

# Evaluation of osteoarthritic features in peripheral joints by ultrasound imaging: a systematic review

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## BACKGROUND

- Osteoarthritis (OA) is a global health burden and leading cause of chronic pain, joint stiffness, functional limitation, and disability among older adults
- Our knowledge of foot and hand OA substantially lags behind that of other joint sites, such as the knee and hip
- Ultrasound (US) imaging presents an alternative to plain radiography in the diagnosis of OA due to its ability to detect features present during disease progression, related both to inflammation and structural damage
- US has been shown to have high sensitivity to detect subclinical inflammatory joint pathology and provides excellent resolution of superficial tissues/structures
- Given the ability of US to depict tissue-specific morphological changes before the onset of pain and before the point of irreversible structural damage, US imaging may play a fundamental role in the earlier detection and assessment of peripheral joint OA

## AIM

The aim of the systematic review was to determine how structural and inflammatory osteoarthritic features in peripheral joints are:

- (1) Assessed,
- (2) Defined and
- (3) Graded by US imaging

## METHODS

- This systematic review is reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines
- An electronic literature search was performed on Medline, CINAHL, SportDiscus and The Cochrane Library
- Methodological quality of studies was assessed using the Critical Appraisal Skills Program (CASP) tool
- The following US measurement techniques were extracted: what OA features were imaged, how the US features were graded, if an US atlas was used, the sonographer(s) involved in the assessment, and all reliability data that were recorded

### Inclusion criteria

#### Studies were included if

- Participants were over 18 years old
- Participants (cases) with OA, defined by either radiographically confirmed OA, patient reported OA, or clinical diagnosis
- They used grey scale US imaging or power Doppler (PD) to assess one or more US imaging features in peripheral joints of the hand and feet

### Exclusion criteria

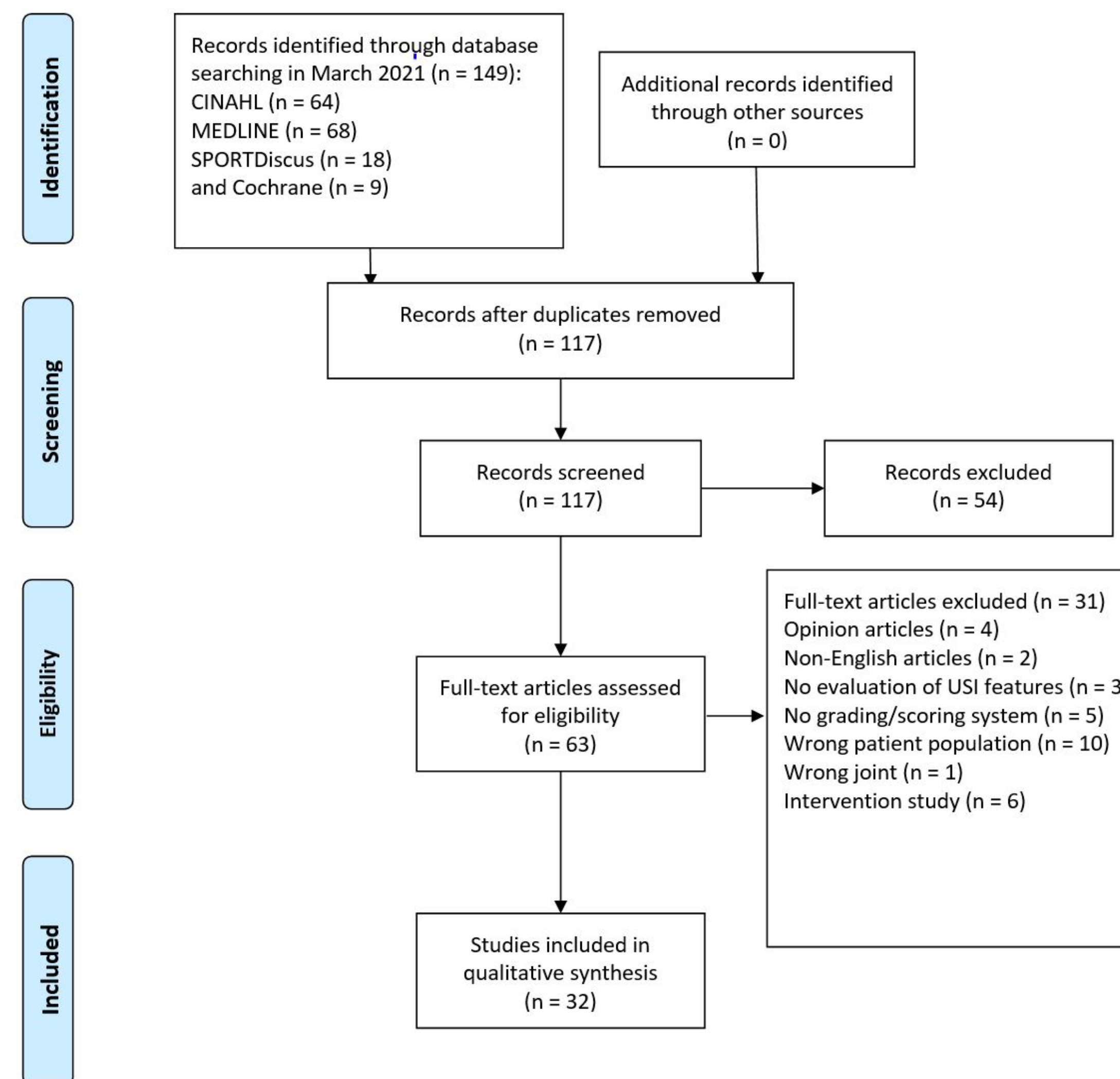
#### Studies were excluded if

- Were unpublished; non-peer-reviewed; do not involve humans; are invitro studies; opinion articles; letters to the editor; non-English articles and abstracts
- Included participants with inflammatory arthritis or a neurological, endocrine or metabolic disorder
- Only evaluated US imaging features evaluated in other joints, aside from those of the hands and feet

## CHARACTERISTICS OF INCLUDED STUDIES

- 30 articles evaluated US features of hand OA and 2 assessed features in the foot
- 3069 participants were reported (654 male, 2330 female)
- Mean age of participants was 61.9 years old (range 51.1 to 74.5), mean BMI was reported in 16 studies, 36.5 kgm<sup>2</sup> (range 24.9 kgm<sup>2</sup> to 28.4 kgm<sup>2</sup>). Eighteen studies reported disease duration, 8.5 years (range, 3.2 to 18.5 years)
- Ethnicity of the study population was reported by one study
- The quality scores for the included cohort studies ranged from 4 to 14/14 on the CASP quality checklist.
- The quality scores for the included case control studies ranged from 5 to 8/12 on the CASP quality checklist

## SEARCH STRATEGY



## RESULTS

### US features associated with OA

- **Inflammatory US features:** synovitis, synovial hypertrophy, joint effusion, tenosynovitis, and PD signal
- **Structural OA features:** osteophytes, joint erosions, cartilage breakdown, and joint space narrowing

### Defining US features

- No consistent use of US definitions used to define each US feature associated with OA
- Common inconsistencies were evident between individual studies interpretation of the different entities of synovial pathology

### Grading US features

- There was no consistent way in which each US feature was graded to classify the degree of pathological change in joint tissue
- The grading systems applied were either dichotomous, semiquantitative, or continuous

### Use of US atlas

- Six studies applied an US atlas
- An US atlas was only used to evaluate synovitis, PD activity, cartilage damage and osteophytes
- Three studies applied an US atlas that was originally developed to assess synovitis in RA
- No foot study has used an US atlas to assist grading

## DISCUSSION & CONCLUSIONS

- Past research has demonstrated an association between active synovitis and structural OA progression. This association indicates that US could identify those patients, or those joints at greatest risk for progression and provide capacity for earlier detection and assessment of OA-related change in peripheral joints
- The synovial inflammation exhibited in early OA suggests a window of opportunity may exist for interventions targeting the inflammatory processes, thus providing the ability to intervene before irreversible structural damage occurs
- Future studies will be improved by including more ethnic and age diverse populations, and assessment of changes in asymptomatic healthy controls as well as those who are symptomatic or have radiographic change
- Future studies should include 3D US to provide further diagnostic information and allow quantification of osteoarthritic change
- This review strengthens the case for further refinement and validation of OA definitions, grading systems and US atlases specific to peripheral joints
- Standardisation is also required regarding imaging acquisition protocols, definitions, grading systems, and US atlases
- More foot specific US research is required to understand the progression of foot OA

