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| Appendix 4. Summary of the literature evaluating soft tissue injections. | | | | | | |
| **Author/Year** | **Target** | **Study Design** | **Level of Evidence** | **Subject Type/Number** | **Accuracy Confirmation** | **Outcome** |
| Ucuncu 2009[121](#_ENREF_121) | SA-SD bursa | Prospective, randomized comparison study of USGI vs. LMGI efficacy | Level 2 | 60 live human subjects | None | USGI = more improvement and pain relief than LMGI |
| Zufferey 2012[51](#_ENREF_51) | SA-SD bursa | Prospective, randomized comparison study of USGI vs. LMGI efficacy | Level 2 | 67 live human subjects | None | USGI = had less pain at rest and more responders than LMGI at 2 and 6 week follow-up. No difference between groups in daytime and night pain or functional improvement |
| Naredo 2004[54](#_ENREF_54) | SA-SD bursa | Prospective, randomized comparison study of USGI vs. LMGI efficacy | Level 2 | 41 live human subjects | None | USGI = significantly greater improvement in pain and function than LMGI group |
| Hanchard 2006[17](#_ENREF_17) | SA-SD bursa | Cadaveric LMGI accuracy | Level 2 | 5 cadaveric specimens | Dissection | LMGI = 72% accurate |
| Hashiuchi 2011[99](#_ENREF_99) | BT sheath | Prospective, randomized comparison study of USGI vs LMGI accuracy | Level 1 | 30 live human subjects | CT arthrogram | USGI = 87% accurate, LMGI = 26.7% accurate |
| Peck 2011[114](#_ENREF_114) | DPC, SPC | Cadaveric USGI vs. LMGI accuracy | Level 2 | 20 cadaveric specimens | Dissection | USGI DPC = 88% accurate, LMGI DPC = 90% accurate, USGI and LMGI SPC = 100% accurate |
| Kang 2008[105](#_ENREF_105) | SA-SD bursa | Prospective study evaluating LMGI accuracy and efficacy of accurate vs. inaccurate injections | Level 2 | 60 live human subjects | Bursogram | LMGI = 70% accurate, Accurate injections had significantly more pain reduction on Neer’s impingement test immediately post-injection, no difference in efficacy between accurate and inaccurate injections at 3 month follow-up |
| Mathews 2005[110](#_ENREF_110) | SA-SD bursa | Cadaveric LMGI accuracy | Level 2 | 20 cadaveric specimens | Bursogram, dissection | LMGI anterolateral approach = 90% accurate when graded by burosgram, but after anatomic dissection, only 60% of injections were accurate. LMGI posterior approach = 80% accurate |
| Henkus 2006[101](#_ENREF_101) | SA-SD bursa | Prospective, randomized LMGI accuracy | Level 1 | 33 live human subjects | MRI arthrogram | LMGI = 69% and 76% accurate depending on approach |
| Reach 2009[71](#_ENREF_71) | Achilles peri-tendinous space, FHL tendon sheath, TP tendon sheath | Cadaveric USGI accuracy | Level 2 | 10 cadaveric specimens | Dissection | USGI = 100% accurate |
| Finnoff 2008[97](#_ENREF_97) | Piriformis | Cadaveric USGI vs. FGI accuracy | Level 2 | 10 cadaveric specimens | Dissection | USGI = 95% accurate, FGI = 30% accurate |
| Finnoff 2010[98](#_ENREF_98) | Pes Anserinus bursa | Cadaveric USGI vs. LMGI accuracy | Level 2 | 24 cadaveric specimens | Dissection | USGI = 92% accurate, LMGI = 17% accurate |
| Dogu 2012[91](#_ENREF_91) | SA-SD bursa | Prospective, randomized comparison study of USGI vs. LMGI accuracy and efficacy | Level 2 | 46 live human subjects | MRI arthrogram | USGI = 65% accurate, LMGI = 70% accurate, no difference in efficacy between accurate and inaccurate injections |
| Hashiuchi 2010[100](#_ENREF_100) | SA-SD bursa | Prospective study comparing pain relief following local anesthetic injection with USG vs. LMG | Level 2 | 16 live human subjects | None | USGI = more pain relief than LMGI |
| Eustace 1997[93](#_ENREF_93) | SA-SD bursa | Prospective study comparing efficacy of accurate vs. inaccurate LMGI | Level 2 | 37 live human subjects | Arthrogram | LMGI = 29% accurate, Accurate injections = more pain relief and functional improvement at 2 week follow-up |
| Yucel 2009[125](#_ENREF_125) | Plantar fascia | Prospective, randomized comparison of USGI vs. LMGI vs. SGI efficacy | Level 2 | 27 live human subjects | None | No significant difference in efficacy between the three techniques |
| Di Geso 2012[89](#_ENREF_89) | Finger flexor, finger extensor, extensor carpi ulnaris, peroneal, and TP tendons | Prospective USGI accuracy and efficacy | Level 4 | 30 live human subjects | Ultrasound | USGI = 100% accurate, 100% had significant improvement in clinical measures and sonographic findings |
| Partington 1998[69](#_ENREF_69) | SA-SD bursa | Cadaveric LMGI accuracy | Level 2 | 12 cadaveric specimens | Dissection | LMGI = 83% accurate |
| Farshad 2012[95](#_ENREF_95) | SA-SD bursa | Human LMGI accuracy | Level 2 | 10 live human subjects | Ultrasound | LMGI = 90% accurate |
| Labrosse 2010[107](#_ENREF_107) | Gluteus medius tendon | Prospective USGI efficacy | Level 4 | 54 live human subjects | None | At 1 month follow-up, 72% of patients = clinically significant pain reduction, 70% satisfied with treatment |
| Kume 2012[106](#_ENREF_106) | DeQuervain’s tenosynovitis | Prospective, randomized comparison between USGI vs. LMGI efficacy | Level 2 | 44 live human subjects | None | USGI = more significant pain relief at 4 week follow-up than LMGI |
| Rutten 2007[115](#_ENREF_115) | SA-SD bursa | Prospective, randomized comparison between USGI vs. LMGI accuracy | Level 1 | 20 live human subjects | MRI arthrogram | USGI and LMGI = 100% accurate |
| Hsieh 2013[103](#_ENREF_103) | SA-SD bursa | Prospective, randomized comparison between USGI vs. LMGI efficacy | Level 2 | 92 live human subjects | None | USGI = significantly more improvement in shoulder range of motion, and physical functioning and vitality scores on the SF-36 than LMGI |
| Bandinelli 2012[84](#_ENREF_84) | Baker’s cyst | Prospective comparison USG Baker’s cyst aspiration followed by Baker’s cyst injection or knee injection | Level 2 | 40 live human subjects | None | USGI Baker’s cyst aspiration followed by Baker’s cyst injection = greater reduction in Baker’s cyst size and improvement in function than Baker’s cyst aspiration followed by knee injection |
| Makhlouf 2013[109](#_ENREF_109) | Carpal tunnel | Prospective, randomized comparison of USGI vs LMGI efficacy | Level 2 | 77 live human subjects | None | USGI = significantly less procedural pain and more pain reduction than LMGI |
| Chavez-Chiang 2010[85](#_ENREF_85) | Carpal tunnel | Prospective, randomized comparison of USGI vs LMGI efficacy | Level 2 | 76 live human subjects | None | USGI = significantly less procedural pain, more clinical improvement and less expense than LMGI |
| Tsai 2006[119](#_ENREF_119) | Plantar fascia | Prospective, randomized comparison of USGI vs. LMGI efficacy | Level 2 | 25 live human subjects | None | USGI = significantly less recurrence than LMGI, but no differences in pain or structural improvement |
| Smith 2012[118](#_ENREF_118) | OI muscle and bursa | Cadaveric USGI accuracy | Level 2 | 5 cadaveric specimens | Dissection | USGI = 100% accurate |
| Housner 2009[102](#_ENREF_102) | Patellar, Achilles, gluteus medius, iliotibial tract, hamstring, common extensor (elbow), and rectus femoris tendons | Prospective USGI efficacy of needle tenotomy | Level 4 | 13 live human subjects (14 tendons) | None | USGI = significant reductions in pain at 4 and 12 week follow-up |
| McShane 2008[112](#_ENREF_112) | Common extensor (elbow) tendon | Prospective USGI efficacy of needle tenotomy | Level 4 | 57 live human subjects | None | USGI = good to excellent outcomes in 92% of subjects and 90% subjects were satisfied at average 22 month follow-up |
| Smith 2010[116](#_ENREF_116) | Popliteus tendon sheath | Cadaveric USGI accuracy | Level 2 | 24 cadaveric specimens | Dissection | USGI = 83% or 100% accurate, depending on approach |
| Lee 2011[108](#_ENREF_108) | Finger flexor tendon sheath | Cadaveric USGI vs. LMGI accuracy | Level 2 | 5 cadaveric specimens (40 fingers) | Dissection | USGI = 70% accurate, LMGI = 15% accurate |
| Ekeberg 2009[92](#_ENREF_92) | SA-SD bursa | Prospective, randomized comparison of USGI vs. systemic steroid administration efficacy | Level 2 | 106 live human subjects | None | USGI = significantly more improvement in primary outcome measures at 6 week follow-up than LMGI, No between group differences in secondary outcomes of range of motion or 2 pain assessments |
| Muir 2011[113](#_ENREF_113) | Peroneal tendon sheath | Cadaveric USGI vs. LMGI accuracy | Level 2 | 20 cadaveric specimens | Dissection | USGI = 100% accurate, LMGI = 60% accurate |
| Yoo 2010[124](#_ENREF_124) | Rotator cuff calcific tendinopathy | Prospective USG calcific aspiration and SA-SD bursa injection efficacy | Level 4 | 30 live human subjects (35 shoulders) | None | USG calcific aspiration and SA-SD bursa injection = significant improvement in pain and function in 71.4% of subjects at 6 month follow-up |
| Yamakado 2002[123](#_ENREF_123) | SA-SD bursa | Human LMGI accuracy | Level 2 | 53 live human subjects (56 shoulders) | Arthrogram | LMGI = 70% accurate |
| Finnoff 2011[96](#_ENREF_96) | Multiple upper and lower extremity tendons | Retrospective case series of efficacy of USG tenotomy (Part A) and prospective case series of structural changes following USG tenotomy (Part B) | Level 4 | 41 live human subjects (Part A), and 34 live human subjects (Part B) | None | USG tenotomy = 68% pain improvement and 83% patient satisfaction, 84% had improvement in echotexture |
| Fanucci 2004[94](#_ENREF_94) | Morton’s neuroma | Human USGI accuracy and efficacy | Level 2 = accuracy, Level 4 = efficacy | 40 live human subjects | Ultrasound | USGI = 100% accurate, 90% of patients had significant pain relief |
| Hughes 2007[104](#_ENREF_104) | Morton’s Neuroma | Human USGI accuracy and efficacy | Level 2 = accuracy, Level 4 = efficacy | 101 live human subjects | Ultrasound | USGI = 100% accurate, 94% of patients had significant pain relief |
| Tsai 2000[120](#_ENREF_120) | Plantar fascia | Human USGI efficacy | Level 4 | 14 live human subjects | None | USGI = significant improvement in pain and decreased plantar fascia thickness on ultrasound |
| Di Sante 2010[90](#_ENREF_90) | Baker’s cyst | Human USG aspiration and injection efficacy | Level 4 | 26 live human subjects | Ultrasound | USG aspiration and injection = significant reduction in cyst volume and pain reduction |
| McDermott 2012[111](#_ENREF_111) | De Quervain’s tenosynovitis | Human USGI efficacy | Level 4 | 40 live human subjects | None | USGI = significant improvement in 97% of subjects |
| Smith 2006[117](#_ENREF_117) | Piriformis | Cadaveric USGI accuracy | Level 4 | Cadaveric specimens (unknown number) | Dissection | USGI = accurate (accuracy rate not reported) |
| Chen 2013[86](#_ENREF_86) | Piriformis | Human study evaluating accuracy of USGI combined with EMG confirmation | Level 5 | 1 live human subject | EMG | USGI = 100% accurate |
| Chen 2006[87](#_ENREF_87) | SA-SD bursa | Human USGI vs. LMGI efficacy | Level 2 | 40 live human subjects | None | USGI = significantly more shoulder range of motion 1 week post-injection than LMGI |
| Balint 2002[52](#_ENREF_52) | Bursa, tendon sheath, cyst, wound | Comparison study between ability to aspirate joints with LMG vs. USG | Level 2 | 4 live human subjects | None | Ability to aspirate joints with USG = 100% |
| Wisniewski 2010[80](#_ENREF_80) | Sinus tarsi | Cadaveric USGI vs. LMGI accuracy | Level 2 | 20 cadaveric specimens (40 ankles) | Dissection | USGI = 90% accurate, LMGI = 35% accurate |
| Ustun 2013[122](#_ENREF_122) | Carpal Tunnel | Prospective randomized single blind comparison of USGI vs. LMGI efficacy | Level 2 | 46 live human subjects | None | USGI = significantly more clinical improvement than the LMGI group at 12 week follow-up |
| Chen 2013[88](#_ENREF_88) | Post-upper extremity amputation neuromas | Human USGI efficacy | Level 5 | 1 live human subject | None | USGI = significant pain reduction post-injection |
| USGI = ultrasound-guided injection, LMGI = landmark-guided injection, vs = versus, LMG = landmark-guided, USG = ultrasound-guided, SA-SD = subacromial-subdeltoid, FGI = Fluoroscopically guided contrast controlled injection, BT = biceps tendon, CT = computed tomography, DPC = deep posterior compartment, SPC = superficial posterior compartment, MRI = magnetic resonance image, TP = tibialis posterior, FHL = flexor hallucis longus, SGI = scintigraphy-guided injection, OI = obturator internus, MCL = medial collateral ligament, EMG = electromyography | | | | | | |