INTRODUCTION:

There exist numerous manual alignment jigs each employing different methods for alignment of the initial femoral guidewire in hip resurfacing. However, there is no clear indication as to which alignment methods or jig characteristics provide the user with the most optimal guidewire placement. Furthermore, there appear to be no studies that have compared the accuracy and precision of the various guidewire alignment jigs presently available to each other and to that of computer navigation. The purpose of the current investigation was to determine the accuracy and precision in placement of the initial femoral guidewire using conventional alignment jigs and to compare results to imageless computer navigation.

METHODS:

Five commercially available jigs were obtained (2 lateral pin (LP); 2 neck centering (NC); 1 head planing (HP)) (Figure 1). Four surgeons used each jig 3 times to drill a guidewire in 10 degrees of relative valgus alignment and neutral version in individual synthetic femurs situated within the foam hip model. The order of jig use was randomized for each surgeon and for each guidewire insertion. Jigs were disassembled between each use. Each surgeon used imageless navigation (VectorVision SR, BrainLAB, Heimstetten, Germany) to drill three consecutive guidewires into individual femurs following jig use. Guidewire insertion time for the jigs was defined as the time to assemble each jig, fix it to the femur, align and drill the femoral guidewire. For Navigation, the guidewire insertion time was defined as the time to insert the Shanz pin into the Lesser Trochanter, register the femur, plan the position of the implant, drill and verify the femoral guidewire.

Utilizing human cadaveric femora, a single surgeon used each jig 3 times in a randomized fashion to align the initial guidewire in 10 degrees of relative valgus alignment and neutral version in each of 10 dried femora. Guidewire alignment for each jig use was verified by navigation. Following jig use, a single navigated guidewire was inserted. Anteroposterior and lateral radiographs of the synthetic and human femurs were taken to assess guidewire inclination and version.

RESULTS:

Using synthetic femora, the only significant difference in coronal alignment error occurred between the two Neck Centering jigs (p=0.028). With respect to version accuracy, there was a significant difference between the two Lateral Pin jigs (p=0.049). In addition, jig LP1 produced a mean version error of 1.8 degrees retroversion (SD 5.9) while the other jigs and Navigation erred in anteversion (0.3-4.9 degrees, SD 3.8-6.5) and this was significant compared to jig HP (p=0.023) and Navigation (p=0.045). Compared to Navigation (range -2 to 2 degrees coronal alignment error, -11 to 5 degrees version error), the range of error for the jigs was 3 to 7 times greater in coronal alignment error but similar in version error. Coronal guidewire alignment accuracy was not dependent on femur specimen (p>0.377), however, version accuracy was, as there were multiple differences in accuracy obtained between specimens (p<0.030).

DISCUSSION:

Correct alignment of the initial femoral guidewire is vital in avoiding malpreparation of the femoral head. The results of the current study demonstrate that there are differences in alignment accuracy obtainable between the different commercially available alignment jigs. Therefore, choice of alignment device may influence the accuracy of guidewire placement ultimately impacting femoral component placement. Imageless computer navigation provided accurate and precise coronal placement of the initial femoral guidewire, superior to that of conventional guidewire alignment jigs, but yielded similar results in femoral guidewire version alignment.