



A Novel Automated Three-Dimensional Framework for Evaluating Alpha Angle in Femur

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Femoroacetabular Impingement (FAI) is considered as one of the main causes of early osteoarthritis of the hip. Cam impingement is femoral cause of FAI, which refers to a situation where the femoral head loses its spherical shape at head-neck junction. This anatomic deformity could be reflected by the alpha angle. In this article we propose a new fully automated framework for measuring alpha angle using 3D data, without any need of manual configuration. This approach provides alpha angles in different orientations, by rotating a radial plane around the femoral head-neck axis. This helps to have an illustration of alpha angle as a continuous curve. The method has been tested on 12 femur 3D datasets (6 left + 6 right), reconstructed from MR images of different female subjects without any reported femoral abnormalities. The mean and standard deviation values of alpha angle are about 36.9° and 1.1° respectively, which are in good agreement with the expected values for alpha angle. In addition, four different resolutions of 3D meshes have been examined by the proposed method. The effect of the resolution on the provided results has been evaluated (in terms of accuracy and speed).

