Simultaneous Bilateral Knee Valgus Stress Radiographic Technique

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Abstract: The medial collateral ligament is the most commonly injured knee ligament. Valgus stress radiographs are reported to be an effective way to quantify the medial compartment opening. However, most of the techniques require the presence of a physician in the radiograph room to apply a manual valgus stress force, and can only be performed in 1 knee at a time. These techniques, although extremely effective, increase radiation exposure to physicians, are time consuming, and require additional radiographs to compare the side-to-side difference. The purpose of this Technical Note is to describe our preferred valgus stress radiographic technique to evaluate medial side laxity, which offers several advantages compared with conventional manual techniques.

The medial collateral ligament (MCL) is an essential structure that provides overall knee stability. This ligament is not only a primary stabilizer of valgus stress, but it also contributes significantly to rotation stability and is a secondary stabilizer in the anterior-posterior plane. The superficial MCL and other knee medial side structures (deep MCL and posterior oblique ligament) are the most commonly injured ligamentous structures of the knee, and for this reason, a comprehensive and reliable physical examination combined with focused radiographic tests is needed to evaluate patients who would benefit from surgical treatment. The first step in the workup of a suspected medial-sided knee injury should be a thorough physical examination, including the valgus stress test both at full extension and 20° to 30° of flexion. In cases with abnormal valgus stress gapping on physical examination, stress radiographs are suggested for an objective comparison between the injured and contralateral unaffected knee. The purpose of this Technical Note is to describe our bilateral simultaneous valgus stress knee radiographic technique, having been performed in our hospital for more than 25 years with good results.

Radiographic Technique

Patient Positioning

To perform this technique, it is important that the patient not be using a brace, external fixator, or cast on

Fig 1. With the patient in supine position and with both limbs extended, the patient is asked to keep both knees together. After this, a Velco strip (yellow arrows) is placed around the knees at the patellar level, maintaining both thighs in contact.
the contralateral limb (Video 1). Another important aspect that has to be taken into account is that the patient should not have had a prior amputation of the contralateral limb. If the patient does not present with any of these conditions, then the technique can be performed. The patient is taken to the radiograph room and placed supine on the radiographic table. After this, the physician chooses the degree of flexion at which the stress radiographs must be performed. If the test is performed in full extension, no soft pad is used. However, when a 20° to 30° of knee flexion is necessary, a soft pad (made of ethylene vinyl acetate) is placed under the knee to achieve the desired and similar knee flexion on both sides. Once the correct knee position is achieved, attention is turned to the application of the stress force.

**Stress Force**

To apply the stress force, the patient is asked to place both thighs and medial malleolus together. After this, a Velcro belt is placed around both knees in the patellar level, keeping the medial side of the thighs together (Fig 1). Attention is then turned to the distal aspect of the limbs. A wedge device designed by the senior author (blinded for revision), made of ethylene vinyl acetate, is used. We suggest having different sizes of this device to adapt to each patient size. The device is placed with the larger portion just below the malleolar level in the ankle (Fig 2). Once the wedge device is placed in this position, the knee will have a valgus stress performed simultaneously and with equal force in both knees (Fig 3). After this, a radiographic tube (Siemens, Erlangen, Germany) is placed 1 m from the knees and the radiographic study is performed. Usually we perform this technique both with the knees in full extension and in 30° of flexion, and the results are compared with the contralateral knee to evaluate the extent of the medial-sided injury. However, care must be taken to repeat all the steps when changing the knee position to ensure the correct and symmetric application of the valgus stress force. Once the radiographic study is performed, the distance between the distal aspect of the medial femoral condyle and the medial tibial plateau is measured and compared with the contralateral side. Care must be taken to ensure that the contralateral knee does not also have a medial-sided injury, because a normal unaffected medial compartment opening is needed for comparison. The final aspect of the radiographic study using our technique is shown in Figure 4. The advantages and disadvantages as well as pearls and pitfalls associated with the technique are summarized in Tables 1 and 2, respectively.

**Discussion**

The MCL is the most commonly injured ligament of the knee, and a reliable method to identify these injuries is extremely important to allow for the correct treatment to avoid future sequelae. Valgus stress radiographies have been shown to be a useful, objective, and reproducible tool for evaluating medial-sided knee injuries. Furthermore, because of their relative ease of use and cost-effective nature, the valgus stress...
radiographs can be used for follow-up examinations either after conservative or surgical treatment.5,7,8 However, radiation exposure is a concern when dealing with radiographs, for both the patient and the physician, because it is related to cancer risk.9 Conventional valgus stress radiographs need the presence of the physician, who applies a valgus stress force to the knee, suffering radiation exposures. Furthermore, standard valgus stress radiographs are usually performed in each knee separately, increasing the number of radiographs and consequently the radiation dose.

In this Technical Note, we describe our preferred technique to reproduce a valgus knee radiograph, which is performed without the need of a physician in the radiograph room. Furthermore, our technique allows the evaluation of both knees simultaneously, with the same valgus stress applied and reducing the number of radiographs. Our clinical experience shows that it can be used for valgus stress applied both at full extension and 20° to 30° of flexion and can be used as an important diagnostic tool to evaluate the extension of the injury. We use simple devices to apply valgus stress in our technique in a way that can be reproducible everywhere and is cost-effective.

We acknowledge the description of a similar valgus technique described by Mauerhan et al.,10 in which they reported similar results when performing their technique and the manual stress radiograph. However, in their technique, the patient is asked to squeeze a ball that is placed between the ankles and no device is placed between the knees, which is different from our technique that does not require any action from the patient. Although we suggest the use of our technique, further studies are needed to correlate the reliability of this technique with the standard valgus radiographic technique for medial injuries of the knee.

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