A Critical Review of Poly (Glycolic Acid) Absorbable Sutures

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Abstract

Small wounds typically heal without incident, but large wounds will form scar tissue upon healing and are at increased risk for fluid loss and infection unless the wound margins are drawn together. Wound closure devices such as absorbable sutures have been developed to join the edges of wounds, increasing the integrity of new tissue while providing fixation without the need for invasive removal. Poly(glycolic acid) (PGA) sutures are the oldest synthetic absorbable suture and derive biological and mechanical properties from the glycolide monomer unit. Biodegradation of PGA produces negligible inflammatory response in healthy tissue, with the degree of crystallinity dictating the degradation rate of PGA sutures and the resulting loss of tensile strength. High capillarity and bacteria transport properties as well as low stiffness come as a result of the multifilament configuration of PGA sutures. PGA sutures have formed the basis for an industry of versatile biomaterials that can be tailor-made to suit a variety of applications.

1. Introduction

1.1. Clinical Relevance and History of Sutures

Wound complications such as infection or mechanical failure are a leading cause of extended hospital stays after operations [1]. A wound where the edges have been adjoined is said to be approximated, and approximation is a key factor in wound healing. Poorly-approximated wounds will form thinner layers of epithelium during the healing process and have a higher recurrence rate than well-approximated wounds [2]. For larger wounds such as lacerations, puncture sites, and surgical sites, approximation has the added benefit of decreasing the risk of infection by minimizing the area of exposed tissue. Wound closure devices such as sutures, staples, or skin adhesives may be indicated for wounds where the risk of infection is high or the wound area is large. In addition to keeping wounds clean, wound closure materials can decrease scarring when used properly and are preferable for closing surgical sites where incisions can be large and visible [3]. Wound closure materials aid in managing tension at wound margins, decreasing tissue pressure and increasing the availability of oxygen to the wound [4].

Sutures are the most widely used skin closure material with a market exceeding $1.3 billion annually [5,6]. A variety of natural materials were first used as sutures including linen fibers, steel wire, dried sheep intestine, and reconstituted collagen [5,6]. Synthetic nonabsorbable sutures made of nylon, polyester, and polypropylene emerged around World War II [6]. In the 1970's the first synthetic absorbable suture, poly(glycolic acid) (PGA), or polyglycolide, was developed by Davis & Geck under the trade name Dexon, and the synthetic absorbable suture industry was born [7]. Absorbable sutures are useful in subcutaneous applications where removing sutures would be an invasive task. These materials provide temporary mechanical support until wounds are mature enough to withstand normal stress [8].