



Analyzing the Novel and Noninvasive Zipline™ Suture and Comparing It with Stapler

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ABSTRACT

Aims The skin suture is one of the inseparable sections of all surgeries; therefore, using noninvasive methods could be very applicable. The skin stapler is one of the methods which is commonly used for skin and is fast. This is while it is risky and may lead to an infection and undesirable cosmetic results. The current study aimed to analyze the noninvasive Zipline™ suture and to compare it with the stapler.

Materials and Methods This experimental study was conducted at the University of Isfahan and 15 operating room technicians who experienced all three methods of suturing were questioned. The noninvasive Zipline™ suture was structurally analyzed and tested for the power of skin protection and flexibility by tensioning. An artificial skin was tested and tensioned 1cm from each side and the space of the incision between the edges was measured.

Findings The Zipline™ suture had a low incision edge space, a good cosmetic outcome, low pain, and low risks of developing an infection considering the viewpoints of those who voted. The structure of Zipline™ which was zigzag led to a high rate of flexibility from one side and created more strength from another side.

Conclusion A high strength rate and installation speed of this noninvasive suture (Zipline™) which can be used in many operations and substitute for invasive sutures. It should be considered that the Zipline™ suture can only be used for the skin and the suture of dermal tissue should be tightly done before using in surgeries.

Keywords Skin; Surgical Procedures; Surgical Stapler; Wound Infection; Suture

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Introduction

Applying a variety of available methods of joining edges of a wound, known as a suture, has changed a lot from the years and different methods and materials have been developed to improve the related conditions. One of the easiest models, widely used these days, is the use of a variety of suture threads and needles which can be applied for sewing various skin layers and subcutaneous tissues. Considering joining edges of a wound and knitting patterns, typical sutures have different types, each of which can be greatly used in relevant situations. However, this method is invasive and can bring about numerous risks and problems [1, 2].

One of the most commonly used types of skin suturing is skin stapling which is conducted by a special tool which staples two edges of the skin. This method is really fast and time-saving; however, it is very invasive and accompanied with several disadvantages including pain, high risk of infection, more severe scarring, and difficulty during removal [3]. Moreover, there are other methods, such as using glue, which in turn have some advantages and disadvantages. All the disadvantages of invasive methods have led to the creation of different ideas. One of these noninvasive and novel methods used to join edges of a wound is known as Zipline™. This method, due to the absence of an object inside an incision and lack of any needles or staple pins, accompanies with the least pain and scars after restoration [4]. This type of suture is completely noninvasive and, because of not having any interactions with the inside of an incision, has a high perfusion compared to other methods [5, 6]. This method can be applied to all surgical procedures with a flat cut including knee replacement, hip replacement, spinal cord, cesarean section, and open-heart surgeries. Furthermore, other studies indicated that one of the benefits of this method is the ability to use it in non-sterile and non-aesthetic conditions and in cases where suturing an incision takes a longer period of time [7] like in patients that are at risk of colloidization [8].

The aim of the present study was to analyze the novel and non-invasive Zipline™ suture and to compare it with Stapler.

Materials and Methods

This experimental study was conducted at the University of Isfahan and 15 operating room technicians who experienced all three methods of suturing were questioned.

The non-invasive Zipline™ suture has a very simple structure and this type of suture consists of two rows of polyurethane elastic films that have hydrocolloid glue under and around the sutures. There are a number of nylon locks and straps on

these films which are responsible for approximating edges of a wound. These locks are connected to each other decussated. The connection side of these locks increases the strength of sutures for transmitting the force both longitudinally and transversely and using the elasticity of the film, the unconnected side provides a possibility to increase the length of sutures. This type of suture was manufactured in the USA and is a product made by Zipline Medical Company (Figure 1).

The zigzag shape of this type of suture can create conditions for increasing the length which is highly applicable to joints location (Figure 2) [9]. Additionally, in terms of length increase, in this type of suture, unlike other sutures, edges of a wound are brought closer to each other.

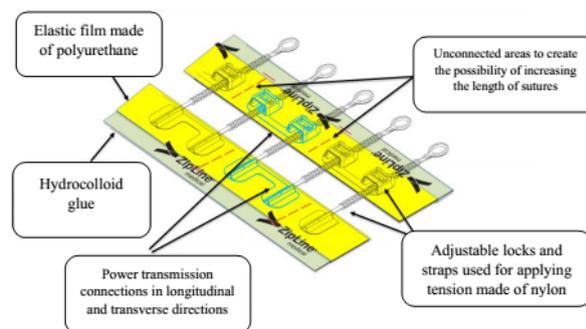


Figure 1) The structural details of the Zipline™ suture

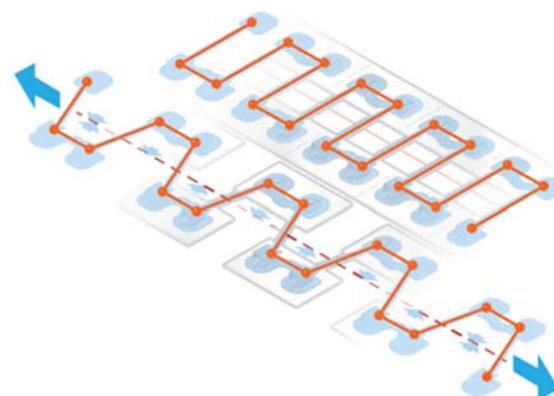


Figure 2) The zigzag structure of the Zipline™ suture which gives it the ability to increase the length

The method of conducting this type of suture is in a way that, first, if it is necessary, all subcutaneous sutures are properly and regularly carried out in a way that the distance between the edges of the skin is about 3mm. Then, the skin is carefully dried and the skin glue is exactly applied in the location of the incision in the space between the films. After ensuring that the straps are fully stuck, they are pulled unilaterally. This joins the edges of the wound together quickly and accurately.

The test carried out in this study aimed to measure the power of skin protection in the interface with a

transverse tension. To examine this performance, initially, the same size incisions were created on an artificial skin made of polyurethane. Afterward, on another model, the noninvasive Zipline™ suture was used for another model of the stapler. Each of these samples was individually tensioned 1cm from each side.

In addition, a survey was conducted on 15 technicians who used these methods.

Findings

The Zipline™ suture had a low incision edge space, a good cosmetic outcome, low pain, and low risks of developing an infection considering the viewpoints of those who voted. The structure of Zipline™ which was zigzag led to a high rate of flexibility from one side and created more strength from another side (Table 1).

Table 1) The results obtained from the tension testing and the survey

	Zipline™	Skin staple
1cm transverse tension	0.37mm	1.96mm
Scar after a surgery	*	
Pain complaints by a patient	*	
Installation speed		*
Risk of inflammation and infection	*	
Ease of removing sutures	*	

Surveys were conducted based on this rule that * indicates the best performance.

The first row shows the amount of displacement of the incision edges relative to the transverse tension.

Discussion

The aim of the present study was to analyze the novel and non-invasive Zipline™ suture and to compare it with Stapler.

Given the conducted examinations and the recorded results, when using the noninvasive Zipline™ suture, in the case of the transverse tension of about 1cm from each side, the edges of the wound were only displaced for 0.37mm [10]. This, on its own, is a factor for reducing the risk of infections. In terms of displacement, the edges of the stapled wound had greatly moved. Moreover, the surveys and the results of the questionnaires indicated that in terms of installation speed, despite being very favorable, it is not faster than the skin stapler [5]. Considering the scar left after the skin stapler, the results are more frustrating [4]; however, in the Zipline™ suture, due to the absence of an external object, the least inflammation, infections, and scars can be left using the simplest way possible [11]. During the removal of the skin staples, the condition is not favorable enough and in some cases, there is a need for local anesthetic and a tool to remove them who are accompanied by pain. This is while considering the Zipline™ suture, this feels like gently removing some glue from the skin. To perform this procedure more easily, it is possible

to immerse the sutures in hot water and/or use a lubricant for a few minutes.

The limitations of this research were the novelty of the Zipline suture which lesser physicians and technician were familiar with it and the suggestions are compared the different type of sutures in animal or human base study related to cosmetic properties.

Conclusion

A high strength rate and installation speed of this noninvasive suture which could be used in many operations and substituted for invasive sutures. It should be considered that the Zipline™ suture can only be used for the skin and the suture of dermal tissue should be tightly done before using in surgeries.

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