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Choosing a Femoral Head: A Survey Study of Academic Adult Reconstructive Surgeons

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ABSTRACT

Background: Our aim was to examine how academic adult reconstructive surgeons have interpreted evidence on femoral head material in total hip arthroplasty (THA).

Methods: A 16-question survey to evaluate attitudes toward ceramic and cobalt-chrome head use was emailed to 274 faculty at 42 US adult reconstruction fellowship programs.

Results: With 116 respondents, the response rate was 42.2%. Faculty use ceramic heads 72.9% of the time. The most common reason why respondents do not use ceramic heads is cost (44.8%). Ninety-four percent of faculty have observed head-neck taper corrosion in cobalt-chrome on polyethylene THA, while 9.5% of faculty have observed head-neck taper corrosion in ceramic on polyethylene THA. Only 6.0% of surgeons have seen BioloX Delta ceramic fracture.

Conclusion: Adult reconstruction thought leaders are guided by evidence suggesting that with ceramic heads, taper corrosion and fracture are rare. Cost and personal experience also strongly influence their implant selection. Efforts to equalize cost of ceramic and cobalt-chrome heads may free surgeons to practice in a purely evidence-based fashion.

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Head-neck taper corrosion has recently received significant attention in the scientific literature [1–4]. Awareness of head-neck taper corrosion as an etiology of total hip arthroplasty (THA) failure and indication for revision surgery has increased of late, although this phenomenon was reported as early as 1991 [5].

Fretting and crevice corrosion at the prosthetic head-neck modular junction may result in adverse local tissue reaction (ALTR), a thick-walled collection of predominantly lymphocytic infiltrate that can be destructive to surrounding tissues [4]. Taper corrosion is less likely with ceramic heads than with cobalt-chrome heads [6–8]. Although the use of ceramic heads in THA has increased over time, from 4% of heads in 2001 to 39% in 2012, surgeons continue to use cobalt-chrome heads (61% in 2012) as considerations other than taper corrosion also impact prosthetic head selection [9].

Additional factors affecting prosthetic head selection include wear properties, implant fracture risk, and cost. Due to a lower coefficient

of friction, ceramic heads theoretically have better wear properties and therefore may have better long-term survivorship than cobalt-chrome heads [10]. However, short-term to mid-term studies show no difference in survivorship between ceramic-on-highly crosslinked polyethylene and metal-on-highly crosslinked polyethylene THA [11,12]. There is a risk of fracture with ceramic heads that does not exist with cobalt-chrome heads. However, the incidence of ceramic head fracture has decreased with advances in ceramic head material composition and has been reported to be 0.003% with fourth generation BioloX Delta ceramic [13]. Ceramic heads are typically more expensive than cobalt-chrome heads, although the cost difference varies by hospital. Some centers have even negotiated equivalent pricing of cobalt-chrome and ceramic heads.

The aim of our study was to examine how academic orthopedic surgeons in the field of adult reconstruction have interpreted the available evidence on femoral head material in THA as reflected by a survey of their clinical practices.

Materials and Methods

Study Design

A 16-question survey formulated by the authors was used to evaluate the following for ceramic and cobalt-chrome heads: (1)

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1. Among those undergoing total hip arthroplasty (THA), in which patients do you use ceramic heads?
 - a. all patients
 - b. patients < 40 years of age
 - c. patients < 50 years of age
 - d. patients < 60 years of age
 - e. patients < 65 years of age
 - f. patients < 70 years of age
 - g. patients < 80 years of age
 - h. high level of activity/function regardless of age
 - i. I do not use ceramic heads
2. Please fill in the percentage of femoral head material used in your THA practice (must equal 100%). Please enter a value in every field.
 - a. Ceramic:
 - b. Cobalt chrome:
 - c. Dual mobility with ceramic head:
 - d. Dual mobility with cobalt chrome head:
 - e. Other:
3. If you do not use ceramic heads in all patients, why would you choose to use a cobalt chrome head (choose all that apply)?
 - a. cost
 - b. there is no benefit to use of ceramic heads
 - c. limitations in neck length options with ceramic heads
 - d. I only use ceramic heads with larger diameter head size
 - e. concern with potential for ceramic fracture
 - f. I use a femoral component with a cobalt chrome trunnion
4. What is the difference in the cost of a ceramic head as compared to a cobalt chrome head at your institution?
 - a. No difference
 - b. \$0-150
 - c. \$151-300
 - d. \$301-500
 - e. \$500-1000
 - f. > \$1000
 - g. I don't know the cost difference
5. If cost were not an issue, would you use ceramic heads in all patients?
 - a. yes
 - b. no
6. Have you personally observed a case of head-neck taper corrosion with a ceramic head on polyethylene THA?
 - a. yes
 - b. no
7. Have you personally observed a case of head-neck taper corrosion with a cobalt chrome head on polyethylene THA?
 - a. yes
 - b. no
8. If you operate on a case of head-neck taper corrosion with a cobalt chrome head on polyethylene THA what femoral head would you use during the revision surgery (regardless of whether the femoral stem was revised)?
 - a. Cobalt chrome
 - b. Ceramic
9. If you operate on a case of head-neck taper corrosion with a cobalt chrome head on polyethylene THA and retain the femoral stem would you use a titanium sleeve between the ceramic head and the previously used trunnion?
 - a. yes
 - b. no
10. Do you believe there is a clinically significant difference in long term wear between ceramic and cobalt-chrome heads on highly cross-linked polyethylene?
 - a. yes
 - b. no
11. Do you believe there is the potential for head-neck taper corrosion any time a cobalt-chrome head is used?
 - a. yes, can occur with any taper
 - b. no, only occurs with certain tapers
12. Should use of ceramic heads be standard of care due to the concern for head-neck taper corrosion with cobalt chrome heads?
 - a. yes
 - b. no
13. Is the potential for ceramic head fracture a significant concern for you?
 - a. yes
 - b. no
14. Have you seen a ceramic head fracture with fourth generation (Bilox Delta) material?
 - a. yes
 - b. no
15. If you have seen a ceramic head fracture with fourth generation (Bilox Delta) material did it occur
 - a. intraoperatively?
 - b. postoperatively?
 - c. I have not seen a ceramic head fracture with fourth generation (Bilox Delta) material
16. Which concerns you more when choosing the femoral head material?
 - a. taper corrosion with a cobalt chrome head
 - b. ceramic head fracture
 - c. both concern me equally
 - d. neither concern me

Fig. 1. Femoral head material survey.

frequency of use; (2) rationale for the choice of material; (3) cost difference of the materials, if known; and (4) experience with taper corrosion. An invitation to complete the survey was sent via email to 274 faculty at 42 academic adult reconstruction fellowship programs in the United States. The 42 academic centers were selected according to number of publications in *Journal of Bone and Joint Surgery, Clinical Orthopaedics and Related Research*, and *Journal of Arthroplasty* [14]. The survey questions (Fig. 1) were administered using

SurveyMonkey (Palo Alto, CA), a web-based survey platform, and were open from June 21, 2016, to September 30, 2016. This study did not require institutional review board approval at our institutions.

Statistical Analysis

We began our analysis by summarizing the distribution of responses to each question in our survey. For question 2, which

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