# Recent Advancements in Tissue Sealing Techniques for Gastrointestinal Defects

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**Abstract**

Effective tissue sealing of resected gastrointestinal organs (GO) is essential to improvingtreatment and healing of wounds. Successful healing of GO often requires gentle tissue handling,hemodynamic stability with tissue oxygenation, and adequate surgical repair. The most commontechniques utilized for wound closure in GO are hand-sewn sutures. However, these methodsrequire high precision and often are associated with anastomotic leakages. In this work, I reviewcurrent clinical advancements in techniques and technologies used to improve wound healing for GO.

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Gastrointestinal surgeries (GS) often occur in organs involved in digestion, such as the mouth, small and large intestines, pancreas, and liver. The most common GS are colon resections, called colostomies, where a part of the large intestine is removed to prevent or treat a condition affecting the colon. These conditions include cancer, Crohn's disease, or bowel obstruction [1]. Following operation in colostomies and tissue sealing, luminal content may leak outside of the abdominal tract, leading to metabolic disturbances or organ failure. This post-operative condition is known as anastomotic leakage (AL), and is the most life-threatening complication after GS, with over a 30% increase in mortality [2].

Even with a proper standard of care, AL are common and often result in sepsis, infection, or death [2]. This occurs because of technical processes requiring high surgical precision, tissue damage from piercing, stress concentration in suture points, and the inherent limitations of suture-based sealing therapies [1]. Therefore, traditional methods such as sutures and staples still remain a challenge to favorable healing of tissue. From these problems, new technologies such as tissue adhesives and bioadhesives have been utilized to resolve the limitations of traditional sealing methods.

Within tissue adhesives, Dermabond is the most commonly used Food and Drug Administration-approved tissue adhesive. Dermabond is a cyanoacrylate-based polymer that creates a strong intermolecular bond between wound edges to ensure normal healing [3]. However, Dermabond is used only to create a water protecting covering over tissue and often rely on dry adhesion [3]. This is problematic because the majority of sealing within the gastrointestinal tract requires wet adhesion to surfaces. In comparison, novel tissue adhesives utilizing gelatin-based materials mostly rely on diffusion of their molecules through interfacial water to form networks of tissue. One example of a tissue adhesive for enhanced adhesion in wet interfaces is a barnacle inspired paste for haemostatic healing [4]. However, these tissue adhesives are underutilized and often struggle due to burdensome application on tissue: these technologies often come in a viscous solution, and require a secondary source for interpretation or solidification of solution, such as ultraviolet light.

Other engineered technologies are bioadhesive polysaccharide-based films that match the biomechanical properties of human tissue (0.4 MPa - 1.2 MPa) while providing tough adhesion to tissue [5]. These films often incorporate biocompatible polymers such as polyvinyl alcohol (PVA), alginate, or polylactic acid (PLA) [5]. These technologies sufficiently provide rapid and coagulation-independent haemostatic sealing without burdensome application shown in current tissue adhesives. One recent advancement of bioadhesive technology in sealing AL was shown by Wu et al., [1], where a polymer patch was utilized to provide *in vivo* sutureless sealing within a rat colon, stomach, and small intestine.

Overall, there has been drastic improvement in tissue sealing for anastomotic leakages post-operation in colostomies. Tissue adhesive technologies have been used to reduce applied pressure coming from surgical procedure, and to lower the need of precision in suturing. In

addition, bioadhesive technologies have been utilized to provide sutureless application of patches to efficiently seal wounds post-operation and prevent anastomotic leakages.

**Sources**

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