Inferomedial or Inferolateral Intra-articular Injections of the Knee to Minimize Pain Intensity

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The knee remains a common site for receiving intra-articular injections. One of the mainstays of nonoperative treatment of knee arthritis involves administration of corticosteroids or viscosupplementation agents via intra-articular injection. Many patients routinely receive corticosteroid injections 2 to 4 times annually. Thus, it is imperative that the practitioner perform these injections in the most atraumatic manner possible.

Historically, injections were administered with the knee in extension by suprapatellar techniques. More recently, with the common use of knee arthroscopy portals, infrapatellar techniques with the knee in flexion have often been alternatively used. However, there have been concerns that these infrapatellar injections may be a source of anterior knee pain by penetrating the fat pad or synovium. Conversely, suprapatellar injections may be painful because they can traverse the muscle and may be more difficult to perform. Furthermore, the accuracy in entering the joint using suprapatellar injections has been called into question.

In summary, there are multiple concerns about pain levels after injection and how accurately injection can be performed. Therefore, the authors’ purpose was to assess pain levels in a prospective, randomized trial using 3 injection sites—(1) suprapatellar, (2) medial infrapatellar, and (3) lateral infrapatellar—to determine if there was an optimal location for knee joint injection.

### Materials and Methods

Appropriate institutional review board approval was obtained for this study. There were 69 patients (69 knees) who underwent intra-articular injections. Patients were stratified by site, demographic, and disease characteristics. All injections were performed by 1 surgeon using a uniform technique. Pain severity was assessed before, 1 minute after, and 5 minutes after injection using a visual analog scale.

Mean visual analog scale scores for the lateral suprapatellar, medial infrapatellar, and lateral infrapatellar injection sites were 7, 4, and 2 points, respectively, but this was not statistically significant. These results suggest intra-articular injections should be administered from an inferomedial or infrolateral site to minimize pain intensity. [Orthopedics. 2016; 39(3):e578-e581.]

### Abstract

Pain levels of 3 knee intra-articular corticosteroid injection sites were assessed to determine if an optimal site exists. Patients were stratified by site, demographic, and disease characteristics. All injections were performed by 1 surgeon using a uniform technique. Pain severity was assessed before, 1 minute after, and 5 minutes after injection using a visual analog scale.

Mean visual analog scale scores for the lateral suprapatellar, medial infrapatellar, and lateral infrapatellar injection sites were 7, 4, and 2 points, respectively, but this was not statistically significant. These results suggest intra-articular injections should be administered from an inferomedial or infrolateral site to minimize pain intensity. [Orthopedics. 2016; 39(3):e578-e581.]
corticosteroid knee injections. These patients were randomized into 3 treatment groups based on the location of the injection: lateral suprapatellar (group 1), lateral infrapatellar (group 2), and medial infrapatellar (group 3) (Figure 1). Patients were asked to rate their pain using a visual analog scale (VAS), which is a validated 10-point Likert scale widely used to assess pain severity.\(^6\)

Patients were stratified by gender, underlying diagnosis, location of the osteoarthritic disease (medial vs lateral), and degree of radiographic joint deformity (≤10° or >10° of varus or valgus deformity) based on long-standing weight-bearing radiographs. These metrics were used to determine if there was an apparent bias between groups, which was not found for any patient-specific factor following statistical analysis (Table).

All intra-articular injections were performed by 1 surgeon (M.A.M.), who used a uniform technique at each site. The suprapatellar injections were performed laterally with the needle aimed at the superior pole of the patella aiming toward the knee joint. Inframedial and infralateral patellar joint injections were done by going to the inferior pole of the patella and feeling the soft spot of the joint, then subsequently aiming toward the notch. All injections were performed by first aspirating the joint for fluid (100% successful), and all were corticosteroid-triamcinolone (1 cc of 40 mg/mL vial) mixed with anesthetic xylocaine (4 cc of 10 mg/mL vial) (Figure 1).

The severity of pain was assessed before, within 1 minute after, and 5 minutes after the injection using the VAS for comparative data analysis for the 3 injection sites. The assessment performed immediately after the injection was used for the study to ensure no recall bias from the patient.

Compiled data were tabulated in a Microsoft Excel Workbook (Microsoft Corporation, Redmond, Washington). Statistical tests were performed with the aid of GraphPad Prism version 5.01 statistical software (GraphPad Software Inc, La Jolla, California). A 2-tailed \(t\) test was performed comparing each of the 3 patient cohorts’ demographic characteristics and pain levels.

**RESULTS**

There were 30 patients randomized to each of the infrapatellar sites. Because the suprapatellar injections were associated with statistically more severe pain (mean VAS score, 7 points), the authors agreed to an early termination of this portal in the current study, with only 9 patients undergoing injection at this site. A comparison of various demographic variables (gender, mean age, primary diagnosis) as well as a comparison of radiographic alignment and degree of arthritis did not show a difference among the 3 groups (Table).


d| Patient Demographics |
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<td>Patients, No.</td>
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<td>Male:female ratio, No.</td>
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<td>Age, mean (range), y</td>
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<td>Primary diagnosis, No.</td>
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<td>Osteoarthritis</td>
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<td>Osteonecrosis</td>
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<td>Rheumatoid arthritis</td>
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<td>Predominant location of disease, medial:lateral ratio, No.</td>
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The mean VAS scores at 1 minute for lateral suprapatellar, medial infrapatellar, and lateral infrapatellar injection sites were 7, 4, and 2 points, respectively (Figure 2). Infrapatellar injections were associated with significantly less pain than suprapatellar injections (P<.003). Although there was a trend of less pain with lateral infrapatellar injections when compared with their medial counterparts, this was not statistically significant (P=.11).

**DISCUSSION**

Because the knee joint remains a common site to receive intra-articular injections and may require multiple injections in a short time period, it is imperative that the most traumatic techniques and locations for intra-articular injections be investigated. The current study suggests that intra-articular knee injections should be administered from an inferomedial or inferolateral site to minimize pain severity.

In addition, this study shows that, whenever possible, a lateral infrapatellar site of entry should be used because it may lead to the least pain. However, this could vary depending on the location and degree of arthritis. For instance, a severely valgus-deformed knee with obliterated joint space would favor using a medial infrapatellar entry site, while varus knees would benefit from the use of its lateral counterpart.

This study is not without limitations. This study was conducted at a high-volume joint preservation and reconstruction center where many injections are performed. Hence, these results may not be generalizable to practitioners who perform fewer injections. In addition, although the authors had to discontinue the use of one entry point because of the severe pain being reported by patients, they believe that the results of this study have merit for practitioners. Furthermore, the authors only assessed pain level using the VAS; however, they believe this was appropriate because multiple studies have shown this scale to be a valid and accurate assessment of patient pain level.

Although there are a paucity of studies that evaluate the intensity of pain with the use of different injection entry points, there are studies that address the accuracy of the use of each portal. Jackson et al compared the accuracy of needle placement in 240 consecutive intra-articular injections through 3 entry sites: anteromedial and lateral (corresponding to infrapatellar for the current study) and a lateral mid-patellar site. At the end of the study, they found that the accuracy rate of the lateral mid-patellar injection point was markedly better than those of the other 2 cohorts (93% vs 75% vs 71%). Although it may seem that this study contradicts the results of the current study by advocating for the use of a different entry site, they did not analyze the pain level associated with each entry site. Furthermore, the authors also stated that future studies should focus on the development of a reproducible and accurate method of therapeutic delivery into the joint.

In addition, there are some studies that have reported higher accuracy rates when injecting in the suprapatellar site. Bliddal evaluated the effect of supralateral injections in a cohort of patients with primary osteoarthritis using an air-arthrography (56 injections), finding that the majority of the injections (91%) were accurately placed using this technique. Similarly, Bum Park et al assessed the accuracy of this injection with both blinded (49 knees) and ultrasound-guided (50 knees) techniques using plain radiography following the injection. Both cohorts benefited from high accuracy rates, with the ultrasound-guided cohort having a significantly higher rate than the blinded cohort (96% vs 83.7%; P<.05). As such, despite technique used, both studies advocated for the use of the supralateral portal as a plausible site for accurate intra-articular injection.

However, these authors failed to evaluate the patients’ pain during injection, which can ultimately play a large role in patient satisfaction. Furthermore, unlike the current study, they did not use the inframedial or infralateral entry points in their assessments. Therefore, it is not clear whether this reportedly high accuracy would have been duplicated with these different injection sites.

Moreover, some authors advocate that some entry points should be avoided due to lack of accuracy. Esenay et al assessed the accuracy of injections at 4 different injection points in a cadaveric study: inframedial, infralateral, lateral mid-patellar, and medial mid-patellar (156 knees). They found that the accuracy rate of the medial mid-patellar entry point was lower than those of the inframedial (P<.05), infralateral (P<.001), and lateral mid-patellar (P<.05) injection points (56% vs 73% vs 85% vs 76%). Although 100% accuracy could not be obtained in any of the cohorts, the authors recommended against the use...
of the medial mid-patellar entry point. However, they stated that the other 3 entry points may be preferred depending on physician experience. This would support the results of the current study, which did show accuracy when using both the inframedial and the infralateral injection points.

**Conclusion**

The current study has important implications for daily orthopedic practice because patients demand relatively pain-free injections. The authors would advocate for the use of infrapatellar injection whenever possible, with the degree and location of arthritis guiding whether it would be inferomedial or inferolateral. Future research should focus on performing larger prospective, randomized trials in lower-volume centers to test the generalizability of these results.

**References**