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Title: Internal-external circumferential crack behaviour in the cement layer of total hip replacement

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Abstract: This study aimed to investigate crack behaviour at the internal and external surfaces of the cement layer in total hip replacement. A three-dimensional model of the femur with the cemented prosthesis was developed and analysed. Cracks were placed on the internal, external and both internal and external surfaces of the cement layer. Stress intensity factors were measured during gait. Results revealed that the stress intensity factors modes I and III were the most dominant in the crack propagation in the cement layer. The domain of mode I was the medial and lateral sides of the cement layer. Meanwhile, the domain of mode III was the anterior and posterior sides of the cement layer. The stress intensity factor and distance from the distal end indicated an inverse relationship. The internal and external cracks had no significant interaction. Moreover, stress intensity factors at the external surface of the cement layer were higher than those on the internal surface.

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