



Research Article

THE NOTCH EFFECT TO STRAIN DISTRIBUTION ON THAI FEMORAL BONE AFTER TOTAL KNEE ARTHROPLASTY†

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ABSTRACT:

The strain distribution occurs on femoral bone while the loads transfer from proximal to distal part. The bone may be fracture after received more strain than 25,000 microstrain. Notching of the anterior femoral cortex after total knee arthroplasty can occur when making an anterior femoral bone cut. The notch of bone makes the stress concentration and transform to strain that should make the bone fracture. This study aims to vary the notch size with 3 depths as 1.5, 2.5 and 3.5 mm. and evaluate the strain distribution on the notch with finite element method under daily activities load to find the notch effect to strain distribution on Thai femoral bone. The result showed that the maximum strain occur 1,530 and 1,830 microstrain under walking and stair-climbing respectively. The rise of depth notch tend to increase the maximum strain on the femoral bone, which the surgeon will be avoid this condition for a good clinical result.

Keywords: Notch effect; Strain distribution; Thai femoral bone;
Total knee arthroplasty

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1. INTRODUCTION

Total joint arthroplasty had greatly improved the treatment of disabling arthritis of the knee. Notching of the anterior femoral cortex during total knee arthroplasty had been complicated as one factor contributing to these periprosthetic femoral fractures. A biomechanical study had shown that notching of the anterior cortex significantly lessens the load to failure by decreasing the bending strength by 18% and torsional strength by 40% [1]. Both clinical and biomechanical strongly suggest that anterior notching of the distal femoral cortex increase the risk of a supracondylar femoral fracture after total knee arthroplasty [2, 3]. The stress concentrations created by anterior femoral cortex notching are of considerable importance because of their possible association with supracondylar femur fractures when a notch is recognized at the time of surgery.

The purpose of this study aims to evaluate the effect of the anterior notching size to strain distribution on Thai femoral bone by finite element method.

2. MATERIALS AND METHODS

The finite element model in this study was divided to two main parts as Three-dimensional Thai femoral bone model and total knee prosthesis model.

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