



## Patella resurfacing in posterior stabilised total knee arthroplasty : A follow-up study in 56 patients

Alessandro GILDONE, Massimiliano MANFREDINI, Roberto BISCIONE, Riccardo FACCINI

From the "Del Delta" Hospital, Lagosanto, Italy

**Patellar resurfacing in total knee arthroplasty (TKA) remains controversial. This study evaluates the results of resurfacing and non-resurfacing of the patella. Fifty-six patients with osteoarthritis (OA) of the knee were enrolled in a prospective randomised clinical trial using a posterior-stabilised TKA. Evaluations were done preoperatively and after 1, 3, 6, 12 and 24 months. Disease specific (Knee Society Score or KSS) and functional (patella-related activities) outcomes were measured. Patient satisfaction and anterior knee pain questionnaires were completed. No patients were lost to follow-up. No significant differences were found between groups with regard to the clinical part of the Knee Society score (KSS) not even in obese patients, the ability of performing daily activities involving the patellofemoral joint, and patient satisfaction. Significant differences were found regarding the functional section of the KSS, passive flexion, anterior knee pain and patellar tilt and subluxation. In conclusion, the authors believe that, for the implant studied, patellar resurfacing can be indicated.**

**Keywords :** knee ; arthroplasty ; patella resurfacing.

### INTRODUCTION

The optimal treatment of the patella in primary total knee arthroplasty (TKA) for osteoarthritis (OA) remains unclear (13). In many early designs of total knee prostheses, the native patella was maintained regardless of its condition or underlying disorder. Anterior knee pain was a predominant

problem and prompted a movement toward patellar resurfacing (16, 20, 40-42, 47).

Many surgeons argue that the patella should always be resurfaced (18, 22, 29, 46, 50), because resurfacing has a low complication rate, its results are predictable, and the risk of anterior knee pain is low (2, 34, 41, 42).

Others contend that the clinical results of non-resurfacing of the patella are similar to those of resurfacing (5, 6, 10, 12, 15, 18, 24, 29, 37, 40), without the added complications associated with resurfacing (11, 30, 35, 43, 48, 52), such as postoperative anterior pain, subluxation, dislocation, patellar fracture, rupture of the quadriceps tendon or patellar ligament, and patellar clunk (7, 8, 21, 23, 45).

Some surgeons selectively resurface the patella, based on factors such as preoperative weight, height, deformity, anterior knee pain, radiographic changes, quality of the remaining patellofemoral

---

■ Alessandro Gildone, M.D., Consultant Orthopaedic Surgeon.

■ Massimiliano Manfredini, M.D., consultant Orthopaedic Surgeon.

■ Roberto Biscione, M.D., Consultant Orthopaedic Surgeon.

■ Riccardo Faccini, M.D., Surgeon-in-Chief.

*Operative Unit of Orthopaedics and Traumatology, "Del Delta" Hospital – Via Valle Oppio – Lagosanto (Fe), Italy.*

Correspondence : Alessandro Gildone, Via Bagaro 74, 44100 Ferrara, Italy. E-mail : anbote@yahoo.it.

© 2005, Acta Orthopædica Belgica.

---

cartilage, intraoperative tracking, and the feasibility of a patella resurfacing. Selective resurfacing has become a popular method of treating the patellofemoral joint in TKA (11, 29, 31, 52). The lack of definitive prospective data has lead surgeons to follow one of these three strategies : always resurface the patella, never resurface the patella, selectively resurface the patella depending on the clinical and intra-operative findings (49).

Absolute indications for patellar resurfacing include inflammatory arthritis and surgical procedures performed primarily for a patellofemoral disease (28). Other relative indications include moderate to severe patellofemoral involvement seen intra-operatively or femoral components with a non-anatomic trochlea .

The results of several randomised controlled clinical trials (6, 10, 12, 18, 27, 29, 38, 46, 50, 52), have failed to agree on the predictors of success and functional outcome, in relation to patella management. Three recently published series on this subject, with minimum follow-up intervals of two (50), three (53), and five years (5, 6) came to diverging conclusions (14). In 2001, Barrack *et al* (5) found no difference in Knee Society scores (25) (overall, pain, and function scores) at a minimum follow-up of 5 years in 93 knees, with or without a resurfaced patella, and concluded that postoperative anterior knee pain may be a dynamic process related to surgical factors other than resurfacing of the patella. In contrast, Wood *et al* (53) studied a group of 220 knees in a randomised trial at minimum 3 years follow-up and found that knees with resurfaced patellae had considerably better clinical outcomes for anterior knee pain and stair descent. They found that resurfacing of the patellofemoral joint was still associated with a 16% incidence of anterior knee pain, and that 10% of resurfaced patellae required revision because of a patellofemoral problem. In 2003, Waters and Bentley (50) reported the most recent and currently largest randomised clinical trial, with 474 knees observed for a minimum of 2 years. Similar to the study by Wood *et al* (53), this study showed a considerable increase in anterior knee pain (25.1% versus 5.3%, respectively) when the patella was not resurfaced in contrast to a resurfaced patella. In the Swedish Knee Arthroplasty

Registry database (44), more than 27,000 knees were available for review between 1981 and 1995. Satisfaction among patients with OA and rheumatoid arthritis was improved when the patella was resurfaced during TKA. Therefore, although predictive factors for postoperative anterior knee pain remain controversial, recent clinical studies have shown favourable results with resurfacing the patella.

The purpose of the current study is to report on the clinical, radiographic, and functional results of a randomised controlled clinical trial of patella resurfacing versus non-resurfacing in 56 knees using the NexGen prosthesis and after a minimum follow-up of two years.

## MATERIALS AND METHODS

A prospective, randomised clinical trial involving patients having primary TKA was started in 2002 at our institution to compare resurfacing versus non-resurfacing of the patella in TKA. The study was explained to each patient, and informed consent was obtained. Fifty-six osteoarthritic knees were randomised for either resurfacing or retention of the patella at the time of TKA. Patients were assessed preoperatively, and at 1 month, 3 months, 6 months, 1 year, and 2 years.

Exclusion criteria included previous patellectomy, inflammatory arthritis, patellar fracture, patellar instability, previous extensor mechanism procedures, high tibial osteotomy, severe valgus or varus deformity ( $> 15^\circ$ ), severe flexion contracture ( $> 15^\circ$ ), previous unicompartmental knee replacement, and a history of septic arthritis or osteomyelitis. Surgery was done by the same senior surgeon (RF) or under his supervision.

Patient demographics were similar between the groups, with regard to age, gender, preoperative mechanical axis, Ahlback classification of OA and alignment of the prosthetic components (table I). All patients received the same type of cemented posterior-stabilised TKA with in one group an all-polyethylene (PE) dome-shaped patellar component (NexGen, Zimmer, Warsaw, Indiana, USA) and a patelloplasty in the non-resurfaced second group. Callipers were used to measure the patellar thickness intra-operatively in an attempt to restore the baseline composite height in all resurfacing procedures.

Clinical assessment preoperatively and at follow-up included the Knee Society clinical rating score. Specific questions were added to evaluate the VAS (visual

Table I. — Patients' characteristics

Feature	Patella unresurfaced	Patella resurfaced
Number of cases	28	28
Mean age	73.6 (max 87 min 67)	74.6 (max 89 min 65)
Male : Female	8 :20	9 :19
Left : Right	15 :13	15 :13
Degree of arthritis (Ahlback)	3 (max 5 min 1)	3 (max 5 min 1)
Preoperative KA angle	1.3° valgus (15° valgus to 13° varus)	1.1° valgus (12° valgus to 10° varus)
Tibial component alignment (frontal plane)	1.3° varus (5° varus to 2° valgus)	0.3° varus (4° varus to 0°)
Femoral component alignment (frontal plane)	6.4° valgus (9° valgus to 5° valgus)	6° valgus (7° valgus to 5° valgus)
Mean follow-up	25.2 months (max 28 min 24)	25.6 months (max 29 min 24)

Table II. — Patellofemoral joint-related problems (score on a visual analogue scale)

Problems in getting out of a car
Problems in getting up and down stairs
Problems in getting into a chair
Anterior knee pain

analogue scale) score for the patellofemoral joint (table II). Clinical results were related to the body mass index (BMI).

On preoperative and postoperative radiographs the anatomical and mechanical axis, the Insall-Salvati Index and patellar tilting were measured, and subluxation was graded following Gomes *et al* (21). The position of the prosthetic components and the prosthesis-bone interface were determined using a standardised Knee Society method (17).

An independent samples t-test was used to compare Knee Society rating scores, body weight, height, body mass index (BMI), and ROM between patients with and without resurfacing of the patella. Chi-square analysis was used to compare the results of function and satisfaction questionnaires, and the radiological results.

## RESULTS

### Knee Society Scores

The Knee Society Score can be divided into a clinical and a functional part. The mean preoperative total knee score was 80.5 for the unresurfaced and 79.9 for the resurfaced knees, and at two years follow-up 178.0 and 178.3 respectively (table III).

The mean clinical KSS score in the non-resurfaced group increased from 30.3 preoperatively to 90.5 at final follow-up, and of the resurfaced group from 30.2 to 91.6 (table IV). The functional pre- and post-operative scores were 50.2 and 85.5 for the non-resurfaced group, and 49.7 and 86.7 for the resurfaced group (table V). The functional KSS scores at 6 months follow-up differed significantly ( $p = 0.034$ ). Also mean passive flexion of the knee at 6 months of follow-up was significantly different between the two groups : 118° in the resurfaced versus 103° in the unresurfaced group ( $p = 0.028$ ).

Within the unresurfaced group, body weight, height and BMI were analysed to determine if they were predictive to the development of anterior knee pain (no patient experienced anterior knee pain at 2 years follow-up in the resurfaced group). There was no relationship observed between developing anterior knee pain and these factors. In fact, within this group, the mean BMI was 27.21 for patients with anterior pain vs. 27.3 for those without pain, the mean height was 166.1 cm vs. 165.6 cm and the mean weight was 75.1 kg for both groups.

### Patient satisfaction and VAS scoring of patellofemoral joint performance

In the two groups the scores raised from 2-3 preoperatively (0 = impossible, 10 = no problem) to 8-9 : there were no significant differences between the two groups (table VI).

Furthermore, 100% of the patients were satisfied with the surgical operation.

Table III. — Mean total KSS Score

Mean KSS Score (total)						
	<i>pre op</i>	<i>1 m</i>	<i>3 ms</i>	<i>6 ms</i>	<i>1 y</i>	<i>2 ys</i>
<i>Unresurfaced patella</i>	80.5	132.8	166.2	172.4	174.0	178.0
<i>Resurfaced patella</i>	79.9	127.7	167.6	173	173.9	178.3

Table IV. — Mean clinical KSS Score

Mean clinical KSS Score						
	<i>pre op</i>	<i>1 m</i>	<i>3 ms</i>	<i>6 ms</i>	<i>1 y</i>	<i>2 ys</i>
<i>Unresurfaced patella</i>	30.3	76.5	87.6	90.3	90.3	90.5
<i>Resurfaced patella</i>	30.2	73.6	87.2	90.4	91.3	91.6

Table V. — Mean functional KSS Score

Mean functional KSS Score						
	<i>pre op</i>	<i>1 m</i>	<i>3 ms</i>	<i>6 ms</i>	<i>1 y</i>	<i>2 ys</i>
<i>Unresurfaced patella</i>	50.2	56.3	78.6	82.1	84.0	85.5
<i>Resurfaced patella</i>	49.7	54.1	80.4	83.7	85.8	86.7

Table VI. — Patellofemoral joint-related performance

	Getting out of a car						Getting into a chair						Getting up/down stairs					
	<i>pre op</i>	<i>1m</i>	<i>3m</i>	<i>6m</i>	<i>1y</i>	<i>2ys</i>	<i>pre op</i>	<i>1m</i>	<i>3m</i>	<i>6m</i>	<i>1y</i>	<i>2ys</i>	<i>pre op</i>	<i>1m</i>	<i>3m</i>	<i>6m</i>	<i>1y</i>	<i>2ys</i>
<i>Unresurfaced patella</i>	2.7	3.2	4.5	6.2	7.9	8	2.8	3.6	4.7	6.7	7.4	8.1	3.2	3.8	5.1	7.6	8.2	8.4
<i>Resurfaced patella</i>	2.5	3.1	4.4	6.0	7.7	7.9	2.7	3.3	4.7	6.2	7.0	8.2	3.1	3.9	4.9	7.4	7.8	8.4

## Anterior knee pain

Preoperatively, 48 of 56 patients (85.7%) declared to have anterior knee pain and postoperatively 40 (83.3%) were markedly relieved or had no pain (table VII).

Patients with preoperative anterior knee pain had lower KSS scores (mean score of 79.9 versus 97.3 :  $p = 0.0094$ ) ; but function was not accordingly disturbed (40.4 versus 42.3). The KSS postoperative score of patients with preoperative anterior knee was not significantly different from those without pain (164.6 versus 163.4).

## Radiographic analysis

Patellar subluxation in the two groups was significantly different. In the unresurfaced group 43% of patients were in group I, 50% in group II, 3.5% in group III and 3.5% in group IV. In the resurfaced group the results were respectively : 78.5%, 21.5%, 0% and 0% (chi-square test :  $p = 0.016$ ). Patellar tilt was significantly different : in the unresurfaced group the mean value for patellar tilt was  $14^\circ$ , versus  $5^\circ$  in the resurfaced group ( $p = 0.032$ ). Table VIII summarises these data.

Table VII. — Anterior knee pain

	<i>Pre op</i>	<i>1 m</i>	<i>3 m</i>	<i>6 m</i>	<i>1 y</i>	<i>2 ys</i>
<i>Unresurfaced</i>	22	5	6	6	8	6
<i>Resurfaced</i>	26	2	2	1	1	0

Table VIII. — Radiological results

	Patellar subluxation				Mean Patellar tilt
	<i>grade 1 (&lt; 20%)</i>	<i>grade 2 (20-40%)</i>	<i>grade 3 (40-60%)</i>	<i>grade 4 (&gt; 60%)</i>	
<i>Unresurfaced patella</i>	12 43%	14 50%	1 3.5%	1 3.5%	14° (max 20° min 0°)
<i>Resurfaced patella</i>	22 78.5%	6 21.5%	0 0%	0 0%	5° (max 12° min 0°)

During the limited follow-up period, we found no radiolucencies at the cement-implant interface.

### DISCUSSION

The decision whether to resurface the patella or not still remains one of the most controversial and debated aspects of TKA. Different options such as always resurfacing, resurfacing in some cases and never resurfacing are defended (31, 39). Most surgeons tend to resurface the patella in primary patellofemoral arthritis in aged patients, in severe patellar damage, in case of mal-tracking and in case of rheumatoid arthritis, and recommend not to resurface when the patella is small, thin and osteoporotic, in order to avoid patella fracture.

Keblish *et al* (29), using the LCS knee, compared bilateral TKA with a patellar component on one side and no replacement on the other and found no difference in clinical results between the two sides. Burnett *et al* (14) did not find significant differences between TKA's with resurfaced and non-resurfaced patellae as to revision rates, KSS scores, patient satisfaction, anterior knee pain, patellofemoral and radiographic outcomes. Barrack *et al* (3, 5) noted that a higher incidence of late-onset anterior knee pain was seen when resurfacing was performed. On the other hand, Enis *et al* (16), with the Townley implant, noted that patients preferred the resurfaced side, while Mayman *et al* (36), in 100 patients treated with the Anatomic Medullary Knee, noted better results in the resurfaced group regarding patient satisfaction and anterior knee pain with

walking and stair climbing. Forster (19), in a meta-analysis of three randomised controlled studies, found no differences between the two groups in terms of revision, but reoperation for patellofemoral problems was significantly more likely in the unresurfaced group.

The results of older reports are not useful in actual decision making : different indications and pathologies were included in the same protocol, studies were not randomised and prospective, results are design dependent and reliable only for the type of prosthesis studied and finally the design of the prostheses has changed dramatically.

Prerequisites for a well-functioning patellofemoral joint are : a properly designed femoral component with a deep, well oriented trochlear groove and an elevated lateral flange, a well positioned femoral component, proper positioning of the tibial component in rotation, adequate ligament balance in a well-aligned leg and a normally tracking extensor mechanism. The importance of "patella-friendly" femoral components designed with a more anatomic patellofemoral groove which may offer less point loading and better tracking is well stated in recent papers by Burnett *et al* (13) and by Bourne *et al* (9). Also Whiteside *et al* (51), in a laboratory and clinical study, stated the importance of the designs of the femoral component in three different implants for the unresurfaced patella, arguing that, given an appropriate trochlear geometry, patellofemoral function can be excellent with the unresurfaced patella articulating with the metal component.

Using an implant with a deep and congruent trochlea design, more compatible with the native patella, Kulkarni *et al* (32) had excellent outcomes with and also without a patellar component ; the incidence of anterior knee pain was similar for both groups. This means that, at least with some types of implants, patellar resurfacing could be unnecessary, as stated in recent reviews (3, 5, 14, 51).

The aim of our study was to find out the best solution regarding our implant (NexGen), since the literature provides no results. We found similar mean clinical KSS scores in the two groups even in obese patients, similar ability to perform daily activities involving the patellofemoral joint, and similar patient satisfaction, although there were significant differences as to the functional KSS score, range of passive flexion, anterior knee pain and patellar tilt and subluxation, in favour of patella resurfacing. Although Wood *et al* (53) determined that weight, but not BMI, was a significant factor for developing anterior knee pain, we have not found any correlation between anterior pain and weight, height or BMI ; similar findings have been reported in the study of Burnett *et al* (14).

Our data suggest that, with this particular implant, patella resurfacing improves ROM and lessens anterior pain, but without any benefit for activities requiring knee flexion superior to 100° (getting up and down stairs, seating and getting out of a car), presumably because the non-resurfaced group had sufficient passive flexion to perform these activities without problems.

In conclusion, we believe that with the type of implant used in this series (Nexgen), the gain in range of motion and the decrease in anterior pain noted after two years in the resurfaced group, are arguments in favour of patellar resurfacing.

## REFERENCES

1. **Abraham W, Buchanan JR, Daubert H *et al*.** Should the patella be resurfaced in total knee arthroplasty ? *Clin Orthop* 1988 ; 236 : 128-134.
2. **Aglietti P, Buzzi R, Gaudenzi A.** Patellofemoral functional results and complications with the posterior stabilized total condylar knee prosthesis. *J Arthroplasty* 1988 ; 3 : 17-25.
3. **Barrack RL.** Orthopaedic crossfire - All patellae should be resurfaced during primary total knee arthroplasty : in opposition. *J Arthroplasty* 2003 ; 18 (Suppl 1) : 35-38.
4. **Barrack RL, Rorabeck CH, Engh GA.** Patellar options in revision total knee arthroplasty. *Orthopedics* 2001 ; 24 : 899-900.
5. **Barrack RL, Bertot AJ, Wolfe MW *et al*.** Patellar resurfacing in total knee arthroplasty. A prospective, randomized, double-blind study with five to seven years of follow-up. *J Bone Joint Surg* 2001 ; 83-A : 1376-1381.
6. **Barrack RL, Wolfe MW, Waldman DA *et al*.** Resurfacing of the patella in total knee arthroplasty. A prospective, randomized, double-blind study. *J Bone Joint Surg* 1997 ; 78-A : 1121-1131.
7. **Bayley JC, Scott RD, Ewald FC, Holmes GB.** Failure of the metal-backed patella component after total knee replacement. *J Bone Joint Surg* 1988 ; 70-A : 668-674.
8. **Bayley JC, Scott RD.** Further observations on metal-backed patellar component failure. *Clin Orthop* 1988 ; 236 : 82-87.
9. **Bourne RB, Burnett RS.** The consequences of not resurfacing the patella. *Clin Orthop* 2004 ; 428 : 166-169.
10. **Bourne RB, Rorabeck CH, Vaz M *et al*.** Resurfacing versus not resurfacing the patella during total knee replacement. *Clin Orthop* 1995 ; 321 : 156-161.
11. **Boyd Jr AD, Ewald FC, Thomas WH *et al*.** Long-term complications after total knee arthroplasty with or without resurfacing of the patella. *J Bone Joint Surg* 1993 ; 75-A : 674-681.
12. **Braakman M, Verburg AD, Bronsema G *et al*.** The outcome of three methods of patellar resurfacing in total knee arthroplasty. *Int Orthop* 1995 ; 19 : 7-11.
13. **Burnett R, Bourne R.** Indications for patellar resurfacing in total knee arthroplasty. *J Bone Joint Surg* 2003 ; 85-A : 728-745.
14. **Burnett RS, Haydon CM, Rorabeck CH, Bourne RB.** Patella resurfacing versus non-resurfacing in total knee arthroplasty : results of a randomized controlled clinical trial at a minimum of 10 years' follow-up. *Clin Orthop* 2004 ; 428 : 12-25.
15. **Cameron HU.** Comparison between patellar resurfacing with an inset plastic button and patelloplasty. *Can J Surg* 1991 ; 34 : 49-52.
16. **Enis JE, Gardner R, Robledo MA *et al*.** Comparison of patellar resurfacing versus non-resurfacing in bilateral total knee arthroplasty. *Clin Orthop* 1990 ; 260 : 38-42.
17. **Ewald FC.** The Knee Society total knee arthroplasty roentgenographic evaluation and scoring system. *Clin Orthop* 1989 ; 248 : 9-12.
18. **Feller JA, Bartlett RJ, Lang DM.** Patellar resurfacing versus retention in total knee arthroplasty. *J Bone Joint Surg* 1996 ; 78-B : 226-228.
19. **Forster MC.** Patellar resurfacing in total knee arthroplasty for osteoarthritis : a systematic review. *Knee* 2004 ; 11 : 427-430.

20. **Freeman MAR, Todd RC, Bainert P, Day WH.** ICLH arthroplasty of the knee 1968-1977. *J Bone Joint Surg* 1978 ; 60-B : 339-344.
21. **Gomes LS, Bechtold JE, Gustilo RB.** Patellar prosthesis positioning in total knee arthroplasty : A roentgenographic study. *Clin Orthop* 1988 ; 236 : 72-81.
22. **Harwin SF, Stein AJ, Stern RE.** Patellofemoral resurfacing at total knee arthroplasty. *Contemp Orthop* 1994 ; 29 : 265-271.
23. **Hozack WJ, Goll SR, Lotke PA et al.** The treatment of patellar fractures after total knee arthroplasty. *Clin Orthop* 1988 ; 236 : 123-127.
24. **Ikejiani CE, Leighton R, Petrie DP.** Comparison of patellar resurfacing versus non-resurfacing in total knee arthroplasty. *Can J Surg* 2000 ; 431 : 35-38.
25. **Insall JN, Dorr LD, Scott RD, Scott WN.** Rationale of the Knee Society clinical rating system. *Clin Orthop* 1989 ; 248 : 13-14.
26. **Ishinishi T, Ogata K, Hara M.** Comparison of cementless and cemented fixation resurfaced and unresurfaced patella on the press fit condylar type total knee arthroplasty. Proc Am Acad Orthop Surg 66<sup>th</sup> Annual Meeting Proceedings.
27. **Kajino A, Yoshino S, Kameyama S et al.** Comparison of the results of bilateral total knee arthroplasty with and without patellar replacement for rheumatoid arthritis. A follow-up note. *J Bone Joint Surg* 1997 ; 79-A : 570-574.
28. **Kawakubo M, Matsumoto H, Otani T, Fujikawa K.** Radiographic changes in the patella after total knee arthroplasty without resurfacing the patella : comparison of osteoarthritis and rheumatoid arthritis. *Bull Hosp Joint Dis* 1997 ; 56 : 237-244.
29. **Keblish PA, Varma AK, Greenwald A.** Patellar resurfacing or retention in total knee arthroplasty. A prospective study of patients with bilateral replacements. *J Bone Joint Surg* 1994 ; 76-B : 930-937.
30. **Kelly M.** Patellofemoral complications following total knee arthroplasty. *Instr Course Lect* 2001 ; 50 : 403-407.
31. **Kim BS, Reitman RD, Schai PA, Scott RD.** Selective patellar non-resurfacing in total knee arthroplasty. 10 year results. *Clin Orthop* 1999 ; 367 : 81-88.
32. **Kulkarni SK, Freeman MAR, Poal-Manresa JC et al.** The patello-femoral joint in total knee arthroplasty : Is the design of the trochlea the critical factor ? *J Arthroplasty* 2000 ; 15 : 424-429.
33. **Lachiewicz PF.** Implant design and techniques for patellar resurfacing in total knee arthroplasty. *Instr Course Lect* 2004 ; 53 : 187-191.
34. **Larson CM, Lachiewicz PF.** Patellofemoral complications with the Insall-Burstein II posterior-stabilized total knee arthroplasty. *J Arthroplasty* 1999 ; 14 : 288-292.
35. **Le AX, Cameron HU, Otsuka NY et al.** Fracture of the patella following total knee arthroplasty. *Orthopedics* 1999 ; 22 : 395-399.
36. **Mayman D, Bourne RB, Rorabeck CH et al.** Resurfacing versus not resurfacing the patella in total knee arthroplasty. Eight to 10 year results. *J Arthroplasty* 2003 ; 5 : 541-545.
37. **Muller W, Wirz D.** The patella in total knee replacement : Does it matter ? 750 LCS total knee replacements without resurfacing of the patella. *Knee Surg Sports Traumatol Arthrosc* 2001 ; 9 (Suppl 1) : S24-S26.
38. **Partio E, Wirta J.** Comparison of patellar resurfacing and nonresurfacing in total knee arthroplasty : A prospective randomized study. *J Orthop Rheumatol* 1995 ; 8 : 69-74.
39. **Phillips AM, Goddard NJ, Tomlinson JE.** Current techniques in total knee replacement : Results of a national survey. *Ann R Coll Surg Engl* 1996 ; 78 : 515-520.
40. **Picetti GD, McGann WA, Welch RB.** The patellofemoral joint after total knee arthroplasty without patellar resurfacing. *J Bone Joint Surg* 1990 ; 72-A : 1379-1382.
41. **Rae PJ, Noble J, Hodgkinson JP.** Patellar resurfacing in total condylar knee arthroplasty : Technique and results. *J Arthroplasty* 1990 ; 5 : 259-265.
42. **Ranawat CS.** The patellofemoral joint in total condylar knee arthroplasty : Pros and cons based on five to ten year follow-up observations. *Clin Orthop* 1986 ; 205 : 93-99.
43. **Rand JA.** The patellofemoral joint in total knee arthroplasty. *J Bone Joint Surg* 1994 ; 76-A : 612-620.
44. **Robertson O, Dunbar M, Pehrsson T et al.** Patient satisfaction after knee arthroplasty : a report on 27,372 knees operated on between 1981 and 1995 in Sweden. *Acta Orthop Scand* 2000 ; 71 : 262-267.
45. **Rosenberg AG.** Management of the failed metal-backed patella. *Orthopedics* 1996 ; 19 : 813-815.
46. **Schroeder-Boersch H, Scheller G, Synnatschke M et al.** Patellar resurfacing. Results of a prospective randomized study. *Orthopädie* 1999 ; 27 : 642-650.
47. **Shoji H, Yoshino S, Kajino A.** Patellar replacement in bilateral total knee arthroplasty : A study of patients who had rheumatoid arthritis and no gross deformity of the patella. *J Bone Joint Surg* 1989 ; 71-A : 853-856.
48. **Tria Jr AJ, Harwood DA, Alicea JA, Cody RP.** Patellar fractures in posterior stabilized knee arthroplasties. *Clin Orthop* 1994 ; 299 : 131-138.
49. **Wasilewski SA, Frankl U.** Fracture of polyethylene of patellar component in total knee arthroplasty, diagnosed by arthroscopy. *J Arthroplasty* 1989 ; 4 (Suppl 1) : S19-S22.
50. **Waters TS, Bentley G.** Patellar resurfacing in total knee arthroplasty. A prospective, randomized study. *J Bone Joint Surg* 2003 ; 85-A : 212-217.
51. **Whiteside LA, Nakamura T.** Effect of femoral component design on unresurfaced patellae in knee arthroplasty. *Clin Orthop* 2003 ; 410 : 189-198.
52. **Windsor RE, Scuderi GR, Insall JN.** Patellar fractures in total knee arthroplasty. *J Arthroplasty* 1989 ; 4 (Suppl 1) : S63-S67.
53. **Wood DJ, Smith AJ, Collopy D et al.** Patellar resurfacing in total knee arthroplasty : A prospective, randomized trial. *J Bone Joint Surg* 2002 ; 84-A : 187-193.