

Design system for an artificial arthrosis with CT scanning and development of a femoral stem made of fabric composites

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【 Outline of survey 】

Since the number of patients of osteoporosis increases worldwide recently, it is important to develop an artificial arthrosis with high function and reliability. Many femoral stems which are made of metal and ceramic materials have been developed, however, it is difficult for these material to fit the individual. And it is essential to recuperate for a long term after the operation for hip joints in order to ensure the stable bonding between the stem and the born.

The aims of this project are to establish the design system with CT scanning to fit the stem to the bone and a multi-scale numerical simulation for an artificial arthrosis to decide the dimension and the rigidity. The outline of this project is as follows; (i) Evaluation of mechanical properties with the high speed technique for bones by a multi-scale simulation coupling an image process of CT scan. (ii) Development of a femoral stem made of fabric composites which have a superiority to adjust the rigidity and the strength to fit the individual bone perfectly. (iii) Establishment of the experimental method for mechanical properties of the stem.

【 Expected results 】

By using the proposed design system, numerical models for finite element analysis can be generated automatically based on the cross sectional images of bones by CT scanning. The mechanical properties can be also evaluated based on the generated numerical model. Furthermore, the mesh superposition method, which is one of the effective multi-scale numerical methods, to analyze the correlation between the local stress and global behavior for a femoral stem and born. The proposed procedure provides the precise estimation of connecting behaviors between a stem and individual born.

【 References by the principal researcher 】

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【 Term of project 】 F Y 2004 - 2008

【 Budget allocation 】 82,400,000 yen

【 Homepage address 】 <http://www.mit.eng.osaka-u.ac.jp/td1/>