Irish Medical Journal
Established 1867

Issue: Ir Med J; Vol 114; No. 10; P484

Exeter® vs Summit® Stems in Total Hip Arthroplasty at 5 Year Follow Up

C. O'Sullivan, G. Sheridan, L. Vernon, K. Linehan, N. Lynch, R. Gul, S. Guerin, J. Harty

Cork University Hospital, Wilton, Cork.

Abstract

Aims

The cemented Exeter® stem is currently considered the gold standard in hip stem prostheses due to its excellent revision rates and patient satisfaction. This study seeks to determine whether the uncemented Summit® stem has a comparable revision rate and functional performance.

Methods

817 consecutive patients undergoing a primary total hip replacement (THR) were retrospectively selected in a 32-month period from January 2012 to August 2014. Patients were divided into two groups depending on the stem type implanted. The clinical outcomes of each group were compared using all-cause revision data and with SF12 and WOMAC scores taken pre-operatively, at two years and at five years post THR.

Results

The likelihood of revision was almost identical (p=1.00). Exeter® had a 1.89% revision rate and Summit® had a 1.78% revision rate. Summit® stems had slightly higher SF12 and WOMAC scores recorded on average at each time point however these were not significantly different at five years (p=0.1633 for SF12, p=0.7605 for WOMAC).

Conclusion

Exeter® and Summit® hip stem prostheses have similar clinical outcomes and patient satisfaction scores at five years post THR. This large cohort study demonstrates that the uncemented Summit® stem has an excellent profile when compared to the gold standard cemented stem in THR's.

Introduction

Often considered as the procedure of the century, total hip arthroplasty has revolutionised the management of hip osteoarthritis since the 1960's[1]. In more recent times, there has been ongoing debate about the benefits and risks of different fixation methods of components used in this procedure.

Cemented femoral stems, and in particular, the Exeter® V40 prosthesis are currently considered the gold standard stem prostheses in primary total hip replacement (THR)[2–5]. A recent systematic review by Moskal et al. published in 2016 suggested that there is a significant role to play for cementless stems in THR, especially in younger patients who demonstrate improved outcomes compared to cemented prostheses. However, older patients are at a higher risk of revision when cementless stems are used[6]. A prospective multicentre study by García-Cimbrelo et al. in 2018 of 485 patients receiving a Summit® stem, with a follow-up range of 2.5-6 years, found that the Summit® stem provided excellent clinical results and had good radiographic outcomes and low revision rates[7].

This retrospective cohort study seeks to compare the clinical outcomes of the Exeter® cemented stem and the Summit® cementless stem at a minimum of five years.

Methods

Eight hundred and seventeen patients who underwent primary THR between January 2012 and August 2014 were included in the study. All data was gathered from the prospectively-collected arthroplasty registry in our institution. All procedures were performed by high-volume fellowship-trained hip arthroplasty surgeons. The surgeons in the study used either Summit® or Exeter® stems exclusively. Patients were divided into two groups based on whether they had an Exeter® V40 femoral stem prosthesis or a Summit® femoral stem prosthesis implanted at the time of the primary procedure.

The Exeter group consisted of 423 patients with a cemented femoral stem (Exeter V40, Stryker Orthopaedics, Michigan, United States) including 216 males and 207 females with a mean age of 68.07 (25-91, σ=10.80). The commonest acetabular component in this group was the uncemented Trident® cup (n=305) followed by the cemented Rimfit® cup (n=100). Eighteen patients had different acetabular components inserted. The Summit® group consisted of 394 patients implanted with a cementless femoral stem (Summit® Tapered Hip System, DePuy Synthes, Johnson & Johnson, Warsaw, Indiana, United States) including 203 males and 191 females with a mean age of 62.92 (19-90, σ=12.76). The uncemented Pinnacle® acetabular component was used in almost all cases (n=392).

The inclusion criteria for this study were: 1: Patients undergoing primary THR. 2: Procedure performed between January 2012 and August 2014. 3: The femoral stem was either an Exeter® V40 or a Summit® Tapered Hip System.

Exclusion criteria for this study were procedures outside of this date range, incomplete datasets, indication of hip fracture fixation or conversion of a dynamic hip screw to a THR.

Patients were assessed pre-operatively, two years post-operatively and at five years post-operatively using the Short Form 12 (SF12) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) health questionnaires. The SF12 is a 12 question multiple choice questionnaire which assesses the patients' own perception of their general health, activities of daily living and wellbeing[8]. WOMAC is used to more specifically evaluate the physical function, stiffness and pain of hip and knee joints in patients with osteoarthritis[9]. SF12 and WOMAC scores were recorded up to five years post primary THR for all patients.

Data collection was performed by examining theatre logbooks, operative notes, and the Irish National Orthopaedic Register (INOR) database for revision data of the primary THR's which may have occurred up to the time of review. The reason for the revision was also verified using theatre logbooks, operative notes and the INOR database. The review was carried out in compliance with audit guidelines and General Data Protection Regulation (GDPR) legislation at our institution.

Stata IC 13.1 for Mac (College Station, Texas, USA) was used for data analysis. Numerical data was presented as mean ± standard deviation and compared by t-test for 5-year SF12 and WOMAC outcomes. Fisher's exact test was used to compare categorical revision rate data. As there were no significant predictors of revision among the measured parameters, there was no indication for multivariate analysis. Therefore, a univariate analysis was used to assess the impact of stem type on revision rates. A Kaplan-Meier curve was generated to compare the survival rates of both femoral stem prostheses over a 5-year period using all-cause revision as the point of failure. A p-value of <0.05 was considered to be statistically significant.

Results

Demographics

The Summit® group had a marginally younger age profile than the Exeter® group with a mean difference of 5.15 years (62.92 v 68.07). Both groups were comparable regarding all other demographic parameters. There was a slight male preponderance of 51.06% in the Exeter® group and 51.52% in the Summit® group.

Revision Rates

The overall revision rate was 1.89% for the Exeter® stem and 1.78% for the Summit® stem at a minimum of five years with no statistically significant difference on univariate analysis (p=1.00). Mean time to revision for Summit® stems was 19.7 months compared to 31 months for Exeter® stems. The commonest indication for revision was periprosthetic fracture (n=8), followed by instability (n=2), infection (n=2) and limb length discrepancy (n=2).

Most of the 8 peri-prosthetic fractures occurred early, with 3 of the Exeter® and 2 of the Summit® fractures occurring less than 6 months post-operatively. All of the remaining peri-prosthetic fractures in both groups occurred >2 years post-operatively. One Exeter® and one Summit® stem were revised for pain of unspecified origin. When analysing the impact of gender, operating surgeon, articulation bearing type, hybrid or uncemented fixation type and acetabular component type on revision rates, we found that no variable was predictive of revision.

Table 1. Demographic data for Exeter & Summit stems.

	Exeter	**Summit**	**Cumulative**
Total	423	394	817
Gender Male/Female	216/207	203/191	419/398
Mean Age	68.07	62.92	65.59
Revised	8 (1.89%)	7 (1.78%)	15 (1.84%)
Revision Indication			
Dislocation	2	0	2
Periprosthetic Fracture	4	4	8
Infection	1	1	2
Limb length discrepancy	0	2	2
Other	1	0	1
Mean time to revision	31 months	19.71 months	25.56 months

Functional Outcomes

SF12 and WOMAC scores were recorded for both prostheses at fixed time intervals preoperatively, then again at 2-years and 5-yeas postoperatively. At the 2-year time point, the Exeter® group had a 35% attrition rate and by the 5-year time point the attrition rate was 59%. The Summit® group showed similar rates of attrition at 35% and 51% respectively. The SF12 and WOMAC scores for both implant groups were comparable in their trend from preoperative to five years postoperatively (Figures 1 & 2). A two-sample t-test with equal variances comparing the results of the Exeter® and Summit® 5-year SF12 scores from 171 and 192 patients respectively with a 95% confidence interval returned a p-value of 0.1633 showing that there was no significant difference between the two groups. Likewise, a two-sample t-test with equal variances for the difference between the WOMAC scores for the two groups returned a p-value of 0.7605. Therefore, the WOMAC scores were not significantly different between the groups. Boxplot analysis in figure 2 and figure 3 of SF12 and WOMAC scores for both groups at each time point illustrate very similar means, medians and interquartile ranges for both scores at all time points.

Figure 1. SF12 boxplots for Exeter® & Summit® stems at pre-op, 2-year & 5-year time points.

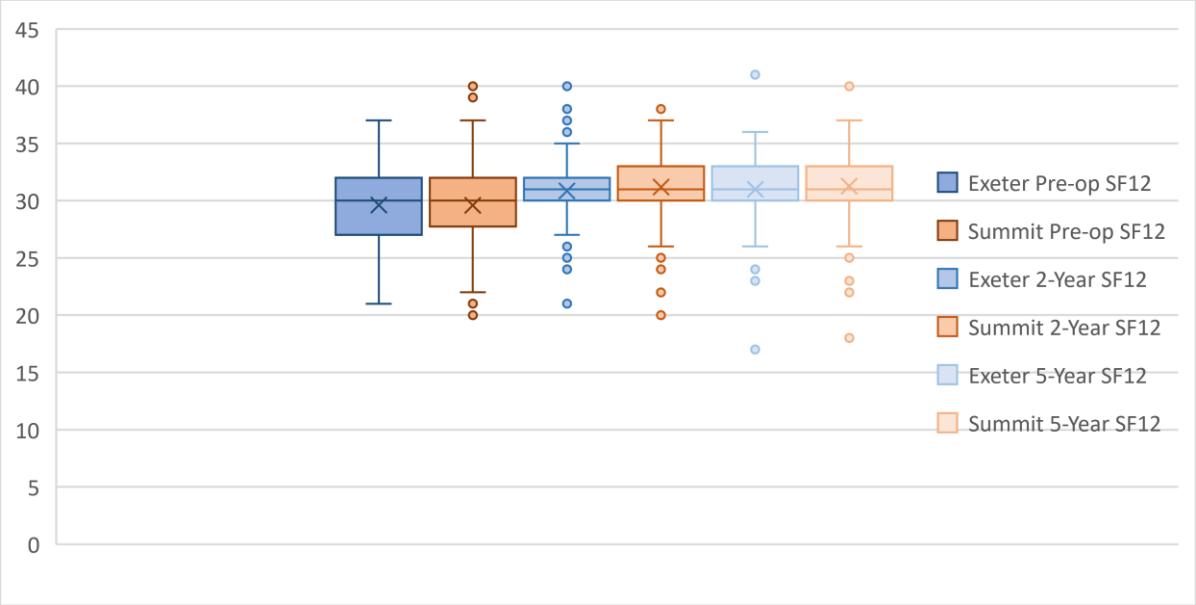
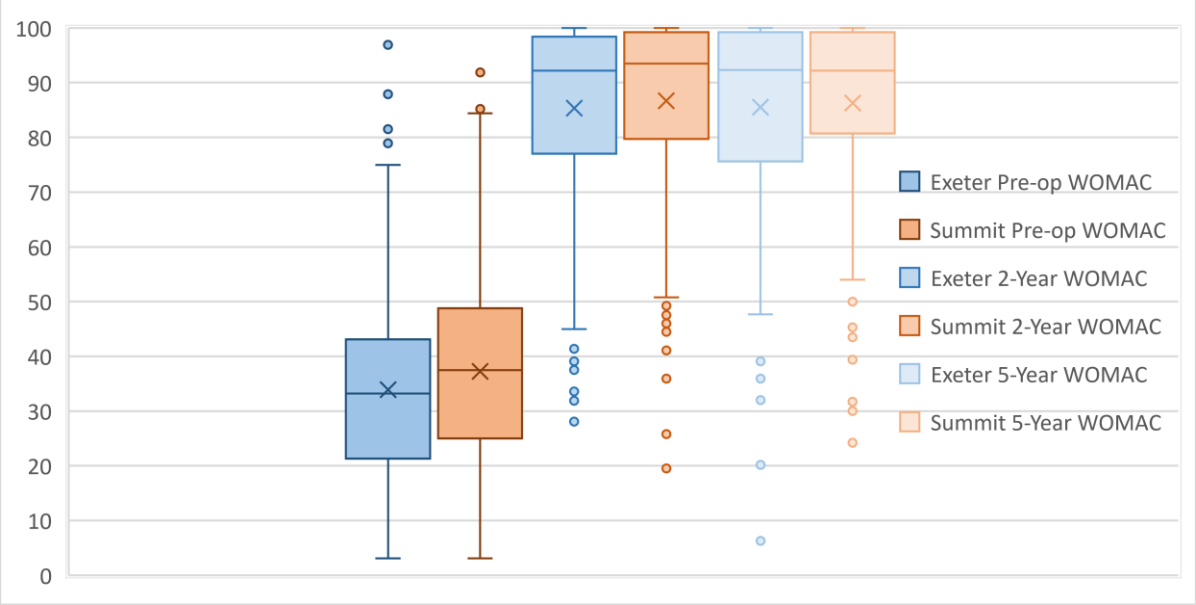


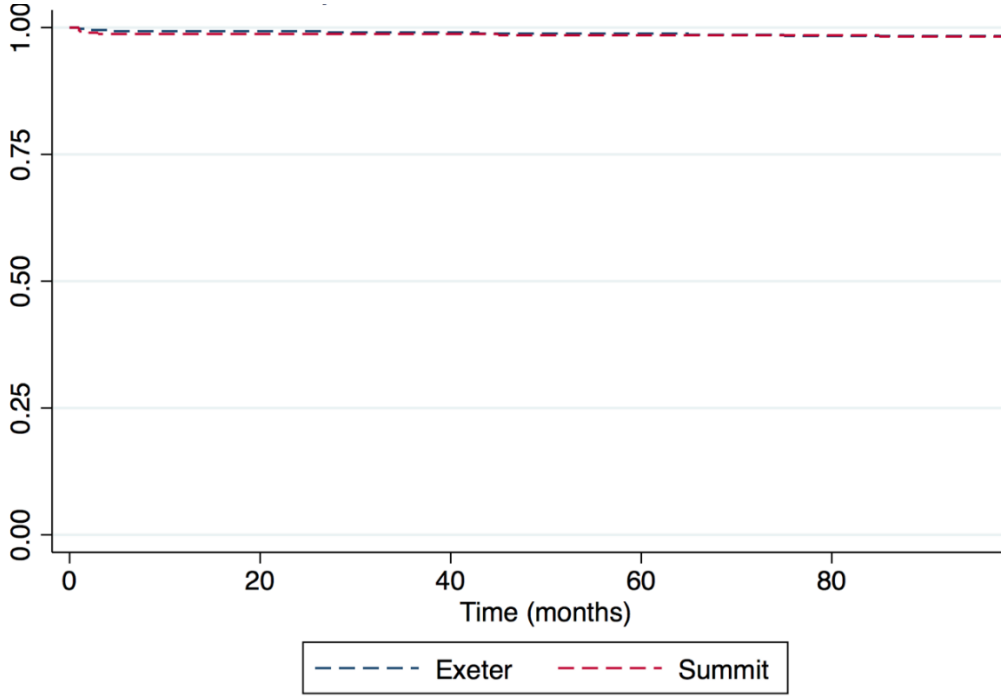
Figure 2. WOMAC boxplots for Exeter & Summit stems at pre-op, 2-year & 5-year time points.



Kaplan-Meier Survival Estimate

The Kaplan-Meier survival estimate based on the patient data provided in this study displayed a near-identical result for both the Exeter® and Summit® stems (Figure 3). The graph represents a survivorship exceeding 98% for both prostheses at a minimum of 5 years.

Figure 3: Kaplan-Meier survival estimates for Exeter & Summit stems at a minimum of five years.



Discussion

The Summit stem currently has no large-scale comparative population study of its clinical outcomes over a long-term period. The largest studies relating to outcomes of the Summit® stem in the current literature included 80 Japanese patients with a follow up period ranging from 48 to 66 months as well as a prospective study relating to radiographic and clinical outcomes in the Summit® stem exclusively of 485 patients with a follow-up period of 2.5 to 6 years[7,10]. This study included 394 patients receiving a Summit® stem implant and followed up to a minimum of five years in comparison with 423 patients who received a cemented femoral Exeter® V40 stem, to determine the viability of the implant against a well-known gold standard prosthesis in primary THR. We therefore present a large cohort of Summit® stems over the longest recorded follow-up period in the literature to date.

The outcomes were very similar between the two stems. The lack of statistically significant difference demonstrates that the clinical outcomes as perceived by the patients in both the Exeter® and the Summit® group were comparable. This correlates with the overall revision rates for both stem prostheses with a 1.89% and a 1.78% revision rate for the Exeter® and Summit® groups respectively. The Fisher's exact test p-value of 1.00 effectively confirms the null hypothesis that patients in either group were equally likely to require a revision procedure irrespective of the femoral stem they had implanted.

Kaplan-Meier survival estimates for both stems were essentially the same. The cumulative survivorship estimates remained at >98% at five years postoperatively for both prostheses.

Considering the potential advantages and disadvantages of using cemented or uncemented stems is now an important exercise considering that the comparative results of each group were nearly indistinguishable. Cemented stems are generally thought of as having better short-term outcomes with less pain. This may be a consequence of earlier solid fixation of the stem to bone secondary to interdigitation of the cement mantle into the cancellous bed[11,12].

However, there is no risk of bone cement implantation syndrome with uncemented prostheses. This is a desirable characteristic in patients with a fragile cardiorespiratory status[13].

Cementless stems may also have a greater risk of peri-prosthetic fracture, particularly in elderly populations[6]. However, with improving technology and surgical techniques, cementless stems may have better outcomes in younger patients even though they are a more active population[14].

Studies of joint registry data have shown that both Exeter® and Summit® stems perform well when compared to other cemented and cementless stems respectively, with significantly more data available on the Exeter® stem as it has been in use for a much longer period of time[15,16].

In 2006, Yates et al. argued that although the cost of the cementless femoral stem component may indeed be higher, it is likely that the reduction in equipment and materials used in the cementing process and the operative time delay for cementing may counterbalance the initial outlay of the cost of the stem[17]. Others disagree with this view and believe the additional cost cannot be justified[18]. Reducing theatre time as a whole by removal of the cementing step of the procedure may also provide cost-saving benefits to the health system as a whole by running more efficient theatres which may be able to complete extra cases with the time saved. This also has the added benefit of reducing patient waiting list times[19].

The performance of the cementless implant may be improving over time as more recent studies tend to have better patient outcomes and lower revision rates for cementless stems than was previously described in the literature[20]. In 2009, a study by Hooper et al. assessing the New Zealand national orthopaedic register with over 42,000 THR's concluded there is a significantly lower revision rate for cementless stems with a lower risk of prosthesis infection in the under 65 age bracket but there is also a significantly higher revision rate for cementless stems in older age groups[21].

The limitations of this study include that this is a medium term study which followed patients for five years who have hip implants which are likely to have a life-expectancy of 20-25 years[22]. The two stems were also not implanted by the same surgeon. The patients included in the study were also not randomised to their cohort stem.

The Exeter® and Summit® stems have comparable clinical outcomes, revision rates and patient satisfaction at a minimum of five years. Based on the results of this medium-term study, both types of stems should be considered thoroughly when deciding on which type of stem prosthesis to use due to their comparable results and risk profile. Further comparative investigation over a longer time frame is underway in our institution and may provide insight into long-term outcomes when comparing cementless and cemented stems.

Acknowledgements:
The authors would like to express their sincere gratitude to the staff of the South Infirmary Victoria University Hospital arthroplasty clinic for their help in acquiring the data over five years.

Declaration of Conflicts of Interest:
The authors have declared that no competing or financial interests exist.

Corresponding Author:
Dr. Colm O'Sullivan
Cork University Hospital.
E-Mail: colm.e.osullivan@gmail.com

References:

1. Learmonth ID, Young C, Rorabeck C. The operation of the century: total hip replacement. Vol. 370, Lancet. 2007. p. 1508–19.
2. Sherfey JJ, McCalden RW. Mid-Term Results of Exeter vs Endurance Cemented Stems. J Arthroplasty. 2006 Dec;21(8):1118–23.
3. Simpson DJ, Little JP, Gray H, Murray DW, Gill HS. Effect of modular neck variation on bone and cement mantle mechanics around a total hip arthroplasty stem. Clin Biomech. 2009 Mar;24(3):274–85.
4. Hook S, Moulder E, Yates PJ, Burston BJ, Whitley E, Bannister GC. The exeter universal stem. Vol. 88, Journal of Bone and Joint Surgery - Series B. 2006. p. 1584–90.
5. Petheram TG, Whitehouse SL, Kazi HA, Hubble MJW, Timperley AJ, Wilson MJ, Howell JR. The Exeter Universal cemented femoral stem at 20 to 25 years a report of 382 hips. Bone Jt J. 2016 Nov 1;98-B(11):1441–9.
6. Moskal JT, Capps SG, Scanelli JA. Still no single gold standard for using cementless femoral stems routinely in total hip arthroplasty. Arthroplast Today. 2016 Dec 1;2(4):211–8.
7. García-Cimbrelo E, Bru-Pomer A, García-Benítez B, Hernández-Blanco M, Vaquero J. Multicentric and prospective study of the Summit cementless stem. HIP Int. 2010 Apr 26;20(7_suppl):63–9.
8. Ware JE, Kosinski M, Keller SD. How to score the sf-12 physical and mental health summary scales. 1995.
9. WOMAC Osteoarthritis Index - WOMAC 3.1 - Knee and Hip Osteoarthritis [Internet]. [cited 2019 Nov 23]. Available from: http://www.womac.com/womac/index.htm
10. Tetsunaga T, Sato T, Shiota N, Tetsunaga T, Okazaki Y, Yamada K. Four-Year Results of Summit Stems for Total Hip Arthroplasty in Japanese Patients. HIP Int. 2015 Nov 18;25(6):553–6.
11. Abdulkarim A, Ellanti P, Motterlini N, Fahey T, O'Byrne JM. Cemented versus uncemented fixation in total hip replacement: a systematic review and meta-analysis of randomized controlled trials. Orthop Rev (Pavia). 2013 Mar 15;5(1):8.

12. Rothman RH, Cohn JC. Cemented versus cementless total hip arthroplasty. A critical review. Clin Orthop Relat Res. 1990 May;(254):153–69.
13. Maggs J, Wilson M. The relative merits of cemented and uncemented prostheses in total hip arthroplasty. In: Indian Journal of Orthopaedics. Medknow Publications; 2017. p. 377–85.
14. Wyatt M, Hooper G, Frampton C, Rothwell A. Survival outcomes of cemented compared to uncemented stems in primary total hip replacement. World J Orthop. 2014;5(5):591–6.
15. Kazi HA, Whitehouse SL, Howell JR, Timperley AJ. Not all cemented hips are the same: a register-based (NJR) comparison of taper-slip and composite beam femoral stems. http://www.tandfonline.com/action/authorSubmission?journalCode=iort20&page=instructions. 2019 May 4;90(3):214–9.
16. Carlson SW, Liu SS, Callaghan JJ, Callaghan □ J J. Not all cementless femoral stems are created equal but the results may be comparable. Bone Jt J. 2017;99(1):14–7.
17. Yates P, Serjeant S, Rushforth G, Middleton R. The relative cost of cemented and uncemented total hip arthroplasties. J Arthroplasty. 2006 Jan;21(1):102–5.
18. Pennington M, Grieve R, Sekhon JS, Gregg P, Black N, Van Der Meulen JH. Cemented, cementless, and hybrid prostheses for total hip replacement: Cost effectiveness analysis. BMJ. 2013 Mar 30;346(7901).
19. Kallala R, Anderson P, Morris S, Haddad FS. The cost analysis of cemented versus cementless total hip replacement operations on the NHS. Vol. 95 B, Bone and Joint Journal. British Editorial Society of Bone and Joint Surgery; 2013. p. 874–6.
20. Morshed S, Bozic KJ, Ries MD, Malchau H, Colford JM. Comparison of cemented and uncemented fixation in total hip replacement. Acta Orthop. 2007 Jan 8;78(3):315–26.
21. Hooper GJ, Rothwell AG, Stringer M, Frampton C. Revision following cemented and uncemented primary total hip replacement. J Bone Joint Surg Br. 2009 Apr;91-B(4):451–8.
22. Evans JT, Evans JP, Walker RW, Blom AW, Whitehouse MR, Sayers A. How long does a hip replacement last? A systematic review and meta-analysis of case series and national registry reports with more than 15 years of follow-up. Lancet. 2019 Feb 16;393(10172):647–54.