UNIVERSITY OF BRESCIA

PhD Program
in
TECHNOLOGY FOR HEALTH

DESIGNING, CHARACTERIZING AND TESTING OF BIOSENSORS AND BIOMATERIALS FOR BIOMEDICAL APPLICATIONS

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XXXI Cycle

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Background

Total knee prosthesis (TKP) is an artificial prosthesis which is required after Total Knee Arthroplasty (TKA). After TKA, a patient has to perform several knee exercises and therapy in order to bring a knee in normal walking state. Thus, there is a need of such biosensor based device that can provide continuous monitoring of knee implant.

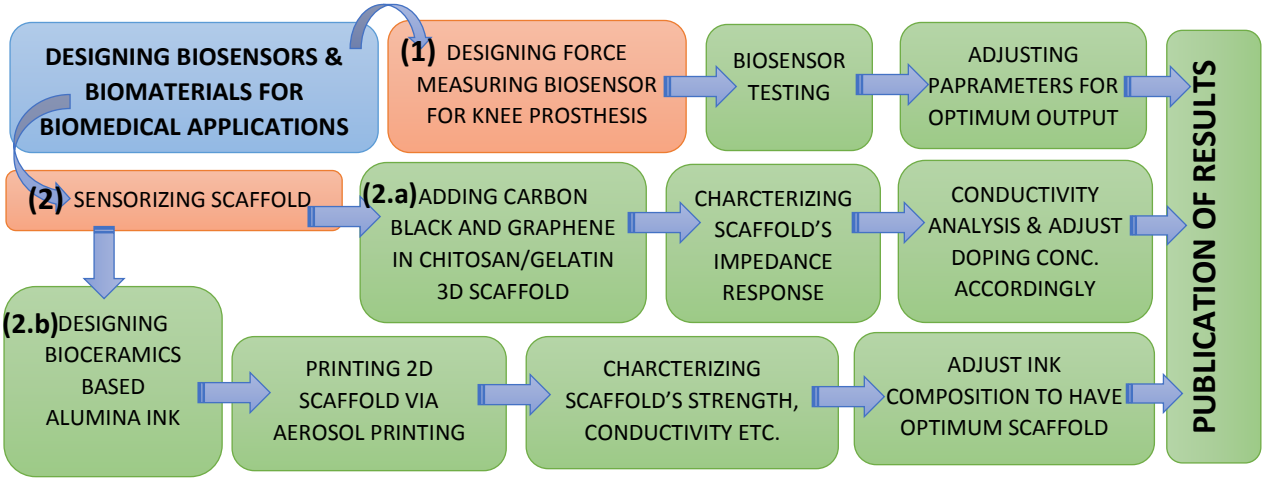
Furthermore, in tissue engineering, sensorizing a classical scaffold and designing biocompatible materials for scaffold is an emerging research. Currently most methods for monitoring cell activities on scaffolds are destructive and invasive. Thus, designing an intelligent scaffold that can act as a biosensor and is capable of monitoring cellular functions (cell adhesion, proliferation etc.) along with directing cellular growth, is of great interest.

Objectives

The main objective of this research is to design, characterize and test biosensors for biomedical applications. This includes designing of force measuring biosensor for knee prosthesis and sensorizing 3D scaffolds which can monitor cellular activities. In addition, to obtain an optimum sensing capability of scaffold, a novel bioceramics based biomaterials has also been designed

Methodologies

The overall methodology that has been adopted in complete project is shown below:



Expected Results and Impact

In a first project, a force measuring biosensor has been designed and it has been tested externally via INSTRON machine but in future, it is expected to test its performance by implanting inside prosthetic knee joint.

On the other hand, in second project, carbon and graphene based 3D scaffolds have been fabricated and characterized, whereas, ceramics based scaffold fabrication is under progress. In future, it is expected that INTELLIGENT SCAFFOLD would be designed that can behave as a biosensor and provides a non-invasive continuous monitoring of cellular activities.