

# Diagnosis and Longitudinal Assessment of Osteoarthritis

## Review of Available Imaging Techniques

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### KEYWORDS

• Osteoarthritis • Imaging • Radiographs • MRI • 4-D CT • CBCT • PET

### KEY POINTS

- Radiographs remain the imaging modality of choice in osteoarthritis (OA) in clinical practice.
- MRI being used for detection and quantification of various OA features as an essential research tool.
- Four-dimensional computed tomography (4-D CT) and cone-beam CT (CBCT) have special applications when a diagnosis of underlying dynamic changes is suspected.

### INTRODUCTION

OA is the leading etiology for chronic musculoskeletal morbidity and disability of the elderly in the world.<sup>1</sup> Treatment and symptomatic management of OA represent substantial annual health care expenditure in the United States and is disproportionately high for women due to its higher prevalence in women.<sup>2</sup> Although OA can be diagnosed clinically, the importance of imaging of OA in diagnosis and longitudinal evaluation of this chronic disease is well recognized by both rheumatologists and radiologists.<sup>3</sup> Although plain radiographs remain the gold standard and initial investigation imaging of choice for OA,<sup>4</sup> cross-sectional imaging modalities, such as MRI and multidetector computed tomography (MDCT), have become indispensable for OA characterization and follow-up assessment in the research setting. Given that imaging

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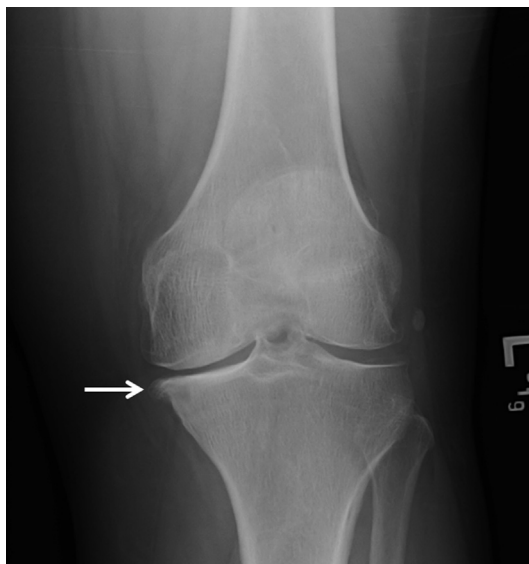
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modalities have the potential to act as risk stratification tools for OA severity and outcome predication, several studies have developed and validated risk models to predict important patient outcomes.<sup>5</sup> Conventional and novel imaging modalities have also been used in diagnostic and therapeutic OA assessment.<sup>1</sup> Several studies have shown the value of MRI in OA risk assessment and outcome prediction.<sup>6,7</sup> In addition to MRI, kinematic and weight-bearing evaluation of the peripheral joints is now feasible using 4-D CT and dedicated extremity CBCT, respectively. In addition to advanced cross-sectional imaging techniques, PET examinations may unveil the underlying metabolic activities related to synovial inflammation in OA. This review article discusses the currently available evidence regarding both the conventional and novel imaging modalities that can be used for evaluation of patients with OA and its longitudinal assessment.

### PLAIN RADIOGRAPH

Plain radiographs are the most widely used imaging modality for OA diagnosis, risk stratification, and outcome determination of patients with OA-related symptoms. Typical radiographic assessments in clinical settings for OA include the following: standing anteroposterior (AP) radiograph of the knees, posteroanterior radiographs of the hand, standing AP radiograph of the hip, and oblique projection of the spine demonstrate gradual narrowing and sclerosis of the facet joints. The key radiographic imaging characteristics in OA are joint space narrowing (JSN), subchondral sclerosis and cystic changes, and the presence of osteophytes.<sup>8</sup> There are established metrics for radiography-based OA diagnosis and grading.<sup>9</sup> The use of semiquantitative scoring systems, such as the Kellgren-Lawrence (K-L) score, allows the characterization of homogenous subsets for clinical and epidemiologic studies (Fig. 1). Multiple image acquisitions (weight bearing vs non-weight bearing) and acquiring radiographs in more than 1 view are often needed to properly describe the presence of OA and the



**Fig. 1.** AP weight-bearing plain radiograph of a patient with JSN and osteophyte formation consistent with KL grade III osteoarthritis.

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