applied sciences

MDPI

Article

Parametric Numerical Modeling and Fabrication of PCL Scaffolds for Bone Tissue Engineering Applications

Anton Früh [1], Bernd Rolauffs [1,2] and Michael Seidenstuecker [1,*]

[1] G.E.R.N. Research Center for Tissue Replacement, Regeneration & Neogenesis, Department of Orthopedics and Trauma Surgery, Albert-Ludwigs-University of Freiburg, Faculty of Medicine, Engesserstr 4, 79108 Freiburg im Breisgau, Germany

[2] Department of Orthopedics and Trauma Surgery, Albert-Ludwigs-University of Freiburg, Faculty of Medicine, Germany, Hugstetterstrasse 55, 76109 Freiburg, Germany

* Correspondence: michael.seidenstuecker@uniklinik-freiburg.de; Tel.: +49-761-270-26104

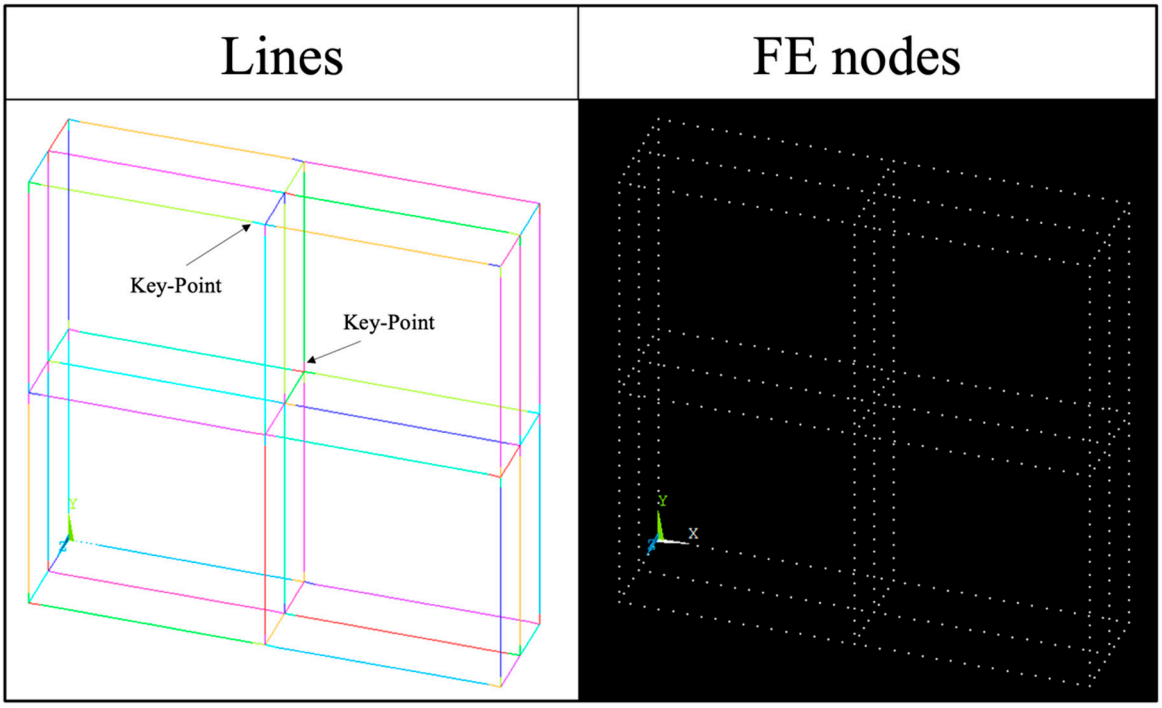

Figure S1. Basic geometric structure of the FE model.

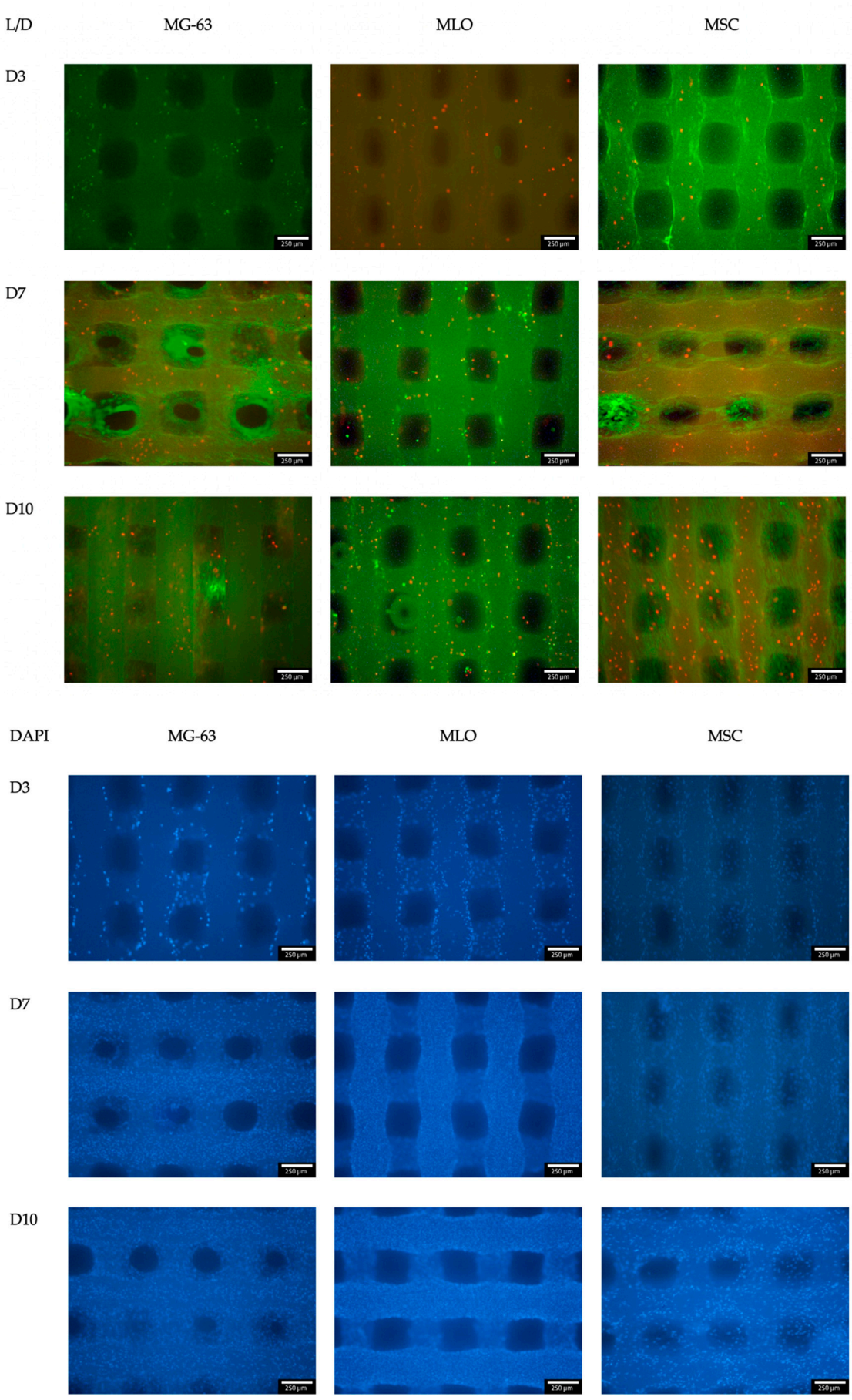
L/D
MG-63
MLO
MSC
D3
D7
D10
DAPI
MG-63
MLO
MSC
D3
D7
D10

Figure S2. Live/Dead and DAPI staining of collagen-coated PCL scaffolds after 3, 7 and 10 days; DAPI was additionally stained after some inter-actions of the live/dead staining kit and the collagen coating; images taken with Olympus BX-51.

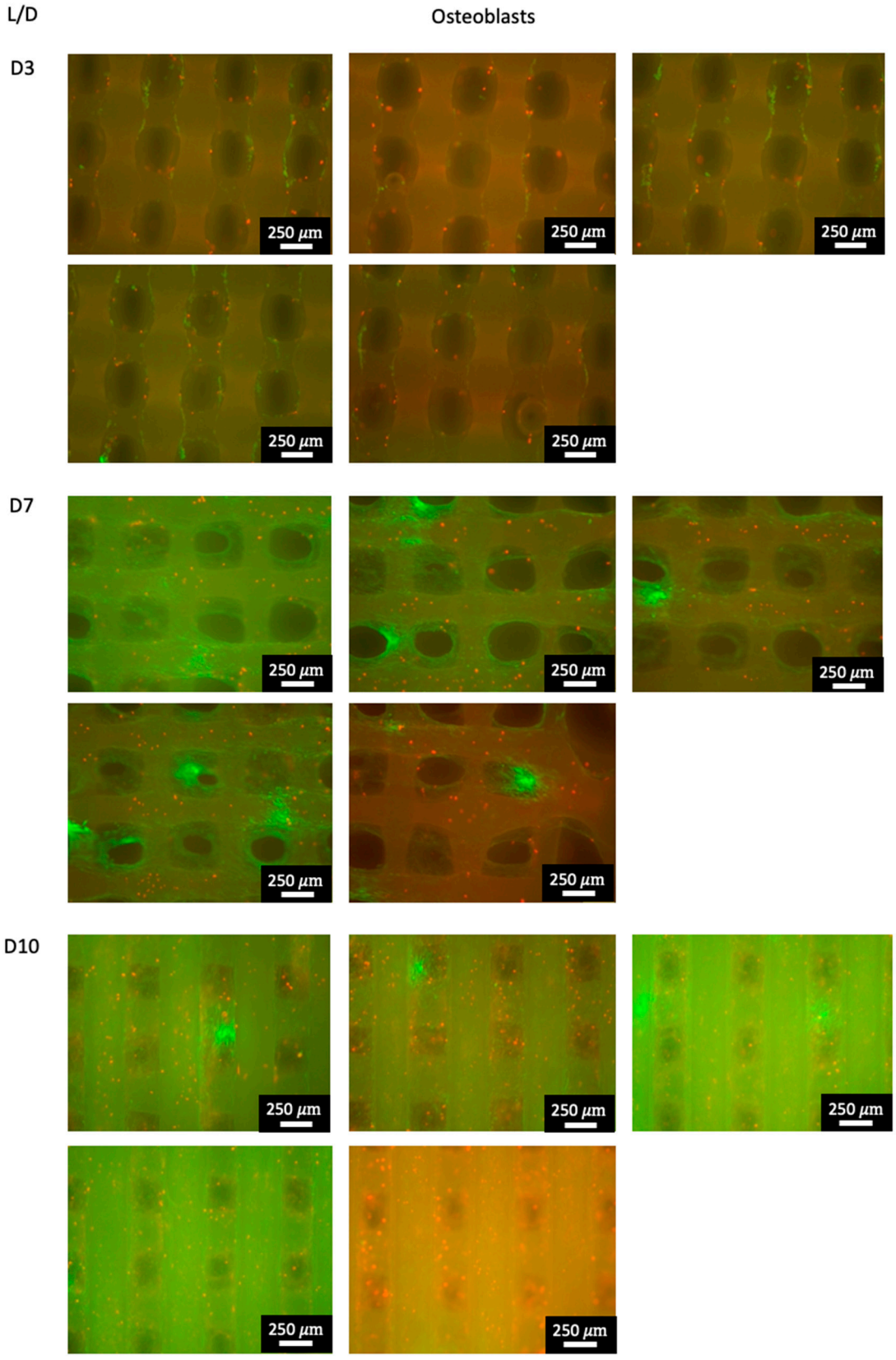

Figure S3. Live/Dead staining of PCL scaffolds after 3, 7 and 10 days.

Table S1. Nutrient solutions.

Cells	Nutrient solutions
Osteoblasts	Medium 199 (Merck) + 10 % Fetal Bovine Serum Superior (Merck) + 1 % Streptomycin/Penicillin (Merck)
MSC	500 ml DMEM Medium (Thermo Fisher Scientific, USA) + 12.5 ml 1 M 4-(2-Hydroxyethyl)-1-piperazinyl)-ethansulfonsäure) (HEPES) + 5 ml L-Glutamin + 5.0 ml Streptomycin/Penicillin + 1 ml Heparine + 25 ml Human Plasma centrifuged and filtered + 25 ml Human Platelet Lysate
MG-63	DMEM-F12 Medium with L-Glutamin and 15 mM HEPES (Thermo Fisher Scientific, USA) + 1 % Penicillin/Streptomycin (Merck) + 10 % Fetal Bovine Serum (Merck)
MLO-Y4	Minimum Essential Medium Eagle with L-Glutamin and Desoxyribonukleoside (Merck) + 2.5 % Newborn Calf Serum (Merck) + 2.5 % Fetal Bovine Serum inactivated (Merck) + 1 % Streptomycin/Penicillin (Merck)

Table S2. Variation of elements.

Force	**Strut Theory**	**Beam Theory**			
	Link180	*Euler–Bernoulli*		*Timoshenko*	
		Beam4	Beam188 *(pseudo thrust stiff)*	Beam188	
	linear-elastic		*elastic-plastic*		*viscoelastic*
$F_{\varepsilon=0.01}$ *[N]*	6.75	6.85	7.02	7.02	7.01
$F_{\varepsilon=0.02}$ *[N]*	13.30	13.70	13.83	13.83	13.81
$F_{\varepsilon=0.03}$ *[N]*	19.66	20.55	20.40	20.39	20.40