A COMPARISON OF SURFACE EMG TEMPORAL AND SPECTRAL PARAMETERS FROM THE VASTUS MEDIALIS OF SUBJECTS WITH AND WITHOUT KNEE JOINT OSTEOARTHRITIS DURING A SUSTAINED, FATIGUING SUBMAXIMAL ISOMETRIC CONTRACTION.

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CERTIFICATE OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made in the acknowledgements.

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ABSTRACT

Knee joint osteoarthritis is recognised as a significant subset of osteoarthritis. Little work has examined muscle changes that occur with knee joint osteoarthritis. Much of this work has centred on strength deficits, while little work has examined the effect of joint pathologies, such as osteoarthritis, on the fatigue resistance of the muscles associated with an affected joint.

The purpose of this study was to investigate the relative fatigue-resistance characteristics of the vastus medialis in subjects with and without knee joint osteoarthritis, as well as the ability to predict endurance times in these groups, using high spatial resolution electromyography and a sub-maximal isometric endurance test. Twenty-six subjects with unilateral knee osteoarthritis, and seventeen subjects with no known knee pathology were evaluated. All subjects performed initial tests to evaluate maximum voluntary contraction (MVC), voluntary activation levels, and true maximum force (TMF). Endurance time was assessed during an isometric quadriceps contraction at 50% of the true maximum force. Surface electromyography (sEMG) data was collected from the vastus medialis muscle of the quadriceps group during the endurance test.

MVC tests showed that the affected leg of the group with osteoarthritis was significantly weaker ($p < 0.05$) than the unaffected leg. Voluntary activation data showed that subjects with osteoarthritis presented with significant bilateral deficits ($p < 0.05$). TMF data showed a significantly lower ($p < 0.05$) true potential for force generation in the affected compared to the unaffected leg of the osteoarthritis group. Endurance time data showed no significant difference between groups. Electromyography data showed significant differences ($p < 0.05$) between the affected and unaffected legs in initial values of Median Frequency (MDF), Mean Power Frequency (MPF) and Conduction Velocity (CV), the percentage change in CV and the relative rate of change in the frequency band between 5 and 30Hz (FB1). Finally, significant correlations were seen between endurance time and the relative rate of change of MDF, MPF and CV calculated over the initial thirty seconds of the endurance test. There were no significant correlations from either leg of the group with knee joint osteoarthritis.

It can be concluded from this study that there are differences in strength measures, and in the sEMG signal collected from the vastus medialis muscle of the affected and unaffected legs of subjects with knee osteoarthritis. It appears likely that the differences observed in the sEMG signals were related to a decrease in the representation of type-2 muscle fibres in the vastus medialis of the affected leg. Furthermore, these changes in the behaviour of the signal appear to indicate an improvement in the relative fatigue resistance of the affected leg in relation to the unaffected leg of the group with knee osteoarthritis.

Moderate success was seen with the prediction of endurance time in control subjects in the current work using a short duration (30-second) endurance test. This relationship was not seen in either the affected or unaffected leg of the subjects with knee osteoarthritis. Further investigation utilising different sEMG collection and analysis techniques in this area may improve prediction of endurance time in unaffected and affected subjects.