Special Radiographic Techniques for Knee Joint: Technical Optimizations, Diagnostic Value, and Clinical Relevance

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Abstract-Specialized knee joint radiography techniques are essential for a carefully examination of intricate anatomical features and minute pathological alterations, and functional anomalies that are frequently not clearly visible on standard anteroposterior and lateral projections. For a thorough evaluation of the patellofemoral articulation, intercondylar notch, tibiofemoral joint spaces, and general knee alignment under physiological loading circumstances, these specialist views are especially helpful. These methods greatly help in accurate diagnosis and efficient treatment planning by improving visibility, which helps in the early detection of joint space narrowing, degenerative alterations, ligamentous instability, patellar maltracking, and cartilage-related abnormalities.

Skyline (sunrise) views, intercondylar (tunnel) views, weight-bearing views, stress radiographs, and different flexion-based approaches are examples of frequently used special projections that are intended to highlight particular anatomical areas or functional features of the knee joint. These perspectives are especially helpful when assessing intercondylar pathology, early osteoarthritis, post-traumatic instability, and patellofemoral abnormalities. Despite advancements in cross-sectional modalities, this article highlights the continued significance of these unique radiographic projections as widely accessible, affordable, and diagnostically useful tools in musculoskeletal imaging by reviewing their indications, patient positioning techniques, technical considerations, and clinical relevance [1-2]

Keywords: Knee radiography, Special radiographic views, Skyline view, Tunnel view, Stress radiography, Weight-bearing knee, patellofemoral joint, Intercondylar view, Tibiofemoral joint, Ligament instability, Osteoarthritis of knee

I. INTRODUCTION

The knee joint is particularly vulnerable to a variety of traumatic, degenerative, and sports-related injuries because it is a complex synovial hinge joint that is essential for weight bearing, movement, and general stability. Because of its complex structure and the dynamic interplay of osseous, cartilaginous, and ligamentous tissues, precise imaging evaluation is crucial for successful diagnosis, treatment planning, and monitoring. An initial review of bone alignment and gross disease can be obtained from conventional anteroposterior and lateral radiography views, but they frequently fall short of effectively illustrating minor abnormalities involving particular knee joint compartments [2-3]

In order to get over these restrictions, specific radiography techniques have been created that allow for the targeted viewing of the tibiofemoral joint spaces, intercondylar area, and patellofemoral joint, frequently in functional or weight-bearing situations. While other specialized views enable in-depth evaluation of the intercondylar area and tibiofemoral compartments, some projections, such as the skyline view and tunnel view, are especially recommended for the best assessment of the patellofemoral articulation. These techniques improve the identification of alignment problems, joint space constriction, and early degenerative alterations that might not be seen on standard projections. Because of their affordability, accessibility, low radiation dose, and capacity to offer useful functional and biomechanical information in routine musculoskeletal practice, special radiographic views continue to be clinically relevant despite the widespread availability of sophisticated cross-sectional imaging modalities like computed tomography and magnetic resonance imaging [4-5]

II. AIMS AND OBJECTIVES

Special radiographic techniques of the knee joint primarily aim to improve diagnostic accuracy by providing targeted and detailed visualization of specific anatomical compartments and functional abnormalities that are not adequately demonstrated on routine anteroposterior and lateral radiographic views. By providing targeted evaluation of intricate knee structures in both static and functional settings, these methods enhance traditional imaging [2]

The objectives of employing special radiographic techniques include using specific projections such as the skyline (sunrise) view to achieve optimal visualization of the patellofemoral joint, precise evaluation of the tibiofemoral joint spaces under physiological loading conditions with weight-bearing radiographs, and detailed assessment of the intercondylar notch, tibial spine, and cruciate ligament attachment sites using tunnel (intercondylar) views [3, 6].

Additional objectives include identifying subtle fractures, osteochondral defects, and post-traumatic abnormalities that are not visible on routine views, evaluating ligamentous integrity and joint instability using stress radiography, and early detection of degenerative changes and joint space narrowing in osteoarthritis. Furthermore, these methods support preoperative planning and postoperative follow-up, evaluate patellar alignment and tracking, evaluate knee joint alignment and biomechanical relationships during flexion and extension, and provide affordable, easily accessible, and repeatable imaging in routine clinical practice [5,7].

III. MATERIALS AND METHODS

A routine digital radiography (DR) or computed radiography (CR) X-ray system with an upright Bucky stand or an adjustable radiographic table is used for the particular radiographic techniques of the knee joint. To accomplish precise and consistent patient positioning, a variety of auxiliary tools are utilized, such as positioning sponges, sandbags, and immobilization aids. To maximize image quality while ensuring patient safety, a calibrated X-ray tube with adjustable angulation, suitable collimation devices, lead markers, and radiation protection equipment including lead aprons and gonadal shields are used. During functional and stress radiography exams, weight-bearing platforms, stress devices, or manual assistance are used as needed [2, 8-9].

Standardized radiographic positioning techniques are followed when situating patients based on the particular projection and clinical indication. To ensure the best possible imaging of the targeted anatomical regions, special projections including skyline (sunrise), tunnel (intercondylar), weight-bearing, stress, and flexion-based views are acquired with close attention to knee flexion angles, central ray alignment, and exposure parameters. Every examination is carried out strictly in accordance with radiation safety guidelines, especially the ALARA (As Low As Reasonably Achievable) concept. Before final interpretation, the obtained images are assessed for anatomical coverage, positioning accuracy, and general diagnostic quality [5, 10-11].

IV. MORPHOLOGY OF KNEE JOINTS

The medial tibiofemoral joint, lateral tibiofemoral joint, and patellofemoral joint are the three articulating parts of the knee joint, which is a sizable, intricate synovial hinge joint. The distal femur, proximal tibia, and patella articulate to produce it. In order to improve joint congruency and load distribution, the medial and lateral menisci deepen the relatively flat tibial plateaus, which articulate with the asymmetrical femoral condyles [10, 12].

The patellofemoral joint is formed by the patella's anterior location within the quadriceps tendon and its articulation with thefemur's trochlear groove. Skyline (sunrise) views are the most effective way to assess the morphology of this joint, including patellar shape, tilt, and tracking. The tibial spines are found in the intercondylar region, which is situated between the femoral condyles and is where the anterior and posterior cruciate ligaments join. Tunnel (intercondylar) views are the best way to see this area [6, 13].

Strong ligamentous structures that regulate anteroposterior, rotational, and varus-valgus movements, such as the cruciate and collateral ligaments, stabilize the knee joint. Smooth mobility and shock absorption depend on the articular cartilage that lines the joint surfaces. Weight-bearing and stress radiography techniques are an efficient way to show subtle morphological changes such joint space narrowing, osteophyte growth, malalignment, and cartilage degradation. Therefore, choosing the proper special radiography projections and accurately interpreting functional and pathological data depend on an understanding of the anatomy of the knee joint [4, 10]

V. SPECIAL RADIOGRAPHIC TECHNIQUES FOR KNEE JOINTS

1. Skyline (Sunrise / Tangential) View:
2. Tunnel view
3. Weight-Bearing AP View
4. Stress Radiography
5. Rosenberg View

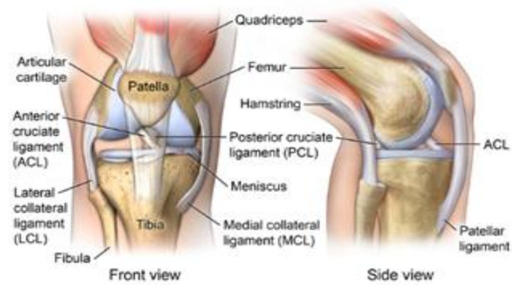


Figure1: Knee Anatomy

1. Skyline (Sunrise / Tangential) View

i) Standard Skyline (Sunrise / Tangential) View: A specific radiographic projection called the skyline (sunrise or tangential) image of the knee joint is utilized to assess the patellofemoral articulation. In order to achieve stable and consistent flexion, the patient is placed supine on the radiography table with their knee flexed, usually between 45° and 60°, and supported by a sponge or positioning block. The obtuse femorotibial angle created during knee flexion is represented by an angle of about 115° in schematic representations; this angle should not be construed as the real knee flexion angle utilized for imaging.

The central ray is directed tangentially toward the patellofemoral joint area, and the X-ray tube is inclined between 15° and 20° caudally with respect to the patella's long axis. This beam configuration minimizes superimposition of nearby bony structures and maximizes imaging of the patellofemoral joint by enabling the X-rays to pass between the posterior surface of the patella and the femoral trochlear groove [14].

The resulting radiographic image shows an axial (tangential) view of the patella, clearly showing the trochlear surface of the femur, the articular surface of the patella, the patellofemoral joint space, and the medial and lateral patellar facets. When evaluating patellar alignment, tilt, subluxation or dislocation, chondromalacia patella, patellar fractures, and patellofemoral osteoarthritis, this view is especially helpful. The skyline view is a crucial part of a thorough knee radiography evaluation because it offers better vision of patellofemoral congruence and tracking than standard anteroposterior and lateral projections [15-16].

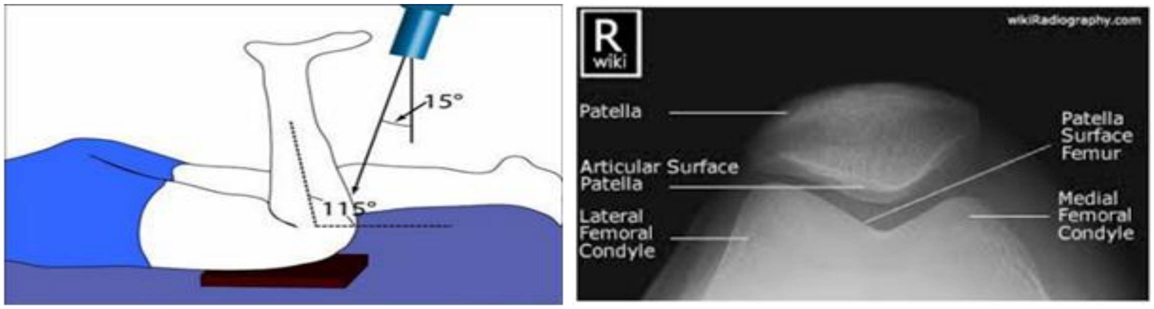


Figure2: The standard skyline (sunrise or tangential) view demonstrates the knee positioned in flexion with appropriate support, allowing a caudally directed tangential X-ray beam to pass through the patellofemoral joint. The resulting axial radiograph clearly depicts the patella, patellofemoral joint space, and femoral trochlear surfaces for assessment of alignment and congruence.

ii) Standard Positioning Technique for the Skyline (Sunrise / Tangential) View: The patient is placed supine on the radiography table with their knee bent to about 45° for the normal skyline (sunrise or tangential) view. To ensure ideal alignment of the patella with the femoral trochlear groove and to maintain steady and repeatable knee flexion, an angled positioning device is positioned beneath the lower leg. In order to receive the tangentially directed X-ray beam, the image receptor is positioned inferior to the knee.

The X-ray tube is directed tangentially toward the patellofemoral joint space at a caudal angle of about 60°. By allowing the central ray to travel between the patella's posterior surface and the femoral trochlear groove, this beam direction reduces the superimposition of nearby bony structures. Accurate assessment of patellofemoral alignment and joint congruence requires precise control over knee flexion and beam angulation in order to get a true axial projection of the patella [17].

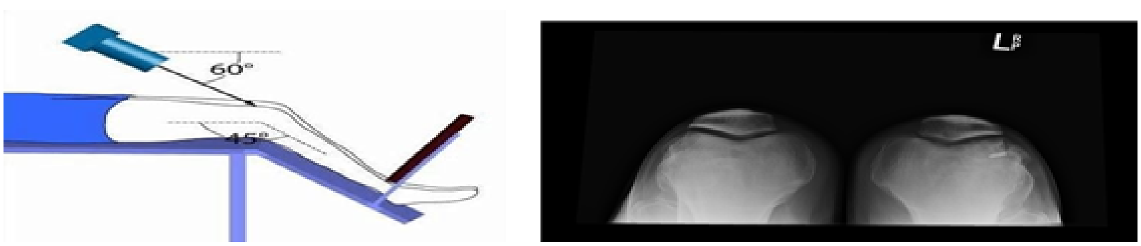


Figure 3: The standard skyline (sunrise or tangential) positioning technique demonstrates a supine patient with the knee flexed approximately 45°, supported by an angled device, and a caudally angled X-ray beam directed tangentially to the patellofemoral joint. The accompanying radiograph shows bilateral axial visualization of the patellae, patellofemoral joint spaces, and femoral trochlear surfaces for assessment of alignment and congruence.

iii) Modified Skyline (Tangential) Techniques: Four frequently used modified skyline (tangential) radiography methods for patellofemoral joint imaging are depicted in the figure. These methods reliably produce an axial projection of the patella while accommodating differences in clinical indications, patient tolerance, and degrees of knee flexion. The goal of each technique is to visualize the patellofemoral articulation as best as possible, despite variations in patient location and X-ray beam orientation.

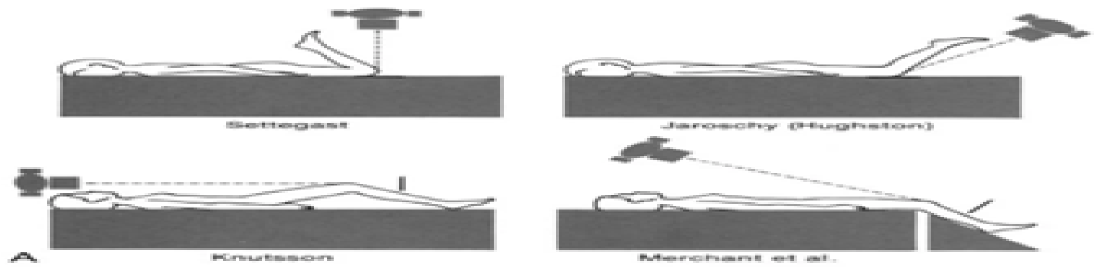


Figure4: The modified skyline (tangential) positioning techniques; Settegast, Jaroschy (Hughston), Knutsson, and Merchant methodshighlighting variations in patient position, knee flexion, and X-ray beam angulation for optimal patellofemoral joint visualization

Settegast Method

The patient is positioned supine with their knee flexed to a high degree typically more than 90°during the Settegast procedure. The image receptor is placed above the knee, and the X-ray beam is directed tangentially into the patellofemoral joint region. Because it gives a better view of the patellar articular surface and patellofemoral joint congruence, this method is highly useful for diagnosing patellar fractures and chondral lesions. However, because it necessitates significant knee flexion, patients with acute trauma, postoperative conditions, or severe knee discomfort are usually contraindicated [16].

Figure5: The Settegast technique for skyline imaging of the patellofemoral joint involves a supine patient with the knee flexed more than 90 degrees, an image receptor placed above the knee, and a tangential radiograph that clearly shows the patellar articular surface and congruence of the patellofemoral joint.

Jaroschy (Hughston) Method: A specific radiographic method for imaging the patellofemoral joint is the tangential patella (Hughston/Jaroschy) method. Compared to high-flexion decreases, this treatment lessens patient discomfort by placing the patient in a prone position with the knee gently flexed to about 45°. The X-ray tube is directed caudally toward the patellofemoral joint, and the image receptor is positioned to receive a tangentially directed beam. To reduce the superimposition of nearby bony structures, the central ray is oriented tangentially between the femoral trochlear groove and the posterior surface of the patella. The resultant radiograph shows the patella, femoral condyles, and patellofemoral articulation in a clear axial (skyline) perspective [18].

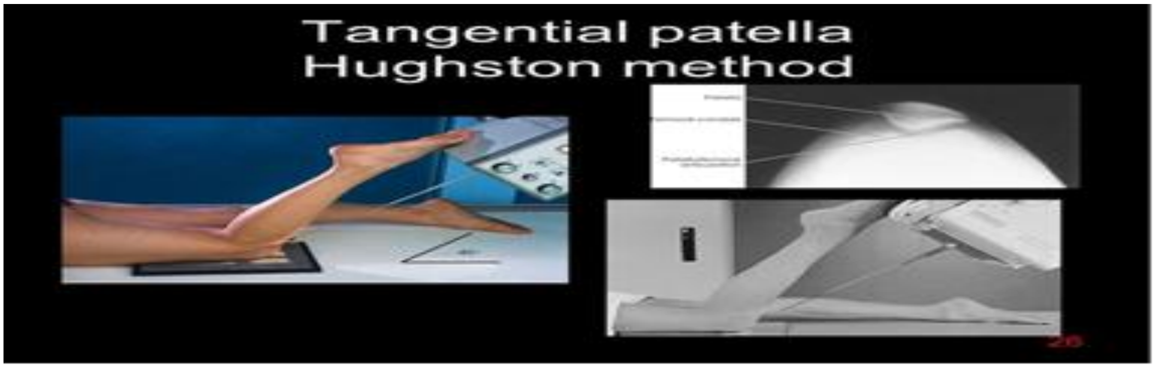


Figure6: Hughston (Jaroschy) tangential patellar method, showing a prone patient with the knee flexed to approximately 45°, a caudally angled X-ray beam directed tangentially to the patellofemoral joint, and the resulting axial radiograph highlighting patellar alignment and joint congruence.

Knutsen Method: The patellofemoral joint is assessed using the Knutsen method, a modified skyline (tangential) radiography technique.

Using a wedge or triangle sponge underneath the knee, the patient is positioned supine on the radiography table with the knee kept in a moderate flexion. The lower limb is stabilized and positioned consistently with the aid of an extra support beneath the ankle. Patients with discomfort, stiffness, or restricted range of motion will find this technique more comfortable as it avoids significant knee flexion.

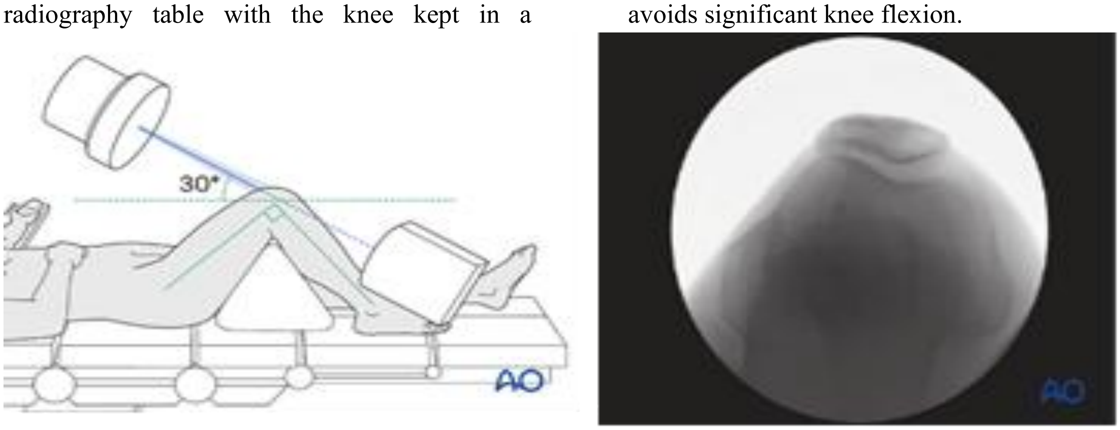


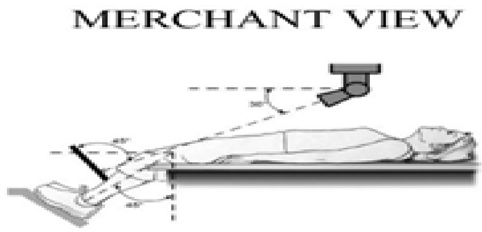
Figure7: Knutsen method (tangential patellar view), showing a supine patient with the knee in moderate flexion supported by positioning aids and a caudally angled horizontal X-ray beam. The corresponding axial radiograph clearly visualizes the patellofemoral join

A tangential X-ray beam directed horizontally is aimed at the image receptor, which is positioned distal to the knee. The diagram shows that the X-ray tube is positioned around 30° caudally with respect to the horizontal plane. The central ray minimizes superimposition of surrounding bony structures by passing tangentially between the femoral trochlear groove and the patella's posterior side.

The patellar facets, patellofemoral joint space, and their relationship to the femoral condyles are all clearly visible in the resultant radiograph, which offers an axial (skyline) image of the patella. For routine clinical evaluation of patellofemoral alignment and pathology, the Knutsen approach provides a useful balance between diagnostic imaging quality and patient comfort [17].

Merchant Method

The Merchant approach is one of the most often used skyline techniques. The patient is placed supine with limited knee flexion, often between 30° and 45°, using a particular positioning device that supports both lower limbs. The X-ray beam is angled caudally to produce a bilateral axial picture of the patellofemoral joints. This method, which is particularly helpful for evaluating patellar alignment, tilt, congruence, and patellofemoral osteoarthritis, can be tolerated by patients with pain, instability, or limited range of motion [6].



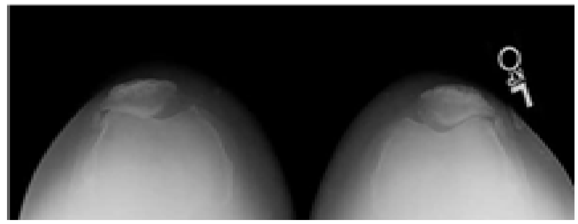


Figure8: Merchant method for patellofemoral imaging, showing a supine patient with both knees flexed approximately 30°–45° using a positioning device and a caudally angled X-ray beam, producing a bilateral axial radiograph for assessment of patellar alignment andjoint congruence.

When combined, these modified skyline approaches offer versatility in imaging and enable customized evaluation of patellofemoral pathologies, ensuring precise diagnosis while taking into account patient comfort and particular clinical limitations.

2. Tunnel view

The tunnel view, sometimes called the intercondylar notch view, is a specific radiographic projection used to assess the knee joint's core compartment, especially the intercondylar area. The intercondylar notch, tibial spines, and the bony attachment sites of the anterior and posterior cruciate ligaments (ACL and PCL), which are frequently not clearly visible on standard anteroposterior and lateral knee radiographs, can all be clearly seen in this image. Consequently, the tunnel view is a crucial supplementary projection in a thorough evaluation of the knee [19-20].

The tunnel view is typically obtained by using a number of positioning strategies. The X-ray beam is directed caudally through the intercondylar fossa toward the image receptor while the patient is in a prone position with the knee flexed between 40° and 50° in the Camp–Coventry method. The Holmblad method, on the other hand, involves the patient kneeling on the table and bending forward to flex the knee so that the central ray passes straight into the intercondylar notch. By projecting the femoral condyles superiorly, both techniques open the intercondylar space for the best possible visualization [21-22].

In clinical settings, the tunnel view is especially useful for identifying degenerative or post-traumatic alterations, tibial spine fractures, loose bodies, osteochondral abnormalities, and intercondylar notch narrowing. Additionally, it is helpful in evaluating conditions associated with early degenerative disease, postoperative evaluation, and cruciate ligament injury. The tunnel view is still a crucial part of special radiography techniques for knee joint evaluation because it can provide important anatomical details not seen on normal views [23].

Figure (A): Camp–Coventry method **Figure (B): Holmblad method**

Figure 9: Fig. A and B demonstrate two standard tunnel (intercondylar notch) projections of the knee. In the Camp–Coventry method, the patient is positioned prone with the knee flexed approximately 40°–50°, and a caudally angled X-ray beam is directed through the intercondylar fossa. In the Holmblad method, the patient kneels with the knee flexed over the image receptor, allowing the beam to pass directly through the intercondylar notch, clearly visualizing the intercondylar fossa, tibial spines, and femoral condyles.

3. Weight-Bearing AP View

A specialized radiographic method called the weight-bearing anteroposterior (AP) view is utilized to assess the knee joint under physiological loading circumstances. This projection, in contrast to traditional supine radiographs, shows the knee in a functional state, making it possible to evaluate joint mechanics, load transmission, and compartmental cartilage integrity throughout the tibiofemoral joint with greater accuracy. It is especially helpful in situations when changes in joint space are only noticeable when bearing weight [24].

Figure 10: the weight-bearing anteroposterior (AP) view of the knee, showing a standing patient with both knees fully extended and bearing equal weight. The corresponding radiograph depicts functional tibiofemoral joint spaces and alignment, allowing accurate assessment of joint space narrowing, compartmental load distribution, and early degenerative changes.

In order to achieve symmetrical loading, the patient is positioned standing upright with equal weight on both lower limbs. Although a small amount of flexion may be used based on patient comfort or clinical guidelines, the knees are usually kept in full extension. The image receptor is placed posterior to the knees, and the anteroposterior direction of the X-ray beam is centered at the level of the knee joint line. In order to accurately visualize the tibial plateaus and joint spaces, great care is used when aligning the patient so that the femoral condyles are parallel to the image receptor. For comparison assessment, bilateral imaging is often carried out. [25].

Clinically, the weight-bearing AP view is essential for evaluating joint space decreasing, especially in the medial tibiofemoral compartment, where non-weight-bearing images might not show early degenerative changes. It is widely used to diagnose and track osteoarthritis, quantify cartilage loss, evaluate varus and valgus deformities, and record postoperative results after surgeries like osteotomy or joint replacement. The weight-bearing AP view continues to be an essential part of specific radiography approaches for thorough knee joint evaluation in routine musculoskeletal imaging because it offers a realistic portrayal of knee alignment and functional joint space [26-27].

4. Stress Radiography

Stress radiography is a specialized imaging technique that uses controlled mechanical stress during radiographic acquisition to evaluate the knee joint's functional stability. Stress views, in contrast to standard static radiographs, assess the integrity of ligamentous systems by showing aberrant joint displacement or opening in response to an external force [28].

This technique involves placing the patient in a supine or seated position and using a valgus, varus, anterior, or posterior stress to the knee, either manually or with the use of a stress device (such as Telos). Depending on the ligament being evaluated, the X-ray beam is directed appropriately, usually in the anteroposterior (AP) or lateral projection. To establish a normal baseline, comparative imaging of the contralateral knee is often carried out [29-30].

Clinical Importance: Stress radiography is especially useful for assessing anterior and posterior cruciate ligament (ACL/PCL) instability using anterior or posterior stress approaches, as well as for evaluating medial and lateral collateral ligament (MCL/LCL) injuries using valgus and varus stress views, respectively. It is also helpful for postoperative evaluation after ligament restoration and for identifying modest joint laxity and chronic instability. Stress radiography continues to be an affordable and accessible supplement to clinical examination and sophisticated imaging because it offers objective and quantitative proof of instability [31].

Types of Stress Positions

i) Valgus Stress Position of the Knee Joint: In the valgus stress position, the patient is positioned supine on the radiographic table with the knee maintained in slight flexion (approximately 20°–30°) to relax the posterior capsule and isolate the medial stabilizing ligamentous structures. The distal femur is stabilized, and a lateral-to-medial force is applied at the level of the knee, either manually or using a mechanical stress device. The X-ray beam is directed in the anteroposterior (AP) projection, centered at the knee joint line, with the image receptor placed posterior to the knee.

The resulting valgus stress radiograph demonstrates opening of the medial tibiofemoral joint space under applied stress. Comparison with the contralateral knee facilitates identification of abnormal widening. Excessive medial joint space opening is indicative of medial collateral ligament (MCL) laxity or rupture, making this technique particularly valuable for evaluating acute and chronic medial knee instability and for postoperative assessment following ligament repair [32-33].

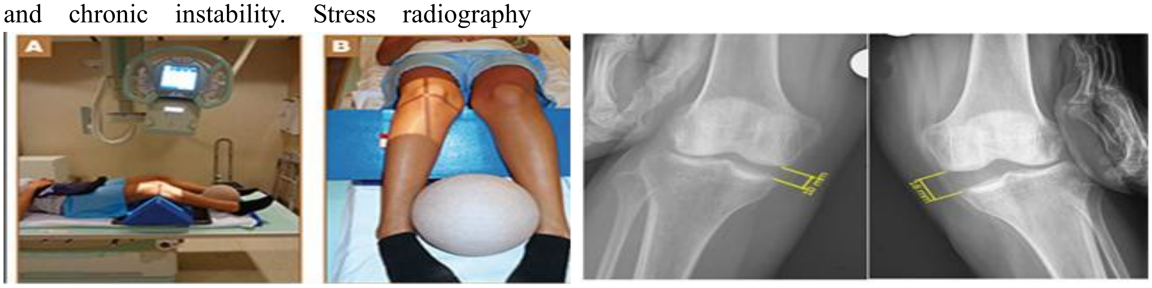


Figure 11: (A) The patient is positioned supine with the knee slightly flexed and supported, while a controlled lateral-to-medial force is applied to create valgus stress. (B) The resultant AP stress radiographs show medial tibiofemoral joint space widening, allowing objective assessment of medial collateral ligament integrity.

ii) Varus Stress Position of the Knee Joint: In the varus stress position, the patient is positioned supine on the radiographic table with the knee maintained in slight flexion (approximately 20°–30°) to relax the posterior capsule and isolate the lateral stabilizing structures. After stabilizing the distal femur, a medial-to-lateral force is applied at the level of the knee, either manually or with the aid of a mechanical stress device. The X-ray beam is directed in the anteroposterior (AP) projection, centered at the knee joint line, with the image receptor placed posterior to the knee.

The resulting varus stress radiograph demonstrates opening of the lateral tibiofemoral joint space under applied stress. Comparison with the contralateral knee facilitates identification of abnormal widening. Excessive lateral joint space opening indicates lateral collateral ligament (LCL) laxity or rupture and may also suggest posterolateral corner instability, making this technique particularly valuable for evaluating acute and chronic lateral knee instability and for postoperative ligament assessment [34].

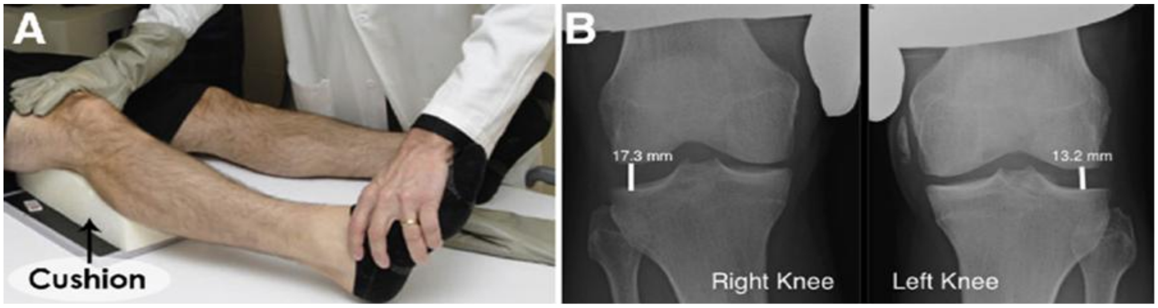


Figure 12 :(A) The image demonstrates varus stress positioning of the right knee with support to apply controlled lateral compartment stress in a patient with suspected posterolateral corner injury. B) The comparative bilateral radiographs reveal a side-to-side difference in joint space width, consistent with a complete posterolateral corner injury.

iii) Anterior Stress Position of the Knee Joint: In the anterior stress position, the patient is positioned supine on the radiographic table with the knee flexed to approximately 10°–30°, a posture that minimizes the stabilizing influence of surrounding structures while optimally isolating the anterior cruciate ligament (ACL). After stabilizing the distal femur, an anteriorly directed force is applied to the proximal tibia relative to the femur, either manually or using a mechanical stress device such as the Telos apparatus. The X-ray beam is directed in the lateral projection, centered at the knee joint, with the image receptor placed laterally to the knee.

The resulting anterior stress radiograph demonstrates anterior translation of the tibia relative to the femur under applied stress. Comparing with the contralateral knee facilitates identification of abnormal displacement. Excessive anterior tibial translation is indicative of ACL laxity or rupture, making this technique particularly valuable for evaluating acute and chronic anterior knee instability as well as for postoperative assessment following ACL reconstruction [35-36].

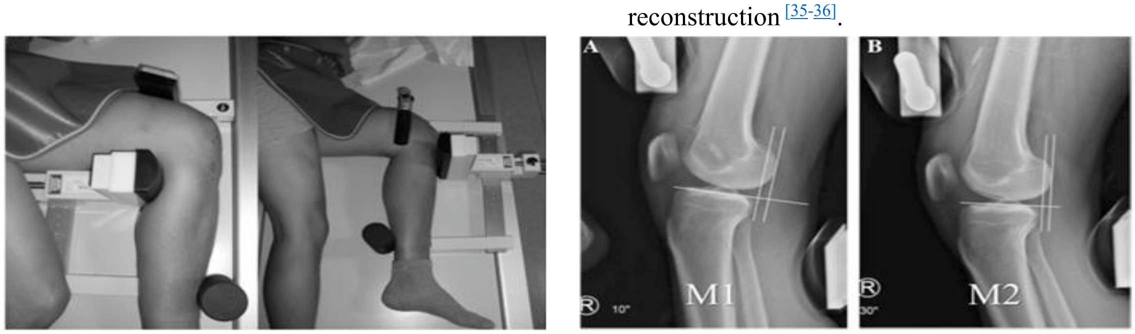


Figure 13: The anterior stress radiography of the knee using a mechanical stress device. The knee is positioned in slight flexion while anterior force is applied to the proximal tibia. Radiographs (A) at 10° and (B) at 30° flexion show increasing anterior tibial translation relative to the femur, enabling objective assessment of anterior cruciate ligament (ACL) instability.

iv) Posterior Stress Position of the Knee Joint: In the posterior stress position, the posterior cruciate ligament (PCL) is optimally isolated by minimizing the contribution of other supporting structures. The patient is positioned supine on the radiographic table with the knee flexed to approximately 70°–90°. After stabilizing the distal femur, a posteriorly directed force is applied to the proximal tibia, either manually or using a mechanical stress device such as the Telos apparatus. The X-ray beam is directed in the lateral projection, centered at the knee joint, with the image receptor placed laterally to the knee.

The resulting posterior stress radiograph demonstrates posterior translation of the tibia relative to the femur under applied stress. Comparison with the contralateral knee facilitates identification of abnormal displacement. Excessive posterior tibial translation indicates PCL laxity or rupture, making this technique particularly valuable for evaluating acute traumatic posterior instability, chronic PCL insufficiency, and postoperative outcomes following PCL reconstruction [37].

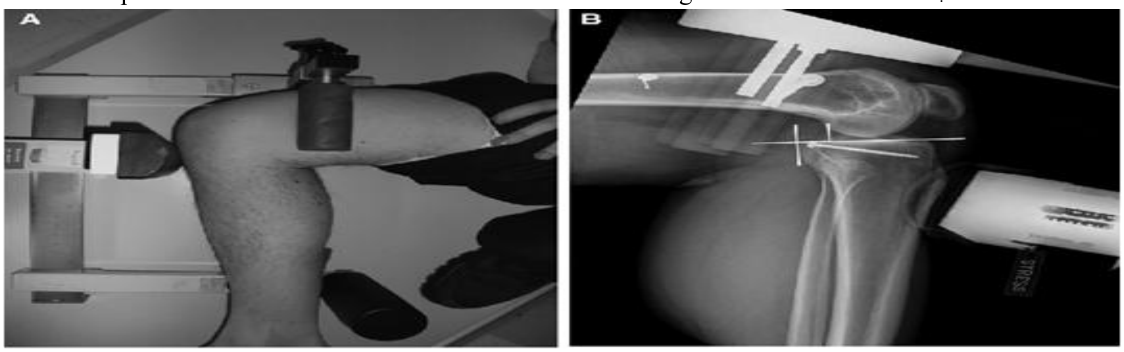


Figure 14: The posterior stress radiography of the knee. (A) The patient is positioned supine with the knee flexed to approximately 70°–90°, stabilized in a mechanical stress device while a posterior force is applied to the proximal tibia. (B) The corresponding lateral radiograph shows posterior tibial translation relative to the femur, allowing objective assessment of posterior cruciate ligament (PCL) integrity.

5. Rosenberg View

A specific weight-bearing radiographic projection of the knee called the Rosenberg view is intended to improve visibility of the tibiofemoral joint spaces, especially the posterior parts of the tibial plateaus and femoral condyles. It is particularly sensitive in identifying early and compartment-specific degenerative alterations that might not be visible on non-weight-bearing or standard anteroposterior (AP) images [38].

The Rosenberg perspective involves the patient bearing equal weight on both lower limbs while standing straight and flexing both knees to a 45° angle. The knees are positioned so that the image receptor is in touch with the anterior parts of the knees. The X-ray beam is centered at the level of the knee joint line, angled 10° caudally, and directed posteroanteriorly (PA). To enable side-to-side comparison, bilateral imaging is often carried out. Subchondral sclerosis, marginal osteophytes, and medial and lateral compartment joint space narrowing can all be accurately evaluated as a result of this projection, which opens the posterior tibiofemoral joint spaces. Compared to standard AP views, cartilage loss especially in the medial compartment is more noticeable because the knee is imaged under physiological load and flexion [39].

In clinically, the Rosenberg view is often used to evaluate meniscal disease. Early knee osteoarthritis, and the results of meniscal or cartilage operations. Patients who have knee discomfort and normal or unclear results on routine radiography benefit most from it.The Rosenberg view is a crucial part of special radiographic techniques for thorough knee joint examination because it combines weight bearing and flexion to provide a more sensitive and functional assessment of tibiofemoral joint integrity [40-41].

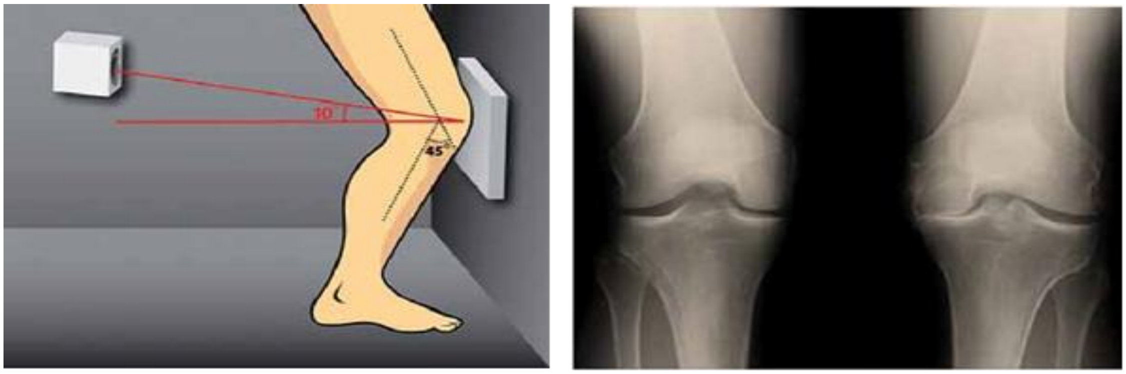


Figure 15: The Rosenberg view of the knee. The patient stands with knees flexed approximately 45° against the image receptor while bearing weight. A posteroanterior X-ray beam angled about 10° caudally opens the posterior tibiofemoral joint spaces, allowing sensitive assessment of joint space narrowing and early degenerative changes.

VI.OBSERVATIONS

When compared to standard anteroposterior and lateral views, the use of specialized radiography techniques for the knee joint greatly improved visualization of particular anatomical compartments and functional problems. Accurate evaluation of patellar alignment, tilt, congruence, and tracking anomalies was made possible by the continuous axial demarcation of the patellofemoral articulation afforded by skyline (sunrise/tangential) projections. Compared to ordinary projections, skyline views made it easier to detect patellofemoral joint space narrowing, marginal osteophytes, and characteristics suggestive of chondromalacia or early patellofemoral osteoarthritis [6]

The intercondylar notch, tibial spines, and cruciate ligament attachment sites were clearly seen by tunnel (intercondylar) views. The identification of tibial spine fractures, osteochondral abnormalities, loose bodies, and intercondylar notch narrowing all of which were difficult to see on traditional views was enhanced by both the Camp–Coventry and Holmblad procedures.In cases of post-traumatic and suspected cruciate ligament-related disease, these projections were especially helpful. Bearing weight Functionally significant tibiofemoral joint space restriction was seen in AP views, particularly in the medial compartment. This narrowing was not as noticeable in non-weight-bearing images.Under physiological loading settings, early osteoarthritic alterations and varus or valgus malalignment were more noticeable [5, 24, 42-43]

Ligamentous instability was objectively and quantitatively demonstrated by stress radiography.Anterior and posterior stress radiographs revealed increased tibial translation consistent with ACL or PCL insufficiency, while valgus and varus stress views showed aberrant medial or lateral joint space opening in cases of collateral ligament injury.Diagnostic confidence was increased by side-to-side comparison. By exposing the posterior tibiofemoral joint spaces during weight-bearing flexion, the Rosenberg view demonstrated a high degree of sensitivity in identifying early and compartment-specific degenerative alterations. Overall, by enhancing diagnostic precision, promoting early pathology detection, and assisting with efficient clinical decision-making, these unique radiographic approaches enhanced routine imaging [32, 35, 39, 44]

VII.DISCUSSION

The current study emphasizes the ongoing clinical utility of specific radiographic techniques in the thorough assessment of knee joint disease. Conventional anteroposterior and lateral radiographs are still the first imaging technique, although they often miss small anomalies associated to the patellofemur, ligaments, and compartments. The results presented in this paper show that specialized projections improve diagnostic accuracy by viewing the knee under functional, weight-bearing, and stress conditions [15, 24]

When assessing the patellofemoral joint, skyline (sunrise/tangential) views were essential for identifying patellar maltracking, tilt, subluxation, and early patellofemoral osteoarthritis. Flexible patient placement was made possible by modified skyline techniques such the Merchant, Knutsen, Hughston, and Settegast methods, which allowed for the best imaging even in patients with pain or limited range of motion. The intercondylar notch and tibial spines were better visible in tunnel (intercondylar) views produced by the Camp–Coventry and Holmblad techniques, making it easier to identify osteochondral defects, loose bodies, and anomalies linked to the cruciate ligament [5, 6, 42]

The significance of imaging the knee under physiological strain was illustrated by weight-bearing AP and Rosenberg images. These projections showed early degenerative alterations and joint space narrowing that were often overestimated on non-weight-bearing imaging, especially in the medial tibiofemoral compartment. By providing an objective, quantitative assessment of ligamentous instability, stress radiography significantly enhanced static imaging and was useful in assessing collateral and cruciate ligament injuries as well as postoperative results. [39 32, 43, 44]

These unique radiographic techniques are still widely accessible, affordable, and low-dose imaging modalities despite advancements in CT and MRI, which makes them particularly useful in everyday musculoskeletal practice in settings with limited resources.

VIII.CONCLUSION

By providing comprehensive visualization of anatomical compartments and functional characteristics that are often inadequately shown on routine anteroposterior and lateral radiographs, special radiographic techniques of the knee joint play a pivotal role in improving diagnostic accuracy. Projections such as the skyline (sunrise), tunnel (intercondylar), weight-bearing anteroposterior, stress radiography, and Rosenberg views enable targeted assessment of the patellofemoral articulation, intercondylar region, tibiofemoral joint spaces, and ligamentous integrity under both physiological loading and applied stress conditions. These techniques are particularly valuable for the early detection of degenerative changes, subtle fractures, patellar maltracking, joint space narrowing, and ligamentous instability.

When appropriately selected and performed with meticulous attention to patient positioning and beam alignment, special radiographic views significantly enhance diagnostic confidence and facilitate timely clinical decision-making. They support early intervention, guide treatment planning, and assist in postoperative evaluation. Despite ongoing advances in cross-sectional imaging modalities, these techniques remain cost-effective, widely accessible, and low-dose imaging tools, underscoring their continued importance in comprehensive knee joint assessment within routine musculoskeletal practice.

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