**Introduction:** Hip resurfacing is currently experiencing a resurgence as a viable option to total hip replacement in the younger, more active patient with end-stage osteoarthritis. Evidence supporting the strong short- to medium-term results is appearing in the literature [1-3]. Despite the relative success of the latest generation of hip resurfacing, the risk of early femoral neck fracture remains a concern when offering patients this alternative. The overall rate of femoral neck fracture is approximately 1-2% [4-7] however rates much greater than this estimate have been reported. Femoral neck fracture is currently the most common indication for revision arthroplasty following hip resurfacing [8]. Several potential risk factors have been identified in the literature that may predispose the prepared femur to post-operative neck fracture including neck notching, implant alignment, and exposed cancellous bone following impaction of the femoral component [2-7,9]. Exposed cancellous bone can result from suboptimal reaming preparation in which the chamfer ream does not extend distal enough or from excessive cement mantle underlying the proximal pole of the implant. Failure to completely cover reamed cancellous bone during impaction of the femoral component has been speculated to predispose the resurfaced femur to neck fracture however, to our knowledge, there has been no specific published biomechanical evidence that exposed cancellous bone weakens the proximal femur following the new generation of metal-on-metal hip resurfacing. Thus, the aim of the present study was to investigate the effect of exposed cancellous bone on the biomechanical strength of the resurfaced femur.

**Materials and Methods:** Eighteen Third Generation Composite Femurs (Sawbone model 3306, Pacific Research Laboratories Inc., Vashon, WA) were divided into three incremental component depth groups and implanted with the Birmingham Hip Resurfacing prosthesis (46 mm, Smith & Nephew Inc., Memphis, TN). The first group (Partial) was prepared with the implant placed at the native femoral head offset of the femur. This implant position covered reamed cancellous bone superiority, however it left partially exposed cancellous bone elsewhere along the circumference of the prosthesis rim. The second group (Proud) was prepared with the implant seated 5 mm proximal to the Partial group creating a ring of exposed cancellous bone with approximately 5 mm of exposed reamed cancellous bone superiorly. The third group (Complete) was seated 5 mm distal to the Partial group covering all reamed cancellous bone. Imageless computer navigation (VectorVision SR, BrainLAB, Heimstetten, DE) was used to position the initial guide wire during femoral head preparation. The femoral head was prepared following standard surgical protocol. Implant offset for the three resurfaced groups was measured by plain digital radiographs and compared to that of the intact specimens. Specimens were secured in the position of single leg stance and tested to failure in axial compression using an Instron mechanical testing machine (Instron Corp., Norwood, MA).

**Results:** The implant offsets of the three resurfaced groups were significantly different from one another (p<0.001). The implant offset of the Partial group was not significantly different from that of the femoral head offset of the intact femur (p=0.279). The Proud group (mean load-to-failure 2063 N) was significantly weaker than both the Partial (mean load-to-failure 2974 N) and Complete groups (mean load-to-failure 5899 N) when tested to failure (p=0.004, p=0.001, respectively). The Partial group was also significantly weaker than the Complete group when tested to failure (p=0.001). All fractures initiated at the superior aspect of the neck, at the component-bone interface.

**Discussion:** The new generation of hip resurfacing is gaining increasing acceptance as a treatment option for young active patients with hip arthritis. The concerns over femoral neck fracture are substantiated by the weakening of the proximal femur following hip resurfacing. The perceived benefit of reconstructing the femur to its native geometry may inherently weaken the proximal femur if reamed cancellous bone remains exposed following impaction of the femoral component. Failure to completely cover all reamed cancellous bone following implant impaction appears to significantly weaken the proximal femur, potentially leading to an increased risk of post-operative femoral neck fracture with hip resurfacing arthroplasty.

**References:**