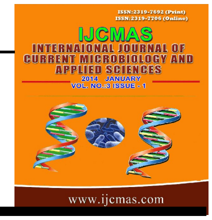
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 1 (2014) pp. 18-22**
http://www.ijcmas.com



Review Article

Advance approaches for skin closure

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A B S T R A C T

Keywords

Laproscopic scar; Cyano-acrylates; Photo-chemical Tissue Bonding.

Since ancient times suturing has been used as skin closure method. Many advancements has been come in front in types of suturing such as absorbable, non-absorbable,various material in manufacturing of suture. Other closure methods include skin staples, full thickness cuticular sutures, surgical tape, and skin adhesives. Then tissue adhesives such as Cyanoacrylates have been recognized. Recently Light-activated protein crosslinking technology is being developed for attaching tissue surfaces with a water-tight, strong bond and for forming engineered tissues with unique properties. For attaching tissues, the technology is called Photochemical Tissue Bonding (PTB).In this article we will review about above mentioned advance in skin closure

Introduction

Traditionally, laparoscopic scar sites have been closed using subcuticular sutures. Other closure methods include skin staples, full thickness cuticular sutures, surgical tape, and skin adhesives (Fig.1).

Cyanoacrylates have been recognized for decades as excellent tissue adhesives (Hollander et al., 1995). They are easy to use, cost-effective, and provide good cosmesis (JAMA, 1997; Maw et al., 1997). Skin adhesives have been used extensively in the closure of pediatric extremity, head, and neck lacerations. Use of cyanoacrylates in otologic and described (Quinn et al., 1997; Singer and Hollander, 1997).

Octylcyanoacrylate (Dermabond, Ethicon; Somerville, NJ) is a new generation, long-chain cyanoacrylate tissue adhesive. It is a combination of monomer and plasticizers that form a flexible bond but has a breaking strength comparable to 5-0 monofilament suture. Multiple clinical applications for which it is commonly being used exist. However, no studies compare its use in closing laparoscopic scar sites.

Fig.1 Traditional closure methods

Why Look For Alternatives To Sutures?

Increased patient demands for more "pleasing" ways of closure.
Something which will forgo the requirement of regular dressings of the wounds.

For the surgeons, which will save time in wound closure and regular checkup visits for removal of the sutures.

History

Cyanoacrylate is the generic name for substances such as methyl-2-cyanoacrylate, which is typically sold under trademarks like Superglue and Krazy Glue. In our part of the country we regularly use it as FEVI KWIK.

Cyanoacrylate was discovered by *Harry Coover* at Eastman Kodak during World War II when searching for a way to make synthetic gun-sights (a substitute for spider silk). It did not solve this problem, since it stuck to all the apparatus used to handle it. It was first marketed to industry as well as consumers in February 1955 as a product called "Flash Glue" which is still available today. It was patented in 1956 and developed into *Eastman 910* adhesive in 1958. The new glue was demonstrated in 1959 on the television show *I've Got a Secret* when the host Garry Moore was lifted into the air by two steel plates held together with a drop of *Eastman 910*. Cyanoacrylates are now a family of adhesives based on similar chemistry.

Properties

Cyanoacrylate is the generic name for substances such as methyl-2-cyanoacrylate.In its liquid form, cyanoacrylate consists of monomers of cyanoacrylate molecules. Methyl-2-cyanoacrylate (CH_2=C(CN)$COOCH_3$ or $C_5H_5NO_2$) has a molecular weight equal to 111.1, a flashpoint of 79 °C, and 1.1 times the density of water. Ethyl-2-cyanoacrylate ($C_6H_7NO_2$) has a molecular weight equal to 125 and a flashpoint of 75 °C.

Exclusion Criteria

Incision wounds within the hairline.
Stellate lacerations.
Patients whose GC is deemed unfit for surgery.
Patients having known allergy to cyanoacrylates or formaldehyde.
Patients who are not likely to come back for a long time followup.

Inclusion Criteria

Patients requiring extra-oral surgical incisions for exposure
Patients whose incision line is minimum 5 cm in length.
Patients who were declared medically fit for the surgery.
Patients who agreed to turn up periodically to our institution for regular followup for am minimum period of 6 months.

Figure.2 Structure of Cyanoacrylate

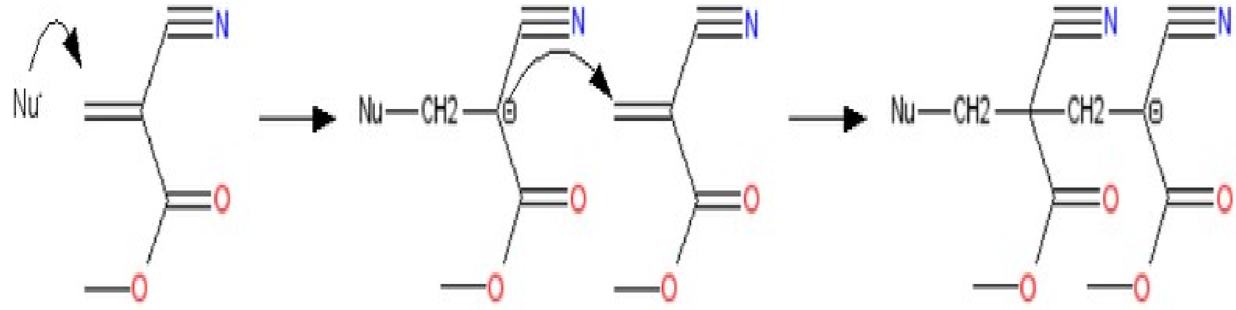
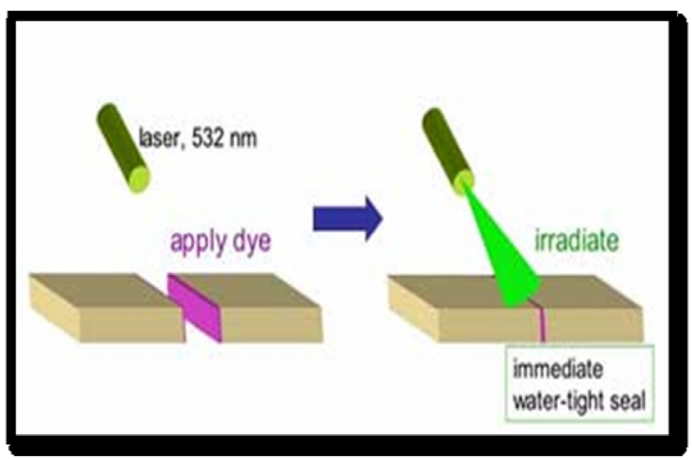


Figure.3 Schematic diagram of the Photochemical Tissue Bonding process for attaching tissues



Light-Activated Tissue Repair

Light-activated protein crosslinking technology is being developed for attaching tissue surfaces with a water-tight, strong bond and for forming engineered tissues with unique properties. For attaching tissues, the technology is called Photochemical Tissue Bonding (PTB). PTB has demonstrated advantages over conventional sutures, staples and glues in a wide variety of surgeries. These technologies were invented and developed in the Kochevar and Redmond laboratories over the last seven years.

In the PTB process, a light-sensitive dye is applied to the tissue surfaces, the surfaces are placed in contact and the dye-stained area is exposed to visible radiation that does not cause thermal damage. An immediate, water-tight strong bond is produced without additional glues or proteins

PTB produced excellent tissue repair and healing in preclinical studies using Rose Bengal (RB) as the dye. Rose Bengal is FDA-approved for diagnosis of ocular surface damage. Clinical lasers emitting cw green light (532 nm) are used.

Surgical applications include sealing corneal incisions and corneal transplants (Hollander et al., 1995; JAMA, 1997; Maw et al., 1997)' closure of skin incisions and excisions (Quinn et al., 1997)' attachment of skin grafts ' reattachment of peripheral nerves with improved outcomes (Coover et al., 1968; Ellis and, Shaikh, 1990; Mizrahi et al., 1988)' anastomosis of small blood vessels (Applebaum et al., 1993), reattachment of small tendons (Singer et al., 1998) and sealing incisions in hard-to-suture vocal fold (manuscript submitted). A pilot clinical study demonstrated that PTB produced less scarring than topical epidermal sutures after closure of surgical skin wounds (manuscript in preparation). Light-activated crosslinking of proteins has also been used in the generation of neocartilage (Quinn et al., 1998).

Photocross linking of proteins has significant advantages over sutures and staples for tissue repair such as-

PTB does not stimulate inflammation or cause additional damage to tissue, thus reducing fibrosis and scarring.

Very small structures that require time-consuming microsurgery can be rapidly joined with less damage using PTB. Soft, delicate, difficult-to-suture tissues can be readily joined with PTB.

An immediate, water-tight seal is formed.
Photochemical crosslinking of proteins also has significant advantages over chemical crosslinking for bioengineered tissues as follows-

Degree of cross linking can be controlled by amount of light delivered
Cross linking stops when light is turned off
Non-toxic for cells within the gel.

The use of cyanoacrylate for skin closure in laparoscopic skin incisions is effective and economical. This method of skin closure has been proven to provide adequate cosmesis. It is much quicker to close these incisions with octylcyanoacrylate than suture. The technique for closure is easy to learn and not technically demanding. This leads to shorter overall operating times, lower cost, and greater efficiency in wound closure.Also Photocheical crosslinking of proteins is also advantageous over the traditional method as skin closure.

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