



Conversion of unicompartmental knee arthroplasty to total knee arthroplasty : The challenges and need for augments

Zeeshan KHAN, Syed Z. NAWAZ, Steven KAHANE, Colin ESLER, Urjit CHATTERJI

From The Trent & Wales Arthroplasty Audit Group, University of Leiceste , Leicester, U.K.

The potential advantages of unicompartmental knee arthroplasty (UKA) include lower morbidity and mortality, quicker recovery, good range of motion, good medium and long term survival results, potential bone conservation and perceived easier revision. Converting a UKA to a total knee arthroplasty (TKA) may be challenging due to issues of bone loss, need for augmentation, restoring joint line and rotation.

We present the intraoperative findings of 201 cases of failed UKA's from the Trent Wales arthroplasty audit group (TWAAG) register. The objectives of the study were to determine the modes of failure, number of cases requiring augments and bone grafting, types of augments and implants used in revision surgery. This study does not include the clinical outcomes after revision knee surgery.

The average age of the cohort at revision surgery was 67 years. There were 111 females and 90 males. The commonest modes of failure in young patients were unexplained pain/instability and aseptic loosening and in older patients they were aseptic loosening and progression of the disease. The survivorship of the implant was higher in the less than 55 years age group in comparison to the older patients. A total of 49 patients (25.9%) required bone grafting commonest in the 60 years and above age group (79.6%). Fifty patients (26.4%) required some form of augmentation, with the commonest site being tibia and commonest augment being tibial stem (35 cases). Only 8% of the cohort required revision knee implants whereas 78% of the cases received a cruciate retaining primary knee implant.

To the author's knowledge, this is one of the largest studies in the literature which signifies the technical difficulties that might be experienced in revising the UKA's which will require appropriate pre-operative planning.

Keywords : UKA to TKA conversion ; age ; delay ; technical problems ; augmentation ; grafting.

INTRODUCTION

McKeever in the 1950's theorized that osteoarthritis isolated to only one compartment of the

-
- Zeeshan Khan, MRCS, Specialist trainee Trauma & Orthopaedics.
 - Syed Zuhair Nawaz, MRCS, Specialist trainee Trauma & Orthopaedics.
 - Steven Kahane, MRCS, Specialist trainee Trauma & Orthopaedics.
 - Colin Esler, FRCS (Tr & Orth), Consulting Trauma & Orthopaedics Surgeon.
 - Urjit Chatterji, FRCS (Tr & Orth), Consulting Trauma & Orthopaedics Surgeon.

The Trent & Wales Arthroplasty Audit Group, University of Leicester, Leicester, U.K.

Correspondence : Mr Zeeshan Khan, Department of Trauma & Orthopaedics, University Hospitals of Leicester, Leicester General Hospital, Gwendolen Road, Leicester, UK. LE5 4PW.
E-mail : zeek1978@yahoo.co.uk

© 2013, Acta Orthopædica Belgica.

knee joint can be treated by replacing only the involved compartment (4).

UKA in the treatment of isolated compartmental disease has been shown to have significantly better results than high tibial osteotomy or TKA (6,7,12,14). It is favoured because of a shorter operating time, lesser invasiveness, decreased blood loss, bone conservation, early return to work compared with TKA, quicker recovery and increased range of motion with excellent patient satisfaction (10). As a result of this, its indications have expanded to include younger patients as compared to being reserved previously for the older patients where it has shown significantly good results (8,23,28).

As its role continues to evolve, long term outcome results have become available with a survivorship of up to 94% being reported at 10 years (1,9,27). The ultimate aim of revision surgery is to attain a satisfactory clinical outcome, which can be technically difficult as it may need complex reconstructive procedures due to bone loss and ligament damage.

Various studies have reviewed the intraoperative findings of revision of UKA's and commented on the amount of bone loss, requirement for augmentation, importance of pre-operative planning and their clinical outcome (11,16,18,26). This article presents the findings of 201 cases from one regional data base in the United Kingdom and reviews the complexities and technical challenges that may arise during conversion of a UKA to TKA.

MATERIALS AND METHOD

The Trent and Wales Regional Arthroplasty Audit Group (TWAAG) was established to assess the outcomes of arthroplasties in this single region of the health system in the United Kingdom (21). From 1990, with the agreement of all consultant orthopaedic surgeons in the Trent region, all hip and knee arthroplasties have been recorded prospectively in a database at the Academic unit of Trauma & Orthopaedics in the University of Leicester. This currently includes 123 named consultant surgeons from 21 different hospitals in the region. The number of UKA's registered into the database at the time of this study was 1459.

A total of 201 patients with revision knee surgery after failed UKA were identified from the register. In this cohort there were 111 females and 90 males. Five patients

were excluded due to insufficient data for the purpose of this study. Revision was defined as exchange of all the implants for the purpose of this study, excluding a further 4 cases leaving a final cohort of 192 patients. The reasons for revision surgery were divided into 6 categories and a table was drawn relating them to age at revision.

The average age at which UKA was undertaken was calculated and the commonest implants used at primary surgery were identified. Those who had missing data were included into an unknown group. Time from primary to revision surgery was calculated and a curve was plotted relating different age groups to survival of the implants. A graph was constructed relating the age at revision surgery with causes.

While reviewing bone grafting, use of augments and types of implants used at revision surgery, 3 cases were excluded due to missing data. Tables were drawn indicating their use and percentages were also calculated.

RESULTS

A total of 1459 UKA's were identified from the TWAAG register over a period of 18 years (Fig. 1). For the same time period, 201 cases of revision knee arthroplasty were identified which were revised from a UKA to TKA. The average age of the cohort at primary surgery was 61.5 years (range : 39-84), including 111 females and 90 males, with the right knee involved in 112 cases. All but 3 cases were medial UKA's. The commonest implant used was the Biomet Oxford unicompartmental knee system (124 cases), followed by the Link Sled system (23 cases).

The average age at revision surgery was 67 years (range : 47-87 years) ; the time in months for revision from UKA to TKA was 4-323 months (some of these patients had their primary surgery (UKA) at a different hospital and were then referred to our institution for revision surgery). On analysis we found that overall, the time from primary to revision surgery initially falls between the ages under 50 and 50-60 and then plateaus in the older age groups. For those who had their UKA's done in their 40's, the average time to revision is 126 months which is longer than in the older age group (Fig. 2).

Reasons for revision surgery fell into 6 groups. Aseptic loosening was the reason for revision in 38% of the cases followed by polyethylene wear

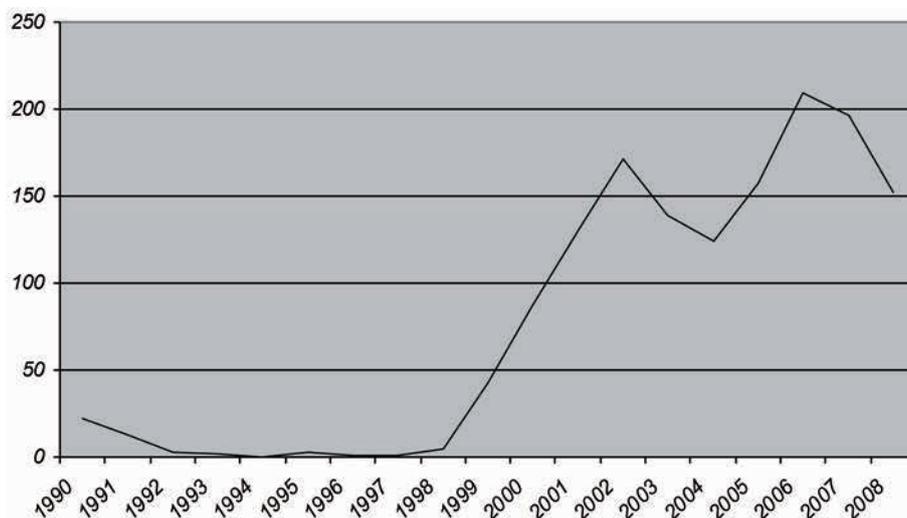


Fig. 1. — Number of UKA procedures performed over 18 years

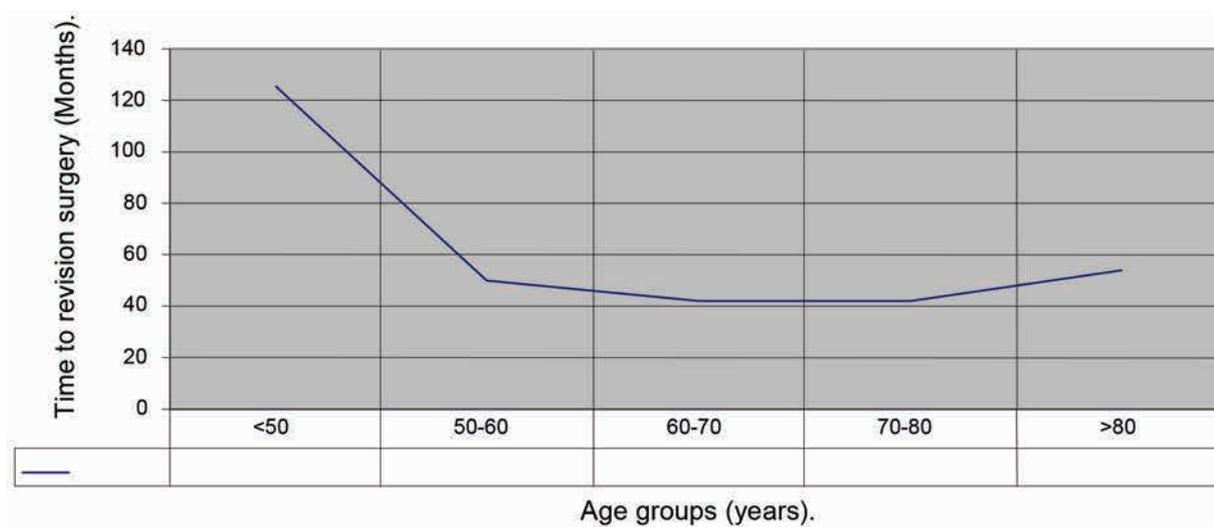


Fig. 2. — Average time to revision surgery in different age groups

and progression of osteoarthritis each in 21% of the cases. Ten per cent of patients presented with pain and instability with no cause found intra operatively at revision surgery (Fig. 3).

The commonest modes of failure identified were instability and unexplained pain in 40-50 years age group (67%), aseptic loosening in the 50-70 years age group (41-44%) and progression of the disease

in 60-70 years (39%) and 70-80 years (35%) age groups (Fig. 4).

Forty nine cases (25.9%) in the cohort needed bone grafting of which 79.6% were in the 60 years and above age group (Table I). A total of 50 cases (26.5%) required some form of augmentation, the commonest of which were tibial stems (35 cases) followed by tibial wedges (24 cases) and femoral

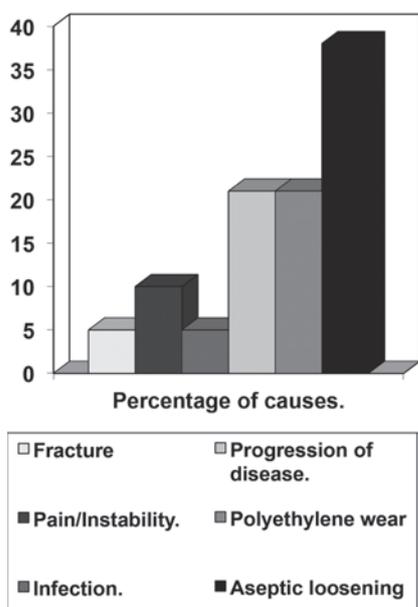


Fig. 3. — Reasons for revision surgery due to any cause calculated in percentages.

stems (17 cases), with the commonest site requiring any augmentation being the tibia (35 cases) (Table II). Of the 50 cases requiring bone augments 50% were found to be in the 60-69 years age group and 20% in the 70-79 years age group (Table III).

Table I. — Use of bone grafts in different age groups at revision surgery

Age	Bone Graft Used	% of Total
<40	0	0
40-49	0	0
50-59	10	20.4
60-69	16	32.7
70-79	15	30.6
80-89	7	14.3
> 90	1	2.0
Total	49	25.9

At revision surgery 92% of cases were noted to have primary knee systems used (78% cruciate retaining and 14% cruciate sacrificing), with 8% of cases requiring a revision system (Condylar constrained or hinged prosthesis) (Table IV).

DISCUSSION

The role of UKA continues to evolve in the management of isolated compartment disease as it is favoured over corrective tibial osteotomy and TKA.

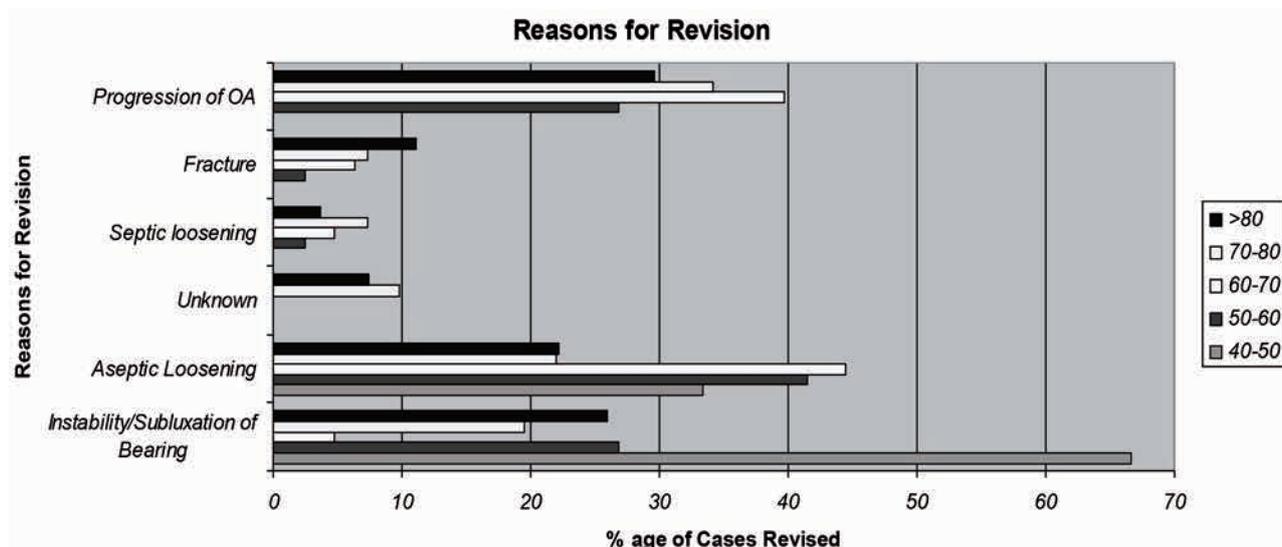


Fig. 4. — Reasons for revision surgery in various age groups

Table II. — Different types of metal augments used

Type of Augment Used	Number of Cases	% of Cases (Total: 50)
Tibial Wedge/Block	24	48%
Unspecified Tibial Augment	2	4%
Tibial Stem	35	70%
Femoral Augments (Posterior)	3	6%
Femoral Augments (Distal)	1	2%
Femoral Augments (Both)	4	8%
Femoral Stem	17	34%

Table III. — Augments used in different age groups

Age (years)	Augments Used	% of Total
< 40	0	0
40-49	0	0
50-59	9	18
60-69	25	50
70-79	10	20
80-89	6	12
> 90	0	0

The reasons for this are its better function, good range of motion, fewer complications and preservation of bone stock (5). Its recent success is attributed to the long term follow-up now available (9,27). Survivorship of 98% at 10 years has been reported (20). Patients with a UKA on one side and a TKA on the other have reported better satisfaction with UKA (14). The UKA has been classically indicated for use in the sedentary, elderly population, particularly females, where the implant in the vast majority of cases has survived through the life time of the patient (23).

Whilst some studies have found higher revision rates after UKA, the introduction of guided instruments for precise surgical technique, stricter indications and avoidance of thinner components have gradually improved their survival which is why its potential scope has now been extended to younger patients (8,25,28). Studies have been quoted reporting that hospitals and surgeons who do not undertake UKA as routine procedure had higher failure rates (13). Based on the results of these studies, it

Table IV. — Various total knee systems used at revision arthroplasty

Type of system	Number	%
Cruciate retaining	148	78%
Cruciate sacrificing	26	14%
Condylar constrained	9	5%
Hinged prosthesis	6	3%

will be safe to assume that the outcomes of UKA in institutions with low volumes can be suboptimal.

Various studies have reported on revision of UKA's and analysed the average age of the primary implant, modes of failure and technical difficulties experienced during revision arthroplasty in terms of requirement for bone grafts, augments and stems (2, 18,22,26). Previous studies have reported small numbers of cases and this weakness is eradicated by our study. Our study only reviews the technical challenges which can be posed to the surgeon during revision surgery because of the need for reconstruction of damaged ligaments and bone loss.

Kuipers *et al* reported a 5 year survival rate of 84.7% for UKA (13). Their study included a similar age group as ours with a mean age of 63. The Swedish knee arthroplasty register highlights a 10 year revision rate between 1998 and 2007 of 17.5% for UKA (16). The commonest cause for failure of UKA has been found to be aseptic loosening followed by wear of the polyethylene component and progression of osteoarthritis (2,16,22). These findings have been complemented by the results of our study which further goes to show that the commonest cause of failure in younger patients is aseptic

loosening of the implants and polyethylene wear as compared to the elderly population, where the commonest cause is progression of osteoarthritis (Fig. 4).

An argument commonly made is that revision of UKA to TKA is often straightforward (17). In our study bone grafting was necessary in 26% of the cases, a significant majority of which have been autografts and used mainly on the tibial side. The reported incidence for the use of bone grafts is between 23% and 76% of cases (2,18,22,26). The use of augments and tibial stems has been in 19% to 50% of the cases, the site mainly involved being the tibia with tibial stem being the most commonly used aid at revision. We found that a total of 50 cases (26%) required some form of supplementation at revision, of which 70% were tibial stems, 34% femoral stems and 48% tibial wedges or blocks. Some cases required 2 or more supplements. It is clearly evident from these figures that during revision arthroplasty, the most challenging aspect is the tibial component.

The use of cruciate retaining primary knee systems in revision of UKA to TKA has been reported from 83% to 97% (19). Our study also reveals the fact that despite the availability of more sophisticated revision systems, 92% of UKA's were revised using primary total knee systems. Only 8% of the cases required revision knee systems (Table IV). Some authors also suggest that it is for this reason that if a revision of a UKA is needed it is often straightforward (17). This along with other studies is challenged by the results of our study which reveals the use of bone grafts or augments in 26% of our cases. The fact that 1/4th of our cases needed either bone grafting or augments and in certain cases both, signifies that a revision UKA to TKA is not always straightforward. We, therefore, suggest that these procedures be undertaken after adequate planning, presence of equipment's and implants and by a surgeon with adequate surgical expertise.

CONCLUSION

As the success of UKA grows, its numbers are likely to increase, which in turn will lead to increased numbers requiring revision at some stage.

UKA is the right procedure if reserved for the right patient and performed at right time by the right surgeon using the right surgical technique (24).

Our study concludes that the revision rate is lower for less than 55 years old age group and the commonest causes for revision in all age groups are aseptic loosening and progression of disease in other compartments. The commonest causes for revision in younger patients are unexplained pain, instability and aseptic loosening, whereas progression of the disease is the commonest cause in elderly patients. About 26% of the patients needed bone grafts or augments, with the site needing most attention being the tibia. Despite the need for augments in 1/4th of the cases, only 8% of the cases required revision knee systems. Revision of a UKA to TKA might be straightforward, but based on the results we suggest ample pre-operative planning and the availability of various types of bone grafts and augments during the surgery.

REFERENCES

1. **Argenson JA, Chevrol-Benkeddache Y, Aubaniac J.** Modern unicompartmental knee arthroplasty with cement : a three to ten-year follow-up study. *J Bone Joint Surg* 2002 ; 84-A : 2235-2239.
2. **Barrett WP, Scott RD.** Revision of failed unicompartmental knee arthroplasty. *J Bone Joint Surg* 1987 ; 69-A : 1328-1335.
3. **Beard DJ, Pandit H, Gill HS et al.** The influence of the presence and severity of pre-existing patellofemoral degenerative changes on the outcome of the Oxford medial unicompartmental knee replacement. *J Bone Joint Surg* 2007 ; 89-B : 1597-1601.
4. **Borus T, Thornhill T.** Unicompartmental knee arthroplasty. *J Am Acad Orthop Surg* 2008 ; 16 : 9-18.
5. **Broughton NS, Newman JH, Bailey RAJ.** Unicompartmental replacement and high tibial osteotomy for osteoarthritis of the knee : A comparative study after 5-10 years follow-up. *J Bone Joint Surg* 1986 ; 68-B : 447-452.
6. **Cameron HU, Jung YB.** A comparison of unicompartmental knee replacement with total knee replacement. *Orthop Rev* 1988 ; 17 : 983-988.
7. **Cobb AG, Kozinn SC, Scott RD.** Unicompartmental or total knee replacement : Patient preference. *J Bone Joint Surg* 1990 ; 72-B : 166-170.
8. **Deshmukh RV, Scott RD.** Unicompartmental knee arthroplasty for younger patients : an alternative view. *Clin Orthop Relat Res* 2002 ; 404 : 108-112.

9. **Deshmukh RV, Scott RD.** Unicompartmental knee arthroplasty : long-term results. *Clin Orthop Relat Res* 2001 ; 392 : 272-278.
10. **Foote JAJ, Smith HK, Jonas SC et al.** Return to work following knee arthroplasty. *Knee* 2010 ; 17 : 19-22.
11. **Gill T, Schemitsch EH, Brick GW, Thornhil TS.** Revision total knee arthroplasty after failed unicompartmental knee arthroplasty or high tibial osteotomy. *Clin Orthop Relat Res* 1995 ; 321 : 10-18.
12. **Katz MM, Hungerford DS, Krackow KA, Lennox DW.** Results of total knee arthroplasty after failed proximal tibial osteotomy for osteoarthritis. *J Bone Joint Surg* 1987 ; 69-A : 225-233.
13. **Kuipers BM, Kollen BJ, Kaijser Bots PC et al.** Factors associated with reduced early survival in the Oxford phase III medial unicompartment knee replacement. *Knee* 2010 ; 17 : 48-52.
14. **Laurencin CT, Zelicof SB, Scott RD, Ewald FC.** Unicompartmental versus total knee arthroplasty in the same patient. *Clin Orthop Relat Res* 1991 ; 273 : 151-156.
15. **Levine WN, Ozuna RM, Scott RD.** Conversion of failed modern unicompartmental arthroplasty to total knee arthroplasty. *J Arthroplasty* 1996 ; 11 : 797-801.
16. **Lewold S, Robertsson O, Knutson K, Lidgren L.** Revision of unicompartmental knee arthroplasty : outcome in 1135 cases from the Sweedish Knee Arthroplasty study. *Acta Orthop Scand* 1998 ; 69 : 469-474.
17. **Marmor L.** Unicompartmental knee arthroplasty. 10-13 year follow up study. *Clin Orthop Relat Res* 1988 ; 226 : 14-20.
18. **McAuley JP, Engh GA, Ammeen DJ.** Revision of failed unicompartmental knee arthroplasty. *Clin Orthop Relat Res* 2001 ; 392 : 279-282.
19. **Miller M, Benjamin JB, Marson B, Hollstien S.** The effect of implant constraint on results of conversion of unicompartmental knee arthroplasty to total knee arthroplasty. *Orthopedics* 2002 ; 25 : 1353-1357.
20. **Murray DW, Goodfellow JW, O'Connor JJ.** The Oxford medial unicompartmental arthroplasty : a ten-year survival study. *J Bone Joint Surg* 1998 ; 80-B : 983-989.
21. **No authors listed.** Trent (and Wales) Regional Arthroplasty Audit Group. http://www.2.le.ac.uk/departments/health_sciences/extrone+/ECC/orthopaedicsurgery/TWAAG.
22. **Padgett DE, Stern SH, Insall JN.** Revision total knee arthroplasty for failed unicompartmental replacement. *J Bone Joint Surg* 1991 ; 73-A : 186-190.
23. **Sah AP, Springer B, Scott RD.** Unicompartmental knee arthroplasty in octogenarians : Survival longer than the patient. *Clin Orthop Relat Res* 2006 ; 451 : 107-112.
24. **Scott RD.** Unicondylar arthroplasty : Redefining itself. *Orthopedics* 2003 ; 26 : 951-952.
25. **Sibanda N, Copley LP, Lewsey JD et al.** Revision rates after primary hip and knee replacement in England between 2003 and 2006. *PLoS Med.* 2008 ; 5(9) : e179.
26. **Springer BD, Scott RD, Thornhill TS.** Conversion of failed unicompartmental knee arthroplasty to TKA. *Clin Orthop Relat Res* 2006 ; 446 : 214-220.
27. **Squire MW, Callaghan JJ, Goetz DD, Sullivan PM, Johnston RC.** Unicompartmental knee replacement. A minimum 15 year follow up study. *Clin Orthop Relat Res* 1999 ; 367 : 61-72.
28. **Swienckowski JJ, Pennington DW.** Unicompartmental knee arthroplasty in patients sixty years of age or younger. *J Bone Joint Surg* 2004 ; 86-A Suppl 1(Pt 2) : 131-142.