



## Subcutaneous Skin Closure: Technique with Literature Review

### KEYWORDS

Wound Closure, Subcutaneous Layer, Subcutaneous Loop

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**ABSTRACT** *Wound closure techniques have evolved from the earliest development of suturing materials to comprise resources that include synthetic sutures, absorbable, staples, tapes, and adhesive compounds. Aesthetic closure is based on knowledge of healing mechanisms and skin anatomy as well as an appreciation of suture material and closure technique. The subcutaneous tissue also called the hypodermis, hypoderm, subcutis, or superficial fascia, is the lowermost layer of the integumentary system in vertebrates. Removal of subcutaneous tumors or masses results in a hollow defect. The ideal approach to closure is one which respects aesthetic boundaries, achieves closure under minimal tension, causes the least alteration in tissue planes, and yields the most favorable results with the fewest complications. The subcutaneous loop is an easily performed and reproduced technique, which prevents the feared consequences of dead space that result from deep skin defects. It yields the benefits of reduced suture cost, and has both a functional and aesthetically pleasing result.*

### Introduction

Medicine arose out of the primary sympathy of Man with Man, out of his desire to help those in sorrow, disease and suffering. Wound, a breach in the surface of the body, can be caused by accident, assault, warfare & surgical operations. The healing of such wounds has always been central consideration in surgical practice. So, understanding of the various mechanisms of healing and factors affecting it is of prime importance for successful practice. Healing is the final outcome of inflammation. A surgeon's role in wound management is to create an environment in which the healing process can be preceded in optimal fashion.<sup>1</sup>

Wound closure techniques have evolved from the earliest development of suturing materials to comprise resources that include synthetic sutures, absorbable, staples, tapes, and adhesive compounds. The engineering of sutures in synthetic material along with standardization of traditional materials (eg, catgut, silk) has made for superior aesthetic results. Similarly, the creation of natural glues, surgical staples, and tapes to substitute for sutures has supplemented the armamentarium of wound closure techniques. Aesthetic closure is based on knowledge of healing mechanisms and skin anatomy as well as an appreciation of suture material and closure technique. Choosing the proper materials and wound closure technique ensures optimal healing.<sup>2</sup>

### Subcutaneous Layer

The subcutaneous tissue (from Latin *subcutaneous*, meaning "beneath the skin"), also called the hypodermis, hypoderm subcutis, or superficial fascia, is the lowermost layer of the integumentary system in vertebrates. The types of cells found in the hypodermis are fibroblasts, adipose cells, and macrophages<sup>3</sup>. The hypodermis is derived from the mesoderm, but unlike the dermis, it is not derived from the dermatome region of the mesoderm. In arthropods, the hypodermis is an epidermal layer of cells that secretes the chitinous cuticle<sup>4</sup>.

A layer of tissue lies immediately below the dermis of vertebrate skin. It is often referred to as subcutaneous tissue though this is a less precise and anatomically inaccurate term. The hypodermis consists primarily of loose connective tissue and lobules of fat. It contains larger blood vessels and nerves than those found in the dermis.

Subcutaneous tissue consists of<sup>5</sup>:

- Fibrous bands anchoring the skin to the deep fascia
- Collagen and elastin fibers attaching it to the dermis
- Fat, except in the eyelids, clitoris, penis, much of the pinna, and scrotum
- Blood vessels on route to the dermis
- Lymphatic vessels on route from dermis
- The glandular part of some sweat glands; mammary glands lie entirely within the subcutaneous tissue (which are modified apocrine sweat glands)
- Cutaneous nerves and free endings
- Hair follicle roots
- Ruffini and Pacinian corpuscles
- Mast cells
- Bursae, in the space overlying joints in order to facilitate smooth passage of overlying skin
- Fine, flat sheets of muscle, in certain locations, including the scalp, face, hand, nipple, and scrotum, called the panniculus carnosus

In some animals, such as whales and hibernating mammals, the hypodermis forms an important insulating layer and/or food store.

Subcutaneous fat is the layer of subcutaneous tissue that is most widely distributed. It is composed of adipocytes, which are grouped together in lobules separated by connective tissue. The number of adipocytes varies among different areas of the body, while their size varies according to the body's nutritional state. It acts as padding and as an energy reserve, as well as providing some minor thermoregulation via insulation. Subcutaneous fat is found just beneath the skin, as opposed to visceral fat, which is found in the peritoneal cavity, and can be measured using body fat calipers to give a rough estimate of total body adiposity. It is thickest in the buttocks, palms, and soles<sup>6</sup>.

Even today, there is a search for ideal suture material. Suture materials can be broadly classified as naturally occurring and synthetic. They can be further classified as monofilament or multifilament (braided), dyed or undyed, coated or uncoated. Several parameters, such as tensile strength, breaking strength, elasticity, capillarity and mem-

ory are used to describe physical characteristic of sutures. In general, braided sutures are more prone to infection and induce greater degree of tissue reaction. Advantages of braided sutures include ease of handling, low memory and increased knot security. A monofilament suture is a single material. These sutures have decreased tendency of infection, ease of passage through tissue and ease of removal. They possess poor handling characteristics and decreased knot security<sup>7</sup>.

### Characteristics of an Ideal Suture

Ideal suture material should<sup>8</sup>:

1. Have good handling characteristics
2. Not induce significant tissue reaction
3. Allow secure knots
4. Have adequate tensile strength
5. Not cut through tissue
6. Be sterile
7. Be non-electrolytic
8. Be non-allergenic
9. Cheap

Removal of subcutaneous tumors or masses results in a hollow defect. The ideal approach to closure is one which respects aesthetic boundaries, achieves closure under minimal tension, causes the least alteration in tissue planes, and yields the most favorable results with the fewest complications. Prompt fusiform suturing is usually favored unless the wound involves a specific area that heals well by second intention. In instances where the lesion is deep, the surgical defect must be closed primarily in order to counteract tissue pulling forces and prevent a gaping scar upon healing<sup>9</sup>. Prevention of the consequences of dead space during skin surface closure can be achieved by inserting a drain or by use of subcutaneous sutures. Performing interrupted absorbable sutures for closure in layers is a widely accepted choice. The surface may then be closed with interrupted or continuous sutures. Intradermal sutures have been demonstrated to effectively prevent the consequences of remaining dead space. Recurrent events of cutaneous foreign body reactions to nonabsorbable monofilament sutures led us to develop a novel technique. We report a modification of the vertical mattress (Donati), which permits closure of the dead space avoiding the use of absorbable subcutaneous sutures.

### Technique

The technique we introduce begins like the suture suggested by Donati by closing symmetrical skin defects that are superficially wide and narrow upon approach to the deeper wound surface using the far-far, near-near system. Our subset of patients, have subcutaneous defects specifically equal or wider at the deeper aspect than at the surface. Following the first far entrance of the needle, the subcutaneous loop is undertaken. A bite from the deep opposing wall of the defect is taken, exiting at a different point along the vertical or horizontal plane at that same wall of the wound. Next a bite from the opposing wall of the first entrance of the defect, including a fair amount of the deep tissue wall, is taken.

Distances should be judged to assure a close approximation to the various planes of the defect at the level of the subcutaneous tissue. The exit, with a far passage as a normal vertical mattress suture, is planned and performed. The depth of the additional loop as well as the size of the bites on each of the walls is determined by the specific size and shape of the deep aspect of the given wound.

We suggest placing all sutures in advance to hold ends in position with hemostats. The knots are tied only after the last suture is in place. This facilitates visualization and access to the base of the defect.

The suture should be tied gently. Application of moderate tension of the ligature, as with the classic mattress, will satisfactorily tighten the deep tissue loop; and no exceptional skill is necessary for this maneuver. Excessive pulling on the knot will create more eversion of the edges and produce excess tension, tissue necrosis, and scarring. This excess tension can also tear the skin at the near-near placement site. With milder tension the natural process of wound inflammation and scar retraction pulls loops of suture that lie on the skin surface downward. Sutures are symmetrically placed, because if the loops of suture are not placed at equal depths and equidistantly from the wound edge, the wound will come together with one edge higher than the other, creating a shelf that usually results in a cosmetically and functionally inferior scar.

We describe a technique that combines the advantages of both the vertical mattress and subcuticular sutures, hopefully providing the added benefit of each of these methods in one single suture. Layered closure is advocated for the prevention of dead space and the additional asset of continued tissue strength beyond removal of the superficial sutures. It obliterates dead space within the wound that would otherwise fill with blood or exudate. However, a "fat stitch" is not necessary because little support is provided by closure of the adipose layer, and the additional suture material required to close the wound may enhance the possibility of infection.

A separate approximation of subcutaneous layers hastens the healing and the return of function to the muscle. Layered closure is particularly important in the management of facial wounds. If a deep, gaping wound is closed without approximation of underlying subcutaneous tissue, a disfiguring depression may develop at the site of the wound. Finally, layered closure is expected to provide support to the wound and considerably reduce tension at the skin surface. Taking all these pros into account, we set out to institute a technique that prevents early dead space formation, but allows suture removal upon demand and endows an acceptable aesthetic result.

Recently, the Donati suture has been commended as an aesthetically favorable suture in comparison to a continuous superficial stitch<sup>10</sup>. The major advantage of the mattress suture technique is that it promotes skin edge eversion. Some authors believe that a properly placed vertical mattress suture everts wound edges better than any other suture technique. Wounds over mobile surfaces, such as the extensor surfaces of joints, should be everted and, in time, the scar will be flattened by the dynamic forces acting in the area. Scars also tend to retract over time; eversion of the wound edges at the time of closure promotes less prominent scarring. In our experience, the use of a monofilament thread of the lowest friction coefficient facilitates smooth performance of this suture.

The finesse of our modification entails an individualized choice of the planes, the size, and orientation of the bites of the deep suture loop. These may either be vertical, oblique, or horizontal to facilitate apposition of the distant deep surfaces. When the thread of the subcutaneous loop is pulled, the defect is closed without dimpling or tension under the surface of the superficial suture line. In the larg-

est defects closed, an additional pass of the needle was added at the extreme deep base of the wound in between both deep walls.

This ensured snug apposition of all the sides together. The results obtained were equally favorable when this technique was used over different anatomic regions. Cautious selection of locations that are not under tension is pertinent before deciding to choose the subcutaneous loop technique, since the main disadvantage is the limited remaining tensile strength of the wound after early suture removal. Therefore, it is essential to warn the patient of the problems of stretching the scar and a poor aesthetic result if the suture is removed too soon. Thus, a careful selection of cases will confer the greater benefits of each approach. The subcutaneous loop technique is simple and inexpensive, providing good final results, particularly in areas of lax skin.

### Conclusion

The subcutaneous loop is an easily performed and reproduced technique, which prevents the feared consequences of dead space that result from deep skin defects. It yields the benefits of reduced suture cost, and has both a functional and aesthetically pleasing result. Experience with this procedure may even reduce wound closure time. The main advantage of this method is that it will not subject the patients to the rare, though significant side effects of retained absorbable sutures, thereby constituting a favorable technique for wounds demanding simultaneous and subcutaneous repair.

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