Osteoarthritis and the Rosenberg Method

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Osteoarthritis is one of the most common causes of physical disability among adults in the United States.[1-3] The National Institute of Arthritis and Musculoskeletal and Skin Diseases projects that more than 20 million people in the United States have osteoarthritis.[2,3] This disease involves the joints and is commonly referred to as degenerative joint disease. Osteoarthritis in the knee joint can be very painful.

In a healthy knee joint, the cartilage on the end of the bones glides smoothly during flexion and extension maneuvers. This happens because synovial fluid lubricates the cartilage, allowing a nice gliding movement between bone ends. Osteoarthritis begins as the cartilage erodes. The surface layer starts to break down and wears away. This allows bone under the cartilage to rub together, causing pain, swelling and loss of motion of the joint. Loss of motion, along with inflammation, can eventually result in a breakdown of the cartilage. As small pieces of cartilage wear away, osteophytes, commonly called bone spurs, grow around the joint. These osteophytes can break off, taking with them small pieces of cartilage that can be dislodged in the joint cavity. These loose bodies cause swelling, pain and damage to the joint.

Fig. 1. *Standing 45° semiflexed position with a 10° caudad tube tilt. (Reprinted with permission of Taylor & Francis AS: Boegård T, Jonsson L. Radiography in osteoarthritis of the knee.* Skeletal Radiol*, www.tandf.no/actaradiologica, 1999;28:612.)*

Erect Radiography of the Knee

Leach et al[4] described the value of performing knee radiography in the erect position to evaluate osteoarthritis. The advantage is that an erect weight-bearing anteroposterior (AP) projection of the knee may show joint space narrowing, while a recumbent AP projection of the same knee may not. It is also interesting to note that the way an erect knee examination is performed can be crucial for a correct diagnosis. Generally, erect knee exams are performed either as an erect AP projection with a horizontal beam, or as an erect posteroranterior (PA) semiflexed position with a 10° to 15° caudad tube tilt. Both methods have varying results; consequently, studies have shown that joint space narrowing can be visualized on one projection but not the other.[5,6]

In a prospective study described in 1988, Rosenberg et al[6] established that by positioning the patient in an erect semiflexed position, using a caudad tube tilt (see Fig. 1.), joint space narrowing could be evaluated more efficiently than with an erect position without flexion. This study of 55 patients involved reviewing radiographs that were performed both ways. Findings demonstrated that more than 80% of the patients had narrowing of the joint, which showed on the erect examination with flexion; approximately 30% of the same patients demonstrated joint space narrowing with the AP projec-

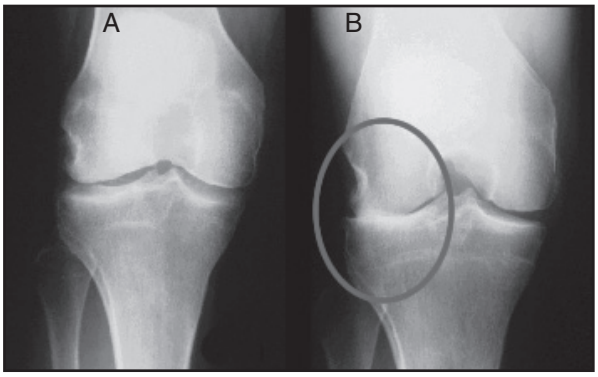

Fig. 2. *Both radiographs are of the same knee and were performed erect. Note the differences in the joint space narrowing in the lateral compartment. A. Standing AP with a horizontal beam. B. Standing PA with knee in semiflexion and a 10° to 15° caudad angle, Rosenberg method. (Modified and printed with permission from: Branovacki G, Abraham E. University of Illinois at Chicago, Department of Orthopaedic Surgery Web site. Available at: www.uic.edu/com/ors/Residencyprogram/residencyprogramcasereport.htm. Accessed November 3, 2005.)*

tion only. This means that the AP standing radiograph of the knee often misses joint space narrowing, while an erect, semiflexed PA projection will show the narrowing. (See Fig. 2.)

Rosenberg and colleagues also compared intraoperative observations on these same patients. They found that the joint space narrowing seen on the PA weight-bearing radiographs performed with 45°of flexion were more accurate, more specific and more sensitive than conventional weight-bearing positions. The value of performing the examination erect with the knees positioned in semiflexion is convincing. Positioning is of utmost importance, as joint space narrowing is suggestive of cartilage degeneration, leading the physician to a diagnosis of osteoarthritis.

Measuring Joint Space Width

Additionally, Boegård and Jonsson[5] suggested that significant cartilage loss can be established by measuring the joint space width. The presence of a minimum joint space width of less than 3 mm is significant.[5] Similarly, Rosenberg et al suggested that narrowing of the cartilage space to 2 mm or less is indicative of major degeneration.[6] This slight difference is the result of the grading system used to evaluate the severity of the osteoarthritis. More importantly, both authors concur that measurements are best made on the weight-bearing radiograph in semiflexion. Thus, after the radiographs

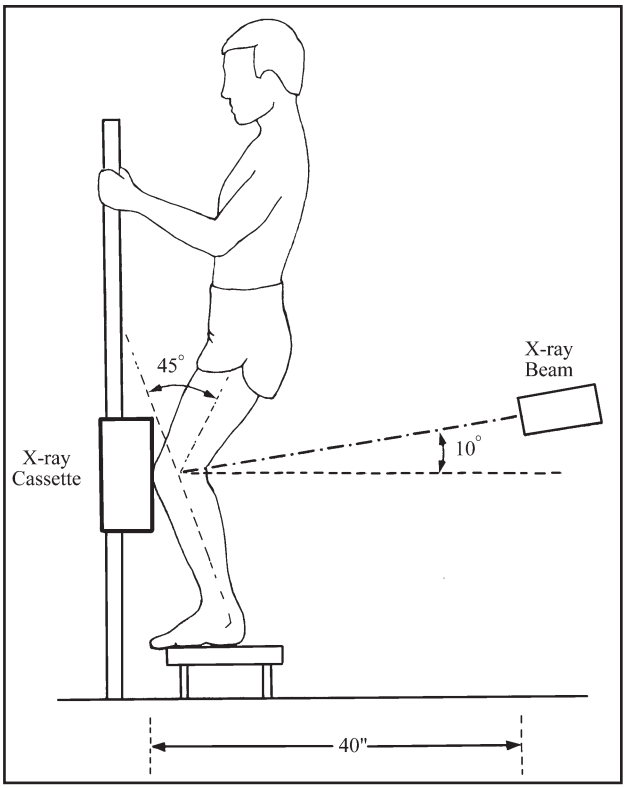

Fig. 3. *Position for the standing 45° PA flexion weight-bearing position for the knees, Rosenberg method. (Reprinted with permission from: Rosenberg TD, Paulos LE, Parker RD, et al. The 45° posteroanterior flexion weight-bearing radiograph of the knee.* J Bone Joint Surg. *1988;70(10):1479.)*

are obtained, the joint space width can be evaluated and graded for the severity of the osteoarthritic process in the joint.

It is the intent of this article to demonstrate the 45° PA flexion weight-bearing radiograph of the knee. This position was described by Rosenberg and colleagues and will be referred to in this article as the Rosenberg method.

Methods

Standing 45° Rosenberg Method

The patient stands in front of an upright Bucky with the knees flexed 45° and the weight distributed evenly on both feet. The patient should hold onto the sides of the Bucky for support. The toes should point straight ahead with the patellae touching the upright Bucky. The x-ray tube is angled 10° caudally and the central ray is adjusted to pass through half an inch distal to

Fig. 4. *Normal bilateral knee radiograph performed using the Rosenberg method, standing 45° PA flexion weight-bearing radiograph of the knees. Both medial and lateral compartment measurements show no significant narrowing.*

Fig. 5. *Abnormal bilateral knee radiograph performed by the Rosenberg method, standing 45° PA flexion weight-bearing radiograph of the knees. Note the obliterated lateral compartment of the left knee. Also, the joint space narrowing is significantly reduced in the medial compartment of this knee.*

the apices of the patellae. (See Fig. 3.) The resulting radiograph demonstrates the bilateral knees and should clearly demonstrate both knees without rotation. (See Fig. 4.) Additionally, the knee joints should be centered to the exposure area and appropriate right or left markers should be used.

Discussion

Conventional AP radiography of the knee does not always confirm the diagnosis of osteoarthritis. Obtaining an erect radiograph with the Rosenburg method improves the chances of demonstrating degenerative joint disease that may be missed by alternate methods. An osteoarthritic knee radiograph that was performed by the Rosenberg method is demonstrated in this article. (See Fig. 5.) This method is typically performed as a bilateral examination, but occasionally will be requested unilaterally. If this is the case, the patient should be instructed to put his or her entire weight on the affected knee. This requires the patient to balance with minimal pressure placed on the unaffected extremity.

Incidentally, knee injuries are commonly referred for magnetic resonance (MR) imaging. However, Turner suggested that undergoing an MR procedure does not guarantee diagnosis of this disease process. He suggested that "[a]lthough MRI is excellent in demonstrating the anatomy and a wide variety of pathologies of the knee, it may be unable to detect tibio-femoral contact of the knee while the patient's knee is flexed and weight-bearing (unless the patient can be scanned standing and with the knee flexed)."[7] The efficacy of the Rosenberg method is therefore persuasive.

Likewise, this projection also has other advantages. The resulting radiograph is similar in appearance to the intercondylar fossa projection, or notch projection. Thus, the radiograph also can be used to evaluate osteophytes, loose bodies, cartilaginous pathology and osteochondral defects.

In conclusion, degenerative joint disease of the knees can be missed if the proper position is not used. The Rosenburg method is a valuable position that aids in the diagnosis of this disease. ◆

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