

Rethinking Pelvic Reconstruction: The Paradigm Shift From Synthetic Meshes to Tissue Engineering and Regenerative Medicine



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Worldwide, pelvic organ prolapse (POP) and stress urinary incontinence are prevalent conditions profoundly impacting the quality of life of many women. Historically, the associated high recurrence rates with native tissue repair led the gynecologic community to adopt non-absorbable synthetic meshes, predominantly polypropylene. For over a decade, these materials have been viewed as the ultimate solution for durable mechanical support of the weakened pelvic floor (1). However, extensive clinical follow-up and evolving biological understanding have forced a critical re-evaluation of this approach.

The fundamental shortcoming of traditional synthetic meshes lies not in their mechanical strength but in their biological incompatibility. Polypropylene meshes act as permanent foreign bodies in the highly dynamic and hormonally responsive environment of the vagina. This induces a prolonged inflammatory response, characterized by macrophage activation and dense fibrotic encapsulation. Clinically, this foreign body reaction manifests as catastrophic complications, including mesh erosion, chronic pelvic pain, and severe dyspareunia. Consequently, global regulatory organizations have heavily restricted or entirely prohibited the use of transvaginal synthetic meshes, creating an important clinical gap and necessitating a shift toward biologically viable alternatives (2).

To truly restore pelvic floor anatomy and function, modern urogynecology must look beyond inert plastics and embrace the principles of regenerative medicine. The new paradigm relies on tissue engineering, which combines biodegradable scaffolds, therapeutic cells, and biochemical signals to regenerate native fascial tissues rather than only replacing them with scar tissue.

Current research is heavily focused on biomimetic scaffolds—such as electrospun polymeric matrices (e.g., poly-4-hydroxybutyrate)—that temporarily support the pelvic organs while gradually degrading as new

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host tissue is formed (3). Furthermore, the integration of mesenchymal stem cells (MSCs), especially those deriving from the human endometrium or adipose tissue, represents a revolution. These stem cells exhibit powerful immunomodulatory properties, reducing the initial inflammatory response and promoting organized collagen deposition and angiogenesis at the implant site (4).

The era of relying only on synthetic, non-absorbable materials for pelvic reconstruction is ending. The future of gynecologic surgery lies at the intersection of cellular biology and materials science. By transitioning from synthetic meshes to tissue-engineered constructs, we can move away from managing mesh-related complications and focus on true anatomical and functional regeneration. We must continue to support translational research to bring these regenerative solutions from the laboratory worktable to the operating room.

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