A method for evaluation of subchondral microarchitecture of human femoral head: A preliminary study

Hyung-Min Ji¹, Ye-Yeon Won¹, Jung Sun Jang²

¹ Department of Orthopaedic Surgery, Ajou University Medical Center, Suwon, Republic of Korea
² Genoss, Co., Ltd., Suwon, Republic of Korea

Aims
This study aims to present a method to quantitatively characterize the microarchitecture of subchondral bone across the human femoral head using a micro-computed tomography and a common reference coordinate system.

Method
The experimental protocol was approved by the institutional review board at our university. One right-sided femur extracted from one embalmed cadaver from 48 year-old male were stripped of soft tissue. He had pulmonary tuberculosis and had no macroscopic abnormality in his femurs. The femur was scanned using a µCT scanner (Skyscan 1173, Skyscan, Belgium) with a resolution of 60.00 µm in all three spatial directions in Genoss, Co., Ltd.(Suwon, Republic of Korea).3D pictures were generated using SkyScan CTvol software. The reconstructed image was aligned along the anatomical axis of the femoral shaft. The highest point of the femoral head was set as the north pole and the longitude of the center of the fovea capitis was set as zero by using sphere-shaped clipping tool in CTvol software.

Results
Volume-rendered image of the femoral head in shown in Figure 1.

Figure 1: Visualization based on the human femur preparation as a whole
Figure 2: Sphere shaped clipping tool used on femoral head

Figure 3: Cut surface at the level of equator
Figure 4 shows subchondral microarchitecture of the femoral head with reference line layered on the image. Varied pattern of subchondral cancellous bone of the femoral head is observed.

**Conclusion**
3D-visualization based on µCT images enables detailed analysis of trabecular architecture of subchondral bone of femoral head. If automated or semi-automated selection of specific area is possible, mapping of the microarchitecture of the femoral head can be accomplished.

**References:**
2. Elke RP, Cheal EJ et al., "Three-dimensional anatomy of the cancellous structures within the proximal femur from computed tomography data",13, J Orthop Res. 1995