Assessing the Reliability and Reproducibility of Determining Planal Dominance of Pes Planovalgus

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INTRODUCTION

Pes planovalgus, also known as flatfoot, describes the collapse of the medial longitudinal arch of the foot. In patients who achieve minimal relief with conservative treatments and for whom the deformity causes the greatest impedance on quality of life, the preferred method for a definitive diagnosis is by angular measurement of radiographs to assess the plane of dominance.

OBJECTIVE

The purpose of this study is to determine the reliability and reproducibility of identifying the plane of dominance (POD) of flatfoot using radiographic evaluation method. While physical examinations and symptomatic presentations of flatfoot are essential to determining if surgery is necessary, radiographic evaluation is equally crucial because it allows podiatrists to pinpoint skeletal abnormalities in pes planovalgus and accordingly, determine the correct surgical procedure.[1] While deformities may exist in all three cardinal planes (frontal, sagittal, and transverse), it is believed that there is one plane where the deformity is strongest which guides surgical intervention.[2] This information may be of immediate value because while existing studies acknowledge the importance of POD, there is no current study which specifically addresses the reliability and reproducibility of determining POD from radiographic evaluation in surgical recommendation.

METHODS

Weight-bearing dorsal-plantar and lateral radiographs of 30 patients' feet with symptomatic pes planus were obtained. Patient identifiers were removed from radiographs to protect patient confidentiality. Five of the 30 radiographs without obvious identifiers such as jewelry and surgical hardware were copied twice without the knowledge of participants and included in the collection of radiographs in order to assess intra-rater reliability and the total 40 images were arranged at random. Eighteen podiatrists were recruited as participants via the American Podiatric Medical Association's "Find a Podiatrist". Participants were asked to review the 40 images and identify the dominant POD choosing between the frontal, sagittal, and transverse planes. Participants were presented with the option to use ImageJ software to measure the angles to better aid their assessment.

Figure 2. Survey Example Images - Lateral and AP Views

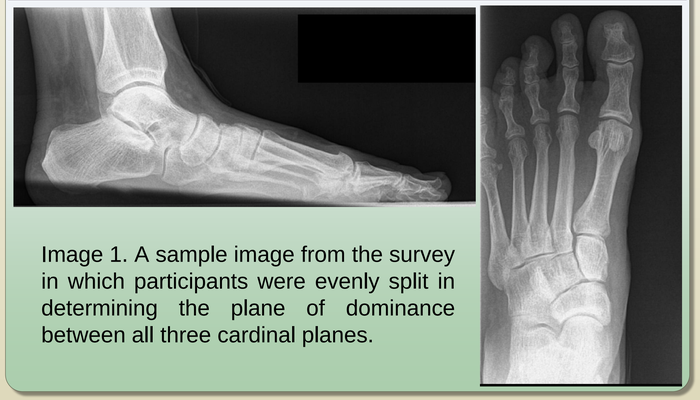
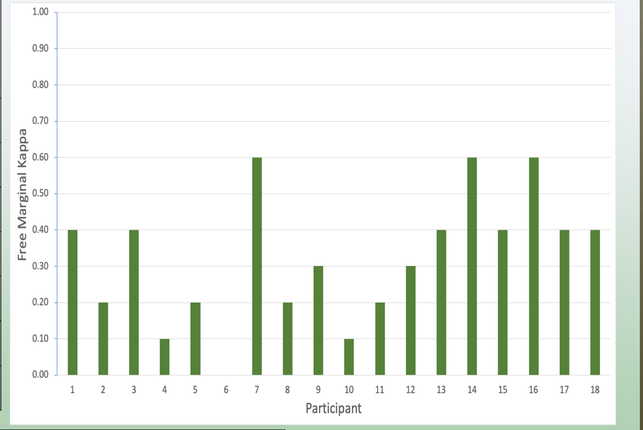


Image 1. A sample image from the survey in which participants were evenly split in determining the plane of dominance between all three cardinal planes.

RESULTS: Table 1 and Figure 1. Free Marginal Kappa Measuring Intra-Rater Reliability. Table 2: Inter-Rater Reliability.

Participant	Free Marginal Kappa	Participant	Free Marginal Kappa	Participant	Free Marginal Kappa
1	0.40	**7**	0.60	**13**	0.60
2	0.20	**8**	0.20	**14**	0.40
3	0.40	**9**	0.30	**15**	0.60
4	0.10	**10**	0.10	**16**	0.40
5	0.20	**11**	0.20	**17**	0.40
6	0.00	**12**	0.40	**18**	0.20
Average Free Marginal Kappa					0.32



RESULTS: Table 2. Inter-Rater Reliability.

Overall Inter-Rater Reliability	**0.11528**

RESULTS

Inter-Rater Reliability

Of the 540 total radiographs presented to participants, 156 feet (28.9%) were identified as having a frontal plane deformity, 235 feet (43.5%) with a sagittal plane deformity, and 149 feet with a transverse plane deformity (27.6%). The free marginal kappa value, a metric for calculating inter-rater reliability, was measured to be 0.11528 for the assessment thereby indicative of barely slight agreement between individual participants in assessing the same radiographs.

Intra-Rater Reliability

Table 1 presents marginal kappa values for individual participants' evaluation of repeated radiographs. Three out of eighteen podiatrists were in poor agreement (16.7%), twelve out of eighteen podiatrists were in fair agreement (66.7%), and three of eighteen podiatrists were in moderate agreement (16.7%) with their respective assessments of the same radiographs.

CONCLUSIONS

With regard to inter-rater reliability, the low kappa value obtained leads to the conclusion that there is low consistency amongst podiatrists evaluating the same radiographs. Intra-rater reliability also fell below what was expected suggesting that podiatrists may not assess planal dominance consistently even by their own radiographic evaluation. Our calculated inter-rater reliability (0.11528) was, nonetheless, lower than intra-rater reliability (0.32), suggesting that individual podiatrists are more consistent when evaluating similar cases presented to them.

REFERENCES

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