[Primary Care]

Joint Line Fullness and Meniscal Pathology

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Background: Meniscal tears have been associated with meniscal cysts and fullness of the knee joint line on physical examination.

Hypothesis: Joint line fullness is an accurate, sensitive, and specific test to detect meniscal tears.

Study Design: Prospective cohort study.

Methods: One hundred consecutive patients undergoing knee arthroscopy were included. All had physical examinations documenting the presence of joint line fullness, joint line tenderness, and the McMurray sign. Arthroscopy was the gold standard for tears. Accuracy, sensitivity, and specificity were calculated and correlated with type of tear. Sixty-one patients had a magnetic resonance imaging preoperatively (the gold standard for determining the presence of a cyst).

Results: Meniscal tears were found in 67 patients at arthroscopy. The accuracy, sensitivity, and specificity of joint line fullness were, respectively, 73%, 70%, and 82% in detecting meniscal tears; 68%, 87%, and 30% for joint line tenderness; and 47%, 32%, and 78% for the McMurray sign. The highest positive predictive value for detecting a tear was 88% for joint line fullness, compared with 77% for joint line tenderness and 76% for the McMurray sign. However, joint line fullness did not correlate well with the presence of a cyst, with a low positive predictive value (29%). Of those patients with joint line fullness on physical examination, 89% had a horizontal cleavage component of their tear at arthroscopy.

Conclusion: Joint line fullness is an accurate, sensitive, and specific test to detect meniscal tears.

Clinical Relevance: The findings support the routine use of joint line fullness during physical examination along with other common tests to improve the accuracy of clinically diagnosing meniscal tears.

Keywords: meniscal tear; meniscal cyst; physical examination; joint line

Meniscal tears are common; diagnosis depends on a careful history and physical examination. The sensitivity and specificity of various physical examination findings, such as joint line tenderness and the McMurray sign, vary in the literature but are generally low.[11] Another finding associated with meniscal tears is a meniscal cyst, with an incidence ranging from 5% to 20%.[2,20] Meniscal cysts often present with joint line swelling, pain, or both and are more common on the lateral side.[19] The lateral compartment is more superficial, with a thinner capsule and collateral ligament. Careful examination often reveals fullness or swelling posterior to the medial collateral ligament on the medial side. Medial meniscal cysts may occur almost twice as often as those in the lateral compartment according to magnetic resonance imaging (MRI).[3] Meniscal cysts vary in size and change with position of the knee.[9] The cyst is usually most prominent in 20° to 30° of flexion (Pisani sign[16]). The purpose of this study was to determine the sensitivity, specificity, and accuracy of the presence of joint line fullness (swelling) on physical examination in detecting the presence of meniscal cysts and/or meniscal tears compared with MRI and arthroscopic findings.

MATERIALS AND METHODS

After appropriate institutional review board approval, 100 consecutive patients undergoing routine knee arthroscopy were included in this study. There were 57 men and 43 women. The age of the patients was between 15 and 80 years (average, 46.1 years; 25 patients, < 40 years; 62 patients, 40-59 years; 13 patients, ≥ 60 years). The majority of patients underwent arthroscopy for a presumed meniscal tear. Eighteen patients underwent arthroscopy for lateral compartment pathology, 70 patients for medial compartment pathology, and 12 for unknown intra-articular knee pathology. Patients

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DOI: 10.1177/1941738111422330

Table 1. Diagnostic value of all 3 tests for lateral and medial meniscal tears (in percentages).[a]

	Joint Line Tenderness	McMurray Sign	Joint Line Fullness
Accuracy	68	47	73
Sensitivity	87	32	70
Specificity	30	78	82
Positive predictive value	77	76	88
False-positive rate[b]	23 (19 of 81)	24 (7 of 29)	12 (6 of 52)
Negative predictive value	53	37	56
False-negative rate[b]	47 (9 of 19)	63 (45 of 71)	44 (21 of 48)

[a]n = 100.
[b]No. in parentheses.

were excluded if they had previous open or arthroscopic surgery of the involved knee. All patients had preoperative radiographs, although not all patients had standardized 45° posteroanterior flexion views or weightbearing views. Severe joint space loss and arthritic changes on any weightbearing or nonweightbearing radiographs were exclusion criteria, as well as the presence of joint line osteophytes, which could mimic joint line fullness. Patients in the acute period of trauma (within 6 weeks of injury) were not included in the study (within 6 weeks of injury).

After a detailed history, all patients had a preoperative examination of the affected knee by 1 of the 3 senior surgeons, assessing joint line fullness, joint line tenderness, and the McMurray sign.

The majority of patients (61%) had preoperative MRI of the involved knee, but it was not a prerequisite for arthroscopy. For those with MRI, the information was used primarily to determine the presence of a parameniscal cyst and was reported by the same senior radiologist. All examiners were blinded to MRI results. The surgical indications were based on history and clinical examination; other diagnostic aids, such as MRI, were not taken into consideration.

Seven statistical parameters—accuracy, sensitivities, specificities, positive predictive value, false-positive rate, negative predictive value, and false-negative rate—were calculated for each physical examination test: McMurray test, joint line tenderness, and joint line fullness. For the joint line fullness group, the correlation between type of tear and positive test result on physical examination was calculated. MRI was used as the gold standard for identifying a cyst and arthroscopy for meniscal tears. When a meniscal tear was suspected by clinical examination and found on arthroscopy, the result was defined as a true positive. A negative arthroscopy following a negative clinical test was defined as true negative. A positive clinical test but a negative arthroscopy was a false positive, and a negative test but a positive arthroscopy was a false negative.

JOINT LINE FULLNESS TEST

The test was performed with the patient supine on the examination table. As with testing for joint line tenderness, the examiner carefully palpated along the joint line. With this maneuver, the examiner was identifying palpable fullness along the joint line in comparison with the normal knee. Any joint line fullness causing a loss of normal joint compression was a positive result. The lateral compartment of the knee was examined at 30° to 45° of knee flexion to relax the iliotibial band and the medial compartment, at 70° to 90° of flexion to relax the medial collateral ligament.

RESULTS

Compilation of the data shows that joint line fullness has the highest level of specificity (82%), the highest positive predictive value (88%), and the highest accuracy (73%) for detecting meniscal tears when compared with joint line tenderness and McMurray test. The low incidence of false-negative results and, therefore, a high negative predictive value shows that joint line fullness better indicates the absence of meniscal tears at the time of the arthroscopy when compared with other tests (Table 1). Joint line fullness was also better for predicting medial-side tears than other tests, as its positive predictive value was of 91% (Table 2).

Joint line fullness did not correlate well with the presence of a cyst with a low positive predictive value (29%) (Tables 3 and 4). Sixty-one patients had preoperative MRI. Of those, only 12 (20%) had a cyst seen on MRI. Nine patients had a medial compartment cyst, while 3 patients had a lateral compartment cyst. Of the 12 patients with a cyst, 11 had a meniscal tear on MRI (Table 4).

Of the 52 patients with positive joint line fullness on physical examination, 46 patients had a meniscal tear. In those patients with a meniscal tear and positive joint line fullness on physical examination, the tear had a horizontal cleavage in 89%, parrot

Table 2. Diagnostic value of all 3 tests for medial meniscal tears (in percentages).[a]

	Joint Line Tenderness	McMurray Sign	Joint Line Fullness
Accuracy	71	40	73
Sensitivity	90	28	73
Specificity	0	87	73
Positive predictive value	77	88	91
False-positive rate[b]	23 (15 of 65)	12 (2 of 17)	9 (4 of 44)
Negative predictive value	0	25	42
False-negative rate[b]	100 (5 of 5)	75 (40 of 53)	58 (15 of 26)

[a]n = 70.
[b]No. in parentheses.

Table 3. Diagnostic value of joint line fullness in detecting a cyst (No.).

Magnetic Resonance Imaging	Positive	Negative
Cyst	9	3
No cyst	22	27

Table 4. Correlation of patients with joint line fullness and finding of a cyst on magnetic resonance imaging (in percentages).[a]

	Joint Line Fullness
Accuracy	59
Sensitivity	77
Specificity	55
Positive predictive value	29
False-positive rate	71 (22 of 31)
Negative predictive value	90
False-negative rate	10 (3 of 30)

[a]n = 61.
[b]No. in parentheses.

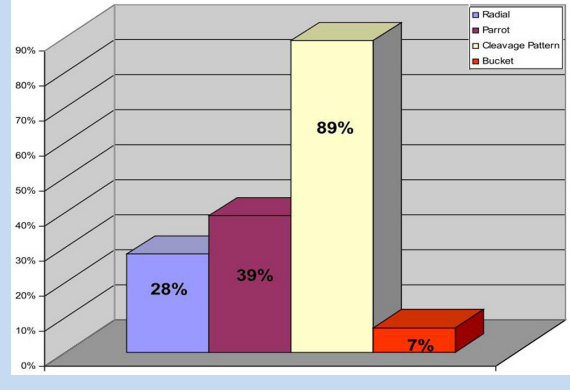

Figure 1. Correlation of joint line fullness test with type of tear at the time of knee arthroscopy.

beak in 39%, radial tear in 28%, and bucket handle in 7%. Some patients had more than 1 type of tear (Figure 1).

DISCUSSION

These results are similar to those reported in the literature for joint line tenderness and the McMurray sign in diagnosing meniscal tears. Joint line tenderness is the most accurate but least specific meniscus test in most studies.[1,5,8] These results show that the accuracy and specificity of joint line fullness was superior to joint line tenderness and the McMurray test. The gold standard for detecting a meniscal tear remains diagnostic arthroscopy. The sensitivity and specificity of MRI in detecting meniscal tears are high but not as definitive as visualizing the joint.[4] MRI is not always superior to physical examination in diagnosing meniscal tears.[13,17]

In the original description of McMurray test in the 1940s, no varus or valgus forces were applied to the knee, and the test result was deemed positive when there was a reproducible snap or click with discomfort.[12] Over the years, some investigators have modified the test by adding varus or valgus components. Also, during the interpretation of the test, some accepted a positive test result when there was a painful click, as in the original description,[5,15] some with a click in the presence or absence of pain,[8] and some with pain in the presence or absence of a click. However, most clinical validations were done with the original description of the McMurray test.[11] In the present study, the McMurray test

was performed with the original definition, without adding any varus or valgus components, and the pain or click at the corresponding joint line was accepted as a positive result.

Acute injuries were not included in this study for a few of reasons. First, we do not typically perform arthroscopy in cases of acute trauma unless the knee is locked. As arthroscopic findings were accepted as the gold standard to compare the results of clinical meniscus tests, we could not use patients who did not undergo arthroscopy. Second, we do not recommend using joint line fullness in acute injuries, because the knee is already painful and tender and may show an intra-articular effusion. This may lead to a high number of false-positive results in acute cases. This is also true for other clinical meniscus tests.

Although all patients had preoperative radiographs, not all patients had standardized 45° posteroanterior and weightbearing views. The radiographs were used mainly to exclude patients if they had osteophytes or severe osteoarthritis, defined as joint space narrowing, osteophytes, subchondral sclerosis, and subchondral cysts.[7] However, because of a lack of standardized views, the correlation between joint space loss and joint line fullness was not determined, and the fact that joint space loss could affect the clinical finding of joint line fullness by causing protrusion of the meniscus cannot be excluded.

Of the 100 patients, 70 were presented separately because they had medial compartment pathology (Table 2). While the results are comparable, joint line fullness seems to be more accurate, sensitive, and specific with the medial joint line when compared with the medial and lateral joint lines combined. Because only 18 patients had lateral compartment pathology, those results were not presented separately.

Three types of true meniscal cysts have been described: intrameniscal, parameniscal, and meniscocapsular separation. The parameniscal cysts and meniscocapsular separation can usually be detected clinically. However, the intrameniscal cysts are small and probably only detectable by MRI. True meniscal cysts are commonly associated with some form of meniscal tear: horizontal cleavage (70%), radial splits (20%), and parrot beak tears (10%).[6] The meniscal tear provides access to synovial fluid, which accumulates and forms a cyst, and a "one-way" valve mechanism may form, which allows the cyst to grow without allowing fluid reentry into the joint.[1] Since cysts are commonly associated with horizontal degenerative cleavage tears, they tend to occur between the age of 30 and 63 years.[10] Morgan-Jones et al[14] coined the term *pseudocyst* for those cysts detectable on examination but not seen at arthroscopy, which occurred 50% of the time without MRI. MRI is the best diagnostic tool to show the meniscal cyst and the accompanying meniscal tear.[18] Joint line fullness correlated well with the presence of meniscal tear. However, it did not correlate well with the presence of cysts (positive predictive value, 29%). Because there seems to be a high correlation between cysts and horizontal cleavage tears and a strong correlation between positive joint line fullness and horizontal cleavage tears, there might be a relationship between joint line fullness and cysts.

Joint line fullness is a simple test that can be used even in the painful knee. Also, it does not require movement or participation from patients, which may affect the results of the test or displace a meniscal tear. These techniques may diminish the need for routine MRI in suspected meniscal tears.

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