

Background

- Orthopedic surgeons have been exposed to weight-bearing CT to obtain detailed 3D information of the foot and ankle but lack validated tools to explore it effectively
- New parameters were developed using traditional axes, angular concepts, and 3D reconstructed bones
- Small sample size, obscure inclusion/exclusion criteria, and skewed validation methods are worrisome
- Therefore, a thorough review of WBCT-based measurements used in foot and ankle was warranted

Methods

- The literature search was conducted in two databases: PubMed (MEDLINE) and EMBASE (Elsevier)
- The main search terms and logics were: ((foot) OR (ankle) OR (hindfoot) OR (midfoot) OR (forefoot)) AND ((WBCT) OR (Weightbearing CT) OR (Cone beam CT scan) OR (PedCAT))
- A longer string of key words, expanded using the MeSH and Emtree features of PubMed and EMBASE, respectively, was utilized to narrow the results to WBCT imaging associated with foot and ankle pathologies
- All articles were reviewed by two independent senior foot and ankle surgeons based on pre-designed exclusion criteria (Figure 1)

Results

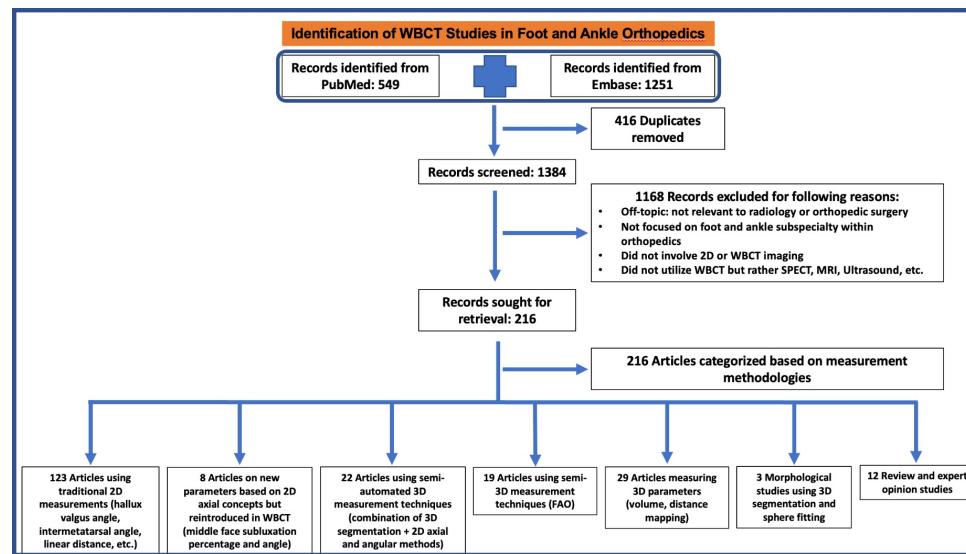


Figure 1. Flow Diagram of Systematic Review

A total of 216 articles were selected for retrieval and further organized by measurement techniques. Seven groups were set by the type of the methodology used. Among them, 123 studies utilized traditional 2D measurement parameters (eg, hindfoot moment arm, Meary's angle, talonavicular uncoverage, hallux valgus angle, etc.), 8 introduced new parameters but based on 2D axial/angular concepts (eg, middle face subluxation percentage and angle), 22 used semi-automated 3D measurement techniques (3D segmentation + 2D axial and angular methods), 19 using semi-3D measurement techniques (Foot and Ankle Offset), 29 measured real 3D parameters (volume evaluation in the syndesmosis and Lisfranc joints, distance mapping), 3 morphological studies used 3D segmentation and sphere fitting. Advantages and disadvantages of each type of measurement were carefully examined and listed out.

Conclusions

- 3D imaging measurements with WBCT appear to be highly variegated
- Axial and angular measurements do not apply well to irregular bones and there is a low reproducibility in 3D scenarios
- Although inter- and intraobserver reproducibility scores have been reported in multiple studies, they were only part of the validation system that should be done

Implications

- A high correlation between parameters, like 2D and 3D hindfoot angles, has been reported, but it is still up to debate which method of measurement is more accurate
- Variations in analytical methods warrant a more uniformly defined coordinate or anatomical system
- More investigation is needed to quantify the variability of the studies' results

Disclosures

- No disclosures.