Promoting patient safety by a novel combination of imaging technologies for biodegradable magnesium implants (MgSafe)

Biomedical imaging has gained a significant technological push and remain the mainstay for diagnosis and therapy monitoring. Multimodal imaging approaches and their integration with nano- and regenerative medicine have been developed at CNR IFC as supported by previous EU projects (Project INSIDE, Call POR FESR 2014/2020; Project Synergy Call POR CReO FESR 2007-2013) and regional project (PREVISION, Call 2016 CARIPAR Foundation).

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In the field of new implant material and regenerative medicine, molecular imaging is yet not optimized: in this framework, recent class of Mg-based biodegradable implants have been investigated by using state-of-the-art imaging technologies. MgSafe brings together leading experts in imaging technologies with specialists in biodegradable Mg implant development to optimize the monitoring of the in vivo performance of this new class of implants. MgSafe addresses this point by training of 15 Early Stage Researchers (ESRs) in both, imaging and implant technologies. The ESRs will address the physical impact and suitability of a variety of modalities on bone implants and regeneration process. Highly sophisticated imaging techniques (nano and µCT, MRT, PET, USPA, IR) have developed beyond the forefront of medical device production in vivo and with in situ labelling options to deliver non-invasively data on different time and length scales of the body reaction and material behaviour during Mg degradation with a precision and plethora of details which is currently not available. Using multiple, non-invasive imaging modalities, MgSafe will gain an in situ picture about the physiological processes and tissue remodelling around the implant and can elucidate the potential of new developments in MRI/MRS, microPET/CT, Ultrasound and Photoacoustic imaging. The multimodal imaging developed will be combined with molecular biological/biochemical analysis, thereby increasing the information about physiological changes without using additional animals. A crucial aspect is to determine the influence of the degradable implant on the initial inflammation, angiogenesis, recruitment of endogenous osteoprogenitors to the implant site and the bone formation and remodelling, together with the structure and organisation of the osteocytic network in the resulting bone.


Keywords: Diagnostic tools (e.g. genetic, molecular diagnostic), Materials engineering, In vitro cell and tissue imaging, In vivo bio- and medical- imaging, Medical engineering and Technology

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