PERSONALIZED DESIGN AND RECONSTRUCTION FOR DEFECT BONE BY DATA DRIVING AND MECHANICS MODELLING

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ABSTRACT

Human periarticular bone defect is a difficult disease in orthopedics. There is challenge issue to recognize anisotropy, heterogeneity of bone tissue structure and graphics by low resolution clinic-CT image. In collaboration with clinical medicine, the data-driven and mechanics modeling technique for bone defect reconstruction is proposed. Data driven micro-CT and clinical-CT images are used to obtain the characteristics of cancellous bone structure and graphics. The experimental technology and numerical method are developed for predicting the mechanics parameters of animal specimen on the multi-axial stress state. The constitutive model of heterogeneous anisotropy of bone tissue is established and the parameters are deduced by Bayesian inference using the data given by numerical simulation and experiment. For designing the robust cancellous prosthesis bone, a kind of spinodal lattice is designed with random, indeterminate, aperiodic, asymmetry, irregular, large space for mechanical and biological function. The digital triplets with physical scanning CT image, virtual equivalent modulus and additive manufacturing lattice design are created to guide the clinical treatment of personalized bone defects. This work has been demonstrated in some clinical applications to the benefit of patients.

REFERENCES

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