UNIVERSITI TEKNOLOGI MARA

EFFECTS OF PROXIMAL CEMENTATION TO THE IMPLANT STABILITY AND BONE ADAPTATION IN CEMENTED HIP ARTHROPLASTY

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ABSTRACT

Total hip arthroplasty, also known as the surgical replacement of the hip joint with a prosthesis, is a reconstructive operation that has improved the management of hip joint illnesses that have not responded well to medical treatment. Evidence supports the hypothesis that the proximal portion of the cement used in THA is more resistant to the effects of stress than the distal component of the cement. Consequently, this study aims to determine whether THA can be carried out by cementing only the proximal part of the hip prosthesis. The tensile strength of the polymethylmethacrylate cement is 29 MPa, the Poisson's ratio is 0.3 and Young's modulus of the polymethylmethacrylate cement is 2 GPa. This research was carried out with the assistance of a stainless-steel stem model provided by the Department of Orthopaedic Surgery at the University of Malaya Medical Centre. The model had a young's modulus of 200 GPa and a Poisson's ratio of 0.28. The femoral bone was made of cortical and had the following material properties: a young modulus of 17GPa, a Poisson's ratio of 0.3, and a yield strength of 115 MPa. A stem prosthesis was inserted into the femoral canal of the THA patient while the bone cement was being modeled to restore the femur. This study used different loading conditions, including stair climbing, walking and abduction. The effects of varied proximal cement lengths in THA were determined by analyzing a THA model's stress distribution and displacement as the individual climbed stairs, walked, and abduction. The result of the Von Mises stress for THA shown during stair climbing is 140.3 MPa, walking 127.6MPa and abduction 115MPa while the displacement of THA for stair climbing is 5.005μm, 4.371μm, and 4.731μm. It was recorded that stair climbing indicates the highest loading and most significant effects. The study also observed that the stress results are significantly lower than the yield strength of each model. Based on the analysis results, it can be concluded that the suitable cement length for reduction is 120mm.

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