Soutenance d'une thèse de doctorat
De l'Université de Lyon
Opérée au sein de l'INSA Lyon

La soutenance a lieu en visioconférence totale

Candidat	MME HANNOUN Amira
Fonction	Doctorant
Laboratoire INSA	LAMCOS
Ecole Doctorale	ED162 : MÉCANIQUE, ENERGÉTIQUE, GÉNIE CIVIL, ACOUSTIQUE DE LYON
Titre de la thèse	« Tribological role of pyrocarbon in the regeneration of articular cartilage. Application in the tribological triplet of shoulder arthroplasty »
Date et heure de soutenance	07/04/2020 à 14h00
Lieu de soutenance	Visioconférence Totale (Villeurbanne)

Composition du Jury

Civilité	Nom	Prénom	Grade / Qualité	Rôle
M.	BERTHIER	Yves	Directeur de Recherche CNRS - Emérite	Directeur de thèse
Mme	TRUNFIO-SFARGHIU	Ana-Maria	Chargé de Recherche HDR - CNRS	co-Directrice de thèse
M.	MALLEIN-GERIN	Frédéric	Directeur de Recherche CNRS	Examinateur
M.	DROUET	Christophe	Directeur de Recherche CNRS	Examinateur
M.	WIMMER	Markus	Professeur	Rapporteur
Mme	PINZANO	Astrid	Chargée de Recherche HDR CNRS	Rapporteur

Résumé

Degenerative shoulder pathologies are currently treated by total arthroplasty or hemiarthroplasty. In these cases, the complication rate reaches 22 %. Therefore, a new spherical interposition implant has been developed. The implant is made with pyrocarbon (PyC). It is inserted between the glenoid cartilage and a surgically-created humeral bone cavity.

Short-term clinical results showed minimal cartilage wear and good bone remodeling in contact with the implant. However, the origin of these results is not yet well understood. In a previous study on human explants, it was showed that humerus bone remodelling involves the synthesis of a neocartilaginous tissue, which partly explains the favourable clinical results. Therefore, the effect of PyC on the remodeling of the surrounding tissues needs investigation. Thus, this thesis aims to understand the origin of tissue remodelling on the bone and cartilage side. Our strategy is: first, to carry out three parallel studies to dissociate the role of the biology, the material, and the transmission of mechanical stresses; and second, to validate the results thus obtained by associating the different aspects in an in vitro tissue bioengineering model. Our methodology was based on 1) the expertise of retrieved explants; 2) the development of chondrocytes cultures in contact with the biomaterials; 3) the in vitro biotribological simulations; and 4) the design of a simulator allowing to combine the biological, physicochemical and tribological results obtained previously.

The final results showed better chondrogenic and osteogenic cell activity in the case of PyC compared to CoCr. This was correlated with the PyC affinity to the phospholipids and with an optimal transmission of the mechanical stress. The in vivo control of transmission of mechanical stresses is essential to guarantee good results in the long-term. This thesis opens up fresh perspectives on the control of this transmission through biomaterials to regenerate the cartilage.