Universität Rostock

Traditio et Innovatio

Student Assistant

Simulating the effect of porous-coated dental implants on bone remodelling

Project description:

Dental implantation has gained clinical importance over the last several decades, which has led to the rapid development of different dental implant designs. Osseointegration is defined as direct structural and functional connection between living bone and the surface of implant plays a vital role in determining the success of implant [1]. A better osseointgeration is believed to be able to improve adaptive remodelling process and minimise healing time. For promoting osseointgeration, various biocompatible materials and different coating technologies has been developed in recent years and, in this regard, porous implant has been making significant success in implantation [2]. However, it still remains unclear how the implant biomaterials and corresponding surface morphologies would affect the bone remodelling activities.

This study aims at providing a preliminary understanding of the effect of porous coated dental implants on bone remodelling. A two-scale FE model of cross-sectional two-dimensional dental implant setting [3] will be modelled and simulated using python-based software FEniCS. The strain energy density based bone remodelling approach (code) developed and currently being implemented in FEniCS by supervisor will be provided for further investigations. Knowledge of numerical methods and python programming is a pre-requisite for this project.

References:

[1] Rungsiyakull C, Li Q, Li W, Appleyard R, and Swain M. Effect of Fully Porous-Coated (FPC) Technique on Osseointegration of Dental Implants. InAdvanced Materials Research, 2008, 32, 189-192.

[2] Xiropaidis A, Qahash M, Lim W, Shanaman R, Rohrer M, Wikesjö U, and Hall J. Bone–implant contact at calcium phosphate-coated and porous titanium oxide (TiUnite™)-modified oral implants. Clinical oral implants research, 2005, 16(5), 532-539.

[3] Rungsiyakull C, Li Q, Li W, and Swain M. Multiscale Bone Remodeling Prediction for Fully Porous-Coated (FPC) Dental Implant Supported Prosthesis. InAdvanced Materials Research, 2009, 79, 2167-2170.

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