Versatile, Programmable Polymer Platform For Atraumatic Tissue Repair: From Bench To Bedside.

TISSIUM

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INTRODUCTION

Tissue adhesives have become ubiquitous in surgical procedures. However, current solutions require a tradeoff between strength, tissue response, and ease of use when a true adhesive for atraumatic tissue repair must excel at all three.

To meet this need, TISSIUM has developed a unique programmable, biocompatible, and biodegradable polymer library based on **poly(glycerol sebacate) acrylate** (PGSA)[3,4]. This versatile platform offers :

- **Precise application** during surgical procedures, both open and minimally invasive, with minimal displacement by body fluids
- **On demand polymerization** using an external, visible blue light or intrinsically upon mixing depending on the formulation
- **Elastic and strong bonding**, allowing the polymer to comply with the underlying tissue while remaining securely attached.

TISSIUM is developing integrated solutions, including dedicated procedure-specific surgical instrumentation, to address diverse clinical needs in vascular repair (CE mark received in 2017), sutureless nerve repair, and a range of gastrointestinal procedures.

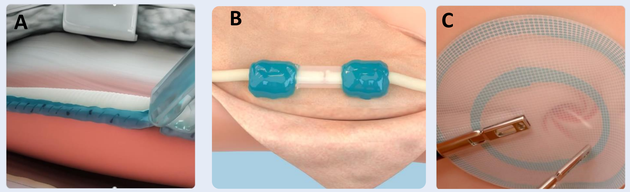


Figure 1. TISSIUM product portfolio. (A) Cardiovascular sealing in wet environment, (B) Sutureless nerve repair, (C) Atraumatic hernia repair.

ADHESIVE SYSTEM FOR INTUITIVE PLACEMENT AND ATRAUMATIC FIXATION OF HERNIA MESH

TISSIUM's polymer-based adhesive system has been successfully validated in a pre-clinical porcine model with a midline hernia repaired using a laparoscopic intraperitoneal onlay mesh (IPOM) approach (n=18 animal, survival up to 3 months).
The system provided equivalent fixation strength and quality of repair compared to commercially available absorbable tacks. Also, clinician testing (n=6) confirmed TISSIUM's superior usability for mesh positioning thanks to the adhesive tackiness, on-demand light activation allowing positioning adjustments, and non-penetrating nature resulting in homogeneous mesh placement with no gaps or wrinkles.

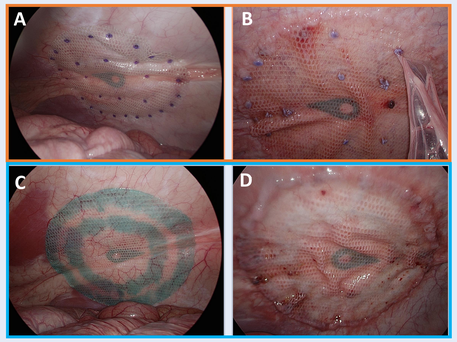


Figure 2 (left) Aspect of composite mesh fixed with commercial absorbable tacks vs TISSIUM polymer in laparoscopic IPOM scenario.
Commercial absorbable tacks at T0 (A), and 30 days (B). TISSIUM polymer at T0 (C) and 30 days (D).

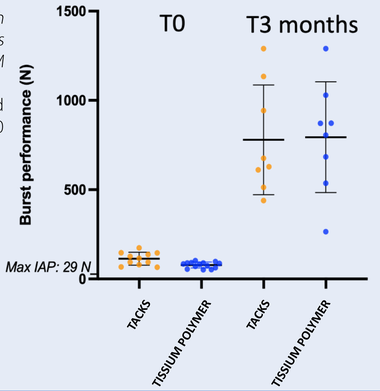


Figure 3 (right) Fixation Strength of mesh with TISSIUM Polymer vs mesh with commercial absorbable tacks. N=18 pigs, Burst ball test.
Equivalent fixation strength and tissue ingrowth in comparison with tacks, with excellent local tolerance and no strong adhesions caused by TISSIUM polymer.

ADHESIVE FILLER FOR THE TREATMENT OF PERIANAL FISTULAS

A new, injectable and cured in-situ polymer formulation, has been specifically designed to treat perianal fistulas.
Pre-clinical testing in a porcine model (n=9 animals, survival up to 3 months) showed that the adhesive filler was not extruded from any fistula tract despite the mechanical constraints in the perianal environment. Histological analysis showed intended tissue response, with fibrous tissue penetration through the pores of the filler and only minimal to mild inflammation, not intensified vs empty control.

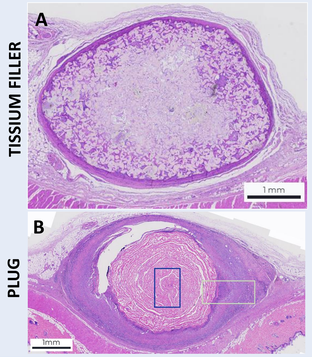


Figure 4 (left) TISSIUM filler vs. commercial anal fistula plug in rodent model of dorsal subcutaneous fistula.
(A) HE staining of TISSIUM filler at 1 month. Neo tissue integration progressing toward the center with minimal inflammation.(B) HE staining of commercial plug at 1 month. No cell invasion and strong neutrophilic response.

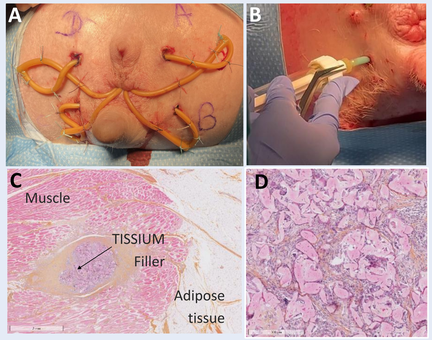


Figure 5 (right) TISSIUM filler in porcine anal fistula model. N=9 pigs, 4 fistulas per animal vs. commercial plug and empty control
(A) Fistulas created mechanically (catheters, dilators, drains)[5]. (B) After 3 weeks, fistulas are treated with TISSIUM filler following debridement of the tract and closure of the internal orifice. (C,D) HE staining of TISSIUM filler in the fistula tract at 1 month.

REFERENCES

[3] Lang N, Pereira MJ et al. 2014, Sci Transl Med. [4] Pellenc Q et al. 2019, J. Cardiovasc Surg. [5]Buchanan et al., 2005, Dis Colon Rectum.

NEXT STEPS FOR TISSIUM POLYMER PLATFORM

TISSIUM platform versatility is inherent to its modular design as it leverages a targeted polymer formulation and distinct proprietary surgical instrumentation for each specific use case. TISSIUM's objective is to continue to innovate on both these elements, design tailored solutions to address a broad range of clinical needs, and effectively translate them from bench to bedside.