Total Knee Arthroplasty 2005

Summary Recommendations

Notes on PROSPECT recommendations

PROSPECT provides clinicians with supporting arguments for and against the use of various interventions in postoperative pain based on published evidence and expert opinion. Clinicians must make judgements based upon the clinical circumstances and local regulations. At all times, local prescribing information for the drugs referred to must be consulted.

Recommendations are graded according to the overall level of evidence (LoE) on which the recommendations are based, which is determined by the quality and source of evidence.

An explanation of how study quality assessments are performed to determine the LoE and GoR can be found in Appendix A: Levels of evidence and grades of recommendation.

Summary recommendations

Pre-, intra- and postoperative interventions have been evaluated for the management of postoperative pain following total knee arthroplasty. Unless otherwise stated, 'pre-operative' refers to interventions applied before surgical incision, 'intra-operative' refers to interventions applied after incision and before wound closure, 'postoperative' refers to interventions applied at or after wound closure.

The following peri-operative interventions for total knee arthroplasty have been reviewed:

Pre-operative recommended	• *Regional analgesia:* – **Femoral nerve block** (Grade A) – **Spinal LA + opioid** (but not as the first choice, Grade D). Morphine is recommended as the opioid (Grade A)

Intra-operative recommended	• *Regional analgesia/anaesthesia:* – **GA + femoral nerve block** (Grade D) ***or*** – **Spinal LA + femoral nerve block** (Grade D) ***or*** – **Spinal LA + morphine** (but not as the first choice, Grade D)

Post-operative recommended	• *Systemic analgesia:* – **Conventional NSAID/COX-2-selective inhibitors** (Grade A) + **strong opioids** (Grade A), titrated to effect (for high intensity pain) + **paracetamol** (Grade B) – **Conventional NSAID/COX-2-selective inhibitors** (Grade A) **+/- weak opioids** (Grade B), titrated to effect (for moderate or low intensity pain) **+ paracetamol** (Grade B) • *Regional analgesia:* – **Femoral nerve block** (Grade A) • **Continuous passive motion** (for reasons other than analgesia) (Grade A) • **Intensive rehabilitation** (for reasons other than analgesia) (Grade D)

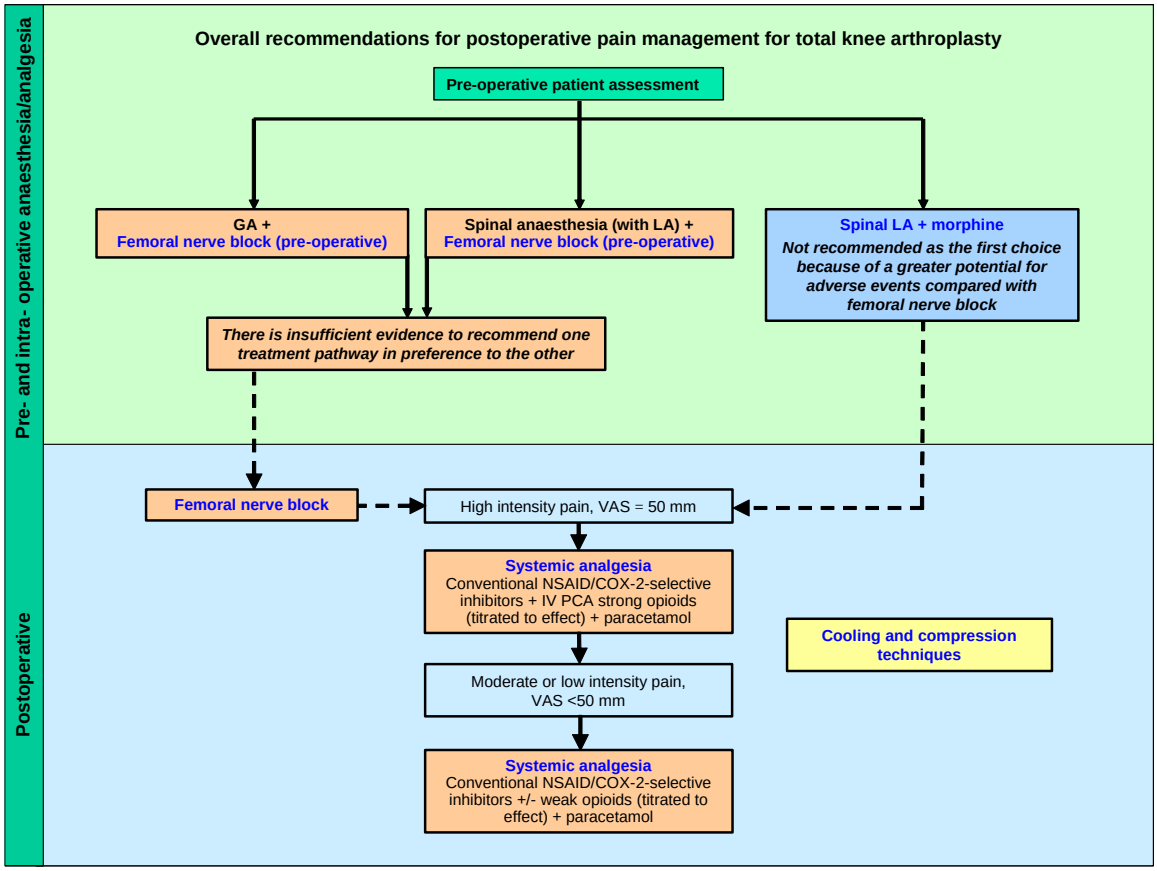
Not recommended for total knee arthroplasty

Pre-operative not recommended	• *Systemic analgesia:* – **Alpha-2-delta subunit ligands** (gabapentinoids) (Grade D), due to a lack of procedure-specific evidence – **Conventional NSAIDs** (Grade B) because of limited procedure-specific evidence and increased risk of bleeding – **Corticosteroids** (Grade D) due to a lack of procedure-specific evidence (may be used for reasons other than postoperative analgesia) – **NMDA antagonists** o **Dextromethorphan** (Grade D) due to inconsistent evidence of analgesic effects o **Ketamine** (Grade D) because of limited procedure-specific evidence – **Strong opioids** (Grade D) due to a lack of evidence for analgesic benefit over postoperative administration • *Peripheral nerve blocks:* – **Combination femoral and obturator block** (Grade D) because of limited procedure-specific evidence – **Combination femoral and sciatic nerve block** (Grade D) because of limited and inconsistent procedure-specific evidence – **Lumbar plexus block** (posterior approach) (Grade D), as femoral nerve block is equally effective and is associated with fewer complications – **Alpha-2-adrenoceptor agonists** (clonidine, epinephrine), as part of the LA solution in peripheral nerve blocks (Grade A) due to a lack of efficacy in procedure-specific studies • *Epidural:* – **LA and/or opioid** (Grade B) due to an increased risk of adverse events and no improvement in analgesia compared with femoral nerve block – **Ketamine** (as adjuvant to epidural) (Grade B) due to side-effects and inconclusive analgesic efficacy – **Tramadol** (as adjuvant to epidural) (Grade B) because of insufficient analgesia • *Spinal:* – **Neostigmine** (Grade D) because of side-effects and limited procedure-specific evidence – **Clonidine** (Grade D) because of limited and inconsistent procedure-specific evidence • **Intra-articular techniques** (Grade D) because of inconsistent evidence

	• **Physical therapy** (Grade D) based on postoperative analgesic effects alone
Intra-operative not recommended	• *Systemic analgesia:* – **NMDA antagonists** o **Dextromethorphan** (Grade D) because of inconsistent analgesia o **Ketamine** (Grade D) due to limited procedure-specific evidence – **Weak opioids** (Grade D) due to lack of evidence for analgesic benefit over postoperative administration • **Peripheral nerve blocks administered intra-operatively** (Grade D) • **GA or spinal anaesthesia without any local or regional analgesic technique** (Grade D) • **Epidural anaesthesia** (Grade D) because postoperative epidural analgesia is not recommended • **Intra-articular techniques** (Grade D) because of inconsistent analgesia • **Drains** (Grade A) due to lack of analgesic and other recovery benefits
Postoperative not recommended	• *Systemic analgesia:* – **Alpha-2-delta subunit ligands** (gabapentinoids) (Grade D) due to lack of procedure-specific evidence – **Clonidine** (Grade D) because of limited procedure-specific evidence – **IV ketamine infusion** (Grade D) because of limited procedure-specific evidence – **IM administration of strong opioids** (Grade B) due to unfavourable pharmacokinetics, injection-associated pain and patient dissatisfaction – **Weak opioids** for high intensity pain (Grade D) due to insufficient analgesic efficacy – **Paracetamol alone** for high intensity pain (Grade D) due to insufficient analgesic efficacy • *Peripheral nerve blocks:* – **Combination femoral and obturator block** (Grade D) because of limited procedure-specific evidence – **Combination femoral and sciatic nerve block** (Grade D) because of limited and inconsistent procedure-specific evidence – **Lumbar plexus block** (posterior approach) (Grade D), as femoral nerve block is equally effective and is associated with fewer complications – **Alpha-2-adrenoceptor agonists** (clonidine, epinephrine), as part of the LA solution in peripheral nerve blocks (Grade A) due to a lack of efficacy

	• *Epidural:* – **LA and/or opioid** (Grade B) due to an increased risk of adverse events and no improvement in analgesia compared with femoral nerve block – **Ketamine** (as adjuvant to epidural) (Grade B) due to side-effects and inconsistent analgesic efficacy – **Tramadol** (as adjuvant to epidural) (Grade B) because of insufficient analgesia • **Intra-articular techniques** (Grade D) because of inconsistent analgesia • **TENS** (Grade B) due to limited procedure-specific evidence suggesting a lack of benefit

Overall Recommendations: Pain Management for Total Knee Arthroplasty



Evidence review process

For each review, a Subgroup of the prospect Working Group performs an initial evaluation of the evidence and also drafts clinical practice statements and recommendations, which are then discussed by the whole Working Group before a final consensus is reached. The Subgroup may sometimes include a non-Working Group member, to provide additional expertise in the procedure being reviewed.

For the total knee arthroplasty review, the Subgroup members were:

- Dr Christian Simanski
- Dr Barrie Fischer

Details of systematic literature review

Literature search

- Systematic review of the literature from 1966–November 2005 using MEDLINE and EmBASE, following the protocol of the Cochrane Collaboration (Appendix B: TKA: Search strategy)
- Inclusion of randomised studies in English, assessing analgesic interventions in total knee arthroplasty in adults, and reporting pain on a linear analogue scale
    - Primary outcome measure: postoperative pain scores
    - Secondary outcome measure: supplemental analgesic requirements
    - Tertiary outcome measures: other recovery outcomes (adverse effects, functional recovery)
- Identification of 247 studies of peri-operative interventions for postoperative pain following total knee arthroplasty
- 112 studies included (Appendix C: TKA: Included studies)
- 135 studies excluded (Appendix D: TKA: Excluded references)
- The most common reasons for exclusion were that the study combined data from knee and hip arthroplasty groups (51 studies) without an identifiable knee subgroup, or that pain scores were not reported (39 studies) (Appendix E: TKA: Reasons for exclusion)

Appendix

A. Levels of evidence and grades of recommendation

From 2006 onwards, the **prospect** methodology has been refined to take more account of the quality of the evidence on which the recommendations are based. The way in which the quality of studies determines the level of evidence, and thereby determines the grade of recommendation, is summarised below. Development of the **prospect** methodology has been an ongoing process, and previous experience indicated the need for these changes, to help clarify the basis for the recommendations.

Sources of evidence in PROSPECT

The evidence for **prospect** is derived from three separate sources, and this evidence is taken into consideration by the **prospect** Working Group to determine the **prospect** recommendations:

- Procedure-specific evidence derived from the systematic reviews of the literature
- Transferable evidence from comparable procedures, or from other relevant sources, identified by the members of the **prospect** Working Group
- Current practice – a commentary on the interventions from the members of the **prospect** Working Group
- Practical **prospect** recommendations are based on all the information **Study quality assessment**

All cited studies are assessed for quality of reporting of methodology and results (assessment performed by the medical writing team and the **prospect** Subgroup):

1. Statistical analyses and patient follow-up assessment: indicates whether statistical analyses were reported, and whether patient follow-up was greater or lesser than 80%.

2. Allocation concealment assessment: indicates whether there was adequate prevention of foreknowledge of treatment assignment by those involved in recruitment (A adequate, B unclear, C inadequate, D not used). Empirical research has shown that trials with inadequate or unclear allocation concealment report significantly greater estimates of treatment effect than those trials in which concealment was adequate (Chalmers 1983, Schulz 1995, Moher 1998). Allocation concealment was found to be more important for preventing bias than other aspects of study quality, such as generation of the allocation sequence and double-blinding (Chalmers 1983, Schulz 1995, Moher 1998, Higgins JPT, Green S, editors, 2005; http://www.cochrane.org/resources/handbook/hbook.htm (accessed 31st May 2005): Section 6.3.)
3. Numerical scores (total 1–5) for study quality: assigned using the method proposed by Jadad et al 1996, to indicate whether a study reports appropriate randomisation, double-blinding and statements of possible withdrawals. Empirical research found that low-quality trials were associated with an increased estimate of treatment benefit than high-quality trials (Moher 1998)

4. Additional study quality assessment: including an assessment of how closely the study report meets the requirements of the CONSORT statement (Moher 2005) (additional assessment performed by the **prospect** Subgroup)

Grading of recommendations based on overall level of evidence

The recommendations are graded according to the overall level of evidence, which is determined by the quality of studies cited, the consistency of evidence and the source of evidence (as indicated in the table below).

<table>
<tr><td></td><td colspan="5">Study quality assessments</td><td rowspan="2">Level of Evidence (LoE)</td><td colspan="2">Grade of recommendation (based on overall LoE, considering balance of clinical practice information and evidence)</td></tr>
<tr><td>Study type</td><td>Statistical analyses and patient follow-up assessment</td><td></td><td>Allocation concealment</td><td>Jadad scores</td><td>Additional assessment of overall study quality required to judge LoE</td><td>Procedure-specific</td><td>Transferable</td></tr>
<tr><td>Systematic review with homogeneous results</td><td>N/A</td><td></td><td>N/A</td><td>N/A</td><td>N/A</td><td>1</td><td>A</td><td>B</td></tr>
<tr><td rowspan="5">Randomised controlled trial (RCT)</td><td rowspan="5">Statistics reported and >80% follow-up</td><td rowspan="5">AND</td><td>A</td><td>(1-5)</td><td>N/A</td><td rowspan="5">1</td><td rowspan="5">A
(based on two or more studies or a single large, well-designed study)</td><td rowspan="5">B</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td>B</td><td>(3-5)</td><td>N/A</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td>B</td><td>(1-2)</td><td>Yes</td></tr>
<tr><td rowspan="5">RCT</td><td rowspan="5">Statistics not reported or questionable or <80% follow-up</td><td rowspan="5">AND/OR</td><td>B</td><td>(1-2)</td><td>Yes</td><td rowspan="5">2</td><td rowspan="5">B
(or extrapolation from one procedure-specific LoE 1 study)</td><td rowspan="5">C</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td>C</td><td>(1-5)</td><td>N/A</td></tr>
<tr><td colspan="2">OR</td></tr>
<tr><td>D</td><td>(1-5)</td><td>N/A</td></tr>
<tr><td>Non-systematic review, cohort study, case study; (e.g. some adverse effects evidence)</td><td>N/A</td><td></td><td colspan="3">N/A</td><td>3</td><td colspan="2">C</td></tr>
<tr><td>Clinical practice information (expert opinion); inconsistent evidence</td><td>N/A</td><td></td><td colspan="3">N/A</td><td>4</td><td colspan="2">D</td></tr>
</table>

B. TKA: Search strategy

Total Knee Arthroplasty November 2005 Search Terms

pain OR analgesi* OR anaesthe* OR anesthe* OR vas OR "visual analog*" OR vrs OR mcgill OR epidural OR neuraxial OR intrathecal OR spinal OR caudal OR "peripheral nerve" OR "peripheral block" OR "femoral block" OR "femoral nerve" OR "femoral 3-in-1" OR "3-in-1 block" OR "sciatic nerve" OR "regional nerve" OR "psoas compartment" OR "lumbar plexus" OR NSAID OR COX-2 OR paracetamol OR acetaminophen OR gabapentin OR pregabalin OR clonidine OR opioid OR ketamine OR corticosteroid OR “intra-articular” OR infusion OR instillation OR injection OR unicondylar OR bicondylar OR “minimal* invasive” OR “patella resurfacing” OR patellofemoral OR parapatellar OR mid-vastus OR midvastus OR drainage OR “activities of daily living” OR ADL OR “joint mobility” OR cryoanalgesia OR “cold therapy”) AND ("knee replacement" OR "knee prosthesis" OR "knee prostheses" OR “revision prosthesis” OR “revision prostheses” OR "total knee" OR "knee arthroplasty" OR “major lower limb surgery“

C. TKA: Included studies

1. Abdel-Salam A, Eyres KS. Effects of tourniquet during total knee arthroplasty. A prospective randomised study. Journal of Bone & Joint Surgery - British Volume 1995;77(2):250-3.

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E. TKA: Reasons for exclusion

Study	Reason for exclusion
1. ALBERT 1991	COMPARES KNEE WITH HIP
2. ALEXANDER 2002	COMBINED KNEE AND HIP SURGERY GROUPS
3. ALLEN 1986	COMPARES TKR TO FEM-POP BYPASS
4. ANDERSON 1991	COMBINED KNEE AND HIP SURGERY GROUPS
5. ASHBURN 1992	NO PAIN SCORES
6. ASHBURN 1993	COMBINED KNEE AND HIP SURGERY GROUPS
7. BACHMANN 1997	COMBINED KNEE AND HIP SURGERY GROUPS
8. BANNWARTH 1993	NOT RCT (NO RANDOMISATION)

9. BASSO 1987	NOT RCT
10. BEARDSWORTH 1989	NOT RCT (NO RANDOMISATION)
11. BEATTIE 1997	COMBINED KNEE AND HIP SURGERY GROUPS, ANALGESIC DATA REPORTED IN ETCHES 1995
12. BIANCONI 2003	COMBINED KNEE AND HIP SURGERY GROUPS
13. BOGOCH 2002	COMBINED KNEE AND HIP SURGERY GROUPS
14. BOURNE 1995	NO SEPARATE PAIN SCORE
15. BRUNSCHWILER 1998	NO PAIN SCORES
16. BREIT 2004	PAIN SCORE DATA NOT ANALYSED
17. CAPDEVILA 1999	COMBINED TKR AND ARTHROLYSIS
18. CHELLY 2001	NOT RCT (NO RANDOMISATION)
19. COLWELL 1992	NO PAIN SCORES
20. COOK 2003	NOT RCT (NO RANDOMISATION)
21. COOPER 1993	COMBINED KNEE AND HIP SURGERY GROUPS
22. DAHLSTEDT 1990	LIGAMENT RECONSTRUCTION. NO PAIN SCORES
23. DALTROY 1998	COMBINED KNEE AND HIP SURGERY GROUPS
24. DALURY 1999	NOT RCT (NO RANDOMISATION)
25. DE ANDRES 1999	NO PAIN SCORES
26. DE BEER 2005	COMBINED KNEE AND HIP SURGERY GROUPS
27. DIAZ-BORJON 2004	NO PAIN SCORES
28. DODD 1990	NOT RCT (NO RANDOMISATION)

29. DRAKEFORD 1991	COMBINED KNEE AND HIP SURGERY GROUPS
30. ELEDJAM 2002	MAJOR OPEN KNEE SURGERY
31. ETCHES 1995	COMBINED KNEE AND HIP SURGERY GROUPS
32. FAURE 1993	NO PAIN SCORES, NOT RCT
33. FELLER 1996	NO PAIN SCORES
34. FERNANDEZ-GALINSKI 2005	COMBINED KNEE AND HIP SURGERY GROUPS
35. FLORY 2001	COMBINED KNEE AND HIP SURGERY GROUPS
36. FORST 1999	COMBINED KNEE AND HIP SURGERY GROUPS
37. FRAGEN 1995	NO PAIN SCORES
38. GANAPATHY 1997	COMBINED KNEE AND HIP SURGERY GROUPS
39. GAO 1995	COMBINED KNEE AND HIP SURGERY GROUPS
40. GEHRIG 2005	COMBINED KNEE AND HIP SURGERY GROUPS
41. GILDONE 2005	NO VAS PAIN SCORES
42. GIUFFRE 1991	NOT RCT (NO RANDOMISATION)
43. GOODCHILD 2001	KNEE RECONSTRUCTIVE SURGERY
44. GREENGRASS 1998	NO PAIN SCORES
45. HASHIMOTO 2003	NOT RCT (NO RANDOMISATION)
46. HAUG 1988	NOT RCT, NO PAIN SCORES
47. HEAVNER 2003	NON-EMERGENCY SURGERY (COMBINED DATA)
48. HECHT 1983	NO PAIN SCORES

49. HERRICK 1996	COMBINED KNEE AND HIP SURGERY GROUPS
50. HOLMSTRÖM 1993	COMBINED KNEE AND HIP SURGERY GROUPS
51. HOMMERIL 1994	COMBINED KNEE AND HIP SURGERY GROUPS
52. ILAHI 1994	NOT RCT
53. ISAAC 2005	NOT RANDOMISED PROPERLY
54. JACOBSON 1988	COMBINED KNEE AND HIP SURGERY GROUPS
55. JACOBSON 1990	COMBINED KNEE AND HIP SURGERY GROUPS
56. JARIT 2003	COMBINED KNEE SURGERIES
57. JARSKI 2000	COMBINED KNEE AND HIP SURGERY GROUPS
58. JOCHUM 2004	NOT RCT (NO RANDOMISATION)
59. KAJINO 1997	NO PAIN SCORES
60. KEATING 1999	NO PAIN SCORES
61. KERRICK 1993	COMBINED KNEE AND HIP SURGERY GROUPS
62. KILICKAN 2000	COMBINED KNEE AND HIP SURGERY GROUPS
63. KIM 2001	NOT RCT
64. KOPACZ 1999	COMBINED KNEE AND HIP SURGERY GROUPS
65. KOSTAMOVAARA 1996	COMBINED KNEE AND HIP SURGERY GROUPS
66. KRAMER 2003	NO PAIN SCORE COMPARISON BETWEEN GROUPS
67. LASKIN 2000	PAIN SCORES NOT ANALYSED FROM RANDOMISED GROUPS – MATCH PAIRED
68. LAU 1998	NOT RCT (NO RANDOMISATION)

69. LEVAI 1983	NOT RCT (NO RANDOMISATION)
70. LICCIARDONE 2004	COMBINED KNEE AND HIP SURGERY GROUPS
71. LOMBARDI 2004	NOT RCT - RETROSPECTIVE STUDY
72. LOVE 1996	COMBINED KNEE AND HIP SURGERY GROUPS (+ GYNECOLOGICAL SURGERY)
73. MACDONALD 2000	NO PAIN SCORES
74. MAHONEY 1990	NOT RCT (NO RANDOMISATION – GROUPS RUN SEQUENTIALLY)
75. MANNION 2005	COMBINED KNEE AND HIP SURGERY GROUPS
76. MANNION 2005	COMBINED KNEE AND HIP SURGERY GROUPS
77. MARTENS 1991	NO SUBGROUP ANALYSIS: TKR, LIGAMENT RECONSTRUCTION, TIBIAL OSTEOTOMIES
78. MASRI 1996	NOT PROPERLY RANDOMISED
79. MCCASKIE 1998	NOT PROPERLY RANDOMISED
80. MISRA 1991	NO PAIN SCORES
81. MISRA 2003	NO SEPARATE PAIN SCORE
82. MORSI 2002	NOT RCT
83. MURDOCH 2002	COMBINED KNEE AND HIP SURGERY GROUPS
84. NAVAS 2005	REVIEW ARTICLE
85. NELISSEN 1998	NO PAIN SCORES
86. NENDICK 2000	NOT PROPERLY RANDOMISED – BY HOSPITAL NO.
87. NEWMAN 1998	NO SEPARATE PAIN SCORES

88. NEWMAN 2000	NO PAIN SCORES
89. NIELSEN 1988	NO PAIN SCORES
90. NIELSEN 1990	NO PAIN SCORES
91. NIEMI 1996	COMBINED KNEE AND HIP SURGERY GROUPS
92. NIZARD 2005	META-ANALYSIS
93. ONG 2003	NO PAIN SCORES
94. OZKOCAK 2004	COMBINED KNEE AND HIP SURGERY GROUPS
95. PANG 1999	COMBINED KNEE AND HIP SURGERY GROUPS
96. PELLINO 2005	COMBINED KNEE AND HIP SURGERY GROUPS
97. PENG 2003	NOT RCT
98. PUOLAKKA 2000	COMBINED KNEE AND HIP SURGERY GROUPS
99. RAJ 1987	NOT RCT (NO RANDOMISATION)
100. RASMUSSEN 2005	COMBINED KNEE AND HIP SURGERY GROUPS
101. RATHMELL 2003	NO PAIN SCORES
102. REAY 1989	COMBINED KNEE AND HIP SURGERY GROUPS
103. REDHA 2005	NO PAIN SCORES
104. REITER 2003	COMBINED KNEE AND HIP SURGERY GROUPS
105. REUBEN 1999	ACL SURGERY
106. REUBEN 2002	PRE-OPERATIVE PAIN SCORES (NOT POST)
107. RISBERG 1999	LIGAMENT RECONSTRUCTION. NO PAIN SCORES

108. RITTER 1988	NO PAIN SCORES
109. RITTER 1989	NOT RCT, NO PAIN SCORES
110. ROBISON 1991	NO PAIN SCORES
111. ROSSELAND 1999	DIAGNOSTIC/THERAPEUTIC KNEE ARTHROSCOPY
112. SCHNEIDER 1998	KNEE SOCIETY SCORE, NO SEPARATE PAIN SCORES
113. SHOJI 1989	NOT RCT
114. SKINNER 2004	NOT RCT - RETROSPECTIVE STUDY
115. STANDL 2001	COMBINED KNEE AND HIP SURGERY GROUPS
116. STEWART 2005	ACL RECONSTRUCTION.
117. TARRADELL 1996	COMBINED KNEE AND HIP SURGERY GROUPS
118. TETER 1990	COMBINED KNEE AND HIP SURGERY GROUPS
119. THOMPSON 2001	NOT A COMPARATIVE STUDY
120. TIMLIN 2003	NO PAIN SCORES
121. TOKOZOGLU 1998	NOT RCT
122. TSUEDA 1998	COMBINED KNEE AND HIP SURGERY GROUPS
123. TURNER 1996	COMBINED KNEE AND HIP SURGERY GROUPS
124. WAIKAKUL 2000	NO PAIN SCORES
125. WALKER 1991	NO PAIN SCORES
126. WARD 2002	COMBINED KNEE AND HIP SURGERY GROUPS
127. WASILEWSKI 1990	NOT RCT (NO RANDOMISATION)

128. WEIDENHIELM 1993	NO PAIN SCORES
129. WHITE 1992	COMBINED KNEE AND HIP SURGERY GROUPS
130. WILDER-SMITH 1994	COMBINED KNEE AND HIP SURGERY GROUPS
131. WILLIAMS-RUSSO 1996	NO PAIN SCORES
132. WONG 1996	COMBINED KNEE AND HIP SURGERY GROUPS
133. WORLAND 1997	NO PAIN SCORES
134. ZENIOS 2002	NO PAIN SCORES
135. ZHOU 2001	COMBINED KNEE AND HIP SURGERY GROUPS