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Supplementary

Table S1. Experimental data from preclinical studies investigating scaffold–cell systems for breast tissue engineering. The table includes scaffold types, cell models, study phases, and observed biological outcomes, with matched peer-reviewed references.

Scaffold	Cell Type	Phase of Study	Summary	Reference
Alginate Modified with Polydopamine (Alg-PDA)	Human breast epithelial cells (MCF-10A)	Preclinical in vitro and in vivo (mice model)	The 3D-printed Alg-PDA scaffold showed flexibility and modulus similar to breast tissue. Enhanced adhesion and proliferation of MCF-10A cells.	1
Alginate Modified with Laminin (G-LAMS)	ADSCs + Rg1	Preclinical in vitro and in vivo (rat model)	Bio-electrospray synthesized ADSC-G-LAMS microspheres demonstrated no toxicity, creating a conducive microenvironment for ADSC proliferation.	1
Poly(urethane)-based scaffolds	Cell-free	Preclinical in vitro and in vivo (murine model)	Cross-linked by TEMED, showing slow infiltration of undifferentiated mesenchymal cells and formation of a vascular network to support viability.	1
Poly(DL)-lactide polymer	Human umbilical cord perivascular and endothelial cells	Preclinical in vitro and in vivo (athymic nude rats)	3D-printed polymer seeded with endothelial cells demonstrated functional capillary network formation and increased adipose tissue area.	2
Devitalized ECM hybrid with RGD-poly(amidoamine) foam (ECM-OPAAF)	hADSCs	Preclinical in vitro and in vivo (nude mouse model)	ECM-OPAAF scaffold regulated adipogenesis and hADSC infiltration.	1

Scaffold	Cell Type	Phase of Study	Summary	Reference
Poly(lactic) acid (PLA)	MC3T3-E1 cells	In vitro	PLA scaffold incubated in Gel-MOD and Li-TPO-L media showed 40% cell viability after one month, with cells stretching along the scaffold.	1
Silk Fibroin Hydrogel	Human fibroblasts	Preclinical in vitro and in vivo (rat model)	Silk fibroin scaffold supported adipose tissue growth and growth factor release.	3
Decellularized Adipose Tissue (DAT) Scaffold	ADSCs	Preclinical in vitro and in vivo (rat model)	DAT scaffold supported ADSC viability and differentiation, ideal for soft tissue regeneration.	4
Gelatin Methacryloyl (GelMA)	ADSCs	Preclinical in vitro	GelMA hydrogel supported ADSC growth and adipogenic differentiation.	3

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