**PAIN MEASUREMENT AND MANAGEMENT IN PEOPLE WITH KNEE OSTEOARTHRITIS**

By

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**CONTRIBUTIONS:**

The body of this thesis contains three original manuscripts – one is published in Critical Reviews in Physical and Rehabilitation Medicine Journal, 24(3–4), 179–195 (2012), one was accepted for publication in Osteoarthritis & Cartilage and one in preparation for submission to Osteoarthritis & Cartilage. Although multiple authors appear on each paper, Ahmed Negm was responsible for all aspects of the study, including the design, analysis, and writing of the manuscripts. The co-authors on the papers had varying involvement ranging from assistance with study design, data collection, data analysis, and manuscript review.

**ABSTRACT**

 Pain is a multidimensional construct and its proper measurement and management is challenging. Despite the evolution of pain theories that helped to understand pain, a theoretical model to lead the pain measurement and management may be required. No gold standard for measuring pain in people with knee osteoarthritis (OA) has been identified and, as such, several pain measures are used in this population. Few studies have investigated the perspective of people with knee OA regarding preferred pain measures and/or the degree to which the pain measures represent their pain experience. In combination with this, there is a need to identify effective conservative interventions to improve knee OA pain and physical function. Low frequency (≤100 Hz) pulsed subsensory threshold electrical stimulation is an emerging potential non-pharmacologic conservative treatment of knee OA. The purpose of this thesis was to improve the understanding of pain measurement and management in people with knee OA through: 1) Developing a theoretical model that may help in pain management and measurement; 2) Exploring the knee OA individuals’ views about three pain measures and 3) To determine if low frequency (≤100 Hz) pulsed subsensory threshold electrical stimulation produced either through pulsed electromagnetic field (PEMF) or pulsed electrical stimulation (PES) versus sham PEMF/PES intervention is effective in improving pain and physical function in the knee OA population.

After pain theories literature review, a theoretical model was developed to address the gap between pain theories and clinical pain measurement and management. The patient’s views about three pain measures were not explored before 96 participants were recruited and completed the Verbal Numerical Rating Scale (VNRS), Intermittent and Constant Osteoarthritis pain Questionnaire (ICOAP) and the Short Form-McGill Pain Quetionnaire-2 (SF-MPQ-2). Participants were asked how well each pain measure describes their pain on a 10 cm Visual Analogue Scale (0 = does not describe your pain at all, and 10 = describes your pain completely. The time taken to score and complete the pain measure as well as the number of errors and questions while filling the pain measures were recorded. Systematic electronic searches after determining inclusion criteria for the studies were performed. Duplicate title, abstract and full text screening, risk of bias assessment, data extraction and grading the quality of evidence were performed. Data analysis was performed using Revman 5 software.

Our sample of individuals with knee OA showed that VNRS, SF-MPQ-2 and ICOAP describe knee OA pain experience with no preference of one over the others. However, VNRS was recommended because it is easier and faster to complete. The systematic review conclusion was that PEMF/PES may be beneficial to improve physical function but not pain in people with knee OA with low and very low quality of evidence respectively. However better quality RCTs are needed to confirm the effectiveness of PEMF/PES. Overall the results of this thesis will inform and give recommendations for pain measurement and management of knee OA in individuals.

**DEDICATION**

This thesis is dedicated to the soul of my father who gave me all the support till he passed away on June 2013.

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**LIST OF ABBREVIATIONS**

BAI- Beck anxiety inventory

BDI- Beck depression inventory

BHI- Beck helplessness inventory

CaM- Calmodulin

CI- Confidence interval

CPCI- Chronic pain coping index

FGF-2- Fibroblast growth factor

HADS- Hospital anxiety depression scale

ICOAP- Measure of Intermittent and Constant Osteoarthritis Pain

IL-1- Interleukin-1

IL-1β- Interleukin-1beta

IQR- Inter quartile range

κ- Kappa

MPI- Multidimensional pain inventory

MPQ-SF- Short form of McGill pain questionnaire

NRS- Numeric rating scale

NSAIDs- Nonsteroidal anti-inflammatory drugs

OA- Osteoarthritis

OARSI- Osteoarthritis Research Society International

OMERACT- Outcome Measures in Rheumatoid Arthritis Clinical Trials

PCS- Pain catastrophizing scale

PDI- Pain disability index

PEMF- Pulsed electromagnetic field

PES- Pulsed electrical stimulation

PGROA- Physician global rating scale of knee OA severity

PRISMA- Transparent reporting of systematic review and meta-analysis

RCT- Randomized control trial

RR- Risk ratio

SD- Standard deviation

SF-MPQ-2- Short-form McGill Pain Questionnaire-2

SMD- Standardized mean difference

SPOMS-Short form of the Profile of Mood States

TGFβ- Transforming growth factor beta

TSK- Tampa scale of kinesiophobia

VAS- Visual analog scale

VEGF- Vascular endothelial growth factor

VNRS- Verbal numeric rating scale

WOMAC- Western Ontario and McMaster Universities osteoarthritis index

χ²- Chi-squared test