

Abnormal knee mobility and meniscal injury

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Stress radiography for anteroposterior mobility of the knees was performed in 17 patients who had undergone medial meniscectomy and 10 patients who had undergone lateral meniscectomy. Sixteen of the patients were also tested for valgus-varus mobility. An increase in varus mobility following medial meniscectomy was primarily attributed to compression of the medial compartment space. No increase in anteroposterior mobility was found in the knees that had undergone meniscectomy compared with the uninjured contralateral knees. Anterior and total anteroposterior mobility were bilaterally greater in patients with medial meniscectomy compared with lateral meniscectomy. Furthermore, for the patients with medial meniscectomies anterior as well as total mobility were bilaterally greater than values obtained in 28 normal knees. We conclude that idiopathic anteroposterior hypermobility seems to predispose to injury of the medial meniscus. Perhaps individuals with generalized joint laxity should be warned against participating in contact sports.

Following meniscectomy, several authors have found increased clinical anteroposterior mobility (Huckell 1965, Johnson et al. 1974, Tapper and Hoover 1969) and increased valgus-varus mobility (Johnson et al. 1974, Tapper and Hoover 1969) in the knee.

We have measured anteroposterior and valgus-varus laxity following meniscectomy using the stress radiographic technique, which eliminates inaccuracy due to displacement of soft tissues.

Patients and methods

Twenty-seven patients (20 males and 7 females), mean age 31 (21-43) years who had had a total medial meniscectomy (17 cases) or a total lateral meniscectomy (10 cases) took part in this study after informed consent had been obtained. The mean follow-up time was 3 (0.5-5.5) years. No associated knee injury had been found at the time

of arthroscopy or operation. The contralateral knees were without any history of trauma in all the cases.

The patients were examined in a specially designed chair. The apparatus and the stress radiographic technique have been described previously (Jacobsen 1976, 1981, Jacobsen and Iversen 1985). Three lateral radiographs were obtained of each knee in 90° of flexion. The exposures obtained were a) unloaded, b) 200 N forward traction, and c) 220 N backward traction. In 11 patients (6 with medial meniscectomy and 5 with lateral meniscectomy), these exposures were also obtained in 15° of flexion. The remaining 16 patients (11 with a medial meniscectomy and 5 with a lateral meniscectomy) had anteroposterior radiographs taken in 15° of flexion with respectively 90 N valgus and varus stress applied.

A control group of 14 persons aged 29 (20-36) years with no history of knee trauma were examined for anteroposterior mobility in both knees by stress radiography in 90 and 15° of flexion.

Anteroposterior laxity was calculated as the mean displacement of the lateral and medial tibial condyles (Jacobsen 1976, 1981). Valgus-varus laxity and joint space width were calculated as shown in Figure 1.

Anteroposterior exposures were examined for signs of arthrosis according to Ahlbäck (1968).

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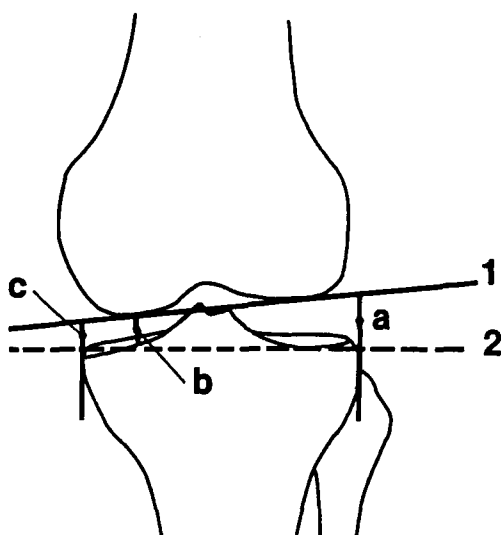
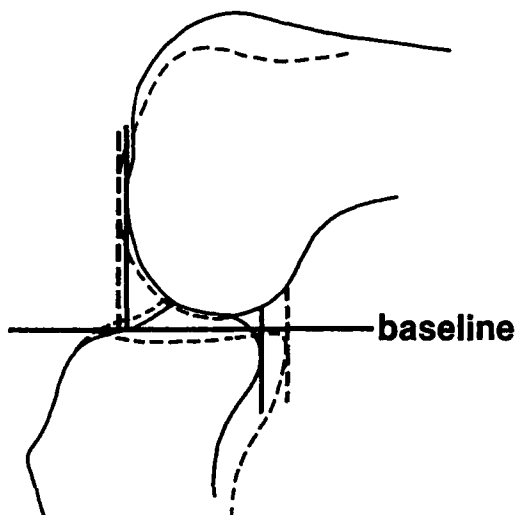


Figure 1. Measurements on a radiograph taken with varus stress applied in a patient with medial meniscectomy.
1. Tangent to the femoral condyles; 2. Tangent to the tibial joint sockets.

a and c distances, perpendicular to 2, between tangents at the lateral medial aspect of the tibia respectively, b. Joint space width. Varus laxity = a minus c.

In patients with a medial meniscectomy, b was measured in the medial chamber on the radiographs with varus stress applied. In patients with lateral meniscectomies, b was measured in the lateral chamber on the radiographs obtained with valgus stress applied.



Measurements on lateral radiographs.

From a baseline on the tibial joint sockets, perpendicular lines were drawn as tangents to the medial femoral condyle and to the posterior margin of the medial tibial joint socket (all broken lines). Similar tangents were drawn to the lateral femoral condyle and to the lateral tibial joint socket (all unbroken lines). Laxity was calculated as the average displacement of the tibial tangents in relation to the femoral tangents on the radiographs obtained with stress applied in relation to the radiographs obtained with unloaded knee.

The two-tailed Pratt and Mann-Whitney tests were used for comparing paired data and the Wilcoxon test for unpaired data.

Results

In 10/11 patients with a medial meniscectomy, a greater varus mobility was found in the knees that had undergone meniscectomy than in the contralateral uninjured knees. Mean varus mobility in this group was 7.9 (3.5-11.5) mm in the injured knees and 5.7 (1.0-10.5) mm in the uninjured knees ($P < 0.01$). There was no difference in valgus mobility between injured and uninjured knees in this group. The medial joint space width was reduced in 10/11 cases with medial meniscectomy ($P < 0.01$). In the 5 patients with lateral meniscectomy, the mean valgus laxity was 3.1 (0.2-7.5) mm and 2.5 (0.0-6.0) mm, respectively, in the operated on and contralateral uninjured knees, whereas the corresponding values for varus laxity were 8.1 (6.0-11.6) mm and 8.4 (4.0-15.0) mm. In this group, narrowing of the joint space

width was found in 3/5 cases. The distance a in Figure 1, representing lateral collateral laxity and measured on the radiographs with varus stress applied, was not greater after medial meniscectomy. The distance c, representing medial collateral laxity and measured on the radiographs obtained with valgus stress applied, was not greater in the cases with lateral meniscectomy when compared with the contralateral knees.

No difference was found in anterior laxity or in total anteroposterior mobility between the operated on and the contralateral knees in the patients who had undergone medial or lateral meniscectomy. This applied to both 15 and 90° of flexion (Table 1).

In patients with medial meniscectomy (Table 1), the anteroposterior mobility in both the operated and nonoperated on knees was greater than in the control group. This difference was, however, not found in the 5 patients with lateral meniscectomies.

None of our patients had radiographic signs of arthrosis.

Table 1. Anteroposterior mobility following meniscectomy (M), in the contralateral knees (C) and in a control group consisting of 14 persons (28 knees). Values are mean (range) mm

Flexion	Lateral meniscectomies		Medial meniscectomies		Control
	M	C	M	C	
15°		n 5		n 6	n 28
Anterior	9.1 (4.8–13.9)	8.0 (3.4–9.9)	11.9 (5.6–14.7) ^a	9.7 (5.5–13.4)	7.3 (4.2–12.5)
Total	13.4 (9.7–17.9)	13.2 (9.3–16.9)	16.7 (8.7–21.8) ^a	16.5 (12.3–19.9) ^a	11.6 (7.9–15.0)
90°		n 10		n 17	n 28
Anterior	4.6 (2.3–6.5)	4.5 (2.4–6.1)	7.8 (2.4–14.2) ^a	7.6 (3.3–14.1) ^a	4.4 (1.5–9.6)
Total	6.3 (4.9–10.5)	6.5 (4.8–8.4)	10.3 (5.9–13.1) ^a	10.1 (6.1–18.4) ^b	7.0 (3.5–13.9)

^a $P < 0.001$, ^b $P < 0.002$. No symbol: not significant. The P -values refer to a comparison with the control group (Mann-Whitney test).

Discussion

Our increase in varus mobility following medial meniscectomy is in agreement with Johnson et al. (1974) and Markolf et al. (1981). In accordance with Fairbank (1948), we attribute this to compression of the medial compartment space, because the distance between the articulating surfaces in the medial chamber of the knees was reduced in the injured knees compared with the contralateral knees. Because the distances measured between the tangents on the lateral aspect of the knees were not increased, this varus mobility could not solely be ascribed to laxity of the lateral collateral ligaments.

Increased anterior mobility following meniscectomy, claimed by some authors (Johnson et al. 1974, Tapper and Hoover 1969), was not substantiated in another in vivo study in which objective assessments were performed (Bargar et al. 1980).

In our study, no increase in anterior or total anteroposterior laxity was found when the operated on knees were compared with the contralateral uninjured knees.

Knees that had undergone medial meniscectomy and the contralateral uninjured knees had a considerably greater anteroposterior mobility when compared with our control group, as well as with Jacobsen's (1981) values on normal knees. Thus, idiopathic hypermobility seems to predispose to injury of the medial meniscus. This finding is consistent with the increased frequency of meniscal tears following injury of the anterior cruciate ligament (McDaniel and Dameron 1980, Indelicato and Bittar 1985). Consequently, one might warn patients with idiopathic hyperlaxity that they run an increased risk of sustaining injury to the medial meniscus if they participate in contact sports.

References

- Ahlbäck S. Osteoarthritis of the knee. A radiographic investigation. Acta Radiol (Diagn) (Stockh) 1968; (Suppl 277): 7–72.
- Bargar W L, Moreland J R, Markolf K L, Shoemaker S C, Amstutz H C, Grant T. T. In vivo stability testing of post meniscectomy knees. Clin Orthop 1980;(150):247–52.
- Fairbank T J. Knee joint changes after meniscectomy. J Bone Joint Surg (Br) 1948;30:664–70.
- Huckell J R. Is meniscectomy a benign procedure? A long-term follow up study. Can J Surg 1965;8:254–60.
- Indelicato P A, Bittar E S. A perspective of lesions associated with ACL insufficiency of the knee. A review of 100 cases. Clin Orthop 1985;(198):77–80.
- Jacobsen K. Stress radiographical measurement of the anteroposterior, medial and lateral stability of the knee joint. Acta Orthop Scand 1976;47(3):335–4.
- Jacobsen K. Gonylaxometry. Stress radiographic measurement of passive stability in the knee joints of normal subjects and patients with ligament injuries. Accuracy and range of application. Acta Orthop Scand 1981;52(Suppl 194):1–263.
- Jacobsen K, Iversen B F. A simple rig for stress radiography of the knee. J Med Eng Technol 1985; 9(6): 277–80.
- Johnson R J, Kettelkamp D B, Clark W, Leaverton P. Factors affecting late results after meniscectomy. J Bone Joint Surg (Am) 1974;56(4):719–29.
- McDaniel W J Jr, Dameron T B Jr. Untreated ruptures of the anterior cruciate ligament. A follow-up study. J Bone Joint Surg (Am) 1980;62(5):696–705.
- Markolf K L, Bargar W L, Shoemaker S C, Amstutz H C. The role of joint load in knee stability. J Bone Joint Surg (Am) 1981;63(4):570–85.
- Tapper E M, Hoover N W. Late results after meniscectomy. J Bone Joint Surg (Am) 1969;51(3):517–26.