ILD Institute for Lifecourse Development

UNIVERSITY of GREENWICH

1st CEAR Meeting

Effects of Microcurrent Therapy with or without Resistance Exercise on Muscle Strength, Body Composition, and Physical Function in Older Adults

MPhil/PhD student: Stefan Kolimechkov

Supervisory Team:

Prof. Fernando Naclerio

Prof. Ian Swaine

Dr Marcos Seijo

Centre for Exercise Activity and Rehabilitation

Institute for Lifecourse Development

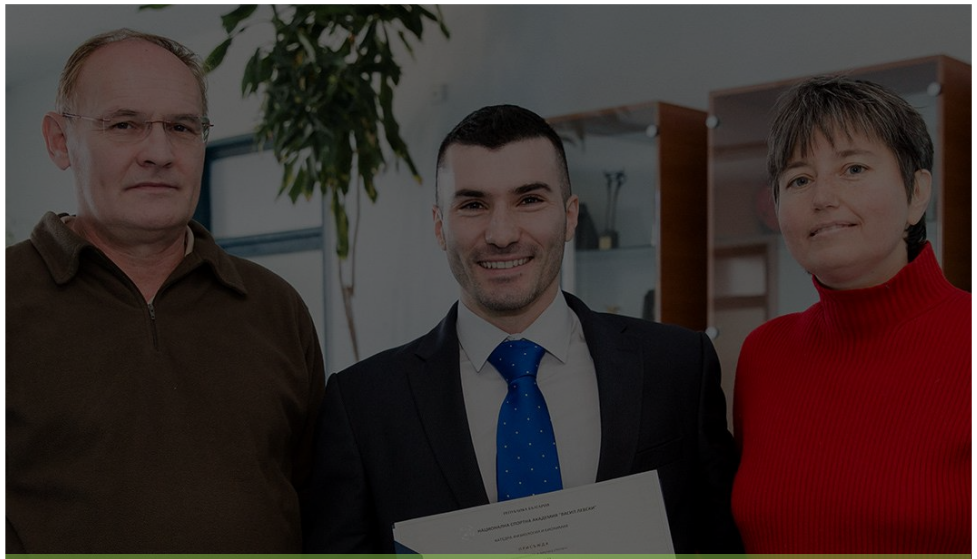
University of Greenwich

SPORTS CAREER

- 4th place in the National Gymnastics Championships (Bulgaria)
- Three-time London Gymnastics Champion
- Multiple medalist from gymnastics competitions for Masters athletes in the UK

Artistic Gymnastics

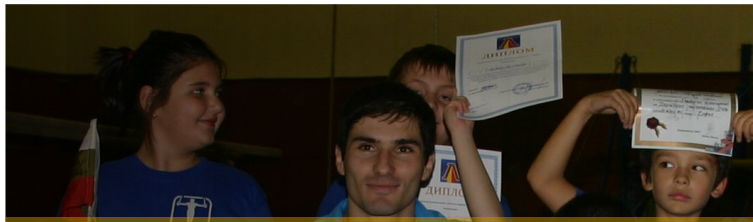
EDUCATIONAL BACKGROUND



- **Bachelor's Degree**
  Sports & Physical Education
- **Master's Degree**
  Physical Education
- **PhD Degree**
  Physical Education

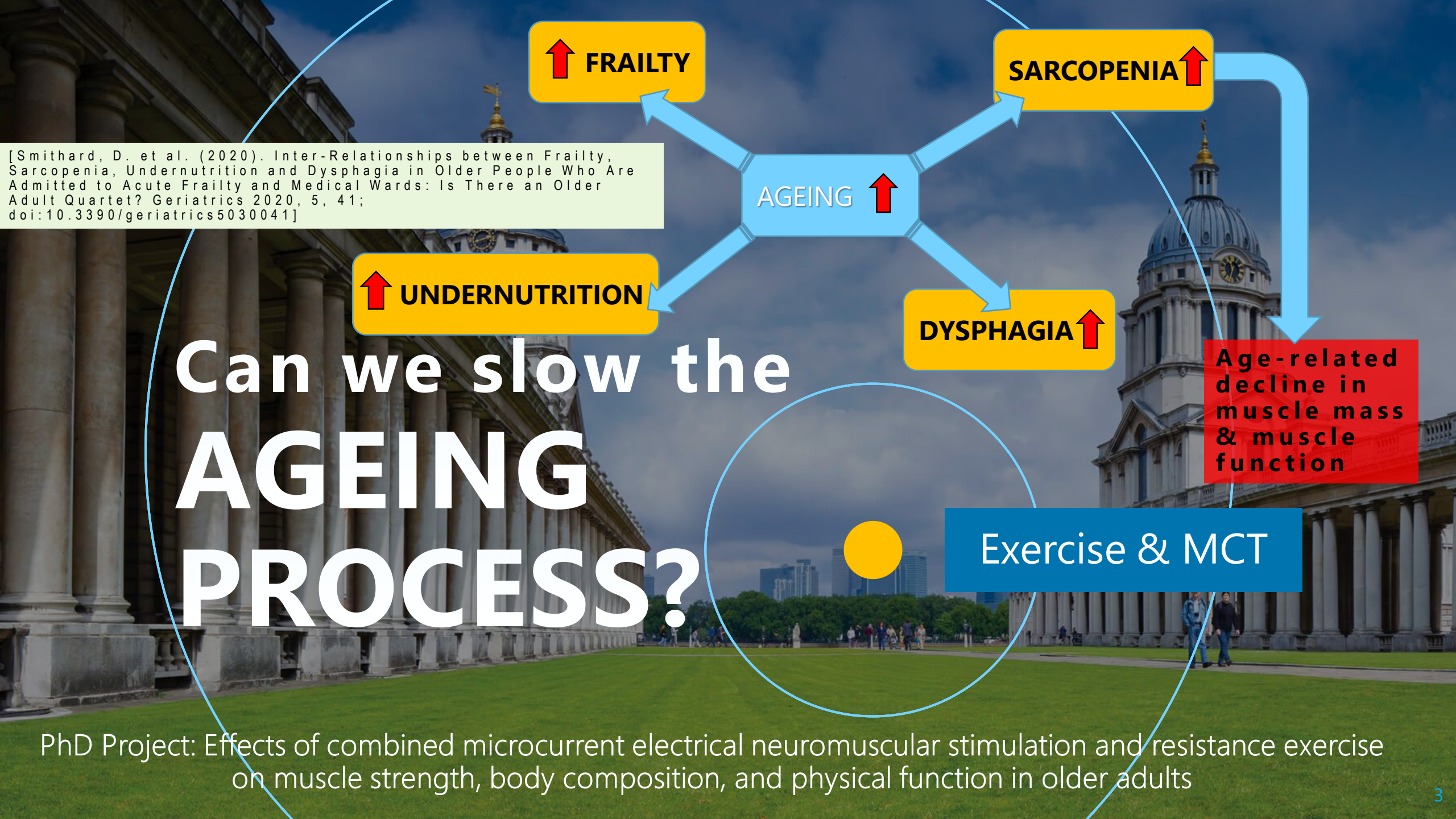
National Sports Academy, Bulgaria

COACHING EXPERIENCE



- Gymnastics Coaching
  5 years in Bulgaria and
  9 years in the UK
- Physical Education
  volunteering as a PE assistant at St Edmunds Primary School for 3 `years

Gymnastics



[Smithard, D. et al. (2020). Inter-Relationships between Frailty, Sarcopenia, Undernutrition and Dysphagia in Older People Who Are Admitted to Acute Frailty and Medical Wards: Is There an Older Adult Quartet? Geriatrics 2020, 5, 41; doi:10.3390/geriatrics5030041]

Can we slow the AGEING PROCESS?

PhD Project: Effects of combined microcurrent electrical neuromuscular stimulation and resistance exercise on muscle strength, body composition, and physical function in older adults

MICROCURRENT

- transmission of sub-sensory current through the skin (<1 mA)
- electrostatically charged gold leaf to treat various skin abnormal skin conditions (17th century)
- developed in the 1970s
- provided by microcurrent device
- non-invasive method

Energy	Electrophysical Agent
Thermal	Thermotherapy Cryotherapy Hydrotherapy
Electromagnetic	Shortwave diathermy Low-level laser therapy Ultraviolet
Electrical	Neuromuscular electrical stimulation Transcutaneous electrical nerve stimulation Electrical stimulation for tissue healing and repair Iontophoresis
Mechanical	Spinal traction Limb compression Continuous passive motion Ultrasound Extracorporeal shock wave therapy

[Bélanger, A. (2015). Therapeutic Electrophysical Agents: Evidence Behind Practice. Lippincott Williams & Wilkins, 3rd edition. ISBN:97814511827 43]

MICROCURRENT

manufactured by ARC Microtech Ltd, UK

Microcurrent can also be found in the literature as:

- microcurrent therapy (MCT)
- microcurrent electrical nerve stimulation (MENS)
- microcurrent electrical therapy (MET)
- low voltage micro amperage stimulation
- low-intensity direct current (LIDC)
- and others

WMCS Wireless Micro Current Stimulation

Frequency Specific Microcurrent

Effects of Microcurrent

- promotes healing, improves immune function, and the rate of tissue synthesis (Poltawski & Watson, 2009).
- increases Adenosine Triphosphate (ATP) concentration, stimulates amino acid transport, and protein synthesis (Cheng et al., 1982). *Currents between 100 μA and 500 μA stimulated the highest increase of ATP, but when the currents exceeded 1000 μA, ATP concentration levelled and then decreased with 5000 μA*
- reduces the severity of symptoms of muscle damage induced by exercise protocols in healthy men (Lambert, Marcus, Burgess, & Noakes, 2002), healthy men and women (Curtis, Fallows, Morris, & McMakin, 2010), trained men (Naclerio et al., 2019), and cross country male athletes (Naclerio et al., 2021).
- reduces symptoms and promotes tendon normalization in chronic tennis elbow (Poltawski, Johnson, & Watson, 2012).
- suggested to facilitate the regeneration of injured skeletal muscles in animals (Fujiya et al., 2015; Ohno et al., 2013), and it might have the potential to become an effective non-invasive therapy for recovering muscle atrophy (Moon, Kwon, & Lee, 2018; Park, Kwon, & Moon, 2018).

European Journal of Applied Physiology (2019) 119:2641–2653
https://doi.org/10.1007/s00421-019-04243-1

ORIGINAL ARTICLE

Effectiveness of combining microcurrent with resistance training in trained males

Fernando Naclerio[1] · Marcos Seijo[1] · Bettina Karsten[2] · George Brooker[1] · Leandro Carbone[1] · Jack Thirkell[3] · Eneko Larumbe-Zabala[4]

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Abstract

Introduction Microcurrent has been used to promote tissue healing after injury or to hasten muscle remodeling post exercise post exercise.

Purpose To compare the effects of resistance training in combination with either, microcurrent or sham treatment, on-body composition and muscular architecture. Additionally, changes in performance and perceived delayed onset muscle soreness (DOMS) were determined.

Methods Eighteen males (25.7 ± 7.6 years) completed an 8-week resistance training program involving 3 workouts per week (24 total sessions) wearing a microcurrent (MIC, $n = 9$) or a sham (SH, $n = 9$) device for 3-h post-workout or in the morning during non-training days. Measurements were conducted at pre and post intervention.

Results Compared to baseline, both groups increased ($p < 0.05$) muscle thickness of the elbow flexors (MIC + 2.9 ± 1.4 mm; SH + 3.0 ± 2.4 mm), triceps brachialis (MIC + 4.3 ± 2.8 mm; SH + 2.7 ± 2.6 mm), vastus medialis (MIC + 1.5 ± 1.5 mm; SH + 0.9 ± 0.8 mm) and vastus lateralis (MIC + 6.8 ± 8.0 mm; SH + 3.2 ± 1.8 mm). Although both groups increased ($p < 0.01$) the pennation angle of vastus lateralis (MIC + 2.90° ± 0.95°; SH + 1.90° ± 1.35°, $p < 0.01$), the change measured in MIC was higher ($p = 0.045$) than that observed in SH. Furthermore, only MIC enlarged ($p < 0.01$) the pennation angle of brachialis (MIC + 1.93 ± 1.51). Both groups improved ($p < 0.05$) bench press strength and power but only MIC enhanced ($p < 0.01$) vertical jump height. At post intervention, only MIC decreased ($p < 0.05$) DOMS at 12-h, 24-h, and 48-h after performing an exercise-induced muscle soreness protocol.

Conclusion A 3-h daily use of microcurrent maximized muscular architectural changes and attenuated DOMS with no added significant benefits on body composition and performance.

European Journal of Sport Science, 2021
https://doi.org/10.1080/17461391.2020.1862305

Effects of adding post-workout microcurrent in males cross country athletes

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Abstract

Post-exercise microcurrent based treatments have shown to optimise exercise-induced adaptations in athletes. We compared the effects of endurance training in combination with either, a microcurrent or a sham treatment, on endurance performance. Additionally, changes in body composition, post-exercise lactate kinetics and perceived delayed onset of muscle soreness (DOMS) were determined. Eighteen males (32.8 ± 6.3 years) completed an 8-week endurance training programme involving 5 to 6 workouts per week wearing a microcurrent (MIC, n=9) or a sham (SH, n=9) device for 3-h post-workout or in the morning during non-training days. Measurements were conducted at pre- and post-intervention. Compared to baseline, both groups increased ($P < 0.01$) maximal aerobic speed (MIC, pre = 17.6 ± 1.3 to post=18.3 ± 1.0; SH, pre=17.8 ± 1.5 to post = 18.3 ± 1.3 $km \cdot h^{-1}$) with no changes in $\dot{V}O_{2peak}$. No interaction effect per group and time was observed (P=0.193). Although both groups increased ($P < 0.05$) trunk lean mass (MIC, pre=23.2 ± 2.7 to post=24.2 ± 2.0; SH, pre=23.4 ± 1.7 to post=24.3 ± 1.6 kg) only MIC decreased (pre=4.8 ± 1.5 to post=4.5 ± 1.5, p=0.029) lower body fat. At post-intervention, no main differences between groups were observed for lactate kinetics over the 5 min recovery period. Only MIC decreased (P<0.05) DOMS at 24-h and 48-h, showing a significant average

regular microcurrent was added to the programme training of resistance and endurance athletes

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To the best of our knowledge, **no formal research** has been conducted to verify the effects of microcurrent added to resistance exercises on muscle strength and physical function in non-trained **middle-aged and older adults**.

!

Therefore, it is important to understand to what extent the application of microcurrent alone as well as added to resistance exercises (the hallmark of prevention and treatment of sarcopenia) can slow the age-related decline of muscular function, and play a role in the prevention of sarcopenia.

AIM

To analyse the effects of microcurrent treatment alone and combined with a resistance exercise programme on muscle strength, body composition and physical function in middle-aged adults.

HYPOTHESES

(1) Microcurrent alone will attenuate the age-related decline in muscle mass, improve functional capacity and wellbeing compared to a sedentary lifestyle.

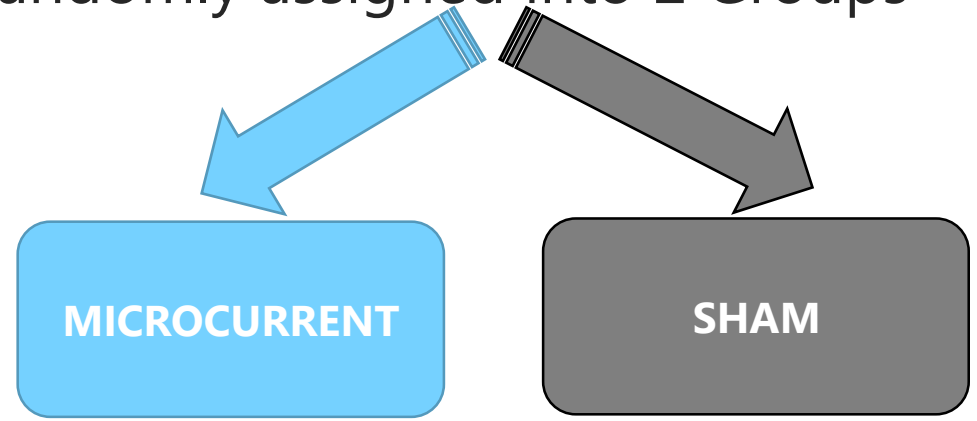
(2) Adding a resistance training programme to microcurrent treatment will maximise the benefits of muscle mass gain, functional capacity and wellbeing.

PARTICIPANTS

- non-regularly trained male & female adults
- aged 40 to 65 years old
- with no musculoskeletal injuries

METHODS

- 6-week randomised, balanced, double-blind design
- Randomly assigned into 2 Groups



- Thereafter, all of the participants will be offered to take part in a supervised resistance training programme which will be combined with either the MCT or SH intervention.

The following 4 treatment conditions are expected to be analysed:

MICROCURRENT ALONE

MICROCURRENT + EXERCISES

SHAM ALONE

SHAM + EXERCISES

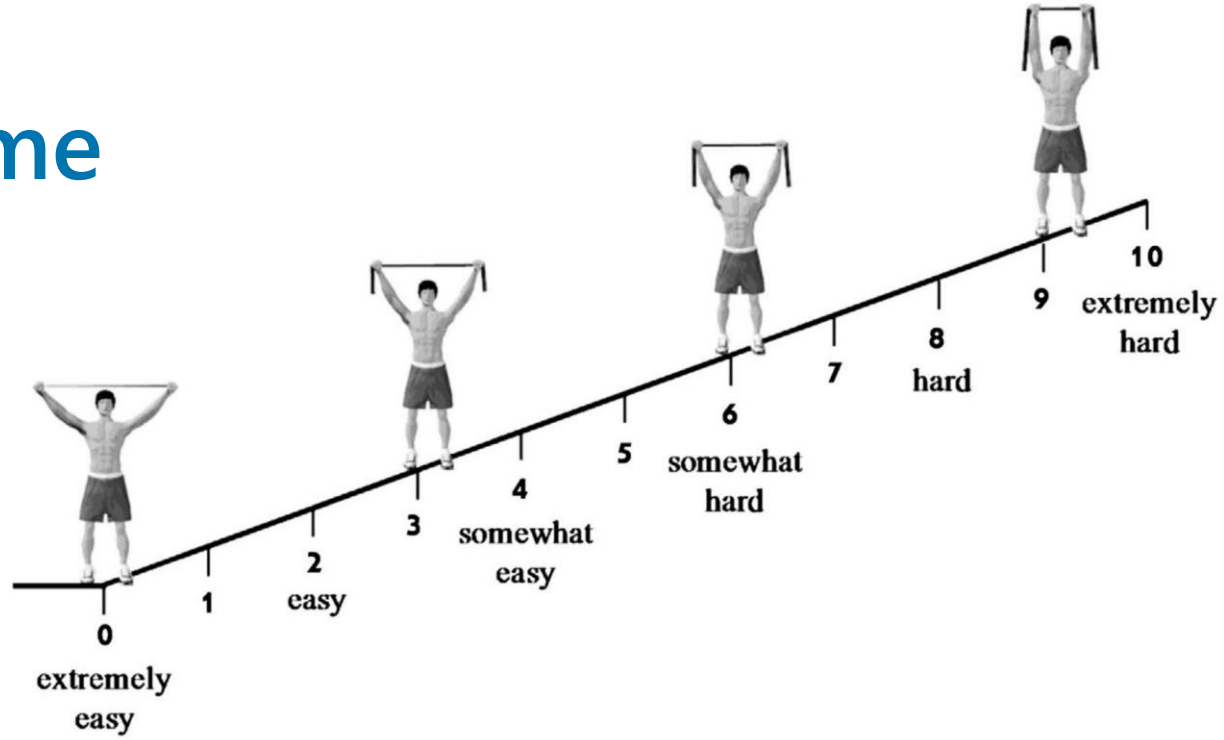
- The Arc4Health microcurrent device (approved as a Class IIa medical device in the areas of pain management and tissue repair) will be used in the study.
- Participants will wear the microcurrent or sham device for 3 hours every day.

manufactured by ARC Microtech Ltd, UK

Resistance Training Programme

- A 6-week progressive resistance training programme using elastic bands (TheraBand®, USA) will be performed twice a week.

- Familiarization of 2 sessions with a qualified strength and conditioning instructor.



OMNI-Resistance Exercise Scale of perceived exertion with TheraBand resistance bands (Colado et al., 2018)

Resistance in Kilograms of Thera-Band Resistance Based on Percent Elongation

Thera-Band® Band/Tubing Color	Increase from Preceding Color at 100% Elongation	Resistance in Kilograms at: 100% Elongation	200% Elongation
Thera-Band Green	25%	2.1	3.0
Thera-Band Blue	25%	2.6	3.9
Thera-Band Black	25%	3.3	4.6
Thera-Band Silver	40%	4.6	6.9
Thera-Band Gold	40%	6.5	9.5

BEGINNER ↓ ADVANCED

Centre for Exercise Activity and Rehabilitation

University of Greenwich

MEASUREMENTS

at baseline & after week 6

- Body composition
  (Fat Mass, Lean Mass, & Fat % will be measured by Air displacement plethysmography - Bod Pod®).
- Muscle strength and Function
  (Maximum strength will be assessed by dynamometers and functional tests)
- Muscular structure
  (To measure changes in muscular architecture under static conditions by using Ultrasound)
- Nutrition will be assessed by using FFQ questionnaire.

EXPECTED OUTCOMES FROM THE INVESTIGATION

It is expected that results from the current intervention will demonstrate the potential benefits of microcurrent treatment alone and combining microcurrent with resistance training to maximise the benefits on body composition, muscle strength, and muscle function in middle-aged adults.

*"Old age, like disease, should be fought against. Care must be bestowed upon the health; **moderate exercise** must be taken; the **food and drink** should be sufficient to recruit the **strength**."*

—MARCUS TULLIUS CICERO, 44 B.C.

[Cicero, M. T. (1887). Cicero De Senectute (On Old Age), translated with an Introduction and Notes by Andrew P. Peabody (Boston: Little, Brown, and Co., 1887).]

THANK YOU

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