To the orthopedic surgeon, locally responsible for the Swedish Knee Arthroplasty Register

Here is the 2001 annual report, accounting for data registered during 2000.
The report is based on the content of the register as of November 1st 2001. There has been a steady increase in the number of operations reported. 6,600 were reported in 2000 or an increase of 11% compared to 1999. This implies that the number of knee arthroplasties performed in Sweden is reaching the number of hip arthroplasties. Vi have decided to make this report somewhat more extensive than usual by including a historical overview of findings and describing our definitions and routines.

For practical reasons we have maintained our previous nomenclature for implant in this report. As previously, each surgical unit gets a list containing information on the arthroplasties they reported in 2000. It is our hope that you will compare the list with locally available data and help us correct any errors found. To make this easier, we provide 2 lists, one sorted on the ID and the other on the date of operation.

The first and second part of the report is general by nature and will be available for downloading from our website: www.ort.lu.se/knee/. It includes information on implants reported in 2000 as well as analyses regarding the latest 10-year period. As last year, the patient administrative system (PAS) was searched for missing revisions before the revision rate was calculated. The registry has thus been updated regarding revisions performed until the end of 1999 making the 10-year period 1990-1999 available for analysis.

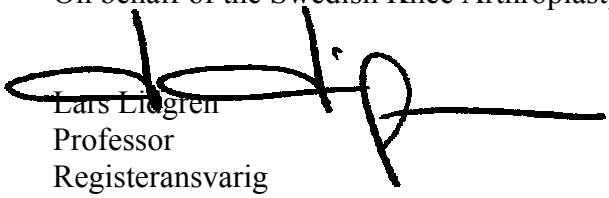
As previously each unit also receives a diskette. It contains information regarding all the registered arthroplasties reported by that unit. If the patients have been revised later at another location, information regarding those revisions is also included.

We find it appropriate to remind you that the Swedish Knee Arthroplasty Register is a prospective project and that revisions reported to the register are only entered if the primary operation has been reported. Thus, if a primary operation became known at a later time because it became a subject of a revision, neither the primary nor the revision will be entered into the database. A late reporting of primary procedures is only allowed in cases when all primaries performed during a time period are reported collectively.

Some of the implants that previously have had a high revision rate have been withdrawn from the market. The revision rate is still relatively high for many of the newer Unicompartmental models and with some anxiety we follow the use of mini-incisions. Unicompartmental implants are even without mini-incisions sensitive to surgical routine.

We at the project center in Lund want to thank you for your cooperation during the last year and ask you to digest and circulate the presented information

Lund den November 5th , 2001
On behalf of the Swedish Knee Arthroplasty Register



Lars Lidgren
Professor
Registeransvarig

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Definitions

Revision is defined as a new operation in a previously resurfaced knee during which one or more of the components are exchanged, removed or added (incl. arthrodesis or amputation). This implies that soft tissue operations such as arthroscopy and lateral release are not considered revisions. The reason for this stringent definition is that some minor operations are not necessarily related to the primary surgery and thus cannot be considered a complication or failure.

All the Scandinavian registers do not use this stringent definition. E.g. the Finnish national implant register defines any re-operation as being a revision. However, in their reports, the additional operations account for only about 3 percent of the revision surgery.

TKA (Total or Tricompartmental Knee Arthroplasty) is defined as a knee arthroplasty where the femoral component has a flange and all three compartments of the knee are affected. Therefore, even in cases where a patellar button is absent, the flange resurfaces half of the femoropatellar compartment and the arthroplasty is considered to be a TKA.

Bicompartmental arthroplasty (historical) uses two components, one on the femoral and one on the tibial side to resurface both the femorotibial compartments (medial and lateral) - but not the femoropatellar compartment. Thus, this implant has no femoral flange and is not meant to allow for resurfacing of the patella.

UKA (Unicompartmental Knee Arthroplasty) implies an arthroplasty that separately resurfaces the medial or lateral femorotibial compartment. (med. UKA or lat. UKA). If 2 UKA implants are used to resurface both femorotibial compartments the arthroplasty it is named bilateral UKA.

Patellar arthroplasty is used to resurface only the femoropatellar compartment. Even if this arthroplasty is unicompartmental by definition, it is accounted for separately.

Hinged implants. As the nam implies these implants only allow for flexion and extension through a fixed axis.

Linked implants (Linked/Rotating hinge) have a mechanical coupling between the femoral and tibial component allowing for flexion and extension as well as for varying amount of rotation.

Stabilized implants. Even if the hinges and the linked implants are extremely stabilizing, the term stabilized implants is used for a group of prostheses that are a kind of TKA but use the form of the femoral and tibial component to restrict movement in valgus, varus and rotation. The posterior cruciate sacrificing type most often has an eminence in the middle part of the tibial polyethylene that can be contained by a box in the femoral component that lies between the medial and lateral sliding surfaces. By a camshaft-like property, the femoral component is forced to slide back during flexion, which simulates the effect of the posterior cruciate ligament. The fit between polyethylene and metal is such that it allows for some rotation. In so-called superstabilized implants the congruency has been increased by making the eminence larger with a total fit against the box of the femoral component thus, restricting the rotation and varus/valgus movement. Intermediary forms also occur. Stabilized implants ar most often used for revision but also for the more difficult primary arthroplasties.

The ordinary TKA can be made somewhat more stabilized by increasing the congruency between the sliding surfaces. In these instances there is a slight eminence of the polyethylene that fits against the femoral component. However, the term stabilized is only used for those implants that are more stabilized than usual by use the above mentioned camshaft construction.

Filling in the Knee Register form

The Knee Register uses a form that it recommends to be filled in during the operation, (by a nurse or other attending personal). The implant-stickers (containing the Part No's and Lot No's) for all used implants are to be glued on to the form. Besides the ID of the patient, the date of operation, diagnosis, side operated, brand of cement and cementing of components has to be filled in. For UKA information regarding the use of miniarthrotomy must be specified. Information regarding the operating surgeon is voluntary.

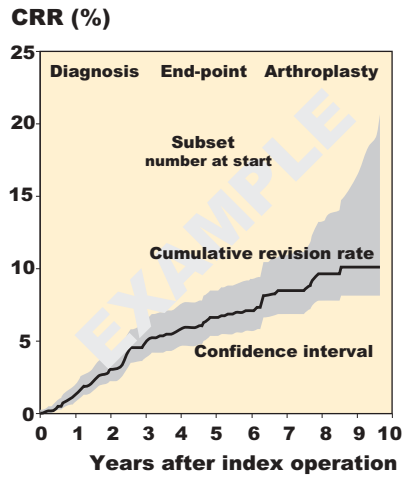
The form is sent to Lund (once a month) where the data is computerized. In our opinion, this procedure has considerable advantages such as minimal workload for the participating units, the most certain information with the least chance of wrong coding. Furthermore, it allows the staff of the registry to check unknown Part.No's during input.

How the Knee Register compares implants

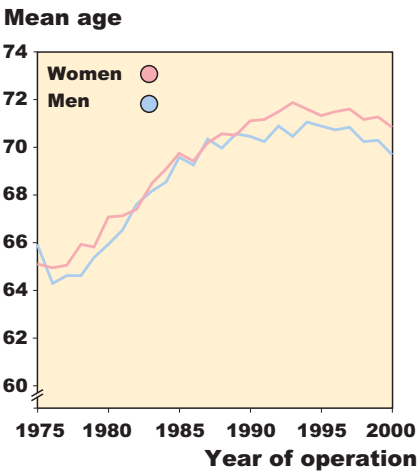
Survival analyses are used for graphical presentation of data using curves that show the Cumulative Revision Rate (CRR). They describe what percentage of the operated patients became revised with time. The calculation is based on the sum of all the revisions and expresses the rate as if none of the patients had died. Most often the time-axis shows a 10-year period. However, it has to be kept in mind that the patients are included as time goes on. Thus, all the patients have not been followed for the whole period. This implies that if 1,000 patients were operated on each year (and nobody dies), a 10-year study would include 10,000 patients of which only 1,000 had been followed for more than 9 years. The last part of the curve (at the right) therefore expresses the long-term rate of revision for patients operated more than 9 years earlier. As the number of these patients is relatively small, the 95% confidence interval becomes large. When the number of patients at risk is small (at the right of the curve), each revision has a large effect (e.g. 50% are revised when 2 patients are left and one has a revision). For this reason the Register cuts the curves when less than 40 patients are left at risk.

A disadvantage of CRR curves is that they express the revision rate for a defined group of patients and do not allow for taking other factors into account (e.g. age and gender). It is possible to circumvent the problem by analyzing smaller groups of different gender and age e.g.. However, unfortunately this reduces the number of patients available for analysis which in turn reduces the possibility of making statistical conclusions.

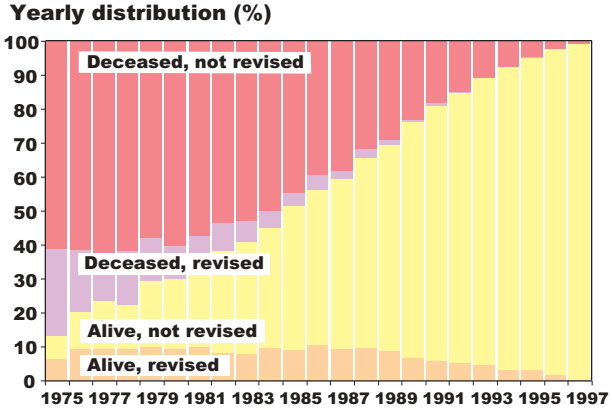
Cox regression allows for taking into account different factors that may vary within a group. The result cannot be shown as curves with confidence intervals but is expressed as risk ratios between factors. If the factor is a category (e.g. a implant), one category is defined as a reference with a risk of 1 to which the other categories are compared. An implant with the risk 1.2 thus has 20% increased risk of becoming revised etc.. For numerical variables (e.g. mean age) the risk ratio relates to the change in risk if the variable increases by one unit (e.g. 1 year). When comparing groups where uneven distribution of factors can be expected (e.g. age in cemented vs. uncemented implants) the Cox regression is especially important.



Example of a CRR curve



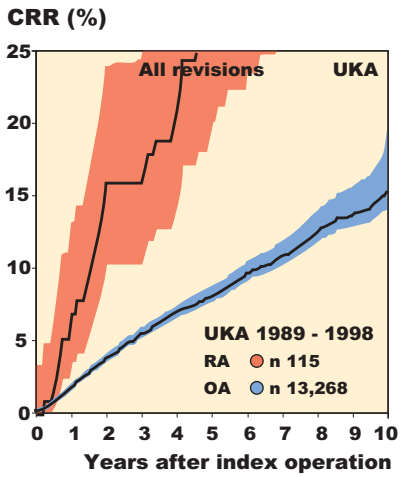
The last 5-year period set aside, the mean age of patients has increased during the years. Therefore, when comparing the rate of revision in series of patients operated during different time periods, separate analyses for different age groups have to be performed or by using analyses such as Cox regression that can take the age into account.



Survival statistics are used to calculate how long an implant stays unrevised. As times goes by, the percentage of deceased patients increases (fig. left). During their lifetime these patients were at risk of becoming revised and the statistics allow them to supply information for that period of time. The probability for each revision that occurs is related to the number of unrevised patients alive with that particular follow-up time. All the probabilities are then added to produce the cumulative rate of revisions.

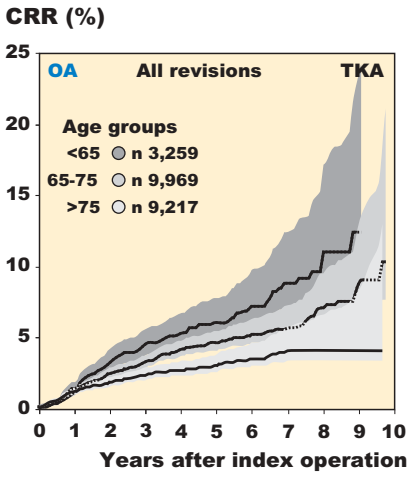
Factors that influence the revision rate

Primary disease – Early it became evident that patients with different primary disease, e.g. rheumatoid arthritis (RA) and osteoarthritis (OA) followed a different postoperative course with differences in the revision rate. Therefore the registry has always produced separate curves for these diagnoses. The differences in CRR between OA and RA that receive unicompartmental knee arthroplasty (UKA) demonstrate the importance of this.



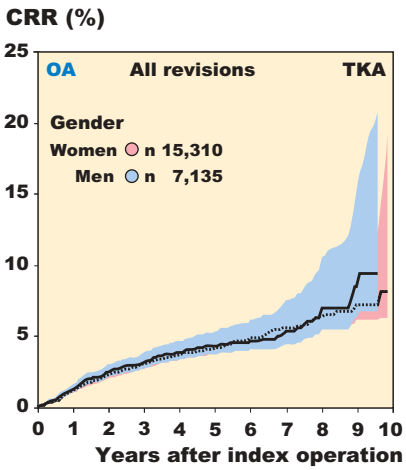
The difference in CRR between OA and RA with UKA shows that these diagnoses have to be separated(Risk Ratio 3.5). However, UKA is no longer used for patients with RA.

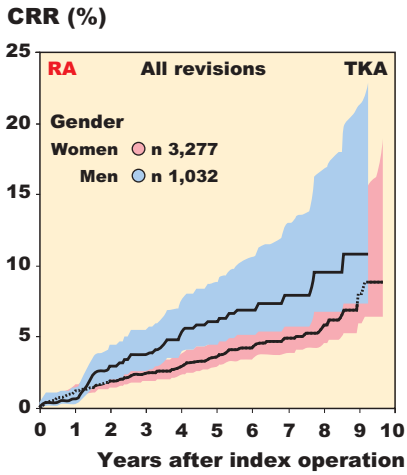
Age – The effect that the age of patients at the primary operation has on the CRR is illustrated by analyzing different age groups separately.



The differences in CRR (1988–1997) between the 3 age groups <65, 65–75, >75 were significant for OA operated with TKA and UKA but not for RA with TKA.

When calculating CRR it would be reasonable to only compare similar age-groups. However, this method would reduce the size of the material and thus the statistical usefulness. The problem with relying on CRR without taking the age into account can be illustrated by the comparison of patients with OA and RA that are operated on with a TKA. While the curves for both groups are very similar, the RA patients have a substantially lower mean age. Cox regression shows that when age has been taken into account, the OA group has 1.3 times the risk of the RA group of becoming revised.

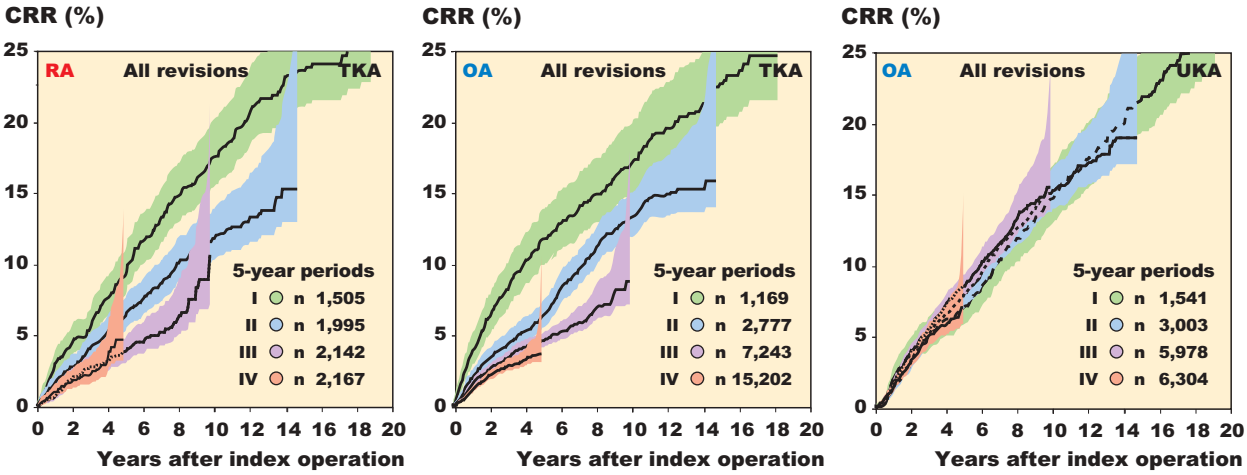




The difference in CRR (1988–1997) between OA and RA operated on with TKA is not large (gender shown separately). However, Cox regression that adjusts for age, gender and year of operation reveals that the Risk Ratio for OA is 1.3 that of RA.

Gender – The registry has for RA, but not for OA, been able to find a difference in the risk of revision between the sexes. (Men with RA and TKA have a Risk Ratio of 1.5 that of comparable women - see above).

Year of operation – Over the years the risk of revision has lessened for TKA. The reduction is not only to be explained by the increasing mean age at operation and even if it can be explained by improved implants, reduction has also been seen

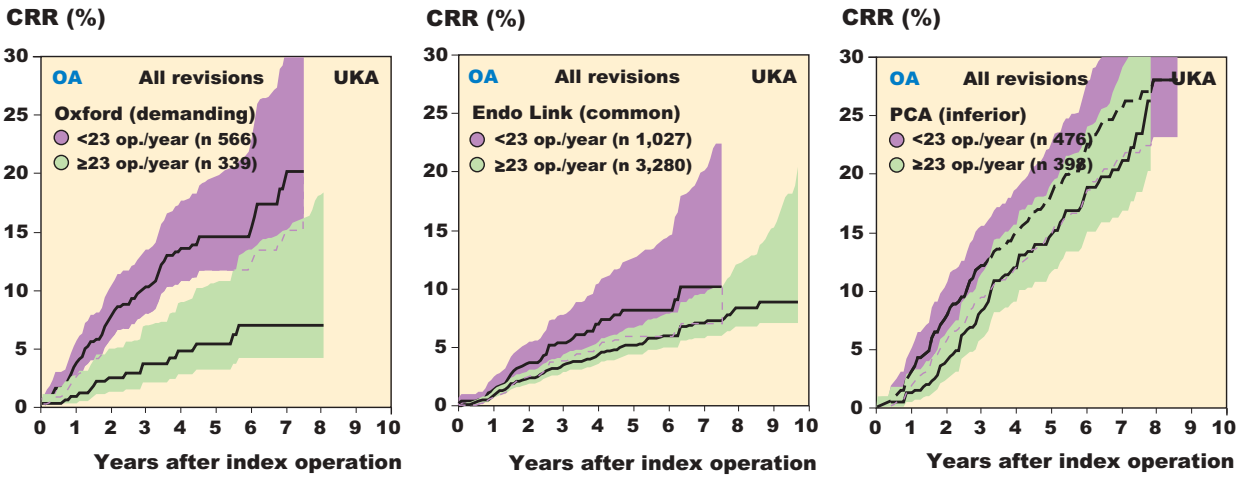


Reduction in the revision rate with time was only seen for TKA when the time periods 1978–1982 (green), 1983–1987 (blue), 1988–1992 (violet) and 1993–1997 (red) were compared.

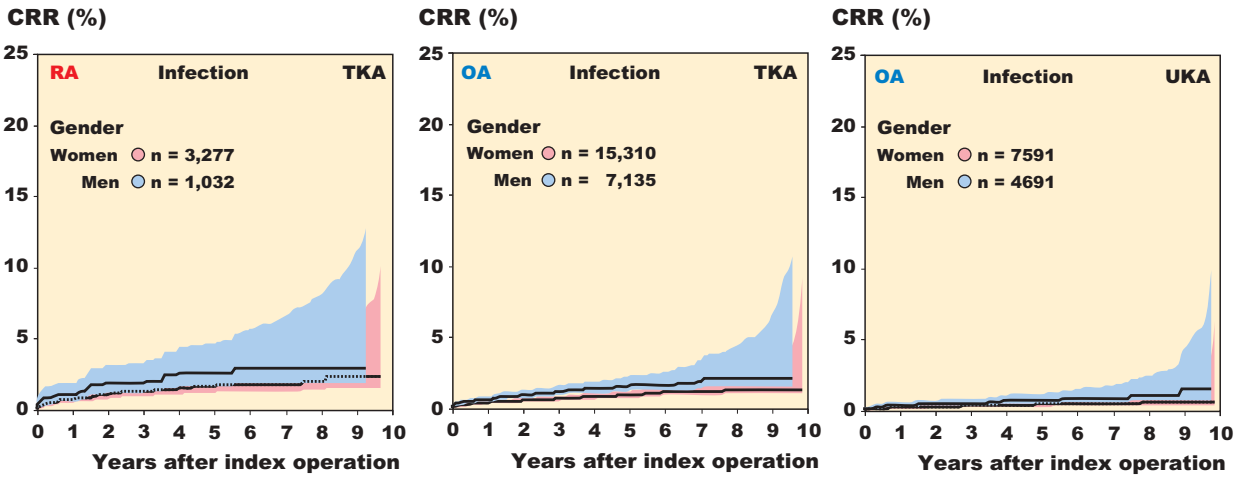
for unchanged implants (Lewold). This indicates improvement in technique (cementing/seating) or in patient selection which explains why comparison between implants must take into account during what time-period they were inserted. Improvement with time has not been seen for the UKA, which probably is caused by some newer models that have shown inferior results. Furthermore, the number of UKA operations has lessened which maybe has reduced the surgical routine.

Surgical routine – For the UKA implants we have shown that there is a relation between the number of operations performed in hospitals and their rate of revisions. Thus, a group of units that performed less than 23 operations/year had substantially more revisions than those that performed more. The Oxford implant with its loose meniscus was found especially sensitive to the surgical routine. The Swedish results for this implant have been quite different and worse than what has been published from large centers in England. This has lead the producer to require that surgeons learn the operative technique before the can buy the implant. It is very likely that the surgical routine can affect the results of other implant types such as the TKA.

Type of implant – Hinges, linked and stabilized implants are mainly used for revisions or especially difficult primary cases. In uncomplicated primary cases TKA is used and if the disease is unicompartmental an UKA may do. For a proper comparison of TKA and UKA the results of patients with osteoarthritis are of interest. Although the UKA has been shown to have substantially higher CRR than TKA, the number of serious complications such as infection/arthrodesis/amputation is much less. If a primary UKA is revised to a TKA at a later time,



The majority of orthopedic units performed relatively few UKA/year and there is a relation between the yearly number and the risk of later revision. For the 3 examined models (above) the effect of volume on CRR varied. The technically demanding Oxford implant was more affected than the most usual Link implant while the inferior PCA implant was not affected by volume at all.

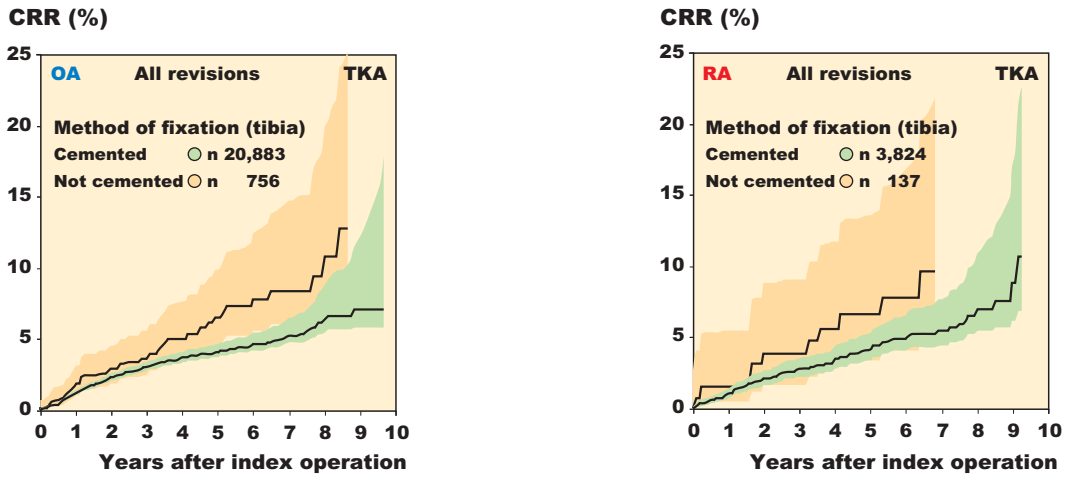


Using revision because of infection as end-point the statistics show that RA patients are more often affected (Risk Ratio 1.4) and within each group men are more often stricken than women. The UKA with smaller components than the TKA are less affected.

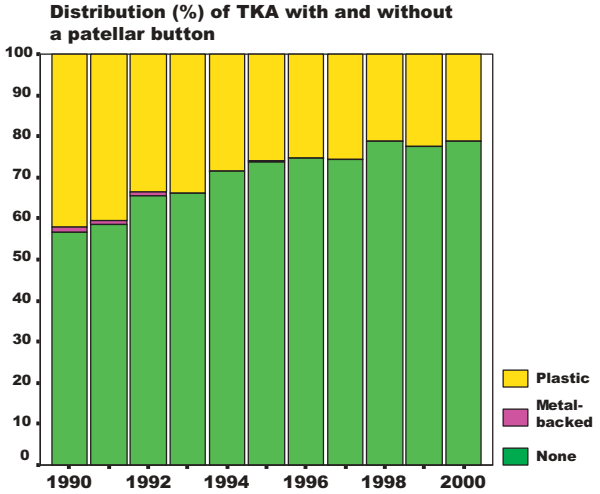
the risk of re-revision is not significantly increased compared to the risk of revision if the patient had primarily been operated on with a TKA. As the UKA implants are less expensive than the TKA, the increased number of revisions due to their use has not resulted in additional cost. When asked, patients with TKA and UKA seem equally satisfied with their knees. In summary we conclude that it cannot be considered wrong to use UKA implants for an unicompartmental disease.

Use of cement – We have found that cement free insertion of the tibial component is associated with an increased risk of revision. This is in agreement with the results of the Finnish implant register that has found substantially increased risk of revision for uncemented implants.

Patellar button in TKA – Estimating how the use of a patellar button affects the revision rate is complex. The use of a patellar button varies with the brand of TKA used while simultaneously its use has lessened over the years. Hitherto, when the TKA implants are analyzed together, we have not found the use of patellar button to influence the revision rate. However, when comparing different time-periods one finds that during the eighties when patellar buttons were used in half of the cases its use had a negative effect. In the nineties during which patellar buttons were used in one quarter of TKA the effect has started to change to the advantage of the button. If only the most commonly used TKA is analyzed (AGC) we find that CRR is considerably lower when a button is used. This



CRR for TKA with uncemented tibial component compared to a cemented one was significantly higher in OA. In RA the difference did not reach statistical significance.



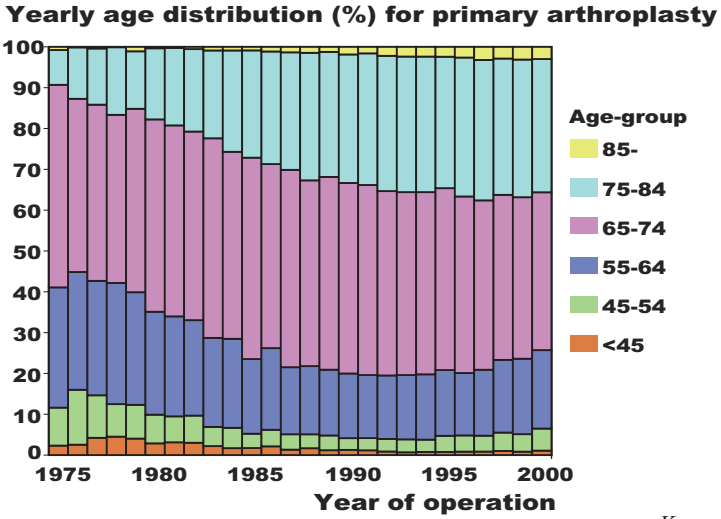
finding in combination with the previous finding that patients that receive a patellar button are more satisfied with their knee (at least at first) implies that a patellar button more often could be inserted - at least for the elderly.

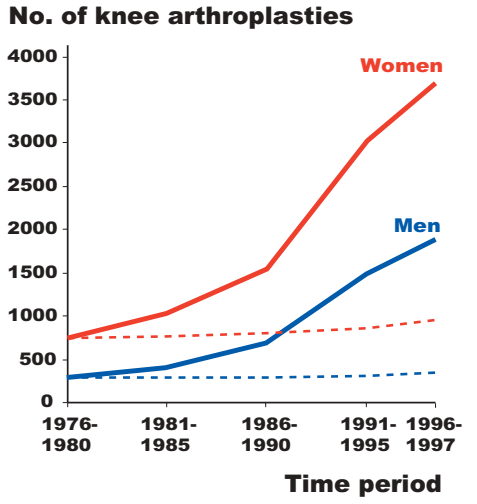
Implant model (brand) – The model is the factor that generates most interest and most often is related to the result after knee arthroplasty. As can be suspected from what has been said, the results are not only affected by the model or design of the prosthesis. In Sweden the most commonly used implants have also been those with the lowest CRR. This can be due to a good design but also to the surgical routine as the same implant is often used. However, some models have had considerably worse results than others. Of the newer brands the Miller-Galante can be mentioned but the use of that implant has now ceased. Regarding the UKA it seems that most the newer implants have difficulties in improving the older wellknown ones.

Average age, age distribution and future incidence

The mean age at the primary operation evenly increased from approx. 65 years in 1975 to approx. 72 years in 1994. (Fig. Page 3). Since then the mean age has not increased but rather shown the tendency of decreasing. The main reason for the rise in mean age has been that older age groups have been offered surgery. However, since 1994 the relative number of patients less than 55 years has again increased.

In a recently published article in *Acta Orthopaedica Scandinavica* (2000; 71: 376-380) it was demonstrated how the number of operations had increased substantially more than could by explained by ageing of the population. Further, it was found that the expected changes in the age distribution would increase the demand for knee arthroplasty by 36% by 2030. At the same time it was argued that the incidence of operations still was rising, why the actual demand would be considerably higher. The article was based on data until the end of 1997 predicted that provided that the incidence was unchanged (as it was in 1996-1997), the number of arthroplasties in year 2000 would be 5,647. The presently reported 6,036 arthroplasties indicate that the incidence still is on the rise.





Knee arthroplasties / year in the marked time-periods. A solid line shows the observed number of operations while a dotted line shows the number to be expected if the increase only had been caused by changes in the age-distribution.

Patient satisfaction and health questionnaires

In 1997 all living registered patient were inquired by mail how satisfied they were regarding their knee. Nine months later, 3,600 of these patients were asked the same question again. They also received a more comprehensives general health questionnaire and a disease/knee specific questionnaire.

The different questionnaires were psychometrically analyzed and it was found that the simpler the questionnaire was, the better the answering rate. Those that did not answer the second time had previously been more dissatisfied than on average. To study the results after knee arthroplasty in a postal survey, one wants to maximize the answering rate as well as to use a sound questionnaire with good psychometric properties. It was found that the most suitable questionnaires for this purpose were the SF12 (general health) and Oxford 12 (knee specific). The Swedish Oxford 12 translation is shown below.

Oxford 12

Problem med ditt knä

Under de senaste fyra veckorna... Markera en ruta för varje fråga

Under de senaste fyra veckorna...

1 Hur skulle Du beskriva den smärta Du vanligtvis har i Ditt knä?

Ingen	Mycket lindrig	Lindrig	Måttlig	Svår
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

2 Har Du haft några problem med att tvätta Dig och torka Dig (hela kroppen) på grund av Ditt knä?

Inga problem alls	Mycket lite problem	Måttliga problem	Mycket stora problem	Omöjligt att göra
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

3 Har Du haft något problem med att komma in i eller ut ur bil eller med att använda offentligt transportmedel (vilket Du nu tenderar att använda) på grund av Ditt knä?

Inga problem alls	Mycket lite problem	Måttliga problem	Mycket stora problem	Omöjligt att göra
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

4 Hur länge har Du kunnat promenera innan smärtan i Ditt knä blivit **svår**? (Med eller utan käpp)?

Ingen smärta / >30 min	16 till 30 min	5 till 15 min	Endast runt huset	Inte alls - svår smärta direkt vid promenad
☐	☐	☐	☐	☐

ISBN 91-630-8224-1

Problem med ditt knä

Under de senaste fyra veckorna... Markera en ruta för varje fråga

Under de senaste fyra veckorna...

5 Efter en måltid (sittande till bords), hur smärtsamt har det varit för Dig att resa Dig upp från stolen på grund av Ditt knä ?

Inte smärtsamt alls	Lätt smärtsamt	Måttligt smärtsamt	Väldigt smärtsamt	Outhärdligt
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

6 Har Du haltat då Du promenerat på grund av Ditt knä?

Sällan / aldrig	Ibland eller endast i början	Ofta och inte bara i början	Merparten av tiden	Hela tiden
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

7 **Kan** Du sätta dig ner på huk och komma upp igen efteråt?

Ja, lätt	Med viss svårighet	Med måttlig svårighet	Med mycket stor svårighet	Nej, omöjligt
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

8 Har Du besvärats av smärta i Ditt knä då Du legat till sängs på natten?

Inga nätter	Bara 1 eller 2 nätter	Vissa nätter	De flesta nätter	Varje natt
☐	☐	☐	☐	☐

ISBN 91-630-8224-1

Problem med ditt knä

Under de senaste fyra veckorna... Markera en ruta för varje fråga

Under de senaste fyra veckorna...

9 I vilken grad har smärtan i Ditt knä påverkat Ditt vanliga arbete (inklusive hushållsarbete)?

Inte alls	Lite grann	Måttligt	I hög grad	Fullständig
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

10 Har det känts som om Ditt knä plötsligt skulle "vika sig" eller svika Dig?

Sällan / aldrig	Ibland eller bara i början	Ofta och inte bara i början	Merparten av tiden	Hela tiden
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

11 **Kan** Du handla det som behövs till hushållet på egen hand?

Ja, lätt	Med viss svårighet	Med måttlig svårighet	Med mycket stor svårighet	Nej, omöjligt
☐	☐	☐	☐	☐

Under de senaste fyra veckorna...

12 **Kan** Du gå nerför en trappa?

Ja, lätt	Med viss svårighet	Med måttlig svårighet	Med mycket stor svårighet	Nej, omöjligt
☐	☐	☐	☐	☐

ISBN 91-630-8224-1

Types of operations and implants in 2000

6,036 primary prostheses reported in 2000, by type and region

(Please observe that there still are occasional units that have not reported completely)

TYP	Stockholm Gotland	Uppsala Örebro	Southeast	South	West	North
Hinges	6	2			1	
Linked		5	1	2	5	
TKA	1,019	1,235	583	914	858	482
UKA medial	162	203	82	233	177	24
UKA lateral	7	4	2	9	3	1
Patella	6	4	3	3		
TOTAL	1,200	1453	671	1161	1,044	507

Implant for primary TKA in 2000

	Number	Percent
AGC	1,494	29,3
PFC Sigma	1,277	25,1
F/S MIII	675	13,3
Duracon	579	11,4
NexGen	349	6,9
Kinemax	320	6,3
Scan	190	3,7
LCS	65	1,3
AMK	58	1,1
Profix	48	0,9
Other	36	0,7
Total :	5,091	100,0

Implant for primary UKA in 2000

	Number	Percent
Link-Uni	419	46,2
MillerGalante	259	28,6
Oxford-Uni	94	10,4
Genesis	62	6,8
PFC	31	3,4
Duracon-Uni	29	3,2
Allegretto	10	1,1
Other	3	0,3
Total :	907	100,0

Compared with 1999, the number of reported primary arthroplasties has increased from 5,432 to 6,036 or 11%. The reason is partly improved reporting by the units, although some units have not fully completed their reporting.

In TKA the 4 most common implants in 1999 have kept their lead in 2000. PFC, Freeman-Samuelsson and NextGen are the implants that have most increased their market share while the MillerGalante has almost disappeared from the market.

In UKA the 2 most common implants in 1999 have kept their lead in 2000. It is noteworthy that in spite of the relatively poor results in Sweden, the number of Oxford implants has 3-folded compared to that reported in 1999. However, improved surgical training may have caused this.

The 3 most common implants for primary TKA in each region in 2000

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	PFC + Σ	2+672	Duracon	151	AGC	67	127
Uppsala/Örebro	AGC	391	F/S MIII	333	Kinemax	276	235
Southeast	AGC	208	PFC Σ	196	NexGen	163	16
South	Duracon	306	AGC	294	PFC Σ	181	133
West	AGC	351	F/S MIII	294	Scan	73	140
North	AGC	183	PFC S	139	Duracon	61	99

The 3 most common implants for primary UKA in each region in 2000

	Model 1	n	Model 2	n	Model 3	n	Other
Stockholm/Gotland	MillerGal.	107	Link	26	Oxford	20	16
Uppsala/Örebro	Link	171	Genesis	18	PFC	15	3
Southwest	Genesis	29	MillerGal.	20	Link	18	17
South	Link	159	MillerGal.	40	Duracon	15	28
West	MillerGal.	87	Oxford	58	Link	28	7
North	Link	17	MillerGala.	4	PFC	3	1

Bone cement and incision in 2000

Use of bone cement in 2000

	Primary TKA		Primary UKA	
All components cemented	4,428		905	
Only the patellar button without cement	532		–	
The Femur and Tibia components without cement (4 med cem pat)	97		–	
Only the Femur component without cement	11		1	
The Femur component and patellar button without cement	2		–	
The Femur component, Tibia and Patella without cement	2		–	
Only the Tibia component without cement	1		0	
Unknown	18		1	
Total	5,091		907	
	Number	**Percent**	**Number**	**Percent**
Palacos/Gentamycin	4,549	91.1	807	89.0
Palacos	310	6.2	73	8.0
CMW/Gentamycin	91	1.8	16	1.8
CMW	18	0.4	9	1.0
Palacos/Genta + Versabond	11	0.2	0	
Copal	3	0.1	0	
Cemex/Gentamycin	2	0.0	0	
Simplex	1	0.0	1	0.1
Palacos/Genta + CMW/Genta	1	0.0	0	
Information missing	10	0.2	1	0.1
Total	4,996	100.0	907	100
Alla implant parts without cement	95			
Grand total	5,091			

NB Many handwrite the type of cement on the report which may be a source of error

The units are encouraged to use the sticker that comes with the cement package

Type of bone cement

In Sweden, the use of bone cement is the most common method for fixing the implantparts to bone. In 2000 less than 2% of all TKA were completely without cement and cement was used for all the UKA. Also the tibial plateau was inserted without cement in less than 2% of TKA, which has to be considered reasonable in light of our finding, that uncemented tibial parts have a higher failure rate. Palacos bone cement was used in 93% of the cemented TKA's and in 96% of the UKA's. Antibiotics were added to the cement in 93% of the cemented TKA's and in 91% of the UKA's.

We want to remind the operative units to report the type of bone cement used whenever possible by using the stickers that normally are to be found in the cement package.

Mini-incision

For UKA we have since 1999 registered whether the implant was inserted by a standard arthrotomy or by the new type of mini-arthrotomy.

Our definition of mini-incision implies that the surgeon gains access to the knee joint by the use of a very small arthrotomy and without needing to dislocate/evert the patella. The benefit of such incision is claimed to be mainly less traumatic surgery, quicker rehabilitation and shorter hospital stay. The material is still to small for evaluating the effect of the mini-incision on the revision rate. However, as the UKA has been shown to be sensitive to surgical routine without a mini-incision, it is not inconceivable that the new operating procedure may further deteriorate the long-term results.

The type of incision for 907 UKA in 2000

	Standard	Mini	?
Endo Link	347	60	12
Oxford	2	92	
Duracon Uni	29		
Allegretto uni (HPT)	9	1	
PFC Uni	31		
Miller-Galante Uni (HPT)	115	143	1
Genesis Uni	61	1	
Unknown impl.	3		

Use of patellar button in 2000

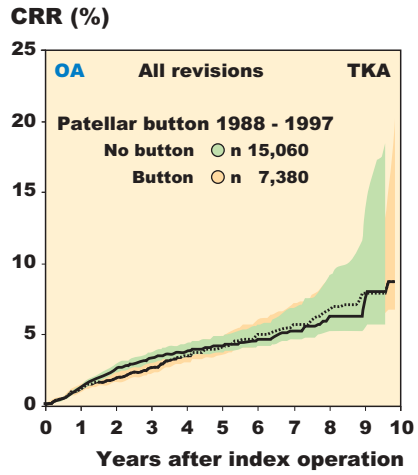
Patellar button for TKA in 2000

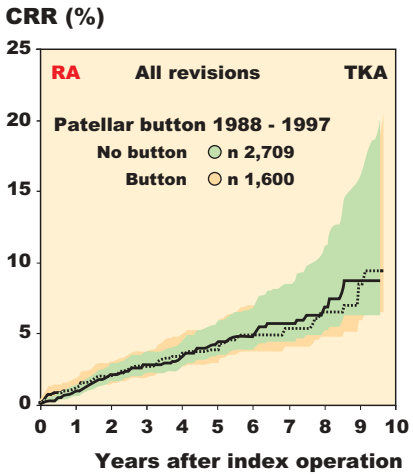
The use of patellar button is heavily dependent on the implant model used. Thus, those that inserted Freeman-Samuelson implants used a button in 87% of their primary cases while the users of LCS (New Jersey) and ScanKnee almost never used a patellar button during their primary operations. When analyzing the operative period 1988-1997 we found no difference in CRR between TKA's inserted with a button or without. In the current time period (1990-1999) we found that the CRR for TKA in OA was slightly lower when a patellar button had been used. The same tendency was found for RA. When the AGC implants were analyzed separately, the difference became still more evident.

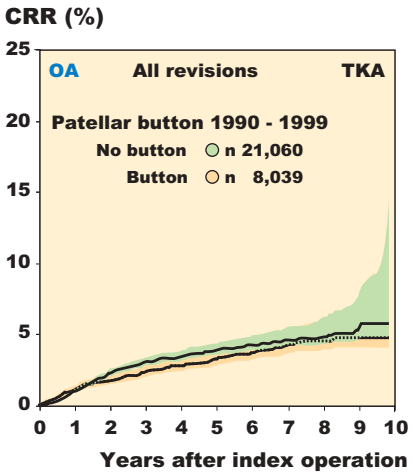
Use of patellar button for primary TKA in 2000

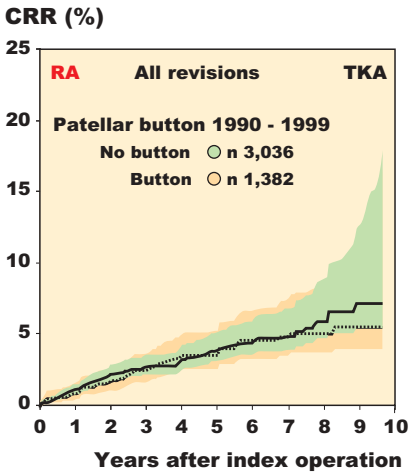
	No patellar button	%	Patellar button	%
AGC	1283	85.2	223	14.8
PFC	1120	87.2	165	12.8
Freeman/Samuelson	89	13	589	87
Duracon	551	94.8	30	5.2
Nexgen	339	96.0	14	4.0
Kinemax	268	84.5	49	15.5
ScanKnee	188	99.5	1	0.5
New Jersey (LCS)	65	100	0	0
AMK	58	100	0	0
Profix	39	81	9	19
Other	5	71	2	29
Total	4005	78.7	1,082	21.3

(Information missing for 4 implants)









The general CRR during the analyzed period 1988-1997 was not affected by whether or not a patellar button was used in TKA. When analyzing the current period 1990-1999 the 10-year CRR has become slightly lower when a button was used in TKA for OA. The rate of loosening increases if a button is used. However, the need for secondary patellar replacement is still bigger. The rate of revision for infection is not affected.

Implants and revisions during 1990–1999

Operations performed early during the analyzed period have a relatively large influence on the cumulative revision rate. This has the largest impact on the older implants.

To be able to account for the reasonably long-term results of relatively modern types of implant types, the registry usually uses the latest 10-year period that is available for analysis.

Implants for primary TKA in 1990–1999

	Number	Percent
AGC	12,244	34.6
F/S MIII	4,208	11.9
F/S ospec	770	2.2
PFC	2,966	8.4
PFC-Sigma	1,236	3.5
Duracon	2,930	8.3
Kinemax	2,854	8.1
Scan	2,829	8.0
MillerGalante2	1,090	3.1
Mill/G ospec	389	1.1
PCA-Mod	679	1.9
PCA ospec	310	0.9
AMK	568	1.6
NexGen	651	1.8
LCS	389	1.1
Synatomic	223	0.6
Tricon	209	0.6
Axiom	139	0.4
Profix	122	0.3
Kinematic	80	0.2
Osteonics	64	0.2
Rotaglide	63	0.2
Townley	47	0.1
Nuffield	37	0.1
Genesis	31	0.1
RMC	30	0.1
Other	186	0.5
Total :	35,344	100.0

Implants for primary UKA in 1990–1999

	Number	Percent
Link-Endo	4,982	38.6
Link-St.Georg	494	3.8
Marmor / Richards	2,326	18.0
Brigham	1,047	8.1
MillerGalante	916	7.1
Oxford	829	6.4
Duracon	671	5.2
PFC	559	4.3
PCA	305	2.4
Allegretto	301	2.3
Genesis	225	1.7
Repicci (AARS)	219	1.7
Other	17	0.1
Total :	12,891	100.0

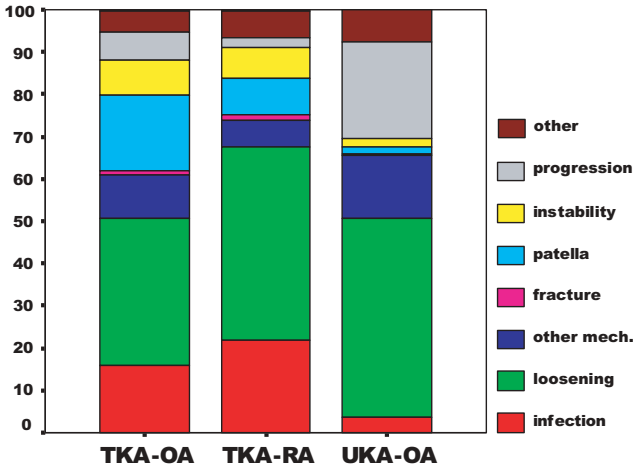
Linked implants in 1990–1999

	Number	Percent
Endo rotation	92	60.9
St.Georg rotation	29	19.2
Kotz	22	14.6
Spherocentric	3	2.0
Other	5	3.3
Total :	151	100.0

Revisions during 1990–1999

1,231 revisions of TKA's for OA, 387 of TKA's for RA and 1,539 revisions of UKA for OA were performed during the 10-year period. The indications for the revisions are shown in the diagram. Note that the index operations may have been performed before the accounted 10-year period. Loosening remains the dominant reason for revision. "Progression" in TKA mainly reflects revisions performed for femoropatellar arthrosis/arthritis. "Patella" includes all kind of problems with the patella in patients that had their primaries inserted with or without a patellar button. Please note that the distribution of the reasons for the revisions does not have to reflect the risk for these complications which preferably are evaluated by the CRR.

Distribution (%) of reasons for revisions 1990 -1999

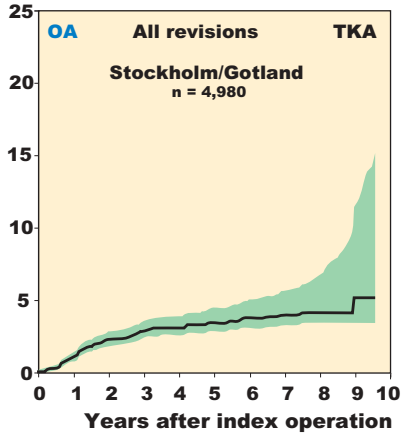


TKA implants for osteoarthrosis in the regions 1990–1999

Stockholm + Gotland
Implants for primary TKA in OA 1990–1999

	Number	Percent
AGC	2,605	52.3
Kinemax	705	14.2
PFC Sigma	495	9.9
PFC	398	8.0
Duracon	428	8.6
F/S MIII	84	1.7
F/S ospec	25	0.5
PCA-Mod	77	1.5
AMK	66	1.3
NexGen	46	0.9
Genesis	14	0.3
Rotaglide	10	0.2
LCS	10	0.2
Other	17	0.3
Total	4,980	100.0

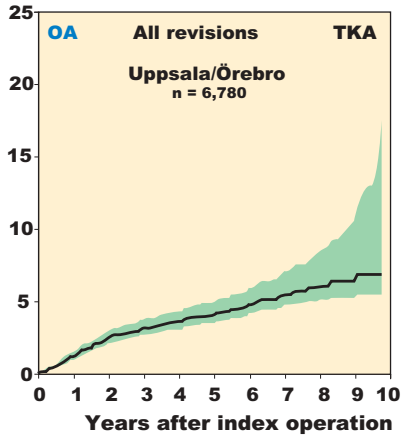
CRR (%)



Uppsala-Örebro
Implants for primary TKA in OA 1990–1999

	Number	Percent
F/S MIII	1,901	28.0
F/S ospec	238	3.5
AGC	1,621	23.9
Kinemax	1,559	23.0
Scan	387	5.7
MillerGalante2	368	5.4
MillerGalante ospec	64	0.9
AMK	247	3.6
PFC	78	1.2
PFC Sigma	38	0.6
NexGen	99	1.5
PCA	66	1.0
PCA-Mod	41	0.6
Tricon	33	0.5
Other	40	0.6
Total	6,780	100.0

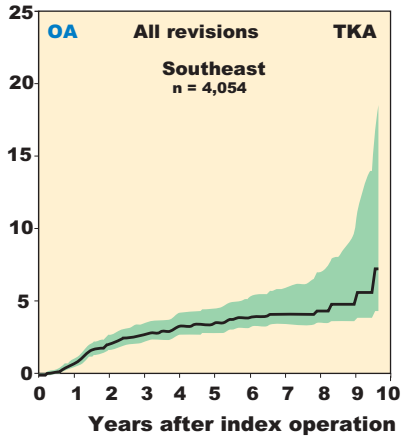
CRR (%)



Southeast
Implants for primary TKA in OA 1990–1999

	Number	Percent
AGC	1,785	44.0
PFC	506	12.5
PFC Sigma	80	2.0
NexGen	408	10.1
MillerGalante2	394	9.7
MillerGalante ospec	129	3.2
Duracon	340	8.4
PCA-Mod	156	3.8
PCA	18	0.4
Scan	130	3.2
Kinemax	45	1.1
RMC	15	0.4
F/S MIII	10	0.2
Other	38	0.9
Total	4,054	100.0

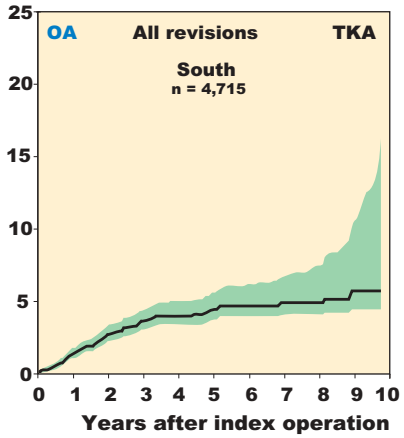
CRR (%)



South
Implants for primary TKA in OA 1990–1999

	Number	Percent
Duracon	1,054	22.4
Scan	996	21.1
PFC	947	20.1
PFC Sigma	262	5.6
AGC	739	15.7
Synatomic	152	3.2
PCA-Mod	143	3.0
PCA	56	1.2
Axiom	63	1.3
Osteonics	63	1.3
F/S MIII	59	1.3
Rotaglide	47	1.0
Nuffield	37	0.8
Kinematic	25	0.5
LCS	20	0.4
AMK	13	0.3
Other	39	0.8
Total	4,715	100.0

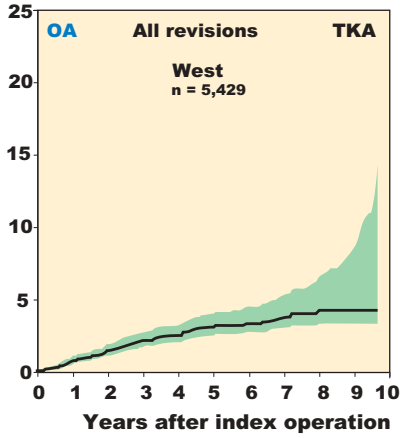
CRR (%)



West
Implants for primary TKA in OA 1990–1999

	Number	Percent
AGC	2,837	52.3
F/S MIII	1,175	21.6
Free-Sam	258	4.8
Scan	381	7.0
Duracon	338	6.2
AMK	116	2.1
Axiom	72	1.3
PFC Sigma	51	0.9
PFC	33	0.6
PCA-Mod	47	0.9
MillerGalante2	46	0.8
MillerGalante ospec	25	0.5
Townley	24	0.4
Other	26	0.5
Total	5,429	100.0

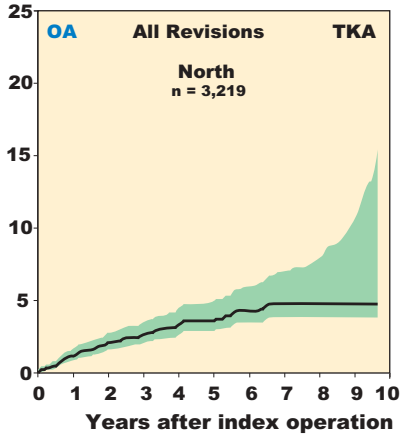
CRR (%)



North
Implants for primary TKA in OA 1990–1999

	Number	Percent
AGC	894	27.8
PFC	487	15.1
PFC Sigma	95	3.0
Duracon	394	12.2
LCS	280	8.7
Scan	151	4.7
F/S MIII	143	4.4
Free-Sam	53	1.6
Tricon	119	3.7
Profix	106	3.3
MillerGalante2	89	2.8
MillerGalante ospec	86	2.7
PCA-Mod	80	2.5
PCA	75	2.3
Kinemax	59	1.8
AMK	42	1.3
Synatomic	25	0.8
Other	41	1.3
Total	3,219	100.0

CRR (%)

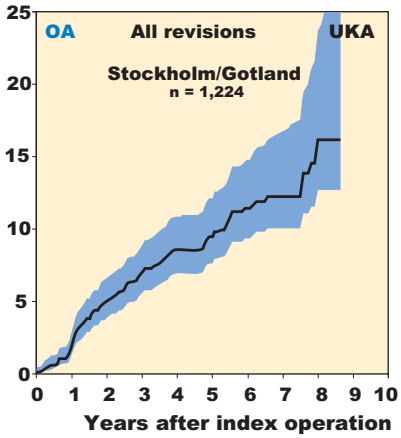


UKA implants for osteoarthrosis in the regions 1990–1999

Stockholm + Gotland
Implants for primary UKA in OA 1990–1999

	Number	Percent
Brigham	622	50.8
Miller/Galante	296	24.2
Oxford	115	9.4
Link	54	4.4
Genesis	47	3.8
Repicci (AARS)	20	1.6
PCA	18	1.5
Allegretto	16	1.3
PFC	13	1.1
Duracon	13	1.1
Marmor	8	0.7
Other	2	0.2
Total	1,224	100.0

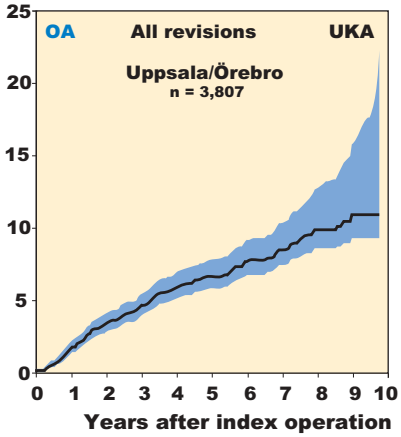
CRR (%)



Uppsala-Örebro
Implants for primary UKA in OA 1990–1999

	Number	Percent
Link	1,994	52.4
Marmor	937	24.6
St. Georg	250	6.6
PFC	242	6.4
Duracon	99	2.6
Oxford	88	2.3
Genesis	66	1.7
PCA	62	1.6
Brigham	31	0.8
Allegretto	23	0.6
Miller/Galante	13	0.3
Other	2	0.1
Total	3,807	100.0

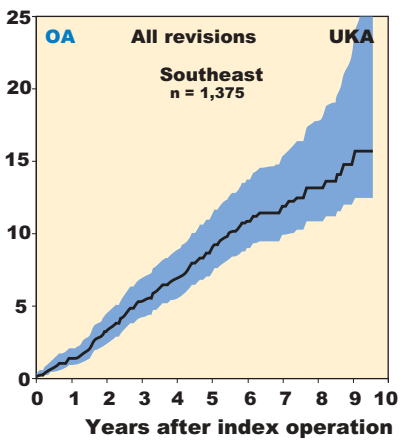
CRR (%)



Southeast
Implants for primary UKA in OA 1990–1999

	Number	Percent
Link	363	26.4
Marmor	296	21.5
Brigham	226	16.4
Duracon	147	10.7
PCA	107	7.8
Allegretto	63	4.6
Genesis	58	4.2
PFC	47	3.4
Oxford	43	3.1
Miller/Galante	12	0.9
St. Georg	9	0.7
Other	4	0.3
Total	1,375	100.0

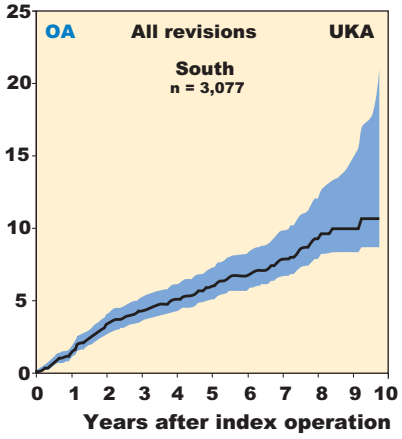
CRR (%)



South
Implants for primary UKA in OA 1990–1999

	Number	Percent
Link	1,182	38.4
Marmor	661	21.5
Duracon	248	8.1
PFC	188	6.1
St. Georg	154	5.0
Oxford	130	4.2
Brigham	129	4.2
Allegretto	117	3.8
Repicci (AARS)	109	3.5
Miller/Galante	71	2.3
PCA	42	1.4
Genesis	42	1.4
Other	4	0.1
Total	3,077	100.0

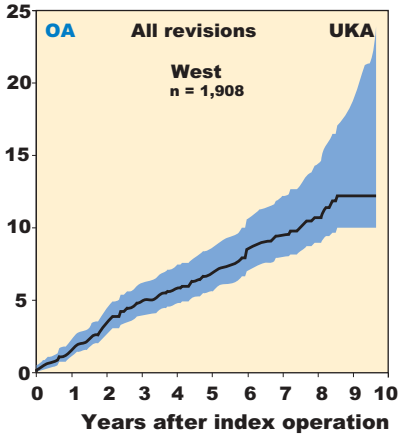
CRR (%)



West
Implants for primary UKA in OA 1990–1999

	Number	Percent
Link	671	35.2
Miller/Galante	445	23.3
Oxford	326	17.1
Marmor	193	10.1
Duracon	100	5.2
Repicci (AARS)	75	3.9
Allegretto	70	3.7
PCA	15	0.8
St. Georg	12	0.6
Other	1	0.1
Total	1,908	100.0

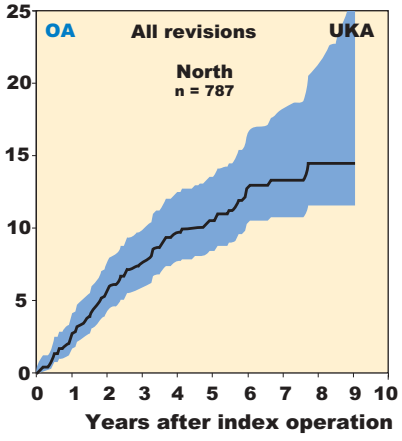
CRR (%)



North
Implants for primary UKA in OA 1990–1999

	Number	Percent
Link	482	61.2
Oxford	87	11.1
Marmor	63	8.0
St. Georg	53	6.7
Miller/Galante	33	4.2
PCA	30	3.8
PFC	24	3.0
Duracon	15	1.9
Total	787	100.0

CRR (%)

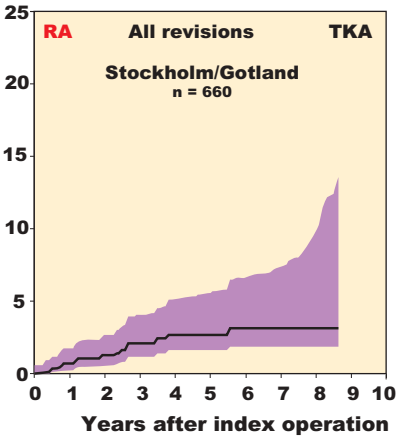


TKA implants for rheumatoid arthritis in the regions 1990–1999

Stockholm + Gotland
Implants for primary TKA in RA 1990–1999

	Number	Percent
AGC	330	50.0
Kinemax	84	12.7
Duracon	70	10.6
PFC Sigma	57	8.6
PFC	40	6.1
PCA-Mod	30	4.5
F/S MIII	28	4.2
Free-Sam	12	1.8
Other	9	1.4
Total	660	100.0

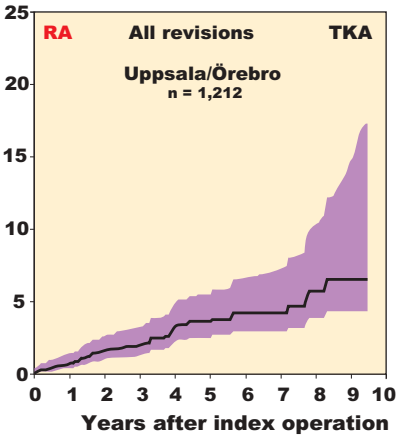
CRR (%)



Uppsala-Örebro
Implants for primary TKA in RA 1990–1999

	Number	Percent
F/S MIII	325	26.8
Free-Sam	90	7.4
Kinemax	254	21.0
AGC	207	17.1
Scan	173	14.3
MillerGalante2	61	5.0
MillerGalante ospec	25	2.1
PCA	17	1.4
PCA-Mod	15	1.2
PFC	12	1.0
PFC Sigma	3	0.2
Other	30	2.5
Total	1,212	100.0

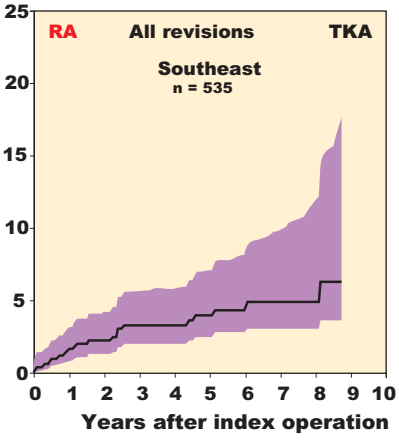
CRR (%)



Southeast
Implants for primary TKA in RA 1990–1999

	Number	Percent
AGC	228	42.6
PFC	80	15.0
PFC Sigma	6	1.1
Scan	46	8.6
NexGen	45	8.4
MillerGalante2	35	6.5
MillerGalante ospec	23	4.3
Duracon	29	5.4
PCA-Mod	18	3.4
PCA	7	1.3
RMC	10	1.9
Other	8	1.5
Total	535	100.0

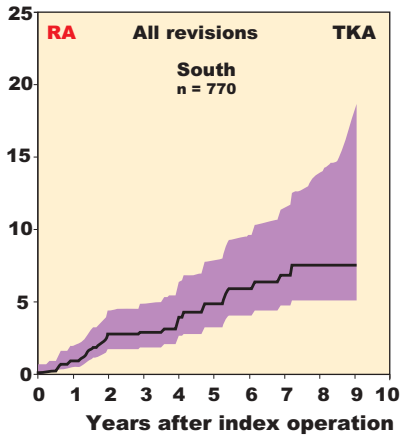
CRR (%)



South
Implants for primary TKA in RA 1990–1999

	Number	Percent
Scan	320	41.6
PFC	142	18.4
PFC Sigma	28	3.6
AGC	94	12.2
Duracon	53	6.9
Kinematic	46	6.0
Synatomic	38	4.9
PCA-Mod	19	2.5
PCA	16	2.1
Other	14	1.8
Total	770	100,0

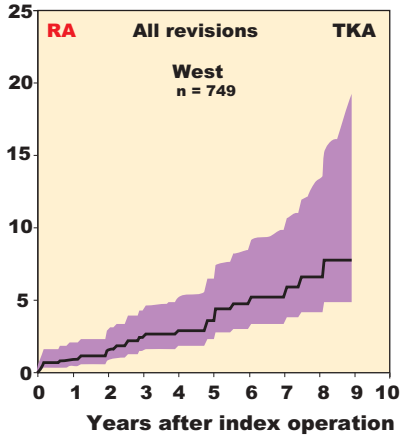
CRR (%)



West
Implants for primary TKA in RA 1990–1999

	Number	Percent
AGC	296	39.5
F/S MIII	229	30.6
Free-Sam	76	10.1
Scan	84	11.2
AMK	20	2.7
Duracon	20	2.7
Townley	15	2.0
Other	9	1.2
Total	749	100.0

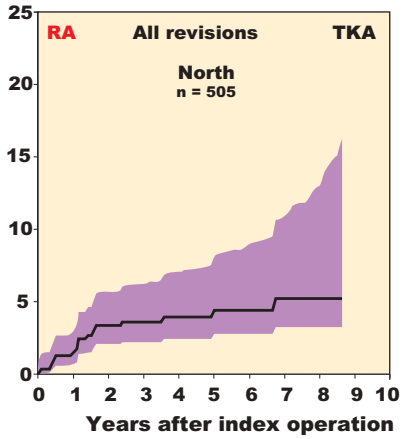
CRR (%)



North
Implants for primary TKA in RA 1990–1999

	Number	Percent
PFC	100	19.8
PFC Sigma	17	3.4
Duracon	89	17.6
AGC	85	16.8
Tricon	45	8.9
PCA	31	6.1
PCA-Mod	31	6.1
MillerGalante2	29	5.7
MillerGalante ospec	13	2.6
LCS	25	5.0
Scan	14	2.8
Other	26	5.1
Total	505	100.0

CRR (%)



Implantat used for primary arthroplasty in 1990–1999

The registry usually uses the latest 10-year period for analysis to present the results of relatively modern implant types and with a reasonably long-term follow-up. It must be noted that when brands are marked as being unspecified, they usually consist of a mix of older and newer variants but where the reporting unit has not delivered a specified description. This has resulted in, that the current results of some older unspecified brands have improved their results compared to prior analyses. This is probably caused by fewer implants of the older variants becoming included in the analysis.

The risk of becoming revised is only one of many ways how differences between implants can be measured. Although not accounted for here, the type of the revision should also be considered. I.e., The observed revision rate will increase when the use of a patellar button is deliberately avoided (see page 11) in favour of a secondary resurfacing of the patella, when needed.

On the following pages there are CRR curves for TKA and UKA implants used for OA. As the table below shows, there are no significant differences for the models when used in RA, why no curves are disclosed.

Presently, we cannot evaluate the effect of mini-incision on the results of UKA. However, it is noteworthy that the implants most often used with mini-incision have a higher CRR than the most commonly used Endo-Link. As even this implant is now becoming used with mini-incision the question may be answered later.

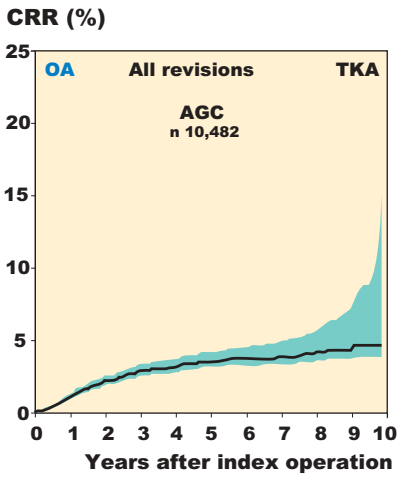
95% confidence interval for Risk Ratios for becoming revised.
The Cox regression is used to adjust for gender, age and year of operation.

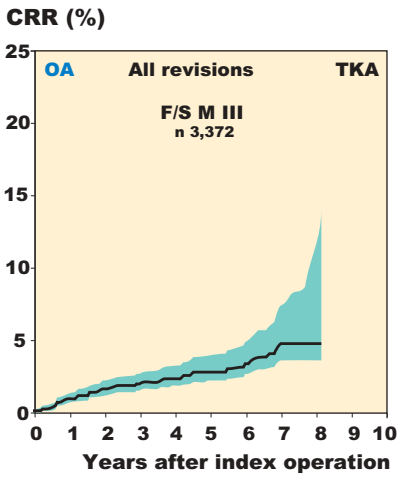
	OA / TKA n	95% CI
AGC	10,482	ref
F/S MIII	3,372	0.71–1.17
F/S unspec	575	0.94–2.00
PFC	2,449	0.94–1.57
PFC-Sigma	1,021	0.09–1.52
Duracon	2,558	0.58–1.09
Kinemax	2,377	0.88–1.47
Scan	2,046	0.95–1.60
Miller-Galante II	897	1.06–2.16
Miller-G. unspec	305	1.72–3.71
PCA-Mod	543	0.88–1.91
PCA unspec	220	0.85–2.46
AMK	490	0.57–2.19
NextGen	558	0.02–1.11
LCS	318	0.51–1.93
Synatomic	179	1.05–3.11
Axiom	139	0.48–3.52
Other	648	0.82–1.80
Gender		0.86–1.15
Age		0.95–0.97
Year of operation		0.94–1.01

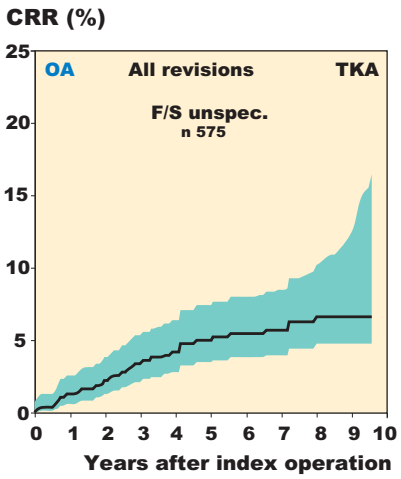
	RA / TKA n	95% CI
AGC	1,240	ref
F/S MIII	587	0.61–1.92
F/S unspec	178	0.45–2.17
PFC	374	0.48–1.95
PFC-Sigma	111	0
Duracon	263	0.31–2.03
Kinemax	350	0.71–2.41
Scan	637	0.51–1.53
Miller-Galante II	129	0.59–3.87
Miller-G. unspec	62	0.60–4.73
PCA-Mod	114	0.35–2.37
PCA unspec	73	0.25–2.75
AMK	36	0
NextGen	47	0.25–14.2
LCS	27	0.15–7.76
Synatomic	38	0.33–5.68
–		
Other	164	1.47–4,88
Gender		0.49–1.01
Age		0.98–1.01
Year of operation		0.92–1.09

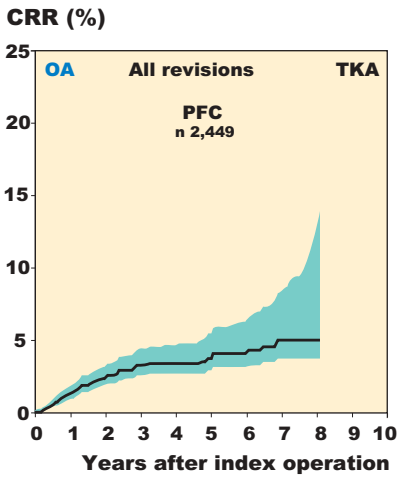
	OA / UKA n	95% CI
Endo Link	4,746	ref
St. Georg	478	0.51–1.22
Marmor/Richards	2,158	1.48–2.13
PFC-Uni	514	1.52–3.12
Brigham	1,008	0.90–1.57
Duracon-Uni	622	1.01–2.01
Oxford	789	1.33–2.19
–		
Miller-Galante	870	1.28–2.68
–		
PCA-Uni	274	2.32–4.19
Allegretto	289	1.09–2.73
–		
Genesis	213	0.60–3.10
Repicci (AARS)	204	1.56–3.86
–		
–		
Other	12	2.42–17.5
Gender		0.90–1.18
Age		0.95–0.97
Year of operation		0.93–1.01

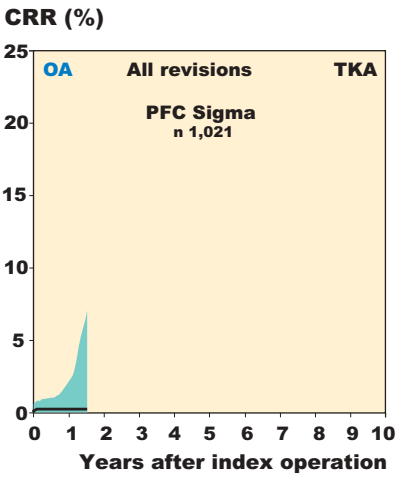
CRR for commonly used TKA implants in OA during 1990–1999

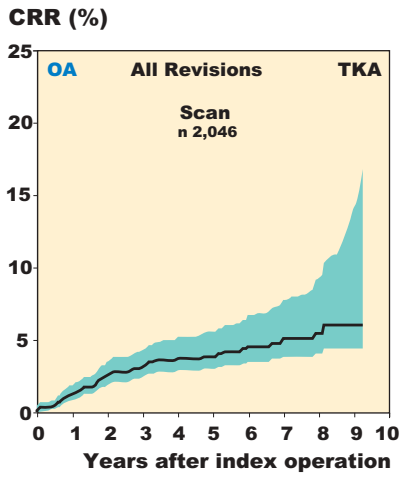


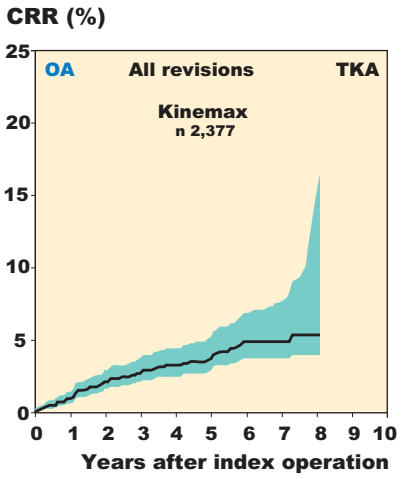


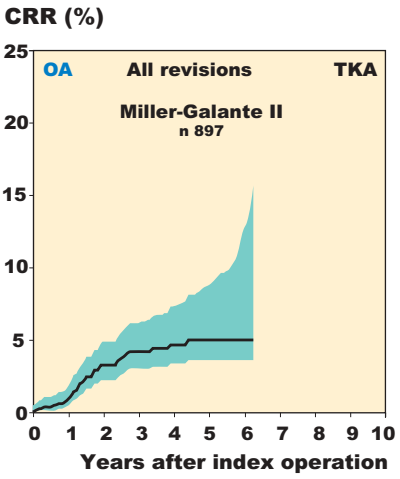


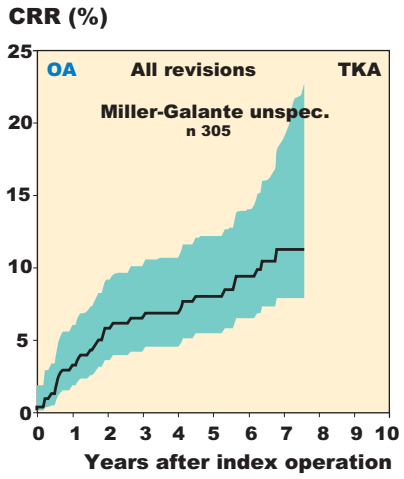


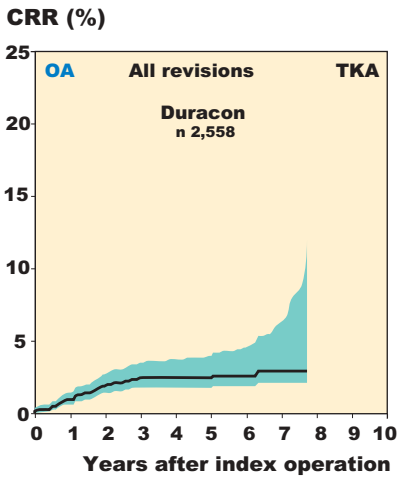


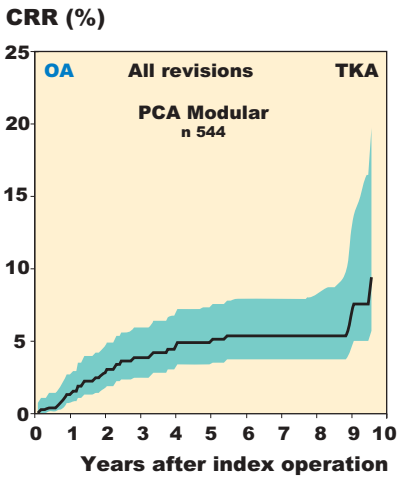


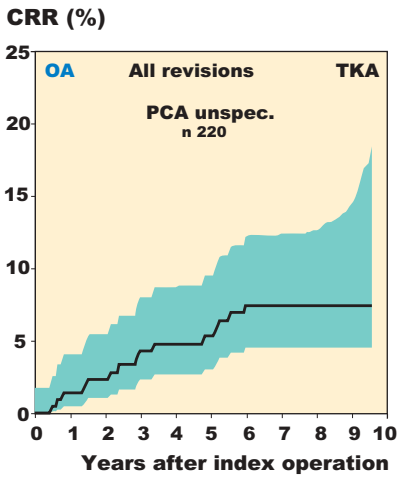


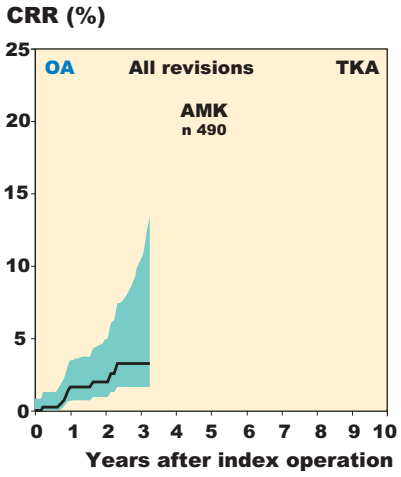


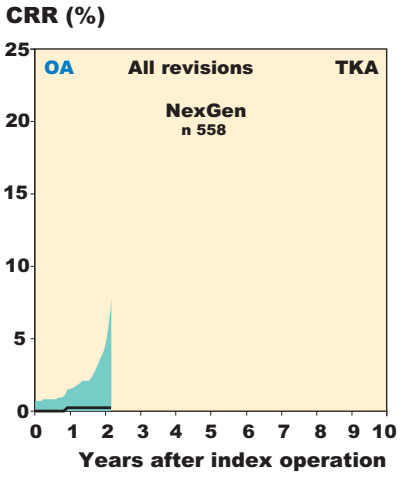


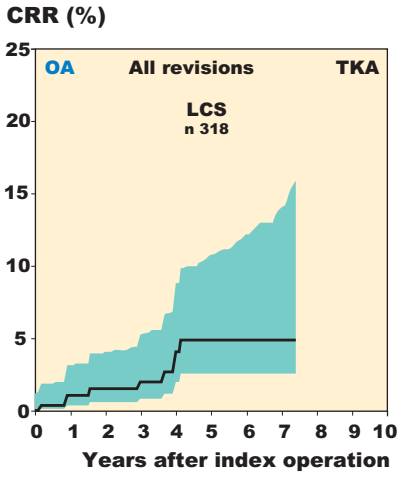

CRR (%)
OA
All revisions
TKA
Duracon
n 2,558
Years after index operation


CRR (%)
OA
All revisions
TKA
PCA Modular
n 544
Years after index operation

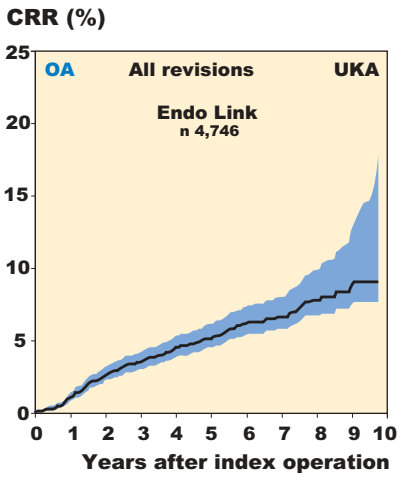

CRR (%)
OA
All revisions
TKA
PCA unspec.
n 220
Years after index operation

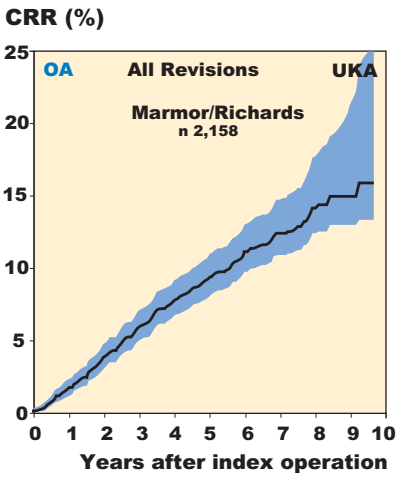

CRR (%)
OA
All revisions
TKA
AMK
n 490
Years after index operation

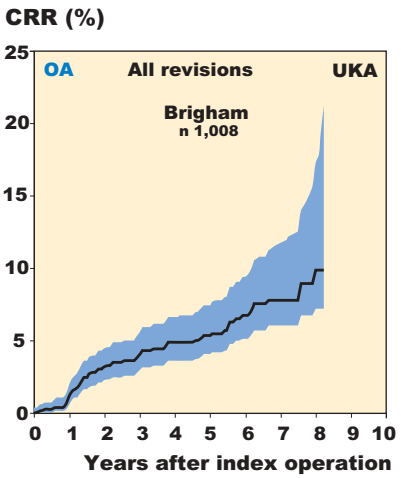

CRR (%)
OA
All revisions
TKA
NexGen
n 558
Years after index operation

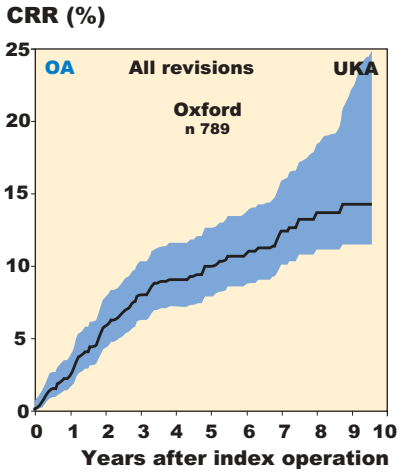

CRR (%)
OA
All revisions
TKA
LCS
n 318
Years after index operation

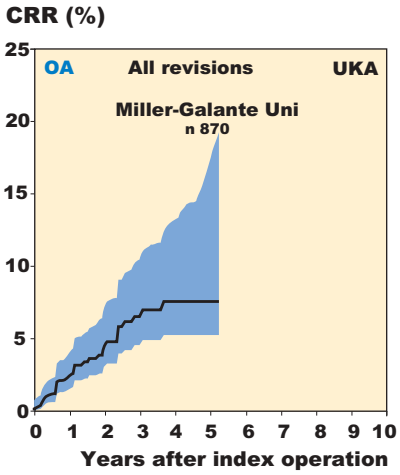
CRR for commonly used UKA implants in OA during 1990–1999

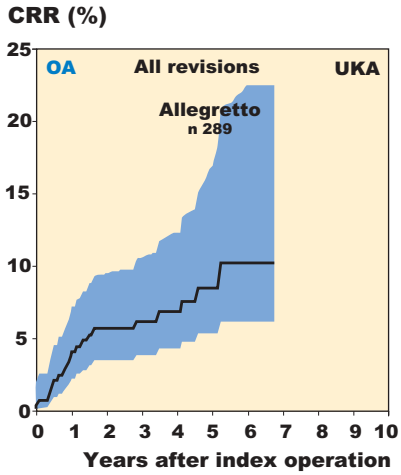


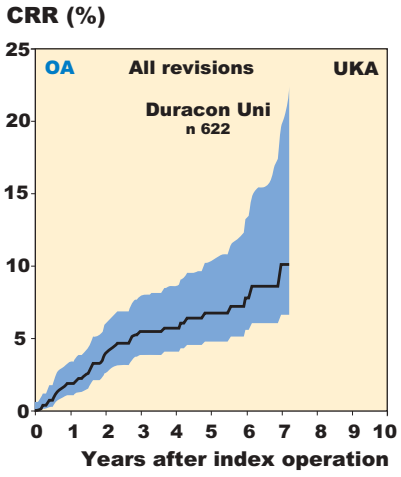


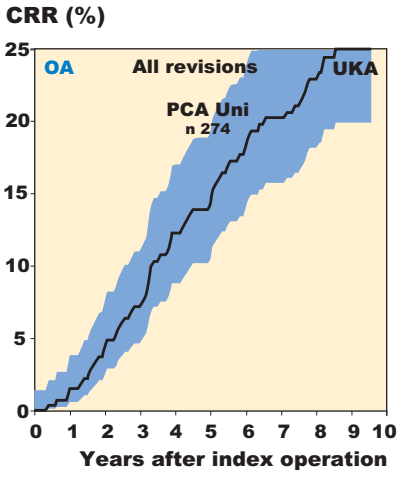


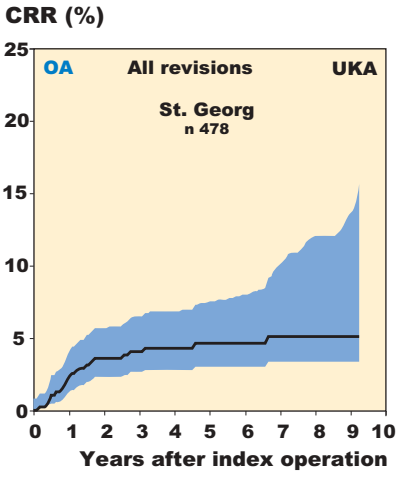


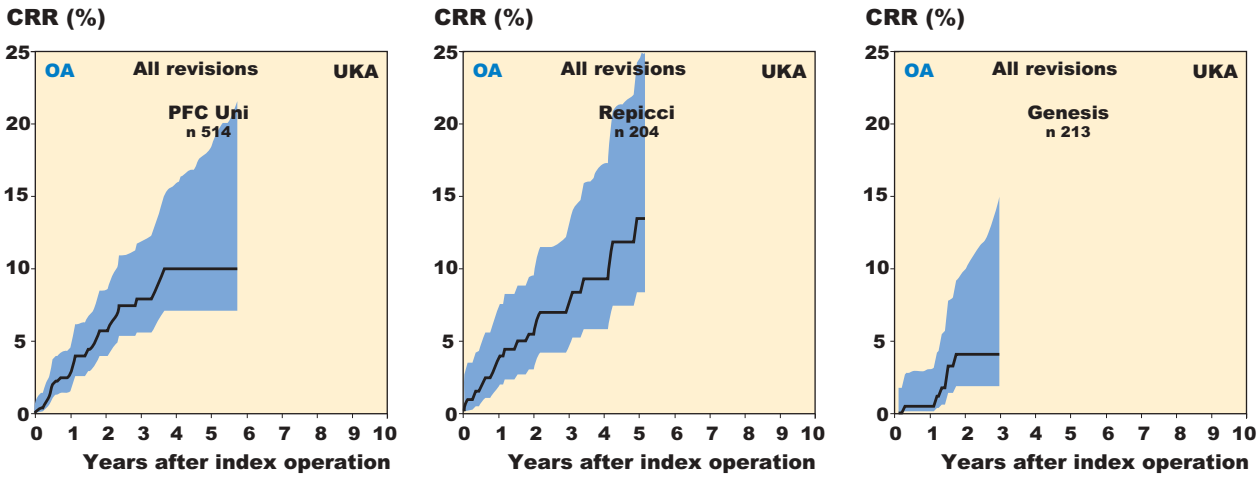











CRR (%)
OA
All revisions
UKA
PFC Uni
n 514
Repicci
n 204
Genesis
n 213
0
5
10
15
20
25
0 1 2 3 4 5 6 7 8 9 10
Years after index operation