3D PRINTED BIODEGRADABLE SCAFFOLD FOR OPTIMAL RESTORATION OF KNEE FUNCTIONALITY AFTER AN ACL INJURY - A DEGRADATION AND STABILITY STUDY

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The Anterior Cruciate Ligament (ACL) is one of the major knee ligaments, one which is greatly exposed to injuries. Currently, in the case of significant damage to ligaments and tendons, the standard treatment approach is to use autografts [1]. The aim of this work is to develop a modern, innovative graft for reconstructing and regenerating the ACL after its injury. One of the major requirements that has to be met for this type of scaffold to promise a successful restoration of a knee functionality are its adequate mechanical properties. All medical devices, implants and grafts included, have to go through a sterilization process before use and because of that some of their properties can be altered, which is very often overlooked in published research, but may have severe consequences on material's performance.

Two types of biodegradable aliphatic polyesters are used in the process of 3D printing to obtain grafts of optimized architecture. Electron beam irradiation is used in two doses: 15 kGy and 25 kGy to assess how such sterilization technique impacts scaffolds properties. 3D printed samples sterilized with those doses as well as a non-sterilized control group are subjected to an experiment in two variations: a) a degradation study in phosphate buffer saline (pH 7.4, 37℃) that mimics the in-vitro environment, b) a stability study in 4℃ (dry) that model normal refrigeration storage condition. Both experiments are conducted over 90 days with multiple control timepoints at which samples are weighed and their molecular mass is measured with gel permeation chromatography.

The obtained data helps to optimize 3D printing scaffold prototyping method to design a graft used in the ACL reconstruction surgery that will facilitate full restoration of knee functionality with reduced occurrence of postoperative complications, pain, and patient's recovery time.

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References

1. Urbanek, O.; Moczulska-Heljak, M.; Wróbel, M.; Mioduszewski, A.; Kołbuk, D. Biomedicines 2023, 11, 507.