# Synapse Micro-Current Recovery Unit

## Synapse micro-current lactate clearance test

**Background**

The Synapse Micro-Current Recovery and Performance units are a completely new concept for sport and performance. They present such a radical innovation in fitness performance and recovery that there is nothing like it available on the market.

The Synapse Micro-Current units work in two ways by safely modifying and enhancing normal physiology associated with exercise performance;

1. Performance: Improves muscle performance by boosting energy levels in muscle cells by significantly increasing the levels of mitochondria ATP (the cells energy pack).

2. Recovery: It will also improve recovery from exercise by reducing the levels of circulating blood lactate post exercise – reducing the muscle acidosis as a result of the accumulation of hydrogen ions as a result of the breakdown of lactic acid to lactate. The recovery programme also aims to reduce exercise induced muscle damage after a hard exercise workout. The amount of creatine-kinase (CK), an indicator of muscle damage, circulating in the subject's blood is lowered after the application of the recovery programme. This will reduce the post-exercise, delayed onset muscle soreness so aiding recovery and importantly reducing the possibility of injury.

**A new concept for a new era in exercise physiology**

Exercise induced muscle pain and soreness is now understood be the result of micro damage to muscle fibres and protein filaments which results in an increase in blood flow=that causes the tissues to become swollen and triggers pain. A study undertaken at Kingston University showed that ice massage/baths had no significant impact upon exercise induced muscle damage or recovery after a hard workout. The study showed that when twelve men received an ice massage/bath repeated 24 and 48 hours later, following a strength workout, no benefit was obtained.

Following another similar exercise session the same group received a placebo of false ultrasound. The researchers measured the amount of creatine-kinase (CK), an indicator of muscle damage in the subjects blood and reported that the ice massage did not significantly reduce CK levels in the 96hrs following the workout. Even more interesting was the fact that the muscle recovered more with the placebo ultrasound indicating that chilling the muscles may even be slowing the recovery process. In addition, the frequency of which the ice was applied did not seem to make a difference. In a similar study Australian researchers applied ice at hourly intervals and reported no positive changes in CK levels.

Preliminary studies have indicated that when the same experiment was undertaken with the Synapse Micro-Current the levels of CK, were lowered. However, the mechanism is to date unclear and further work needs to be undertaken to help understand these findings.

**Lactate Acid**

Lactic acid has always received bad press. However, it seems that rather than be demonized lactic acid should be respected or perhaps more accurately the lactate that is rapidly produced from lactic acid. In a published article "Biochemistry of Exercise-Induced Metabolic Acidosis," Professor Robert Robergs from the University of New Mexico, makes a strong case that lactic acid has been hopelessly misunderstood.

"If muscles did not produce lactate, acidosis and muscle fatigue would occur more quickly, and exercise performance would be severely impaired."

However, this information is not new; for ten years Professor George Brooks from UCLA in the USA has been promoting this perspective stating that lactic acid is a key substance used to provide energy, burn dietary carbohydrates, produce blood glucose and liver the so called lactate shuttle or lactate transport system, a mechanism where lactate moves around the body from muscle fibres to organs.

So how did this system become so misunderstood for so long? Two Nobel laureates, AV Hill and Otto Meyerhof, awarded Nobel Prizes in 1922 for their studies of carbohydrate

metabolism in working muscles noticed that lots of lactic acid was being produced at just the point where the muscles stopped functioning and concluded that lactic acid must be the cause of muscle fatigue – WRONG! This turned out to be a classic mistake – a conclusion based on related events, but not a true cause-and-effect relationship. In addition, Hill and Meyerhof were working with frog muscles, and human muscles have a much higher endurance potential. Another fundamental flaw in the reported research was that the frog muscles were cut off from the rest of the frog, and isolated in a jar, which prevented a fresh flow of oxygen to complete the metabolic process. The moral here is do not blindly believe published work just because it has been published.

**Lactate Threshold**

When muscles are operating at a low level of intensity they burn modest amounts of carbohydrate and produce modest amounts of lactic acid. At higher levels of exercise intensity muscles burn more carbohydrates and to produce more lactic acid, which quickly breaks down into lactate hydrogen ions. The hydrogen ions lower the pH of the working muscles, decreasing muscle efficiency, and causing the burning sensation. Circulating oxygen in the blood mops up the excess hydrogen ions to produce water. Therefore, the oxygen delivery has to keep up with the production of hydrogen ions.

To improve muscle performance the lactate-transport system has to be improved or/and binding of oxygen and the hydrogen ions.

**Targeted Experiments**

1. CK measurements in the circulating blood indicating levels of muscle damage following application of the Synapse Recovery and placebo units.
2. Levels of muscle acidosis following intense exercise.

**Working hypothesis**

The preliminary studies are based upon the hypothesis that:

1. The application of Synapse micro-current will decrease muscle acidosis and circulating blood lactate levels following a period of sustained and intense exercise*, in comparison to a control group.

2. Following a similar exercise session the same group's level of creatine-kinase (CK) (an indicator of muscle damage) in the subject's blood when exposed to a treatment of the Synapse Recovery the levels of CK, will be lowered.

**Aim**

1. To evaluate if the application of Synapse micro-current influences the clearance of elevated circulating blood lactate following physical exercise undertaken at a rate above the lactate threshold of 4mmol/litre.

2. To evaluate if the application of Synapse micro-current influences levels of blood circulating creatine-kinase (CK).

**Objectives**

- To ascertain if the timing and/or sequence of the application of micro-current in relation to the exercise has an influence on lactate accumulation at a given intensity of exercise.
- To ascertain if the timing and/or sequence of the application of micro-current in relation to the exercise has an influence on blood lactate clearance following exercise at a given intensity
- To establish the subjective evaluation of post-exercise fatigue following the application of micro-current following a period of sustained and intense exercise*
- To ascertain if circulating CK levels are influenced at any specific time point

*The definition of sustained and intense exercise we are adopting for this study is using an outdoor running model where the exercise intensity is incrementally increased step wise until the subject reaches exhaustive fatigue. Each subject will run a series of 50m lengths progressively increasing their effort to reach 100%. This is with the aim of achieving their highest blood lactate levels.

**Method**

A prospective randomised, blind control study method will be used. There will be eighteen trained, male subjects used in the study in an age range 18 – 30 years.
All subjects will be required to sign a consent form prior to participating in the study.

The eighteen subjects are numbered 1 -18 and randomly divided into two groups, Group A and Group B.

**Protocol**

1. All subjects will be provided with an information sheet and consent form prior to the test. All subjects will be required to read and provide written consent before commencing the test.
2. All subjects will have a pre-test lactate assessment and CK screen using blood from a finger prick. The resting heart rate will also be noted.

3. Group A subjects will be exposed to 30-minutes of micro-current prior to their exercise test.

4. Group B subjects will not be exposed to the micro-current pre-test and will commence their test immediately after their base-line lactate assessment.

5. Following their 30-minute exposure to the micro-current Group A subjects will undergo the same exercise test as the group B subjects

6. All subjects will undergo the same post-test regime as follows:

- All subjects will remain seated for 30 minutes after the test. After this time they may walk about.
- All subjects will undergo a blood-lactate test at the following intervals post-test: 0, 5, 10, 30, 60 and 120 minutes minutes.
- All subjects will undergo a blood test at 24 hours and 48 hours to assess CK levels

7. Subjects will be required to subjectively assess their levels of post-exercise muscle stiffness/soreness by completing a simple questionnaire.

8. The following week the same test will be conducted using the same method but crossing over the groups.

N.B There will be a number of placebo micro-current units in each group. These will act as the controls. As the application of micro-current is sub-sensory and the appearance of the units will be identical to the working units neither the tester nor the subject will be aware whether they have a real or a placebo unit.

**Exercise protocol**

1. Players work in groups of three, running a 50-metre length, commencing with two subjects at one end and one at the other. The exercise starts with one of the two running towards the single subject. When he is reached he runs back towards the waiting subject from the pair and so on.

2. The exercise intensity will be increased incrementally, commencing at 50% of maximum effort, being increased to 100% in 10% increments.

3. The sets of three will be run at staggered intervals. It is estimated that each test will take 10 - 15 minutes

# Micro-current lactate and CK test

**Subject information**

The purpose of this study is to test a new piece of equipment that we believe may reduce the degree of tiredness you feel in your muscles during exercise and also the amount of muscle stiffness after a game. Tired muscles stop players performing at their maximum and can lead to injury and missed playing opportunities.

This new equipment uses something called micro-current. Micro-current is a very small electric current, like those that exist in your body naturally, but you are unaware of. The application of it is completely painless; in fact you will not feel anything at all. We believe that there is no risk to you being exposed to the micro-current. The device used is a CE marked unit.

The micro-current is applied using small pad like dressing that are placed on your skin.

The aim of the study is to see if the application of micro-current influences the clearance of raised circulating blood lactate following physical exercise*. We will also measure a chemical called creatine-kinase (CK), this is produced when muscles are damaged which happens with intense or sustained exercise and produces stiff muscles sometimes several days after exercise sessions.

*The definition of sustained and intense exercise we are adopting for this study is using an outdoor running model where the intensity is incrementally increased step wise until the subject reaches exhaustive fatigue. Each subject will run a series of 50m lengths progressively increasing their effort to reach 100%. This is with the aim of achieving their highest blood lactate levels.

You will be put into Group A or Group B. All subjects will have the same test so it does not matter which group you are in.

In order to remove the placebo effect some of the units will not be delivering any of the micro-current. Neither the tester nor the subject will know which units these are.

**Protocol**

1. All subjects will be provided with an information sheet and consent form prior to the test. All subjects will be required to read and provide written consent before commencing the test.
2. All subjects will have a pre-test lactate test using blood from a finger prick test. Their resting heart rate will also be taken.
3. Group A subjects will be exposed to 30-minutes of micro-current prior to their exercise test.
4. Group B subjects will not be exposed to the micro-current and will commence their test immediately after their base-line lactate assessment.
5. Following their 30-minute exposure to the micro-current Group A subjects will undergo the same exercise test as the group B subjects
6. All subjects will undergo the same post-test regime as follows:
    - All subjects will remain seated for 30 minutes after the test. After this time they may walk about.
    - All subjects will undergo a blood-lactate test at the following intervals post-test: 0, 5, 10, 30 and 60 minutes.

7. Subjects will be required to subjectively assess their levels of post-exercise muscle stiffness/soreness by completing a simple questionnaire.
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**Exercise protocol**

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**CONSENT FORM FOR**

**Micro-current lactate creatine-kinase (CK), clearance test**

I have read the information sheet and I consent to participating in this study

I realised that I may withdraw from the study at anytime with no detriment to me.

Name

Address

Signature

Date

If you require any further information please contact:

**Synapse Microcurrent Ltd 01959 569433**

**MICRO-CURRENT LACTATE/CK TEST**

## SUBJECT QUESTIONNIRE

**Which group were you in A B (please circle)**

**What is your subject number?**

**1. If you received the treatment before the running test how did you feel during the treatment?**

- **No different to normal**
- **Different to normal (if so how?)**

**2. When you received the treatment after the running test how did you feel during the treatment?**

- **No different to normal**
- **Different to normal (if so how?)**

**3. If you received the treatment before the running test, during the running test did you feel you had,**

- **More energy?**
- **Less energy?**
- **No difference to normal?**

**4. After the test did you feel that you recovered,**

- **More quickly than expected?**
- **Less quickly than expected?**
- **No different to expected?**

**5. How did you or your muscles feel the next day?**

- **More stiff than you expected?**
- **Less stiff than expected?**
- **No different to expected?**

**Thank you for completing this questionnaire.**