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CORR Insights®: Exchangeable Femoral Neck (Dual-Modular) THA Prostheses Have Poorer Survivorship than Other Designs: A Nationwide Cohort of 324,108 Patients

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Where Are We Now?

While discussing THA in the 21st century, one of my mentors would often declare: “Modularity is an addiction.” The modularity evolution offered surgeons the possibility of assembling the

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components in situ, rather than implanting them as a monoblock or with a monolithic design. Many of us became swept up in the idea that we could uncouple fixation from variables such as length, offset, and version. It was believed that in the hands of a skilled surgeon, this technology could offer perfect restoration of our patients’ anatomy, minimizing the likelihood of uncommon complications such as instability, leg length inequality, and impingement. The wide adoption of dual-modular femoral stems—despite sparse data to support their utility—remains the most striking example of this “movement.”

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As with most addictions, some negative consequences arose from our fascination with modularity. There was the recognition that even the time-tested modular head-neck junction was a source of clinically important metal corrosion debris, occasionally causing severe adverse local tissue reactions [3]. Shortly thereafter, the modular junction between the neck and body of the femoral stem caused similar problems with specific stem designs [4, 7], albeit at a much earlier time point and at a much higher prevalence than that seen at the modular head-neck junction [9]. These dual-modular designs were subject to other unique failure mechanisms such as implant fracture [16] and disassociation [15].

Owing to these case reports, case series, and recalls of specific implant designs, dual-modular stems have mostly fallen out of favor. However, many designs still remain on the market and are available for use today. Several studies have demonstrated high complication rates with specific dual modular stem designs [9, 11, 14],

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yet it remains unclear whether this high failure rate is isolated to a handful of specific designs, or if it extends to the entire class of dual-modular stems.

In the current study, Colas and colleagues report the survivorship results of dual modular stems compared to monolithic designs in a registry analysis of 324,108 patients who underwent THA in France between 2009 and 2012. They found that dual-modular THAs had lower survivorship than their monolithic counterparts. This should lead us to question the routine use of dual-modular stems.

Where Do We Need to Go?

There are at least two important questions that remain unanswered. First, are these survivorship differences universal, or are there certain specific dual-modular designs that offer similar survivorship to monolithic stems? The recent report from the Australian Orthopaedic Association National Joint Replacement Registry [2] demonstrates wide variability in survivorship of different dual-modular stems, suggesting that survivorship is design-dependent. Still, the vast majority of the 14 designs in the Australian registry database demonstrated lower survival than monolithic stems. By contrast, a study

of nearly 900 patients by Duwelius and colleagues [5] found no difference in survival or hip scores between a modular and monolithic version of one particular stem design, suggesting that certain dual-modular stems may function quite well. Colas and colleagues were unable to examine this discrepancy in their study due to the limitations of their registry database, and it remains a question of interest going forward.

It remains unclear whether there are specific indications where the benefits of using a dual-modular stem might outweigh potential risks of failure. Prior studies have shown potential benefit with this stem design in certain “at-risk” populations, but these have been small, short-term, and with limited scope [1, 6, 8, 10, 12]. This leads to my second question: Are there specific classes of patients, such as those with severe proximal femoral deformity, who might benefit from a well-designed version of this stem? Unless this latter question can be answered affirmatively, the former is likely irrelevant.

How Do We Get There?

While imperfect, registry data offer the potential to assess implant survival across a large population-based cohort, and minimize the effects of a

surgeon’s biases. The Australian registry [2] is capable of comparing specific dual modular designs, albeit over a limited number of implants compared to the number available in Europe. If registries (including the French Health Insurance Information System) capture these additional variables, we can better assess individual implant performance, and perhaps discover whether specific designs offer comparable survivorship to monolithic designs. As a caveat, this kind of data granularity must be balanced with the administrative burden of maintaining up-to-date and accurate databases.

The second question may prove more difficult to answer. Prior studies have demonstrated that dual-modular stems allow for more consistent restoration of the native head center [1, 6, 13]. However, the clinical implications of this are unclear. This design may help prevent prosthetic impingement in the setting of excessive femoral anteversion or retroversion [8, 10], but comparative clinical data demonstrating improved outcomes remains sparse [12]. Prosthetic impingement and instability remain relevant clinical problems in modern THA, particularly in patients with proximal femoral deformities seen following trauma or with developmental conditions such as hip dysplasia or Legg-Calvé-Perthes disease. In order to justify the potential

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increased risk of this stem design, additional prospective data in one or more of these specific patient populations demonstrating a clear improvement in dislocation rates or prosthetic impingement will be necessary. At present, there is insufficient justification to support the use of these devices until more-robust evidence is provided.

References

1. Archibeck MJ, Cummins T, Carothers J, Junick DW, White RE. A comparison of two implant systems in restoration of hip geometry in arthroplasty. *Clin Orthop Relat Res*. 2011;469:443–446.
2. Australian Orthopaedic Association National Joint Replacement Registry. Annual report 2016. Available at: <https://aoanjrr.sahmri.com/annual-reports-2016>. Accessed February 9, 2017.
3. Cooper HJ, Della Valle CJ, Berger RA, Tetreault M, Paprosky WG, Sporer SM, Jacobs JJ. Corrosion at the head-neck taper as a cause for adverse local tissue reactions in total hip arthroplasty. *J Bone Joint Surg Am*. 2012;94A:1655–1661.
4. Cooper HJ, Urban RM, Wixson RL, Meneghini RM, Jacobs JJ. Adverse local tissue reaction arising from corrosion at the femoral neck-body junction in a dual-taper stem with a cobalt-chromium modular neck. *J Bone Joint Surg Am*. 2013;95:865–872.
5. Duwelius PJ, Burkhart B, Carnahan C, Branam G, Ko LM, Wu Y, Froemke C, Wang L, Grunkemeier G. Modular versus nonmodular neck femoral implants in primary total hip arthroplasty: which is better? *Clin Orthop Relat Res*. 2014;472:1240–1245.
6. Duwelius PJ, Hartzband MA, Burkhart R, Carnahan C, Blair S, Wu Y, Grunkemeier GL. Clinical results of a modular neck hip system: hitting the “bull’s-eye” more accurately. *Am J Orthop*. 2010; 39:2–6.
7. Gill IPS, Webb J, Sloan K, Beaver RJ. Corrosion at the neck-stem junction as a cause of metal ion release and pseudotumour formation. *J Bone Joint Surg Br*. 2012;94:895–900.
8. Matsushita A, Nakashima Y, Fujii M, Sato T, Iwamoto Y. Modular necks improve the range of hip motion in cases with excessively anteverted or retroverted femurs in THA. *Clin Orthop Relat Res*. 2010;468:3342–3347.
9. Meftah M, Haleem AM, Burn MB, Smith KM, Incavo SJ. Early corrosion-related failure of the rejuvenate modular total hip replacement. *J Bone Joint Surg Am*. 2014;96:481–487.
10. Miki H, Sugano N. Modular neck for prevention of prosthetic impingement in cases with excessively anteverted femur. *Clin Biomech (Bristol Avon)*. 2011;26:944–949.
11. Regis D, Sandri A, Bartolozzi P. Stem modularity alone is not effective in reducing dislocation rate in hip revision surgery. *J Orthop Traumatol*. 2009;10:167–171.
12. Sakai T, Ohzono K, Nishii T, Miki H, Takao M, Sugano N. A modular femoral neck and head system works well in cementless total hip replacement for patients with developmental dysplasia of the hip. *J Bone Joint Surg Br*. 2010;92-B:770–776.
13. Sariali E, Mouttret A, Pasquier G, Durante E, Catone Y. Accuracy of reconstruction of the hip using computerized three-dimensional preoperative planning and a cementless modular neck. *J Bone Joint Surg Br*. 2009;91B:333–340.
14. Silverton CD, Jacobs JJ, Devitt JW, Cooper HJ. Midterm results of a femoral stem with a modular neck design: clinical outcomes and metal ion analysis. *J Arthroplasty*. 2014;29:1768–1773.
15. Sporer SM, DellaValle C, Jacobs J, Wimmer M. A case of disassociation of a modular femoral neck trunion after total hip arthroplasty. *J Arthroplasty*. 2006;21:918–921.
16. Wright G, Sporer S, Urban R, Jacobs J. Fracture of a modular femoral neck after total hip arthroplasty. *J Bone Joint Surg Am*. 2010;92:1518–1521.