TWO DIFFERENT KNEE BRACES ALTER PATELLA POSITION: A MOVING IMAGE ANALYSIS USING WEIGHT BEARING MAGNETIC RESONANCE IMAGING.

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Purpose:

A recent study found clinical efficacy using a patellar brace in those with PFJOA[1]. It is still unclear how the light and flexible sleeve support used in that trial could bring about the clinical significant decreases in pain and in the volume of BMLs. One theory is the minor alterations in the distribution of forces over a greater PF joint area decreased the mechanical stress at the PF joint. Using a 'train and rail-track' analogy, a knee sleeve may alter the position of the 'train' (patella) by supporting the patella; a different brace design may change the position of the 'track' (trochlea) by externally rotating the femur. Our goal in this study was to assess the effect on PF joint position of two different braces. We report an imaging technique that produced a sequence of images from weight bearing MRIs to reveal the effect of both types of brace on patella position.

Methods: Two asymptomatic subjects. We used two commercially available braces. One was designed to externally rotate the femur (SERF brace, Donjoy Inc, Ca USA); the other was designed to alter the position of the patella rather than the femur (Bioskin patellar tracking Q brace, Ossur UK, Manchester England). Weight bearing knee MRIs with and without the two braces were obtained using an upright open 0.25 Tesla scanner. In order to visualise the movement of the patella relative to the femur, a rigid transformation was applied to each image without the brace in order that the femur was in the same position as in the equivalent image when wearing the brace. Pulse sequences included a PD -weighted with TE range of 690 - 830ms and TR range of 14-28ms with a slice thickness of around 4mm and a

centre to centre gap between slices of 0.4mm. In order to study the effect of the brace, it was necessary to align the images. We performed a rigid registration to align the femur in each image with one without a brace. All images were then resampled (using trilinear interpolation) for display. We then display the with/without-brace images in the same reference frame. This registration ensures that the femur does not appear to move, allowing the movement of the other bones and tissues relative to the femur to be examined.

Results: Estimates of the translation and rotation of the patella, relative to the femur for each brace and both conditions are given in Table 1. Subject 1 had a more lateralised patella. Compared with no brace, the SERF brace produced translation of the patella in the inferior-superior and the mediolateral directions. Compared to no brace, the Bioskin Q brace caused inferior superior and mediolateral translation, but to a lesser degree. Subject 2 had a more normalised position of the patella. Compared to no brace, the SERF brace caused smaller patellar movements. The Bioskin Q brace cause minimal patellar movement.

Conclusion: A Bioskin Q brace and a SERF brace altered patella position relative to the femur. This was more marked in a person with lateralised patella. Either brace would increase contact area between the patella and femoral trochlea and lower mechanical stress at the PFJ. These changes in patella position in weight bearing provide a possible biomechanical rationale for using either brace for PFJOA. (464 words)

Keywords: PF joint, knee bracing, MRIs.

Table 1

Reference List

(1) Callaghan MJ, Parkes MJ, Hutchinson CE et al. A randomised trial of a brace for patellofemoral osteoarthritis targeting knee pain and bone marrow lesions. *Ann Rheum Dis* 2015 January 16;74(6):1164-1170.