

■ **KNEE**

Mobile- versus fixed-bearing modern total knee replacements – which is the more patella-friendly design?

THE 11-YEAR NEW ZEALAND JOINT REGISTRY STUDY

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Objectives

Our study aimed to examine if a mobile-bearing total knee replacement (TKR) offered an advantage over fixed-bearing designs with respect to rates of secondary resurfacing of the patella in knees in which it was initially left unresurfaced.

Methods

We examined the 11-year report of the New Zealand Joint Registry and identified all primary TKR designs that had been implanted in > 500 knees without primary resurfacing of the patella. We examined how many of these were mobile-bearing, fixed-bearing cruciate-retaining and fixed-bearing posterior-stabilised designs. We assessed the rates of secondary resurfacing of the patella for each group and constructed Kaplan-Meier survival curves.

Results

Our study showed a significantly higher rate of revision for secondary resurfacing of the patella in the fixed-bearing posterior-stabilised TKR designs compared with either fixed-bearing cruciate-retaining or mobile-bearing designs ($p = 0.001$ and $p = 0.036$, respectively).

Conclusions

This New Zealand Registry study shows that during the last 11 years, revision procedures to resurface an unresurfaced patella in primary TKR occurred at a higher rate in fixed-bearing posterior-stabilised designs.

Keywords: Total knee replacement, Patellar resurfacing, Knee revision, Patella pain, Anterior knee pain.

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Article focus

- To investigate total knee replacements (TKRs) undertaken for osteoarthritis
- To assess whether mobile- or fixed-bearing TKRs were protective of an unresurfaced patella in terms of secondary resurfacing of the patella in modern TKR designs

Key messages

- New Zealand Joint Registry Study focused on TKRs implanted in numbers > 500 knees in the 11-year report
- Stratification of TKRs into mobile-bearing, fixed-bearing cruciate-retaining and fixed-bearing posterior-stabilised designs, all performed without resurfacing of the patella at primary operation
- Comparison of rates of secondary resurfacing of the patella between the bearing groups

Strengths and limitations

- A total of 20 495 primary TKRs implanted without initial patellar resurfacing, with 96% follow-up
- We assumed that all secondary resurfacings patellar were undertaken for pain, with a constant surgeon intervention rate
- There were no details in the registry regarding circumferential patella electrocautery and its effect on rates of revision

Introduction

There is a rapidly increasing demand for total knee replacement (TKR) worldwide and the role of resurfacing of the patella remains an important question. There are currently profound geographical differences regarding resurfacing in the osteo-arthritic knee: in the New Zealand Joint Registry the majority of TKRs have the patella un-resurfaced¹ while several studies from the United States show

Table 1. Rates of revision for secondary patellar resurfacing in fixed-bearing (FB) cruciate-retaining (CR), FB posterior-stabilised (PS) and mobile-bearing (MB) total knee replacements implanted in numbers > 500 in New Zealand (CI, confidence interval)

	Design			p-values		
	FB CR	FB PS	MB	FB CR vs FB PS	FB CR vs MB	FB PS vs MB
Knees without primary patellar resurfacing (n)	13 595	3852	3518			
Secondary patellar resurfacing (n)	81	39	21			
Rate of revision per 100 component years (%) (95% CI)	0.14 (0.12 to 0.18)	0.29 (0.2 to 0.39)	0.16 (0.1 to 0.25)	0.001	0.863	0.036

the opposite.²⁻⁵ There are conflicting results from Level 1 studies on whether or not to resurface the patella at the time of primary TKR for osteoarthritis. Some surgeons may consider it necessary in selected cases, such as in the rheumatoid knee.⁶ Waters and Bentley⁷ performed a prospective randomised controlled trial of patellar resurfacing in 514 cruciate-retaining (CR) and posterior-stabilised (PS) TKRs, and found a higher rate of revision for patellofemoral pain in those knees in which resurfacing had not been performed. Conversely, Burnett et al⁸ undertook a prospective randomised controlled trial of 100 CR TKRs in 90 patients for a minimum of ten years. They found no significant differences in functional score, satisfaction, anterior knee pain or rate of revision between knees that had undergone resurfacing of the patella and those that had not.⁸ The authors therefore did not advocate patellar resurfacing.

There is also evidence that the functional results after secondary patellar resurfacing for pain after primary TKR are not only less predictable but also less favourable than if the patella was resurfaced at the index procedure.^{9,10}

Mobile-bearing TKRs are potentially more 'patella-friendly' from a biomechanical standpoint, as they may provide more forgiving tibiofemoral kinematics. A prospective randomised controlled trial of bilateral LCS mobile-bearing TKRs (DePuy Orthopaedics Inc., Warsaw, Indiana), with one patella resurfaced and the other not, showed that the mobile bearing did not convey an additional advantage over leaving the patella unresurfaced,¹¹ and this also supports findings from the Swedish Joint Registry.¹²

Materials and Methods

The aim of this study was to compare the rates of a second operation to resurface the patella after a primary TKR for osteoarthritis using a PS, CR or mobile-bearing modern TKR designs used in New Zealand.

The New Zealand Joint Registry has over 11 years of prospective data and a 96% capture rate. Since its inception after ethical approval in 1998, over 38 326 primary TKRs have been performed, 70% of which did not have the patella resurfaced.

We used the 11-year report¹ to identify TKR designs implanted in > 500 knees. We then obtained the product numbers from the Registry and classified these implants as

fixed- or mobile-bearing implants. We did not differentiate the mobile-bearing group as to whether PS or CR. We stratified the fixed-bearing TKRs into CR and PS designs and identified how many of each group had the patella resurfaced at index surgery. We then examined the Registry data for rates of revision for patellar resurfacing.

Statistical analysis. The data were analysed by a medical statistician (CF) with 95% confidence intervals calculated and significance testing performed using Student's *t*-test (SPSS v19; SPSS Inc., Chicago, Illinois). A *p*-value < 0.05 was considered to denote statistical significance.

Results

From the 11-year report (January 1999 and December 2009) of the New Zealand Joint Registry we identified 20 945 TKRs implanted for osteoarthritis, which had not had the patella resurfaced. Only implants with > 500 were included. The numbers of fixed-bearing CR, fixed-bearing PS and mobile-bearing implants and their revision rates for secondary resurfacing of the patella are shown in Table 1.

These results were used to construct a Kaplan-Meier survival curve (Fig. 1). CR fixed-bearing TKRs had the lowest rate of secondary patellar resurfacing but not significantly greater than mobile-bearing (*p* = 0.863). PS fixed-bearing TKRs had a significantly greater rate of secondary patellar resurfacing compared with both mobile-bearing (*p* = 0.036) and CR fixed-bearing TKRs (*p* = 0.001) in the New Zealand Joint Registry.

Discussion

This New Zealand Joint Registry study of modern TKR designs suggests that CR fixed-bearing and mobile-bearing TKR designs implanted without resurfacing of the patella are superior to fixed-bearing PS designs in terms of rates of secondary patellar resurfacing. Within each group there were several different manufactures and therefore designs, but it was not possible to analyse each subset within the broad grouping as the numbers would not have been sufficient to have produced a statistically significant result. These results agree with the prospective randomised controlled trial using CR fixed-bearing prostheses by Burnett et al.⁸ In addition our results are consistent with the findings of Keblish et al,¹² and imply that the

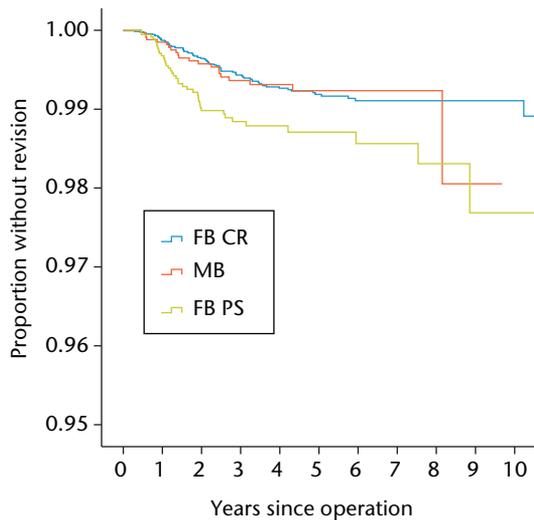


Fig. 1

Kaplan-Meier survival curve of fixed-bearing (FB) cruciate-retaining (CR), FB posterior-stabilised (PS) and mobile-bearing (MB) total knee replacements, with secondary patellar resurfacing as the endpoint.

patella can be left unresurfaced if using a mobile-bearing design. Our results suggest that the use of a fixed-bearing PS TKR may be an indication for resurfacing of the patella at the index procedure. However, a therapeutic trial would ideally be performed to determine true clinical significance. We propose that this finding may be because the PS design leads to increased stresses at the patellofemoral joint compared with the mobile-bearing or CR designs.

This study has several weaknesses. It is a retrospective review of Registry data and does not record the indication for secondary resurfacing of the patella, nor the surgeon's practice of using electrocautery around the unresurfaced patella – there is evidence that such treatment may improve post-operative pain.¹³ We have assumed that modern patellar resurfacings and TKR designs are very similar in terms of their functional results. For simplicity, and directly as a result of what data is recorded in the New Zealand Joint Registry, we have assumed that secondary resurfacing in our study was performed for anterior knee

pain rather than instability. In addition there is a paucity of knowledge as to why patients develop anterior knee pain when the patella is left un-resurfaced. This study does not support the view that mobile-bearing TKR designs are more 'patella-friendly' than PS or CR fixed-bearing designs.

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- M. C. Wyatt: Writing the paper
- C. Frampton: Data collation, Statistical analysis, Manuscript review
- J. G. Horne: Writing the paper
- P. Devane: Manuscript review

ICMJE Conflict of Interest:

- None declared

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