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simulating the deformation of the UIA anatomy when interacting with a controlled virtual clip. In order to assess the realism and usefulness of the simulations in training, a clinical Likert-like questionnaire study has been conducted with neurosurgical residents and specialists (n=14).

Results: Haptic feedback of the physical phantoms was indicated as realistic during the simulation (good/excellent = 93%), with the phantoms having realistic dome thickness (0.44 ± 0.11 mm) and complete occlusion confirmed by both the fluorescence angiography and CT scan. On the other hand, the holographic simulation aided the understanding of anatomy (good/excellent = 100%). Both the physical and the holographic simulators also resulted useful in selecting or discarding clips for proper occlusion.

Conclusions: The developed simulators represent affordable platforms for the training of neurosurgical residents' skills in a realistic clinical scenario.

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DEVELOPMENT OF AN INTEGRATED IN VITRO-IN SILICO MODEL TO PREDICT THE INTERACTION OF IMMUNE CELLS WITH SOLID CANCERS

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Objectives: Immune cells play a crucial role in the development and progression of cancer [1]. To better understand this interaction, we developed an in vitro model that combines a millifluidic bioreactor called MOAB (MOAB Srl, Milano, Italy) [2], that provides a controlled environment for cell circulation and mass transport [3], and 3D bioprinted constructs, which act as physical structures for cancer cells to grow in [4]. In parallel, we developed an in silico model to provide insights into multiphysics interactions between immune cells and cancer cells and help to better understand the mechanisms of the immune response to cancer.

Methods: Gelatin methacrylamide 3D scaffolds containing lung cancer primary cells were designed to obtain 3x6x0,5mm3 constructs with 0,1mm thick fibers laid in a woodpile fashion. Samples were statically cultured for 2 days before perfusing them with suspended lymphocytes from healthy donor buffy coat. In parallel, an in-silico model was developed to retrieve adequate perfusion and mass transport parameters through CFD analyses and particle tracing.

Results: The scaffolds promoted viability and proliferation of the cancer cells for a few weeks of perfusion inside the bioreactor. The results of the in silico simulation helped the fine tuning of the perfusion and mass transport parameters of the 3D bioprinted constructs, yielding optimal shear stress ranges and concentration profiles of factors to cultured cells, while allowing efficient circulation of immune cells.

Conclusions: Our model to recapitulate and analyze the cancer-immune cells interaction using an in silico and an in vitro model resulted in a reliable and cost-effective platform for conducting the in-depth investigation of the molecular mechanisms that regulate the cancer-immune cells interaction. Our work helps to bridge the gap of currently popular in vitro models in providing controlled perfusion of solid cancers, enabling the focusing on molecular interplay.

References: [1]10.7554/eLife.69015; [2]10.1007/s10544-011-9600-0; [3]10.3389/fbioe.2021.799594; [4]10.1088/1758-5090/ABDACF

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DURABILITY TESTING OF WOVEN SCAFFOLDS FOR A NEW GENERATION OF ARTIFICIAL HEART VALVE LEAFLETS

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Objectives: The current state of the art in the treatment of heart valve disease is bioprostheses with leaflets made from animal pericardium. These leaflets are subject to biological variability, prone to calcification and structural degeneration, which limits their lifespan and requires repeated surgical interventions. The goal of this project is to investigate a leaflet scaffold based on a load-oriented woven textile. It is designed to provide structural integrity and can be further processed with a hemocompatible and bioactive coating. An important milestone is the achievement of fatigue strength of the leaflet scaffold integrated into a valve ring.

Methods: Pre-selection of the weave configuration was done by mechanical testing (tensile strength, bending stiffness, thread shift) and microscopic assessment of porosity. Woven scaffolds were coated with TPU-chloroform (Carbothane PC-3585A, Lubrizol) and mounted in a valve ring. Accelerated wear tests were performed under simulated physiological load in a LinA testing device (AME-HIA) and run for 20 million cycles at 37° C. Leaflet function and indications of wear were assessed by slow motion movie, photographic and microscopic inspection. Resulting favorite textile scaffold-valve ring constructs were tested with a higher number of load cycles.

Results: Labtypes of woven leaflet valves have undergone sequential design optimization and currently withstand more than 90 million load cycles (tests are ongoing). Critical failure zones near the commissures could be addressed by weave modification and the pattern of weave attachment to the valve ring. New R&D results regarding both aspects will be presented.

Conclusions: Preliminary results support the achievement of adequate durability of leaflet scaffolds composed of load-oriented warp and weft threads. A milestone will be 200 million cycles, with a further increase in perspective.

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FIRST ANALYSIS OF DURAL FIBROBLASTS AND STEM CELLS MONOCULTURE ON ELECTROSPUN SCAFFOLDS WITH DIFFERENT COMPOSITIONS FOR MENINGEAL TISSUE ENGINEERING

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Objectives: Dura mater is the most external meninge, a half-rigid membrane located between central nervous system and bone tissues. Upon injury, complications are frequent because of its inefficient regeneration and scar tissue formation. Dural tissue engineering could lead to better understanding of this interface and help developing an in vitro model and innovative implantable scaffolds as artificial dura. Our goal is to develop a multiphasic biomaterial mimicking the dura mater thanks to electrospun scaffolds cultured with stem cells and/or