#4 - Compex Technology Improves Recovery *Bill Misner, Ph.D, C.S.M.T.*

Better Recovery Improves Cycling Time Trial Performance

INTRODUCTION

During 17 years of private, clinical, and university physical therapy practice, I applied interferential current, direct current, alternating current, micro-current, Russian current, and trans-electrical neuromuscular stimulation devices for a variety of prescribed rehabilitation treatments, including patients with post-surgical, post-trauma, and chronically or acutely strained muscle conditions, projecting return to normal function. Each electrical stimulation device presented several limitations, and none of them completely substituted for an active patient-motivated exercise progression inducing complete recovery.

Brian Frank, CEO of E-CAPS, and a representative from Compex International requested that I test the Compex Sport unit to determine if it generated recovery potential sufficient to ameliorate overtraining. Having been subjected to countless experiences with exaggerated claims made by manufacturers for an electrical muscle stimulation (EMS) unit that delivered little or no promised results, I was highly skeptical. Nevertheless, I reluctantly agreed to test the Compex Sport Unit.

CASE STUDY METHODS

Nine cycling time trial courses were selected on which previous personal course records were set between 1999-2002. Prior to each personal record performance, periodized rest and graduated taper were employed. It was rational to assume that if the Compex Recovery mode actually improved recovery, then it might be substituted for a tapering period prior to a time trial. If so, then the quality of training would positively influence performance by compacting recovery mechanisms, resulting in an increased rate of physiological adaptation to training stress, as evidenced by improved performance. Conversely, if the unit failed to regenerate recovery in a fraction of the time by "substituting" for tapering, then performance attempts should miserably fail. By age 63, former personal bests of yesteryear (set at ages 59-62) typically do not reoccur.

RESULTS

Training preceded the time trial test period until an aerobic fitness base was established. Next, cycling time trials were measured on nine courses in an abbreviated 39-day period, which allowed no tapering prior to each time trial. Each course was selected because personal TT records had been established previously during the 1999-2002 seasons. During this test period, the Compex Sport unit Recovery mode was substituted for tapering after daily training or course record attempt. time trials, new course records were established.

These results suggest one of the following two conclusions:

(1) A remarkable placebo effect was established through application of the Compex Sport Unit.

(2) The Complex Sport Recovery mode reduced recovery time, resulting in eight out of nine personal best performances in a 63 year-old male subject.

DISCUSSION

That a 63-year old male cyclist produced eight of nine personal bests on previously known courses during a 39-day period without employing tapering is an observation meriting review. If a tapering intervention preceded each of the previous personal bests on the same courses when the subject was younger-age (59-62), then was a hypothetical placebo effect sufficiently significant to evoke superior results without recovery periods? How would conservative physiotherapy scientists evaluate this case study report?

PHYSIOTHERAPY SCIENCE POSITION

This case study was then submitted to the highly respected British Elsevier Journal, Physical Therapy in Sport in October 2003.

In March of 2004, the Physical Therapy in Sport returned a 5-month peer review of this paper with four general statements:

Lack of control group data failed to eliminate the placebo effect.
The case study failed to prove by scientific methodology that square-wave EMS enhanced performance.

The study is of interest, but there are too many gaps for it to make a significant contribution to the knowledge in the field and too many suppositions and assumptions (especially with regards previous literature) to fully support the arguments implied.

This is an interesting case study, which suggests that electrical stimulation may be of value in the older athlete.

AUTHOR'S REPLY

This single-subject case study presents findings indicating an association between application of a square-wave EMS and performance gain.

It neither conclusively determines cause and effect nor does it eliminate placebo effect, but it does call for further study to assess if these results were due either to square-wave EMS, placebo effect, or both in combination.

If performance-enhancing results were induced in a skeptic influenced by 17 years clinical physiotherapy exposure to a broad spectrum of electrical stimulation devices, how was the placebo effect reproduced in a negatively biased subject?

Overtraining is reported to commence within seven days training. Optimal performance is not predicted immediately following a seven-day training period, unless physiological mechanisms are manipulated to hasten complete recovery (1).

Square-wave EMS has been shown to improve blood flow and waste-removal dynamics, advancing recovery following extreme exercise stress (2).

Whether square-wave EMS induces placebo effect or physiological dynamics that reduce recovery time is undetermined. That this device produced positive performance gains in a skeptical subject by effectually hastening recovery implies that the results achieved by one athlete may be repeated in others.

CONCLUSION

There is evidence to suggest that square-wave EMS application enhances the physiological mechanisms required to promote recovery between 50-500% over periodic rest or duration and intensity tapering prior to a performance-demanding event.

Whatever the actual mechanism by which recovery was advanced, it is plausible that training adaptations were hastened by use of this device in a 63 year-old male cyclist who subsequently enjoyed otherwise unexplainable performance gains. This case study does not prove by scientific methodology that square-wave EMS applications generate a specific physiological action. However, in one subject, a Compex Sport Unit Recovery mode application was substituted for tapering, with the end result that eight out of nine personal bests were recorded during a 39-day period on courses where each of the previous records had been established preceded by a tapering intervention. It is therefore suggested that athletes over age 35 employing a square-wave recovery mode may enjoy similar results in their training experience.

Having been the subject of this case study, the author, employed by an organization that markets this unit, discloses competing interests that could infringe upon an unbiased view.

References

Halson SL, Bridge MW, Meeusen R, Busschaert B, Gleeson M, Jones DA, Jeukendrup AE. Time course of performance changes and fatigue markers during intensified training in trained cyclists. J Appl Physiol. 2002 Sep;93(3):947-56. Researchers studied the cumulative effects of exercise stress and subsequent recovery on performance changes and fatigue indicators; the training of eight endurance cyclists was systematically controlled and monitored for a 6-wk period. Subjects completed 2 wk of normal (N), intensified (ITP), and recovery training. A significant decline in maximal power output (N = 338 +/- 17 W, ITP = 319 +/- 17 W) and a significant increase in time to complete a simulated time trial (N = 59.4 +/- 1.9 min, ITP = 65.3 +/- 2.6 min) occurred after ITP in conjunction with a 29% increase in global mood disturbance. The decline in performance was associated with a 9.3% reduction in maximal heart rate, a 5% reduction in maximal oxygen uptake, and an 8.6% increase in perception of effort. Despite the large reductions in performance, no changes were observed in substrate utilization, cycling efficiency, and lactate, plasma urea, ammonia, and catecholamine concentrations. These findings indicate that a state of overreaching can already be induced after 7 days of intensified training with limited recovery.

Zicot M, Rigaux P., [Effect of the frequency of neuromuscular electric stimulation of the leg on femoral arterial blood flow] J Mal Vasc. 1995;20(1):9-13. (Compex Electrical Stimulation Hastens Blood Vascularity Flow Reducing Recovery Time) Researchers demonstrated that transcutaneous neuromuscular electrical stimulation of the muscles of the leg in the human increases largely the arterial femoral blood flow. This elevated flow is stable during the stimulation. This present work deals with the influence of the frequency of the stimulation on the level of this hyperaemia. The neuromuscular electrical stimulation is applied to the internal and external branches of the sciatic nerve in order to stimulate the whole muscles of the leg and the foot. The stimulus is yielded by a Compex stimulator for seven minutes with frequencies in random order between 3 and 15 Hz. The intensity of the current (mean: 31 mA) is set up at such a level to increase blood flow by at least 100% at 5 Hz. The femoral arterial flow velocity and the pulsatility index are assessed during the last minute of the stimulation by a duplex ultrasound method. The peripheral vascular resistance is calculated on the base of the femoral blood flow and the mean arterial pressure. Seven healthy volunteers are studied (6 males and one female, aged 26.9 years, +/- 6.9). The haemodynamic variables are recorded at rest. They observed a linear increase of the blood flow with increasing frequencies of stimulation (181% of the rest value at 3 Hz and 276% at 9 Hz). When the electrical stimulation intensity was sufficient to cause moderate muscle contractions, a transient, local increase in blood flow occurred.