graft provides thicker coverage with good color match and a fairly inconspicuous donor site.

Similarly, the root of the helix of the ear may also be used to reconstruct the alar rim, providing skin coverage and cartilaginous support.

CLASSIFICATION OF SKIN GRAFT

TYPE	DESCRIPTION	THICKNESS
SPLIT THICKNESS	**Thin** (Thiersch-Ollier)	0.006–0.012
	Intermediate (Blair-Brown)	0.012–0.018
	Thick (Padgett)	0.018–0.024
FULL THICKNESS	Entire dermis (Wolfe-Krause)	Variable
COMPOSITE	Full-thickness skin with additional tissue (cartilage, fat, muscle)	Variable

PROPERTIES OF SKIN GRAFT

The donor site epidermis regenerates from the immigration of epidermal cells originating in the hair follicle shafts and adnexal structures left in the dermis. In contrast, the dermis never regenerates. Because split-thickness skin grafts remove only a portion of the dermis, the original donor site may be used again for a subsequent split-thickness skin graft harvest. Thus, the number of split-thickness skin grafts harvested from a donor site is directly dependent on the donor dermis thickness. Although donor sites heal by re-epithelialization, there is always visible evidence that an area was used as a donor site. This can

vary from keloids to simple hyper- or hypopigmentation. Less conspicuous donor sites are the buttocks or scalp.

An ungrafted wound bed is essentially a healing wound which, left alone, will undergo the typical processes of granulation, contraction, and reepithelialization to seal its surface. When a skin graft is placed on a wound bed, these processes are altered by the presence of graft.[11]. The response of a skin graft after placing it on the graft bed was similar to response of skin to chemical or physical injury. The changes in wound healing brought about by the skin graft can also be described as a general adaptation of connective tissue to a diminished blood supply[12].

HISTOLOGICAL AND BIOCHEMICAL ASPECTS OF GRAFT

During the first four days post grafting there is increased activity in the graft epithelium which causes doubling in thickness, crusting and scaling. This is due to the following process –

1) swelling of the epithelial nuclei and cytoplasm,

2) epithelial migration towards surface of graft,

3) altered mitosis of glandular and follicular cells.

On the third day there is increased mitotic activity in the epidermis and on the fourth day there is increased proliferation and thickness of the graft followed by desquamation. There is increased cellular turnover that causes increased thickness of the epithelium. The upper layer of epithelium exfoliates and is replaced by newly formed upwardly migrating follicular epithelial cells. By the end of fourth week post graft epithelial thickness will return to normal pre graft state. Histochemical analysis shows increased alteration in RNA content on the fourth day which is increased greatly in the basal layer of epithelium paralleling the hyperactivity of epithelial cells. This is due to increased protein synthesis as a result of rapid cellular proliferation. By the end of day ten RNA return to normal[13].

CELLULAR COMPONENTS OF DERMIS

The source of fibroblast in skin still remains obscure. It is believed that they are not obtained from indigenous fibrocytes. There is a fall in number in the first 3 days after grafting. The remaining fibrocytes lay in two layers, one in dermoepidermal junction and the other lies just above host bed. After three days fibroblast like cells appear in the graft bed initially and then the graft itself. By day 7 fibroblast and enzymatic activity increases due to capillary ingrowth and vascular supply.[14]

Most of the collagen in an autograft persists through the 40th day. Studies have shown that split-thickness and full thickness skin autografts undergo considerable collagen turnover[15][16]. The dermal collagen became hyalinized by the third or fourth day postgraft, and by the seventh day all of the collagen was replaced by new small fibers. The replacement continued through the 21st post graft day, and by the end of the sixth week postgraft all the old dermal collagen was replaced completely. The rates of collagen turnover and epithelial hyperplasia peaked simultaneously in the firs t2–3 weeks postgraft. Studies have shown higher levels of hydroxyproline in the graft peaked in the 21st day indicating increased collagen activity. Elastin fibers in the dermis are responsible for the resilience of skin. Elastin fiber integrity is maintained through the third postgraft day, but by postgraft day 7 the fibers are short, stubby, and have begun to fragment. Elastin degeneration continues through the third postgraft week until new fibers can be seen beginning to grow at 4–6 weeks postgraft. This replacement process is the same in full- and split thickness skin grafts[17]

Although both full- and split-thickness skin grafts demonstrate sebaceous gland activity, thin split thickness grafts do not contain functional sebaceous glands and typically appear dry and brittle after take. Hair follicles are subjected to the same hyperplastic stimuli as the rest of the graft. On the fourth day postgraft the original hair sloughs off and the graft becomes hairless.

SKIN GRAFT ADHERENCE

For the skin graft to take, it must adhere to the bed. There are two phases of graft adherence. The first begins with placement of the graft on the recipient bed, to which the graft adheres because of fibrin deposition. This lasts approximately 72 hours. The second phase involves ingrowth of fibrous tissue and vessels into the graft.

MESHED VERSUS SKIN SHEET GRAFT

Multiple mechanical incisions result in a meshed skin graft, allowing immediate expansion of the graft. A meshed skin graft covers a larger area per square centimeter of graft harvest and allows drainage through the numerous holes. Meshed skin grafts result in a "pebbled" appearance that, at times, is aesthetically unacceptable. In contrast, a sheet skin graft has the advantage of a continuous, uninterrupted surface, often leading to a superior aesthetic result, but has the disadvantages of not allowing serum and blood to drain through it and the need for a larger skin graft.

.PROCESS OF GRAFT TAKE

Multiple physiological events take place in the graft take process. The success of a graft depends primarily on the extent and speed at which vascular perfusion is restored to this parasitic, ischemic tissue. Two factors influence graft take one is the vascularity of the harvested site and the second is the metabolic activity of the harvested graft which determines its capacity to withstand a period of ischemia.

Skin graft take occur in three phases –

1) plasmatic imbibition
2) inosculation and capillary ingrowth
3) revascularization

PLASMATIC IMBIBITION

The first phase involves a process of serum imbibition and lasts for 24 to 48 hours. Initially, a fibrin layer forms when the graft is placed on the recipient bed, binding the graft to the bed. Absorption of nutrients into the graft occurs by capillary action from recipient bed. 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. Grafts placed

on poorly vascularized beds will be ischemic for a longer time than those placed on wounds with good blood supply. Full thickness skin graft seem to tolerate ischemia for up to 3 days. Split-thickness grafts take well even after 4 days of ischemia.[18]

Phase of plasma imbibition make the graft to become edematous and gain weight upto 40 percent of its pre graft weight[19]. This occurs due to fluid movement from the bed and follows the same principle as inflammatory edema which includes

1. disaggregation and depolymerization of proteoglycans,
2. accumulation of osmotically active metabolites
3. increased vascular permeability.[20][21]

INNOSCULATION AND CAPILLARY INGROWTH

A fine vascular network is established in the fibrin layer between graft and recipient bed by the end of 48 hrs. the capillary bud of recipient blood vessels come in contact with the graft capillaries and channels are formed and blood flow occurs. The graft now appears pink. Delay in inosculation is due to

1) insufficient vascular proliferation
2) wound contamination

REVASCULARISATION

Three theories have been put forth to explain revascularization

1) connection of graft and host vessels
2) formation of a new vascular channel
3) combined old and new vessels

CONNECTION OF GRAFT AND HOST VESSELS

After innosculatory event, the definitive vasculature of the graft consists of the blood vessels originally present in the graft itself[22]. The circulation is restored after it starts communicating with the vessels of the recipient bed. This was proved by injecting Indian ink via the host vessels of autograft and on postoperative day 2 ink was noted on the graft vessels

FORMATION OF NEW VASCULAR CHANNEL

This theory suggest that the graft is perfused by new vessels going from the recipient bed into the transplanted graft[23][24]. A study was done based on diaphorase activity. Degenerative changes in the original graft vasculature were apparent in the first 4 days postgraft, as evidenced by progressive loss of diaphorase activity during this time. With subsequent vessel ingrowth there was return of diaphorase activity.

Hence, concluded that the final vasculature of graft stemmed from ingrown vessels from the host bed[25][26].

COMBINED OLD AND NEW VESSELS

Circulation in a graft is reestablished in various ways; that is, in any graft old vessels maybe 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[27]

There are two methods of skin graft revascularization

1) primary

2) secondary

PRIMARY REVASCULARIZATION

Circulation in the skin graft is reestablished through vascular anastomosis between budding new vessels from the bed and those already present in the graft. Following this the graft turns pink which indicates graft survival. The old vessels of the graft are dilated and denervated and some of the circulatory routes are severed during graft harvest. Blood vessels of the graft, both arteries and veins attach to the recipient bed which are predominantly afferent vessels. This causes trapping of blood

and tissue fluid which is unable to return to the recipient bed due to absence of reverse flow. By 4^{th} to 7^{th} day vascular connections are well established with both afferent and efferent vessels[28].

SECONDARY NEOVASCULARISATION

When the vascular connection between the bed and the graft are delayed secondary revascularization occurs. Under normal condition vasoactive agents responsible for ingrowth of vessels cease to function and capillary proliferation stops as good blood flow is established. If ischemic time is more, then the vasoactive agents remain in the tissue for longer time thereby causing newer number of capillaries to grow into graft. If vascular connection is well established it inhibits the formation of newer capillary bud and viceversa.

Within the graft itself the vessels may be functionally deficient or the vascular ingrowth may not reach the required level of biologic activity for the inosculatory event. If anastomosis fail to develop in time, the ischemic period is extended and capillary proliferation in the bed continues. Degenerative processes in the graft and exuberant granulation tissue in the host bed go hand in hand with prolonged ischemia. If blood vessels reach the graft in time, the graft will survive; if not, the graft will fail.

Anastomosis is delayed due to

1) increased distance between the graft and its bed from interposed necrotic material, a thick fibrin layer,
2) hematoma,
3) seroma,
4) air bubbles.

Grafts that heal by secondary intention are smooth, fibrotic, tight, and have a slick, silvery sheen on the surface reflecting the large amount of cicatrix within the graft. Large grafts often heal both by primary and secondary revascularization, and certain areas show the typical appearance and desquamation where the secondary process occurs.

SELECTION OF DONOR SITE

The selection of a graft donor site is based on three factors:

1) whether a full-thickness skin graft or a split-thickness skin graft is used
2) whether the donor site matches the recipient bed in color
3) potential morbidity of graft harvest at that site.

Donor site should be similar to the recipient site in terms of consistency, thickness, color, and texture[29].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. Split-thickness skin grafts may be taken from any area of the body, including the scalp. The donor site of a split-thickness skin graft is frequently scarred or discolored. 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[30][31].

GRAFT SIZING

Techniques for sizing skin grafts usually involve preformed templates of easily available materials, such as cardboard and latex. A simple and reproducible technique consists of placing cardboard on the wound to develop a blotter pattern. The cutout is then applied over the donor site, traced with a marking pen, and a graft of the outlined area is resected.

GRAFT EXPANSION

Meshing is the term used for cutting slits into a sheet graft and stretching it open prior to transplantation. Meshed grafts have a number of advantages over sheet grafts:

(1) meshed grafts will cover a larger area with less morbidity than non-meshed grafts

(2) the contour of the meshed graft can be adapted to fit in a regular recipient bed

(3) blood and exudate can drain freely through the interstices of a meshed graft;

(4) in the event of localized bacterial contamination, only a small area of meshed graft will be jeopardized;

(5) a meshed graft offers multiple areas of potential reepithelialization[32]

A small ratio of expansion 1:1.5 and pulling the graft lengthwise to narrow the skin perforations to slits before transplantation lessens these problems[33][34].

GRAFT ADHERENCE

Two distinct phases of graft adherence occur.

Phase 1 begins immediately after grafting and lasts about 72 hours. During this time the graft remains adherent to the bed through the bond formed by the fibrin layer.

Phase 2 coincides with the onset of fibrovascular in growth and vascular anastomosis between the graft and the host.[35]

GRAFT HEALING

Graft on removal from donor site is initially white but on placing it over the recipient bed it becomes pink ensuring graft survival. There is blanching on pressure with prompt capillary refill. At first graft surface is below the level of normal skin but by the end of 3th week it comes back to same level.

Collagen replacement begins in the 7^{th} postoperative day and is completed in about 6 weeks[36]. There is abundance of polymorphonuclear lymphocytes and monocytes. Vascular remodeling in the graft may take many months. Newer vessels in the graft show great arborization than those in normal skin. Lymphatic connection is also established within 6^{th} postoperative day[37].

GRAFT CONTRACTURE

Wound contraction is a critical part of wound healing and is clinically useful because it reduces wound size. A contracted wound is often tight and immobile and there is distortion of surrounding normal tissue. The degree of graft contraction can be manipulated somewhat by adjusting the thickness and proportion of dermis in the graft. Greater the portion of dermis, lesser is the chance of contracture.

Primary contracture

It is the degree to which a graft shrinks following harvesting and before grafting. Primary contraction is the immediate recoil of freshly harvested grafts as a result of the elastin in the dermis. The more dermis the graft has, the more primary the contraction that will be experienced. So split thickness skin graft has less primary contracture, more secondary contracture and more chances of healing[38][39].

Secondary contracture

It involves contraction of a healed graft and is probably a result of myofibroblast activity. Secondary contracture is the degree to which graft shrinks during healing. Amount of dermis determines the chances of contracture. The contracture inhibiting effect of dermis depends on the percentage of dermis included in the graft with greater portion of dermis showing greater inhibition. The graft does not prevent the formation of myofibroblasts,

but rather speeds up completion of their lifecycle and eventual disappearance. STSG cause a rapid decline in the number of myofibroblasts, and wounds contract less than comparable non grafted sites[40]. Full-thickness grafts trigger an even faster decrease in the myofibroblast population, and wounds show minimal contraction

GRAFT REINNERVATION

Nerves grow into skin grafts from wound margins and the graft bed. Human skin grafts begin to show sensory recovery at 4–5 weeks postoperatively. The return of normal sensation is usually complete by 12–24 months[41]. The extent of reinnervation depends on how accessible the neurilemmal sheaths are to the invading nerve fibers, more accessible in full thickness skin graft.

GRAFT FAILURE

A meticulous surgical technique contributes greatly to the survival of a skin graft. Particular attention should be paid to ensuring

- atraumatic graft handling
- a well-vascularized, scar-free bed
- careful hemostasis and removal of accumulated
- blood before dressing the wound
- postoperative immobilization of the graft recipient
- site
- use of a tourniquet during graft harvest and
- transfer
- no proximal constricting bandages

COMMON CAUSES OF GRAFT FAILURE

1) Hematoma
2) Infection
3) Seroma in areas with rich lymphatic supply
4) Excess use of electrocautery
5) Gravitational dependency
6) Arterial insufficiency
7) Lymphatic stasis
8) Venous congestion
9) Surgeons error
10) High bacterial load
11) Streptococcal infection

Dirty wounds had high bacterial counts and increased levels of active plasmin. High plasmin and proteolytic enzyme activity was generally seen in wounds contaminated with beta-hemolytic streptococci and various species of Pseudomonas. The presence of fibrin under autografts was associated with success in graft take and the absence of fibrin was associated with graft failure. This finding suggested to the fact that dissolution of fibrin by plasmin and proteolytic enzymes is the probable mechanism in graft failure secondary to microorganisms[42].

Low dose erythromycin along with vitamin c supplementation promotes healing. Abstinence from alcohol consumption and cigarette smoking is essential.

SKIN GRAFT DONOR SITE DRESSING

- SEMIOPEN
    - Fine mesh gauze – scarlet red
    - Vaseline gauze
    - xeroform
    - Biobrane
- OCCLUSIVE
    - Duoderm
- SEMIOCCLUSIVE
    - Op site
    - Tegaderm
- BIOLOGIC
    - Autograft
    - Allograft
    - Xenograft
    - Amniotic fluid membrane
    - Cultured keratinocyte cells

TUMESCENT ANESTHESIA

TUMESCENT local anesthesia (TLA) is a technique that provides anesthesia of large areas of skin and subcutaneous tissue by means of the direct infiltration of large volumes of a dilute local anesthetic solution into subcutaneous fat. The injection of such large volumes of fluid produces swelling and firmness (tumescence) of the surgical area[49]. Tumescent contains lidocaine that results in paralysis of sensory nerve endings and minute nerve twigs that result in reduction of pain. Tumescent technique significantly reduced intraoperative blood loss. It is safe, inexpensive and easy to use.

The subdermal adrenaline/saline injection creates a smooth, tense surface which assists debridement and donor harvesting[50]. In the preparation of the tumescent solution, the commonest catecholamine used is adrenaline. The effect of adrenaline on the skin is mainly mediated by its binding alpha adrenergic receptors leading to vasoconstriction and cutting off blood supply to the skin. As epinephrine is used to control bleeding from vasoconstriction, it is likely that it causes transient hypoxia of the skin. If this hypoxia is prolonged it could lead to reduced skin graft survival and also delay healing at the donor site when tumescent technique is used for harvesting STSG. The use of the TLA technique

results in lower blood loss because of the presence of vasoconstrictor in the solution, and the separation of tissue planes by the injective, allowimg the surgeon to have an improved plane of dissection[51][52].

Adoption of tumescent technique in STSG has been low due to inadequate information on the viability of the graft especially after using adrenaline. The tumescent local solution was prepared on the day of surgery in the operating room, immediately before surgery, and consisted of 0.05% (0.5 mg/ml) or 0.1% (1 mg/ml) lidocaine and 10 mEq/l sodium bicarbonate in lactated Ringer's solution with 1:1,000,000 epinephrine. The maximum dose of lidocaine was set at 7 mg/kg, corresponding to 7 ml/kg for 0.1% dilution and 14 ml/kg for 0.05% dilution[55]. The concentration was decided on the basis of the surgical site: the wider the surgical site is, the lower the concentration is and the larger the volume is. Infiltration was performed using a manual technique with a syringe alone, both for harvesting the skin graft and for the burn excision. The solutions were warmed in an incubator adjusted at 37°C. If the infiltration of tumescent local solution produced a peaud'orange appearance of the overlying skin, surgery was started after a minimum of 15 min to avoid undermining of skin graft due to the vasoconstrictive property of epinephrine combined with the hydrostatic pressure within a superficial

tissue plane[57]. If the surgical site was in proximity to the fingers, toes, or penis, then a solution without epinephrine was used.

Tumescent local anesthesia solution has been reported to have antibacterial effects due to lidocaine's bacteriostatic properties, which are enhanced by the addition of sodium bicarbonate and the washout effect of the solution commonly used in TLA[58].

LIGNOCAINE

Lidocaine is a class 1 B antiarrhythmic agent, which is mainly used for the treatment of ventricular arrhythmias. Since its advent in 1948, it has also become the most commonly used local anesthetic in the outpatient setting. Miscalculation of the dose, injection of the drug into a blood vessel or repeated administration of therapeutic doses are the major causes of systemic toxicity [67-68]. Lidocaine works by binding voltage-gated sodium channels thus inhibiting the propagation of action potential. The main target organs are the central nervous system (CNS) and the cardiovascular system (CVS). Since the CNS is more sensitive to electrophysiological changes than CVS changes, neurological symptoms such as dizziness, tinnitus and peri-oral numbness usually precede cardiovascular manifestations .Therapeutic concentrations of lidocaine can be up to 5.5 milligrams per liter (mg/L), whereas a plasma level of 8-

12 mg/L and above is associated with CNS and cardiotoxicity [69]. The most critical aspect of local anesthetic is appropriate dosing. The recommended maximum dose for subcutaneous infiltration of lidocaine without epinephrine is 4.5 milligrams per kilogram (mg/kg) and for lidocaine with epinephrine is 7 mg/kg

SODIUM BICARBONATE

When the acidic local anesthetic solution is injected into healthy tissue, buffers within the tissue fluids will neutralize the solution towards the physiologic pH, favoring the formation of more membrane-crossing base form [70,71]. This mechanism can be complicated by the presence of acute inflammation. This may limit the formation of the non-ionized base form of the local anesthetic as the formation of the cation will be favored in more acidic conditions. The local anesthetic will essentially be trapped in the ionized form and less free base form will be available to penetrate the nerve, delaying the onset of anesthesia and possibly limiting it altogether [72]. It would be advantageous to have a local anesthetic that could counteract the limitations of the low pH levels associated with areas of inflammation.

Buffering of local anesthetics has been described in the literature. Buffered local anesthetics would have a higher pH and perhaps be more efficient in achieving pain control, particularly during painful procedures

such as incision and drainage. The theory behind buffering of local anesthetics is logical according to the Henderson-Hasselbalch equation: if a local anesthetic solution is buffered to a pH that is closer to its pKa, more of the free base form will be available upon injection to enter the nerve sheath, potentially resulting in faster onset and improved efficacy [75-78]. The most common method for buffering of local anesthetics is by the addition of sodium bicarbonate. Addition of sodium bicarbonate to local anesthetics has been examined pharmacologically.

A commonly recommended dilution of local anesthetic to 8.4% sodium bicarbonate is 10:1 to create a final sodium bicarbonate concentration of 0.1 mEq/mL [76] Concern has been raised about precipitation of the solution occurring if too much sodium bicarbonate is added and the pH is raised too high. The addition of sodium bicarbonate to local anesthetics not only will increase the pH of the solution, but will also result in the production of carbon dioxide and water carbon dioxide potentiated the action of local anesthetics by showing that in the presence of carbon dioxide, nerve conduction blockade was significantly greater than in its absence.

Studies [79] suggest that carbon dioxide acts by increasing the flow of local anesthetic into the nerve and demonstrated that the addition of carbon dioxide to lignocaine shortened the time to onset and spread of analgesia by 20% to 30% in epidural anesthesia. Some other studies

explain the effects of carbon dioxide and concluded that its role in potentiating local anesthesia was related to either direct effects on the nerve membrane or by indirect action on intracellular pH. It was also concluded that carbon dioxide potentiates local anesthesia by three mechanisms: a direct depressant effect of carbon dioxide on the axon, by concentrating local anesthetic inside the nerve trunk, and by decreasing the pH inside the nerve which will allow a greater conversion of anesthetic to its active cation form once inside the membrane

Diffusion trapping occurs as carbon dioxide enters the nerve and lowers the internal pH, resulting in a concentration gradient favoring the flow of free base local anesthetic into the nerve. Once the free base form enters the nerve, the low internal pH results in rapid ionization of local anesthetic to its cation form, effectively “trapping” the anesthetic inside the nerve [81].

CLINICAL EFFECT OF TUMESCENT LOCAL ANESTHESIA

A. Tumescent Local Anesthesia

B. Hemostasis – Vascular Constriction & Compression

C. Hydro-Dissection of Tissue

D. Heat Sink

E. Bactericidal

F. Drug Delivery System

G. Hypodermoclysis (Systemic Delivery of Crystaloid Fluids)

A) Tumescent Local Anesthesia

- Long Lasting (Extremely Slow Systemic Absorption)
- Profound (No Sedation Required)
- Requires – Skilled Infiltration – Knowledge of Pharmacology, Drug Interactions

B) Tumescent Hemostasis

- Vasoconstriction (pharmacologic: epinephrine/adrenaline)
- Vasocompression (hydraulic: hydrostatic pressure)
- Profound surgical hemostasis
- Affects Veins & Capillaries
- Potent α- and β-adrenergic agonist
- Principal site of action: small arterioles & precapillary sphincters
- Vasoconstriction in the capillaries
- Vasodilation in skeletal muscles and pulmonary vasculature

C) Mechanical vascular compression

- Physical (Space-Occupying) Effects of TLA Solution
- Transvenous Pressure Outside Interstitial > Inside Hydrostatic
- Decreases Radius of Vessels.
-

D) Hydro-Dissection of Tissue

- Expansion of natural subcutaneous tissue spaces
- Physical separation of adjacent anatomical structures (separation target tissue from vulnerable or innocent by-stander tissues)

E) Thermal Sink

- Thermal insulation of vulnerable tissue
- Water absorbs eat

F) **Bactericidal effects of lidocaine**[111,112]

- Bacteriostatic in an Acid Solution
- Bacteriocidal in a Neutral Solution
- 10 meq of Na Bicarbonate/Liter
- Perioperative infection rate is decreased

G) **Hypodermoclysis**[washing, drenching]

- Injection of fluids under the skin for systemic replacement of fluids for acute or chronic dehydration (cholera or end stage cancer).
- IV Fluids requirement is decreased.

ADVANTAGES

1. Anesthesia of wide areas of the body
2. Simple and safe method
3. Hydrodissection as a surgical tool

4. Low bleeding
5. Improved in hematoma resorption
6. Long duration of the effect of local anesthetic
7. prolonged postoperative analgesia
8. Antibacterial effect.

DISADVANTAGE

(1) TLA fluid may go into the surgical site

(2) performing infiltration is time-consuming

(3) it may be associated with more difficult identification of bleeding sources

PREPARATION OF TUMESCENT SOLUTION

The tumescent technique has evolved substantially since the method was first published in 1987.33 The use of an even more dilute lidocaine solution, 0.05% instead of 0.1%, permits greater tumescence with better vasoconstriction and more uniform anesthesia. The addition of sodium bicarbonate to the anesthetic solution minimizes the pain of infiltration[79]. Prior to using sodium bicarbonate in the local anesthetic solution, the stinging-burning pain of infiltration was enough to necessitate the use of IV sedation and narcotic analgesia. With the use of sodium bicarbonate (12.5 mEq/L) to neutralize the pH of the anesthetic

solution, the tumescent technique does not require IV sedation or narcotic analgesia.

EFFECT OF ADRENALINE

The vasoconstrictive effect of epinephrine to the tumescent solution has three consequences

1) limitation of bleeding

2) contribution to prolonging the anesthetic effects of lidocaine;

3) slowing and delay of lidocaine absorption.

Tumescent Technique Anesthetic Solutions Preparation

Lidocaine	500 mg (50 ml of 1% lidocaine solution)
Epinephrine	1 mg (1 ml of 1:1,000 solution of epinephrine)
Sodium bicarbonate solution	12.5 mEq (12.5 ml of an 8.4% $NaHCO_3$
Normal saline	1000 ml of 0.9% NaCl solution

Because of the minimal blood loss associated with the tumescent technique and because of the large volumes of normal saline infiltrated into fat, routine IV fluid replacement is not necessary.

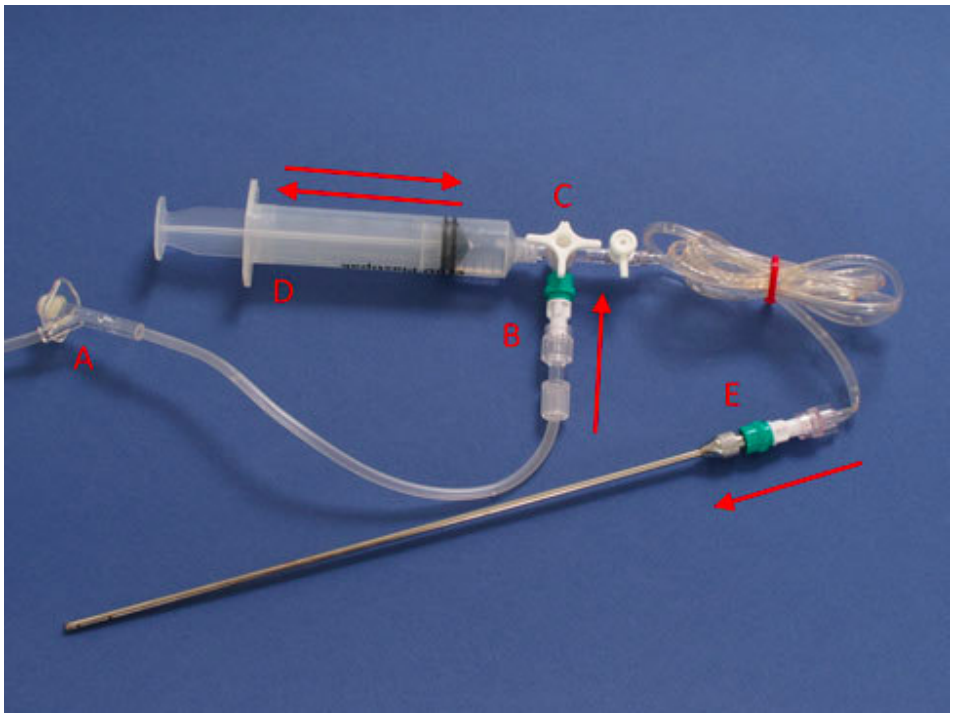
The concentration and volume of the solution may differ on the basis of the size of the surgical site: the wider the surgical site is, the

lower the concentration is and the larger the volume is. TLA has been reported to produce analgesia for a duration of up to 18 h. The maximum safe dose for TLA of 55 mg/kg lidocaine[80].

It is prudent to measure blood pressure before infiltrating the solution, even in patients with not referred hypertension. It is advisable to make a compressive dressing to prevent late bleeding and to review the patient the next day to check possible hematoma.

INSTRUMENT USED

Klein needle connected to a 10cc syringe and tumescent local anesthesia infusion bag via a three way canula



An assembled device: [A] tubing coming from the bag with fluid, [B] valve preventing backflow to the bag, [C] stopcock three way tap that has to be open in all directions, [D] syringe [E] valve preventing aspiration of fluid back from

This system has proven to be cheap, simple, and easy to use and implement. The disadvantage of using three way tap is that it requires two concurrent actions: pumping action using then plunger of the syringe and coordinated turning of the stopcock tap in order to either aspirate fluid from the infusion bag or inject it into the patient[83-86].

MATERIAL AND METHODS

MATERIAL AND METHOD

SAMPLE SIZE	50 CASES
STUDY DESIGN	OBSERVATIONAL (PROSPECTIVE)
STUDY POPULATION	50 CASES
STUDY PERIOD	JULY 2017 TO JUNE 2018
STUDY CENTRE	MADRAS MEDICAL COLLEGE AND RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL

AIM AND OBJECTIVE

1. To compare the efficacy of tumescent and non-tumescent technique in split skin graft.

2. To assess age/gender differences in the two groups.

3. To assess the percentage healing of donor sites on day 10 in both groups.

4. To assess the percentage graft take on day 5 for patients who had harvesting done by tumescent technique and those who had non-tumescent technique.

5. To assess the final outcome of non-healed donor and recipient sites after short term follow up of 3 weeks

SUBJECT SELECTION

INCLUSION CRITERIA

1. Patients aged 18-65 years with no comorbid conditions and who gave consent to participate in the study.
2. Patients with clean wounds prepared for grafting.

EXCLUSION CRITERIA

1. Patients with comorbid conditions (HTN, Diabetes, Liver disease, Renal failure, malignancies, vasculitis, HIV/AIDS, PEM)
2. Patient with albumin levels < 30 g/dl, Hemoglobin level < 10 g/dl
3. Patients who refused or were unable to give consent.
4. Patient with known allergy to adrenaline.
5. Pus swab growing beta-hemolytic streptococcus, citrobacter and acinobacter.
6. Patients who were currently smoking and had stopped smoking less than six months.
7. Patients with chemical and electrical burns.

METHODOLOGY

All Patients who fit the inclusion criteria will be observed and following data collected

1. Routine blood investigations

- Hemoglobin

- Total WBC count

2. HIV tests

3. Surface area of raw site to be grafted will be traced and approximated.

4. Pus swab test

5. A test dose of lignocaine and adrenaline is given

6. Comparative study is done on the same patient with a graft being harvested without tumescent technique and the next graft being harvested with tumescent technique.

All collected data will be analyzed and conclusions derived

PROCEDURE

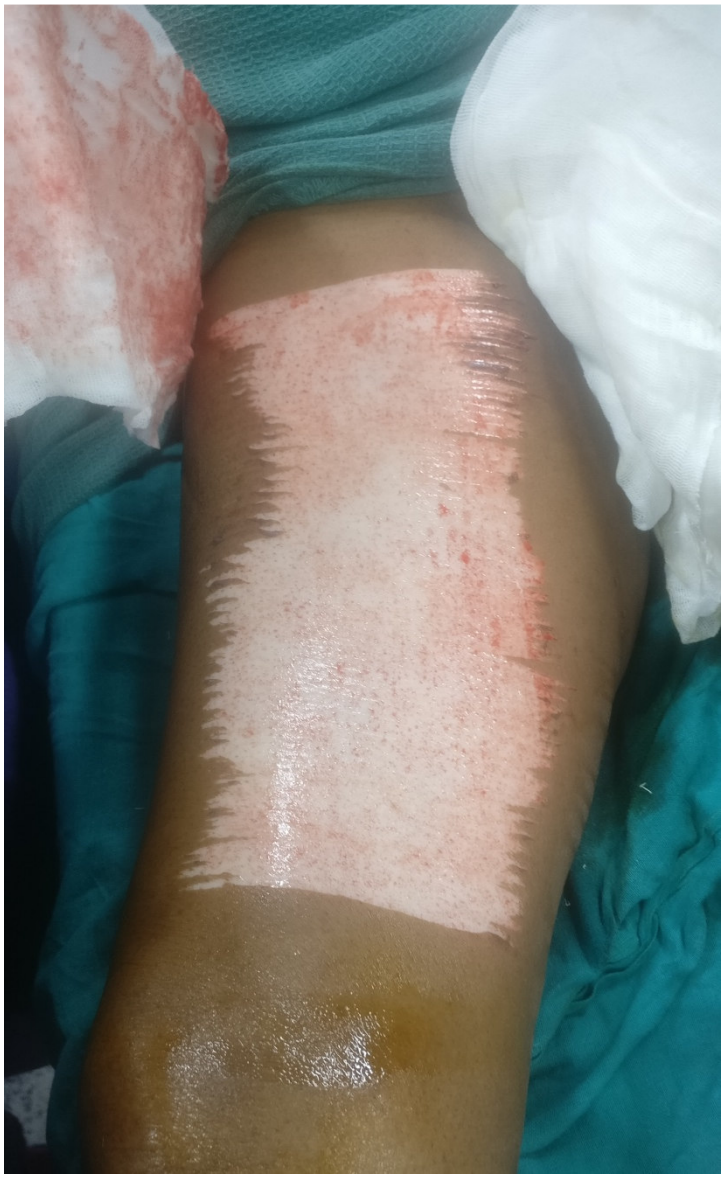
Patients who fulfilled the inclusion criteria were recruited for the study. The aim of the study was to compare the effectiveness of tumescent anesthesia with non tumescent technique for harvesting split thickness skin graft and check for better graft take on day 5, better donor site healing on day ten and overall effectiveness after 3 weeks. Routine blood investigation along with hiv testing was done. Wound swab was taken and the procedure was commenced only after swab was found to be

negative. Anesthetic fitness was obtained. A test dose of lignocaine and adrenaline is given.

The tumescent local solution was prepared on the day of surgery in the operating room, immediately before surgery, and consisted of 0.1% (1 mg/ml) or 0.05% lidocaine and 10 mEq/l sodium bicarbonate in lactated Ringer's solution with 1:1,000,000 epinephrine. The concentration was decided on the basis of the surgical site: the wider the surgical site is, the lower the concentration is and the larger the volume is. Infiltration was performed using a manual technique with a syringe and Klein needle.

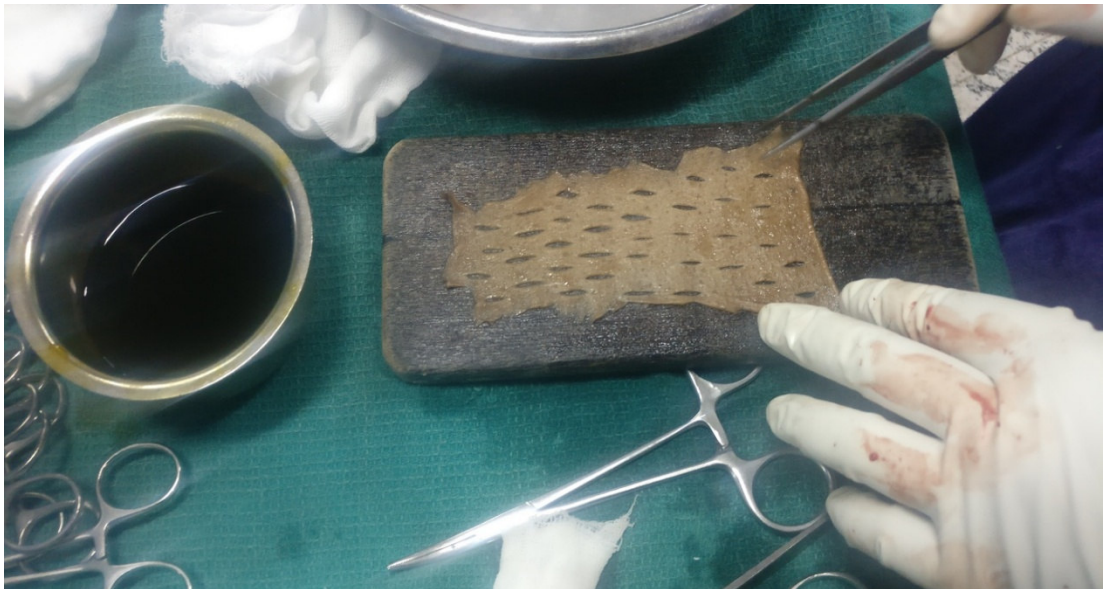
Spinal anesthesia was given to the patient as all the cases in the following study involve the lower limb. Surface area of raw site to be grafted was traced using a sterile gauze. Graft donor site was prepared Tumescent local anesthesia was taken in a 10 ml syringe connected to Klein needle using three way canula and injected intradermally and subdermally over the donor site. Raised surface was formed and graft harvesting was commenced after 10 minutes. Graft was harvested from donor site after lubricating with vaseline and stabilizing the leg using Humby's knife and downe blade. Meshing of the graft was done and recipient site was prepared. Graft was placed on the raw site and fixed with monocryl. Bactigras dressing was done and limb was immobilized with POP. Tight dressing of donor site was done was. The recipient site

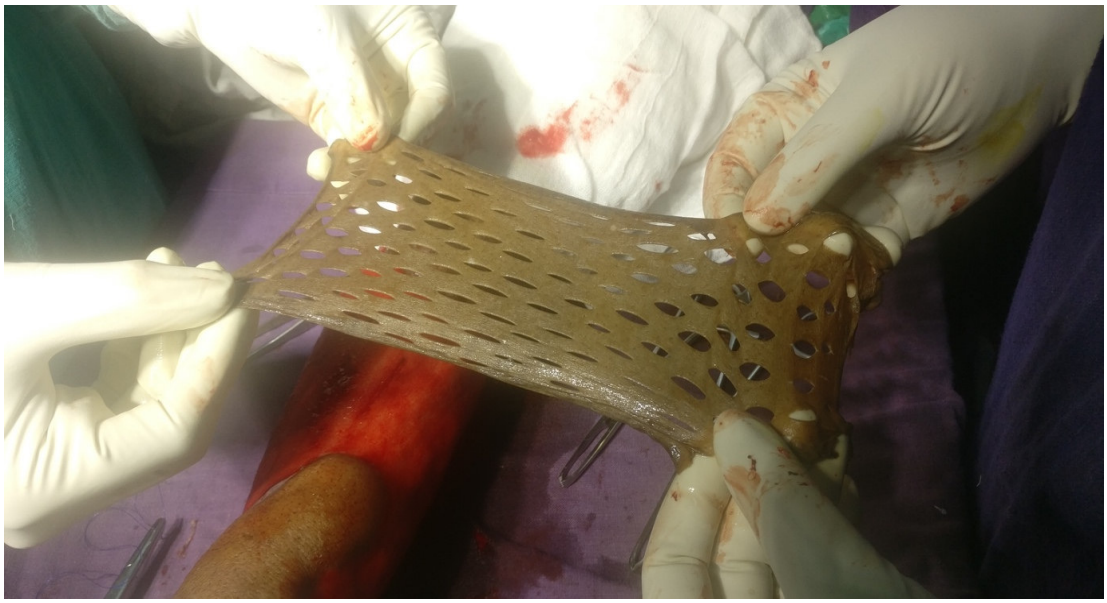
was analysed on day 5 for take rate and the donor site on day 10 for percentage healing.



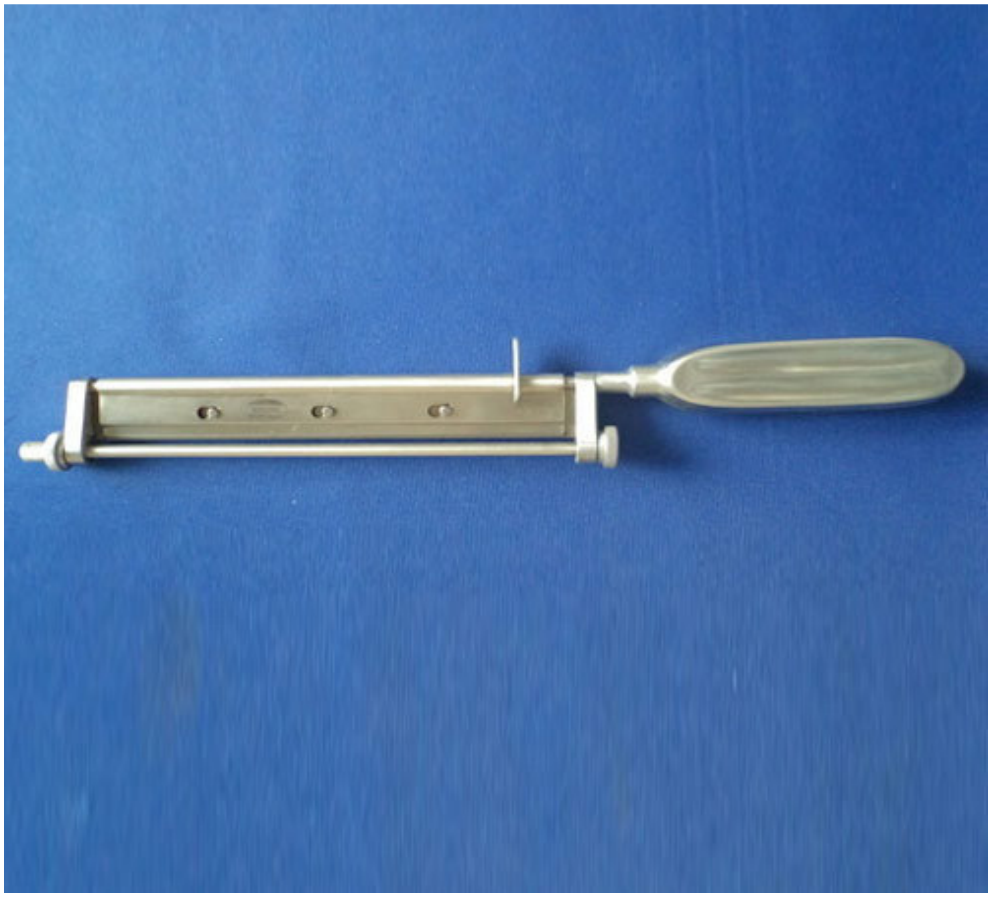
Harvesting graft from donor site following tumescent and non tumescent technique

MESHING OF GRAFT

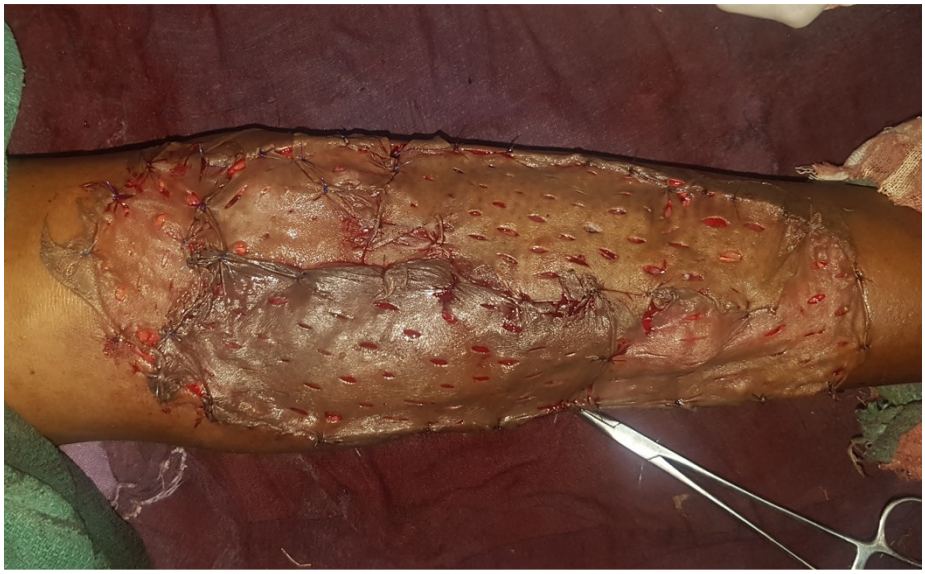




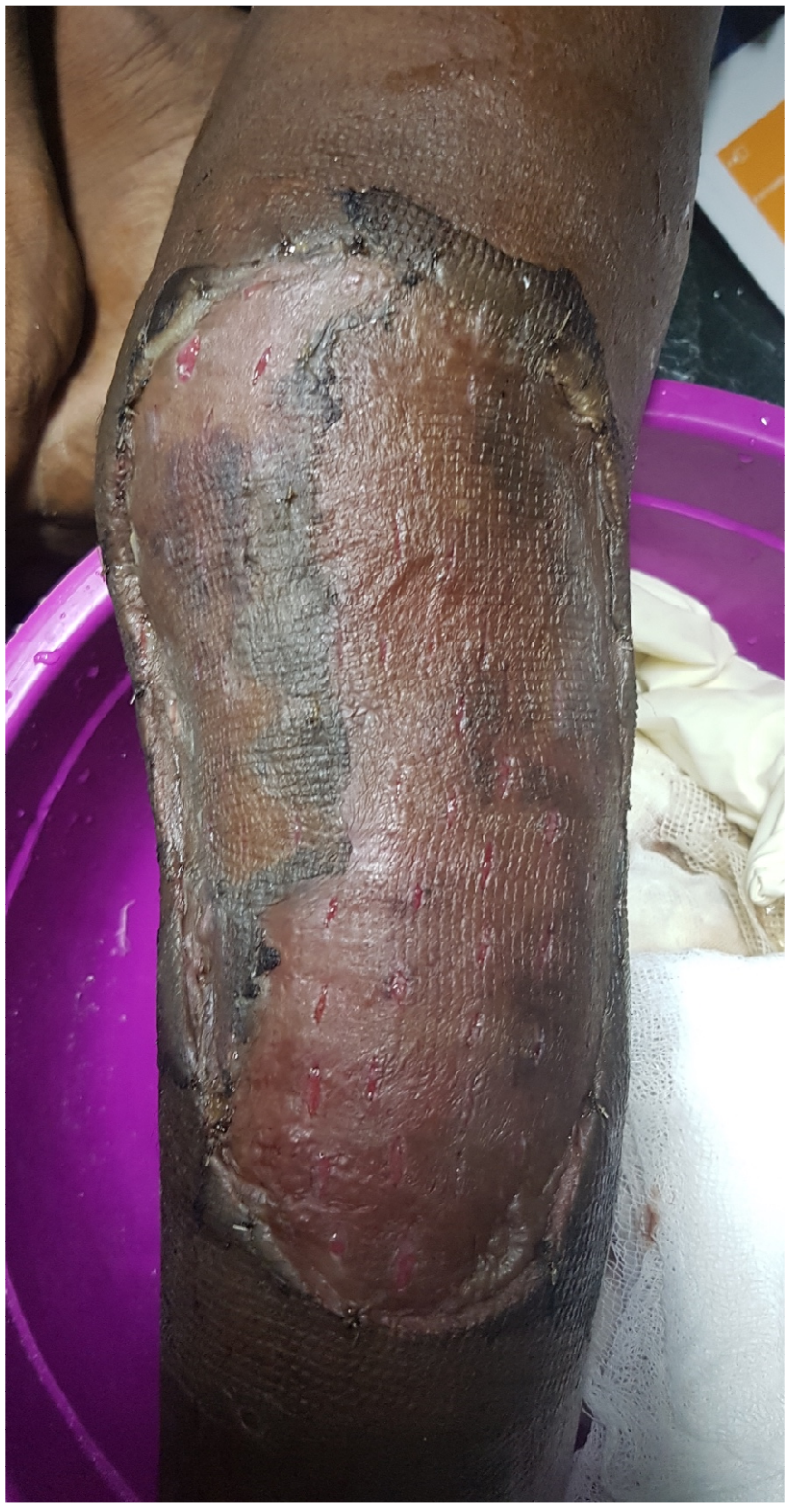
HUMBY KNIFE

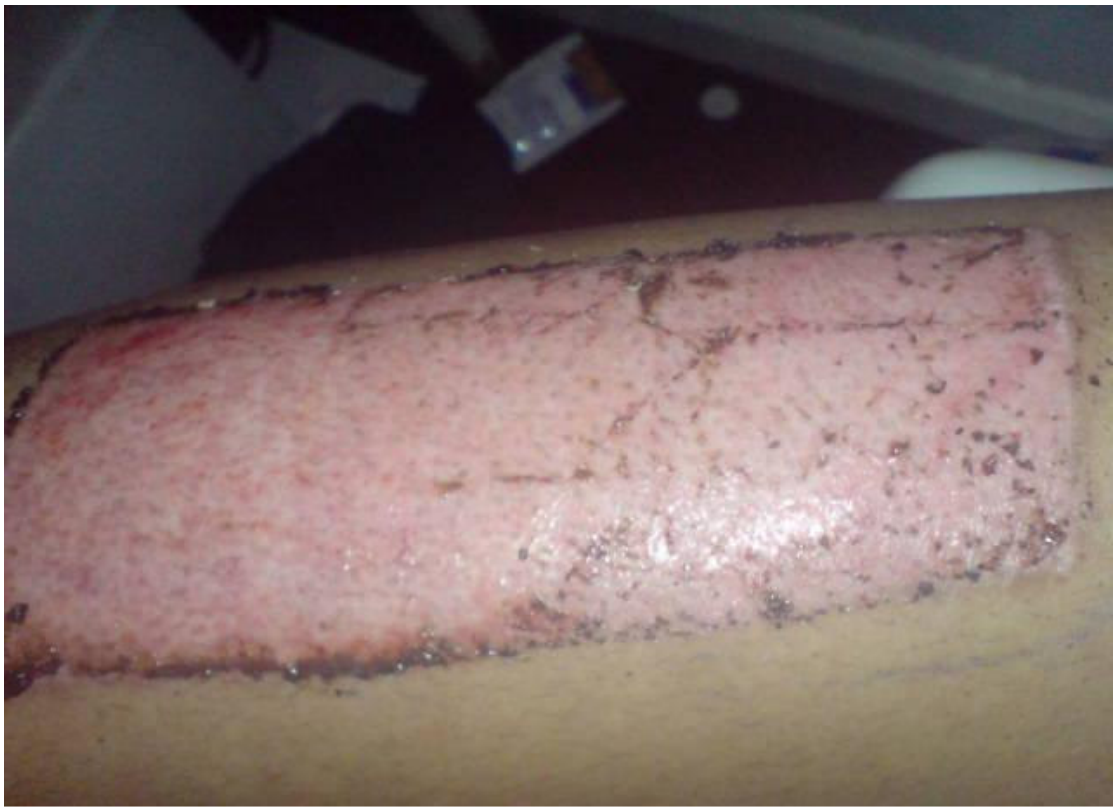


POST OPERATIVE DRESSING WITH BACTIGRAS



Non tumescent **tumescent**





TUMESCENT NONTUMESCENT

DONOR SITE ON DAY 10

DATA AND ANALYSIS

DATA AND ANALYSIS

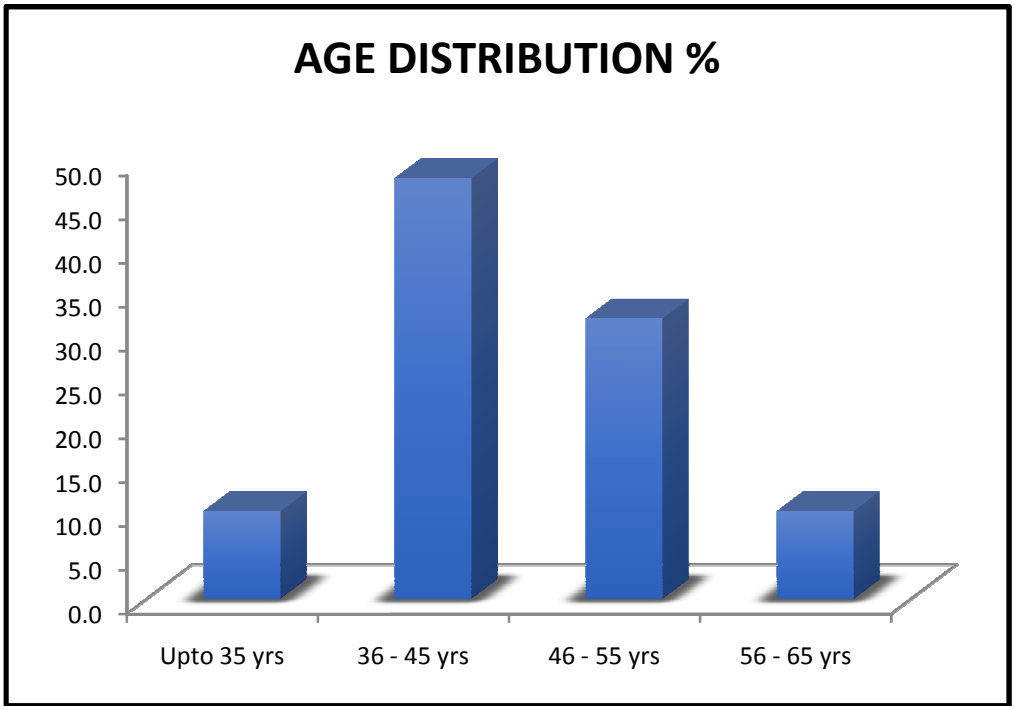
The collected data were analysed with IBM.SPSS statistics software 23.0 Version.To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in dependent groups the Paired sample t-test was used. For the multivariate analysis of repeated measures the Repeated measures of ANOVA was used with Bonferroni correction to control the type I error on multiple comparison. In all the above statistical tools the probability value .05 is considered as significant level.

P - Value	** Highly Significant at P ≤ .01
P -Value	# No Significant at P >.050

FREQUENCY TABLES

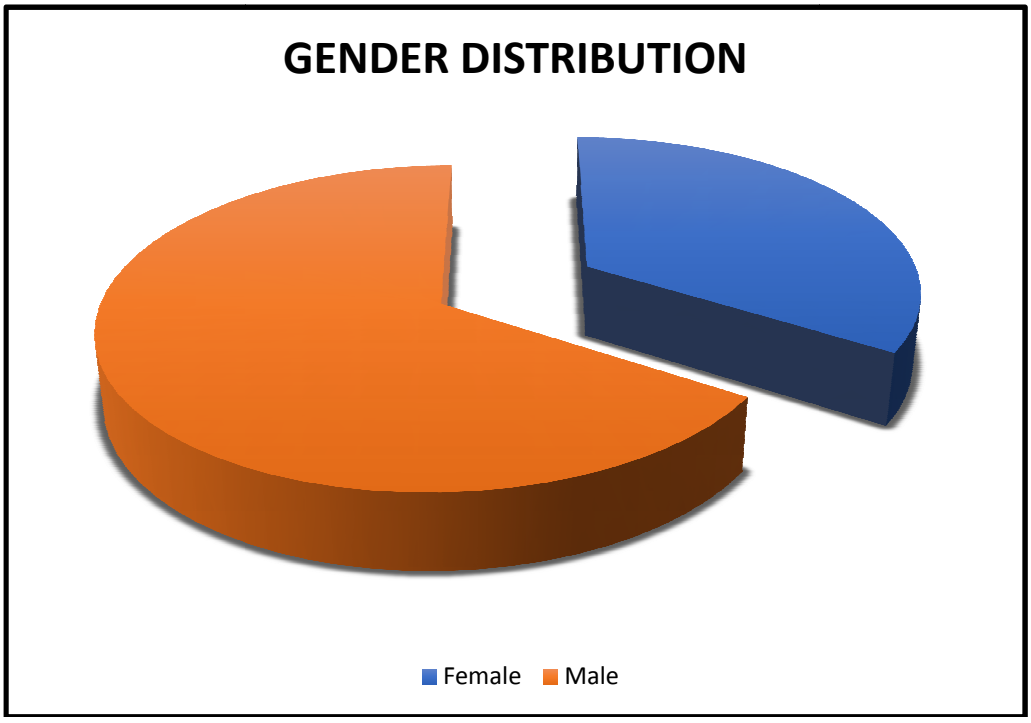
AGE

	Frequency	Percent
Upto 35 yrs	5	10.0
36 – 45 yrs	24	48.0
46 – 55 yrs	16	32.0
56 - 65 yrs	5	10.0
Total	50	100.0

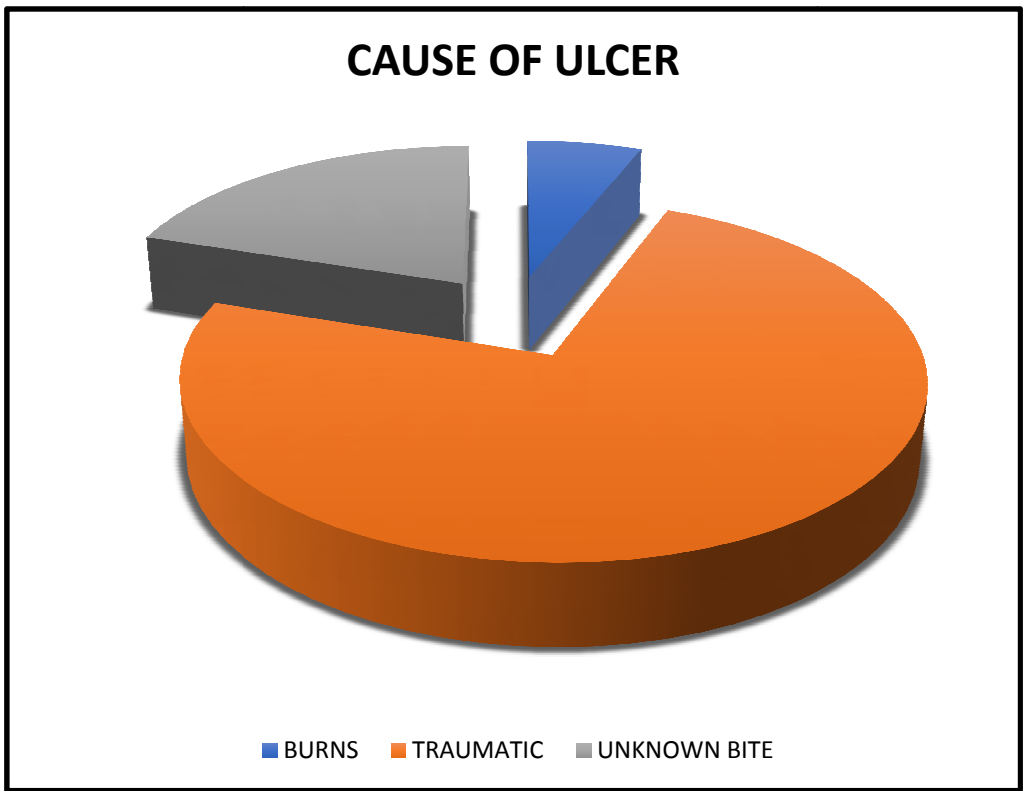


Majority of the patients taken for study belonged to the age group of 36-45yrs

SEX			
		Frequency	Percent
	Female	17	34.0
	Male	33	66.0
	Total	50	100.0

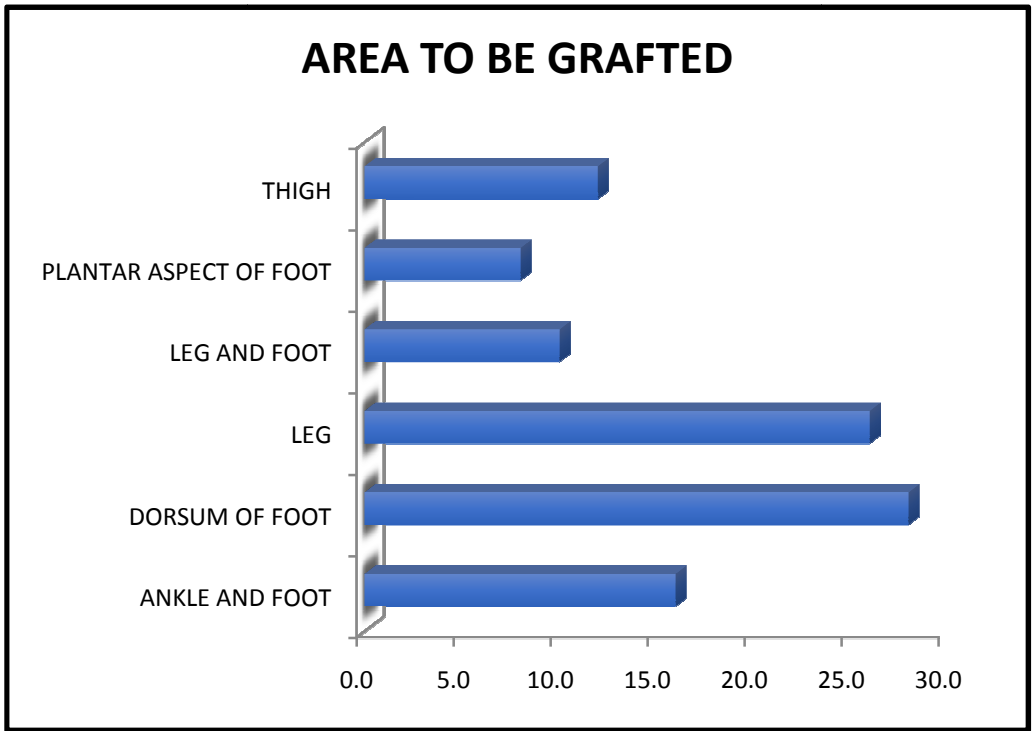


CAUSE OF ULCER			
		Frequency	Percent
	BURNS	3	6.0
	TRAUMATIC	37	74.0
	UNKNOWN BITE	10	20.0
	Total	50	100.0



Most common cause of raw area in this study was traumatic

AREA TO BE GRAFTED			
		Frequency	Percent
	ANKLE AND FOOT	8	16.0
	DORSUM OF FOOT	14	28.0
	LEG	13	26.0
	LEG AND FOOT	5	10.0
	PLANTAR ASPECT OF FOOT	4	8.0
	THIGH	6	12.0
	Total	50	100.0



T- TEST

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	TT D5	97.10	50	3.655	.517
	NTT D5	94.40	50	1.641	.232
Pair 2	TT D10	99.50	50	1.515	.214
	NTT D10	95.00	50	0.000	0.000
Pair 3	TT W3	97.40	50	3.232	.457
	NTTW3	97.40	50	3.534	.500

The mean value of the patients who's graft was harvested with tumescent showed better results (97.10%) on day 5 and faster donor site healing (99.50) on day 10. The final outcome at the end of 3 weeks was same for both TT and NTT.

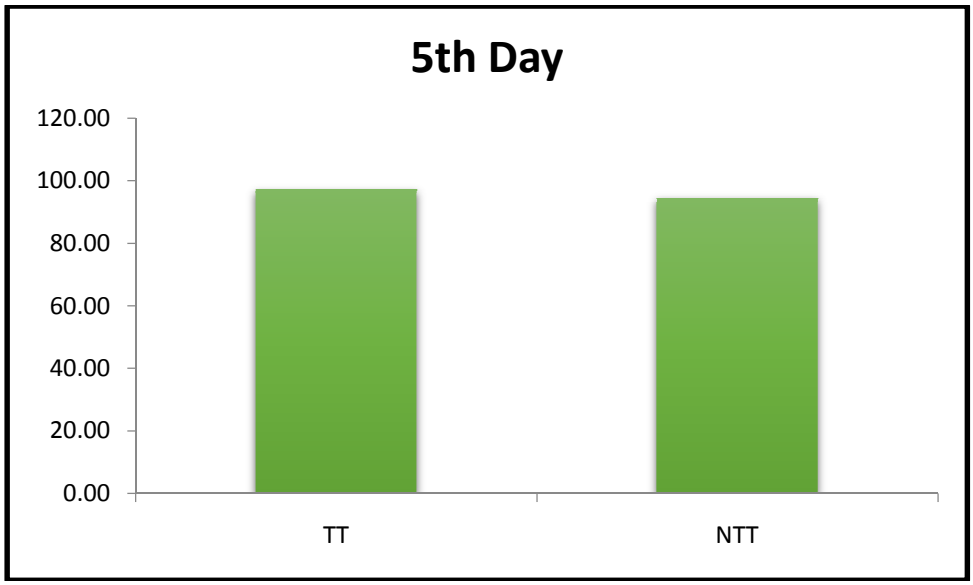
Paired Samples Test

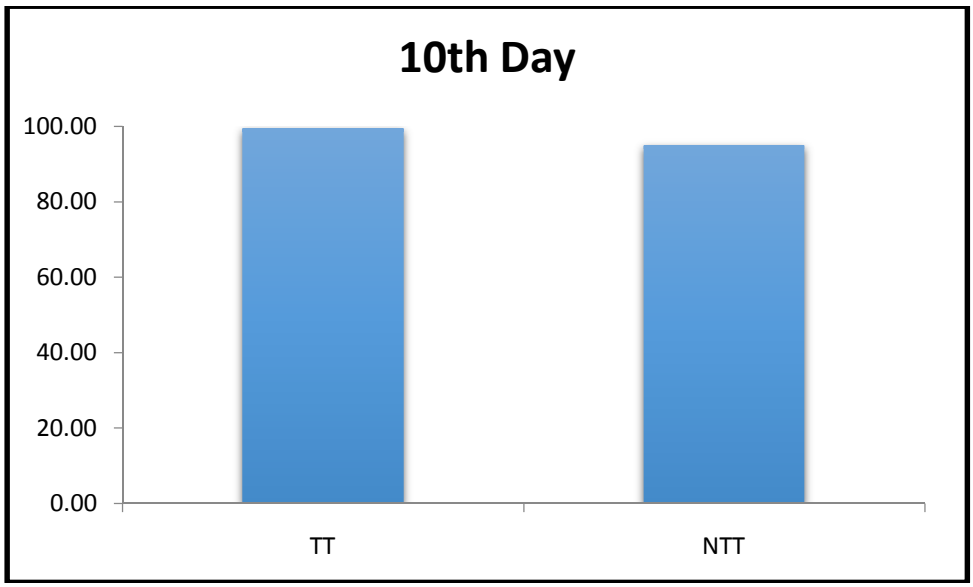
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair1	TT D5 - NTT D5	2.700	3.382	.478	1.739	3.661	5.645	49	.0005
Pair2	TT D10 - NTT D10	4.500	1.515	.214	4.069	4.931	21.000	49	.0005
Pair3	TT W3 - NTTW3	0.000	2.259	.319	-.642	.642	0.000	49	1.000

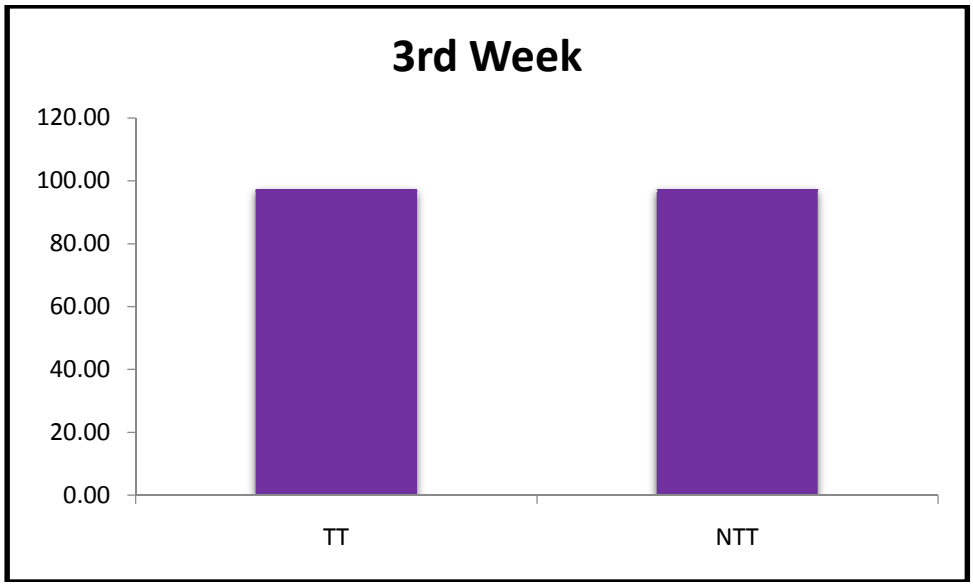
On comparing the result on day 5 and day 10 between tumescent and non tumescent technique p value was .0005 and found to be significant. Hence tumescent technique had better results.

There was no statistical significance with the results after 3 week with both techniques.

	TT	NTT
5th DAY	97.10	94.40
	TT	NTT
10th DAY	99.50	95.00
	TT	NTT
3 Week	97.40	97.40




10th Day
100.00
80.00
60.00
40.00
20.00
0.00
TT
NTT


3rd Week
120.00
100.00
80.00
60.00
40.00
20.00
0.00
TT
NTT

GENERAL LINEAR MODEL FOR *TUMESCENT TECHNIQUE*

WITHIN SUBJECT FACTOR

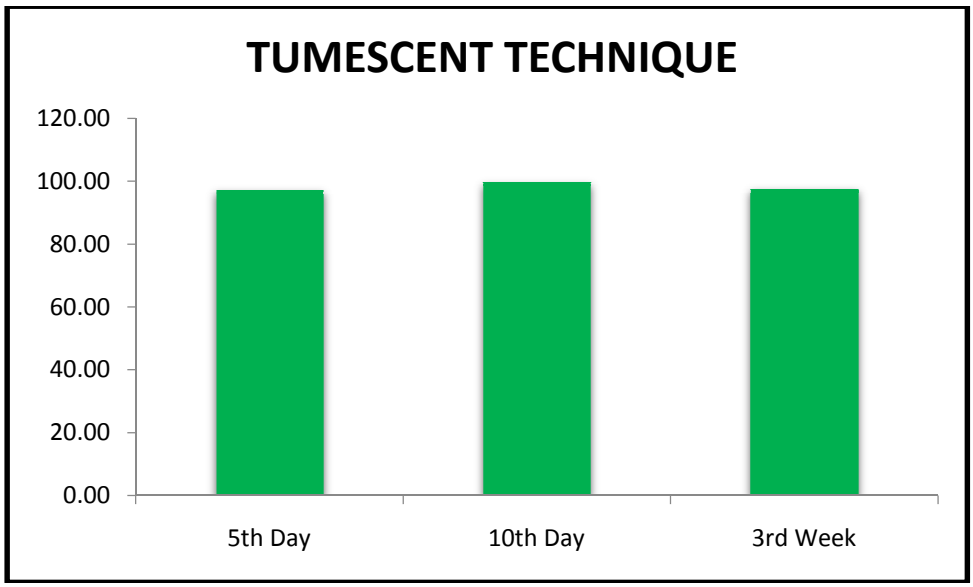
TT	Dependent Variable
1	TTD5
2	TTD10
3	TTW3

Descriptive Statistics

	Mean	Std. Deviation	N
TT D5	97.10	3.655	50
TT D10	99.50	1.515	50
TT W3	97.40	3.232	50

TUMESCENT TECHNIQUE

5th DAY	97.1O
10th DAY	99.50
3 WEEKS	97.40



Mauchly's Test of Sphericity[a]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
TT	.967	1.630	2	.443	.968	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

b. Within Subjects Design: TT. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the tests of within subjects effects on table.

Tests of Within-Subjects Effects table.

Measure: MEASURE_1						
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
TT	Sphericity Assumed	171.000	2	85.500	12.977	.0005
	Greenhouse-Geisser	171.000	1.935	88.355	12.977	.000
	Huynh-Feldt	171.000	2.000	85.500	12.977	.000
	Lower-bound	171.000	1.000	171.000	12.977	.001
Error(TT)	Sphericity Assumed	645.667	98	6.588		
	Greenhouse-Geisser	645.667	94.834	6.808		
	Huynh-Feldt	645.667	98.000	6.588		
	Lower-bound	645.667	49.000	13.177		

ESTIMATED MARGINAL MEANS - TUMESCENT TECHNIQUE

Estimates

Measure: MEASURE_1

TT	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	97.100	.517	96.061	98.139
2	99.500	.214	99.069	99.931
3	97.400	.457	96.481	98.319

Pairwise Comparisons

Measure: MEASURE_1

(I) TT		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-2.400*	.558	.0005	-3.782	-1.018
	3	-.300	.483	1.000	-1.496	.896
2	1	2.400*	.558	.000	1.018	3.782
	3	2.100*	.497	.0005	.869	3.331
3	1	.300	.483	1.000	-.896	1.496
	2	-2.100*	.497	.000	-3.331	-.869

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

GENERAL LINEAR MODEL FOR *NON TUMESCENT TECHNIQUE*

Within-Subjects Factors

Measure: MEASURE_1

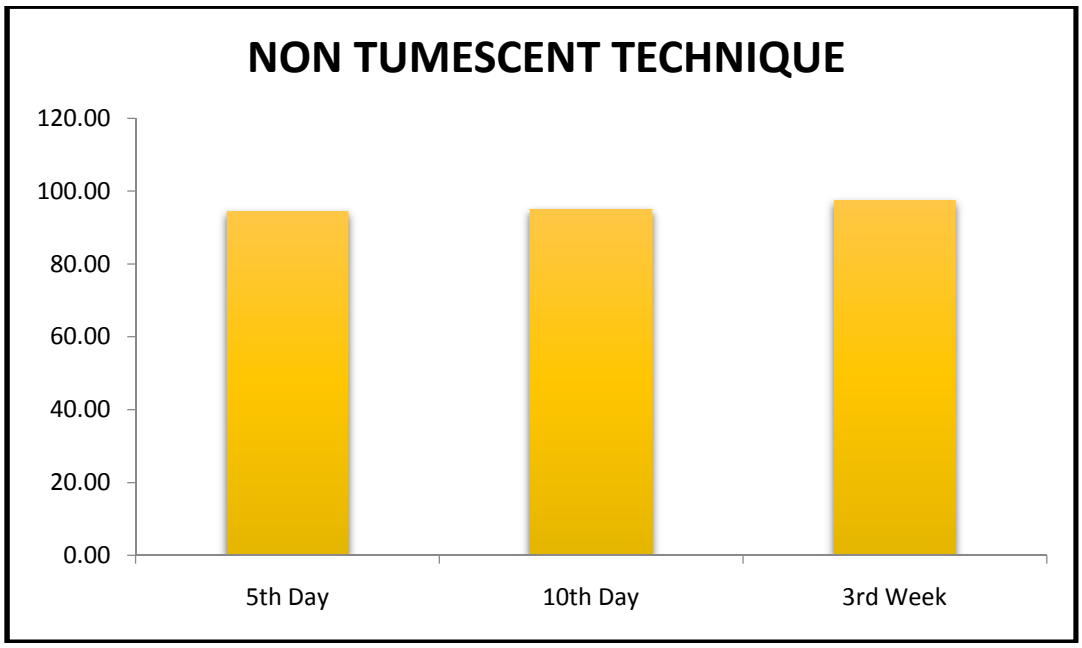
NTT	Dependent Variable
1	NTTD5
2	NTTD10
3	NTTW3

Descriptive Statistics

	Mean	Std. Deviation	N
NTT D5	94.40	1.641	50
NTT D10	95.00	0.000	50
NTTW3	97.40	3.534	50

NON TUMESCENT TECHNIQUE

5th DAY	94.40
10th DAY	95.00
3 WEEKS	97.40



Mauchly's Test of Sphericity[a]							
Measure: MEASURE_1							
Within Subjects Effect	**Mauhy's W**	**Approx. Chi-Square**	**df**	**Sig.**	**Epsilon[b]**		
					Greenhouse-Geisser	**Huynh-Feldt**	**Lower-bound**
NTT	**.498**	**33.454**	**2**	**.000**	**.666**	**.677**	**.500**

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. Design: Intercept

Within Subjects Design: NTT

b May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
NTT	Sphericity Assumed	252.000	2	126.000	31.025	.000
	Greenhouse-Geisser	252.000	1.332	189.240	31.025	.000
	Huynh-Feldt	252.000	1.355	186.003	31.025	.0005
	Lower-bound	252.000	1.000	252.000	31.025	.000
Error(NTT)	Sphericity Assumed	398.000	98	4.061		
	Greenhouse-Geisser	398.000	65.250	6.100		
	Huynh-Feldt	398.000	66.386	5.995		
	Lower-bound	398.000	49.000	8.122		

ESTIMATED MARGINAL MEANS – NON TUMESCENT TECHNIQUE

Estimates				
Measure: MEASURE_1				
			95% Confidence Interval	
NTT	Mean	Std. Error	Lower Bound	Upper Bound
1	94.400	.232	93.934	94.866
2	95.000	0.000	95.000	95.000
3	97.400	.500	96.396	98.404

Pairwise Comparisons

Measure: MEASURE_1

(I) NTT		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-.600*	.232	.038	-1.175	-.025
	3	-3.000*	.429	.0005	-4.062	-1.938
2	1	.600*	.232	.038	.025	1.175
	3	-2.400*	.500	.0005	-3.639	-1.161
3	1	3.000*	.429	.000	1.938	4.062
	2	2.400*	.500	.000	1.161	3.639

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

DISCUSSION

DISCUSSION

Ulcer or raw area that is formed due to tauma, wound debridement of necrotising fscitis or burns is treated with a skin cover using split thickness skin graft technique. STSG harvesting can be done under tumescent anesthesia to reduce the blood loss associated with graft harvesting and is found to give early and better uptake of graft on recipient site. But tumescent anesthesia for STSG is not much in practise.

This study is aimed at showing better and early graft uptake on the recipient site and better healing on the donor site. The patients selected were in the age group of 18-65 years with no comorbid conditions patients with clean wounds prepared for grafting. Both the techniques were practiced on the same patient with one graft taken with tumescent anesthesia and other without it there by reducing the other confounding factors.

The commonest site of raw area was mostly dorsum of foot followed by leg. The graft was harvested from the thigh. . In our study we found that the skin graft take rate was 97.10%(3.9) in the tumescent group of patients and 94.40%(3.8) in the non tumescent group of patients. This showed in fact that tumescent technique gave better skin graft take rates.

However we wish to point out that the grafts were monitored relatively on day 5. In both groups the donor site had healed by day 10 (99.50% and 95% respectively). Tumescent technique was found to be superior on the donor site. By the end of 3 weeks both techniques showed similar results. Tumescent technique had better outcome and we postulate that there could be less hematoma/seroma formation on grafted site, bacteriostatic property of lignocaine maintained an aseptic environment under the graft.

CHALLENGES

The infusion of tumescent was done manually by hand. Inadequate analgesia at time of opening the wounds could have led to loss of a few of the skin grafts. We recommend adequate analgesia or sedation at that time of opening grafted wounds

CONCLUSION

CONCLUSION

Based on the following study conclusion is made that harvesting graft with tumescent technique give better take results and donor site healing compared to non tumescent technique non tumescent technique. The effect of both techniques at the end of 3 weeks was found to be the same. hence tumescent technique is considered superior except for the challenges faced.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Kelton PL. Skin grafts and skin substitutes. Selected Readings Plast Surg. 1999;9:1

2. Plewig, G. and Marples, R. R., (1970). Regional differences of cell sizes in the human stratum corneum. I. British Journal of Dermatology, 54(1), 13-18.

3. Holbrook, K. A. and Odland, G. F., (1974). Regional differences in the thickness (cell layers) of the human stratum corneum: an ultrastructural analysis. Journal of Investigative Dermatology, 62(4), 415-422.

4. .Brody, I., (1977). Ultrastructure of the stratum corneum. International Journal of Dermatology, 16(4), 245-256. [

5. Elias, P. M., (2005). *Stratum corneum defensive functions: an integrated view*. British Journal of Dermatology, **125**(2), 183-200

6. Avram, A. S., Avram, M. M., and James, W. D., (2005). *Subcutaneous fat in normal and diseased states: 2. Anatomy and physiology of white and brown adipose tissue*. Journal of the American Academy of Dermatology, **53**(4), 671-683

7. Albright, A. L. &. S. J. S., (2005). *adipose tissue*, http://sportsci.org/encyc/adipose/adipose.html

8. 8S. S. Lee, C. C. Tsai, C. S. Lai, and S. D. Lin, “An easy method for preparation of postage stamp autografts,” Burns, vol. 26, no. 8, pp. 741–749, 2000.

9. T. Harashina and R. Iso, “The treatment of leukoderma after burns by a combination of dermabrasion and “chip” skin grafting,” British Journal of Plastic Surgery, vol. 38, no. 3, pp. 301–305, 1985.

10. A. Ragnell, “The secondary contracting tendency of free skin grafts,” British Journal of Plastic Surgery, vol. 5, no. 1, pp. 6–24, 952.

11. Ratner D: Skin grafting. From here to there. Dermatol Clin 16(1):75, 1998.

12. Hauben DJ, Baruchin A, Mahler D: On the history of the free skin graft. Ann PlastSurg 9:242, 1982.

13. Brown JB, McDowell F: Massive repairs with thick splitskin grafts; emergency “dressing” with homografts in burns. Ann Surg 115:658, 1942.

14. Tanner JC Jr, Vandeput J, Olley JF: The mesh skin graft. Plast ReconstrSurg 34:287, 1964.

15. Rheinwald JG, Green H: Serial cultivation of strains of human epidermal keratinocytes: the formation of keratinizing colonies from single cells. Cell 6:331, 1975.

16. Green H, Kehinde O, Thomas J: Growth of cultured epidermal cells into multiple epithelia suitable for grafting. PNAS 76:5665, 1979.

17. Vistnes LM: Grafting of skin. SurgClin North Am 57:939, 1977.

18. Grabb WC: Basic techniques in plastic surgery (skin grafts). In: Grabb and Smith's Plastic Surgery, 3rd ed, Boston, Little Brown, 1979.

19. Rudolph R, Klein L: Healing processes in skin grafts. Surg GynecolObstet 136:641, 1973.

20. Smahel J: The healing of skin grafts. ClinPlastSurg 4:409, 1977.

21. Marckmann A: Reaction of skin to autotransplantation. Studies on the microcirculation and the biochemical composition in dermis (thesis). Copenhagen, Munksgaard, 1966.

22. Medawar PB: The behaviour and fate of skin autografts and skin homografts in rabbits. J Anat 78:176, 1944.

23. Scothorne RJ, Tough JS: Histochemical studies of human skin autografts and homografts. Br J PlastSurg 5:161, 1952.

24. Van Winkle W: The fibroblast in wound healing. Surg GynecolObstet 124:369, 1967.

25. Richard R, Miller SF, Steinlage R, Finley RK Jr: A comparison of the Tanner and Bioplasty skin mesher systems for maximal skin graft expansion. J Burn Care Rehabil 14:690, 1993.

26. Kreis RW, Mackie DP, Hermans RK, Vloemans AR: Expansion techniques for skin grafts: comparison between mesh and Meek island (sandwich-) grafts. Burns 20:S39, 1994.

27. Zhang ML, Wang CY, Chang ZD, et al: Microskin grafting. II. Clinical report. Burns 12:544, 1986.

28. Zhang ML, Chang ZD, Wang CY, Fang CH: Microskin grafting in the treatment of extensive burns: a preliminary report. J Trauma 28:804, 1988.

29. Lai C-S et al: An easy way to prepare microskin grafts. Burns 20:151, 1994.

30. Lin T-W: The algebraic view-point in microskin grafting in burned patients. Burns 20:347, 1994.

31. Lin T-W, Horng S-Y: A new method of microskin mincing. Burns 20:526, 1994.

32. Vandeput J, Tanner J: Easy way to prepare microskin grafts. Burns 20:476, 1994.

33. Wang LN, Hsu JH, Lu KH: Experimental studies on combined use of homografts and autografts. Chin Med J 4:221, 1973.

34. Yeh FL, Yu GS, Fang CH, et al: Comparison of scar contracture with the use of microskin and Chinese-type intermingled skin grafts on rats. J Burn Care Rehabil 11:221, 1990.

35. Peer LA, Walker JC: The behaviour of autogenous human tissue grafts, I. PlastReconstrSurg 7:6, 1951.

36. Peer LA: Transplantation of Tissues, Vol 2. Baltimore, Williams & Wilkins, 1955.

37. Birch J, Branemark PI: The vascularization of a free fullthickness skin graft. I. A vital microscopic study. Scand J PlastReconstrSurg 3:1, 1969.

38. Birch J, Branemark PI, Lundskog J: The vascularization of a free full-thickness skin graft. II. A microangiographic study. Scand J PlastReconstrSurg 3:11, 1969.

39. Birch J, Branemark PI, Nilsson K: The vascularization of a free full-thickness skin graft. III. An infrared thermographic study. Scand J PlastReconstrSurg 3:18, 1969.

40. Psillakis JM, de Jorge FB, Villardo R, et al: Water and electrolyte changes in autogenous skin grafts. Discussion of the so-called “plasmatic circulation.” PlastReconstrSurg 43:500, 1969.

41. Haller JA, Billingham RE: Studies of the origin of the vasculature in free skin grafts. Ann Surg 166:896, 1967.

42. Converse JM, Rapaport FT: The vascularization of skin autografts and homografts; an experimental study in man. Ann Surg 143:306, 1956.

43. Converse JM, Ballantyne DL Jr, Rogers BO: A study of viable and non-viable skin grafts transplanted to the chorioallantoic membrane of the chick embryo. Transplant Bull 5:108, 1958.

44. Converse JM, Filler M, Ballantyne DL: Vascularization of split-thickness skin autografts in the rat. Transplantation 3:22, 1965.

45. Zarem HA, Zweifach BW, McGehee JM: Development of microcirculation in full thickness autogenous skin grafts in mice. Am J Physiol 212:1081, 1967.

46. Ljungvist A, Almgard IE: The vascular reaction in the free skin allo- and autografts. Acta Path MicrobiolScand 68:553, 1966.

47. Wolff K, Schellander FG: Enzyme-histochemical studies on the healing process of split skin grafts. J Invest Dermatol 45:38, 1965.

48. Tsukada S: Transfer of free skin grafts with a preserved subcutaneous vascular network. Ann PlastSurg 4:500, 1980.

49. Tucker GT, Mather LE: Properties, absorption, and disposition of local anesthetic agents, Neural Blockade in Clinical Anesthesia and Management of Pain, 2nd edition. Edited by Cousins MJ, Bridenbaugh PO. Philadelphia: Lippincott Williams & Wilkins, 1988, pp. 47–110

50. Rao RB, Ely SF, Hoffmann RS: Deaths related to liposuction. N Engl J Med 1999; 340:1471–5

51. Bergfeld D, Sommer B, Sattler G: Infiltration technique, Tumescent Local Anesthesia. Edited by Hanke CW, Sommer B, Sattler G. New York, Springer, 2001, pp 55–60

52. Ramirez OM, Galdino G: Does tumescent infiltration have a deleterious effect on undermine skin flaps? PlastReconstrSurg 1999; 104:2269–72

53. Schwarz S, Bergfeld D, Sommer B: Pharmacology, Tumescent Local Anesthesia. Edited by Hanke CW, Sommer B, Sattler G. New ork, Springer, 2001, p 24

54. Butterwick KJ, Goldman LP, Sriprachya-Anunt S: Lidocaine levels during the first two hours of infiltration of dilute anesthetic solution for tumescent liposuction: Rapid versus slow delivery. Dermatol Surg 1999; 25:681–5

55. American Society of Dermatologic Surgery: Guiding principles for liposuction. Dermatol Surg 1997; 23:1127–9

56. Klein JA, Kassarjdian N: Lidocaine toxicity with tumescent liposuction. Dermatol Surg 1997; 23:1169–74

57. Rice LJ: Regional anesthesia and analgesia, Smith's Anesthesia for Infants and Children, 6th edition. Edited by Motoyama EK, Davis PJ. St. Louis, Mosby, 1996, p 405

58. Craig SB, Concannon MJ, McDonald GA, Puckett CL: The antibacterial effects of tumescent liposuction fluid. PlastReconstrSurg 1999; 103:666–70

59. Thompson KD, Welykyj S, Massa MC: Antibacterial activity of lidocaine in combination with a bicarbonate buffer. J Dermatol Surg Oncol 1993; 19: 216–20

60. Klein JA: The tumescent technique: Anesthesia and modified liposuction techniques. Dermatol Clin 1990; 8:425–37

61. Gilliland MD, Coates N: Tumescent liposuction complicated by pulmonary edema. PlastReconstrSurg 1997; 99:215–9

62. Chaplan SR, Bach FW, Shafer S, Yaksh TL: Prolonged alleviation of tactile allodynia intravenous lidocaine in neuropathic rats. ANESTHESIOLOGY 1995; 83:775

63. Raymond SA, Steffensen SC, Gugino LD, Strichartz GR: The role of length of nerve exposed to local anesthetic in impulse blocking action. AnesthAnalg 1989; 68:563–70

64. Breuninger H, Hobbach PS, Shimek F: Ropivacaine: An important anesthetic agent for slow infusion and other forms of tumescent anesthesia. Dermatol Surg 1999; 25:799–802

65. Lillis PJ: Liposuction surgery under local anesthesia: Limited blood loss and minimal lidocaine absorption. Dermatol Surg Oncol 1988; 14:1145–8

66. Robinson J, Fernando R, Sun Wai WYS, Reynolds F. Chemical stability of bupivacaine, lidocaine and epinephrine in pH-adjusted solutions. Anesth 2000;55:853-8.

67. Ackerman WE, Ware TR, Juneja M. The air-liquid interface and the pH and PCO2 of alkalinized local anaesthetic solutions. Can J Anaesth 1992;39:387- 9.

68. Condouris GA, Shakalis A. Potentiation of the nerve-depressant effect of local anaesthetics by carbon dioxide. Nature 1964;204:57-9.

69. Bromage PR, Burfoot MF, Crowell DE, Truant AP. Quality of epidural blockade III: carbonated local anaesthetic solutions. Brit J Anaesth 1967;39:197-208.

70. Bokesch PM, Raymond SA, Strichartz GR. Dependence of lidocaine potency on pH and PCO2. AnesthAnalg 1987;66:9-17.

71. Catchlove RFH. The influence of CO2 and pH on local anesthetic action. J PharmacolExpTher 1972;181:298-309.

72. Mehta R. Verma DD, Gupta V, Gurwara AK. To study the effect of alkalinization of lignocaine hydrochloride on brachial plexus block. Indian J Anaesth 2003;47:283-6.

73. Catchlove RFH. Potentiation of two different local anaesthetics by carbon dioxide. Brit J Anaesth 1973;45:471-3.

74. Otsuguro K, Yasutake S, Yamaji Y, Ban M, Ohta T, Ito S. Why does carbon dioxide produce analgesia? AATEX 2007;14:101-6. 118

75. Cepeda MS, Tzortzopoulou A, Thackrey M, Hudcova J, Arora-Gandhi P, Schumann R. Adjusting the pH of lidocaine for reducing pain on injection (review). Cochrane Database Syst Rev 2010.

76. McGlone R, Bodenham A. Reducing the pain of intradermal lignocaine injection by pH buffering. Arch Emerg Med 1990;7:65-8.

77. Bartfield JM, Ford DT, Homer PJ. Buffered versus plain lidocaine for digital nerve blocks. Ann Emerg Med 1993;22:216-9.

78. Steinbrook RA, Hughes N, Fanciullo G, Manzi D, Ferrante FM. Effects of alkalinization of lidocaine on the pain of skin infiltration and intravenous catheterization. J ClinAnesth 1993;5:456-8

79. Stewart JH, Cole GW, Klein JA: Neutralized lidocaine with epinephrine for local anesthesia . J DermSurg Oncol 15:1081-1083, 1989

80. Stoelting RK: Plasma lidocaine concentrations following subcutaneous or submucosal epinephrine-lidocaine injection. AnesthAnalg 57:724-726, 1978

81. Kucera IJ, Lambert TJ, Klein JA, Watkins RG, Hoover JM, Kaye AD (2006) Liposuction: contemporary issues for the anesthesiologist. J ClinAnesth 18(5):379–387

82. Robertson RD, Bond P, Wallace B, Shewmake K, Cone J (2001) The tumescent technique to significantly reduce blood loss during burn surgery. Burns 27(8):835–838

83. Mago V, Prasad M (2009) Tumescent local anesthesia for release of postburn neck contractures. J Burn Care Res 30(6):1049

84. Ramon Y, Barak Y, Ullmann Y, Hoffer E, Yarhi D, Bentur Y (2007) Pharmacokinetics of high-dose diluted lidocaine in local anesthesia for facelift procedures. Ther Drug Monit 29(5):644–647

85. Brody GS (1994) The tumescent technique for facelift. PlastReconstrSurg 94(3):563

86. Aydin HU, Yig˘it B, Serin DA, Gu¨ven E (2009) A simple setup for easy infiltration of large volumes. Aesthetic PlastSurg 33(1): 129–130

87. Hodanbosi C (2010) Pascal's principle and hydraulics. Available at http://www.grc.nasa.gov/WWW/k-12/WindTunnel/Activities/Pascals_principle.html [accessed September 2010]

88. Robertson RD et al. The tumescent technique to significantly reduce blood loss during burn surgery. Burns 2001:27(8):835-838.

89. Hughes WS et al. Intradermal infusion of epinephrine to reduce blood loss during split thickness skin grafting. Journal of Burn care Rehabilitation 1996:17:243-245.

90. Kahalley L et al. Methods to diminish intraoperative blood loss. Journal of Burn care Rehabilitation 1991:12:160-161

91. Mitchell Ryan TM et al. Phenylephrine tumescence in split thickness skin graft donor sites in surgery for burn injury – a concentration finding study. Journal of Burn Care and Research January/February 2011:32:129-134.

92. Achauer B et al. Burn excision with intraoperative vasopressin. Journal of Burn Care and Rehabilitation 1989:10:375-378.

93. GlatterRD et al. Carbon Dioxide laser ablation with immediate autografting in full thickness porcine burn model. Annals of Surgery 1998:228:257-265.

94. Hukki J et al. Burn excision with contact neodymium: YAG Laser. Journal of Burn Care and Rehabilitation 1989:10:402-405.

95. Levine NS et al. Clinical Evaluation of the carbon dioxide laser for burn wound excision: A comparison of the laser scalpel and eletrocautery. Journal of trauma 1975:15:800-807.

96. Szyfelbein SK et al. Use of controlled Hypotension for primary surgical excision in a severely burned child. Anesthesiology 1974;41:510-513.

97. EngelbrechtKotze JJK. Tumescent technique to reduce blood loss. CME Publication September 2008:446-448.

98. Yves-GererdIllouz. History and current concepts of lipoplasty. Clinics in Plastic Surgery. 1996:23(4):721-730.

99. Medical Records Department KNH 25/8/2011.

100. Factsheet Number 365 www.who.int/mediacentre/factsheets May 2012.

101. Wallace B et al. Energy Balance studies and plasma catecholamine values for patients with healed burns. Journal of Burn Care and Rehabilitation 1991:12(^):505-509.

102. Missavage A et al. The effect of clysed and topical epinephrine on intraoperative catecholamine levels. Journal of Trauma 1998:45:1074-1078.

103. Linda S. Costanzo. Physiology. 2007 Elsevier Inc. 3rd Edition, 2: 58-61.

104. Antony A. Papp et al. Burns. September 2009:35(6):832-839

105. Levy B et al. Effect of epinephrine and norepinephrine on hemodynamics, oxidative metabolism and organ genetics in endotoxaemic rats. Intensive Care Medicine 2003:29(2):292-300.

106. Samuelsson A et al. Microdialysis shows metabolic effects in skin during fluid resuscitation in burn injured patients. Critical Care 2006:10:172-179.

107. Eriksson G, Klingenstrom P, Nylen B, Wersall J: Electron microscopic studies on the epidermis in human split-skin autografts. Scand J PlastReconstrSurg 2:83, 1968.

108. Zoltan J: Transplantationslehre. In: Gohrbandt-Gabka-Berndorfer (eds), Handbuch der PlastischenChirurgie, Band 1, Lieferung 3, Beitrag 12. Berlin, Walter de Gruyter, 1965.

109. Kurul S: Is the groin region a good source for full-thickness skin graft? J Surg Oncol 77:281, 2001.

110. Shiffman MA: Re: Cervicomental "turkey gobbler": a new source for full-thickness grafts (letter). Dermatol Surg 28:1099, 2002.

111. Craig SB, Concannon MJ, McDonald GA, Puckett CL: The antibacterial effects of tumescent liposuction fluid. PlastReconstrSurg 1999; 103:666–70

112. Thompson KD, Welykyj S, Massa MC: Antibacterial activity of lidocaine in combination with a bicarbonate buffer. J Dermatol Surg Oncol 1993; 19: 216–20

113. Klein JA: The tumescent technique: Anesthesia and modified liposuction techniques. Dermatol Clin 1990; 8:425–37

114. Robert Cartotto et al. Minimizing Blood Loss in Burn Surgery. Journal of Trauma Injury Infection and Critical Care. December 2000:49:1034-1039.

115. Subrahmanyam M. Topical application of honey in treatment of burns. Burns J. 1999: 25(8): 729-731

116. Tompkins RG et al. Significant reduction in mortality for children with burn injuries through prompt eschar excision. Annals of Surgery 1988:208:577-585.

117. Heimbuch DM. Early surgical excision versus conventional therapy in patients with 20-40% burns. American Journal of surgery. 1982:144:76-79.

118. Engrav LH. Early excision and grafting versus non-operative treatment of burns of intermediate depth; a randomized prospective study. Journal of Trauma. 1983:23:1001-1004.

ANNEXURE

INFORMATION SHEET

TITLE:"COMPARITIVE STUDY OF GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON-TUMESCENT TECHNIQUE."

Name of Investigator: Dr. VAISHNAVI .V

Name of Participant:

Purpose of Research: To improve graft take rate after harvesting.

Study Design: Observational Prospective Study.

Study Procedures: Patient will be subjected to physical examinations of raw sites, to determine surface area to be grafted. Routine lab investigations, complete haemogram, HIV test, LFT and pus swab tests will be analyzed.

Possible Risks: No risks to the patient

Possible benefits:

To patient : A better understanding of their problem so as to devise a plan of management which suits their needs.

To doctor & to other people: Based upon the study, graft take rate can be improved. This will help in providing better treatment to other patients in future.

Confidentiality of the information obtained from you: The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Can you decide to stop participating in the study: Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time

How will your decision to not participate in the study affect you: Your decision will not result in any loss of benefits to which you are otherwise entitled.

Signature of Investigator Signature of Participant

Date :

Place :

PATIENT CONSENT FORM

Study Detail	:	"COMPARITIVE STUDY OF GRAFT TAKE AFTER HARVESTING WITH TUMESCENT AND NON-TUMESCENT TECHNIQUE."
Study Centre	:	Rajiv Gandhi Government General Hospital, Chennai.
Patient's Name	:	
Patient's Age	:	
In Patient Number	:	

Patient may check (☑) these boxes

- I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction.

- I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected.
- I understand that sponsor of the clinical study, others working on the sponsor's behalf, the Ethics committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published,

unless as required under the law. I agree not to restrict the use of any data or results that arise from this study.

- I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or wellbeing or any unexpected or unusual symptoms.
- I hereby consent to participate in this study
- I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological tests and to undergo treatment

Signature/thumb impression
Patient's Name and Address

Signature of Investigator
Study Investigator's Name
Dr. VAISHNAVI. V

QUESTIONNAIRE

Study Number _____

Date _____

Age _____yrs

Gender: Male ____ Female _____

Occupation_____

When did you get injured?

What caused the injury?

When have been told you are going to theatre

QUESTIONAIRE

PATIENT DETAILS:

Name: Age: Sex:

IP No:

Occupation:

ON ADMISSION:

PRESENTING COMPLAINTS:

ASSOCIATED COMPLAINTS:

CAUSE OF RAW AREA - ( ) TRAUMATIC ( ) UNKNOWN BITE ( ) BURNS

CLINICAL EXAMINATION:

Pulse: BP:

RR: Temp:

Pallor: Icterus:

CVS: RS:

P/A: CNS:

INVESTIGATIONS:

CBC: Hb % TC: DC: Platelets:

RBS: Urea: Creatinine: Na^+: K^+:

Bilirubin: SGOT: SGPT: SAP: T.Protein: S. Albumin:

Pus Swab C/S:

Area to be grafted ( ) cm^2 Amount of tumescent solution used in cm^3

Area to be grafted: Face ( ) Trunk ( ) Upper Limb ( ) Lower limbs ( ) Others specify

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TREATMENT

OPERATIVE MANAGEMENT: SPLIT SKIN GRAFT

Intra OP findings:

OUTCOMES

Day 5 Recipient Site, Take %

Day 10 Donor Site, Healing %

FOLLOW UP:

Final outcome after 3 weeks

Complication +/-

ஆராய்ச்சியில் பங்கேற்பவர்கான தகவல் அறிக்கை

ஆராய்ச்சி தலைப்பு

தோல் ஒட்டுக்கலை மற்றும் தோல் எடுப்பு முறைகளில், வீக்கமான மற்றும் வீக்கம் அல்லாத உத்திகளை பயன்படுத்துவதை பற்றிய ஓர் ஒப்பிட்டு ஆய்வு.

பங்கு கொள்பவரின் பெயர் :

ஆராய்ச்சி செய்பவரின் பெயர் : மரு.வ.வைஷ்ணவி

இடம் : இராஜீவ்காந்தி அரசு பொது மருத்துவமனை சென்னை - 3.

இந்த ஆராய்ச்சி / ஆயவு / செய்முறை / சோதனையில் தாங்கள் பங்கேற்க அழைக்கிறோம். இந்த தகவல் அறிக்கையில் கூறப்பட்டிருக்கும் தகவல்களை தாங்கள் இந்த ஆராய்ச்சியில் பங்கேற்கலாமா வேண்டாமா என்பதை முடிவு செய்ய உதவியாக இருக்கும். இந்த படிவத்தில் உள்ள தகவல்கள் பற்றி உள்ள சந்தேகங்களை நீங்கள் தயங்காமல் கேட்கலாம்.

இந்த ஆய்வின் நோக்கம் என்ன?

தோல் ஒட்டுக்கலை மற்றும் தோல் எடுப்பு முறைகளில், வீக்கமான மற்றும் வீக்கம் அல்லாத உத்திகளை பயன்படுத்துவதை பற்றிய ஓர் ஒப்பிட்டு ஆய்வு.

ஆய்வு முறைகள்

தோல் ஒட்டுக்கலை மற்றும் தோல் எடுப்பு முறைகளில், வீக்கமான மற்றும் வீக்கம் அல்லாத உத்திகளை பயன்படுத்துவதை பற்றிய ஓர் ஒப்பிட்டு ஆய்வு. மேலும் எந்த உத்தி உயர்ந்தது என்பதைப்பற்றியும் ஓர் ஆய்வு

ஆய்வினால் நோயாளிகளுக்கு ஏற்படும் நன்மைகள்

இந்த ஆய்வின் முடிவில் கிடைக்கும் தகவல்கள் சமுதாயத்திற்கு பயனுள்ளதாகவும், எதிர்காலத்தில் நோயாளிகளுக்கு மருத்துவ தீர்வாகவும் அமையும்.

ஆய்வினால் மருத்துவருக்கு ஏற்படும் நன்மைகள்

மருத்துவர் நோயின் தன்மையை தேர்வு செய்யவும் அதன் பயனை நோயாளிக்கு எடுத்து உறைக்கவும் பயன்படும்.

தங்களிடமிருந்து பெறப்படும் தகவல்களின் நம்பகத்தன்மை

தங்களிடமிருந்து பெறப்பம் தகவல்கள் பாதுகாக்கப்படுவதற்கான முழு உரிமையும் தங்களுக்கு உண்டு:

இந்த படிவத்தில் கையொப்பமிடுவதன் மூலம், தாங்கள் தங்களை பற்றிய விவரங்களையும், ஆய்வு விவரங்களையும் ஆராய்சியாளர், ஆய்வு நடத்தும் ஏனையோர் வரைமுறை ஒழுங்கு குழுவினர் மற்றும் சட்டத்திற்கு உட்பட்ட மருந்து கட்டுப்பாடு இயக்குநர் ஆகியோர் பார்வையிட அனுமதிக்கின்றீர்கள்.

இந்த ஆய்வில் காட்டப்படும் தகவல்கள் அறிவியல் நாளேடுகளிலோ அறிவியல் கூட்டங்களிலோ சமர்ப்பிக்கப்படும் பட்சத்தில் தங்களது அடையாளம் வெளிப்படுத்தப்படமாட்டாது.

இந்த ஆய்வில் பங்கேற்காமல் இருப்பதனால் எற்படும் பாதிப்பு

இந்த ஆய்வில் தாங்கள் பங்கேற்க விருப்பம் தெரிவிக்காத நிலையில் தங்களின் மருத்துவர் மற்றும் மருத்துவமனையில் தங்களுக்கு உள்ள உறவில் எந்த

பாதிப்பும் ஏற்படாது. தாங்கள் சிறப்பாக கவனிக்கப்படுவீர்கள். மேலும் இதனால் தாங்களுக்கு இழப்பு ஏதும் ஏற்படாது.

ஆய்வின் நடுவில் அதிலிருந்து விலகி கொள்ள நினைத்தால்

இந்த ஆய்வில் பங்கேற்பது தங்களின் சொந்த விருப்பமே. மேலும் ஆய்வின் நடுவில் எந்த நேரத்திலும், எக்காரணமும் கூறாமல் விலகிக் கொள்ள தங்களுக்கு முழு உரிமை உண்டு. இருப்பினும் ஆய்விலிருந்து விலகுவதற்கு முன் ஆராய்ச்சி குழுவுடன் கலந்து ஆலோசிப்பது உகந்தது என பரிந்துரைக்கப்படுகிறது.

ஆராய்ச்சியாளர் கையொப்பம் பங்கேற்பாளர் கையொப்பம்.

தேதி : தேதி :

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சியின் தலைப்பு

தோல் ஒட்டுக்கலை மற்றும் தோல் எடுப்பு முறைகளில், வீக்கமான மற்றும் வீக்கம் அல்லாத உத்திகளை பயன்படுத்துவதை பற்றிய ஓர் ஒப்பிட்டு ஆய்வு.

ஆராய்ச்சி செய்பவரின் பெயர் : மரு.வ.வைஷ்ணவி

இடம் : இராஜீவ்காந்தி அரசு பொது மருத்துவனை சென்னை -3.

..... எனும் நான், எனக்கு கொடுத்துள்ள தகவல் தாளை படித்து புரிந்துகொண்டேன். நான் பதினெட்டு வயதை கடந்துள்ளதால், என்னுடைய சுய நினைவுடனும், முழு சுதந்திரத்துடனும், இந்த ஆராய்ச்சியில் என்னை சேர்த்துக் கொள்ள சம்மதிக்கிறேன்.

1. நான் எனக்கு அளிக்கப்பட்ட ஒப்புதல் படிவத்தையும் தகவல்களையும் படித்து புரிந்துகொண்டேன்.
2. ஒப்புதல் படிவத்தில் உள்ள தகவல்கள் எனக்கு விளக்கிக் கூறப்பட்டன.
3. ஆய்வின் தன்மை பற்றி எனக்கு விளக்கப்பட்டுது.
4. என்னுடைய உரிமைகளையும், பொறுப்புகளையும் ஆராய்ச்சியாளர் விளக்கிக் கூறினார்.
5. நான் ஆராய்ச்சியாளருடன் ஒத்துழைப்பேன் என்றும் எனக்கு ஏற்படக்கூடிய அசாதாரணமான நிகழ்வுகள் பற்றியும் உடனடியாக ஆராய்ச்சியாளரிடம் தெரிவிப்பேன் என்று உறுதி கூறுகிறேன்.

6. நான் கடந்த ..... மாதங்களாக வேறு எந்தவிதமான ஆய்வுகளிலும் பங்கேற்கவில்லை.

7. எனக்கு செய்யப்படும் அனைத்து பரிசோதனைகளும் (உதாரணம் : இரத்தம் எடுத்தல்) என நோயின் தன்மையை அறிவதற்காக செய்யப்படுபவை என்பதை அறிகிறேன்.

8. இந்த ஆய்விலிருந்து என்போது வேண்டுமானாலும் எக்காரணமும் கூறாமல் என்னை விடுவித்துக் கொள்ளலாம் என்பதை அறிவேன். மற்றும் இதனால் எனக்குத் தரப்படும் சிகிச்சைக்கு எந்த பாதிப்பும் வராது என்பதை அறிவேன்.

9. ஆராய்ச்சியாளர்கள் இந்த ஆய்வில் எனது பங்களிப்பை எந்த நேரத்திலும், எக்காரணமும் கூறாமல் என் சம்மதம் இல்லாமலும் என்னை விலக்கிவிட முடியும் என்பதை அறிவேன்.

10. என்னிடம் இருந்து பெறப்படும் தகவல்கள் அரசு, வரைமுறை அதிகாரிகள் ஆகியோர்களுடன் பகிர்ந்து கொள்ள ஆராய்ச்சியாளர்களுக்கு அனுமதி அளிக்கிறேன். என்னுடைய தஸ்தாவேஜீக்கள்ள பார்வையிட அவர்களுக்கு உரிமை உண்டு.

11. என்னிடம் பெறப்படும் தகவல்களை பொதுவாக பிரசுரிக்கப்பட்டால், என்னுடைய அடையாளம் இரகசியமாக வைக்கப்படும் என்பதை அறிவேன்.

12. இந்த ஆராய்ச்சியில் பங்கேற்க தன்னிச்சையாக முழு மனதுடன் நான் சம்மதிக்கிறேன்.

இந்த ஆய்வின் போது எனக்கு என்ன சந்தேகம் ஏற்பட்டாலும் ஆராய்ச்சியாளரை தொடர்பு கொள்ளலாம் என்பதை அறிவேன். இந்த ஒப்புதல் படிவத்தில் கையெழுத்திடுவது மூலம் இங்கு தரப்பட்டிருக்கும் அனைத்து தகவல்களும் தெளிவாக கூறப்பட்டு என்னால் முழுமையாக புரிந்துகொள்ளப்பட்டது என்பதை சான்றளிக்கிறேன். இந்த ஒப்புதல் படிவத்தின் நகல் என்னால் பெற்றுக்கொள்ளப்பட்டது.

பங்கேற்பவரின் கையொப்பம் இடம்:

கட்டைவிரல் ரேகை : தேதி:

பங்கேற்பரின் பெயர் :

ஆய்வாளரின் பெயர் :

இடம் :

தேதி :

MASTERCHART

NAME	IP NO	AGE	SEX	CAUSE OF ULCER	AREA TO BE GRAFTED	GRAFT HARVESTED SITE	DAY 5 TAKE % ON RECEPIENT SI' TUMESCENT TECHNIQUE	DAY 5 TAKE % ON RECEPIENT SITI NONTUMESCENT TECHNIQUE	DAY 10 DONOR SITE HEALING % TUMESCENT TECHNIQUE	DAY 10 DONOR SITE HEALING % NONTUMECENT TECHNIQUE	FINAL OUTCOME AFTER 3 WEEK TUMESCENT TECHNNIQUE	FINAL OUTCOME AFTER 3 WEEKS NON TUMESCENT TECHNIQUE
CHINNAMAL	89358	56	F	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	100	95
ROSY	2E+05	43	F	TRAUMATIC	LEG	THIGH	100	95	100	95	100	100
MAARIYAMMAL	1E+06	40	F	UNKNOWN BITE	LEG	THIGH	100	95	100	95	100	100
KANNAIRAM	4E+05	55	M	UNKNOWN BITE	PLANTAR ASPECT OF FOO1	THIGH	95	90	100	95	95	95
ELUMALAI	38765	54	M	UNKNOWN BITE	PLANTAR ASPECT OF FOO1	THIGH	95	90	100	95	95	90
PERUMAL	2675	52	M	TRAUMATIC	LEG AND FOOT	THIGH	100	95	95	95	100	100
SOORYA	10007	37	M	TRAUMATIC	ANKLE AND FOOT	THIGH	90	95	100	95	90	90
MOHAMMED NISHAR	85647	42	M	UNKNOWN BITE	LEG AND FOOT	THIGH	90	95	100	95	90	90
MOHAN	35624	27	M	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	100	95
SELVI	76543	56	F	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	95	95	100	100
SRIDEVI	98764	53	F	TRAUMATIC	ANKLE AND FOOT	THIGH	100	95	100	95	95	95
MADHAVI	22342	41	F	BURNS	DORSUM OF FOOT	THIGH	90	95	100	95	100	100
KALPANA	76534	32	F	UNKNOWN BITE	LEG AND FOOT	THIGH	85	90	100	95	90	90
KRISHNAVENI	39827	47	F	BURNS	PLANTAR ASPECT OF FOO1	THIGH	100	95	100	95	100	100
MANORANJAN	76354	33	M	TRAUMATIC	PLANTAR ASPECT OF FOO1	THIGH	100	95	100	95	100	95
HARI	28365	35	M	UNKNOWN BITE	LEG	THIGH	95	95	100	95	100	100
SIVAKUMAR	19032	43	M	TRAUMATIC	DORSUM OF FOOT	THIGH	95	90	95	95	95	95
KAMALA	54763	38	F	TRAUMATIC	ANKLE AND FOOT	THIGH	100	95	100	95	100	100
SENTHIL	86735	38	M	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	100	100
PRABAKAR	87365	64	M	BURNS	LEG AND FOOT	THIGH	100	95	100	95	100	100
KANNIYAPPAN	38754	38	M	TRAUMATIC	LEG	THIGH	100	95	100	95	100	100
KARTHIK	3E+05	55	M	TRAUMATIC	DORSUM OF FOOT	THIGH	95	95	95	95	95	95
CHELLAKANNU	9E+05	43	F	UNKNOWN BITE	LEG AND FOOT	THIGH	95	95	100	95	95	95
KANNIYAMMAL	96354	49	F	TRAUMATIC	LEG	THIGH	95	90	100	95	95	90
ANJALA	26357	50	F	TRAUMATIC	LEG	THIGH	100	95	100	95	100	100
SIVA	1E+05	52	M	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	100	100
MARY	67567	44	M	UNKNOWN BITE	THIGH	CONTRALATERAL THIGH	90	95	100	95	100	100
NAGARAJAN	63534	42	M	TRAUMATIC	DORSUM OF FOOT	THIGH	95	90	95	95	95	95
SARAVANAN	62534	51	M	TRAUMATIC	LEG	THIGH	100	95	100	95	95	100
BALAKRISHNAN	8E+05	34	M	TRAUMATIC	THIGH	CONTRALATERAL THIGH	100	95	100	95	100	100
RAMAMOORTHY	84539	44	M	TRAUMATIC	ANKLE AND FOOT	THIGH	100	95	100	95	95	100
TIMOTHY	75463	36	M	UNKNOWN BITE	THIGH	CONTRALATERAL THIGH	95	95	100	95	100	100
CHAKRAVARTHY	29187	56	M	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	95	100
VIJAYKUMAR	37645	38	M	TRAUMATIC	THIGH	CONTRALATERAL THIGH	95	95	100	95	95	100
PAVITHRA	32928	36	M	TRAUMATIC	ANKLE AND FOOT	THIGH	95	95	100	95	95	95
RANGANAYAKI	1E+05	36	F	TRAUMATIC	THIGH	CONTRALATERAL THIGH	95	95	100	95	100	100
KANNAN	7E+05	41	M	UNKNOWN BITE	DORSUM OF FOOT	THIGH	100	95	100	95	100	100
PANDIYAN	8E+05	45	M	TRAUMATIC	DORSUM OF FOOT	THIGH	100	95	100	95	100	100
DEVARAJ	3E+05	54	M	TRAUMATIC	DORSUM OF FOOT	THIGH	95	95	100	95	95	95
GOPAL	33425	61	M	TRAUMATIC	LEG	THIGH	95	95	100	95	95	95
GOPIKA	74634	54	M	TRAUMATIC	ANKLE AND FOOT	THIGH	95	95	100	95	100	100
MANIKANDAN	33324	55	M	TRAUMATIC	ANKLE AND FOOT	THIGH	100	95	100	95	100	100
MUNIRASU	98765	45	M	TRAUMATIC	THIGH	CONTRALATERAL THIGH	100	95	100	95	95	95
PACHAYAPPA	76854	43	M	TRAUMATIC	LEG	THIGH	95	95	100	95	100	100
SREEDHAR	63527	42	M	TRAUMATIC	LEG	THIGH	95	95	100	95	90	90
PAANDURANGAN	44658	48	M	TRAUMATIC	LEG	THIGH	100	95	100	95	95	95
KURUVAMMA	93876	46	F	TRAUMATIC	LEG	THIGH	100	95	100	95	100	100
RAAKAYEE	3E+05	37	F	TRAUMATIC	ANKLE AND FOOT	THIGH	100	95	100	95	100	100
POOVAEE	25674	47	F	TRAUMATIC	DORSUM OF FOOT	THIGH	95	95	100	95	100	100
KUPPU	98476	42	F	TRAUMATIC	LEG	THIGH	100	95	100	95	95	100