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097 Identifying novel acoustic emission biomarkers for use in knee osteoarthritis clinical trials

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Background: The recent development of techniques to measure high-frequency acoustic emission (AE) from knees has opened up the possibility of identifying AE features which reflect the integrity of interactions between joint components during weight bearing movement. The objective of this study was to determine whether novel candidate biomarkers, based on AE measurements, can be identified for future use in clinical trials and stratified medicine applications for knee osteoarthritis (OA). We focused on testing the reproducibility of candidate AE biomarkers and their association with other markers, using a cohort approach.

Methods: Participants with knee pain and KL scores between 1-4 were recruited from local NHS primary and secondary care organisations. AE data were collected and analysed from the worse knee, as identified by each participant, using our established sit-stand-sit movement protocol. Variation in AE measurement was analysed in 45 participants by fitting two linear mixed effects models. In addition to random effects terms for practitioners and visits, respectively, both models included a fixed effect term for the AE machines and random effects terms to capture between-participant variability and residual error. Associations with other markers were tested in 68 participants by fitting a linear mixed effects model for each candidate biomarker. The model included fixed effects for the covariates of interest, a participant-specific random effect that accounts for correlation between repeated measurements within the same individual, and a residual error term. A multiple regression model was developed using forward selection based on the likelihood ratio test with a cut-off for significance of $p < 0.1$.

Results: Of four candidate AE biomarkers tested, AE number of hits showed the best reproducibility profile regarding variation within session, day to day, week to week, between practitioner, and between machines. AE number of hits was higher in people with KL2, 3 or 4 scores than in those with KL1. Hits occurred predominantly in two of the four pre-defined sit-stand movement quadrants. AE number of hits also showed significant associations with contralateral knee pain, and with body weight. The protocol used was feasible and acceptable to all participants and health professionals involved.

Conclusion: Measurement of AE hits using a simple sit-stand-sit movement protocol offers a novel and convenient approach for assessing the integrity of interactions between joint components during weight bearing movement. AE number of hits offers a novel potential knee OA biomarker for use in large multicentre clinical trials of knee OA treatments. AE measurement may reflect a composite of knee structural changes and joint loading factors. Refinement of the method may further strengthen the utility of the AE approach for clinical trials. This approach may also have applications for monitoring knee OA in primary care.