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### **A defined problem: Working towards a clinical definition of foot osteoarthritis**

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“The beginning of wisdom is in the definition of terms” is a quote often attributed to Socrates (1). While it is unclear whether these were Socrates’ actual words, it is well accepted that both he and Plato (and many) **This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1002/ACR.24594](https://doi.org/10.1002/ACR.24594)**

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other philosophers) debated the importance of meanings ascribed to words and terms, and how these meanings can change over time. Clinicians and researchers have likewise argued the importance of defining osteoarthritis (OA), and of updating the definition as understanding of the disease changes (2). This is because defining a complex and heterogeneous condition such as OA has implications not only for clinical decision making, but also for public policy decisions such as health care resource allocation, research priority setting and funding, and for research methodology. In other words, defining OA is crucial for our collective wisdom in understanding and managing this highly prevalent disease.

Definitions for OA at the knee, hip and hand are well established, and are based on decades of research efforts. In contrast, there has been a relative lack of research on defining foot OA compared to these other sites. However, significant progress towards this goal has been made in recent years. A notable example is a large cohort study which used both structural joint changes on x-ray, and pain in the corresponding location, to define the population prevalence of symptomatic radiographic foot OA (3). The development of this standardised definition of symptomatic radiographic foot OA is important as it will help to align global foot OA research efforts that aim to describe its epidemiology, identify risk factors, and ultimately, develop treatment targets. However, in this editorial we argue that a complementary *clinical* definition of foot OA, based solely on clinical signs and symptoms without the need for radiography, is also necessary.

A clinical definition is important for several reasons. Clinical symptoms are important to patients and are what drives them to seek care. For example, the main reasons patients with knee OA consult their general practitioner (and most likely other health professionals), include pain severity and duration, difficulties with daily activities and joint swelling (4). Thus, given these are the OA features that are important to patients, and patients are the population to which researchers want to generalise their results, it is symptoms that ultimately drive research aims. A validated clinical definition of foot OA also might decrease the need for x-rays in clinical practice, reducing patient burden and health care costs. Likewise, it has the potential to make research less expensive and less burdensome for participants.

A clinical definition for foot OA is also important because there is some evidence of a discordance between OA symptoms such as pain and physical dysfunction, and radiographic changes, at joints such as the knee (5). This is less clear at the foot however, with at least one study showing a dose-response relationship between radiographic severity of the first MTP joint and a range of clinical factors including joint pain (6).

Notwithstanding, the most recent recommendations from an expert international OA taskforce state that radiography or other imaging is not needed to diagnose OA in patients with typical symptoms, or to monitor disease progression (7). Instead, imaging should only be used in atypical presentations or if there is a rapid change in symptoms. It should be acknowledged that like most OA research, these recommendations were solely based on studies of knee, hip and hand OA, and hence further research is needed to confirm whether they also apply to OA in the foot. This is especially important because the foot is anatomically complex and fundamentally different to the knee, hip and hand. Furthermore, it could also be argued that foot pain in older people may be more likely due to causes other than OA compared to these other sites, given the anatomical complexity of the foot and range of potential musculoskeletal, vascular, and neurological diagnoses.

At other sites such as the knee (8), hip (9) and hand (10), clinical definitions of OA have been in use for at least three decades. These definitions all include pain, combined with at least three other features such as stiffness, bony enlargement, bony tenderness, older age, limited range of motion, and/or swelling (depending on the site). Of note, guidelines from the UK also advise that a clinical diagnosis of peripheral joint OA can be made without additional investigations if the patient is aged 45 years or older, has activity-related joint pain, and has either no morning stiffness, or has morning stiffness that lasts less than 30 minutes (11). As with imaging recommendations however, it is unclear whether these criteria also apply to foot OA given the lack of research in the area.

Combining this legacy of clinical OA definitions from other sites, with research on foot OA symptoms conducted to date, provides a possible platform on which to work towards a clinical definition of foot OA. Yet a fundamental consideration unique to the foot is whether separate definitions are needed for specific foot regions. In this editorial, we propose that the development of a clinical definition of foot OA includes an overarching foot OA definition, complemented by two sub-definitions for different types of foot OA. An overarching definition may borrow components from OA at other sites, and/or the general definition of peripheral joint OA used in the UK guidelines, such as age and stiffness. However, further sub-definitions may also be useful given foot OA is known to cluster in the first metatarsophalangeal (first MTP) and midfoot joints (talonavicular, navicular-cuneiform and cuneiform-metatarsal) (12), with evidence that these phenotypes have distinct risk factors (12), clinical presentations (13, 14) and prognoses (15).

Osteoarthritis of the first MTP joint is characterized by localised pain, stiffness and reduced range of motion (13). Joint deformity may arise in advanced cases, with bony enlargement, dorsal osteophytes (a dorsal ‘bump’) and interphalangeal joint hyperextension common clinical findings (13, 16). Associated findings include plantar hyperkeratoses on the interphalangeal joint or lesser metatarsophalangeal heads, and degenerative changes of the sesamoids and flexor tendons (16). Diagnostic criteria have been successfully developed for *radiographic* OA of the first MTP joint, whereby a clinical model including the presence of longstanding pain and clinical signs such as a palpable dorsal joint osteophyte, crepitus, hard end-feel and restricted range of motion has good diagnostic accuracy (sensitivity 88%, specificity 77%) (13). Whilst this may provide a basis for a clinical definition of first MTP joint OA, further testing and refinement in larger cohorts including a wider spectrum of patients and diagnoses will enhance the utility of a clinical definition, particularly for settings such as primary and allied health care. However, such an undertaking will require a significant amount of research time, personnel and funding.

The clinical presentation of midfoot OA includes persistent midfoot pain (often on the dorsal aspect) localised to the tarsometatarsal, naviculo-cuneiform, talonavicular and/or calcaneocuboid joints. Pain is aggravated by weightbearing activity, and in severe cases, triggered by pressure from footwear (17). Midfoot OA is the most disabling form of foot OA, affecting the ability to walk, stand for prolonged periods and carry out daily activities (12). Although midfoot and first MTP OA share some similarities, establishing a clinical definition for midfoot OA is more problematic compared to first MTP joint OA. The midfoot joints are in close proximity making them more challenging to isolate and grade for features such as tenderness, stiffness and deformity. The complex (and at times variable) anatomy also yields multiple potential differential diagnoses, and there is a lack of specific and validated clinical tests for assessing the midfoot joints. Brief clinical assessments involving measures of foot posture, range of motion and palpation have been shown to perform poorly in identifying painful midfoot OA compared to midfoot pain alone (14). The development of more detailed and specific tests for the midfoot joints presents an opportunity to determine whether distinguishing midfoot OA from other painful foot disorders can be achieved.

In summary, there has been significant progress in understanding the symptoms that typically characterize foot OA. Combining this knowledge with the substantial body of clinical OA research from other joints means a clinical definition of foot OA is possible, albeit, it will require a significant amount of research effort and collaboration going forward. A clinical definition will help to advance the field, ensuring clinicians and researchers can develop and implement best-practice clinical care for patients. Whilst we

may not be at the beginning of foot OA research, we have the perfect opportunity to begin work towards a clinical definition of foot OA that will ultimately provide the wisdom necessary to understand and manage this under-researched disease.

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