The purpose of this study was to evaluate gaze patterns and classification of ankle fractures in the Lauge-Hansen classification system. The hypothesis was that there are differences in gaze patterns and classification between experienced surgeons vs. residents. This was tested using eye-tracking software during the evaluation of ankle fracture radiographs.

Methodology

A total of 8 participants were recruited and consented to take part in the study: 4 foot and ankle surgeons (who take a Level-4 trauma center and 4 fourth-year podiatric medical students). Participants completed a 10 ankle fracture radiographic series on PowerPoint slides and were asked to classify each fracture using the Lauge-Hansen system. Each slide consisted of an AP and Lateral ankle fracture projection of the same ankle fracture. For each ankle fracture in the series, the AP and Lateral ankle view were randomly assigned to be on either the left or right side of the screen. Once participants classified the fracture in an area of focus, they were prompted to the next slide until they completed the entire radiographic series. During this evaluation, eye-tracking and gaze recognition software (Gazepoint©, Graz, Austria) was utilized to provide objective measurements of the specific anatomic structures of interest focused on by the participants [3, 4, 5].

The primary outcome measure was the total length of time utilized to classify the entire radiographic view of 10 ankle fractures as measured in seconds. Descriptive statistics were calculated and included the mean, standard deviation, and range, and differences were compared between groups with an unpaired t-test. The secondary outcome measures were collected utilizing the eye-tracking and gaze recognition software. We first evaluated whether the participant initially looked at the AP projection or the Lateral projection. We then evaluated how many times the participant revisited their focus between the AP and Lateral projections, as well as the last projection evaluated. We then orthogonalized which distinct anatomic structures were evaluated on each projection [Figure 2]. For the AP projection, the anatomic structures were considered as follows: Medial malleolus, medial malleolar cartilage, talocrural joint, tibial plafond, talus, fibula and tibia at the syndesmosis, and the proximal fibula. For the Lateral ankle projection the anatomic structures considered were as follows: Anterior tibia/lateral malleolus, posterior tibia/lateral malleolus, distal fibula, talus at the syndesmosis, and the proximal fibula. The total number and sequence of the distinct anatomic structures focused on was obtained and recorded for each trial. The total number of participants evaluated in the series [Figure 2]. These comparisons were performed with the Fisher’s exact test.

Results

First, experienced foot and ankle surgeons were found to evaluate and classify ankle fracture radiographs in the same order as the Level-4 podiatric medical students. We had originally hypothesized that experienced surgeons might arrive at the classification faster. However, this finding might indicate that classification determination requires careful evaluation of multiple specific structures and projections, as opposed to a more macroscopic analysis. In future fractures guidelines, residents should be instructed to also weight evaluating ankle fracture radiographs. It appears that time required a multiple evaluation. In a similar way, both groups transitioned between the AP and Lateral projection, although the Lateral projection was evaluated more often. The surgeon’s gaze was less likely to focus on the width of the AP projection vs. the Lateral projection for a longer duration. The results demonstrated a relatively unfocused gaze on the AP view vs. the Lateral view, which might be because the ankle fracture radiographs were systematically [9-11].

In conclusion, the results of this investigation provide original objective evidence on how ankle fracture radiographs are evaluated when attempting to determine Lauge-Hansen classification. It is hoped that this information might be used to facilitate development of protocols for the education of future generations of Podiatric medical students.