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| **Table 2. Study Characteristics** | | | | | |
| **Study** | **Risk of Bias** | **Sample Description** | **Intervention(s)** | **Comparison(s)** | **Participant Number** |
| **Adie et al50**  **2012**  **Systematic Review** | Low | Primary TKA for OA  Mean age across studies  64.2 to 73.8 | Cryotherapy alone  (Cryotherapy defined as ice packs, cooling pads, or other cold devices within 48 hours of surgery) | compression only | **# studies /outcome**  Pain POD1=6 |
| nothing | Pain POD2=4 |
| Cryotherapy with compression | compression only | Pain POD3=6 |
| nothing | Knee flexion POD1-6=6 |
| Knee flexion discharge=2 |
| Swelling=4 |
| LOS=5 |
| **Alaca et al29**  **2015** | Moderate | TKA  Mean age  I: 68.7  C: 68.1 | Standard TKA program followed by PNF exercise to involved LE 1x/d starting POD1 | Standard TKA program and CPM | I: 15  C:15 |
| **Alkire & Swank28**  **2010**  **RCT** | High | TKA  Mean age I: 65.6  C: 66.9 | CPM 3X/d  PT 2x/d | No CPM  PT 2x/d | I: 33  C: 32 |

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| **Beaupre et al55**  **2001**  **RCT** | Low | TKA  Mean age  68.4 | **I1:** slider board and standard exercise  2, 10 min sessions/day, independently | Exercise only  Exercises walking as tolerated with assistive deviceactive  ROM using slider board 10-15 min, short-arc quad ex  Isometric knee extension  SLR after 4 days  Stairs after 4 days | I1: 38  I2: 40  C: 39 |
| **I2:** CPM and standard exercise  CPM= 3, 2 hr sessions/day with ROM increasing daily  All: Exercises walking as tolerated with assistive deviceactive  ROM using slider board 10-15 minshort-arc quad ex  Isometric knee extension  SLR after 4 days  Stairs after 4 days |

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| **Bennett et al27**  **2005 ‘**  **RCT** | Moderate | TKA  Mean age  I1: 70.7  I2:71.4  C: 71.7 | **I1:** CPM in recovery; 0-40 degrees for 3 hours  POD 0: CPM 0-45 degrees in am for 3 hours and afternoon at 0-50 degrees for 3 hours  POD1-4 CPM increased 5 degrees twice a day until stopped at POD5  **I2**: CPM in recovery, cycled 50-90 degrees for 3 hours, knee rested at 90 degrees flexion overnight  POD1: CPM 40-90 degrees for 3 hours in AM; rest at 90 degrees on CPM; then 30-90 degrees in PM for 3 hours; rest at 90 degrees overnight  POD2 CPM 20-90 degrees for 3 hrs AM and 10-90 PM; extension splint at night  POD3-5: CPM 0- 90 degrees 3 hours AM and PM  knee splint at night | Exercise only 30 min 2x/d  Exercise=  Active ankle  Isometric quad sets  Active/active-assist short arc quads  Isometric gluteal  Active hip/knee flex on slider board then over side of bed  Transfers  Walking  Stairs | I1: 47  I2: 48 C: 52 |
| All: exercise program beginning POD1 |
| **Boese et al30**  **2014**  **RCT** | High | TKA  Mean age I: 69.1 C1: 66,7 C2: 68.3 | CPM immediately postop  0-110 degrees, adjusted per pt. tolerance daily for minimum 5 hrs minimum of 2 days  Continued until 90 degrees knee flexion achieved  PT 2x/d:  AROM of knee, hip, ankle  Walking;  Rocking chair;  Sand bag on knee to hold in extension | **C1**: CPM immediately postop at ~90 degrees and held for 8-19 hrs  PT 2x/d:  All subsequent days=same as I group. | I: 55 C1: 51 C2: 54 |
| **C:2**: No CPM  PT 2x/d only  All subsequent days=same as I group. |
| **Borckardt et al36**  **2013**  **RCT** | Low | TKA  Mean age  67.0 | Transcranial direct current stimulation in PACU,  4 hours later, am postop day 1, pm postop day 1;  20 min @2mA on BA9 and C1h/C2h | Sham tDCS=electrodes placed;  Output @ 2mA for 30 seconds, then off for remainder of 20 min. | I: 20 C: 20 |
| **Bruun-Olsen et al56**  **2009**  **RCT** | High | TKA  Mean age I :68 C: 71 | CPM plus active exercises  Ex=30 min/d active exercise, transfer training, gait training | Active exercises alone | I: 30 C: 33 |

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| **Chang et al39** | Low | TKA  Mean age  I: 71.23  C: 70.74 | Auricular acupressure  3 min/point, 3x/d, for 3 d | Sham acupressure | | I: 31  C:31 |
| **Demoulin et al45**  **2012**  **RCT** | Moderate | TKA  Age range  40-85 | Gaseous cryotherapy (hyperbaric CO2)  Sprayed on 3X/day  90 sec internal side of knee; 30 sec lateral side of knee, 30 sec popliteal fossa  PT 30 min/d:  knee mobilization, muscle strengthening gait training. | **C1:** cold pack over knee 5x/day, 20 min  PT 30 min/d | | I: 22  C1: 22  C2: 22 |
| **C2:** Cryocuff over knee 5x/day, 20 min  PT 30 min/d | |
| **Den Hertog et al40**  **2012** | Moderate | TKA  Mean age  I:66.6  C:68.3 | Mobilization on POD0  positive and competitive messages to pt; PT 2 hr/d with walking exercises, passive knee ROM strengthening of the lower limb  muscles, respiratory training; focus on ADL | Mobilization on POD2  PT 1hr/d walking exercises, passive knee ROM strengthening of the lower limb  muscles, respiratory training | | I:74  C:73 |
| **Denis et al57**  **2006**  **RCT** | Low | TKA  Mean age I1: 69.6 I2: 68.4 C: 67.1 | **I1:**CPM starting POD2; 35 min/d; 35-45 deg; increasing based on flex ROM + PT  **I2**: CPM starting POD2; 2 continuous hrs/d; 35-45 deg; increasing based on flex ROM + PT | PT only: supervised sessions of cardio/pulm ex; active and passive knee, hip ROM; transfer training and walking | | I1: 26  I2: 28  C: 27 |
| **Ebert et al54**  **2013**  **RCT** | Low | TKA  Mean age  I= 70.8 C=69.2 | MLD 30 min postop day 2,3,4.  Knee ROM; 10 repetitions, 3x daily  Cryotherapy for 20 min 3 to 4x daily  CPM 1 hour, 2x daily | Knee ROM exercises; 10 repetitions,  3x daily; | | I= 26 C= 24 |
| **He et al18**  **2013**  **RCT** | Low | TKA  Mean age I:62.56 C:61.58 | Auricular acupressure  Imbedded seed in ear  4 acupuncture points in ipsilateral ear: knee joint, shenmen, subcortex, sympathesis  Pressure on each point with fingers for 3 min, 4x/d for 7 days | Auricular acupressure  Imbedded seed in ear  4 non-acupuncture points ion helix of ipsilateral ear  Pressure on each point with fingers for 3 min, 4x/d for 7 days | | I:45 C:45 |
| **Kim et al18**  **2009**  **RCT** | High | Bilateral TKA  Mean age  67.9 | PROM provided by PT for first TKA  Plus CPM 50 min/day;  Quad strengthening;  Gait training,  AROM | No PROM for second TKA on other side | | N=53  106 knees |
| **Labraca et al53**  **2011**  **RCT** | Low | TKA  Mean age  I:65.5  C:66.4 | Rehabilitation  started within 24 hours post-surgery  Rehabilitation=  Active, active assisted and passive exercises of knee, ankle and hip; transfer training; walking; stairs | Rehabilitation (same as intervention group) started 48-72 hours post-surgery | | I:138  C:135 |
| **Lang19**  **1998**  **Quasi-experimental** | High | TKA  Mean age  I=68.9  C=67.6 | 7 Days  Therapy:  CPM 3x/day  Exercise and precautions education  Gait training  Stair training  Care giver education | 6 Days  Therapy: same as intervention group | | I=25  C=23 |
| **Lau and Chiu31**  **2001**  **Quasi-experimental** | High | Unilateral or bilateral TKA  Mean Age  69.5 | CPM  23 hrs/d  6 d | Immobilization for 6 d | | N = 48  N=17 with bilateral served as own controls |
| **Leach et al32**  **2006**  **RCT** | Moderate | TKA  Mean age  I=71.2  C=72.9 | CPM: POD1, 0-30 degrees, 1hr, 2x/d  Increased by 10 degrees each day  PT POD1 slider board used independently  quad strengthening  POD3 walking | No CPM  PT POD1: :Slider board quad strengthening  POD3: Walking | | I=38  C=44 |
| **Lenssen et al52**  **2006**  **RCT** | Low | TKA  Mean age  I=70  C=67 | PT 2x/d, 40 minutes daily total  PT: active and passive ROM of  the knee, quadriceps strengthening;  transfer training; walking;  stair climbing | PT (same as intervention group) 1x/d, 20 minutes daily total | | I: 21 C: 22 |
| **Maniar et al46**  **2012**  **RCT** | High | TKA  Mean Age  I1: 66.81 I2:66.06 C: 67.42 | **I1:** One day of CPM  **I2:** Three days of CPM | No CPM | | I1: 28 I2: 30 C: 28 |
| **Mau-Moeller et al44**  **2014**  **RCT** | Moderate | TKA  Mean age  67.95 | Sling exercise training | Continuous passive motion (CPM) | | I=19  C=19 |
| **Munk et al47**  **2002**  **RCT** | Moderate | TKA  Mean age  I: 65,  C: 63 | Medical elastic compression stocking. | | No stocking. | I: 43 C: 42 |
| **Ni et al51**  **2015**  **Systematic Review** | Moderate | TKA | Cryotherapy | | Any comparison | **# studies /outcome**  Pain on POD1: 7 studies, 469 TKAs |
| Pain on POD2: 4 studies, 262 TKAs |
| POD3: 5 studies, 371 TKAs |
| **Nigam etal20**  **2011**  **RCT** | High | TKA  Mean age  I: 67.9  C: 69.3; | Non-invasive, interactive Neurostimulation using InterX  Plus ‘Standard’ rehabilitation  3d  2-3x/d  20 min  36 electrodes in contact with skin  intensity strong but comfortable  Preset pulses/sec (1 or 4) | Standard rehabilitation  Chair transfer  Walking with device  ROM exercises; stairs  Car transfers  3 d  2x/d | | I: 30  C: 31 |
| **Pereira and Jolles33** | Moderate | TKA  Mean age  71.1 | A+ mobilization for knee flexion and extension 2x/d from POD1 to POD7; plus  Standard care | Standard care only | | I: 19  C: 21 |
| **Pichonnaz et al48**  **2016**  **RCT** | High | TKA  Mean age  I:70.1  C: 71.3 | Manual lymphatic drainage 30 min from POD2 and POD7 plus standard rehabilitation program 2x/d (active, active-assistive, and muscle strengthening exercises, CPM, weight-bearing on POD2, ice) | Relaxation exercise sessions plus standard rehabilitation | | I: 30  C: 30 |

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| **Pongkunakorn and Sawatphap22**  **2014**  **Quasi-experimental** | High | TKA  Mean age  I: 67.0  C: 68.5 | Drop and dangle operative leg over side of bed while sitting; passively flexing by pushing on the leg with opposite foot; followed by active extension with assistance by pushing with opposite foot on the calf  1 hr, 3x/d | CPM starting from 0 to 60 degrees and increasing by 15 degrees or more each day as tolerated.  1 hr, 3x/d | | | | I: 36  C: 33 |
| **Pope et al21**  **1997**  **RCT** | High | TKA  Mean age  I1: 72.5 I2: 72.7 C: 69.6 | **I1:** CPM 0 to 40 degrees  **I2:** CPM 0-70 degrees | No CPM | | | | I1:19 I2: 18 C: 20 |
| **Pua et al23**  **2014**  **Quasi-Experimental** | High | TKA  Mean age  I:66.1  C: 66.8 | Ambulation on POD1 plus standard physiotherapy (knee ROM and strengthening) | Ambulation on POD2 plus standard physiotherapy (knee ROM and strengthening) | | | | I: 803  C: 701 |
| **Rakel et al41**  **2014**  **RCT** | Low | TKA  Mean age  I:63  C1:62  C2:62 | TENS  Continuous, frequency of 150pps, duration 150μsec  Applied 20 min prior to and during exercise session  Exercise session: flexibility, strengthening and endurance  1-2x/d | **C1**: placebo TENS with exercise session  **C2:** exercise sessions and standard pharmacological management of pain | | | | I: 122  C1: 128  C2:72 |
| **Renkawitz et al24**  **2010**  **Controlled Trial** | High | TKA  Mean age  I:67.0  C:68.1 | Optimized accelerated clinical pathway | Standard accelerated clinical pathway | | | | I:76  C:67 |
| **Starks et al25**  **2014**  **Quasi-experimental (historical comparison group)** | High | TKA  Mean Age  I:71  C:72 | Enhanced Recovery Pathway | Standard Care | | | | I:1,245  C:1,099 |
| **Thienpont26**  **2013**  **RCT** | High | TKA  Mean Age  I:67.5  C:68.5 | Advanced Cryotherapy: computer assisted device for continuous cold therapy at 11 degrees C  Full weight-bearing and active ROM POD1 | Cold Pack: intermittent cold at -17 degree C for 15 min  Full weight-bearing and active ROM POD1 | | | | I:58  C:58 |
| **Tsang et al38**  **2007**  **RCT** | Low | Bilateral TKA  Mean age  I:70.6 C:66.1 | Acupuncture start POD4  Points=ST32, ST33, GB31, GB35, GB34, ST36  13-25mm deep manipulated until numbness and tingling, every 5 min for 20 min  breathing exercises  active and passive lower limb exercises  ice  Quadriceps strengthening exercise  NEMS if quad strength<3  Full weight-bearing ambulation with assistive device | | | Sham acupuncture start POD4  2 cms away from points=ST32, ST33, GB31, GB35, GB34, ST36  <5mm deep not manipulated  Breathing exercises  Active and passive lower limb exercises  Ice  Quadriceps strengthening exercise  NMES if quad strength<3  Full weight-bearing ambulation with assistive device | | I: 18  C: 18 |
| **Wang, et al34**  **2015**  **RCT** | Moderate | Elective TKA  Mean age  C: 71.7  I: 73.5 | CPM with 30 min biofeedback –assisted progressive muscle relaxation training | | | CPM without biofeedback therapy | | C: 33  I: 33 |
| **Wanich, et al43**  **2011**  **RCT** | Moderate | TKA | Percutaneous neuromodulation beginning 36 to 48 hrs post-op.  2x/d, 30 min, strong intensity per patient sensation  CPM 2x day  Physical therapy | | Sham percutaneous neuromodulation beginning 36 to 48 hrs post-op.  2x/d, 30 min, strong intensity per patient sensation  CPM 2x day  Physical therapy | | | I: 13  C: 10 |
| **Yang et al35**  **2013**  **RCT** | Moderate | TKA | **I1:**TCM, CPM, PT, NSAIDS  **I2:** TCM, CPM, NSAIDS  TCM: rotate skin and muscle of thigh inward with push/pull along hip; mobilize hip, foot, ankle with rotating and shaking; acupressure or massage calf, leg, thigh, gluteal and lower back; slow mobilization of knee as tolerated (3-5x)  CPM= 8 hrs/d  PT= daily, isotonic, isometric knee and hip muscles; walking with device and weight-bearing; transfers | | C:PT,CPM, NSAIDs | | | I1: 13  I2:11  C: 17 |
| Mean age I1: 70.9 I2: 68 C: 69.5 |
| **Yashar et al49**  **1997**  **RCT** | Moderate | Bilateral or unilateral TKA  Mean age I: 69.8 C: 69.1 | CPM with accelerated flexion beginning in PACU  70-100 degrees of motion for 24 hrs  40-100 degrees of motion after 24 hrs  Progressed as tolerated  PT with emphasis on walking and ROM | | Knee immobilizer for 24 hrs postop;  CPM 0-30 degree starting POD1;  Progressing 10 to 15 degrees per day as tolerated  PT with emphasis on walking and ROM | | I: 104 C: 106 | |
| **Zietek, et al42**  **2015**  **RCT** | Moderate | TKA  Mean Age C:70 I:68 | Two 15 minute walks, 4 to 6 hours after recovery from anesthesia  Active and passive exercises, transfers, full weight bearing on POD1, stairs on POD2; cold | | One 15-minute walk, 4 to 6 hours after recovery from anesthesia  Active and passive exercises, transfers, full weight bearing on POD1, stairs on POD2; cold | | I:31  C:31 | |

Abbreviations: AROM: active range of motion; C: comparison group; CPM: continuous passive motion; d: day; I: intervention group; hr: hour; MLD: manual lymphatic drainage; NMES: neuromuscular electrical stimulation NSAIDS: non-steroidal anti-inflammatory drugs; OA: osteoarthritis; PACU: post-anesthesia care unit; PCA: patient controlled analgesia; preop: pre-operative; POD: post-operative day; postop: post-operatively; PROM: passive range of motion; pt: patient; PT: physical therapy; RA: rheumatoid arthritis; RCT: randomized controlled trial; ROM: range of motion; sec: second; TCM: traditional Chinese medicine; TKA: total knee arthroplasty