



Ideal Wound Closure Methods for Minimizing Scarring after Surgery: A Study in a Tertiary Care Hospital

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Abstract

Background: The healing of open cutaneous wounds involves the generation of vascularized granulation tissue that closes the gap in the skin. Thereafter, an effective epidermal barrier is created over the granulation tissue. Wounds in which sutures have approximated the edges also undergo granulation, albeit less than in open wounds that must heal by secondary intention. In both cases, the adherence of the wound edges becomes stronger over time. This study aimed to analyze the ideal wound closure methods for minimizing scarring after surgery. **Material & Methods:** This prospective observational study was conducted at Ibn Sina Medical College Hospital in Kallyanpur, Dhaka, Bangladesh from January 1st to December 30th, 2022. The study included a sample of 50 patients. A subcutaneous super-tension-reduction suture was used to minimize wound-closing tension by applying maximum tension reduction on both the dermis and subcutaneous tissue, away from the incision. The sampling technique used in this study was based on the operative technique. This suturing technique resulted in elevated wound edges centrally, creating a bump after tying the buried knot. Informed written consent was obtained from all study participants, and ethical clearance was obtained from the hospital's ethical review committee. **Results:** The wounds healed primarily in 49 cases. The bump at the incision began to flatten out after 2 to 3 months and was almost completely flat by 12 months postoperatively. The use of a subcutaneous super-tension-reduction suture can greatly decrease tension on the dermis and the subcutaneous tissue. **Conclusion:** To reduce tension on the dermis, much deeper structures should be accessed, such as the superficial and deep fascia, and suture them. Another way to prevent pathological scar formation in high-tension areas is to use zigzag suturing techniques such as Z-plasty.

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INTRODUCTION

Scars result from the deposition of collagen fibrils by fibroblasts following a dermal disruption. Surgical incisions are often healed by primary intention, the most expedient form

of wound healing, which always results in some degree of scarring. The process of primary wound healing involves four phases: hemostasis, inflammation, the proliferation of fibroblasts with extracellular matrix (ECM) deposition and new vessel formation, and

remodeling, in which collagen fibers and other ECM molecules are reorganized into mature scars. Imbalance or stress during any of these phases can lead to a prolonged healing process, susceptibility to infection, and increased fibrosis and scarring. Scarring may cause social and psychological effects beyond cosmesis.^[1] Multiple techniques can be used for wound closure. These include sutures, staples, and adhesives. Staples For many minor wounds, sutures are the gold-standard method for closure. In a case where you have a linear laceration located on the scalp or extremities, it is a reasonable alternative to use staples. The advantage is that they can be placed quickly. This is immensely useful in situations where there is brisk bleeding and in mass casualty settings where there are multiple wounds to which to attend. They are also widely used to close postoperative incised wounds. Staples are cost-effective, easily placed, require minimal training, and have similar healing times and infection rates as sutures. Sutures In primary wound closure, sutures are the standard of care. There are two types of sutures, absorbable and non-absorbable. Non-absorbable sutures are preferred because they provide great tensile strength, and the body's chemicals will not dissolve them during the natural healing process. Non-absorbable sutures are used primarily to close superficial wounds; whereas, absorbable sutures can be placed in a double-layer closure for deeper wounds. In doing so, absorbable sutures help decrease the tension and better approximate the wound edges. This will allow for a lower risk of wound dehiscence and a more aesthetically pleasing outcome.^[2,3,4] The siting of an incision and the choice of wound closure may have profound effects on the success of an operation and the patient's

lasting perception of their surgeon.^[5] The risk of pathological scarring can be greatly reduced by using subcutaneous/fascial tensile reduction sutures. This is because dermal sutures do not effectively reduce tension on the dermis: rather, to achieve this, we must access much deeper structures, namely, the superficial and deep fascia, and suture them. This type of suturing will elevate the wound edges smoothly while placing minimal tension on the dermis. In other words, it will cause the wound edges to attach naturally to each. In the case of benign tumor excision or scar revision surgery in high-tension areas such as the chest wall, the cutaneous mass should be completely excised along with a minimum of normal skin margin and all fatty tissues under the mass. Hence, all tissues above the deep fascia of the muscle are removed. The wound edges are then undermined under the deep fascia, and the deep fascia is sutured. After fascial suturing, dermal sutures are started. This is followed by superficial sutures with 6-0 polypropylene or nylon sutures such as Prolene.^[6,7,8]

Objective

General Objective

- To determine the performance of ideal wound closure methods for minimizing scarring after surgery

Specific Objectives

- To see the phases of wound healing.
- To know the outcome among the patients.

MATERIAL AND METHODS

This prospective observational study was conducted at Ibn Sina Medical College Hospital

in Kallyanpur, Dhaka, Bangladesh from January 1st to December 30th, 2022. The study included a sample of 50 patients. A subcutaneous super-tension-reduction suture was used to minimize wound-closing tension by applying maximum tension reduction on both the dermis and subcutaneous tissue, away from the incision. The sampling technique used in this study was based on the operative technique. This suturing technique resulted in elevated wound edges centrally, creating a bump after tying the buried knot. Informed written consent was obtained from all study participants, and ethical clearance was obtained from the hospital's ethical review committee. The collected data were edited, coded, and analyzed using SPSS software (Version 23.0). Descriptive and inferential statistical analyses were performed to evaluate the effectiveness of the Ideal Wound Closure Methods for Minimizing Scarring After Surgery. The results were presented using diagrams, pie charts, and tables. The inclusion and exclusion criteria of this study were as follows:

Inclusion Criteria

- Patients of >15 years old.
- Patients of both sexes.
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Patients with surgical complications.
- Patients who did not give consent to participate in the study.
- Patients with chronic diseases.

RESULTS

a. The fatty tissues are removed along with the scar or tumor. b. Undermining between the deep fascia and the muscle is performed. c. The deep and superficial fasciae are then sutured to release the tension on the dermis. The red lines indicate where the tissue is incised and undermined. Dermal sutures themselves do not effectively reduce tension on the dermis. To achieve this, we must access much deeper structures, namely, the superficial and deep fasciae, and suture them. [Figure 1]

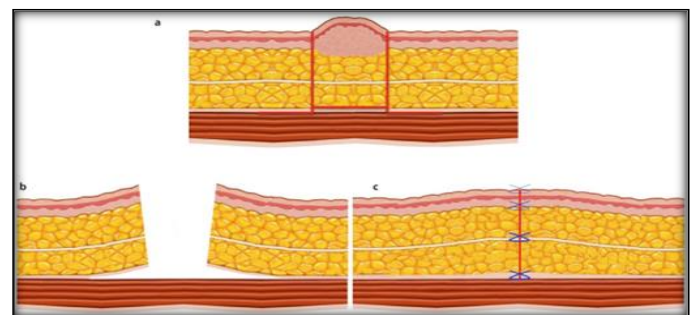


Figure 1: Suturing techniques for minimizing the tension on the dermis.

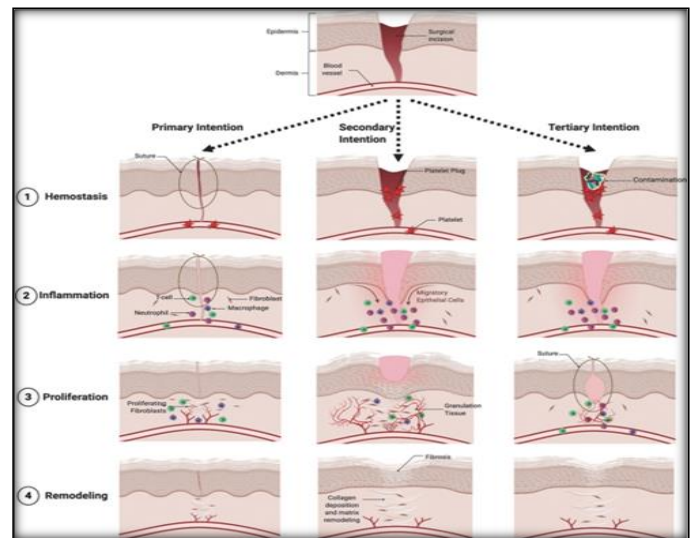


Figure 2: Phases of wound healing in the context of primary, secondary, and tertiary intention wound healing

Table 1: Outcome among the patients (N=50).

Variables	N	%
Healed	49	98.0
Duration of flattening of scar (months)	12	-
Relapse of scar	01	2.0

Wounds healed primarily in 49 (98.0%) cases. The bump at the incision began to flatten out after 2 to 3 months and was almost completely flat by 12 months postoperatively. The use of a subcutaneous super-tension-reduction suture can greatly decrease tension on the dermis and the subcutaneous tissue.

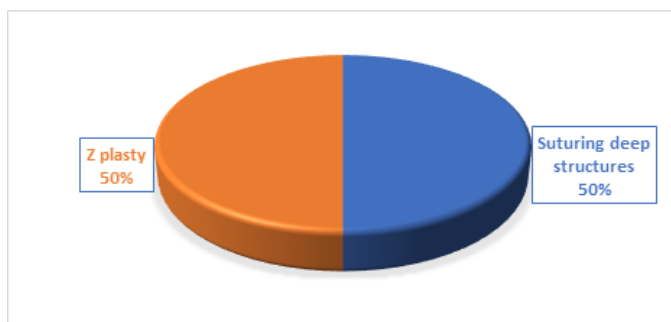


Figure 3: Methods of wound closure (N=50).

DISCUSSION

The risk of pathological scarring can be greatly reduced by using subcutaneous/fascial tensile reduction sutures. This is because dermal sutures do not effectively reduce tension on the dermis: rather, to achieve this, we must access much deeper structures, namely, the superficial and deep fascia, and suture them. This type of suturing will elevate the wound edges smoothly while placing minimal tension on the dermis. In other words, it will cause the wound edges to attach naturally to each. Only then should dermal and superficial sutures be used.^[9] In this study, wounds healed primarily in 49 cases. The bump at the incision began to flatten out after 2

to 3 months and was almost completely flat by 12 months postoperatively. The use of a subcutaneous super-tension-reduction suture can greatly decrease tension on the dermis and the subcutaneous tissue. A study stated, due to continuous collagen remodeling it takes around 12-18 months for the scar to mature and gain tensile strength of 70-80% of uninjured skin. Immature scars are prone to hypertrophy and give poor results after scar revision. Adjunct treatments like the use of silicone sheets and intralesional steroid injections can be given during this period. However, if early intervention is needed it is wiser to do it only after 8-12 weeks in adults and 6 months in children smaller than 7 years of age.^[10] A well-balanced diet is essential for good protein synthesis. Vitamins A, C, E, and zinc help in wound healing. Herbal supplements and medicines that increase bleeding should be stopped 3 days to 2 weeks before scar revision.^[11] is based on geometrical principles and is the most commonly used technique for scar revision. This technique has several advantages: it irregularities a linear scar, making it less noticeable; changes the direction of the scars and aligns them to the RSTLs; helps in lengthening the webbed or contracted scar; and it helps change the position of a displaced anatomical point by elevating or depressing it. Two components determine the performance and tissue lengthening of Z-plasty-the size of the angle and the length of the center line of 'Z', called the common diagonal (common limb or

common member).^[12,13] While doing Z-plasty, the original scar is used as the common diagonal. In the classical Z-plasty, from each end of this common diagonal, two arms of the same length (to avoid puckering).^[14] as the common diagonals are extended in opposite directions. An angle of 60° is formed between the arm and the common diagonal. This angle determines the degree of lengthening of the tissue, the larger the angle, the greater the length gain. An angle of 60° in Z-plasty gives a gain of 75% in tissue length and changes the scar direction by 90°. An angle of 30° lengthens the scar by 25%, an angle of 45° by 50%, an angle of 75° by 100%, and an angle of 90° by 125%.^[15] An angle < 60° though easier to transpose, results in less scar lengthening and realignment of < 90°. Whereas, an angle > 60° is avoided as it increases the force required for transposing the flaps, making the closure difficult.

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

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CONCLUSIONS

This study suggested, to reduce tension on the dermis, much deeper structures should be accessed, such as the superficial and deep fascia, and suture them. Another way to prevent pathological scar formation in high-tension areas is to use zigzag suturing techniques such as Z-plasty.

Recommendations

Management of incisional scars is intimately connected to stages of wound healing. The management of a surgical incision does not end when the sutures are removed. Surgical scar care should be continued for one year. Patient participation is paramount in obtaining the optimal outcome. Postoperative visits should screen for signs of scar hypertrophy and has a dual purpose of continued patient education and reinforcement of proper care. Moreover, further studies should be conducted involving a large sample size and multiple centers.



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