Anton Rosenthal

Split Skin Thickness Donor Site Re-epithelization: Planimetric Analysis and Investigation of Healing Variations Under Cotton Gauze Dressing

Master's Thesis

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1. Abstract

**Research Aim:** To investigate the clinical efficiency of cotton gauze in split thickness donor wound: epithelization speed, complications, patient outcome and other variables.

**Objectives:** To analyze indications for STSG and evaluate healing variables such as: infection rate, pain, exudations, adherence of the dressing and planimetry of the wound.

**Methodology:** In this study 40 patients which met the criteria were assigned for treatment of a STSG DSW with cotton gauze. The primary outcomes were time to re-epithelization and complications, secondary outcomes were pain during rest and movement.

**Results:** The main indications for STSG were burns (47%) and chronic ulcers (40%). Mean time to re-epithelialization was 15.2 days. There was significant correlation between platelet count and time to re-epithelialization (p=0.034, r=-0.336). Mean pain score at day 1 postoperatively was 3.00 and gradually decreased to 1.40 and 0.80 at days 9 and 12, respectively. From day 9 there was significant positive correlation between pain scores and DSW area (p<0.04). 15% complication rate was observed, which included bleeding and partial deattachment of the dressing due to excessive exudations. There was positive correlation between complications and time to re-epithelialization (p=0.034).

**Conclusions:** Time to re-epithelialization is influenced by platelet count and prolonged by complications. Pain scores associated with DSW area and significant after day 9 postoperatively.
2. Conflicts of interest

The author *reports* no conflicts of interest related to this study
3. Clearance issued by the Ethics Committee

This study was a part of bigger research preformed by Prof. Rytis Rimdeika MD PhD and Mindaugas Kazanavicius MD. M. Kazanavicius was accompanying and present in all patient encounters.
# 4. Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC</td>
<td>Complete blood count</td>
</tr>
<tr>
<td>CC</td>
<td>Correlation coefficient</td>
</tr>
<tr>
<td>DSW</td>
<td>Donor site wound</td>
</tr>
<tr>
<td>Hb</td>
<td>Hemoglobin</td>
</tr>
<tr>
<td>Htc</td>
<td>Hematocrit</td>
</tr>
<tr>
<td>LSMULKK</td>
<td>Lithuanian University of Health Sciences “Kauno Klinik”</td>
</tr>
<tr>
<td>PLT</td>
<td>Platelets</td>
</tr>
<tr>
<td>RBC</td>
<td>Red blood cell</td>
</tr>
<tr>
<td>SG</td>
<td>Skin graft</td>
</tr>
<tr>
<td>STSG</td>
<td>Split thickness skin graft</td>
</tr>
<tr>
<td>TrE</td>
<td>Time to re-epithelialization</td>
</tr>
<tr>
<td>WBC</td>
<td>White blood cell</td>
</tr>
</tbody>
</table>
5. Terms

Donor Site Wound– a wound, which created after harvesting skin graft.

Flat – is a surgical technique, in which tissue is lifted from the donor site and moved to its recipient site while maintaining intact blood supply.

Primary Intension – a term describing union of accurately inline wound edges, with minimal scarring and granulation tissue.

Secondary Intension – a term given to a wound that left open and healing occurred by granulation tissue, contraction and re-epithelialization.

Skin Graft – a piece of skin or skin substitute which transplanted to a new site.
6. Introduction

Split thickness skin grafts are commonly used in surgical procedures to close defects in which primary intention cannot be done. In many cases, it's preferable over secondary intentions and surgical flaps. Most common indications include large traumatic cutaneous lesions, burns, chronic ulcers or for cosmetic purposes. Harvesting the graft produces a secondary superficial clean wound, donor site wound, which contains variable components of the dermis. Due to this fact, the regeneration of the DSW involves migration of keratinocytes from the wound margins and from skin appendages (e.g. sebaceous glands, hair follicles) located in the remaining dermis and subcutaneous tissue. This process is called re-epithelialization, and it lasts on average 14 days, if no complication arises.

A proper management is needed for the DWS to decrease the rate of infections, promote faster healing, and provide comfort and pain-free postoperative period. Additionally to the routine postoperative antibiotics and analgesics, proper dressing of the DWS is recommended. Until this day, there isn't sufficient clinical data to recommend a specific dressing that would benefit the patient while staying cost-effective. Blood imbued gauze dressing is the oldest conventional dressing, which still commonly used by many surgeons. It can be dry or drug impregnated, and it's considered cheap. It's associated with undesirable outcomes such as pain, infections, high adherence rate to the wound and inability to absorb much exudate. Although, the gauze dressing has a long history, there aren't enough clinical data about its efficiency, in terms of epithelialization speed, pain and irritation scores, and complications rate.

In this research, we will evaluate the efficiency of the gauze dressing in correlation with DWS size and patients' variable (e.g. age, sex, CBC). Additionally, based on the clinical studies analysis and clinical experience reported from “Kauno Klinikos” Department of Plastic and Reconstructive Surgery, it is believed that the rate of complications (e.g. active bleeding, exudations, adherence and infections) in DSW healing under gauze cotton dressing is 10%.
7. Aim and objectives

**Aim:** To investigate the clinical efficiency of cotton gauze in split thickness donor wound: epithelization speed, complications, patient outcome and other variables.

**Objectives:**

1. Analysis of indications for split thickness skin graft.
2. Evaluation of healing variables: infection, exudation, pain and adherence.
3. Planimetry of wound healing.
8. Literature review

8.1 Skin anatomy and histology

The skin is the largest and heaviest organ in the body, with a surface area ranging from 1.5 to 2m², contributing to 1/6 of body weight. The skin consist of 3 layers, epidermis, dermis and a fatty subcutaneous tissue below them. The average thickness of the epidermis and dermis is 2 to 3 mm. The skin is penetrated by three systems (lymphatic, vascular and neurological) which connect it to the rest of the body and provide it with basic functions, as nutrition and oxygen supply, toxin removal, fluid balance, sensation and immune responds[1-3].

The superficial skin layer, epidermis, which contributes 5% of the skin thickness, contains no blood supply. Due to this fact, its’ basic metabolic functions (nutrition supply, waste and toxins disposal) fully dependant on the dermal layer. Histologically, the epidermis composed of keratinized stratified squamous epithelium, compose primary from keratinocytes along with a small populations of melanocytes, merkel cells and migratory cells (langerhands cells and intraepidermal T cells). It could be divided into 5 cellular layers (from deep to superficial): stratum basale, stratum spinosum, stratum granulosum, stratum lucidum and stratum corneum. Stratum lucidum is a thin layer found only in thick epidermis. Straum basale contains a pool of epithelial stem cells which keratinocytes originate from and migrate to the outer layers, this process takes on average 10 days. Straum basale and straum spinosum compose together the Malpighian layers, the regeneration of this layer takes on average 19 days. Stratum corneum composed of anucleated keratinocytes filled with keratin filaments and amorphous protein matrix surrounded by cornified envelope. This layer provides most of the barrier functions (against microorganisms, water and chemicals) of the epidermis. In stratum basale melanocytes could be found, they produce melanin which protect the
skin against UV radiation and responsible for the characteristic pigmentation of the skin. The Langerhans cells, are migratory cells and part of the immune system, they responsible to identify, process and present antigens. Merkel cells are specialized cells responsible for the perception of light touch\cite{1-3}.

The more deeper dermis contribute the rest 95% of the skin thickness. Its main function is to support the epidermis. It composed of two layers, the thin outer papillary layer and thick inner reticular layer. Additionally, it contains the skin appendages; sebaceous glands, sweat glands, apocrine glands and hair follicles, these structures play a major role in re-epitheliazation. These intradermal epithelial structures contains a pool epithelial stem cells with the ability to proliferate and migrate. The population of cells include mainly dermal fibroblasts and migratory immune cells (mast cells, macrophages and leukocytes). The location of the fibroblast stem cells is unclear, but one hypothesis suggests the hair follicles as the source. The dermal fibroblast synthesis collagen fibers which provide it with its strength. The collagen produced is mainly 80% type I, 15% type III and traces of type V and VI. The vascular supply of the dermis is provided by the cutaneous arteries which form small plexuses within it. The dermis also contains rich supply of sensory nerves, autonomic fibers and lymphatic plexuses\cite{1-3}.

The subcutaneous layer, is the last most inner layer of the skin. The dominant cells in this layer are the adipocytes. The main functions of this layer are thermal isolation and energy source\cite{1-3}.

8.2 Wound physiology and healing process

A wound defined as a disruption of the normal anatomy and function of the skin. It can be classified as acute or chronic. Acute wound regeneration in a healthy individual will follow the sequence of normal physiological events. In the contrary, in case of a patient with underlying medical disorder (e.g. Diabetes Mellitus, Hypertension) the normal physiology is impaired causing a slower regeneration. In that case the wound would be defined as chronic wound\cite{4-6}.

The normal physiological regeneration of a wound is a complex process involving cellular, humoral and molecular mechanisms \cite{9}. There are several overlapping phases: hemostasis, inflammation, epithelialization, fibroplasia and maturation. The first phase, hemostasis, starts immediately after the injury and continue for 5 to 10 minutes. It involves vasoconstriction of small blood vessels, platelets activation and initiation of the coagulation
cascade. During that period, platelets release growth factors and cytokine which serves a role in attracting premature cells and stimulating proliferation. Platelets also have a positive influence on the immune respond at the site of the wound by attracting macrophages.\textsuperscript{[10,11]}

The next, inflammatory phase, last on average three days, involves increment of vascular permeability and recruitment of migratory cells (e.g. macrophages, mast cells). In cases of chronic wounds, the process of regeneration is arrested in this phase. Epithelialization begins at stratum basale, where proliferation and migration of basal cells occur. Additionally, in epidermal and superficial dermal wounds, as in cases of STSG, the skin appendages provides additional source of epithelial cells. Fibroplasia begins within the first 24 hours of injury and peak at the 10\textsuperscript{th} day. Major events in this phase include; fibroblast proliferation, migration and collagen production. The last phase of wound healing, maturation, includes collagen remodeling, wound contraction and repigmentation.\textsuperscript{[5-9,12,13]}

There isn’t a single factor causing impaired wound regeneration, but rather, multiple, accumulative events. Most common examples include; local ischemia due to peripheral vascular diseases, neuropathy effecting chemotaxis due to diabetes mellitus and uncontrolled wound edema which disrupt myofibroblast contraction and collagen maturation. Aging is another factor contributes to an impaired wound healing. With age there is loss cutaneous innervation, vascular supply and collagen production ability. This factor cannot be neglected. Infection is a major cause of impair wound healing by impairing the normal phase of inflammation and delaying the epithelialization phase.\textsuperscript{[5,12,13]}

Anemia is common factor assigned to poor wound healing. However, clinical studies have shown over and over again, that in healthy normovolemic patients, mild to moderate anemia alone wasn’t associated with impaired wound healing. Conditions which might accompany anemia, such as malnutrition, impaired blood supply and inflammation have a more dominant impact on wound healing abnormalities.\textsuperscript{[14,15]}

\textbf{8.3 Split thickness skin graft}

STSG is widely used in dermatological and plastical procedures to manage surgical wounds, postoperative defects (e.g. malignancy excision), chronic wounds, large traumatic wound, prevent fluid loss (e.g. burns) and for cosmetics purposes,\textsuperscript{[1,17,20,24]} especially when primary intention is not possible.\textsuperscript{[17]} Generally STSG are more suitable than surgical flaps or closure by secondary intention.\textsuperscript{[18]}
Skin grafts could be classified according to thickness; Full Thickness SG and Split Thickness SG (also called, partial thickness SG). Additionally STSG could be divided into thin (0.2-0.3mm), medium (0.3-0.45mm) and thick (0.45-0.75mm). The STSG layer involves all the epidermis and variable parts of the dermis [2].

Harvesting the graft could be performed from any area of the body, but preferable from hidden places and along with the patient wishes [2,16]. After harvesting the graft, a superficial flat wound is remain - STSG donor site wound. This wound regenerate by re-epithelialization from migration of keratinocytes originate from the wound margins and skin appendages left in the dermis and subcutaneous tissue (e.g. hair follicles, sebaceous glands and apocrine glands) [2,18]. The donor site is expected to heal within 7 to 14 days without complications, but can be prolong even to 21 days depending on the patient associated conditions [18,24]. In general, the more thinner the STSG the faster the recovery [2]. Subjectively, most patients are more irritated from the donor site wound then the primary wound [17,22].

8.4 Donor site wound management

Management of the donor site wound should include local dressing to promote re-epithelializing and comfort, and decreasing pain, irritation, blood loss and infections while been cost-effective [21,24]. Now days, there is not a superior dressing fulfilling all the requirements, and there isn’t enough clinical evidence to promote a specific one [14-18,22].

The traditional dressing commonly used is a non-occlusive gauze bandage imbued with patients’ blood, which may be dry or drug impregnated. It will peel itself step by step during the re-epithelialization process. When it’s finished the dressing will spontaneously fall off the donor site wound.

The results from Kaiser [16] study on 16 patients shown that the re-epithelialization time of paraffin gauze ranged from 9 to 23 with average of 15.4 days, low pain scores and no infections recorded. However, 4 (25%) of the patients needed a dressing change due to exudations and shifting of the dressing from the DSW. Another study on 15 patients using paraffin gauze, performed by Hasatsri [19] demonstrated re-epithelialization time of 14±6 days, pains scores ranging from 8/10 at day 1 postoperative decreasing up to 2/10 at day 5 postoperative. No record of infections, excessive exudations and shifting of the dressing.

B. S. Atiyeh had similar results preforming two studies [23,30] treating 15 patients with traditional dressing; re-epithelialization time of 10 to 12 days and no clinical evidence of
infections in both researches. Liu Jl's[26], Yoav Barnea's[27] and Visnu's[28] studies shown similar re-epithelialization time of mean 8, 10-14 and 11.2 days respectively, without complications.

A study performed by J. Terren[29] on 24 patients, reported re-epithelialization mean time of 10 days and infections rate of 12.5% (3 patients), with strong adherences of the traditional dressing to the donor wound. A higher rate reported in Smith D[32] study on 15 patients - 25% infection rate. From Hutchinson and McGuckin[31] analysis of 29 studies on traditional dressings in DSW management, which included 360 patients, the infections rates was found to be only 6.4%.

The advantages of the traditional dressing are its' low cost and easy accessibility. However, common disadvantages seen in many clinical studies include prolong re-epithelialization, adherence to the wound causing discomfort and irritation, and increased pain compare to the modern dressings. Postoperative management with analgesics is usually sufficient in reduction of pain and discomfort. Applying paraffin wax may decrease the adherence of the bandage to the DSW and decrease the irritation[16-32].
9. Research Methodology and Methods:

9.1 Patient selections and amount

During the period of February 2015 to November 2015, 40 patients who met the criteria were collected from “Kauno Klinikos” Department of Plastic and Reconstructive Surgery for prospective observational cohort study comparing outcome variables in the recovery of split-thickness skin graft donor site under cotton gauze dressing.

Each patient was evaluated for inclusion and exclusion criteria before the surgical procedure. After meeting all the requirements, the patient was given information about the study and consent was obtained.

9.2 Inclusion criteria

1. The patient has been hospitalized in LSMU “Kauno Klinikos” Department of Plastic and Reconstructive Surgery.
2. The patient suffered from skin lesion due to burns, trauma or ulcer and treated with split-thickness skin graft.
3. The donor site was bandaged with cotton gauze.
4. The patient is above 18 years of age.
5. The patient has given a verbal or written consent to participate in the study.

9.3 Exclusion criteria

1. The patient is pregnant.
2. The patient has no discussion making capacity due to a mental illness or due to other medical conditions.
3. The patient has an uncontrolled systemic disease (e.g. Diabetes Mellitus, Hypertension) or local diseases which might influence the recovery of the donor site.
4. Oncological patients who had received or will receive treatment with chemotherapy, radiotherapy or biological therapy.

9.4 Outcome variables

Primary outcomes were time to re-epithelization and complications (infection, exudation, adherence and bleeding). Secondary outcomes included pain during rest and movements.
9.5 Donor site selection

Theoretically, the donor site can be selected at any part of the body, but it’s preferred to be in a hidden, non-visible area such as the inner thigh or the gluteal area. Additionally, the patient’s wishes were taken into consideration.

General principles of donor site selections: upper extremities were used for a small and localized skin defect in the upper body while lower extremities (thigh and calf) were used for large defects in the lower part of the body.[2,16]

Other consideration which had taken into account: no previous traumas, scars or lesions at the donor site. Although, in cases of large skin lesions which requires multiple skin grafts, it’s possible to harvest a new graft from a previous donor site after an average of 6 weeks passed from the previous harvest, and only after it is fully healed.

9.6 Technique

All 40 split-thickness skin grafts were harvested using a standard technique[33] with a Zimmer electrical dermatome (Zimmer, Inc., Warsaw, Ind, USA) at a depth of 0.25mm, which include all the epidermis and part of the dermal layer. Then the donor site was covered with a sterile bandage imbued with the patients’ blood, which later dried up to form a hard surface over the wound. In any suspicion of vascular compromise at the donor site location, evaluation of the area by vascular surgeon was done.

During the preoperative period, patients’ blood samples were taken, for evaluation of RBC, Hct, Hb, WBC and PLT. All patients received intraoperative intravenous anesthesia, routine antibiotics and antiseptics. At postoperative day 1, the donor site surface area was measured using a simple planimetric technique[34] and a picture was taken (pic. 1-2).

9.7 Postoperative care and follow-up

The intervals of visitations were determined as 1, 3, 6, 9, 12 and 15 or until full re-epithelization. During each visit the wound healing parameters were evaluated, which include: pain during rest and movement, adherence level and signs of inflammation, exudation or infection.

The pain was assessed by using a VAS (visual analogue scale), a psychometric scale used to measure subjective pain, grading it from 0 to 10. When 10 is the worst pain the patient felt in his life, and 0 indicates no pain at all. The patient asked to grade the pain felt
over the area of the donor site while at rest, and after a mild to moderate movements. After full re-epithelization and removal of the bandage, the patient asked again to grade his pain.

On every visit, the donor site was assessed for any signs of infection or inflammation using standard criteria: increase in pain, redness, swelling and local skin temperature. Any changes were recorded, bandage change and local or systemic antibiotic were considered.

Additionally to the evaluation of the healing variables of the donor site, graft acceptance and rejection of the primary wound were assessed. During the first and second week postoperative, the primary wound was assessed by the surgeon, and graft acceptance/rejection evaluation was given using standard grading of percentages (e.g. 50%, 80%, 90% and 100%).

9.8 Statistical analysis

The statistical analysis was performed using IBM “SPSS” – Statistical Package for the Social Science, version 17.0 and Microsoft Excel. For evaluation of variable distributions and groups correlations the following tests were used: Kolmogorov-Smirnov Test, Chi-squared test, Student T-Test, Pearson Test and Mann-Whitney Test. A statistical difference between two groups defined as p < 0.05.

Pic 1. STSG donor site wound under gauze dressing, 1 day postoperatively. Left arm.

Pic 2. STSG donor site left arm on postoperative day 12, immediately after the fall of the gauze dressing. Adhesions of the gauze could be noticed.
10. Results and their discussion

Fourty patients fulfilled the inclusion criteria and were enrolled in the study. The study consisted of 16 females and 24 males, by conventional criteria, this difference is not considered to be statistical significance ($p = 0.2059$), see table 1.

<table>
<thead>
<tr>
<th>Table 1. Patients gender distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
</tbody>
</table>

The mean age of the patient was 60, ranging from 26 to 90 years. The mean age of the males and females was 54 and 69 years, respectively. The mean area of the donor site wound was $177 \text{ cm}^2$ and ranging from 20 up to $725 \text{ cm}^2$. Using Kolmogorov-Smirnov Test, the DSW size was found to consist with normal distribution.

The most frequent locations of the donor site wound were the left and right thighs, 13 and 19 respectively, see table 3. The etiologies which requires skin graft transplantation included; 19 burns (chemical, electrical, thermal and mixed), 16 chronic ulcers, 3 postoperative wound complications and 2 traumatic injuries, see figure 1.

<table>
<thead>
<tr>
<th>Table 2. Age and Primary outcome measures</th>
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</thead>
<tbody>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
</tr>
<tr>
<td>Median</td>
</tr>
<tr>
<td>Mode</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>Range</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Female Mean</td>
</tr>
<tr>
<td>Males Mean</td>
</tr>
</tbody>
</table>

10.1 Laboratory parameters assessment

As defined and used in practice at LSMULKK, normal laboratory parameters of RBC, Hb, Hct, WBC and PLT shown in table 4. According to these standards, there were 10 mild normovolemic anemic patients and 20 moderate normovolemic anemic patients enrolled in the study. As it was mentioned in the literature, mild to moderate normovolemic anemia had no influence on the re-epithelialization time.
Additionally, there were 10 patients with leukocytosis and 21 patients with thrombocytosis. With no clinical evidence of infections, these parameters were contributed to the general inflammatory state of the patient.

### Table 3. DSW Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Frequency</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Arm</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Left Calf</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Left Thigh</td>
<td>13</td>
<td>32.5</td>
</tr>
<tr>
<td>Right Arm</td>
<td>3</td>
<td>7.5</td>
</tr>
<tr>
<td>Right Buttock</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Right Thigh</td>
<td>19</td>
<td>47.5</td>
</tr>
</tbody>
</table>

### Table 4. Normal CBC parameters and Patients’ CBC in correlation with TrE

<table>
<thead>
<tr>
<th></th>
<th>RBC $(10^{12})$</th>
<th>Hb (g/L)</th>
<th>Hct (%)</th>
<th>WBC $(10^3)$</th>
<th>PLT $(10^9)$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td>4.4 - 5.6</td>
<td>135 - 169</td>
<td>40 – 49</td>
<td>3.9 – 8.8</td>
<td>166 – 308</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>3.9 – 5.1</td>
<td>119 - 149</td>
<td>37 - 44</td>
<td>4.4 – 9.7</td>
<td>173 – 390</td>
</tr>
<tr>
<td><strong>Pearsons’ Correlation</strong></td>
<td>0.234</td>
<td>0.204</td>
<td>0.280</td>
<td>-0.176</td>
<td>-0.336</td>
</tr>
<tr>
<td><strong>p value</strong></td>
<td>0.146</td>
<td>0.207</td>
<td>0.08</td>
<td>0.279</td>
<td>0.034</td>
</tr>
</tbody>
</table>

10.2 Time to epithelialization

The mean time to re-epithelialization was 15.2 days, and range from minimum of 10 days and up to 23 days, see table 2. Using the Mann-Whitney Test, the gender difference was excluded as a confounding factor ($p=0.549$). Using Spearman’s rho test, we excluded age of the patient ($CC = 0.1$, $p = 0.538$) and DSW area ($CC = -0.428$, $p = 0.06$) as influencing factors. Using one-sample Kolmogorov-Smirnov Test, it can be said that our results followed normal distribution. Additionally, according to Pearson Test, assessing the laboratory tests, it was found that only the platelet count had followed negative correlation with the time to full re-epithelialization (see table 4). A regression equation and plot was made to demonstrate the correlation between those variables (see figure 2).
10.3 Assessment of pain

Postoperative pain scores were assessed until day 12, for the purpose of maintaining an adequate number of patients for statistical power. The pain scores during rest at day 1 were perceived with a mean score of 3.00 and gradually decreased below 1.40 and 0.80 at days 9 and 12, respectively. The mean values of resting pain scores at days 1, 3, 6, 9, 12 shown in Figure 3. Wilcoxon Signed Ranks Test, shown a statistical significant decrease in pain scores between every visitation (p<0.03). Mann-Whitney Test was used to exclude gender influence on pain scores (p>0.264, in days 1 to 12), the common belief was that women complain more frequently and rate higher pain scores than men\cite{35-38}.

Using Spearman’s rho Test, we assessed the correlation between age and pain scores\cite{36,38}, and it was found that there is no statistical significant correlation (p>0.05 in all days). Significant positive

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure2.png}
\caption{Regression Plot}
\textbf{Time to re-epithelialization on y axis. Platelets count on x axis.}
\textit{Regression equation:}
\[ y = 17.316 - 0.006 \times x \]
\[ r = -0.336 \]
\[ p=0.034 \]
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{Figure3.png}
\caption{Average resting pain score VAS on days}
\end{figure}
correlation ($p<0.04$) between pain scores from days 9 to 12 and the area of the DSW was seen, see figure 4. From day 9, 20 patients continued to complain on pain, 95% confidence interval was made; $x = 244.6 \pm 1.96 \times 44.49$, compare to the 20 patient who reported pain score of 0; $x = 110.83 \pm 1.96 \times 16.803$. It is seen clearly that as the DSW area getting bigger, the odds that the patients will continue experiencing pain after day 9 increasing.

The mean pain scores during movement were 3.8 at day 1 and gradually decrease to 2.22 and 1.75 at days 9 and 12, respectively. As it would be expected there was a strong correlation ($CC = 0.923$, $p<0.01$) between pain in rest and movement.

10.4 Assessment of complications

There were six complications (15%), the complication rate did not reject our primary hypothesis about 10% complication associated with DSW under gauze dressing ($p = 0.501$). These complications included; one case of partial dressing detachment due to excessive exudations, and five cases of active bleeding from the DSW. Five of the complications happened during the first five days, while two active bleeding happened during the second week of recovery (at days 12 and 15). Additionally, it’s important to note, that all DSW locations were on the thighs, and the active bleeding were initiated during the night. Although, it was reported in the literature about significant rate of infections (ranged from 6.4% to 25%), there were no clinical evidence of infections, which assessed by signs of redness, warmth, purulent exudation.

The adhesion rates couldn’t be assessed, majority of the patients discharge before full re-epithelialization, and their subjective evaluation of the DSW is inadequate. For each patient a paraffin wax prescribed, it was applied at the late stages of the wound recovery to ease the irritation and decrease adhesions of the gauze. There were no association between rate of complications and sex, age, DSW area and laboratory abnormalities. T-Test and Mann-Whitney Test, showed strong positive correlation ($p = 0.034$) between complications and increase time to full re-epithelialization. Random sampling of 22 uncomplicated cases to increase the statistical power, yield no new results.
11. Conclusions

- In this observational study of 40 patients, the belief that the rate of complications is 10% in STSG donor site re-epithelialization under cotton gauze dressing, was not rejected by the studies findings.
- The main indication for the operation was burns (47%) followed closely by chronic ulcers (40%).
- Main graft harvest location were the thighs (80%), although all the complications were at that location, there was not enough data to link between them.
- The pain scores were considerably low and associated with DSW area, with clinical significance after day 9.
- Gender and age of the patient had no influence on the pain scores.
- Time to full re-epithelialization, as mentioned in the literature review, was found to be associated with platelet count, which might be a confounding factor, further studies in this matter are needed.
- Mild to moderate normovolemic anemia had no association with wound healing.
- In cases where complications arise, a prolong re-epithelialization should be expected.
12. References


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