Trabecular Metal-Backed Compared To Fiber Mesh-Backed Cementless Acetabular Components. A Single-Centre Study (6,563 Hips)

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INTRODUCTION: Cementless fixation has seen ongoing advancements in materials, surface technologies, and design features to optimise bone ingrowth and ensure implant stability.The advantage of cementless fixation is the potential for osseointegration and therefore a more lasting bond between the implant and bone, meeting the demands of a broader patient demographic, including younger, more active individuals seeking durable solutions for their mobility. .Among cementless options, various surface coatings have been explored, ranging from porous coatings, grit-blasted and fiber mesh surfaces, with or without hydroxyapatite enhancements. Notably, porous tantalum implants have been developed to offer improved initial stability owing to a high coefficient of friction of a trabecular structure.

This study compares the long-term outcomes of different cementless acetabular components at a single institution, particularly fiber mesh titanium and porous tantalum.

METHODS:

This study included 6,563 patients who underwent primary THA with either fiber mesh titanium or trabecular metal backed acetabular components. Data was sourced from a prospectively maintained local arthroplasty database and linked with the National Joint Registry.

We identified 6563 patients with either a fiber mesh titanium shell (Trilogy and Trilogy IT, Zimmer Biomet, Warsaw, IN) or a porous tantalum shell (Continuum, Zimmer Biomet, Warsaw, IN). All implants were used for primary THA.

Information regarding age, gender, indication for primary THA, fixation, and bearing surface was collected. Outcomes including death, follow up and cause for revision were also obtained. Institution review board approval was obtained.

RESULTS:

Over the 14-year period, there were 5,603 fiber mesh acetabular components and 960 TM acetabular components. Patients' characteristics are summarised in Table 1. At the final follow-up, there were 1,102 (19.69%) deaths in the fiber mesh group and 108 (11.25%) in the TM group. The mean follow-up was 6.5 years (SD 4.5) in the fiber mesh group and 7.1 years (SD 3.9) in the TM group.

During the study period 123 (2.20%) fiber mesh components and 9 (0.94%) TM components underwent a revision procedure. The causes for revision and frequency are causes for revision, and frequency is illustrated in Table 2.

The 10-year survivorship was 97.3% (95%CI 96.7-97.8) in the fiber mesh group and 98.9% (95%CI 98.2-99.6) in the TM group (Figure 1). Log-rank comparisons showed the survival distributions of the two groups were statistically different $\chi 2(2) = 6.8$, $P = 0.009$.

Cox proportional hazard regression analyses showed that fiber mesh had an increased risk of all-cause revision (HR = 1.73). This was not statistically significant (Table 3). The remaining covariates included in the regression analysis did not reach significance but cementless, COC & COP had lowest risk of all-cause revision in comparison to hybrid fixation and other articulations.

DISCUSSION AND CONCLUSION:

To our knowledge, this is the first non registry study comparing clinical outcomes of TM and fiber mesh cups in primary THA. It demonstrated excellent 10-year survivorship of over 96% for both implants. Our results revealed low revision rates for both the acetabular components, with TM components having a marginally better survival. Although not statistically significant, there were notably lower revision rates of infection and acetabular loosening of TM components. This is the first study to publish results comparing clinical outcomes of TM and fiber mesh cups. This is because there appears to be a clinical equivalence between using tantalum and titanium acetabular cups.

With ever-increasing demand on an already stretched healthcare system under significant financial pressure, cost-effectiveness is paramount. There is an increased cost with TM compared to fiber mesh cups. TM cups are 19% more expensive at our institute than fiber mesh cups. Although this study highlights improved survival, fiber mesh illustrates excellent survival. This prompts a revaluation of TM application in primary THA. It appears that TM cups are best used selectively, particularly in cases involving complex primary surgeries or revision surgeries with less bone contact or a greater need for primary stability. In such cases, the unique material properties of the TM can be fully utilised.

Conclusion

This study highlights the effectiveness of cementless acetabular components in THA, evidenced by high survivorship rates and low revision rates over a 14-year period. TM cups illustrate improved survival over fiber mesh cups, but this is marginal, and we therefore do not recommend the widespread use of TM cups in uncomplicated primary THA due to cost-effectiveness concerns. We suggest a selective application of TM cups, potentially reserved for complex primaries and revisions.

Table 1: Characteristics of THA by acetabular components (COC = ceramic-on-ceramic, MOP = metal-on-polyethylene, COP = ceramic-on-polyethylene, OxOP = oxinium-on-polyethylene)

	Trabecular Metal	Fiber mesh	p-value
Number of patients	960	5,603	
Number of deaths	108	1102	
Mean follow up in years (SD)	7.1 (3.9)	6.5 (4.6)	
Range	0.1 -14.1	0.1 – 20.4	
All-cause revision	9 (0.94%)	123 (2.20%)	
Dislocation	5 (0.52%)	49 (0.87%)	P=0.26
Infection	3 (0.31%)	51 (0.91%)	P=0.06
Stem periprosthetic fracture	1 (0.10%)	9 (0.16%)	P=0.68
Acetabular loosening	0	6 (0.11%)	P=0.31
Stem loosening	0	6 (0.11%)	P=0.31
Liner wear	0	1 (0.02%)	P=0.67
Acetabular fracture	0	1 (0.02%)	P=0.67

Table 2: Revision rate and causes for revision of THA

	All-cause revision		
	Multivariable		
	Hazard Ratio	95% CI	p-value

	Trabecular Metal	Fiber mesh
Number of patients	960	5,603
Gender (Women)	569 (59.27%)	3344 (59.68%)
Age distribution		
Less than 60	601 (62.60%)	1925 (34.36%)
60 to 75	18 (19.27%)	2100 (37.48%)
Great for, 75	174 (18.13%)	1578 (28.16%)
Number of surgeons	16	50
Primary indication		
Osteoarthritis	751 (78.23%)	4699 (83.87%)
Avascular necrosis	63 (6. 56%)	151 (2.69%)
DDH/Perthes/Congenital	78 (8.13%)	137 (2.45%)
Failed hemiarthroplasty	4 (0.42%)	23 (0.41%)
Malignancy	1 (0.10%)	8 (0.14%)
Inflammatory arthropathy	25 (2.60%)	97 (1.73%)
Trauma	21 (2.19%)	423 (7.55%)
Other	17 (1.78%)	65 (1.16%)
Construct		
Cementless	387 (40.31%)	814 (14.53%)
Hybrid	573 (59.69%)	4789 (85.47%)
Articulation		
COC	426 (44.38%)	86 (1.53%)
MOP	167 (17.40%)	2561 (45.71%)
COP	365 (38.02%	2862 (51.08%)
OxOP	1 (0.10%)	82 (1.46%)

Age			
<65	1	-	-
65-74	1.19	0.77-1.85	0.42
>=75	1.06	0.64-1.73	0.97
Gender			
Women	1	-	-
Men	0.93	0.65-1.33	0.69
Acetabular Component			
Trabecular Metal	1	-	-
Fiber Mesh	1.73	0.77-3.91	0.181
Construct			
Cementless	1	-	-
Hybrid	1.31	0.69-2.48	0.41
Articulation			
COC	1	-	-
COP	1.34	0.35-3.18	0.99
MOP	1.42	0.62-5.96	0.99
OxOP	1.4	0.30-11.38	0.99

Table 3: Table showing comparisons between groups for all-cause Revision