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COVID-19 may causes cardiac fibrosis and decompensation. Hence, effective therapies are needed to recover heart functionality after SARS-CoV-2 infection. *In vitro* models of pathological cardiac tissue could be predictable platforms for preclinical trials.

In this work, ventricular human cardiac fibroblasts (HCFs) were cultured on biomimetic scaffolds to reproduce different sizes of pathological cardiac tissue. 2D and 3D polycaprolactone (PCL) scaffolds, respectively made by electrospinning and fused deposition modelling, were grafted with gelatin to confer biomimetic properties. Gelatin coating favored cell attachment and proliferation and supported their extracellular matrix deposition ("biomatrix") within 21 days culture time. Scaffold architecture affected the expression of fibroblast markers (α-SMA) and biomatrix features. The obtained *in vitro* models of cardiac fibrotic tissue could be exploited as testing platform for drugs (e.g. reprogramming microRNAs) aimed at reducing adverse effects on heart due to SARS-CoV-2.

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