THE UNIVERSITY of NEW MEXICO
RHEUMATOLOGY

Enhanced Arthrocentesis of the Flexed Knee with Pneumatic Compression

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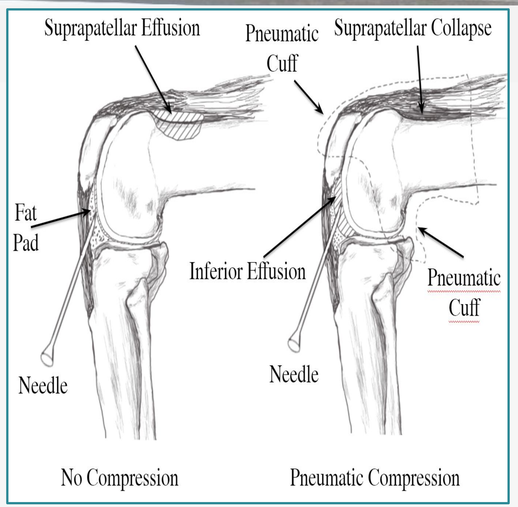
Background

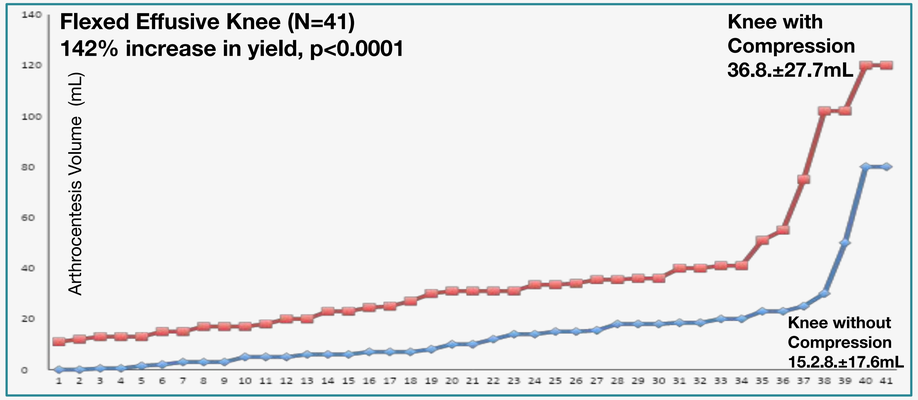
- Standard anatomic approach for arthrocentesis of the effusive knee is the **extended knee anteroateral access port** (1)
  - This approach is **highly accurate in the setting of a large joint effusion** (2)
  - **Limitations** with this approach are when there is minimal joint fluid, or if the patient wishes to remain seated, has flexion contractures of the knee, is confined to a wheelchair, or cannot lie supine (3)(4)
- Modified **arthrocentesis with a flexed knee** in a seated position has been **shown to have equal synovial fluid returns as the extended knee**(5)
- Meehan et al have demonstrated that **external compression of the knee can shift small volumes of synovial fluid into anterior knee access points**(6)
- We hypothesize that highly controllable pneumatic compression of suprapatellar bursa and patellofemoral joint of the flexed knee would also provide similar improved arthrocentesis success as the extended knee position.

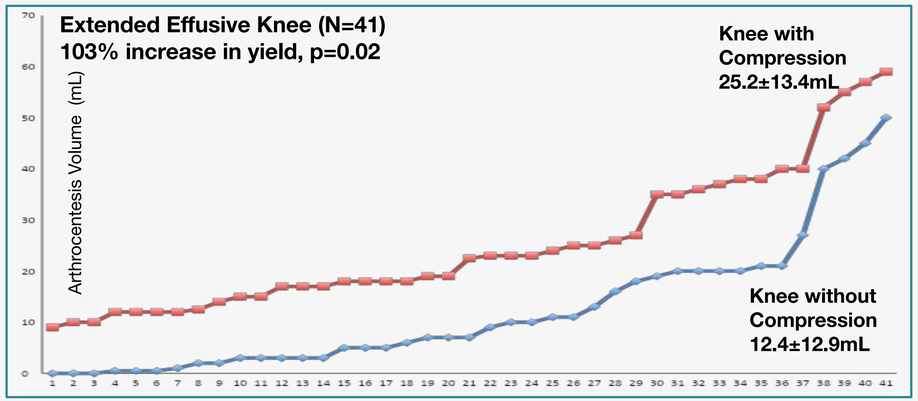
Methods

- **Eighty-two patients with effusive osteoarthritic knees** were included
- **Presence of a knee effusion was determined clinically** by palpation for suprapatellar bursa distention, ballottement of a floating patella, and fluid shift with asymmetric compression confirmed by physical examination.
- **Inclusion criteria** 1) the presence of a clinically palpable knee effusive, 2) indications for therapeutic-diagnostic arthrocentesis 3) formal signed consent of the patient to undergo the procedure
- **41 patients** underwent arthrocentesis with the **knee in the extended position without compression**, and **then mechanical compression using an elastomeric brace** was applied and arthrocentesis resumed
- **41 patients** underwent arthrocentesis with the **knee in the extended position without compression**, and **then mechanical compression using pneumatic compression** was applied and arthrocentesis resumed

- **Outcome Measures**
  - Patient pain was measured with Visual Analogue Pain Scale, prior to the procedure, during arthrocentesis, and immediately post procedure (post-procedural pain).
  - Aspirated fluid volume was quantified in milliliters (ml) for pre and post compression.







Results

	Extended Knee	Extended Knee with Compression	Flexed Knee	Flexed Knee with Compression
Number	41	41	41	41
Age	62.0±11.3	62.0±11.3	66.8±12.1	66.8±12.1
Male:Female Ratio	9:32 (65% female)	9:32 (65% female)	5:36 (89% female)	5:36 (89% female)
Preprocedure Pain	7.7± 1.1	7.7± 1.1	7.9 ± 1.5	7.9 ± 1.5 cm
Procedure Pain	2.4±1.5	2.4±1.5	4.4±2.2	4.4±2.2
Post-Procedure Pain	1.3±2.0	1.3±2.0	1.4±1.7	1.4±1.7
Diagnostic Arthrocentesis ≥ 3 ml	80 % (33/41)	100% (41/41)	85% (35/41)	100% (41/41)
Synovial Fluid Yields (ml)	12.4±12.9	25.2±13.4	21.6±17.6	36.8±27.7

Discussion

- Based on our findings, there is a significant quality improvement in arthrocentesis fluid yield and diagnostic success from compression of the knee similar.
- Compression of the effusive flexed knee with a suprapatellar pneumatic cuff markedly improves the success and fluid yield of arthrocentesis and is non-inferior to standard extended knee arthrocentesis with or without compression.
- Arthrocentesis of the flexed knee with pneumatic compression is especially useful in patients who wish to remain seated or who cannot extend their knee due to flexion contracture, wheelchair confinement, pain or severe arthritis.

References

1. Roberts W. Knee aspiration and injection. Phys Sports Med. 1998;26:93-4.
2. Jackson DW, Evans NA, Thomas BM. Accuracy of needle placement into the intra-articular space of the knee. J Bone Joint Surg Am. 2002;84:1522-1527.
3. Roberts WN. Primer: pitfalls of aspiration and injection. Nat Clin Pract Rheumatol. 2007;3:464-72.
4. Roberts WN, Hayes CW, Breitbach SA, Owen DS Jr. Dry taps and what to do about them: a pictorial essay on failed arthrocentesis of the knee. Am J Med. 1996;100:461-442.
5. Yaqub S, et al Can Diagnostic and Therapeutic Arthrocentesis Be Successfully Performed in the Flexed Knee? Clin Rheumatol. 2018 Sep;24(6):295-301. doi: 10.1097/RHU.0000000000000707.PMID: 29424762
6. Meehan R, Wilson C, Hoffman E, Altimier L, Kaessner M, Regan EA. Ultrasound measurement of knee synovial fluid during external pneumatic compression. J Orthop Res. 2019 Mar;37(3):601-608. doi: 10.1002/jor.24216. Epub 2019 Feb 12.PMID: 30644131