

Goodacre, John, Schlueter, Daniela K., Shark, Lik-Kwan, Spain, Lucy ORCID: <https://orcid.org/0000-0002-6442-6778> , Platt, Nicola, Mercer, Joe, Waterton, John C., Bowes, Mike, Dixon, Mandy and Huddleston, Jane (2018) Identifying novel acoustic emission biomarkers for use in knee osteoarthritis clinical trials. *Rheumatology*, 57 (S3). key075.321.

Downloaded from: <http://insight.cumbria.ac.uk/id/eprint/3956/>

Usage of any items from the University of Cumbria's institutional repository 'Insight' must conform to the following fair usage guidelines.

Any item and its associated metadata held in the University of Cumbria's institutional repository Insight (unless stated otherwise on the metadata record) may be copied, displayed or performed, and stored in line with the JISC fair dealing guidelines (available [here](#)) for educational and not-for-profit activities

provided that

- the authors, title and full bibliographic details of the item are cited clearly when any part of the work is referred to verbally or in the written form
 - a hyperlink/URL to the original Insight record of that item is included in any citations of the work
- the content is not changed in any way
- all files required for usage of the item are kept together with the main item file.

You may not

- sell any part of an item
- refer to any part of an item without citation
- amend any item or contextualise it in a way that will impugn the creator's reputation
- remove or alter the copyright statement on an item.

The full policy can be found [here](#).

Alternatively contact the University of Cumbria Repository Editor by emailing insight@cumbria.ac.uk.

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

John Goodacre, Daniela K Schlueter, Lik-Kwan Shark, Lucy Spain, Nicola Platt, Joe Mercer, John C Waterton, Mike Bowes, Mandy Dixon, Jane Huddleston

**Rheumatology, Volume 57, Issue suppl_3, 1 April 2018, key075.321,
<https://doi.org/10.1093/rheumatology/key075.321>**

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.