

Influence of Prosthetic Design on Squeaking After Ceramic-on-Ceramic Total Hip Arthroplasty



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Many studies have attempted to elucidate the etiology of squeaking in ceramic-on-ceramic THA's. Proposed causes include component malposition causing impingement or "edge loading," ligamentous laxity leading to microseparation and "stripe wear," inadequate lubrication, particulate metal debris, and component design.

The primary author began implanting ceramic-on-ceramic total hips in 1999. Over the course of 10 years, 4 distinct implant brands were utilized. However, an unusually high incidence of intense, audible squeaking became apparent shortly after implanting a cohort of Stryker Trident acetabular components and Accolade femoral stems. This study was undertaken to determine if squeaking is related to this particular implant combination and to elucidate any other factors which might be related to squeaking.

METHODS:

Frequency and severity of squeaking were graded as shown in Table 1. "PROBLEM SQUEAKING" was defined as squeaking which was always perceptible to others (Severity Grades 3-4) and occurred at least once per week (Frequency Grades 2-4).

Twelve independent variables (Table 2) were analyzed using a logistic regression analysis with additional Chi-square analysis where appropriate to determine variables associated with squeaking.

Table 1: Frequency and Severity Rating of Squeaking

Severity Grade	Severity of Squeak
1	Perceptible only to patient
2	Occasionally perceptible to others
3	Always perceptible to others, but not social problem
4	Loud; creates social problem for patient
Frequency Grade	Frequency of Squeak
1	<1 time/week
2	1-4 times/week
3	>4 times/week
4	Daily

Table 2: Independent Variables Assessed

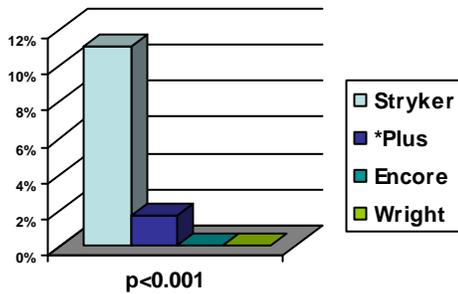
Demographic Variables	Implant Variables
Age	Component Company
Height	Acetabular Component Size
Weight	Femoral Head Size
Body Mass Index (BMI)	Femoral Head—Neck Length
Gender	Femoral Component Offset
Diagnosis	
Activity Level (UCLA Score)	

RESULTS:

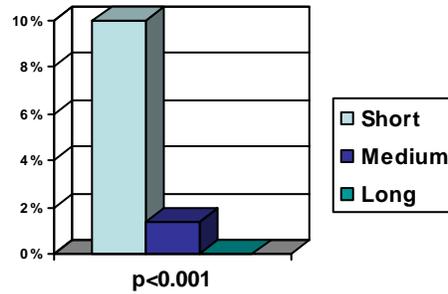
PROBLEM SQUEAKING was associated with 3 independent variables:

1. Acetabular implant (Stryker Trident)
2. Short neck length
3. Diagnosis of rheumatoid arthritis

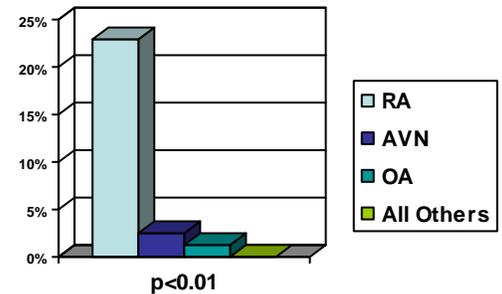
Implant Company



Problem Squeaking vs. Neck Length



Diagnosis



Incidence of Squeaking (Any Frequency/Severity)

Acetabular Implant	Number of Squeakers	Number of Implants	Incidence
Stryker	16	45	35.6%
*Plus	4	58	6.9%
Encore	3	138	2.2%
Wright	1	29	3.4%
Total	24	270	8.8%

Incidence of PROBLEM SQUEAKING

Implant	Number of Squeakers	Number of Implants	Incidence
Stryker	5	45	11.1%
*Plus	1	58	1.7%
Encore	0	138	0
Wright	0	29	0
Total	6	270	2.2%

DISCUSSION:

Stryker’s Trident acetabular component design is unique compared to the other 3 designs investigated in this study in that the ceramic is encased in a metal shell which extends past the ceramic to protect it from neck impingement. However, this extended rim increases the likelihood of neck impingement against the metal casing, which may generate particulate metal debris or lever the ceramic head against the liner, either which may damage the articular surfaces and lead to squeaking.

Capello, et al. (2008) reported a low incidence of squeaking in their series of Stryker Trident cups and Omnifit stems made from the standard alpha+beta titanium alloy (Ti-6Al-4V). However, Murphy (2008) recently reported a high incidence of squeaking ONLY when the Trident cup was mated with the Accolade stem (which is HA coated and uses a beta titanium alloy (TMZF) containing molybdenum, zirconium, and iron). This study corroborates his findings.

Short necks may increase the likelihood of damage to the ceramic articulation if inadequate offset results in lax soft tissues and microseparation with resultant stripe wear damage to the ceramic surfaces. Short necks may also lead to more impingement if the geometry of the neck is tapered such that a short neck positions a wider part of the femoral neck against the acetabular rim than a long neck (Keurentjes, 2008).

The explanation for a higher incidence of squeaking in rheumatoid patients remains elusive. One would speculate that rheumatoids would be less likely to damage the ceramic surfaces due to a) relatively low activity levels and b) reduced mobility resulting in less likelihood of impingement. Perhaps inflammatory synovial fluid loses some of its lubricating properties in rheumatoids.

CONCLUSIONS:

Based on the findings of this study, the authors recommend against the use of the Stryker Trident cup with the Accolade stem and the use of short necks in ceramic-on-ceramic total hip arthroplasty. Ceramic-on-ceramic articulations should be used with caution in rheumatoids. Further research will likely elucidate the mechanisms causing problem squeaking in these subgroups of patients. Once again, we should be careful not to throw out the baby with the bathwater.