FINITE ELEMENT ANALYSIS OF BIOSCREW FIXATION IN ACL RECONSTRUCTION

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ABSTRACT

Bio-screw is an interference screw used in Anterior Cruciate Ligament (ACL) reconstruction. ACL reconstruction is a process of replacing the broken ACL with a graft made from soft tissue from the other parts of human body. The screw is used to fix the graft in the tunnel. Bio-screw is a screw made from bio-absorbable material that is Poly-L Lactide Acid (PLLA). It replace the use of metal interference screw for its bio-absorbable properties and the strength it posses. However, its capability to fix the graft to the femoral tunnel is questioned by the clinical. Thus, experimental study had been done to answer it. In this project, the mechanical behavior of samples of screws with different diameters and lengths in the bone tunnel with respect to the ACL reconstruction is studied. In spite using experimental study, finite element modeling is used to study the behavior. The distal femur and the bio-screw is remodeled using computer aided design (CAD) software and the stress distribution between the screw and the bone tunnel is obtained using the finite element software. In this project, a tensile force of 200 N is used as the loading conditions because it is the approximation of the graft tension at full extension of the knee during gait. It is found that the maximum Von Mises stress occurs on the tunnel is 29 MPa which is far away from the bone's yield strength that is 182 MPa. The maximum Von Mises stress occurs on the screw is 15.5 MPa which is also far from the screw's yield strength that is 26 MPa. The maximum deformation occurs on the screw caused by the 200 N tensile force is recorded to be 0.021 which is too small. It can be concluded that the bio-screw is capable to fix the graft in the tunnel. Further study using different contact condition is suggested to clarify the effects of bio-screw in the tunnel.

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