



AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

Locking Plates for Extremity Fractures

A Technology Overview

EVIDENCE TABLES

Adopted by the American Academy of Orthopaedic Surgeons

Board of Directors

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This document is a supplement to the *Technology Overview* available on the AAOS website www.aaos.org/technologyoverviews.

These *Technology Overview Evidence Tables* were prepared using systematic review methodology, and summarize the findings of studies published as of April 1, 2008 on locking plates for extremity fractures. As a summary, this document does not make recommendations for or against the use of locking plates for extremity fractures. It should not be construed as an official position of the American Academy of Orthopaedic Surgeons. Readers are encouraged to consider the information presented in this document and reach their own conclusions about locking plates for extremity fractures.

The American Academy of Orthopaedic Surgeons has developed and is providing the *Technology Overview Evidence Tables* as an educational tool. Patient care and treatment should always be based on a clinician's independent medical judgment given the individual patient's clinical circumstances.

Table 1. Patient Enrollment Criteria for Included Studies

Author	Application	Fracture	Age	Medical History
Koshimune et al ¹⁶ 2005	Distal Radius	failed closed reduction, subchondral space for screws or pins	nr	nr
Hahnloser et al ¹² 1999	Distal Radius	>20° dorsal angulation, loss of radial length >10 mm	nr	nr
Egol et al ⁵ 2008	Proximal Humerus	nr	adult	nr
Handschin et al ¹³ 2008	Proximal Humerus	displaced 2,3, or 4 part (Neer) fracture, no head split fracture	nr	no multiple injuries, able to perform post-op physiotherapy
Hepp et al ¹⁴ 2008	Proximal Humerus	displaced fracture, 1.0 cm displacement or 45° angulation	nr	nr
Lafamme et al ¹⁹ 2008	Proximal Humerus	displaced (>1cm or >45°) 2 part surgical neck or 3-part severely impacted (>160°) valgus fracture	skeletal maturity	fit for anesthesia, previous normal shoulder function
Owsley et al ²² 2008	Proximal Humerus	nr	> 18 years	nr
Sharafeldin et al ²⁹ 2008	Proximal Humerus	nr	nr	nr
Gardner et al ¹⁰ 2007	Proximal Humerus	Acute traumatic fracture	> 18 years	nr
Moonot et al ²¹ 2007	Proximal Humerus	displaced 3 or 4 part fracture	nr	nr
Koukakis et al ¹⁷ 2006	Proximal Humerus	closed 2,3,or 4 part (Neer) fracture, < 3 weeks old,	> 18 years	failed conservative treatment (unsatisfactory position), no primary or metastatic tumors
Fankhauser et al ⁷ 2005	Proximal Humerus	nonpathologic, displaced, and unstable	nr	no hemiparesis, no previous surgery on affected shoulder
Schutz et al ²⁸ 2005 †	Distal Femur	any degree and severity	skeletal maturity	nr
Wong et al ³³ 2005	Distal Femur	no compound fracture	> 60 years	fit for surgery
Fankhauser et al ⁸ 2004	Distal Femur	nr	nr	nr
Kregor et al ¹⁸ 2004	Distal Femur	Supracondylar or intercondylar fracture, no periprosthetic, pathologic, growth plate, or medial femoral condyle fracture	nr	no nonunion of previous fracture
Markmiller et al ²⁰ 2004	Distal Femur	Types 33 A 1-3 and C 1-3	nr	nr
Ricci et al ²³ 2004	Distal Femur	acute, nonpathologic fracture (including displaced intra-articular and open fractures)	skeletal maturity	polytrauma
Syed et al ³² 2004	Distal Femur	any severity of fracture with or without intra-articular extension or bone loss, or open fracture. No severely articulated, comminuted fracture not amenable to reconstruction	skeletal maturity	nr

nr = not reported

† The Schutz, et al 2005 study is a subgroup analysis of the Schutz, et al 2001 study.

Table 1. Patient Enrollment Criteria for Included Studies (continued)

Author	Application	Fracture	Age	Medical History
Schutz et al ²⁷ 2001 [†]	Distal Femur	All degrees and severity	skeletal maturity	nr
Erhardt et al ⁶ 2008	Periprosthetic Femur	nr	nr	nr
Buttaro et al ³ 2007	Periprosthetic Femur	Vancouver type B-1	nr	nr
Fulkerson et al ⁹ 2007	Periprosthetic Femur	Fracture pattern that can be adequately reduced (closed), adequate bone for fixation, well fixed implant (no loosening)	nr	nr
Ricci et al ²⁴ 2006	Periprosthetic Femur	supracondylar fracture above a well fixed, non stemmed, TKA (Type 33A)	nr	nr
Jiang et al ¹⁵ 2008	Tibial Plateau	acute fracture. No pathologic, severe open (IIIB or IIIC), or concomitant ipsilateral femur fracture	nr	ability to walk without assistance prior to surgery, no patients requiring ICU or departmental transfer
Gosling et al ¹¹ 2005	Tibial Plateau	Type C	nr	nr
Stannard et al ³¹ 2004	Tibial Plateau	High energy, acute bicondylar (Schatzker V) or meta/diaphyseal (Schatzker VI) fracture. No medially based (Schatzker IV) high energy fracture	nr	No tibial infections
Boldin et al ² 2006	Proximal Tibia	No AO type 41B fractures	adult	nr
Cole et al ⁴ 2004	Proximal Tibia	diaphyseal-metaphyseal dissociation with or without articular involvement	nr	nr
Ricci et al ²⁵ 2004	Proximal Tibia	comminuted metaphyseal fracture	adult	nr
Schutz et al ²⁶ 2003	Proximal Tibia	shaft and intra-articular fracture of any severity	skeletal maturity	nr
Stannard et al ³⁰ 2003	Proximal Tibia	any fracture, malunion, or nonunion	adult	unable or unwilling to follow-up
Bahari et al ¹ 2007	Distal Tibia	tibia or pilon fracture	nr	nr

nr = not reported

† The Schutz, et al 2005 study is a subgroup analysis of the Schutz, et al 2001 study.

Table 2. Patient Oriented Outcomes from Comparative Studies - Distal Radius

Outcome Measure	Duration	Application	Results		N	p-value	Author	Level of Evidence
			Mean (dispersion)	% of patients				
Gartland and Werley – Excellent	Final Follow-up	Distal Radius (LP)	n/a	36%	22	nr	Koshimune et al ¹⁶ 2005	II
Gartland and Werley – Excellent	Final Follow-up	Distal Radius (NLP)	n/a	32%	31			
Gartland and Werley – Good	Final Follow-up	Distal Radius (LP)	n/a	59%	22	nr	Koshimune et al ¹⁶ 2005	II
Gartland and Werley – Good	Final Follow-up	Distal Radius (NLP)	n/a	65%	31			
Gartland and Werley – Fair	Final Follow-up	Distal Radius (LP)	n/a	5%	22	nr	Koshimune et al ¹⁶ 2005	II
Gartland and Werley – Fair	Final Follow-up	Distal Radius (NLP)	n/a	3%	31			
Gartland and Werley – Poor	Final Follow-up	Distal Radius (LP)	n/a	0%	22	nr	Koshimune et al ¹⁶ 2005	II
Gartland and Werley – Poor	Final Follow-up	Distal Radius (NLP)	n/a	0%	31			
Pain – Absent (VAS = 0)	6 months	Distal Radius (LP)	n/a	33%	21	nr	Hahnloser et al ¹² 1999	II
Pain – Absent (VAS = 0)	6 months	Distal Radius (NLP)	n/a	44%	24			
Pain – Mild (VAS = 0-3)	6 months	Distal Radius (LP)	n/a	57%	21	nr	Hahnloser et al ¹² 1999	II
Pain – Mild (VAS = 0-3)	6 months	Distal Radius (NLP)	n/a	44%	24			
Pain – Moderate (VAS = 4-7)	6 months	Distal Radius (LP)	n/a	5%	21	nr	Hahnloser et al ¹² 1999	II
Pain – Moderate (VAS = 4-7)	6 months	Distal Radius (NLP)	n/a	12%	24			
Pain – Severe (VAS = 8-10)	6 months	Distal Radius (LP)	n/a	5%	21	nr	Hahnloser et al ¹² 1999	II
Pain – Severe (VAS = 8-10)	6 months	Distal Radius (NLP)	n/a	0%	24			
Global Assessment – Excellent	6 months	Distal Radius (LP)	n/a	29%	21	nr	Hahnloser et al ¹² 1999	II
Global Assessment – Excellent	6 months	Distal Radius (NLP)	n/a	52%	24			
Global Assessment – Good	6 months	Distal Radius (LP)	n/a	37%	21	nr	Hahnloser et al ¹² 1999	II
Global Assessment – Good	6 months	Distal Radius (NLP)	n/a	32%	24			
Global Assessment – Fair	6 months	Distal Radius (LP)	n/a	29%	21	nr	Hahnloser et al ¹² 1999	II
Global Assessment – Fair	6 months	Distal Radius (NLP)	n/a	16%	24			
Global Assessment – Poor	6 months	Distal Radius (LP)	n/a	5%	21	nr	Hahnloser et al ¹² 1999	II
Global Assessment – Poor	6 months	Distal Radius (NLP)	n/a	0%	24			
Return to Previous Activities	nr	Distal Radius (LP)	n/a	52%	21	nr	Hahnloser et al ¹² 1999	II
Return to Previous Activities	nr	Distal Radius (NLP)	n/a	50%	24			
Grip Strength (% opposite hand)	6 months	Distal Radius (LP)	85% (SD: ±24)	n/a	21	nr	Hahnloser et al ¹² 1999	II
Grip Strength (% opposite hand)	6 months	Distal Radius (NLP)	95% (SD: ±9)	n/a	24			
Pinch Grip (% opposite hand)	6 months	Distal Radius (LP)	89% (SD: ±23)	n/a	21	nr	Hahnloser et al ¹² 1999	II
Pinch Grip (% opposite hand)	6 months	Distal Radius (NLP)	96% (SD: ±8)	n/a	24			

LP = Locking Plates; NLP = Non-Locking Plates; nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error; NS = not significant

Table 3. Patient Oriented Outcomes from Comparative Studies - Proximal Humerus

Outcome Measure	Duration	Application	Results		N	p-value	Author	Level of Evidence
			Mean (dispersion)	% of patients				
Constant-Murley Score (all patients)	Final Follow-up	Proximal Humerus (LP)	59 (SE: ±11)	n/a	31	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (all patients)	Final Follow-up	Proximal Humerus (NLP)	61 (SE: ±15)	n/a	60			
Constant-Murley Score (< 60 years old)	Final Follow-up	Proximal Humerus (LP)	62 (SE: ±8)	n/a	31	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (< 60 years old)	Final Follow-up	Proximal Humerus (NLP)	70 (SE: ±14)	n/a	60			
Constant-Murley Score (> 60 years old)	Final Follow-up	Proximal Humerus (LP)	49 (SE: ±7)	n/a	31	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (> 60 years old)	Final Follow-up	Proximal Humerus (NLP)	54 (SE: ±11)	n/a	60			
Constant-Murley Score (2-part fracture)	Final Follow-up	Proximal Humerus (LP)	64 (SE: ±8)	n/a	8	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (2-part fracture)	Final Follow-up	Proximal Humerus (NLP)	67 (SE: ± 21)	n/a	10			
Constant-Murley Score (3-part fracture)	Final Follow-up	Proximal Humerus (LP)	60 (SE: ±7)	n/a	13	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (3-part fracture)	Final Follow-up	Proximal Humerus (NLP)	62 (SE: ± 3)	n/a	33			
Constant-Murley Score (4-part fracture)	Final Follow-up	Proximal Humerus (LP)	57 (SE: ±8)	n/a	10	NS	Handschin et al ¹³ 2008	III
Constant-Murley Score (4-part fracture)	Final Follow-up	Proximal Humerus (NLP)	57 (SE: ±12)	n/a	17			
Subjective Assessment – Excellent	nr	Proximal Humerus (LP)	n/a	20%	31	nr	Handschin et al ¹³ 2008	III
Subjective Assessment – Excellent	nr	Proximal Humerus (NLP)	n/a	32%	60			
Subjective Assessment – Good	nr	Proximal Humerus (LP)	n/a	60%	31	nr	Handschin et al ¹³ 2008	III
Subjective Assessment – Good	nr	Proximal Humerus (NLP)	n/a	42%	60			
Subjective Assessment – Fair	nr	Proximal Humerus (LP)	n/a	10%	31	nr	Handschin et al ¹³ 2008	III
Subjective Assessment – Fair	nr	Proximal Humerus (NLP)	n/a	20%	60			
Subjective Assessment – Poor	nr	Proximal Humerus (LP)	n/a	10%	31	nr	Handschin et al ¹³ 2008	III
Subjective Assessment – Poor	nr	Proximal Humerus (NLP)	n/a	6%	60			
Operative Time (minutes)	n/a	Proximal Humerus (LP)	153 (SE: ±62)	n/a	31	NS	Handschin et al ¹³ 2008	III
Operative Time (minutes)	n/a	Proximal Humerus (NLP)	110 (SE: ±42)	n/a	60			
Hospitalized (days)	n/a	Proximal Humerus (LP)	8 (range: 3-9)	n/a	31	NS	Handschin et al ¹³ 2008	III
Hospitalized (days)	n/a	Proximal Humerus (NLP)	12.6 (range: 5-26)	n/a	60			

LP = Locking Plates; NLP = Non-Locking Plates; nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error; NS = not significant

Table 4. Patient Oriented Outcomes from Comparative Studies - Tibial Plateau

Outcome Measure	Duration	Application	Results		N	p-value	Author	Level of Evidence
			Mean (dispersion)	% of patients				
HSS Score	12 months	Tibial Plateau (LP)	81.8 (SD: ±4.7)	n/a	41	0.215	Jiang et al ¹⁵ 2008	II
HSS Score	12 months	Tibial Plateau (NLP)	80.3 (SD: ±6.6)	n/a	43			
HSS Score	24 months	Tibial Plateau (LP)	83.3 (SD: ±4.4)	n/a	41	0.836	Jiang et al ¹⁵ 2008	II
HSS Score	24 months	Tibial Plateau (NLP)	83.1 (SD: ±6.3)	n/a	43			
Operative Time (minutes)	n/a	Tibial Plateau (LP)	347 (SD: ±65)	n/a	41	0.478	Jiang et al ¹⁵ 2008	II
Operative Time (minutes)	n/a	Tibial Plateau (NLP)	410 (SD: ±106)	n/a	43			

LP = Locking Plates; NLP = Non-Locking Plates; nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error; NS = not significant

Table 5. Patient Oriented Outcomes from Case Series Studies - Proximal Humerus

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
Constant-Murley Score	1.5 months	40.2 (range: 19-62)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score	3 months	54.4 (range: 29-77)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score	3 months	53.5 (range: 23-93)	n/a	83	Hepp et al ¹⁴ 2008	IV
Constant-Murley Score	3-6 months	76.1 (range: 30-100)	n/a	18	Koukakis et al ¹⁷ 2006	IV
Constant-Murley Score	6 months	61.2 (range: 35-79)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score	6 months	70.4 (range: 23-105)	n/a	83	Hepp et al ¹⁴ 2008	IV
Constant-Murley Score	11 months	66.5 (range: 30-90)	n/a	32	Moonot et al ²¹ 2007	IV
Constant-Murley Score	12 months	74.6 (range: 37-96)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score	12 months	77.2 (range: 32-105)	n/a	83	Hepp et al ¹⁴ 2008	IV
Constant-Murley Score	12 months	79 (nr)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Constant-Murley Score	Final Follow-up	82 (SD: ±16)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Constant-Murley Score	nr	50.5 (SD: ±17.8)	n/a	27	Sharafeldin et al ²⁹ 2008	IV
Constant-Murley Score – Activity	Final Follow-up	15.1 (SD: ±3.8)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Constant-Murley Score – ADL	1.5 months	3.6 (range: 0-6)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – ADL	3 months	4.9 (range: 0-8)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – ADL	6 months	5.4 (range: 3-8)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – ADL	12 months	7.9 (range: 3-10)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Mobility	Final Follow-up	30.1 (SD: ±7.9)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Constant-Murley Score – Pain	1.5 months	9.8 (range: 5-15)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Pain	3 months	10.9 (range: 5-15)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Pain	6 months	12.0 (range: 7-15)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Pain	12 months	13.9 (range: 8-15)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Power	1.5 months	9.9 (range: 5-15)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Power	3 months	13.0 (range: 7-19)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Power	6 months	15.4 (range: 9-19)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Power	12 months	17.6 (range: 9-23)	n/a	28	Fankhauser et al ⁷ 2005	IV
Constant-Murley Score – Power	Final Follow-up	21.8 (SD: ±4.9)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Constant-Murley Score – Excellent	11 months	n/a	47%	32	Moonot et al ²¹ 2007	IV
Constant-Murley Score – Satisfactory	11 months	n/a	37%	32	Moonot et al ²¹ 2007	IV
Constant-Murley Score – Poor	11 months	n/a	16%	32	Moonot et al ²¹ 2007	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 5. Patient Oriented Outcomes from Case Series Studies - Proximal Humerus (continued)

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
Blood Loss (cc)	n/a	113 (range: 50-250)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Blood Loss (g/dL)	n/a	2.8	n/a	20	Koukakis et al ¹⁷ 2006	IV
DASH score	nr	51.8 (SD: ±17.6)	n/a	27	Sharafeldin et al ²⁹ 2008	IV
DASH Score	12 months	21 (nr)	n/a	34	Laflamme et al ¹⁹ 2008	IV
DASH Score	Final Follow-up	26.2 (SD: ±26.5)	n/a	34	Laflamme et al ¹⁹ 2008	IV
Quick DASH	12 months	15 (nr)	n/a	53	Owsley et al ²² 2008	IV
Quick DASH-S	12 months	7 (nr)	n/a	53	Owsley et al ²² 2008	IV
Quick DASH-W	12 months	11 (nr)	n/a	53	Owsley et al ²² 2008	IV
Hospitalized (days)	nr	5 (range: 0-174)	n/a	27	Sharafeldin et al ²⁹ 2008	IV
Operative Time (minutes)	n/a	75 (range: 60-120)	n/a	20	Koukakis et al ¹⁷ 2006	IV
Operative Time (minutes)	n/a	53 (range: 28-135)	n/a	34	Laflamme et al ¹⁹ 2008	IV
SF-36 – Function	nr	88.0 (SD: ±18.5)	n/a	27	Sharafeldin et al ²⁹ 2008	IV
SF-36 – Physical	nr	68.7 (SD: ±28.1)	n/a	27	Sharafeldin et al ²⁹ 2008	IV
SMFA	12 months	47 (range: 34-94)	n/a	53	Owsley et al ²² 2008	IV
SMFA-B	12 months	14 (nr)	n/a	53	Owsley et al ²² 2008	IV
SMFA-F	12 months	10 (nr)	n/a	53	Owsley et al ²² 2008	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 6. Patient Oriented Outcomes from Case Series Studies - Distal Femur

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
Blood Loss (cm ³)	n/a	373 (range: 50-3000)	n/a	99	Kregor et al ¹⁸ 2004	IV
Hospitalized (days)	n/a	22 (range: 5-61)	n/a	27	Fankhauser et al ⁸ 2004	IV
HSS – Excellent	Final Follow-up	n/a	24%	25	Syed et al ³² 2004	IV
HSS – Fair	Final Follow-up	n/a	16%	25	Syed et al ³² 2004	IV
HSS – Good	Final Follow-up	n/a	40%	25	Syed et al ³² 2004	IV
HSS – Poor	Final Follow-up	n/a	20%	25	Syed et al ³² 2004	IV
HSS Score	Final Follow-up	71.7 (nr)	n/a	25	Syed et al ³² 2004	IV
Knee Society Score	20 months	131 (range: 79-200)	n/a	27	Fankhauser et al ⁸ 2004	IV
Lysholm Score	3 months	48 (nr)	n/a	16	Markmiller et al ²⁰ 2004	IV
Lysholm Score	12 months	81 (nr)	n/a	16	Markmiller et al ²⁰ 2004	IV
Lysholm Score	20 months	71 (range: 43-100)	n/a	27	Fankhauser et al ⁸ 2004	IV
Lysholm Score – Excellent (80-100)	12 months	n/a	87.5%	16	Markmiller et al ²⁰ 2004	IV
Lysholm Score – Fair (70-79)	12 months	n/a	12.5%	16	Markmiller et al ²⁰ 2004	IV
Lysholm Score – Poor (<70)	12 months	n/a	0%	16	Markmiller et al ²⁰ 2004	IV
Operative Time (minutes)	n/a	183 (range: 52-540)	n/a	99	Kregor et al ¹⁸ 2004	IV
Operative Time (minutes)	n/a	155 (nr)	n/a	16	Markmiller et al ²⁰ 2004	IV
Operative Time (minutes)	n/a	96 (range: 40-300)	n/a	96	Schutz et al ²⁷ 2001 [†]	IV
Oxford Knee Score	23 months	46 (range: 22-60)	n/a	16	Wong et al ³³ 2005	IV
Pain Free	10 weeks	n/a	100%	18	Ricci et al ²³ 2004	IV
Pain – Absent	12 months	n/a	62.5%	16	Markmiller et al ²⁰ 2004	IV
Pain – Absent	20 months	n/a	22%	27	Fankhauser et al ⁸ 2004	IV
Pain – Absent	23 months	n/a	56%	16	Wong et al ³³ 2005	IV
Pain – At Rest	23 months	n/a	12.5%	16	Wong et al ³³ 2005	IV
Pain – Slight	20 months	n/a	37%	27	Fankhauser et al ⁸ 2004	IV
Pain – Occasional Moderate	20 months	n/a	33%	27	Fankhauser et al ⁸ 2004	IV
Pain – Constant Moderate	20 months	n/a	8%	27	Fankhauser et al ⁸ 2004	IV
Pain – On Loading	12 months	n/a	37.5%	16	Markmiller et al ²⁰ 2004	IV
Pain – Weight Bearing	23 months	n/a	19%	16	Wong et al ³³ 2005	IV
Pain – Requiring Oral Analgesic	23 months	n/a	12.5%	16	Wong et al ³³ 2005	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

† The Schutz, et al 2005 study is a subgroup analysis of the Schutz, et al 2001 study.

Table 6. Patient Oriented Outcomes from Case Series Studies - Distal Femur (continued)

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
SF-36 – Mental	30 months	54.8 (SD: ±2.9)	n/a	18	Ricci et al ²³ 2004	IV
SF-36 – Physical	30 months	53.6 (SD: ±4.7)	n/a	18	Ricci et al ²³ 2004	IV
Weight Bearing - Full (weeks)	n/a	nr (range: 6-18)	n/a	27	Fankhauser et al ⁸ 2004	IV
Weight Bearing - Full (weeks)	n/a	12 (range: 5-24)	n/a	99	Kregor et al ¹⁸ 2004	IV
Weight Bearing - Full	12 months	n/a	92%	52	Schutz et al ²⁸ 2005 [†]	IV
Weight Bearing - Partial	12 months	n/a	6%	52	Schutz et al ²⁸ 2005 [†]	IV
Weight Bearing - None	12 months	n/a	2%	52	Schutz et al ²⁸ 2005 [†]	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error † The Schutz, et al 2005 study is a subgroup analysis of the Schutz, et al 2001 study.

Table 7. Patient Oriented Outcomes from Case Series Studies - Periprosthetic Femur

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
Blood Loss < 50 ml	n/a	n/a	100%	24	Fulkerson et al ⁹ 2007	IV
d'Aubigne and Postel Score – Gait	nr	5.0 (nr)	n/a	14	Buttaro et al ³ 2007	IV
d'Aubigne and Postel Score – Mobility	nr	5.4 (nr)	n/a	14	Buttaro et al ³ 2007	IV
d'Aubigne and Postel Score - Pain	nr	5.8 (nr)	n/a	14	Buttaro et al ³ 2007	IV
Hospitalized (days)	n/a	14.5 (nr)	n/a	24	Erhardt et al ⁶ 2008	IV
Operative Time (minutes)	n/a	101 (range: 65-130)	n/a	14	Buttaro et al ³ 2007	IV
Operative Time (minutes)	n/a	104.5 (nr)	n/a	24	Erhardt et al ⁶ 2008	IV
Operative Time (minutes)	n/a	90 (range: 60-120)	n/a	24	Fulkerson et al ⁹ 2007	IV
Return to Previous Activities	Final Follow-up	n/a	91%	22	Erhardt et al ⁶ 2008	IV
Return to Previous Ambulatory Status	Final Follow-up	n/a	55%	20	Ricci et al ²⁴ 2006	IV
Subjective Contentment – High	Final Follow-up	n/a	90%	21	Erhardt et al ⁶ 2008	IV
Subjective Contentment – Medium	Final Follow-up	n/a	5%	21	Erhardt et al ⁶ 2008	IV
Subjective Contentment – Low	Final Follow-up	n/a	5%	21	Erhardt et al ⁶ 2008	IV
Time to Weight Bearing (weeks)	n/a	13 (range: 8-18)	n/a	22	Ricci et al ²⁴ 2006	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 8. Patient Oriented Outcomes from Case Series Studies - Tibial Plateau

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
Operative Time (minutes)	n/a	124.5 (range: 45-390)	n/a	62	Gosling et al ¹¹ 2005	IV
SF-36 – Physical	6 months	29	n/a	33	Stannard et al ³¹ 2004	IV
SF-36 – Physical	12 months	40 (range: 24-60)	n/a	33	Stannard et al ³¹ 2004	IV
SF-36 – Mental	6 months	51 (nr)	n/a	33	Stannard et al ³¹ 2004	IV
SF-36 – Mental	12 months	52 (nr)	n/a	33	Stannard et al ³¹ 2004	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 9. Patient Oriented Outcomes from Case Series Studies - Proximal Tibia

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
HSS Score	3 years	79.3 (nr)	n/a	24	Boldin et al ² 2006	IV
Knee Society Score	3 years	84.2 (nr)	n/a	24	Boldin et al ² 2006	IV
Functional Score	3 years	85.6 (nr)	n/a	24	Boldin et al ² 2006	IV
Full Weight Bearing (weeks)	n/a	12.6 (range: 6-21)	n/a	75	Cole et al ⁴ 2004	IV
Operative Time (minutes)	n/a	122 (range: 65-160)	n/a	20	Schutz et al ²⁶ 2003	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 10. Patient Oriented Outcomes from Case Series Studies - Distal Tibia

Outcome Measure	Duration	Results		N	Author	Level of Evidence
		Mean (dispersion)	% of patients			
AOFAS Score	19 months	90 (nr)	n/a	42	Bahari et al ¹ 2007	IV
SF-36 Score	19 months	85 (nr)	n/a	42	Bahari et al ¹ 2007	IV

nr = not reported; n/a = not applicable; SD = standard deviation; SE = standard error

Table 11. Adverse Events and Complications - Proximal Humerus and Distal Radius

LP = Locking Plates patients NLP = Non-Locking Plates patients nr = Not Reported * author(s) report overall complications ** plate or screw failure/break *** author(s) did not specify deep/superficial **** patient underwent another surgical procedure due to implant				Complications (any)*	Avascular Necrosis	Extensor Tendon or Nerve Injury	Failure of Hardware**	Hemiarthroplasty	Heterotopic Ossification	Implant Removal	Implant Replaced	Infection, any***	Infection, Deep	Infection, Superficial	Nerve Palsy or Parasthesia	Redislocation	Reoperation****	Screw Pullout	Secondary Palmar Dislocation	Subacromial Impingement	Sudeck Syndrome	Tenosynovitis
Author	Level of Evidence	Application	N																			
Koshimune et al ¹⁶ 2005	II	Distal Radius (LP)	22	nr	nr	0%	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
		Distal Radius (NLP)	31	nr	nr	0%	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Hahnloser et al ¹² 1999	II	Distal Radius (LP)	21	14%	nr	nr	0%	nr	nr	19%	nr	0%	nr	nr	nr	nr	nr	nr	0%	nr	5%	10%
		Distal Radius (NLP)	24	0%	nr	nr	0%	nr	nr	4%	nr	0%	nr	nr	nr	nr	nr	nr	0%	nr	0%	0%
Egol et al ⁵ 2008	IV	Proximal Humerus	51	24%	4%	nr	4%	nr	2%	nr	nr	2%	nr	nr	nr	nr	16%	2%	nr	nr	nr	nr
Handschin et al ¹³ 2008	III	Proximal Humerus (LP)	31	16%	6%	nr	0%	nr	nr	6%	nr	nr	nr	nr	nr	3%	10%	nr	nr	6%	nr	nr
		Proximal Humerus (NLP)	60	15%	3%	nr	2%	nr	nr	7%	nr	nr	nr	nr	nr	2%	12%	nr	nr	3%	nr	nr
Hepp et al ¹⁴ 2008	IV	Proximal Humerus	83	nr	5%	nr	1%	nr	nr	1%	nr	nr	nr	nr	0%	nr	11%	nr	nr	2%	nr	nr
Lafamme et al ¹⁹ 2008	IV	Proximal Humerus	34	nr	0%	nr	0%	nr	nr	3%	nr	nr	nr	nr	0%	nr	6%	nr	nr	nr	nr	nr
Owsley et al ²² 2008	IV	Proximal Humerus	53	36%	4%	nr	0%	4%	nr	8%	nr	nr	nr	nr	nr	nr	13%	nr	nr	2%	nr	nr
Sharafeldin et al ²⁹ 2008	IV	Proximal Humerus	27	nr	nr	nr	4%	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Gardner et al ¹⁰ 2007	IV	Proximal Humerus	35	nr	nr	nr	nr	nr	nr	nr	3%	nr	nr	nr	nr	nr	11%	nr	nr	nr	nr	nr
Moonot et al ²¹ 2007	IV	Proximal Humerus	32	nr	3%	nr	3%	nr	nr	nr	nr	nr	nr	3%	3%	nr	9%	nr	nr	9%	nr	nr
Koukakis et al ¹⁷ 2006	IV	Proximal Humerus	20	nr	5%	nr	nr	nr	nr	5%	nr	nr	nr	5%	nr	nr	nr	nr	nr	0%	nr	nr
Fankhauser et al ⁷ 2005	IV	Proximal Humerus	28	nr	7%	nr	4%	nr	nr	4%	nr	nr	4%	nr	7%	nr	7%	nr	nr	14%	nr	nr

Table 12. Adverse Events and Complications - Distal Femur and Periprosthetic Femur

LP = Locking Plates patients NLP = Non-Locking Plates patients nr = Not Reported * author(s) report overall complications ** plate or screw failure/break *** author(s) did not specify deep/superficial **** patient underwent another surgical procedure due to implant				Complications (any)*	Compartment Syndrome	Deep Vein Thrombosis	Failure of Hardware**	Iliotibial Tract Pain	Implant Removal	Infection, any***	Infection, Deep	Infection, Superficial	Infection, MRSA	Instability	Pulmonary Embolism	Reoperation****	Revised to Amputation	Screw Pullout
Author	Level of Evidence	Application	N															
Schutz et al ²⁸ 2005†	IV	Distal Femur	52	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Wong et al ³³ 2005	IV	Distal Femur	16	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	13%	nr	nr
Fankhauser et al ⁸ 2004	IV	Distal Femur	27	nr	nr	nr	nr	26%	26%	nr	nr	nr	nr	22%	nr	11%	nr	nr
Kregor et al ¹⁸ 2004	IV	Distal Femur	99	9%	nr	nr	1%	nr	3%	nr	nr	nr	3%	nr	nr	nr	nr	5%
Markmiller et al ²⁰ 2004	IV	Distal Femur	16	nr	nr	nr	0%	nr	nr	nr	0%	nr	nr	nr	nr	nr	nr	nr
Ricci et al ²³ 2004	IV	Distal Femur	18	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Syed et al ³² 2004	IV	Distal Femur	25	nr	1%	nr	nr	nr	4%	nr	4%	8%	nr	nr	8%	12%	nr	nr
Schutz et al ²⁷ 2001†	IV	Distal Femur	96	nr	nr	1%	2%	nr	nr	4%	nr	nr	nr	nr	1%	22%	1%	nr
Erhardt et al ⁶ 2008	IV	Periprosthetic Femur	21	nr	nr	nr	14%	nr	nr	nr	nr	5%	nr	nr	nr	14%	nr	nr
Buttaro et al ³ 2007	IV	Periprosthetic Femur	14	nr	nr	nr	21%	nr	nr	nr	nr	nr	nr	nr	nr	29%	nr	nr
Fulkerson et al ⁹ 2007	IV	Periprosthetic Femur	24	29%	nr	nr	nr	nr	nr	nr	4%	nr	nr	nr	nr	25%	nr	nr
Ricci et al ²⁴ 2006	IV	Periprosthetic Femur	22	nr	nr	nr	0%	nr	nr	9%	nr	nr	nr	nr	nr	nr	nr	nr

† The Schutz, et al 2005 study is a subgroup analysis of the Schutz, et al 2001 study.

Table 13. Adverse Events and Complications - Tibial Plateau, Proximal Tibia, Distal Tibia

LP = Locking Plates patients NLP = Non-Locking Plates patients nr = Not Reported * author(s) report overall complications ** plate or screw failure/break *** author(s) did not specify deep/superficial **** patient underwent another surgical procedure due to implant				Complications (any)*	Compartment Syndrome	Deep Vein Thrombosis	Failure of Hardware**	Fasciotomy	Implant Pain	Implant Removal	Infection, any***	Infection, Deep	Infection, Superficial	Irritation from Hardware	Nerve Palsy	Pulmonary Embolism	Reoperation****	Revised to TKA	Revised to Amputation	Tenderness or Impingement	Wound Hematoma/Seroma	
Author	Level of Evidence	Application	N																			
Jiang et al ¹⁵ 2008	II	Tibial Plateau (LP)	41	63%	nr	2%	0%	nr	nr	17%	17%	7%	10%	12%	nr	nr	nr	nr	nr	nr	nr	24%
		Tibial Plateau (NLP)	43	49%	nr	5%	2%	nr	nr	9%	12%	5%	7%	0%	nr	nr	nr	nr	nr	nr	nr	22%
Gosling et al ¹¹ 2005	IV	Tibial Plateau	62	nr	nr	nr	nr	nr	nr	2%	nr	2%	6%	nr	nr	nr	nr	nr	nr	nr	nr	nr
Stannard et al ³¹ 2004	IV	Tibial Plateau	33	nr	nr	nr	18%	nr	nr	30%	nr	nr	6%	6%	nr	nr	3%	nr	nr	nr	nr	nr
Boldin et al ² 2006	IV	Proximal Tibia	24	nr	nr	nr	nr	nr	nr	8%	0%	nr	nr	8%	nr	nr	nr	4%	nr	nr	nr	nr
Cole et al ⁴ 2004	IV	Proximal Tibia	75	nr	nr	nr	3%	nr	nr	13%	nr	3%	nr	5%	3%	nr	13%	nr	nr	nr	nr	4%
Ricci et al ²⁵ 2004	IV	Proximal Tibia	38	nr	5%	nr	nr	11%	5%	5%	0%	nr	nr	nr	nr	nr	nr	3%	nr	nr	nr	nr
Schutz et al ²⁶ 2003	IV	Proximal Tibia	20	nr	nr	nr	nr	nr	nr	nr	5%	nr	nr	nr	nr	nr	15%	nr	nr	nr	nr	nr
Stannard et al ³⁰ 2003	IV	Proximal Tibia	32	nr	nr	nr	nr	nr	nr	nr	nr	6%	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Bahari et al ¹ 2007	IV	Distal Tibia	42	nr	nr	nr	2%	nr	nr	7%	nr	2%	5%	nr	nr	nr	nr	nr	nr	nr	12%	nr

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