

REVIEW ARTICLE

Wound Closure-Alternatives to Sutures

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Abstract

Suturing remains the gold standard of wound closure. The technique of wound closure by means of needle and thread emerged several thousand years ago. The introduction of both new surgical devices and reengineered existing devices leads to modifications of traditional tasks and allows for the development of new surgical techniques. The on-going introduction of new devices and continuing technical improvements in existing surgical devices are changing the way surgeons perform traditional tasks. This review summarizes all the available alternatives to sutures, focusing on their current and prospective indications in the clinical forum.

Keywords: Sutures, surgical staples, skin clips, fibrin glue

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Introduction

Suturing remains the gold standard of wound closure. The technique of wound closure by means of needle and thread emerged several thousand years ago. The introduction of both new surgical devices and reengineered existing devices leads to modifications of traditional tasks and allows for the development of new surgical techniques. The on-going introduction of new devices and continuing technical improvements in existing surgical devices are changing the way surgeons perform traditional tasks. This review summarizes all the available alternatives to sutures, focusing on their current and prospective indications in the clinical forum.

Surgical Staples

Surgical stapling was developed in 1908 by HumerHultl. The original instrument was massive, weighing 7.5 pounds. Von Petz modified the instrument and provided a lighter and simpler stapling device, and in 1934 Friedrich of Ulm designed an instrument that resembled the modern linear stapler. The most significant recent modification has been the introduction of absorbable staples (Lactomer). Stapling devices usually apply two rows of

staples, offset in relation to each other to produce sound anastomosis. Many of them divide the bowel or tissue to which it has been stapled.¹

Indications

Staples are particularly advantageous for large truncal and extremity excisions, scalp reductions and for securing split thickness grafts.

Advantages

The main advantage of staples is that they permit rapid wound closure. A long wound can be stapled in 25%-50% less time than it can be sutured. Staples can also reduce tissue trauma if correctly placed. Staples are very strong and are very useful for closing wounds under significant tension. Staples also provide excellent wound eversion and are relatively painless to remove.

Disadvantages

Staples are not ideal for all wound closures. Although for most wounds they provide adequate cosmesis, they may be less appropriate for fine cosmetic closures on the face.

The staple should be placed so that it rides high. This correct placement prevents tissue strangulation as swelling occurs and avoids cross-hatching. Although study results differ, some reports have shown that with potentially contaminated wounds, staples may decrease the

chance of infection compared with sutures. Staples may be left in the wound for weeks with little tissue reaction because they are made of inert steel.

To remove staples, specially designed staple extractors are available. They are similar in shape to suture removal scissors but have broader tips.

Figure 1:Closing the Suture with Surgical Staples¹



Skin Tapes

Ambroise Pare, the French military surgeon, introduced the use of stitched strips of linen adhesives to close saber wounds. Modern skin tapes are relatively non-occlusive and yet have excellent adhesive characteristics. The microporous surgical tapes with a backing of viscous rayon fibers coated with an adhesive copolymer are impervious to blood and purulent material.

Figure 2: Skin Tapes²



Advantages

- Minimizes the opportunity for wound dehiscence.
- It allows earlier suture or staple removal.
- Skin tapes may be reapplied to the wound for long periods of time to provide continuous support to the wound edges.
- May discourage scar expansion.
- In children, selection of skin tapes avoids the ordeal of suture replacement and removal.

- Skin tapes do not effectively evert the edges of the wound, and they readily loosen when wet by blood or serum.
- They have less inflammatory reaction and lower rate of wound infection
- Greater tensile strength
- Better cosmetic results than sutured or stapled wounds.
- Needle puncture marks and suture canals are eliminated.
- Strangulation and necrosis of tissues is avoided because of gentle handling of tissue. Foreign body granulomas and cellulitis are avoided.
- Sterile paper tape is non-expensive and convenient alternative with which to close wounds.¹

Miller has said the following about sutureless gingival grafting²:

1. Suturing a gingival graft is the most time consuming stage of the grafting procedure, especially in regions of difficult access.
2. Instead of suturing, bandage tape should be placed on the attached gingiva on either side of the graft. The success of the procedure depends on complete hemostasis as any moisture prevents the tape from adhering to the gingiva.
3. The advantages of using bandage tape are
 - The graft lies flat on the recipient site and is kept under slight pressure by the tape.
 - Minimal blood clot is present between the graft and the recipient site.
 - The “wick” effect is eliminated. (Sutures allow fluids to penetrate through them from outside, which could easily cause infections).
 - Chair-side time is greatly reduced.
 - Patient discomfort is less.²

Skin Clips

Advantages

- Skin clips produce a very neat scar with good wound eversion and a minimal cross hatching effect.
- They can be placed faster than suture insertion.
- Have lower predisposition to infection, as they do not penetrate the wound entirely.
- Do not produce a complete track from one wound edge to the other.

Disadvantages

- They can be uncomfortable for the patient.
- They require a special instrument to remove them.
- They are an expensive method for wound closure than simple suture techniques.³

Tissue Adhesives

Tissue adhesives represent a group of natural and artificial compounds that are currently used for a variety of local applications including hemostasis and wound closure⁴.When applied to a wound, this material rapidly polymerizes, forming a firm and adhesive bond. The wound should be clean, dry and able approximated without tension. The wound edges should be approximated accurately before applying the adhesive, as the polymerization is very rapid and mistakes can occur.³They comprise of the following:

Autologous fibrin glue

Autologous fibrin glue is a biologic adhesive consisting of fibrinogen, factor XIII, fibronectin, thrombin, aprotinin and calcium chloride.Fibrin glue is "Fibrin Fibronectin Sealing System (FFSS)". It is available as two component system: first component contains highly concentrated fibrinogen, factor XIII, fibronectin, and traces of other plasma proteins. The second component contains thrombin, calcium chloride, and antifibrinolytic agents such as aprotinin. Mixing of two components promotes clotting with the formation and cross-linking of fibrin⁵.Fibrin glue works as an adhesive by emulating the exudative phase of wound healing. The preparation of the glue is easy and can be done on the morning of operation with approximately 200ml of autologous blood. Significantly increased stress, energy absorption, and elasticity values resulted from the use of fibrin glue with a fibrinogen concentration of nearly 39gm per liter, a thrombin concentration of 200-600 units per ml, and no added factor XIII. The autologous fibrin glue is prepared from single donor human plasma, eliminating the danger of multidonor pools.

A Review article on ‘Can use of fibrin glue in periodontal flap surgery be an alternative to suturing?’ by Shlipashetty et al; (2015) in a research article reported that fibrin sealant

can form a better alternative and an effective means for fixing tissues after periodontal surgery⁶

Fibrin seal adhesive

Fibrin sealants are the most successful tissue adhesives to date. Fibrin seal adhesive is a two component system (Tissucol) derived from the whole blood. When mixed, the elements reproduce the final pathway of blood coagulation to form a viscous adhesive that maintains tissue approximation.

Cyanoacrylate

Numerous encouraging experimental and clinical reports advocate the use of cyanoacrylate tissue adhesives for repair of organs or as hemostatic agents in emergency situations. However, when cyanoacrylate is applied to skin closure, the polymer acts as a barrier, prevents wound apposition, delays healing, and increases the infection rate.¹

Figure 3: Cyanoacrylate Tissue Adhesive¹



Advances in Wound Closure

- 1.Growth factor impregnated suture** – Animal studies have shown beneficial effects of the slow release of growth factors impregnated in absorbable suture into the wound.
- 2.Anastomotic clips** – Various vascular surgery and microsurgery anastomotic ring clips have been developed to replace the more time consuming suture methods.
- 3.More practical fibrin sealant** – The current fibrin sealant systems require refrigeration of the component ingredients and mixing just prior to use, making them impractical for battlefield wounds and bedside procedures. Work is underway to make the ingredients stable at room temperature⁷.

Conclusion

The options available for wound closure are large. All the alternatives to sutures explained has its own advantages and disadvantages. Every practitioner should keep himself abreast with the ever expanding field of suture technology so as to provide the patient with the best treatment possible.

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