JOURNAL OF THE MECHANICAL BEHAVIOR OF BIOMEDICAL MATERIALS 63 (2016) 386–389

Available online at www.sciencedirect.com

ScienceDirect

www.elsevier.com/locate/jmbbm

Short Communication

Buried absorbable polyglactin 910 sutures do not result in stronger wounds in porcine full thickness skin incisions

Katy L. Townsend[a,*], *William Lear*[b], *Bria L. Robertson*[c], *Jamie J. Kruzic*[c]

[a]*Veterinary Clinical Science, College of Veterinary Medicine, Oregon State University, Corvallis, OR 97330, USA*
[b]*JULVIA Technologies Inc., Corvallis, OR 97330, USA*
[c]*Materials Science, School of Mechanical, Industrial, and Manufacturing Engineering, Oregon State University, Corvallis, OR 97330, USA*

ARTICLE INFO

Article history:
Received 26 April 2016
Received in revised form
23 June 2016
Accepted 30 June 2016
Available online 7 July 2016

Keywords:
Wound
Strength
Buried suture
Pig
Polyglactin 910

ABSTRACT

Objective: To test the hypothesis that the mechanical strength of wounds closed with a combination of buried dermal absorbable sutures and superficial nonabsorbable nylon sutures will be higher than wounds closed with only superficial nonabsorbable nylon sutures.

Methods: Four Yucatan pigs were anesthetized and each received four 4.5 cm full thickness incisions on their dorsal surfaces, placed 8 cm apart. Half of all incisions were randomly allocated and repaired with 3–0 polyglactin 910 (Vicryl™) buried dermal absorbable sutures and superficial 3–0 nylon sutures, using a simple interrupted pattern. The other half received only 3–0 nylon sutures. Two pigs were humanely euthanized at day 10, with specimen harvest for mechanical testing; the other two pigs had superficial nylon sutures removed at day 10, as per current clinical practice, and were humanely euthanized at day 42, with specimen harvest for mechanical testing. Tensile loads were applied perpendicularly to the wounds with a displacement rate of 40 mm per minute.

Results: Wounds at day 42 were >9 times stronger than wounds at day 10 ($p<0.0001$). There was no difference in average wound strength at either day 10 or day 42 between wounds with and without buried dermal absorbable sutures.

Significance: Buried dermal absorbable sutures failed to provide additional wound support at either 10 or 42 days. This result may have immediate implications for clinicians who perform cutaneous surgery and keep superficial sutures in for at least 10 days. Future research will be directed to shorter time studies, other buried dermal absorbable suture materials, and alternatives to buried dermal absorbable sutures.

*Corresponding author.
E-mail addresses: katy.townsend@oregonstate.edu (K.L. Townsend), bill@julvia.com (W. Lear), roberbri@oregonstate.edu (B.L. Robertson), jamie.kruzic@oregonstate.edu (J.J. Kruzic).

http://dx.doi.org/10.1016/j.jmbbm.2016.06.033

1. Introduction

1.1. Significance

Full thickness skin wound closures of surgical operations or traumatic lacerations are often closed with a combination of buried dermal absorbable (BDA) sutures and superficial non-absorbable (SNA) sutures (Adams et al., 2006). The BDA sutures are placed in the mid to lower dermis and are formed so that the knot lies in the deep dermis or subcutaneous layer while the SNA sutures are placed more superficially, with their knots on the surface of the skin (Fig. 1). BDA sutures are widely used and promoted to provide several weeks of support as a wound heals, hopefully providing added strength after SNA suture or staples are removed at 5–14 days after the procedure (Miller et al., 2015; Tajirian and Goldberg, 2010).

1.2. Existing literature

The evidence supporting the role of BDA sutures in wound strength is largely based on experimental data in which intact strands of absorbable suture are inserted and remain in a body cavity of a living animal for various time periods (Wound Closure Biomaterials and Devices, 1996). The strands are removed at various time points and tested for retention of original breaking strength (Wound Closure Biomaterials and Devices, 1996). Polyglactin 910 suture (Vicryl™), the most frequently-used absorbable suture for cutaneous surgery (Adams et al., 2006), is widely cited to have 40% of its original strength at 3 weeks (Tajirian and Goldberg, 2010). While some studies in the literature have directly compared strength of cutaneous wounds repaired with different forms of absorbable sutures (Zaruby et al., 2011), we are unaware of studies that have attempted to answer how much extra strength is present in wounds closed with the combination of BDA and SNA sutures versus SNA sutures alone.

2. Materials and methods

2.1. Choice of animal model

Yucatan miniature white hairless swine were chosen for their similarity to human skin (Swindle et al., 2012). Swine skin has similar epidermal-to-dermal ratios to human skin, with similar hair follicle morphology. Like human skin, it also heals primarily by reepithelialization rather than by contraction. However, swine skin also has far fewer eccrine glands compared to human skin and is less vascular. Nonetheless, it is considered the most equivalent animal model to human skin (Swindle et al., 2012). The experimental design and methods were approved by Oregon State University Institutional Animal Care and Use Committee (IACUC). Four three months old ~15 kg female Yucatan pigs were sourced from Sinclair Bio Resources, LCC, for this study and housed singly at Oregon State University's Lab Animal Research Facilities (LARC) for the duration of the study.

2.2. Surgical procedure

Each pig was placed under general anesthesia and after sterile preparation, four 4.5 cm full-thickness cutaneous incisions were made on the dorsum of each pig, 8 cm apart, with a new sterile #10 scalpel blade (Bard-Parker™ Aspen Surgical™ products, Caledonia, Michigan). Wounds were randomized to receive either a combination of BDA and SNA sutures versus SNA sutures alone. Wounds closed with BDA sutures using 3–0 polyglactin 910 (Vicryl™, Ethicon, Somerville, New Jersey),

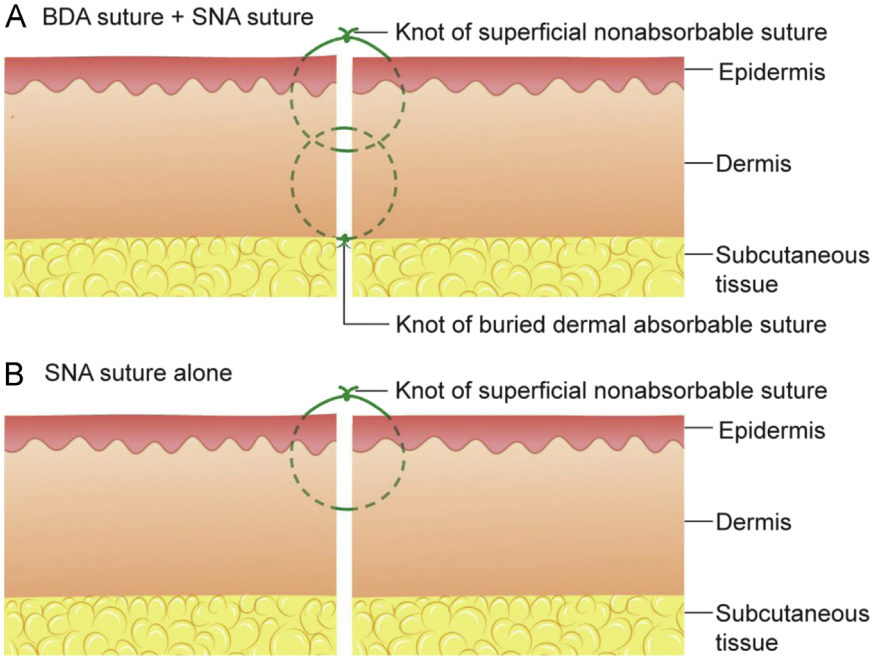

Fig. 1 – (A) Buried dermal absorbable (BDA) suture placed with superficial nonabsorbable (SNA) suture. (B) Superficial nonabsorbale (SNA) suture.