Table 1. Studies of beliefs about indications, referrals, and thresholds for total knee arthroplasty

Study	Journal	Population focus, N	Objective	Results
Wright et al., 1995[12]	Can Med Assoc J	All orthopaedic surgeons in Ontario, Canada n=325	Determine extent of agreement on indications for TKA and how perceptions differ according to the number of procedures performed	- Clinical agreement (>90%) in 14 of 34 patient characteristics (38%) in determining need for TKA - Clinical disagreement (<60%) with 7 of 34 (21%) patient characteristics - No agreement in treatment with 3 hypothetical case scenarios with varying degrees of osteoarthritis (n=205) (highest agreement was 86.8%) - High volume orthopaedists disagreed with low volume orthopaedists in 7 of 34 patient characteristics as indication for TKA (21%) - Speculated causes for disagreement: 1. may reflect limitation of available knowledge 2. may reflect controversy within orthopaedic literature 3. information may not be adequately disseminated to, or adopted by, practicing orthopedists despite the fact that the factor's effect on outcome of TKA has been clearly demonstrated in the medical literature 4. surgeons may choose to treat patients based on personal experience or training
Coyte et al., 1996[14]	J Rheum	Rheumatologists and family practitioners n=98 Rheumatologists, 250 family practitioners (66 & 99 in final analysis respectively)	Assess agreement for indications for TKA, outcomes of TKA, and non-surgical management of osteoarthritis between family practitioners and rheuma-tologists. These results were to be compared with data on orthopaedists	- Clinical agreement (>90%) for BOTH rheumatologists and family practitioners with 2 of 32 patients factors - Rheumatologists clinical agreement (>90%) with 6 of 32 (13%) patients factors - Family practitioners Clinical agreement (>90%) with 4 of 32 (19%) - Clinical disagreement (<60%) with 10 of 32 factors for family practitioners - Clinical disagreement (<60%) with 10 of 32 factors for rheumatologists - Disagreement among specialties: Family practitioners > rheumatologists > orthopaedists (family practitioners & orthopaedists P<0.0001, rheumatologists & orthopaedists P<0.04).
Wright et al., 1999[15]	Medical Care	Orthopaedists and primary care physicians n=(Provider data from Wright et al., 1995 in Can Med Assoc J and Coyte et al., 1996 in J Rheum) [See both studies above for provider numbers]	Identify factors that might be amenable to intervention by investigating determinants of regional variation in the use of knee replacement surgery	- Surgeon opinion or "enthusiasm" was "the dominant modifiable determinant of area variation" in the utilization of TKA - Surgeons propensity to operate (based on responses to the survey in the article cited above) and opinions on patient outcome were both positively correlated with the total # of procedures performed in the study period (p<0.0001)

Table 1. Studies of beliefs about indications, referrals, and thresholds for total knee arthroplasty (continued)

Hadorn & Holmes, 1997a, 1997b[19, 20]	BMJ	New health policy description	Describes New Zealand's new priority criteria for major joint replacement (TKA & THA)	- Checklist utilizes 4 major components incorporating both clinical and social factors in determining order for receiving TKA: Pain (40% of scale), Functional Activity (20%), Movement and deformity (20%), Other factors (20%) - Checklist created to assess where patients would be placed on list for elective surgeries prior to New Zealand moving away from waiting list format to booking appointments
Mancuso et al., 1996[13]	J Arthroplasty	Orthopaedists n=328 (80 in final analysis)	Survey of all orthopaedists in specific geographic area regarding their indications and modifying factors for primary TKA and THA	- Clinical agreement (>90%) with 6 of 24 (25%) factors related to determining need for TKA - Clinical disagreement (<60%) with 3 of 24 (13%) factors related to determining need for TKA - They found no correlation with # of years in practice and agreement
Dieppe et al., 1999[18]	Rheumatology	Review article: consensus panel of professionals to examine problems re: use of TKA in management of osteoarthritis	"review literature of effectiveness of TKA for osteoarthritis of the knee, the evidence of practice variation and underutilization, and the publications on possible indications for TKA"	- Primary care MDs likely to lack confidence in the exam of the knee joint leading to delays in diagnosis and inability to assess severity of joint damage due to little exposure in training - 4 potential problems: 1. persistent negative attitudes towards osteoarthritis in general and towards value of TKAR in particular amongst the public and primary care MDs 2. the lack of simple tools to help assess severity and impact of knee osteoarthritis that can be used in the community 3. the absence of any clear guidelines or agreed evidence based indications for TKA 4. the absence of any studies that compare the efficacy of TKA with that of non-surgical intervention strategies - 3 useful variables for surgical decision making in TKA: 1. severity of joint damage (pain at night, severity of pain, function) 2. other patient related variables (psychosocial, patient motivation) 3. the environment (socio-economic status – availability of surgeons, economic status of patients) Consensus panel conclusions and recommendations: 1. no clear evidence-based indications for TKA 2. no comparisons with other forms of treatment 3. no understanding of which patients are particularly likely to benefit from the procedure 4. the absence of any studies that compare the efficacy of TKAR with that of non-surgical intervention strategies

Table 1. Studies of beliefs about indications, referrals, and thresholds for total knee arthroplasty (continued)

<table>
<tr><td>Malmlin et al., 1998[16]</td><td>Arch Fam Med</td><td>Family practitioners and general internists
n=300 each (70 and 72 in final analysis)</td><td>Description and comparison of the self-reported practice patterns of family practitioners and general internists for the evaluation and management of severe osteoarthritis of the knee, including factors that might influence referral for TKA</td><td>- Combining family practitioners and general internists, clinical agreement (>90%) with 6 of 26 patient factors (23%) determining need for TKA
- Clinical disagreement (<60%) with 5 of 26 patient factors determining need for TKA</td></tr>
<tr><td>Tierney et al., 1994[11]</td><td>Clin Ortho</td><td>All orthopaedists in Indiana, USA.
n=280 (188 in final analysis)</td><td>To understand reasons for variation of who gets TKAs using orthopaedists' perspectives of indications and outcomes and comparing them with self-reported annual number of TKAs they performed</td><td>- Clinical agreement (>95%) in 7 of 34 patient factors (21%)
- Agreement (=95% and >60%) with 21 of 33 factors
- No agreement (<60%) with 5 of 34 (15%) patient factors
- When correlated with # of TKAs in prior year, significant factors were:
<u>Patient Characteristics</u>: female gender (r=0.17, p=0.02), non-compliant patient (r=0.20, p=0.008), unstable knee (r=0.20, p=0.008)
<u>Continuous parameters</u>: old age (r=0.16, p=0.03), varus deformity (r=0.16, p=0.03), valgus deformity (r=0.17, p=0.02)
- Independent variables associated with reported # of TKAs in prior year
<table>
<tr><th>Independent Variable</th><th>Fraction of Variance explained</th><th>P-value</th></tr>
<tr><td>Female gender</td><td>0.06</td><td>0.0009</td></tr>
<tr><td>Unstable knee</td><td>0.02</td><td>0.488</td></tr>
<tr><td>Patient can be too old</td><td>0.01</td><td>0.076</td></tr>
</table></td></tr>
</table>

Table 1. Studies of beliefs about indications, referrals, and thresholds for total knee arthroplasty (continued)

Naylor & Williams, 1996[17]	Quality in Health Care	Consensus Panel (n=11) 4 orthopaedic MDs 2 rheumatoid MDs 2 general practitioners 1 “general physician” 1 epidemiologist 1 physiotherapist	Consensus finding using 120 case scenarios to try and gain agreement on priorities and appropriateness for hip and knee replacement surgery. Consensus findings also with 42 case scenarios for urgency of replacement	- Found that key determinants to prioritize surgery were: pain at rest, severity of functional impairment, problems with care-giving, perceived likely improvement in function - Panel agreement statistics: ♦ Agreement of =9/11 panelists occurred 61% (73/120) of appropriateness scenarios for referral for TKA (not appropriate, uncertain, appropriate) and in 17% of urgency categories ♦ Agreement of =10/11 panelistsoccurred in 92% of appropriateness scenarios and 74% (31/42) of urgency scenarios

Table 2. Summary of studies of clinical agreement about patient factors for either referral or surgery (set at >90% for significant agreement)

Study	Journal / Population	Pro	Neutral	Con	Clinical Factors of Disagreement (<60% agreement)
Wright et al., 1995[12]	Can Med Assoc J Orthopaedic surgeons	Pain despite meds	Male Female White race Non-white race	Peripheral vascular disease Isolated patellofemoral arthritis Alcohol/Drug Abuse Local active skin infection Major psychiatric disorder Patient non-compliant Age <55 years old High physical demands at work Septic arthritis >1 year ago	Patient is >80 years old Nursing home resident Severe hip osteoarthritis Local psoriasis Quadriceps lag Weak quads Sensation of instability
Mancuso et al., 1996[13]	J Arthoplasty Orthopaedic surgeons	Be independent		Poor soft tissue coverage Dementia Poor patient motivation Hostile personality Unreal expectations	Age >80 years old Weight >200 pounds Wants psychiatric benefit
Malmin et al., 1998[16]	Arch Fam Med Family practitioners and general internists	Pain despite meds Persistent weight bearing knee pain	Male Female White race Non-white race		Septic knee arthritis > 1 year ago No health insurance Isolated patellofemoral arthritis Patient demands TKA Painful feet

Table 2. Summary of studies of clinical agreement about patient factors for either referral or surgery (set at >90% for significant agreement) (continued)

Study	Journal / Population	Pro	Neutral	Con	Clinical Factors of Disagreement (<60% agreement)
Coyte, Hawker et al., 1996[14]	J Rheum Rheumatologists and family practitioners	Pain despite meds – family practitioner/rheumatologist Limited walking <1 block – family practitioner	Male – Family practitioners/ rheumatologists Female – Family practitioners/ rheumatologists	Peripheral vascular disease (Rheumatologist) Isolated patellofemoral arthritis (Rheumatologist) Local active skin infection (Rheumatologist)	Family practitioner/rheumatologist: non-compliant patient obese patient septic knee >1 year ago Varus or Valgus deformity High physical demands at work Family practitioner: <55 years old, severe hip osteoarthritis, Quadriceps lag, weak quads Rheumatologist: Nursing home resident Patient demands TKA Limited active flexion/extension Sensation of instability
Tierney et al., 1994[11]	Clin Ortho Orthopaedic surgeons	Persistent weight bearing pain	Female Race (white or black)	Alcohol/drug abuse Major psychiatric disorder Local active skin infection	Nursing home resident Painful feet Patient demands TKA Unstable knee Severe hip osteoarthritis

Table 3. Descriptive statistics on 62 studies

Patent Characteristics	Average	SD	Number of Studies Reporting
Mean Age (years)			
Average	67.5	4.4	57
Weighted by patients	69.1		50
Weighted by knees	69.2		56
Percent Female			
Average	65.4	17	47
Weighted by patients	64.6		41
Weighted by knees	64.5		47
Percent Obese (BMI >30)			
Average	36.7	3.5	3*
Weighted by patients	37.7		3
Weighted by knees	37.3		3
Percent Osteoarthritis			
Average	86.8	13	45
Weighted by patients	86.7		40
Weighted by knees	85.6		43

*One study of all obese patients not included

Table 4. Mean followup duration according to functional assessment scale (in months)

	Number of Studies	Mean Weighted Followup Time (months)			
		Baseline Patients	Followup Patients	Baseline Knees	Followup Knees
KS	46	66.2	79.3	89.8	65.7
HSS	24	66.9	63.0	61.2	61.4
WOMAC	8	44.5	68.1	67.7	72.7
SF-36	9	18.0	23.6	59.2	61.6

Table 5. Weighted baseline and followup scores for TKA outcomes measures

Outcome Measure	Number of Studies Reporting Pre/post Scores Based on Number of Subjects	Baseline Score Based on Number of Subjects	Followup Score Based on Number of Subjects	Number of Studies Reporting Pre/post Scores Based on Number of Knees	Baseline Score Based on Number of Knees	Followup Score Based on Number of Knees
Knee Society (KS)	30 / 7* (n=12,261)	39.8	80.0	27 / 5** (n=15,454)	41.1	82.4
Hospital for Special Surgery (HSS)	17 / 3* (n=2,546)	54.2	89.2	16 / 2** (n=3,333)	52.8	88.7
Western Ontario and McMaster Osteoarthritis Index (WOMAC)	7 (n=2,925)	48.3	76.8	NA †		
SF-36 physical function	8 / 7* (n=2,166)	27.6	43.8	2 / 1**	22.4	47.1

* subjects only
** knees only
† 1 study only

Table 6. Functional outcomes by measure and followup interval based on number of subjects

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
HSS / patients									
0-2 years									
Ververli et al., 1995[52]	HSS	Group 1	63.5	42	10.7	84.5	42	12.1	2
		Group 2	65	41	9.5	81.3	41	11.1	
Worland et al., 1998[53]	HSS	Continuous passive machine	62.9	37	7	95.3	37	2.8	0.5
	HSS	Physical therapy	61.7	43	10	95.7	43	3	
				163			**163**		
				MEAN=63.3			**MEAN=89.1**		
2.1-5 years									
Hasegawa et al., 2002[54]	HSS	With heterotopic ossification	48	9	16	91	9	7	3
	HSS	Without heterotopic ossification	48	131	14	93	131	6	
Hsu et al., 1998[55]	HSS		64	113	13.2	90	113	10.2	4.8
Larson et al., 2001[56]	HSS		58	82	10.25	89	82	8.75	4
Liu & Chen, 1998[57]	HSS	Group 1	42	64	9.58	84.1	64	4.81	2
		Group 2	47.4	24	11.7	85.3	24	4.51	
Moskal & Diduch, 1998[58]	HSS		48	514	15	89	488	22.25	4.3
Pereira et al., 1998[59]	HSS	PCL sacrificing	51.12	67	NR	92.16	67	NR	3
		PCLsparing	56.08	40	NR	90.2	40	NR	
Rand & Gustilo, 1996[60]	HSS		59	182	10	88	182	8	2.3
				1226			**1200**		
				MEAN=51.9			**MEAN=89.3**		
>5 years									
Diduch et al., 1997[61]	HSS		55	88	11	92	80	6	8
Evanich et al., 1997[62]	HSS		58	251	NR	98	169	NR	7.6
Healy et al., 2002[63]	HSS	1992	57.68	56	11	86.92	56	10.5	5,8 years
	HSS	1995	60.64	103	15	88.06	103	9.25	

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
Ikejiani et al., 2000[64]	HSS	With patellar resurfacing	56	45	13.4	91	45	7.4	6.5
		Without patellar resurfacing	54.8	140	12.7	89.1	140	9.5	
Malkani et al., 1995[65]	HSS		55	118	12	81	84	9	10
O'Rourke et al., 2002[66]	HSS	Modular tibial component	59	106	12	87	92	9.5	6.4
		All polyethylene tibial components	71	28	9.25	87	22	5	
Regner et al., 1997[67]	HSS		42	120	10	82	103	10	6.8
Schroder et al., 2001[68]	HSS		52	102	12	91	52	8	10
				1157			**946**		
				MEAN=55.4			**MEAN=89.1**		
KS / patients									
0-2 years									
Bert et al., 2001[69]	KS	KS	41	264	15	85	90	16	1
		Function	45	264	17	71	90	19	
Bourne et al., 1995[70]	KS clinical	Patella resurfaced	37	50	15	81	50	15	2
		Patella not resurfaced	41	50	14	87	50	8	
	KS function	Patella resurfaced	41	50	13	67	50	26	
		Patella not resurfaced	44	50	13	76	50	19	
Cohen et al., 1997[71]	KS	Unilateral group	55	100	NR	87	100	NR	0.5
		Bilateral group	53	86	NR	89	86	NR	
Deshmukh et al., 2002[27]	KS	KS score	23	177	16	79	130	19	1
		KS function	42	177	17	63	130	24	
Heck et al., 1998[72]	KS	KS score	34.7	291	22.2	68.4	268	19.6	2
		KS function	41.2	291	18.8	69	268	26.2	
Lin et al., 2002[73]	KS score	Preclinical pathway	43	53	12.54	93.5	36	4.77	2
		Clinical pathway	40.56	69	16.86	93.68	42	2.71	
	KS function	Preclinical pathway	34.14	53	22.76	84.72	36	9.47	
		Clinical pathway	46.67	69	13.18	84.21	42	10.71	

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
Matsueda & Gustilo, 2000[74]	KS score	Parapatellar	52	143	18.5	90	143	10	0.5
		Subvastus	51	148	15.25	90	148	12.5	
	KS/ function	Parapatellar	46	143	20	74	143	17.5	
		Subvastus	47	148	17.5	75	148	17.5	
				2676 MEAN=42.3			2100 MEAN=77.6		
2.1-5 years									
Bullens et al., 2001[75]	KS		32.9	108	16.3	83.5	86	12.9	4.9
Elke et al., 1995[76]	KS score	OA	30	300		87	*187*		
		RA	21	43		77	*27*		
	KS function	OA	50	300		65	*187*		
		RA	40	43		67	*27*		
Jenny & Jenny, 1998[77]	KS score	ACL replacing	50	32	12	89	32	11	2.5
		ACL retaining	41	93	16	90	93	11	
	KS function	ACL retaining	41	32	20	80	32	13	
		ACL replacing	38	93	23	79	93	21	
Konig et al., 1998[30]	KS score		28.7	249	NR	82.3	249	NR	3.3
Meding et al., 2001[78]	KS score		37.3	1888	NR	84	1888	NR	2.5
	KS function		42.9	1888	NR	78	1888	NR	
Ranawat et al., 1997[79]	KS score		44	118	15	93	96	10.75	4.9
	KS function		40	118	17.5	78	96	25	
Rand & Gustilo, 1996[60]	KS/pain		40	195	15	89	182	11	2.3
	KS function		46	195	17	81	182	20	
Rodriguez et al., 1996[80]	KS score		28	99	NR	55	67	NR	4.3
Yang et al., 2001[81]	KS score		37	86	13.5	79	86	11	3
	KS function		44	86	16.25	64	86	14.25	
				5966 MEAN=37.2			**5584 MEAN=80.6**		

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
>5 years									
Brown et al., 2001[82]	KS	Symmetric	51	250	12	90	250	12	6.4
		Asymmetric	54	18	14	91	18	10	
Clouter et al., 2001[83]	KS	KS score	33	130	10	90.7	89	8.5	10
		KS function	44	130	16	82	89	21	
Duffy et al., 1998[84]	KS score	Cement	32	47	17.9	92.4	47	8.2	10
		Cementless	33	46	18.9	87.8	46	13.8	
	KS/ function	Cement	45.4	47	22.4	72.4	47	25.9	
		Cementless	52.3	46	20.7	66.3	46	29.1	
Ewald et al., 1999[85]	KS score		42	180	NR	82	180	NR	10 to 14
	KS function		37	180	NR	68	180	NR	
Gill et al., 1999[86]	KS score		39	223	17	90	223	25	16.8
	KS function		44	223	20	58	223	25	
Healy et al., 2002[63]	KS score	1995	51.58	103	23.25	92.11	103	10	5,8
		1992	43.61	56	15.25	90.75	56	13.75	
	KS function	1995	49.9	103	25	75.11	103	20	
		1992	45.18	56	20	74.69	56	25	
Indelli et al., 2002[87]	KS score		41	91	18	94	85	11	7.5
	KS function		48	91	24	79	85	18	
Martin et al., 1997[88]	KS score		28	231	19.2	88	231	7.6	6.5
	KS function		49	231	NR	72	231	NR	
Miyasaka et al., 1997[89]	KS score		28.1	83	14.7	88.7	46	9.7	14
	KS function		30.2	83	22.2	69.2	46	28.6	
Mokris et al., 1997[90]	KS/pain		50	90	16.75	97	90	8.25	4.25
	KS function		41	90	18.75	88	90	15	

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
Mont et al., 1999[91]	KS score		52	101	13	94	101	8.5	5.4
	KS function		42	101	20	70	101	25	
O'Rourke et al., 2002[66]	KS score	Modular tibial component	30	106	15	85	92	15.25	6.4
		All polyethylene tibial component	34	28	13	87	22	11.5	
	KS function	Modular tibial component	50	106	17.5	79	92	17.5	
		All polyethylene tibial component	64	28	11.25	79	22	17.5	
Rinta-Kiikka et al., 1996[92]	KS score		48.5	97	NR	76.9	89	NR	5.3
	KS function		42.6	97	NR	64.2	89	NR	
Sextro et al., 2001[93]	KS score		32.8	61	16	87.9	50	14.2	15.7
	KS function		48.7	66	16.5	51.3	50	32.9	
				3619			**3368**		
				MEAN=42.3			**MEAN=80.5**		
WOMAC / patients 0-2 years									
Bachmeier et al., 2001[94]	WOMAC	Physical function	38.3	108		54.8	48		0.8
Fortin et al., 1999[28]	WOMAC function	High function	24.3	59		39.1	59		0.5
		Low function	44.2	47		65.4	47		
Beaupre et al., 2001[95]	WOMAC	Slider board pain	46	40	13	85	32	15	0.4
		Continuous passive machine pain	47	38	14	76	34	15	
		Control pain	51	39	15	79	34	16	
		Slider board stiffness	50	40	22	73	32	19	
		Continuous passive machine stiffness	44	38	15	65	34	21	
		Control stiffness	49	39	18	69	34	19	
		Slider board function	41	40	13	81	32	15	
		Continuous passive machine function	51	38	14	74	34	15	
		Control function	53	39	15	77	34	18	

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
Jones et al., 2001[96]	WOMAC pain	<80 years	44	221	18	78	221	19	0.5
		≥80 years	41	35	16	73	35	20	
	WOMAC function	<80 years	43	221	18	72	221	18	
		≥80 years	38	35	12	66	35	17	
	WOMAC stiffness	<80 years	39	221	21	64	221	22	
		≥80 years	43	35	21	65	35	23	
Stickles et al., 2001[97]	WOMAC	Body Mass Index <25	57	146	NR	77.5	146	NR	1
		25-30	53.7	304	NR	77.1	304	NR	
		30-35	49.9	271	NR	73	271	NR	
		35-40	46.8	149	NR	72.1	149	NR	
		>40	46.9	92	NR	73.6	92	NR	
				2295			**2184**		
				MEAN=46.2			**MEAN=71.9**		
2.1-5 years									
Clark et al., 2001[98]	WOMAC	Posterior stabilized	50.4	76		78	57		3
		Cruciate retaining	47.2	67		75.9	51		
				143			**108**		
				MEAN=48.9			**MEAN=77.0**		
>5 years									
Hawker et al., 1998[29]			58.2	487		98.4	487		
				MEAN=58.2			**MEAN=98.4**		
SF-36 / patients									
0-2 years									
Bachmeier et al., 2001[94]	SF-36/ physical function		25.2	108	17.2	49.7	45	27	0.8
Beaupre et al., 2001[95]	SF-36/ physical function	Slider board	31	40	19	53	32	24	0.4
		Continuus passive machine	31	39	15	46	36	20	
		Control	31	40	22	55	34	27	
Bert et al., 2000[99]	SF-36/ physical function		29	254	7	41	158	11	1
Fortin et al., 1999[28]	SF-36/ physical function	High function	37.3	59	22.2	63	59	25	0.5
		Low function	14.9	47	12.2	47	47	26.8	

Table 6. Functional outcomes by measure and followup interval based on number of subjects (continued)

Study	Scale	Group	Base Score	n	SD	Followup Score	n	SD	Followup in Years
Heck et al., 1998[72]	SF-36/ physical function		24.2	291	17.01	50.9	268	26.2	2
Jones et al., 2001[96]	SF-36/ physical function	<80 age	21	221	18	47	221	25	0.5
		≥80 age	17	35	17	35	35	23	
Kiebzak et al., 2002[100]	SF-36/ physical function		27	70	NR	50	70	NR	2
Stickles et al., 2001[97]	SF-36/ physical function	Body Mss Index <25	32.2	146	NR	40.2	146	NR	1
		25-30	30.7	304	NR	40	304	NR	
		30-35	30	271	NR	38.3	271	NR	
		35-40	27.8	149	NR	37.3	149	NR	
		>40	28.1	92	NR	37.9	92	NR	
				2166			**1967**		
				MEAN=27.58			**MEAN=43.76**		

Table 7. Functional outcomes by measure and followup interval based on number of knees

Study	Scale	Group	Base Score	Number of Knees	SD	Followup Score	Number of Knees	SD	Followup Years
HSS / KNEES									
0-2 years									
Worland et al., 1998[53]	HSS	Continous passive motion	62.9	49	7	95.3	49	2.8	0.5
		Physical therapy	61.7	54	10	95.7	54	3	
			TOTALS	**103**			**103**		
				MEAN=62.3			**MEAN=95.5**		
2.1-5 years									
Baldwin & Rubinstein, 1996[101]	HSS	Group A	55	272	NR	90	272	NR	4
		Group B	48	74	NR	87	74	NR	
Liu & Chen, 1998[57]	HSS	Group 1	42	128	9.58	84.1	128	4.81	2.6
		Group 2	47.4	48	11.7	85.3	48	4.51	
Hsu et al., 1998[55]	HSS		64	140	13.2	90	140	10.2	4.8
Larson et al., 2001[56]	HSS		58	118	10.25	89	118	8.75	4
Moskal & Diduch, 1998[58]	HSS		48	646	15	89	617	22.25	4.3
Pereira et al., 1998[59]	HSS	PCL sacrificing	51.12	93	NR	92.16	93	NR	3
		PCL sparing	56.08	50	NR	90.2	50	NR	
Rand & Gustilo, 1996[60]	HSS		59	251	10	88	251	8	2.3
			TOTALS	**1820**			**1791**		
				MEAN=52.4			**MEAN=88.8**		
> 5 years									
Diduch et al., 1997[61]	HSS		55	114	11	92	103	6	18
Harwin, 1998[102]	HSS	OA	49	241	6	93	241	10	5.1
		RA	42	109	8	84	109	10	
Ikejiani et al., 2000[64]	HSS	Patellar resurfacing	56	45	13.4	91	45	7.4	6.5
		without patellar resurfacing	54.8	140	12.7	89.1	140	9.5	

Table 7. Functional outcomes by measure and followup interval based on number of knees (continued)

Study	Scale	Group	Base Score	Number of Knees	SD	Followup Score	Number of Knees	SD	Followup Years
Malkani et al., 1995[65]	HSS		55	168	12	81	119	9	10
O'Rourke et al., 2002[66]	HSS	Modular tibial component	59	145	12	87	128	9.5	6.4
		All-polyethylene tibial component	71	31	9.25	87	25	5	
Regner et al., 1997[67]	HSS		42	144	10	82	106	10	6.8
Schroder et al., 2001[68]	HSS		52	114	12	91	58	8	10
Healy et al., 2002[63]	HSS	1992	57.68	56	11	86.92	56	10.5	5,8 years
	HSS	1995	60.64	103	15	88.06	103	9.25	
			TOTALS	**1410**			**1233**		
				MEAN=52.7			**MEAN=88.0**		
KS									
0-2 years									
Cohen et al., 1997[71]	KS	Unilateral group	55	172	NR	87	172	NR	0.5
		Bilateral group	53	100	NR	89	100	NR	
Matsueda & Gustilo, 2000[74]	KS score	Parapatellar	52	169	18.5	90	169	10	0.5
		Subvastus	51	167	15.25	90	167	12.5	
	KS/ function	Parapatellar	46	169	20	74	169	17.5	
		Subvastus	47	167	17.5	75	167	17.5	
			TOTALS	**944**			944		
				MEAN=50.5			**MEAN=83.8**		
2.1-5 years									
Bullens et al., 2001[75]	KS		32.9	126	16.3	83.5	100	12.9	4.9
Gioe & Bowman, 2000[103]	KS score	All-polyethylene tibial component	38.1	103	15.4	84.3	103	14.2	4.1
		Metal-backed tibial component	35.4	97	16.1	85.4	97	11.8	
	KS/ function	All-polyethylene tibial component	55.9	103	15.4	74.4	103	19.6	
		Metal-backed tibial component	57.2	97	17.2	72.1	97	22.1	
Hube et al., 2002[104]	KS		52.3	297	NR	90.6	276	6.25	3

Table 7. Functional outcomes by measure and followup interval based on number of knees (continued)

Study	Scale	Group	Base Score	Number of Knees	SD	Followup Score	Number of Knees	SD	Followup Years
Jenny & Jenny, 1998[77]	KS score	ACL retaining	50	32	12	89	32	11	2.5
		ACL replacing	41	93	16	90	93	11	
	KS/ function	ACL retaining	41	32	20	80	32	13	
		ACL retaining	38	93	23	79	93	21	
Jordan et al., 1997[105]	KS score		29	472	12.25	93	410	3.25	4.7
	KS/ function		34	472	11.25	92	410	22.5	
Konig et al., 1997[106]	KS score		28.7	276	NR	82.3	276	NR	4.7
Meding et al., 2001[78]	KS score		37.3	2759	NR	84	2759	NR	2.5
	KS/ function		42.9	2759	NR	78	2759	NR	
Mokris et al., 1997[90]	KS/pain		50	105	16.75	97	105	8.25	4.25
	KS/ function		41	105	18.75	88	105	15	
Ranawat et al., 1997[79]	KS score		44	150	15	93	125	10.75	4.9
	KS/ function		40	150	17.5	78	125	25	
Rand & Gustilo, 1996[60]	KS/pain		40	277	15	89	251	11	2.3
	KS/ function		46	277	17	81	251	20	
Rodriguez et al., 1996[80]	KS score		28	145	NR	55	104	NR	4.3
Title et al., 2001[107]	KS score	Total condylar prosthesis	43.4	74	NR	95.4	74	3.5	4.3
		Press-fit condylar prosthesis	44	74	NR	96.7	74	3.2	
	KS/ function	Total condylar prosthesis	31	74	NR	85.5	74	20.8	
		Press-fit condylar prosthesis	30.4	74	NR	92.2	74	19.5	
Yang et al., 2001[81]	KS score		37	109	13.5	79	109	11	3
	KS/ function		44	109	16.25	64	109	14.25	
			TOTALS	**9534**			**9220**		
				MEAN=39.6			**MEAN=82.8**		

Table 7. Functional outcomes by measure and followup interval based on number of knees (continued)

	Study	Scale	Group	Base Score	Number of Knees	SD	Followup Score	Number of Knees	SD	Followup Years
> 5 years										
	Brown et al., 2001[82]	KS	Symmetric	51	500	12	90	500	12	6.4
			Asymmetric	54	36	14	91	36	10	
	Cloutier et al., 2001[83]	KS	KS score	33	163	10	90.7	163	8.5	10
			KS function	44	107	16	82	107	21	
	Duffy et al., 1998[84]	KS score	Cemented	32	51	17.9	92.4	51	8.2	10
			Cementless	33	55	18.9	87.8	55	13.8	
		KS/ function	Cemented	45.4	51	22.4	72.4	51	25.9	
			Cementless	52.3	55	20.7	66.3	55	29.1	
	Ewald et al., 1999[85]	KS score		42	306	NR	82	306	NR	>10
		KS/ function		37	306	NR	68	306	NR	
	Gill et al., 2001[86]	KS score		39	254	17	90	254	25	16.8
		KS/ function		44	254	20	58	254	25	
	Harwin, 1998[102]	KS score	OA	42	241	6.75	92	241	4.5	5.1
			RA	32	109	8	86	109	5	
		KS/ function	OS	52	241	6.5	90	241	6.5	
			RA	28	109	11	68	109	7	
	Indelli et al., 2002[87]	KS score		41	100	18	94	92	11	7.5
		KS/ function		48	100	24	79	92	18	
	Martin et al., 1997[88]	KS score		28	306	19.2	88	306	7.6	6.5
		KS/ function		49	306	NR	72	306	NR	
	Miyasaka et al., 1997[89]	KS score		28.1	108	14.7	88.7	60	9.7	14.1
		KS/ function		30.2	108	22.2	69.2	60	28.6	
	Mont et al., 1999[91]	KS score		52	118	13	94	118	8.5	5.4
		KS/ function		42	118	20	70	118	25	

Table 7. Functional outcomes by measure and followup interval based on number of knees (continued)

Study	Scale	Group	Base Score	Number of Knees	SD	Followup Score	Number of Knees	SD	Followup Years
O'Rourke, et al., 2002[66]	KS score	Modular tibial component	30	145	15	85	128	15.25	6.4
		All-polyethylene tibial component	34	31	13	87	25	11.5	
	KS/ function	Modular tibial component	50	145	17.5	79	128	17.5	
		All-polyethylene tibial component	64	31	11.25	79	25	17.5	
Rinta-Kiikka et al., 1996[92]	KS score		48.5	102	NR	76.9	100	NR	5.3
	KS/ function		42.6	102	NR	64.2	100	NR	
			TOTALS	**4658** **MEAN=42.4**		**TOTALS**	**4496** **MEAN=81.4**		
WOMAC									
No Studies									
SF-36									
0-2 years									
Jones et al., 2001[96]	SF-36/ physical function	<80 years	21	221	18	47	221	25	0.5
		≥80 years	17	35	17	35	35	23	
			TOTALS	**256** **MEAN=20.5**			**256** **MEAN=45.4**		
2.1-5 years									
Giow & Bowman, 2000[103]	SF-36/ physical function	All-polyethylene tibial component	25	103	36	45	103	47	4.1
		Metal-backed tibial component	25	97	18	54	97	23	
			TOTALS	**200** **MEAN=25**			**200** **MEAN=49.4**		
> 5 years									
No Studies									

Table 8. Meta analysis for HSS

(0-2 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Ververeli et. al., 1995[52]	41	41	82	1.56	1.06	2.07
	Ververeli et. al., 1995[52]	42	42	84	1.82	1.30	2.34
	Worland et. al., 1998[53]	37	37	74	6.01	4.90	7.13
	Worland et. al., 1998[53]	43	43	86	4.56	3.74	5.39
Fixed	**Combined (4)**	**163**	**163**	**326**	**2.47**	**2.15**	**2.78**
Random	**Combined (4)**	**163**	**163**	**326**	**3.43**	**1.66**	**5.21**

(2-5 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Hasegawa et. al., 2002[54]	9	9	18	3.32	1.66	4.98
	Hasegawa et. al., 2002[54]	131	131	262	4.17	3.73	4.60
	Hsu et. al., 1998[55]	113	113	226	2.20	1.86	2.53
	Larson et. al., 2001[56]	82	82	164	3.24	2.77	3.71
	Liu & Chen, 1998 [57]	64	64	128	5.51	4.74	6.29
	Liu & Chen, 1998[57]	24	24	48	4.21	3.13	5.28
	Moskal & Diduch, 1998[58]	488	514	1002	2.15	2.00	2.31
	Rand & Gustilo, 1996[60]	182	182	364	3.20	2.88	3.51
Fixed	**Combined (8)**	**1093**	**1119**	**2212**	**2.63**	**2.51**	**2.74**
Random	**Combined (8)**	**1093**	**1119**	**2212**	**3.45**	**2.74**	**4.16**

(5 + years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Diduch et. al., 1997[61]	80	88	168	4.10	3.56	4.65
	Healy et. al., 2002[63]	103	103	206	2.16	1.81	2.51
	Healy et. al., 2002[63]	56	56	112	2.68	2.16	3.20
	Ikejiani et. al., 2000[64]	45	45	90	3.21	2.56	3.85
	Ikejiani et. al., 2000[64]	140	140	280	3.02	2.68	3.37
	Malkani et. al., 1995[65]	84	118	202	2.39	2.02	2.75
	O'Rourke et. al., 2002[66]	92	106	198	2.56	2.18	2.94
	O'Rourke et. al., 2002[66]	22	28	50	2.05	1.33	2.76
	Regner et. al., 1997[67]	103	120	223	3.99	3.53	4.45
	Schroder et. al., 2001[68]	52	102	154	3.59	3.06	4.11
Fixed	**Combined (10)**	**777**	**906**	**1683**	**2.87**	**2.73**	**3.01**
Random	**Combined (10)**	**777**	**906**	**1683**	**2.97**	**2.53**	**3.40**

Table 9. Meta analysis for KS

(0-2 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Bert et. al., 2000, 2001[69]	90	264	354	1.48	1.22	1.74
	Bert et. al., 2000, 2001 [69]	90	264	354	2.88	2.56	3.20
	Bourne et. al., 1995[70]	50	50	100	2.91	2.34	3.49
	Bourne et. al., 1995[70]	50	50	100	4.00	3.31	4.70
	Bourne et. al., 1995[70]	19	50	69	1.12	.55	1.69
	Bourne et. al., 1995[70]	26	50	76	.83	.33	1.33
	Deshmukh et. al., 2002[27]	130	177	307	1.03	.79	1.28
	Deshmukh et. al., 2002[27]	130	177	307	3.22	2.88	3.57
	Heck et. al., 1998[72]	268	291	559	1.24	1.05	1.42
	Heck et. al., 1998[72]	268	291	559	1.56	1.37	1.75
	Lin et. al., 2002[73]	36	53	89	4.94	4.07	5.81
	Lin et. al., 2002[73]	42	69	111	3.92	3.26	4.58
	Lin et. al., 2002[73]	36	53	89	2.69	2.10	3.29
	Lin et. al., 2002[73]	42	69	111	2.99	2.43	3.55
	Matsueda & Gustilo, 2000[74]	148	148	296	1.60	1.33	1.86
	Matsueda & Gustilo, 2000[74]	143	143	286	2.55	2.23	2.86
	Matsueda & Gustilo, 2000[74]	148	148	296	2.78	2.46	3.11
	Matsueda & Gustilo, 2000[74]	143	143	286	1.49	1.22	1.75
Fixed	**Combined (18)**	**1859**	**2490**	**4349**	**1.85**	**1.77**	**1.92**
Random	**Combined (18)**	**1859**	**2490**	**4349**	**2.35**	**1.95**	**2.76**

(2-5 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Bullens et. al., 2001[75]	86	108	194	3.41	2.96	3.86
	Jenny & Jenny, 1998[77]	32	32	64	3.35	2.56	4.14
	Jenny & Jenny, 1998[77]	32	32	64	2.28	1.63	2.93
	Jenny & Jenny, 1998[77]	93	93	186	1.85	1.51	2.20
	Jenny & Jenny, 1998[77]	93	93	186	3.55	3.09	4.02
	Ranawat et. al., 1997[79]	96	118	214	3.66	3.21	4.10
	Ranawat et. al., 1997[79]	96	118	214	1.79	1.47	2.11
	Rand & Gustilo, 1996[60]	182	195	377	1.89	1.64	2.13
	Rand & Gustilo, 1996[60]	182	195	377	3.70	3.36	4.03
	Yang et. al., 2001[81]	86	86	172	1.32	.99	1.66
	Yang et. al., 2001[81]	86	86	172	3.40	2.92	3.87
Fixed	**Combined (11)**	**1064**	**1156**	**2220**	**2.47**	**2.35**	**2.58**
Random	**Combined (11)**	**1064**	**1156**	**2220**	**2.73**	**2.16**	**3.30**

Table 9. Meta analysis for KS (continued)

(5 + years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Brown et. al., 2001[82]	18	18	36	2.97	1.96	3.99
	Brown et. al., 2001[82]	250	250	500	3.25	2.98	3.51
	Cloutier et. al., 2001[83]	89	130	219	6.14	5.49	6.78
	Cloutier et. al., 2001[83]	89	130	219	2.08	1.75	2.42
	Duffy et. al., 1998[84]	46	46	92	3.27	2.63	3.91
	Duffy et. al., 1998[84]	47	47	94	1.11	.67	1.55
	Duffy et. al., 1998[84]	47	47	94	4.27	3.52	5.03
	Duffy et. al., 1998[84]	46	46	92	.55	.13	.97
	Gill et al., 1999[108]	223	223	446	.62	.43	.81
	Gill et al., 1999[108]	223	223	446	2.38	2.14	2.63
	Healy et. al., 2002[63]	103	103	206	1.11	.81	1.40
	Healy et. al., 2002[63]	103	103	206	2.26	1.91	2.61
	Healy et. al., 2002[63]	56	56	112	1.29	.88	1.71
	Healy et. al., 2002[63]	56	56	112	3.22	2.64	3.79
	Indelli et. al., 2002[87]	85	91	176	3.51	3.03	3.99
	Indelli et. al., 2002[87]	85	91	176	1.45	1.11	1.78
	Martin et. al., 1997[88]	231	231	462	4.11	3.79	4.43
	Miyasaka et. al., 1997[89]	46	83	129	1.57	1.16	1.98
	Miyasaka et. al., 1997[89]	46	83	129	4.51	3.84	5.18
	Mokris et. al., 1997[90]	90	90	180	2.73	2.32	3.15
	Mokris et. al., 1997[90]	90	90	180	3.52	3.05	4.00
	Mont et. al, 1999[91]	101	101	202	1.23	.93	1.54
	Mont et. al., 1999[91]	101	102	203	3.74	3.28	4.20
	O'Rourke et. al., 2002[66]	92	106	198	3.65	3.19	4.11
	O'Rourke et. al., 2002[66]	92	106	198	1.65	1.32	1.98
	O'Rourke et. al., 2002[66]	22	28	50	4.15	3.11	5.19
	O'Rourke et. al., 2002[66]	22	28	50	1.04	.43	1.65
	Sextro et. al., 2001[93]	50	61	111	3.61	2.99	4.23
	Sextro et. al., 2001[93]	50	66	116	.09	-.28	.47
Fixed	**Combined (29)**	**2599**	**2835**	**5434**	**2.07**	**2.00**	**2.14**
Random	**Combined (29)**	**2599**	**2835**	**5434**	**2.57**	**2.08**	**3.05**

Table 10. Meta analysis for WOMAC

(0-2 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Beaupre et. al., 2001[95]	34	38	72	1.98	1.40	2.56
	Beaupre et. al., 2001[95]	34	39	73	1.79	1.23	2.35
	Beaupre et. al., 2001[95]	32	40	72	1.10	.59	1.61
	Beaupre et. al., 2001[95]	32	40	72	2.77	2.10	3.44
	Beaupre et. al., 2001[95]	34	38	72	1.15	.64	1.66
	Beaupre et. al., 2001[95]	34	39	73	1.07	.57	1.57
	Beaupre et. al., 2001[95]	32	40	72	2.84	2.16	3.52
	Beaupre et. al., 2001[95]	34	39	73	1.44	.91	1.97
	Beaupre et. al., 2001[95]	34	38	72	1.57	1.03	2.11
	Jones et. al., 2001[96]	221	221	442	1.16	.96	1.36
	Jones et. al., 2001[96]	221	221	442	1.83	1.61	2.06
	Jones et. al., 2001[96]	35	35	70	1.88	1.30	2.46
	Jones et. al., 2001[96]	221	221	442	1.61	1.39	1.82
	Jones et. al., 2001[96]	35	35	70	1.75	1.18	2.31
	Jones et. al., 2001[96]	35	35	70	.99	.48	1.49
Fixed	**Combined (15)**	**1068**	**1119**	**2187**	**1.54**	**1.44**	**1.64**
Random	**Combined (15)**	**1068**	**1119**	**2187**	**1.62**	**1.39**	**1.86**

Table 11. Meta analysis for SF-36

(0-2 years)

	Citation	N1	N2	NTotal	Effect	Lower	Upper
	Bachmeier et. al., 2001[94]	45	108	153	1.22	.84	1.60
	Beaupre et. al., 2001[95]	32	40	72	1.02	.51	1.52
	Beaupre et. al., 2001[95]	36	39	75	.84	.36	1.33
	Beaupre et. al., 2001[95]	34	40	74	.97	.48	1.47
	Bert et. al., 2000, 2001[69, 99]	158	254	412	1.37	1.15	1.59
	Fortin et. al., 1999[28]	47	47	94	1.52	1.05	1.99
	Fortin et. al., 1999[28]	59	59	118	1.10	.70	1.49
	Heck et. al., 1998[72]	268	291	559	1.24	1.06	1.42
	Jones et. al., 2001[96]	35	35	70	.88	.38	1.38
	Jones et. al., 2001[96]	221	221	442	1.19	.99	1.39
Fixed	**Combined (10)**	**935**	**1134**	**2069**	**1.21**	**1.11**	**1.30**
Random	**Combined (10)**	**935**	**1134**	**2069**	**1.20**	**1.10**	**1.30**

Table 12. Revision rates after primary TKAs

	Based on Knees		Based on Patients	
Followup	Revisions	Revisions Other Procedures	Revisions	Revisions Other Procedures
0-2 years	0	0	< 1%	< 1%
2.1-5 years	2.0%	3.5%	1.6%	2.9%
5+ years	2.0%	3.1%	2.1%	3.5%

Table 13. Assessment of TKA prostheses and surgical procedures

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Prothesis				
Baldwin & Rubinstein, 1996[101]	Intermedics Natural Knee TKA, (1) Subjects with excellent/good bone quality (GB) vs. (2) Subjects with fair/bad bone quality (BB)	Hospital of Special Surgery (HSS) HSS GB: 55 BB: 48	Followup = 4 years HSS GB: 92 BB: 90	Study concludes bone quality had little effect on the four-year outcome of this ingrowth TKA.
Bert et al., 2000, 2001[69, 99]	Total condylar TKA. Low demand patients were randomized to receive either (1) All-polyethylene or (2) metal-backed implant type. Not reported for medium/high demand subjects	Knee Society Knee Score (KS) AP, low demand: 41 MB, low demand: 38 Function score (KSF) AP, low demand: 41 MB, low demand: 43	Followup = 1 year KS AP, low demand: 82 MB, low demand: 87 KSF AP, low demand: 72 MB, low demand: 54	Study hypothesis that prosthetic choice should be determined by peroperative activity level (demand matching) was not validated.
Cloutier et al., 2001[83]	Total condylar, posterior cruciate-retaining	KS: 33 KSF: 44	Followup = 10 years KS: 90.7 KSF: 82	After TKA with PCR both anterior and posterior cruciate ligaments (even degenerate) remain functional after an average of 10 years. Survival at 10 years with end point being revision was 94.8%.
Evanich et al., 1997[62]	Cementless Intermedics Natural Knee TKA using metal-backed, porous-coated patellar component	HSS: 58	Followup = 6-10 years HSS: 98	Overall patellar survivorship was 96%. Study concludes comparatively good results from the use of a metal-backed patellar component if component design, surgical technique and patellar alignment are properly addressed.
Ewald et al., 1999[85]	Kinematic nonconstrained TKA, posterior cruciate-retaining	KS: 42 KSF: 37	Followup = 10-14 years KS: 82 KSF: 68	Overall revision rate was 6.5%. Data from study suggests patella replacement is not appropriate with this design
Gill & Joshi, 2001[86]	Cemented posterior cruciate ligament-retaining TKA. Total Condylar Knee (54%) and Kinematic Condylar (46%).	KS: 39 KSF: 44	Followup = 16.8 years KS: 90 KSF: 58	Study finds the long-term results of cemented posterior cruciate ligament-retaining TKA excellent in terms of improved function and pain relief.
Gill et al., 1999[108]	Total Condylar Knee, posterior cruciate-retaining	KS: 40.3	Followup = 16-21 years KS: 88.4	Prosthetic survivorship at 20 years was 96% for revision. Total Condylar with retention of the posterior cruciate produces results comparable to the original Total Condylar Knee with cruciate-sacrifice.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Gioe & Bowman, 2000[103]	Press-Fit Condylar, (1) All-polyethylene (APT) vs. (2) Metal-backed tibial (MBT) components.	KS APT: 38.1 MBT: 35.4 KSF APT: 55.9 MBT: 57.2	Follow up = 3 years KS APT: 84.3 MBT: 85.4 KSF APT: 74.4 MBT: 72.1	Study reports TKA with all-polyethylene components functions equivalently to metal-backed tibial components, and is less costly.
Hsu et al., 1998[55]	Hybrid Miller-Galante I (MGI) TKA using uncemented femoral components with cemented tibial and patellar components	HSS: 64	Followup = 4.8 years HSS: 90	Study does not recommend MGI TKA due to high rate of patellar complications but may be a useful alternative fixation mode in TKA procedures.
Indelli et al., 2002[87]	Insall-Burstein II	KS: 41	Followup = 7.5 years KS: 94	Survivorship analysis using worst-case scenario showed a success rate of 91%.
Jordan et al., 1997[105]	Mobile meniscal bearing TKA	KS: 29 KSF: 34	Followup = 8 years KS: 93 KSF: 94	Kaplan-Meier survivor analysis, using revision surgery for any mechanical reason, showed a survivorship of 94.6%.
Larson et al., 2001[56]	Insall-Burstein II posterior-stabilized TKA	HSS: 58	Followup = 4 years HSS: 89	80% and 17% of the knees were rated excellent and good, respectively. Using the patellar resurfacing technique used in this study, patellofemoral complications were only 4.2%.
Liu & Chen, 1998[57]	Four different implants used.			Not possible to test effect of prosthesis.
Malakani et al., 1995[65]	Kinematic Condylar prosthesis, posterior cruciate-retaining	HSS: 55 KS: 33 KSF: 46	Followup = 10 years HSS: 81 KS: 80 KSF: 64	Using revision as end point, rate of survival was 96%. Study found knee scores, rate of survival of implants were similar to reported previously subjects who had a total condylar TKA with sacrifice of the posterior cruciate ligament. Loosening of patellar components was noted to be a major problem.
Meding et al., 2001[78]	Posterior cruciate-retaining TKA (98%) Insall-Burstein II posterior stabilized TKA (2%)			Not possible to test effect of prosthesis.
Miyasaka et al., 1997[89]	Total Condylar, posterior cruciate-sacrificing	KS: 28.1 KSF: 30.2	Followup = 14 years KS: 88.7 KSF: 69.2	Survival of retention of the prosthesis was 91% at 13 years.
Mokris et al., 1997[90]	Genesis TKA system, conversion module allowing for posterior cruciate-sacrifice	KS: 50 KSF: 41	Followup = 6.5 years KS: 97 KSF: 88	Clinically, results were excellent in 95% of knees, good in 4%.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Mont et al., 1999[91]	Duracon TKA system, posterior cruciate-retaining	KS: 52 KSF: 42	Followup = 5 years KS: 94 KSF: 70	At final follow up 96% of knees had good or excellent results. Almost complete absence of patellofemoral complications was noted.
O'Rourke et al., 2002[66]	Insall-Burstein II, (1) All-polyethylene (APT) vs. (2) Cemented metal-backed tibial (MBT) components.	KS APT: 34 MBT: 30 KSF APT: 64 MBT: 50 HSS APT: 71 MBT: 59	Followup = 6.4 years KS APT: 87 MBT: 85 KSF APT: 79 MBT: 79 HSS APT: 87 MBT: 87	Modular Insall-Burstein II TKAs were found to function well at followup although the authors noted that the high prevalence of osteolysis in subjects with good/excellent clinical scores was worrisome. Routine followup radiographs after TKA to detect asymptomatic osteolytic changes was recommended.
Regner et al., 1997[67]	Freeman-Samuelson TKA with three different types of tibial components fixed with macrointerlocking pegs: (1) High density polyethylene without stem (Group 1); (2) Metal-backed tibial without stem (Group 2); (3) Metal-backed tibial with stem (Group 3)	HSS: 42	Followup = 6.8 years HSS: 82	Using revision as end point, rate of survival was 79% at 10 years. Investigators found cementless fixation of this design using the macrointerlocking pegs and no other stabilization resulted in poor fixation and a high revision rate and cannot be recommended.
Rinta-Kiikka et al., 1996[92]	Cementless Synatomic TKA, posterior cruciate-retaining	KS: 48.5 KSF: 42.6	Followup = 5-7 years KS: 76.9 KSF: 64.2	Clinical survival rate, based on aseptic loosening, was 88.6%.
Ritter et al., 1995[109]	Anatomic Graduated Components TKA, posterior cruciate-retaining		Followup = 10.7 years KS: 81	Clinical survival rate, based on revision, was 98.86% at 15 years.
Rodriguez et al., 1996[80]	Total Condylar TKA	KSF: 28	Followup = 12.7 years KSF: 55	At the 15-year followup period, survivorship analysis suggested a 91% probability of survival for the prosthesis. Cemented Total Condylar TKA in severe rheumatoid arthritis provided durable pain relief and restoration in function.
Schroder et al., 2001[68]	Cementless porous-coated Anatomic Graduated Components TKA	HSS: 52	Followup = 10 years HSS: 91	At followup, 92% of the patients were satisfied or very satisfied with their TKA. Cumulative prosthesis survival after 10-11 years was 97%.
Sextro et al., 2001[93]	Kinematic I condylar TKA, posterior cruciate-retaining	KS: 32.8 KSF: 48.7	Followup = 15.7 years KS: 87.9 KSF: 51.3	At the 15-year followup period, survivorship was 88.7%, using revision as the endpoint. Study shows good function and survivorship of the Kinematic I condylar TKA.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Title et al., 2001[107]	(1) Total Condylar TKA, posterior cruciate-sacrificing (TCP) vs. (2) Press-Fit Condylar, posterior cruciate-substituting (PFC)	KS TCP: 43.4 PFC: 44 KSF TCP: 31 PFC: 30.4	Followup = 4 and 4.5 years KS TCP: 95.4 PFC: 96.7 KSF TCP: 85.5 PFC: 92.2	Both designs showed comparable pain relief and walking ability.
Yang et al., 2001[81]	Total condylar-type design with or without posterior cruciate-retention			Not possible to test effect of prosthesis.
Procedures				
Bourne et al., 1995[70]	All subjects received single type featuring an anatomic patellofemoral joint, (1) Patella resurfaced group (PR) vs. (2) Patella not resurfaced group (PNR)	KS PR: 37 PNR: 41 KSF PR: 41 PNR: 44	Followup = 2 years KS PR: 81 PNR: 87 KSF PR: 67 PNR: 76	The not resurfaced group had significantly less pain at two-year followup. A required longer followup suggested.
Brown et al., 2001[82]	Non reported identical prosthesis type, reports on component asymmetry. (1) Asymmetric TKA (AS) vs. (2) Symmetric TKA (S)	KS AS: 54 S: 51	Followup = 6.4 years KS AS: 91 S: 90	No statistical differences in knee scores were noted between right and left TKAs performed with asymetrically sized components.
Bullens et al., 2001[75]	Press-Fit Condylar TKA, posterior cruciate-retaining (PCR) in 95%	KS: 32.9 KSF: 29.1	Followup = 4.9 years KS: 83.5 KSF: 51.5	Five-year survival with revision as end point being revision 99% (best-case scenario), but decreased to 69% with revision, pain scale (visual analog -VAS) >20, satisfaction VAS <80, or lost to follow up as endpoint (worst-case scenario).
Clark et al., 2001[98]	(1) Posterior cruciate-sacrificed (PCS) vs. (2) Posterior cruciate-retaining (PCR) TKAs	KS PCS: 98.8 PCR: 100.6 WOMAC PCS: 50.4 PCR: 47.2	Followup = 2 years KS PCS: 157.1 PCR: 156.5 WOMAC PCS: 22.8 PCR: 18.5	No notable differences between groups at years two and three of followup.
Cohen et al., 1997[71]	AMK, a condylar cruciate-sparing implant, (1) Bilateral, and (2) Unilateral TKA	KS B: 53 U: 55	Followup = 0.5 years KS B: 89 U: 87	Study concludes simultaneous bilateral TKA does not result in any significant increase in patient morbidity or effect post-op function compared to unilateral TKA.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Deshmukh et al., 2002[27]	Cemented Kinemax, patella retained. Role of body weight investigated	KS: 23 KSF: 42	Followup = 0.5 years KS: 79 KSF: 63	Study found body weight did not adversely affect the outcome of TKA in the short-term.
Diduch et al., 1997[61]	Posterior stabilized, posterior cruciate-substituting	HSS: 55	Followup = 8 years HSS: 92	Survival at 18 years with end point being revision was 94%.
Duffy et al., 1998[84]	Press-Fit Condylar, (1) Uncemented (UC) vs. (2) Cemented (C) (Press-Fit Condylar)	KS UC: 33 C: 32 KSF UC: 52.3 C: 45.4	Followup = 10 years KS UC: 87.8 C: 92.4 KSF UC: 66.3 C: 72.4	Survival at end point being revision or aseptic loosening was 72% in the uncemented group and 94% in the cemented group.
Elke et al., 1995[76]	Unconstrained posterior cruciate ligament-retaining TKA. 424 cemented, 100 uncemented TKA	KS not broken down by cemented vs. uncemented	Followup = 4.8-9.8 years	Cemented TKA can be recommended for patients with RA.
Griffin et al., 1998[110]	Posterior stabilized, cemented with metal-backed tibial components and patella resurfacing in obese patients	HSS Obese: 47.7 Not Obese: 55	Followup = 10 years HSS Obese: 88.3 Not Obese: 90.3	HSS scores comparable between groups and revision rates were not higher in the obese group at followup.
Harwin, 1998[102]	Kinemax cemented posterior cruciate ligament-retaining condylar with a symmetrical femoral component articulating with a medially offset symmetrical dome patella component	KS: 38 KSF: 47	Followup = 5.1 years KS: 91 KSF: 86	Study suggests cemented TKA with symmetrical patellofemoral resurfacing with an offset patella dome and posterior cruciate ligament-retention yields low patellofemoral complications and reoperations
Hasegawa et al., 2002[54]	Cruciate-retaining (cementless) and posterior stabilized (cemented)			Not possible to test effect of prosthesis.
Hube et al., 2002[104]	Midvastus approach for TKA	KS: 52.3	Followup = 3 years KS: 90.6	95% of the patients had excellent or good functional result.
Ilkejiani et al., 2000[64]	Genesis knee system, (1) Patella resurfaced group (PR) vs. (2) Patella not resurfaced group (PNR)	HSS PR: 54.8 PNR: 56.0	Followup = 2 years HSS PR: 89.1 PNR: 91	No significant difference between groups with regard to pain, HSS scores, and complications.
Jenny & Jenny, 1998[77]	Search total knee prosthesis which allows retention or replacement of the anterior cruciate ligament (ACL). (1) ACL-retaining group (AR) vs, (2) ACL-replacing (ARP)	KS AR: 50 ARP: 41 KSF AR: 41 ARP: 38	Followup = 2-3 years KS AR: 89 ARP: 90 KSF AR: 80 ARP: 79	Results showed clinical and functional outcomes were neither improved nor worsened with the ACL-retaining prosthesis.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Konig et al., 1997, 1998, 2000[30, 106, 111]	Posterior cruciate-retaining, press-fit condylar TKA using uncemented femoral components with cemented tibial and patellar components	Data from Konig et al., 1997[85] KS: 28.7 KSF: 45.5	Followup = 3.2 years KS: 82.3 KSF: 71.9	Study showed hybrid TKA provides good results comparable to cemented TKA.
Lombardi Jr et al., 2001[112]	(1) Maxim posterior cruciate-retaining (PCR) vs. (2) Maxim posterior cruciate-sacrificing (PCS)	KS PCR: 118.04 PCS: 112.90 KSF PCR: 54.77 PCS: 47.91 KS-Pain PCR: 16.67 PCS: 13.63 Converted from HSS	Followup = 5 years KS - Total PCR: 162.16 PCS: 158.05 KSF PCR: 71.22 PCS: 66.77 KSF – Pain PCR: 44.23 PCS: 44.10	No significant differences in outcome between the groups were observed.
Martin et al., 1997[88]	Press-Fit Condylar TKA.	KS: 28 KSF: 49	Followup = 6.5 years KS: 88 KSF: 72	Study reports good results with the Press-Fit Condylar, 95% of patients were pain free on level walking and were satisfied with their functional result.
Matsueda & Gustilo, 2000[74]	Genesis TKA system	KS S: 51 MP: 52 KSF S: 47 MP: 46	Follow up = 0.5 years KS S: 90 MP: 90 KSF S: 75 MP: 74	There were no significant differences in the KS score.
Moskal & Diduch, 1998[58]	Several designs			Not possible to test effect of prosthesis.
Pereira et al., 1998[59]	Kinemax, (1) Posterior cruciate-retaining (PCR) vs. (2) Posterior cruciate-sacrificing (PCS)	HSS PCR: 56.08 PCS: 51.12	Followup = 3 years HSS PCR: 90.2 PCS: 92.16	Data revealed no difference in clinical outcome between PCR and PCS.
Ranawat et al., 1997[79]	Press-Fit Condylar modular TKA, posterior cruciate-substituting	KS: 44 KSF: 40	Followup = 4.8 years KS: 93 KSF: 78	Study found Press-Fit Condylar modular TKA resulted in excellent relief of pain and restoration of function with a low prevalence of patellofemoral problems. Survival of the implant at 6 years was 97%.

Table 13. Assessment of TKA prostheses and surgical procedures (continued)

Study	Prosthesis Type	Measure(s) and Baseline Score	Followup Length and Score	Notes
Rand & Gustilo, 1996[60]	Genesis TKA system, (1) Resurfacing patellar component (RSC) vs. (2) Inset Biconvex patellar component (BPC)	KS RSC: 37 BPC: 42 KSF RSC: 48 BPC: 44 HSS RSC: 60 BPC: 57	Follow up = 2.3 years KS RSC: 92 BPC: 86 KSF RSC: 81 BPC: 82 HSS RSC: 88 BPC: 88	At followup, KS score was higher in the RSC group. The inset BPC appeared to provide better radiographic alignment than the RSC, but it had a higher incidence of radiolucent lines.

Table 14. Assessment of TKA procedures/programs

Study	Procedure Type	Measure(s) and Baseline Scores	Followup Length and Scores	Notes
Beaupre et al., 2001[95]	(1) Standard exercise and continuous passive motion (CPM) vs. (2) Standard exercise and Slider Board (SB) vs. (3) Standard exercise alone (SE)	Western Ontario and McMaster Osteoarthritis Index (WOMAC) and SF-36, Physical Functioning (SF-36 PF) WOMAC Pain, CPM: 47 Stiffness, CPM: 44 Function, CPM: 51 Pain, SB: 46 Stiffness, SB: 50 Function, SB: 41 Pain, SE: 51 Stiffness, SE: 49 Function, SE: 53 SF-36, PF CPM: 31 SB: 31 SE: 31	Followup = 0.5 years WOMAC Pain, CPM: 76 Stiffness, CPM: 65 Function, CPM: 74 Pain, SB: 85 Stiffness, SB: 73 Function, SB: 81 Pain, SE: 79 Stiffness, SE: 69 Function, SE: 77 SF-36 PF CPM: 46 SB: 53 SE: 55	No differences between groups in WOMAC and SF-36 scores at any measurement interval. When postop rehabilitation regimens that focus on early mobilization are used, adjunct CPM or SB that are added to SE are not required.
Healy et al., 2002[63]	(1) Clinical pathway group (CP) vs. (2) No clinical pathway group (NCP)	KS CP: 51.58 NCP: 43.61 KSF CP: 49.90 NCP: 45.18 HSS CP: 60.64 NCP: 57.68	CP Followup = 5 years NCP Followup = 8 years KS CP: 92.11 NCP: 90.75 KSF CP: 75.11 NCP: 74.69 HSS CP: 88.06 NCP: 86.92	Both groups had excellent relief of pain and improvement in function. The CP program reduced resource utilization and cost.
Lin et al., 2002[73]	(1) No (or Pre) clinical pathway group (NCP) vs. (2) Clinical pathway group (CP)	KS CP: 40.6 NCP: 43.0 KSF CP: 46.7 NCP: 34.1	Followup = 2 years KS CP: 93.6 NCP: 93.5 KSF CP: 84.2 NCP:84.7	No significant differences were found between groups in the knee scores. Clinical pathway is an effective management tool for TKA.

Table 14. Assessment of TKA procedures/programs (continued)

Study	Procedure Type	Measure(s) and Baseline Scores	Followup Length and Scores	Notes
Ververeli et al., 1995[52]	(1) Continuous passive motion (CPM) vs. (2) no CPM (NCPM)	HSS CPM: 63.5 NCPM: 65	Followup = 2 years HSS CPM: 84.5 NCPM: 81.3	No clinical differences in knee scores at follow up. CPM is efficacious in increasing short-term flexion and decreasing need for knee manipulation without increasing costs.
Worlund et al., 1998[53]	(1) Continuous passive motion (CPM) vs. (2) Professional physical therapy (PT)	HSS CPM: 62.9 PT: 61.7	Followup = 0.5 years HSS: CPM: 95.3 PT: 95.7	Study concludes CPM is an adequate rehabilitation alternative with lower costs and no difference in clinical results.

Table 15. Complications: Prevention of Venous Thrombosis (VT)/Pulmonary Embolism (PE) studies

Study	Study Type: Intervention; Control	Results	Conclusions
Blanchard et al., 1999[113]	RCT: (1) Nadroparin calcium, a LMWH, adjusted to body weight., subcutaneously 12 hours before and after surgery then once a day for 10-12 days vs. (2) Continuous intermittment pneumatic compression device (CIPC) of the foot.	DVT: 31/48 (65%, 95% CI 49.5-77.8) for CIPC group and 16/60 (27%, 95% CI 16.1-39.7) for the nadroparin group (p<0.001). Only one patient in the nadroparin group had severe bleeding.	Authors conclude that a once daily fixed, weight-adjusted dose of nadroparin is superior to CIPC of the foot.
Colwell et al., 1995[114]	RCT, open-label: (1) Postoperative Enoxaparin 30 mg subcutaneously bid vs. (2) Unfractionated heparin 5000 IU subcutaneously three times daily. MDT = 7 (up to 14 days)	77/225 (34%) of heparin subjects and 56/228 (25%) of enoxaparin subjects had an incidence of DVT (p=0.02). Two subjects receiving heparin had a PE, one fatal. three major hemorrhagic episodes in each group.	Study found postoperative enoxaparin more effective and as safe as unfractionated heparin in preventing DVT in patients having elective TKA.
Francis et al., 1996[115]	RCT: (1) "Two-step" warfarin, administered 10-14 days preoperatively then postoperatively vs. (2) warfarin, one dose night before TKA. Postoperatively, dose adjusted to target INR 2.2. Treatment up to nine days.	Occurrence of DVT nearly identical, 39% in the two-step regimen vs. 38% for the night before group. Occurrence of proximal VT was 5% vs. 7%, respectively (p ns). Patients in two-step regimen received 1.3 transfusions vs. 0.95 of the night before regimen (p<0.05).	Authors conclude night before warfarin regimen is more convenient and may be associated with less bleeding than the two-step warfarin regimen.
Heit et al., 2000[116]	Double-blind (DB), placebo-controlled, randomized controlled trial (RCT), TKA and THA. (1) Postoperative Ardeparin, a low molecular-weight heparin (LMWH), 50 anti Xa, IU/kg body weight subcutaneously bid vs. (2) Placebo. Mean duration of treatment (MDT) = 7 days postoperative.	Results for TKA only. DVT, PE, or death: 5 (1.4%) for ardeparin group, 6 (1.7%) for placebo, OR = 0.8 (95% CI 0.2-2.7). DVT: 1 (0.3%) for ardeparin group, 3 (0.8%) for placebo, OR = 0.3 (95% CI 0.03-3.1).	Study found the cumulative incidence of symptomatic DVT or death was not significantly reduced by ardeparin prophylaxis. Authors conclude extended ardeparin use is not clinically important for most patients and future research should identify high-risk patients who would benefit most from extended prophylaxis.
Leclerc et al., 1996[117]	DB, RCT: (1) Postoperative Enoxaparin 30 mg subcutaneously bid vs. (2) Postoperative Warfarin, dose adjusted to INR 2-3. MDT = 9 (up to 14 days).	109 of 211 (51%) warfarin subjects had an incidence of DVT vs. 76/206 (37%) of enoxaparin subjects (p=0.003). 22 (10.4%) warfarin and 24 (11.7%) had proximal VT (p>0.2). 6 (1.8%) warfarin and 7 (2.1%) had major bleeding (p>0.2).	Study found postoperative fixed-dose enoxaparin more effective than adjusted-dose warfarin in preventing DVT after TKA. No differences were observed for incidence of proximal VT or clinically overt hemorrhage.
Leclerc et al., 1998[24]	Cohort study, TKA and THA: Postoperative Enoxaparin, a LMWH, 30 mg subcutaneously bid. MDT = 9 (up to 14 days.	Results for TKA cohort only. VT: 33/842 (3.9%, 95% CI 2.6-5.2) Symptomatic proximal VT or PE: 23/842 (2.7%) Fatal PE: 3/842 (0.4%) Major hemorrhage: 24/842 (2.9%)	Postoperative use of enoxaparin for a mean of nine days is associated with a clinically acceptable rate of symptomatic VT and major hemorrhage. Authors conclude predischarge compression ultrasonography cannot be justified.

Table 15. Complications: Prevention of Venous Thrombosis (VT)/Pulmonary Embolism (PE) studies (continued)

Study	Study Type: Intervention; Control	Results	Conclusions
Perhoniemi et al., 1996[118]	DB, RCT, TKA, and THA: (1) Postoperative Enoxaparin 40 mg subcutaneously once a day vs. (2) Dihydroergotamine 0.5 mg + Heparin 5000 IU (HDHE) subcutaneously bid. One dose from each group prior to surgery. Treatment for seven days.	Results for TKA and THA combined. Overall incidence of thromboembolic events was low (3%). One DVT seen in the Enoxaparin group and two PE in HDHE group.	Study found the two regimens showed comparable efficacy and overall safety in preventing DVT.
Robinson et al., 1997[119]	DB, RCT, TKA, and THA. All subjects receiving postoperative warfarin adjusted to target International Normalized Ratio (INR) 2-3 for a mean of 9.8 days were randomized to (1) Bilateral Compression Ultrasonography vs. (2) Sham.	Results for TKA only. In the screening group, one subject developed symptomatic proximal DVT and one had a nonfatal PE. One subject in the sham group had a symptomatic proximal DVT. Asymptomatic DVT was detected in six subjects in the screening group.	Use of warfarin prophylaxis during hospitalization results in very low rates of symptomatic DVT or PE after discharge. Authors conclude use of compression ultrasonography is not justified in this setting.
Westrich & Sculco, 1996[120]	RCT: (1) Postoperative Aspirin 325 mg bid (also given night of operation) vs. (2) Postoperative Aspirin + Pulsatile pneumatic plantar-compression device (PPPC) for 5 days. Warfarin administered if either treatment was judged to have failed.	22/81 (27%) of PPPC subjects had an incidence of DVT vs. 49/83 (59%) of aspirin alone subjects ($p<0.001$).	Study confirms safety and efficacy of PPPC with aspirin compared with aspirin alone and supports use of mechanical compression for prophylaxis against DVT.

Table 16. Complications: Prevention of infection studies

Study	Study Type: Intervention; Control	Results	Conclusions
Chiu et al., 2002[121]	Randomized controlled trial (RCT): (1) Cefuroxime 2 grams -impregnated cement vs. (2) Cement without cefuroxime.	No knees developed deep infections in the Cefuroxime-impregnated cement group vs. 5 knees (3.1%, p=0.02) in the group receiving cement without Cefuroxime.	Cefuroxime-impregnated cement was demonstrated to be effective in the prevention of early to late deep infection after TKA.
Mauerhan et al., 1993[25]	Double blind (DB), RCT, TKA and THA: (1) Cefuroxime 1.5 grams followed by 750 mg x 2 doses for a total of one day of antibiotic treatment vs. (2) Cefazolin 1 gram three times daily for three days.	Results for TKA cohort only. Rate of deep wound infection was 0.6% (1/178) for subjects receiving Cefuroxime vs. 1.4% (3/207) for subjects receiving Cefazolin.	Study found no significant differences in the prevalence of wound infections between the two antibiotic regimens.
Periti et al., 1999[122]	RCT, TKA, and THA: (1) Teicoplannin 400 mg IV x 1 dose at induction of anesthesia vs. (2) Cefazolin, 5 doses over 24-hour period (2 grams at induction of anesthesia and 1gram daily IV).	Results for TKA cohort only. 6 (1.5%) subjects in the Teicoplannin group and 7 (1.7%) subjects in the Cefazolin group developed a surgical wound infection during postoperative hospital stay (p ns).	Study concludes a single preoperative dose of Teicoplannin ensures adequate surgical antisepsis compared with a standard, multiple-dose regimen of Cefazolin.

Table 17. Complications: Tourniquet studies

Study	Study type: Intervention; Control	Results	Conclusions
Abdel-Salam & Eyres, 1995[123]	RCT: (1) Undergo TKA surgery with tourniquet vs. (2) Surgery without tourniquet.	4/40 (10%) subjects in tourniquet group had DVT within 8-21 days after surgery vs. none (0/40) for the no tourniquet group. 5/40 (12.5%) subjects in tourniquet group had a wound infection within 10 days of surgery vs. none (0/40) for the no tourniquet group.	Study concludes TKA can be safely performed without the use of the tourniquet.
Wakankar et al., 1999[124]	Randomized controlled trial (RCT): (1) Undergo TKA surgery with tourniquet vs. (2) Surgery without tourniquet.	One subject in tourniquet group had an asymptomatic DVT on post-op ultrasonography.	Study found no siginificant differences in the incidence of DVTs or wound complications. Use of tourniquet is safe for TKA.

Table 18. Number of studies that include potential correlates of function

Potential Correlates	Number of Studies
BMI	6
Age	7
Arthritis	3
Gender	5
Age and gender	6
Age, gender, BMI	4
Any	12

Table 19. TKA outcomes scores based on age, gender, BMI-index/obesity, and type of arthritis

Study/Group, n (baseline)	Outcome Instrument	Baseline Score	Followup Score	Percent Improvement*/ p-value Between Groups (scores)
Age (n=2 studies)				
Jones et al., 2001[96]	WOMAC**		*Followup = 6 months*	
Age < 80 years (n=221)	pain	44 ± 18 (sd)	78 ± 19	77%
Age = 80 years (n=35)	pain	41 ± 16	73 ± 20	78% / p = 0.17
Age < 80 years (n=221)	function	43 ± 18	72 ± 18	67%
Age = 80 years (n=35)	function	38 ± 12	66 ± 17	74% / p = 0.09
Age < 80 years (n=221)	stiffness	39 ± 21	64 ± 22	64%
Age = 80 years (n=35)	stiffness	43 ± 21	65 ± 23	51% / p = 0.78
Diduch et al., 1997[61]			*Mean followup = 8 years*	
Age = 55 (n=88)	HSS†	55 ± 11 (sd)	92 ± 6	67%
Gender (n=1 study)				
Hawker et al., 1998[29]			*Followup = 2-7 years*	
Men (n=172)	WOMAC	51.9 ± 1.8 (se)	19.6 ± 2.5 (se)	62.0%
Women (n=315)	WOMAC	61.0 ± 1.6 (se)	17.9 ± 1.6 (se)	70.7%
Obesity/Body Mass Index (BMI) (n=2 studies)				
Stickles et al., 2001[97]				
BMI (kg/m2)			*Followup = 1 year*	
< 25 (n=146)	WOMAC	57.0	77.5	36%
25-30 (n=304)	WOMAC	53.7	77.1	44%
30-35 (n=271)	WOMAC	49.9	73.0	46%
35-40 (n=149)	WOMAC	46.8	72.1	54%
> 40 (n=92)	WOMAC	46.9	73.6	57% / p = 0.0819
Griffin et al., 1998[110]			*Followup = 10 years*	
Obese-BMI > 30 (n=22)	HSS	47.7	88.3	85%
Nonobese-BMI < 30 (n=34)	HSS	55.0	90.3	64%
Type of Arthritis (n=3 studies)				
Harwin, 1998[102]	KS††		*Mean followup = 5.1 years*	
OA (n=241)	knee score	42 (33-60)	92 (80-98)	119%
RA (n=109)	knee score	32 (16-48)	86 (72-92)	168%
OA (n=241)	function	52 (40-66)	90 (72-98)	73%
RA (n=109)	function	28 (16-60)	68 (52-80)	143%
Regner et al., 1997[67]			*Mean followup = 6.8 years*	
OA (n=39)	HSS	46 ± 8 (sd)	84 ± 8	83%
RA (n=81)	HSS	39 ± 10	81 ± 11	108%
Elke et al., 1995[76]	KS		*Followup = 4.5-9.8 years*	
OA (n=300)	knee score	-30 (from graph)	*87*	190%
RA (n=43)	knee score	-21 (from graph)	*77*	260%
OA (n=300)	function	-50 (from graph)	*-65 (from graph)*	30%
RA (n=43)	function	-40 (from graph)	*-67 (from graph)*	68%

* from last followup
** WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index
† HSS = Hospital for Special Surgery
†† KS = Knee Society

Table 20. TKAR studies using multiple regression modeling

Study	N	Independent Variables of Interest Assessed	Findings
Jones, et al., 2001[96] Stepwise multiple linear regression	247 (pain) 248 (function)	Age (continuous) Sex (female) Body mass index (BMI)	Regression models were run for changes in pain and function. The dependent variables were pain and function measured by the WOMAC (calculated as the difference between preoperative and 6-month post-operative scores). Change in pain: Regression analysis found age and female sex were not significant predictors for change in pain at 6 months. Change in function: Age, female sex, and BMI were not significant predictors for change in function at 6 months.

Model for change in pain

Variable	Coefficient Unstandardized (95% CI)	Coefficient Standardized	P value
Intercept	52.41 (26.07 to 78.75)		<.001
Age	0.01 (-0.24 to 0.42)	0.03	.58
Female	-1.10 (-6.30 to 4.11)	-0.03	.68
Waiting time	0.01 (-0.02 to 0.04)	0.05	.40
Length of stay	-1.31 (-2.64 to –0.01)	-0.12	.05
Preop bodily pain (SF-36)	-0.42 (-0.56 to –0.27)	-0.35	<.001
Number of comorbid conditions	-0.67 (-1.96 to 0.62)	-0.06	.31
Cementless prosthesis	-9.48 (-16.20 to –2.77)	-0.17	.01

Model for change in function

Variable	Coefficient Unstandardized (95% CI)	Coefficient Standardized	P value
Intercept	74.42 (44.57 to 103.91)		<.001
Age	0.06 (-0.25 to 0.38)	0.03	.69
Female	0.43 (-4.47 to 5.34)	0.01	.86
Waiting time	-0.002 (-0.03 to 0.02)	-0.01	.86
Length of stay	-1.33 (-2.53 to –0.13)	-0.13	.03
Preop joint pain (WOMAC)	-0.43 (-0.57 to –0.28)	-0.38	<.001
BMI	-0.31 (-0.71 to 0.10)	-0.09	.14
Contralateral joint involvement	-1.68 (-5.27 to 1.91)	-0.05	.36
Lives alone	-3.04 (-8.43 to 2.34)	-0.07	.27
Number of comorbid conditions	-1.56 (-2.74 to –0.37)	-0.16	.01
Preop bodily pain (SF-36)	-0.21 (-0.35 to –0.07)	-0.19	.003

(from Jones et al., Arch Intern Med, Vol 161, Feb 12, 2001, pp 454-60)

Study	N	Independent variables of interest assessed	Findings
Deshmukh et al., 2002[27] Hierarchical multiple regression	180	Age Sex BMI/Obesity	Regression models were run for changes in pain and function measured by the KS** (change in scores at 12 months). BMI accounted for only a small percentage of variation in the outcome scores indicating body weight did not negatively influence the outcome of total knee arthroplasty at followup in the short-term.

Table 20. TKAR studies using multiple regression modeling (continued)

Study	N	Independent variables of interest assessed	Findings
Fortin et al., 1999[28] Multiple linear regression	106	Age Sex	Regression models were run for changes in pain and function measured by the WOMAC (6-month post-operative scores). Change in pain: Regression analysis found age and sex were not independent predictors for change in pain at 6 months. Change in function: Age and sex were not independent predictors for change in function at 6 months.
Hawker et al., 1988[29] Stepwise multiple linear regression *Note: Only independent variables that showed a significant association with the dependent variable in bivariate analyses were included in the final set of variables.*	1193 (All) 362 (Indiana) 344 (Pennsylvania)	Demographic characteristics BMI	Regression analyses were used to evaluate factors related to knee pain, knee function, and satisfaction with knee replacement. Pain and function were measured with the WOMAC. Pain: Age, gender, and BMI-index were not significant predictors of pain in the knee (bivariate analyses). Physical function: A lower BMI was a predictor of better physical function after TKA. Age and gender were not significant predictors of physical function (bivariate analyses). Satisfaction with knee replacement: A greater BMI index was a predictor of lower level patient satisfaction with knee replacement. Pennsylvania sample odds ratio (OR) = 0.90 (95% CI 0.82 to 0.98) and Indiana sample. OR = 0.91 (0.83 to 1.00).
Heck et al., 1998[72] Logistic regression modeling	291	Age Gender Race	Logistic regression modeling was used to determine improvement in the SF-36 physical health status at 2-years followup. Age (older patients) was a significant predictor of improvement of physical health (OR = 1.09, CIs not provided).
Konig et al., 1998)[30] Multiple linear regression	249	Age Sex BMI	Regression analyses were used to evaluate factors related to knee pain, knee score and function measured by the KS at 2-years followup. Pain: Age, gender, and BMI-index were not significant predictors of regression Knee score: Age, gender, and BMI-index were not significantly correlated with the knee score at last followup. Function: BMI correlated ($p < 0.0025$) with function at last followup.

Table 21. Gender/racial disparities in total knee arthroplasty studies

Study	Population Focus; N	Objective	Results
Dunlop et al., 2003[32]	Racial groups, USA KNEE AND HIP n=6,159 subjects aged 69 to 103 years with arthritis (AHEAD participants)	Focus on health conditions/economic access to explain differences in joint arthroplasty (JA)	Older blacks and Hispanics were less likely to use JA compared to whites. Annual rates for JA were 1.48 (95% CI 1.24-1.72) for whites, 0.98 (95% CI 0.39-1.56) for blacks, 0.97 (95% CI 0.01-1.93) for Hispanics. The odds ratio (OR) for JA, black/Hispanics vs. whites, was 0.37, 95% CI 0.20-0.71] after controlling for demographics, arthritis, and other health needs. *Conclusion: JA was not explained by differences in health needs/economic access*
Hawker et al., 2000[31]	Gender, Canada KNEE AND HIP n=2,411 subjects aged >55 years with arthritis	Gender differences in the need for knee arthroplasty (TKA) and willingness to undergo procedure	Versus men, women had worse symptoms and greater disability but were less likely to receive TKA [OR = 0.54, 95% CI 0.21-0.80, adjusted for age and self-reported arthritis or osteoporosis], and were less likely to discuss getting TKA with a physician despite equal willingness to have surgery [OR = 0.63, 95% CI 0.44-0.90]. The potential need for JA was 45 persons per 1000 for women and 21 persons per 1000 for men. *Conclusion: Degree of underuse for arthoplasty is greater than 3 times for women. Authors propose barriers, perceived or actual, exist at the level of the interaction between primary care physician and the patient in the process of referral to orthopaedic surgery.*
Katz et al., 1996[125]	Gender and racial, USA KNEE n=414,079 of Medicare beneficiaries	What demographic variables are determinants of area TKA rates	TKA more likely in women than men [OR = 1.95, No CIs] Black women vs. black men, OR= 1.66 White women vs. white men, OR= 1.24 White men vs. black men, OR = 2.50 White women vs. black women, OR = 1.16 *Conclusion: Variation in TKA rates unexplained*
McBean & Gornick, 1994[126]	Racial, USA n=52,501 (1986) n=111,475 (1992) Data were derived from MedPAR (Medicine Part A data file) Age $\geq$ 65	Explore differences by race in the rates of TKA and other procedures performed in hospitals for Medicare beneficiaries	Rates for TKA for blacks and whites in 1986 were 1.21 and 2.11 per 1,000 enrollees, respectively. The rates in 1992 for blacks and whites were 2.68 and 4.17, respectively. The black vs. white ratios for TKA were 0.57 in 1986 and 0.64 in 1992. *Conclusion: Black beneficiaries were less likely to receive TKA than whites. The difference in TKA rates suggests barriers to TKA and other "referral sensitive" surgeries.*

Table 21. Gender/racial disparities in total knee arthroplasty studies (continued)

Study	Population Focus; N	Objective	Results
Wilson et al., 1994[33]	Gender and racial, USA KNEE n=290,675 from several databases, including Medicare and the National Hospital Discharge Survey Age >65 with osteoarthritis (OA)	Determine differences in the use of TKA among black and white Americans and investigate whether clinical/economic factors contribute to these differences	Findings showed blacks received TKA less often than whites although blacks had higher rates (nonsignificantly) of OA of the knee than whites. Mean annual rates of TKA for 1984-1988 were 112.6 per 100,000 and 35.6 per 100,000 for white and black men, aged 65-69, respectively. The white vs. black rate ratio was 3.16 (95% CI 1.69-5.91). For women aged 65-69, the mean annual rates of TKA were 141.8 per 100,000 for whites and 91.5 per 100,000 for blacks, with a rate ratio of 1.55 (95% CI 1.00-2.41). *Conclusion: Although b lacks have higher rates of knee OA they are not treated with TKA as often as whites. Racial differences do not appear to have an economic basis. Future research should focus on non-clinical and non-economic factors of the inequality of TKA procedures betwe en blacks and whites.*
Escarce et al., 1993[127]	Racial, USA Several Medical procedures, including KNEE n=1,309,474 from Medicare beneficiaries Age ≥65	Examine racial differences in the use of medical procedures amongst Medicare enrollees	Rates for TKA for whites and blacks were 18.2 and 8.9 per 1000, respectively. RR for whites vs. blacks was 2.02 [95% CI 1.63-2.49], adjusted for age and sex. *Conclusion: Race may exacerbate the impact of other barriers (eg. financial) to access to medical procedures.*

Table 22. Summary of race and gender effects on TKA rates

	Odds Ratios	
	Nonwhite/White	**Women/Men**
Dunlop et al., 2003[32]	0.37 (0.20-0.71)	
Hawker et al., 2000[31]		0.54 (0.21-0.80)
Katz et al., 1996[125]	0.40 (Male) 0.86 (Female)	1.95
McBean & Gornick, 1994[126]	0.57 (1986) 0.64 (1992)	
Wilson et al., 1994[33]	0.32 (0.59-0.17) (Male) 0.37 (0.7-1.0) (Female)	1.26 (White) 2.57 (Black)
Escarce et al., 1993[127]	0.49 (0.4-0.61)	

Table 23. Updates on total knee revision studies

Reference	Measure	N	Outcomes	Followup	Age	Gender	Arthritis	Notes
Gofton et al., 2002[43]	KS-Pain, function, total	97 Revision TKAs -6 Attrition -2 death =89 59 posterior stabilized, 30 varus/ valgus stabilized	Preop: 1) Posterior stabilized-KS pain=16 ± 13 Function=44 ± 24 Total=91 ± 38 2) Varus/ valgus-KS: Pain=15 ± 15 Function=34 ± 24 Total=73 ± 41	Followup mean=4.7 months (2-11.2) 1) Posterior stabilized-KS: Pain=38 ± 14 Function=57 ± 29 Total=137 ± 39 2) Varus/valgus stabilized Pain=39 ± 14 Function=44 ± 28 Total=123 ± 42	Mean 69.1 (41.1-81.5)	Male=32 Female =52	71=OA 10=RA 3=TA	Review of midterm results of contemporary revisions knee systems with alternative design features fixed with hybrid cementing. All components cobalt chromium alloy comparing posterior stabilized vs. varus/valgus constrained articular inserts. Findings: Found no difference in post-op KS though there was a difference in preop KS: Post stabilized=91±38, Varus/Valgus=73±41
Nazarian et al., 2002[44]	KS	227 TKAs -20 =207 in study	Preop KS Average for all 4 groups=52 (37-70)	Postop followup=mean 4.7 months (2-11.2) Group I-with femoral/tibial stems KS=82 Group II-femoral stem only KS=85 Group III-tibial stem only KS=84 Group IV not reported	Mean=67 (43-84)	Male=105 Female=75	OA/RA/post traumatic osteonecrosis	Objective: Compare retrospectively the results of TKAR constrained condylar knee implant with and without intramedullary stems. Groups I-IV showed marked improvement in post-op KS though there was no statistically significant difference between groups. No correlation with other factors.

Table 23. Updates on total knee revision studies (continued)

Reference	Measure	N	Outcomes	Followup	Age	Gender	Arthritis	Notes
Brooks et al., 2002[39]	HSS overall and HSS instability portion (max=10 patients)	16 patients with tibiofemoral instability treated with polyethylene exchange -2 attrition =14 remaining in study	Preop HSS= 51.7(20-71) HSS instability= 4.1 (0-8)	Average followup=56 months HSS mean= 75.29 (50-97) HSS instability= 9 (5-10)	Average=54 (28-75)	Male=5 Female=9	-	The study found treatment of tibiofemoral instability with TKAR via polyethylene exchange only to be effective in certain types (I-IV) of instability: I=Ligaments competent and unbalanced. II=Ligaments incompetent. III=Flexion/extension gap mismatch IV=combined instability pattern. Found to be effective in types II and III (statistically significant)
Springer et al., 2001[51]	KS pain, function and KS scores	77 knees (Kinematic Rotating Hinge) -6 knees attrition =69 Kinematic Rotating Hinge remaining 57 Revisions 12 Primary	Preop KS score average= 40.3 (2-93)	Followup KS Knee score Category A- 32 patients Unilateral or bilateral TKA =81.9 (54-99) Category B- 11 patients unilateral TKA + symptomatic conralateral. Knee.=57.2 (33-94) Category C-26 patients multiple arthridities or medical infirmity=79 (44-99)	Average=72 (46-89)	Male=23 Female=35	-	Recommended that knee rotating hinge TKA be reserved for final salvage option when performing complex primary or salvage TKAR -Found no significant difference in improvement upon KRH revision between groups A,B,C in KS scores. -No improvement in KS pain score for category A/C or significant Improvement for B -No significant Improvement is KS function score for A,B,C

Table 23. Updates on total knee revision studies (continued)

Reference	Measure	N	Outcomes	Followup	Age	Gender	Arthritis	Notes
Benjamin et al., 2001[46]	KS	33 patients (# knees not reported)-all patients had morselized grafting to reconstruct tibial and femoral defects in revision TKA	Preop KS scores for morselized graft TKAs (revision) = 28-35 For patients without morselized graft TKAs (revision) = 28-35	Post-op (2 year average) KS scores with morselized graft TKA revision.= 62-79 KS scores without morselized graft TKA revision = 53-75	-	-	OA=27 RA=6	Study compared KS scores of patients with and without morselized bone grafting for tibial or femoral defects in patients undergoing TKARwith one revision knee system -No statistical significance in KS scores found
Parviz et al., 2002[49]	KS pain and function scores	37 knees -2 deaths =35 knees	Group I-Isolated patellar component resection-preop KS pain = 49, function = 48 Group II-Patellar resection + revision of tibial and/or femoral component-preop KS pain = 50, function = 49	Average followup = 7.9 years (2-18 years) Group I-post-op pain=51, function = 50 Group II postop-pain = 66, function = 56	Average = 66.6 (32-85)	Male=17 Female=14	OA=27 RA=6 Osteonecrosis =1 patient Post traumatic arthritis=1 patient	Objective: Evaluate clinical and functional results of patella resection arthroplasty for severely compromised patella for which insertion of another patellar component was not possible. Findings: No statistically significant difference found between Groups I and II without KS function score post-op KS function scores were better for patients in group II post-op
Lonner et al., 2002[45]	KS clinical and function scores	17 knees	Pre-op KS clinical-average = 49 (7-84) KS functional-average = 48 (20-80)	Followup average= 3 months KS clinical-average= 95 (88-99) KS function = 73 (60-110)	Average = 68 (59-79)	Male=13 Female=4	-	Evaluated the short term results of cancellous allografting + molded wire mesh for massive uncontained defects about the knee. Findings: found to be an effective method of treatment for the above No statistical analysis.

Table 23. Updates on total knee revision studies (continued)

Reference	Measure	N	Outcomes	Followup	Age	Gender	Arthritis	Notes
Jones et al., 2001[26]	HSS KS pain KS function	19 knees -3 deaths 16 knees in study	Preoperative HSS=43.6 KS pain=33.6 KS function=29.2 All revisions were with the S-ROM mobile bearing hinge prosthesis	Followup=47 months (27-71) HSS=70.8 KS pain=76.5 KS function =43.5 All revisions were with the S-ROM mobile bearing hinge prosthesis.	Mean=63 years (33-83)	Male=4 Female=11	OA=7 knees RA=6 knees Post-traumatic=2 knees	Sought to delineate the success of S-ROM mobile bearing hinge prosthesis under appropriate conditions (severe instability/bone loss)
Christensen et al., 2002[42]	KS	11	39	Followup=37.6 months KS=66	62.1	Male=1 Female=10	OA =10 RA=1	Evaluates improvement in range of motion and KS scores after revision total knee arthroplasty
Hanssen, 2001[47]	KS	8	39.5	Followup=36 months KS=88	65.9	Male=5 Female=3	OA=7 RA=1	Surgical technique for severe patellar bone loss during TKAR
Babis et al., 2002[40]	KS	56	53	Followup=4. 6 years KS=68	66	Male=29 Female=26		Isolated tibial insert exchange leads to early failure rates
Leopold et al., 2003[48]	HSS	40	72	Followup=62 months HSS=87				Isolated revision of the patellar component in revision TKA
Miller et al., 2002[41]	KS	38	50	Followup=6 months KS=68	71	Male=23 Female=11	OA=29 RA=2	UKR to TKA vs. primary TKA comparing PCL substituting and PCLsparing
Werle et al., 2002[50]	HSS KS	5	HSS=38 KS=22	Followup=37 months HSS=71 KS=60	67	Female=5	Infection, osteolysis	Use of large distal femoral augments to compensate for structural metaphyseal bone loss in revision

Table 24. Potential study questions

Question	Examples of Variables that Might be Tested
What are the effects of patient characteristics on outcomes?	♦ Age (very old age) ♦ Social Demographics ♦ Gender* ♦ Activity ♦ Underlying etiology (OA,AVN,RA)* ♦ Bone Quality ♦ Number of previous procedures ♦ Alternative procedure o High tibial osteotomy o Unicondylar replacement ▪ Medial ▪ Lateral o Patellofemoral replacement o Arthroscopy o Chondrocyte transplantation ▪ Autogenous ▪ Autograft ♦ BMI (severe obesity) ♦ Co-morbidities ♦ Bilateral TKAR: when to stage or do simultaneously ♦ Patient Indications—symptoms/function ♦ Cognitive status
What is the effect of surgical technique on outcomes?	♦ Component positioning
What is the effect of surgical characteristics on outcomes?	♦ Annual volume ♦ Years in practice ♦ Board certification
How does the choice of prosthesis affect outcomes?	♦ Exposure type ♦ Polyethylene o Non-modular/modular tibial components o All polyethylene tibial components o Rotating platform components ♦ Fixation o Noncemented o Cemented o Hybrid ♦ Interface material o Ceramics o Polyethylene o Oxinium ♦ Posterior cruciate ligament o Non substituting o Substituting
How does rehabilitation affect outcomes?	♦ Anticoagulation o Low molecular weight heparin o Coumadin o Aspirin ♦ Pain control protocols to enhance rehabilitation ♦ Rehabilitation protocols o Settings o Timing (after surgery) ♦ Continuous passive motion ♦ Cost effective followup-how often and when. ♦ Followup radiographs how often and when