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Diagnostic Accuracy of Orthopedic Special Tests for Meniscal Injury

Disciplines

Physical Therapy

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Title: Diagnostic Accuracy of Orthopedic Special Tests for Meniscal Injury

Clinical Scenario: At the outpatient orthopedic clinic that I am currently at we tend to see a lot of knee patients, both acute and post-operative. When I was reviewing the different orthopedic special tests for the knee with my CI, I was asked about the Thessaly Test and what I knew about it. Having never heard of that test before, I was told that it is the best test to use to test for meniscal injuries. This led me to my clinical question of which orthopedic special test for the knee, specifically the Thessaly Test, has the best diagnostic criteria to rule in or out meniscal injuries.

Brief Introduction: Injuries to the meniscus are common among athletes and result in the majority of knee surgeries in this population. Tears to the meniscus tend to be the result of a twisting injury or degeneration. Currently magnetic resonance imaging (MRI) is the most widely used non-invasive diagnostic tool for meniscal injuries. Not only are MRI's expensive but are limited to certain health care professionals allowed to refer for MRIs adding an additional expense for a trip to the Doctor. Physical examinations coupled with history and subjective findings can aid in the proper diagnosis of meniscal derangement for the physical therapist. Currently the McMurray Test is the most widely used special test for meniscal injury but has a reported accuracy of 58% (Anderson AF, et al.) The Thessaly Test is a more recent dynamic clinical test where the examiner supports the patient by holding their outstretched arms while the patient stands with one foot flat on the ground. The patient then rotates their knee/body internally and externally both at 5 degrees of knee flexion and 20 degrees. A positive test is noted if patient experiences medial or lateral joint-line discomfort as well as a sense of locking or catching in the knee.

My Clinical Question: What orthopedic special test for the knee, including the Thessaly Test, has the best diagnostic criteria to rule in or out injuries to the meniscus.

Clinical Question PICO:

Population: adult patients with knee pain following a twisting injury

Intervention: the Thessaly Test

Comparison: Arthroscopic and MRI data

Outcome: diagnostic accuracy, likelihood ratios, sensitivity, specificity

Overall Clinical Bottom Line: Overall both articles closely matched my clinical question comparing a number of clinical diagnostic tests for medial and lateral meniscus involvement. Both articles demonstrated high specificity for the Thessaly Test at 20° of flexion for diagnosing lateral meniscus tears, whereas the article by Karacholios et al. also found high sensitivity and specificity for the Thessaly Test at 20° of flexion for diagnosing medial meniscus tears. The second article by Konan et al. also found that Joint-line tenderness and McMurray's had high specificity for ruling in lateral meniscus involvement. Further studies with larger sample sizes and a less-strict exclusion criteria need to be conducted to further analyze this information. At this point, medial and lateral meniscus tears should be clinically diagnosed by history, mechanism of injury, and clinical examination through use of the Thessaly test at 20° of flexion for medial meniscus and a combination of the Thessaly test at

20° of flexion, McMurray's and Joint-line tenderness for lateral meniscus. Magnetic Resonance Imaging should be used as a second-line screening tool for confirmation of positive clinical tests of meniscus injury prior to arthroscopic surgery.

Search Terms: Thessaly Test, diagnostic criteria, meniscal injury, meniscus, physical examination, knee injury

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Article #1: Karachalios T, Hantes M, Zibiz AH, et al. Diagnostic Accuracy of a New Clinical Test (the Thessaly Test) for Early Detection of Meniscal Tears. *The Journal of Bone and Joint Surgery*, 2005; 87-A:5:955-962

Clinical Bottom Line: The study showed that the Thessaly Test at 20° of flexion had the highest sensitivity and specificity out of 5 popular clinical tests (McMurray, Apley, Joint Line Tenderness, and the Thessaly Test at 5° and 20° of knee flexion) for clinical diagnosis of both lateral and medial meniscus derangement. The Thessaly Test at 20° of flexion was 89% specific and 97% sensitive for medial meniscus tears and 92% specific and 96% sensitive for lateral meniscus tears. Primary threats to internal validity included non-blinding of clinical examiners, minimal overlap of test similarity, lack of reported diagnostic performance, and extensive exclusion criteria. These threats could have affected the outcome of this study as well as make it harder to extrapolate to a much larger patient population. Based on results from this study, the Thessaly test at 20° of flexion can be used as a first-line screening tool to rule in and out both medial and lateral meniscal tears.

Article PICO:

- Population:** 213 patients with a diagnosis of meniscal tears based on history and mechanism of injury between the ages of 18 and 55 and 197 volunteers with no knee symptoms.
- Intervention:** medial and lateral joint-line tenderness test, the McMurray test, the Apley compression and distraction test, the Thessaly test at 5° of knee flexion, and the Thessaly test at 20° of knee flexion
- Comparison:** arthroscopic and magnetic resonance imaging for test subjects and magnetic resonance imaging data for the control group
- Outcome:** sensitivity, specificity, false-positive, false-negative, and diagnostic accuracy

Representative Sample: The patient population in this study matched that of which I would use the Thessaly test on in clinical practice.

Blind Comparison: The examiners performing the clinical examination were blinded to the results of the magnetic resonance imaging (MRI). The evaluators of the MRI scans were also blinded to the results of the clinical tests.

Independent Reference Standard: All subjects were evaluated by the following five tests: medial and lateral joint-line tenderness test, the McMurray test, the Apley compression and distraction test, the Thessaly test at 5° flexion, and the Thessaly test at 20° of flexion. There is minute overlap in the above listed tests in that they apply compression to the knee joint and could aggravate symptoms, affecting overall results.

Reliability of clinical test and reference test: The authors state that all clinical tests showed a high rate of intraobserver and interobserver reliability but failed to elaborate in greater detail the specific reliability for each test.

Ascertainment: All subjects in the study received a thorough clinical examination that included the above 5 tests as well as MRI scans to their knees.

Validation in Second Independent Sample: A second independent sample was not used in this study. However, the authors did cite evidence for the diagnostic performance of the McMurray test, joint-line tenderness, and MRI scans.

Study: 780 patients from a single clinic were screened for participation in this study. Two-hundred-and-thirteen patients (157 men, 56 women) between the ages of 18 and 55 with symptoms of knee pain were included. Inclusion criteria included patients with a knee injury that had an initial diagnosis of meniscal tears. Exclusion criteria included: multiple knee injuries, neurological and musculoskeletal degenerative disorders, disorders of the synovium, history of knee surgery, articular cartilage injuries, and early clinical and radiographic signs of osteoarthritis. An additional 197 volunteer patients with no knee symptoms or history of knee disorders were used as the control. All subjects in the study underwent a thorough clinical examination of their knee to include the medial and lateral joint-line tenderness, the Apley compression and distraction test, the Thessaly test at 5° of flexion, the Thessaly test at 20° of flexion, and the McMurray test as well as MRI scans to the knee. Following the clinical examination and the MRI scans, the 213 patients with knee symptoms underwent arthroscopic surgery.

Summary of Internal Validity: A moderate sized study sample, blinding of evaluators to clinical findings and MRI results, and reports of high inter- and intra-rater reliability suggest fair-to-moderate internal validity. However, the authors do not state whether or not the clinical examiners were blinded to group allocation. There is also some overlap in the 5 clinical tests performed and therefore any one test could aggravate knee symptoms. The diagnostic performance for all 5-tests were not reported. Another threat to internal validity is that 73% of the original chosen subjects were not enrolled in the study due to pain; therefore the results of the tests could have been skewed secondary to the extensive exclusion criteria and may not have been representative of a broader population of patients with knee pain and/or dysfunction. Four threats to internal validity were identified, 3 of which were minor and 1 which was a moderate threat.

Evidence: Outcome measures I was most interested in were sensitivity, specificity, false-positive, false-negative, and diagnostic accuracy for all 5 clinical tests for diagnosis of medial meniscus and lateral meniscus involvement. This data will be further analyzed in tables.

Table 1. Medial Meniscus

	Sensitivity (95% CI)	Specificity (95% CI)	+ LR	- LR
McMurray	48%	94%	8.00	5.00
Apley	41%	93%	5.86	.63
Joint-line tenderness	71%	87%	5.46	.33
Thessaly @ 5°	66%	96%	16.5	.35
Thessaly @ 20°	89.2% (0.862-0.922)	96.7% (0.949-0.984)	26.86	0.11

Table 1 illustrates the between group likelihood ratios (LR), and Confidence Intervals (CI). The Thessaly test at 20 degrees of flexion has the highest specificity (89.2%) and sensitivity (96.7%) of all clinical meniscal tests. Both sensitivity and specificity had small CI. Therefore you can say that if the Thessaly performed at 20 degrees is positive you are 89% confident that the patient does have a torn medial meniscus. Consequently if the same test is performed and is negative you are 97% confident that the patient does not have a medial meniscus derangement.

Table 2. Lateral Meniscus

	Sensitivity (95% CI)	Specificity (95% CI)	+ LR	- LR
McMurray	65%	86%	4.64	.41
Apley	41%	86%	2.93	.96
Joint-line tenderness	78%	90%	7.8	.24
Thessaly @ 5°	81%	91%	9.0	.21
Thessaly @ 20°	91.9% (0.892-0.945)	96.0% (0.941-0.979)	22.85	0.08

Table 2 illustrates the between group likelihood ratios (LR), and Confidence Intervals (CI). The Thessaly test at 20 degrees of flexion has the highest specificity (91.9%) and sensitivity (96.0%) of all clinical meniscal tests. Both sensitivity and specificity had small CI. Therefore you can say that if the Thessaly performed at 20 degrees is positive you are 92% confident that the patient has a torn medial meniscus. Consequently if the same test is performed and is negative you are 96% confident that the patient does not have a medial meniscus derangement.

Applicability of Study Results:

Is the clinical test available, affordable, accurate, and precise in our setting?: All five clinical tests are easily reproducible in the outpatient orthopedic setting. They require no additional equipment, only one assessor, and take minimal time to perform and therefore are quite affordable to use.

Summary of External Validity: The subject samples included in this study are similar to those that you would find in an outpatient orthopedic clinic. The subjects were taken from one single sports injuries clinic over a course of 2 years making it harder to extrapolate the results to a wider population.

Article #2: Konan S, Rayan F, Haddad FS. Do physical diagnostic tests accurately detect meniscal tears?. *Knee Surgery, Sports Traumatology, Arthroscopy* 2009; 17:806-811

Clinical Bottom Line: Out of 4 popular clinical meniscal tests for medial and lateral meniscus tears (McMurray, Joint-line tenderness, and the Thessaly at both 5° and 20° of knee flexion), the study showed that Joint-line tenderness had the highest sensitivity (76.2%) and specificity (82.5%) for medial meniscus derangement as well as the highest sensitivity (68.4%) and specificity (96.9%) for lateral meniscus involvement. However, the McMurray and Thessaly at 20° of knee flexion also had high specificity >93%. Primary threats to internal validity included subject selection, lack of reported reliability of clinical tests and validity of reference standards, as well as a patient population from a single location. Based on the results of this study, if Joint-line tenderness, McMurray's, and the Thessaly at 20° were all performed and were positive, you could more confidently rule in a lateral meniscus derangement.

Article PICO:

Population: 109 patients who presented with a history suggestive of a meniscal tear

Intervention: joint line tenderness, McMurray's test, and the Thessaly Test

Comparison: MRI and arthroscopy results

Outcome: diagnostic accuracy, specificity, sensitivity, positive predictive value, negative predictive value, likelihood ratio of positive and negative tests, and diagnostic odds

Representative Sample: The subjects in the study are similar to that of which I would use the Thessaly test for based on subjective history.

Blind Comparison: The examiner was blinded to the history, site, and nature of the meniscal tear, as well as the findings of the MRI scans.

Independent Reference Standard: All subjects underwent a routine clinical examination to include the Thessaly test at both 5° and 20° of flexion, the McMurray test, and joint line tenderness as well as a diagnostic MRI prior to undergoing knee arthroscopy. Although minute, there could be minimal overlap with the clinical tests as they may further aggravate symptoms.

Reliability of clinical test and reference test: The authors did not report their own or site reliability or reference tests for the clinical tests used.

Ascertainment: All but 4 subjects of the 109 included in the study received an MRI scan, performed the Thessaly test, and received arthroscopy.

Validation in Second Independent Sample: A second independent sample was not used in this study. However the authors did report the diagnostic accuracy of the Thessaly test using data reported by Karachalias et al.

Study: One hundred and nine patients from a single clinic with a history of a knee injury, locking of the knee, knee swelling, clicking sensation with movement of the knee, and knee pain or discomfort suggestive of meniscal derangement were included in this study. All subjects underwent clinical examination, MRI scans and were scheduled for arthroscopic surgery. On their scheduled surgery day, a blinded observer re-examined the patient using the Thessaly tests at 5° and at 20° of flexion, the McMurray test, and joint line tenderness. Exclusion criteria from the originally selected group of subjects included patients who were not confident in performing the clinical tests or who would not consent to perform the tests. Specificity, sensitivity, likelihood ratios, positive and negative predictive values, diagnostic odds, and diagnostic accuracy were calculated with a 95% confidence interval.

Summary of Internal Validity: The primary threats to internal validity include subject selection, lack of reported reliability of clinical tests and validity of the reference standards. Since all subjects were chosen from one clinic and were all awaiting arthroscopy, it is hard to extrapolate to a more general primary care setting.

Evidence: Outcome measures I was most interested in were sensitivity, specificity, false-positive, false-negative, and diagnostic accuracy for all 4 clinical tests for diagnosis of medial meniscus and lateral meniscus involvement. This data will be further analyzed in tables.

Table 3. Medial Meniscus

	Sensitivity (95% CI)	Specificity (95% CI)	+ LR	- LR
McMurray	50% (.393 - .607)	77.3% (.683-.862)	2.2	.65
Joint-line tenderness	82.5% (.744-.907)	76.2% (.671-.853)	3.47	.23
Thessaly @ 5°	41.4% (.306-.522)	68.2% (.58-.784)	1.3	.86
Thessaly @ 20°	59.3% (.486-.701)	66.7% (.563-.770)	1.78	.61

Table 3 illustrates the between group likelihood ratios (LR), and Confidence Intervals (CI). Joint line tenderness has the highest specificity (82.5%) and sensitivity (76.2%) of all clinical meniscal tests for medial meniscus. Both sensitivity and specificity had small CI. Therefore you can say that with a positive joint-line tenderness test you are 83% confident that the patient has medial meniscus involvement. Consequently if the same test is performed and is negative you are 76% confident that the patient does not have a medial meniscus derangement. However, the values reported from the study are moderate and therefore as a clinician you can only say that you are about three-quarters positive that the test is positive or negative.

Table 4. Lateral Meniscus

	Sensitivity (95% CI)	Specificity (95% CI)	+ LR	- LR
McMurray	21.1% (.123-.298)	93.8% (.887-.990)	3.42	.84
Joint-line tenderness	68.4% (.585-.784)	96.9% (.932-1.006)	22.24	.33
Thessaly @ 5°	15.8% (.078-.238)	88.5% (.815 to .955)	1.38	.84
Thessaly @ 20°	31.6% (.214-.418)	95.1% (.903-.998)	6.42	.72

Table 4 illustrates the between group likelihood ratios (LR), and Confidence Intervals (CI). Joint-line tenderness has the highest sensitivity for lateral meniscal involvement at 68.4% which is not very high to rule out a lateral meniscus derangement. For specificity, joint-line tenderness, Thessaly at 20 degrees and McMurray’s all have

high specificity with small CI, suggesting that if each of those three tests were performed and were positive you could more confidently suggest that there was lateral meniscus involvement.

Applicability of Study Results:

Is the clinical test available, affordable, accurate, and precise in our setting?: All three clinical tests that were performed in this study are easily reproducible in the outpatient orthopedic setting. They require no additional equipment, only one assessor, and take minimal time to perform and therefore are quite affordable to use.

Summary of External Validity: The subject samples included in this study are similar to those that you would find in an outpatient orthopedic clinic. The subjects were taken from one single clinic and were all scheduled for knee arthroscopy for meniscal repair making it harder to extrapolate the results to a larger clinical population.

Synthesis/Discussion:

The patient populations of both articles were similar to my patient population. However in the first article by Karachalios et al. 73% of the original subjects were eliminated because of pain in their knee based on the studies extensive exclusion criteria. This could have skewed the results of this study because a high number of meniscal injuries present with pain and discomfort around the involved tissues. Secondly, in a study by Zanetti M, et al. in 2003 that compared symptomatic vs. contralateral asymptomatic knees in 100 subjects with suspected meniscus injuries they found that of those with symptomatic meniscal tears, 63% of the asymptomatic knees also had meniscal tears. Therefore not all meniscus injuries will present with pain.

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