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RESEARCH

10-year survival comparison of two cemented implants in primary total hip arthroplasty for osteoarthritis: a New Zealand regional study

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Abstract

Introduction Compare 10-year survival of the cemented highly crosslinked polyethylene Exeter® Rimfit™ (Rimfit) Cup and its predecessor, the ultra-high molecular weight polyethylene Exeter® Contemporary Flanged Cup™ (ECF), both with an Exeter® V40™ stem, in primary total hip arthroplasty (THA) for osteoarthritis in the Bay of Plenty region of NZ.

Method We extracted national registry data for THA surgeries in the region between 1 January 2003 and 30 June 2023 and report the 10-year survival and reasons for revision of the two fully cemented implants ($n=495$). We compared standard Kaplan-Meier estimates using the log-rank test. Cox proportional hazard models investigated the potential influence of six patient variables on the survival of each implant: sex, age, body mass index (BMI), ethnicity, American Society of Anesthesiologists (ASA) rating, and funding source (public/private).

Results No statistically significant difference in 10-year survival rate between the implants ($p=0.334$) (ECF 95.6% [93.4, 97.9], Rimfit 97.0% [95.9, 98.2]) or statistically significant difference in revision reasons between the implants ($p=0.09$) was noted. Cox regression revealed no statistically significant influence of any of the six patient variables on the 10-year survival of the ECF ($p=0.584$) or Rimfit ($p=0.611$).

Conclusion Both implants exceeded 95% survival at 10-years, which is favourable compared to the corresponding 94.8% national survivorship of cemented implants in NZ. There is no statistically significant difference in the 10-year survival rate or reasons for revision of the two cemented implants compared in this region. The Rimfit appears a suitable alternative to the ECF, from a survival and revision perspective.

Keywords Total hip replacement · Fixation · Revision · Hybrid · Polyethylene

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Introduction

In 1962 Sir John Charnley pioneered the first fully cemented, low friction total hip arthroplasty (THA) using a cemented stainless-steel stem, cemented polyethylene cup (PE) and polymethylmethacrylate bone cement [1]. Since then designers have introduced substantial improvements such as flanged cups to improve cement pressurisation [2] and improved cement formulations [3]. The Exeter® Contemporary Flanged Cup™ (Stryker Orthopaedics, Mahwah, NJ, USA) (ECF), developed in 1998 reports excellent survival outcomes up to 15 years [4, 5] with extremely low dislocation [6] and aseptic loosening rates [7]. From 2010 the focus became the reduction of PE wear and improvement in cement mantle consistency [8]. New cemented components, such as the highly crosslinked polyethylene Exeter® X3® Rimfit™ (Stryker Orthopaedics, Mahwah, NJ, USA) (Rimfit) were introduced, proposed to reduce wear and lower osteolysis risk [9]. Key improvements in the Rimfit included polymethylmethacrylate spacers; a rimcutter for mantle control; a slim curved flange to match the rim; and built in radiographic marker wire [10]. Many high volume hospitals and public settings gradually discontinued use of the ECF [5] in favour of the more durable Rimfit [9]. The recommended stem for both the ECF and Rimfit is the cemented Exeter® V40™ (with a 40 mm bore diameter of the taper) with excellent survival outcomes [7, 11, 12] and a low rate of revision [7, 13]. The ECF/V40 combination is the most prominent cemented THA in NZ, representing nearly 8,000 of the 93,487 THA surgeries recorded between 1999 and 2013 [14]. The Rimfit/V40 combination is the second most prevalent cemented THA with over 3,000 surgeries from 2010 to 2022 [14].

There are few studies on survival outcomes of the ECF [4–7] or the Rimfit [15–17], and none restricted to osteoarthritis. There is no study directly comparing their survival, reasons for revision, or revision predictors of interest in osteoarthritis. In the only published comparison study [18], both displayed "similar 5-year outcomes" in radiotranslucent lines and clinical scores, but survival was not reported. Such comparison is essential to justify the transition from the ECF to the Rimfit in clinical practice.

An ideal comparison between the ECF and the Rimfit would control for fixation, stem type or approach, handling, and instrumentation. Comparing these THA components in the same region with the same group of surgeons also eliminates variations in surgical skill, experience, and preferred technique. Therefore, our analysis focused on data from a regional registry. We compared and reported patient characteristics, 10-year survival, reasons for revision, and effects of patient-specific predictors (age, sex, BMI, ethnicity, ASA rating, and funding source) on survival outcomes in the two cemented implants for primary THA for osteoarthritis in the Bay of Plenty region of NZ to identify implant superiority in survival and revision reasons, and meaningful predictors of poorer survival.

Materials and methods

Data source and collection

Ethical approval was obtained from The University of Waikato Human Research Ethics Committee (HREC2023#12). The New Zealand Orthopaedic Association (NZOA) supplied anonymised data from the mandatory national joint registry (NZJR) for the Bay of Plenty region of NZ from 1 January 2003 up to and including 30 June 2023. All primary THAs for osteoarthritis with an Exeter V40 stem and either an Exeter Contemporary flanged Cup (Stryker Orthopaedics, Mahwah, NJ) made of ultra-high molecular weight polyethylene, or Exeter X3 Rimfit Cup (Stryker Orthopaedics, Mahwah, NJ) of highly crosslinked polyethylene, were included in analysis with follow-up to 30 June 2023 or a maximum of 10 years. We elected to report outcomes at 10 years as this represents a clinically meaningful and widely accepted benchmark in arthroplasty research. THAs were performed in three hospitals and 93% performed by four surgeons using the same modern, third generation cementing technique. Both cemented cups are widely used, intended for the same patient populations but differ in features such as flange geometry and rim configuration.

We categorised adverse events (revision) as a "1" and included censored data up until the date of death or end of the observation period or upon 10 years of follow-up and categorised as "0". Patient-specific predictors were treated as categorical variables, and included sex, age, BMI, ethnicity, ASA rating, and funding source. Predictors and subcategories are summarised in Table 1. Age at surgery was classified to align with the New Zealand, Australia, England-Wales, and Finland national joint registry categories. Only a small number of ≤ 55y observations (2%) in both implants were noted (ECF: $n = 8$; Rimfit: $n = 28$) and were combined with the 56–64y age group creating a < 65y category. We classified BMI at surgery into five categories as per the Centre for Disease Control [19]. ASA ratings are graded into four categories. However, eight ASA 4 observations between both implants (ECF: $n = 1$; Rimfit, $n = 7$) were recoded as ASA 3 for analysis. Ethnicities are self-reported and extracted via the National Health Index (unique identifier assigned to each person in New Zealand).

Table 1 Classification of categorical variables

Sex	
Male	Assigned male at birth
Female	Assigned female at birth
Funding	
Public	Public health system funding source
Private	Insurance or self-paid funding source
Age (years)	
< 65	Under but not including 65 years
65–74	Including 65 and up to and including 74 years
≥ 75	Including and over 75 years
BMI (kg/m²)	
< 25	Normal BMI
25-29.9	Overweight
30-34.9	Obese Class I
35–40	Obese Class II
> 40	Obese Class III
ASA rating	
ASA 1	Patient is a completely healthy, fit patient.
ASA 2	Patient has mild systemic disease.
ASA 3	Patient has severe systemic disease that is not incapacitating.
ASA 4	Patient has incapacitating disease that is a constant threat to life.
Ethnicity ‡	
NZ European	New Zealanders of European descent
Māori	A person of the Māori race and includes any descendant
Other	All other ethnicities and undetermined ethnicities

ASA, American Society of Anesthesiologists Physical Status classification system; BMI, body mass index; NZ, New Zealand

‡ NZ Government Stats NZ, Tatauranga Aotearoa

Survival

We implemented a pairwise deletion approach to handle missing data so that all available data were used in statistical analysis. Revision and death were identified through the compulsory national joint registry, which captures all primary procedures, revision operations, and mortality through national data linkage. As a result, loss to follow-up was negligible. Patients who had not experienced the event of interest (revision) were right censored at the earliest of the study end date. We performed standard Kaplan-Meier analysis on the dataset using the R studio 2024.09.0 "Cranberry Hibiscus" statistical package [20]. Kaplan-Meier assumptions of independent, non-informative censoring; time-to-event data; homogeneity of survival and no influential events affecting survival were met. We considered competing risk of death analysis; however, standard Kaplan-Meier analysis was chosen as the population below 75 years where death is less likely to be a competing risk exceeded the older population group of above 75 years. *T* tests were used to determine differences in mean age or BMI between the implant groups, and *Chi square* tests to compare proportions for each categorical predictor between implants.

Reasons for revision

Reasons for revision were categorised into dislocations, infection, periprosthetic fracture, pain, aseptic loosening of acetabulum, aseptic loosening of both components, loosening of acetabulum due to infection, fall, and broken stem. *Chi square* tests compared proportions between implants.

Regression

Uni- and multivariate Cox regressions were performed on the overall cemented sample as well as for each implant. To assess the robustness of our findings, we evaluated the proportional hazards assumption using Schoenfeld residuals and log-log survival plots. The results were consistent across methods, supporting the validity of the primary analysis. Across statistical analyses, the 95% confidence intervals [lower, upper] of estimates were extracted and significance set to $p < 0.05$. All analyses were conducted using R studio 2024.09.0.

Results

Patient variables and revisions per component are shown in Table 2. THA surgeries for OA from 1 January 2003 and 30 June 2023 ($n = 1630$, age: 71.7 ± 8.5 y, BMI: 28.1 ± 5.2 kg/m^2) included ECF in 363 instances (22.3%, age: 71.3 ± 8.5 y, BMI: 28.2 ± 4.8 kg/m^2) and Rimfit in 1267 instances (77.7%, age: 71.7 ± 8.5 y, BMI: 28.1 ± 5.3 kg/m^2), with no statistically significant difference between implant groups in mean age ($p = 0.427$) or BMI ($p = 0.812$) at surgery. *Chi square* tests revealed no statistically significant differences in proportion of men and women ($p = 0.095$), BMI categories ($p = 0.555$), or age categories ($p = 0.596$) between implants. Statistically significant differences of proportion in ASA ratings ($p < 0.001$), ethnicities ($p < 0.001$) and funding pathways ($p = 0.004$) between implants (Table 3) were noted. The Rimfit reported a higher proportion of Māori, ASA 3 rating, and publicly funded surgeries.

† Missing values have not been included in proportion calculations.

Survival

A total number of 1630 implants for the observation period were included in analysis, 495 in situ for 10 years (ECF:

Table 2 Patient variables and revisions per component

		Both Implants				ECF				Rimfit			
		n	%	Revisions	Revision %	n	% of Total Implants	Revisions	Revision %	n	% of Total implants	Revisions	Revision %
Total		1630		43	2.6%	363	22.3%	14	3.9%	1267	77.7%	29	2.3%
Sex	Male	648	39.8%	19	2.9%	158	43.5%	3	0.8%	490	38.7%	16	3.3%
	Female	982	60.2%	24	2.4%	205	56.5%	11	3.0%	777	61.3%	13	1.7%
Age (years)	≤64	337	20.7%	15	4.5%	81	20.1%	4	4.9%	256	20.2%	11	4.3%
	65–74	670	41.1%	16	2.4%	150	41.3%	5	3.3%	520	41.0%	11	2.1%
	≥75	623	38.2%	12	1.9%	132	36.4%	5	3.8%	491	38.8%	7	1.4%
BMI (kg/m²)	<25	367	25.4%	7	1.9%	61	23.8%	3	4.9%	306	19.7%	4	1.3%
	25-29.9	618	42.7%	15	2.4%	120	46.9%	2	1.7%	498	32.1%	13	2.6%
	30-34.9	322	22.3%	10	3.1%	53	20.7%	3	5.7%	269	17.3%	7	2.6%
	35-39.9	94	6.5%	4	4.3%	13	5.1%	0	0.0%	81	5.2%	4	4.9%
	≥40	45	3.1%	1	2.2%	9	3.5%	0	0.0%	36	2.3%	1	2.8%
	Missing†	184	NA	6	3.3%	107	NA	6	5.6%	77	NA	0	0.0%
ASA	1	216	14.0%	4	1.9%	59	20.7%	1	1.7%	157	12.4%	3	1.9%
	2	946	61.1%	25	2.6%	175	61.4%	6	3.4%	771	61.0%	19	2.5%
	3 & 4	386	24.9%	10	2.6%	51	17.9%	3	5.9%	335	26.5%	7	2.1%
	Missing†	82	NA	4	4.9%	78	NA	4	5.1%	4	NA	0	0.0%
Funding	Public	566	40.5%	16	2.8%	118	33.8%	7	5.9%	448	42.7%	9	2.0%
	Private	833	59.5%	24	2.9%	231	66.2%	7	3.0%	602	57.3%	17	2.8%
	Missing†	231	NA	3	1.3%	14	NA	0	0.0%	217	NA	3	1.4%
Ethnicity	NZEU	1455	89.3%	39	2.7%	304	83.7%	12	3.9%	1151	90.8%	27	2.3%
	Māori	110	6.7%	3	2.7%	14	3.9%	1	7.1%	96	7.6%	2	2.1%
	Other	65	4.0%	1	1.5%	45	12.4%	1	2.2%	20	1.6%	0	0.0%

ASA, American Society of Anesthesiologists grading; BMI, body mass index; ECF, Exeter Contemporary Flanged cup; NZEU, New Zealand European; Rimfit, Exeter X3 Rimfit cup

Table 3 Tests of proportion for each implant

Variable	Group	ECF			Rimfit			Model comparison	
		Actual	Expected	χ^2	Actual	Expected	χ^2	χ^2	*p*-value
Sex	Male	158	144	1.3	490	504	0.37	2.57	0.095
	Female	205	217	0.86	777	763	0.25		
Age (years)	≤64	81	75	0.47	256	262	0.14	1.03	0.596
	65–74	150	149.00	0	520	521	0		
	≥75	132	139	0.33	491	484	0.09		
BMI (kg/m²)	<25	61	65	0.24	306	302	0.05	3.01	0.555
	25-29.9	120	109	1.02	498	509	0.22		
	30-34.9	53	57	0.28	269	265	0.06		
	35-39.9	13	17	0.8	81	77	0.17		
	≥40	9	8.00	0.13	36	37.00	0.03		
ASA	1	59	40	9.3	157	176	2.1	18.4	0.0001
	2	175	174	0	771	772	0		
	3 & 4	51	71.00	5.67	335	315.00	1.28		
Funding	Public	118	141	3.81	448	425	1.27	8.16	0.004
	Private	231	208	2.59	602	625	0.86		
Ethnicity	NZEU	304	324	1.24	1151	1131	0.35	90.2	0.00001
	Māori	14	25	4.5	96	85.5	1.29		
	Other	45	15	64.4	20	50.52	18.4		

Missing values have not been included in overall proportion calculations

Abbreviations: ASA, American Society of Anesthesiologists grading; BMI, body mass index; ECF, Exeter Contemporary Flanged cup; NZEU, New Zealand European; Rimfit, Exeter X3 Rimfit cup

*Significance set at $p<0.05$

n = 245 Rimfit: n = 250 Table 4) with a median follow-up of seven years. Kaplan-Meier analysis revealed a combined 10-year survival rate of 96.5% [95.5, 97.6] with log-rank revealing no statistical difference in survival between the implants (ECF: 95.6% [93.4, 97.9]; Rimfit: 97% [95.9, 98.2], p = 0.334) (Fig. 1). No statistically significant difference in survival between patient predictors was noted (Table 4).

Reasons for revision

Forty-three revisions (2.6%) performed over the period (ECF n=14, Rimfit n=29). Most revisions were due to dislocation (30%) followed by infection (23%). No statistically significant difference in proportion of dislocation (p=0.08) or any other revision reason was noted (Table 5). Of the 43 revisions, 24 (56%) occurred in females and 19 (44%) in males reflecting the overall cohort distribution. By funding status, 24 (56%) were privately funded, 16 (37%) publicly funded, and 3 (7%) had missing data. Regarding ethnicity, 29 (67% were NZ European, 3 (7%) Māori and 1 (2%) Other, with the remaining missing or uncategorised. These distributions provide context for subsequent revision patterns. Notably, 15 (35%) revisions occurred in patients under 65 years, 16 (37%) in those 65–74 years and 12 (28%) in patients≥75 years. Compared with the overall cohort, patients under 65 were overrepresented (20.7% of the total sample), whereas those≥75 were underrepresented (38.2% of the total sample). However, these differences were not statistically significant in either univariate or multivariate Cox regression. BMI data were missing for 13 revision cases, limiting interpretation across categories.

Regression

Multivariate Cox regression for both implants found no statistically significant effect of any predictor on 10-year survival (Table 6). Certain subgroups (BMI 35-39.9 and ≥40, NZ Māori) had small sample sizes, which should be considered when interpreting these findings.

Discussion

Survival

Our combined survival rates exceed 95% at 10 years, suggesting durable outcomes with both implants using the V40 stem. This benchmark outcome is consistent with the 10-year performance of broad cemented implants in NZ [14] and internationally [21–25]. For example, our 10-year 97% Rimfit survival rate aligns with the UK national joint registry and the Australian Orthopaedic association broad cemented category (97.2% and 96.6%, respectively) [22], substantiating it as a suitable replacement for the ECF. The Rimfit was introduced almost decade after the ECF, yet

Table 4 Implant survival at 10 years

Factor		Both Implants				ECF				Rimfit			
		At risk (n)	Events (n)	Survival % [95%CI]	log-rank *p*-value†	At risk (n)	Events (n)	Survival % [95%CI]	log-rank *p*-value†	At risk (n)	Events (n)	Survival % [95%CI]	log-rank *p*-value†
Component		495	43	96.5 [95.5, 97.6]	—	245	14	95.6 [93.4, 97.9] §	—	250	29	97.0 [95.9, 98.2] §	0.334 §
Sex	Male	215	19	96.4 [94.8, 98.1]	0.628	105	3	98.0 [95.7, 100]	0.113	110	16	95.8 [93.6, 98.0]	0.089
	Female	280	24	96.6 [95.1, 98.0]		140	11	94.0 [90.5, 97.5]		140	13	97.9 [96.8, 99.1]	
Age (years)	<65	154	15	94.5 [91.7, 97.3]	0.172	71	4	94.8 [90.0, 99.9]	0.854	83	11	94.7 [91.6, 97.9]	0.103
	65–74	229	16	97.1 [95.7, 98.5]		120	5	96.3 [93.2, 99.5]		109	11	97.5 [96.0, 99.0]	
	≥75	112	12	97.7 [96.3, 99.0]		54	5	95.9 [92.4, 99.2]		58	7	98.3 [96.9, 99.6]	
Ethnicity	NZEU	417	39	96.5 [95.4, 97.7]	0.748	201	12	95.6 [93.2, 98.1]	0.696	216	27	96.9 [95.7, 98.1]	0.744
	Māori	34	3	95.2 [89.3, 100]		11	1	90.9 [75.4, 100]		23	2	97.8 [94.8, 100]	
	Other	44	1	98.3 [95.1, 100]		33	1	97.7 [93.4, 100]		11	0	100 [100, 100]	
BMI (kg/m²)	<25	83	7	97.2 [95.2, 99.4]	0.784	37	3	94.7 [89.1, 100]	0.487	46	4	97.7 [95.5, 100]	0.527
	25-29.9	175	15	97.0 [95.4, 98.6]		79	2	98.2 [95.7, 100]		96	13	96.6 [94.6, 98.6]	
	30-34.9	82	10	95.5 [92.6, 98.5]		35	3	93.3 [86.3, 100]		47	7	96.5 [93.9, 99.2]	
	35-39.9	30	4	95.7 [91.6, 99.9]		10	0	100 [100,100]		20	4	95.0 [90.3, 99.9]	
	≥40	20	1	97.8 [93.6, 100]		9	0	100 [100,100]		11	1	97.2 [92.0, 100]	
	missing	184	6			107	6			77	0		
ASA	1	85	4	97.3 [94.7, 100]	0.705	49	1	98.2 [94.6, 100]	0.336	36	3	96.5 [92.2, 100]	0.892
	2	267	25	96.8 [95.5, 98.0]		114	6	96.2 [93.3, 99.3]		153	19	96.9 [95.5, 98.3]	
	3 & 4	83	10	95.7 [92.6, 99.0]		22	3	89.8 [79.1, 100]		61	7	97.7 [96.1, 99.4]	
	missing	82	4			78	4			4	0		
Funding	Public	160	16	96.4[76.3, 94.9]	0.917	65	7	92.6[87.4, 98.1]	0.128	95	9	97.8[96.3, 99.3]	0.314
	Private	292	24	96.4[98.5, 94.4]		170	7	96.7[94.4, 99.2]		122	17	96.1[94.2, 98.1]]	
	missing	231	3			14	0			217	3		

ASA, American Society of Anesthesiologists grading; BMI, body mass index; ECF, Exeter Contemporary Flanged cup; NZEU, New Zealand European; Rimfit, Exeter X3 Rimfit cup

* *p*-value set at <0.05; † log rank *p*-value for main effect of a given predictor; § log rank *p*-value for survival rates of ECF and Rimfit

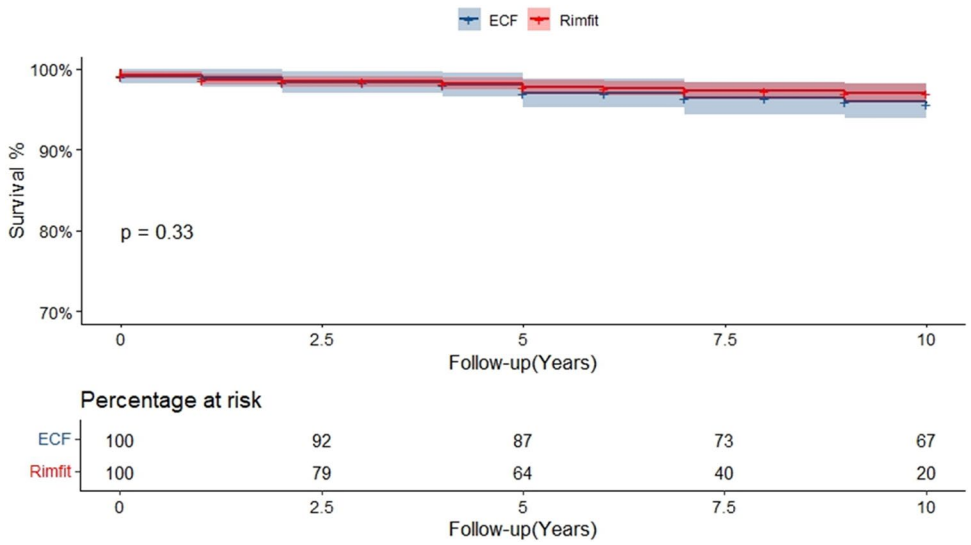

Fig. 1 10-year Kaplan-Meier survival for both implants

Table 5 Reasons for revision

	Both implant revisions		ECF revisions		Rimfit revisions		χ^2
	($n=43$)	% total	($n=14$)	% total	($n=29$)	% total	*P*-value*
Dislocations	13	0.80%	6	1.65%	7	0.55%	0.08
Infection	10	0.61%	2	0.55%	8	0.63%	1
Periprosthetic fracture	8	0.49%	2	0.55%	6	0.47%	1
Pain	5	0.31%	2	0.55%	3	0.24%	0.68
Aseptic loosening (Acetabulum)	3	0.18%	1	0.28%	2	0.16%	1
Aseptic loosening (Femur & Acetabulum)	1	0.06%	1	0.28%	–	–	–
Loosening acetabulum (infection)	1	0.06%	–	–	1	0.08%	–
Fall	1	0.06%	–	–	1	0.08%	–
Broken stem	1	0.06%	–	–	1	0.08%	–

**Chi square* tests of proportion with significance set at $p < 0.05$

equivalent survival rates suggest implant design/material changes did not translate into measurable differences in long term fixation. Both designs provide robust outcomes across different eras of surgical practice and support the generalisability of our findings.

Reasons for revision

Both implants demonstrated no statistically significant difference in survival up to 10 years and low rates of dislocation, infection, and aseptic loosening. This finding suggests that implant design differences did not substantially influence the underlying mechanisms of failure. From a clinical perspective, this lack of difference indicates both designs are comparable in terms of stability, infection risk, and fixation durability, with other surgical and/or patient factors potentially influencing revision risk. Comparing revision cases with overall cohort distribution revealed that patients under 65 years were overrepresented and those over 75 years were underrepresented. This pattern suggests younger, more active patients may face a relatively higher risk of revision, consistent with registry evidence linking activity levels and implant demand to early failure [26]. BMI comparisons were less reliable due to missing data in 13 revision cases, limiting firm conclusions.

Regression

Sex, age, BMI, ethnicity, ASA rating, and funding did not significantly influence the 10-year survival of implants individually or when combined. It is worthwhile noting that no variables significantly impacted on the time until the event of interest in either the overall cemented sample or when stratified by implant design. The variables considered did not have a meaningful association with revision in our population, indicating possible weak or non-existent relationship. A low number of Māori and Other ethnicity patients, patients with BMI categories of 35 to 39.9 kg/m^2 and >40 kg/m^2, and those<55 years reduced precision of survival and Cox regression analysis. Hence, the lack of significance should be interpreted with caution. Our extended analysis provide insight in a NZ context, indicating that the two implants perform well across a broad range of patients, regardless of sex, age, ethnicity, BMI, ASA rating,

Table 6 Cox multiple regression for both implants

Covariate	Both Implants				ECF				Rimfit			
	Coeff (OR)	HR	95% [CI] ‡	*P*-value	Coeff (OR)	HR	95%CI ‡	*P*-value	Coeff (OR)	HR	95%CI ‡	*P*-value
ASA 2	0.48	1.62	[0.54, 4.87]	0.388	0.83	2.30	[0.25, 20.90]	0.461	0.37	1.45	[0.41, 5.16]	0.562
ASA 3	0.59	1.8	[0.49, 6.64]	0.376	1.30	3.60	[0.31, 44.06]	0.303	0.38	1.46	[0.31, 6.72]	0.624
Age≥75	-0.83	0.43	[0.17, 1.10]	0.079	-0.64	0.53	[0.10, 2.88]	0.460	-0.83	0.44	[0.14, 1.31]	0.139
Age 65–74	-0.81	0.44	[0.19, 1.00]	0.505	-0.12	0.31	[0.05, 1.97]	0.213	-0.69	0.5	[0.20, 1.25]	0.141
BMI≥40	-0.17	<0.001	[0.00, inf]	0.997	-0.2	<0.001	[0.00, inf]	0.999	-0.17	<0.001	[0.00, inf]	0.997
BMI 25.29.9	0.07	1.07	[0.43, 2.72]	0.877	-1.03	0.36	[0.06, 2.27]	0.276	0.44	1.56	[0.49, 4.93]	0.451
BMI 30-34.9	0.20	1.22	[0.44, 3.42]	0.703	0.01	1.01	[0.18, 5.57]	0.987	0.30	1.35	[0.37, 5.03]	0.652
BMI 35-39.9	0.38	1.46	[0.39, 5.49]	0.567	-19.7	<0.001	[0.00, inf]	0.999	1.01	2.73	[0.61, 12.31]	0.191
Sex Female	-0.22	0.79	[0.39,1.59]	0.527	0.72	2.04	[0.38, 11.00]	0.404	-0.49	0.62	[0.28, 1.36]	0.228
Ethnicity Māori	-0.46	0.63	[0.14, 2.80]	0.544	-18.3	<0.001	[0.00, inf]	0.999	-0.29	0.74	[0.16, 3.46]	0.706
Ethnicity Other	-17.00	<0.001	[0.00, inf]	0.997	-18.1	<0.001	[0.00, inf]	0.999	-17.34	<0.001	[0.00, inf]	0.998
Funding Public	-0.09	0.92	[0.44, 1.93]	0.821	0.39	1.48	[0.32, 6.77]	0.613	-0.27	0.77	[0.32, 1.84]	0.550
Implant ECF	-2.14	8.08	[0.36,1.08]	0.602								
†Log-rank test of model for both implants				$p=0.645$	† Log-rank test of model for ECF			$p=0.658$	† Log-rank test of model for Rimfit			$p=0.584$

or funding source. Future research could explore additional patient variables not included in our model, such as pre- and post-surgical activity and smoking status.

Decline in cemented THA

Despite their proven durability, however, there has been a noticeable decline in the use of fully cemented THAs, particularly in NZ, Australia, the UK, and the USA [27, 28]. One key reason is the rise of cementless and hybrid implants, perceived to offer easier revisions and better long-term bone integration [29] particularly in younger patients [16]. The move from cemented to cementless fixation was driven by the promise of biological ingrowth, anticipated simpler revision, and influence from training and industry [30–32]. But registry evidence shows cementless fixation is not universally superior particularly in elderly women [33], and many systems are rebalancing toward a selective, patient-specific fixation choice [34]. The extremely low periprosthetic fracture rate of both the ECF and Rimfit cohorts indicate the cemented V40 stem offers reduced fracture risk, which is especially important in osteoporotic and fragile bone by offering immediate fixation and uniform load transfer, reducing micromotion and early loosening [35] particularly those over the age of 65 [36]. A growing body of evidence suggests that hybrid implants with cemented stems and cementless acetabular components might offer advantages over fully cemented or cementless options due to the combined benefits of stem stability and acetabular osseointegration [15, 16, 30, 37–39]. Pearce et al. (2025) noted there exists limited definitive evidence of specific hybrid implant superiority for osteoarthritis [40].

Patient reported outcomes

Other than survival, PROMs are an important consideration in determining THA success. Extended THA survival, yet poor quality of life, pain, and impaired function, indicates a poor outcome regardless of implant longevity [41]. Comparative PROMs studies for broad category cemented implants versus other categories show inconsistent outcomes [42–45] with studies investigating heterogenous populations and a selection of different PROMs tools [40]. Pearce et al. [46] identified excellent long-term PROMs up to 10 years for this ECF cohort in a recent study with a mean Oxford Hip score >41 and very good mean score >39 up to 15 years, with no significant difference in scores at 1, 5, 10 and 15 years. A similar study of Rimfit PROMs and comparison to the ECF would offer a strong comparison of these cemented implants. Future THA research should incorporate PROMs to better capture functional recovery and quality of life crucial for a comprehensive evaluation of implant success [47].

Specific instruments such as the Oxford Hip Score, Western Ontario and McMaster Universities Osteoarthritis index and a health-related quality of life tool, with domains including pain, function and overall patient satisfaction could be used to complement registry-based data alongside comparison of homogenous patient populations.

Considering the predominant use of hybrid fixation (51%) over cemented (4%) [14] in NZ, we recommend a comparative survival and Cox regression analysis of high-use hybrid implants; with consistent V40 stem use and highly crosslinked PE liners; with the cemented Rimfit in this population, over the same observation period, and a closer inspection and comparison of 10-year PROMs. Such a study may identify patient subgroups more susceptible to poor THA survival but also poorer PROMs outcomes.

Conclusion

The 10-year survival of both the ECF and Rimfit in this region of NZ is positive. The favourable survival rate of the Rimfit supports its continued use and justifies it as a replacement of the ECF in this region, with 10-year survival outcomes not affected by age, sex, BMI, ethnicity, ASA rating, or funding source. Future studies should include PROMs comparison between the Rimfit and ECF to identify whether Rimfit PROMs are at a minimum consistent with the ECF. With the increased use of hybrid THA in NZ, a survival and PROMs comparison of the Rimfit with a commonly used hybrid implant; with the same V40 stem; analysing the same patient predictors, is also recommended.

Limitations

This study is observational thus causal influences cannot be made. While overall survival success is an important outcome, we acknowledge that it is not the sole indicator of a successful THA. We also acknowledge that patient characteristics are not the only predictors of outcomes. Potential confounders such as differences in surgical approach, cement brands and intraoperative technique may influence outcomes but could not be fully accounted for in this study. However, as 93% of surgeries were performed by the same surgeons the possibility of confounding is less likely. The relatively small sample sizes representing Māori and Other ethnicities, patients under 55 years, and individuals with greater BMI may lead to less reliable analyses and increases risk of error. Lack of statistical significance therefor warrants cautious interpretation. This uncertainty may not accurately reflect the true population values.

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Author contributions AP led the project and is the primary author of the manuscript. KHL contributed as second author. GC, TL, SM, and AV facilitated access to data and, together with AP and KHL, contributed to the study design, defined the research focus, and provided critical feedback and intellectual input throughout the project. CJ developed the statistical methodology and analysis in collaboration with AP. All authors reviewed and approved the final manuscript for submission.

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Data availability The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request. Data are located in controlled access data storage at the University of Waikato.

Declarations

Conflict of interest One author is an Editorial board member, Journal of Hand Surgery (Asia-Pacific), and another is on the Committee Asia Pacific, Orthopaedic Association, Hand & Upper Limb Section. One author is a Council member of the NZ Orthopaedics Association. Two authors have disclosed paid presentations for Stryker in 2023. One author has a Training & Education contract for Stryker.

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