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Original article

Radiologic analysis of hindfoot alignment: Comparison of Méary, long axial, and hindfoot alignment views

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ABSTRACT

Background: Among radiographic views available for assessing hindfoot alignment, the antero-posterior weight-bearing view with metal cerclage of the hindfoot (Méary view) is the most widely used in France. Internationally, the long axial view (LAV) and hindfoot alignment view (HAV) are used also. The objective of this study was to compare the reliability of these three views.
Hypothesis: The Méary view with cerclage of the hindfoot is as reliable as the LAV and HAV for assessing hindfoot alignment.
Material and methods: All three views were obtained in each of 22 prospectively included patients. Intra-observer and inter-observer reliabilities were assessed by having two observers collect the radiographic measurements then computing the intra-class correlation coefficients (ICCs).
Results: The intra-observer and inter-observer ICCs were 0.956 and 0.988 with the Méary view, 0.990 and 0.765 with the HAV, and 0.997 and 0.991 with the LAV, respectively. Correlations were far stronger between the LAV and HAV than between each of these and the Méary view. Compared to the LAV and HAV, the Méary view indicated a greater degree of hindfoot valgus.
Discussion: Intra-observer reliability was excellent with both the LAV and HAV, whereas inter-observer reliability was better with the LAV. Excellent reliability was also obtained with the Méary view. Combining the Méary view to obtain a radiographic image of the clinical deformity with the LAV to measure the angular deviation of the hindfoot axis may be useful when assessing hindfoot malalignment. A comparison of the three views in a larger population is needed before clinical recommendations can be made.
Level of evidence: II, prospective study.

1. Introduction

Among the radiographic views specifically designed to assess hindfoot alignment, the hindfoot alignment view (HAV) or Saltzmann view [1] and the long axial view (LAV) [2] are widely used. Both these views visualise the calcaneus and tibia without superimposition of other foot and ankle bones. In comparative studies [3], both views exhibited good intra-observer and inter-observer reliabilities, although inter-observer reliability was better for the LAV. These views have been proven useful for guiding the surgical correction of hindfoot malalignment [4,5] and for positioning ankle arthrodesis [6].

The Méary antero-posterior weight-bearing view with metal cerclage of the hindfoot is less popular internationally but is the most widely used view in France [7]. The Méary view provides a good radiographic image of the clinical deformity but has not been validated as a hindfoot alignment assessment tool in studies providing a high level of evidence. Furthermore, no study has compared the reliability of the LAV, HAV, and Méary view.

The objective of this study was to compare the inter-observer and intra-observer reliabilities of the LAV, HAV, and Méary's view with cerclage of the hindfoot. Our working hypothesis was that the Méary view was as reliable as the LAV and HAV for assessing hindfoot alignment.

2. Material and methods

2.1. Population

A prospective single-centre study was conducted between September 2014 and May 2015 at the Clinique du Mail radiology

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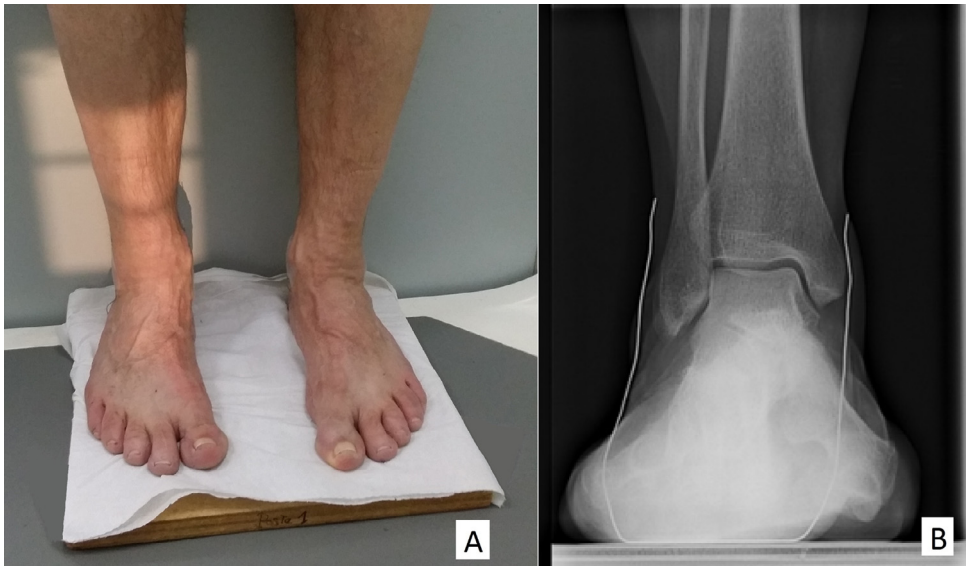

Fig. 1. Méary antero-posterior weight-bearing view with metal cerclage of the hindfoot. A. Positioning of the patient. B. Example of a Méary view.

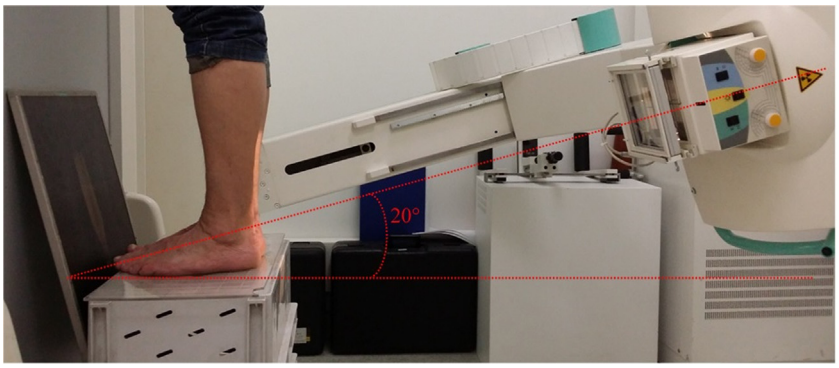

Fig. 2. Hindfoot alignment view: patient position with the beam angled at 20° to the floor and the film cassette perpendicular to the source.

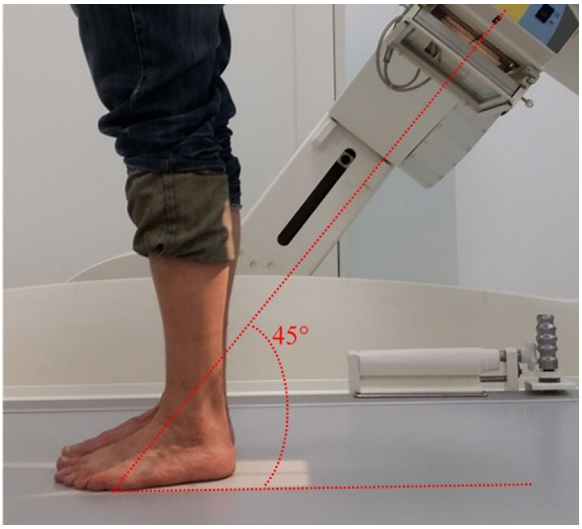

Fig. 3. Long axial view: patient position with the beam angled at 45° to the floor and the patient standing on the film cassette.

office in Grenoble, France. The required sample size was estimated as described by Walter et al. [8,9]. To maximise statistical power, the unit for the sample size estimation was the patient and not the foot. Assuming a minimum intra-class coefficient (ICC) of 0.70 (H0: $\rho 0 = 0.70$) and an expected ICC of 0.9 (H1: $\rho 1 = 0.90$), with the alpha risk set at 0.05, the number of patients needed to obtain 80% power was 18 (36 feet). For the statistical analysis, the unit was the foot.

We included 22 patients who underwent a radiological assessment of the hindfoot because of an ankle and/or hindfoot disorder (ankle instability, $n = 9$; pes plano-valgus, $n = 5$; or hindfoot pain with a lesion of the tibialis posterior or spring ligament, $n = 8$). Exclusion criteria were as follows: unavailability of all three radiographic views, history of foot and/or ankle surgery or trauma, inflammatory disease, and ongoing growth.

2.2. Radiographic techniques

A Méary view, LAV, and HAV of both feet was obtained in all patients. The settings were as follows: 75 kv, 40 mAs, 150 ms, and 150 cm source-to-film distance.

For the Méary view, a flexible malleable lead wire was passed under the heel then wrapped up on either side around the malleolus (Fig. 1) [7]. The X-ray beam was horizontal, along the axis of the second metatarsal, parallel to the floor, and centred on the middle of the ankle. The cassette was placed behind the two heels, perpendicularly to the direction of the beam.

The HAV was obtained with the patient standing on both feet, positioned parallel to each other, on a radiolucent cassette-holding box with a Plexiglas surface. The beam was angled 20° to the floor and pointed at the middle of the ankle. The field of exposure

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