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[SELECTED STUDIES OF WHOLE-BODY ELECTROSTIMULATION]

Sport & Training, Medical & Health or Beauty & Wellness – the capabilities of miha bodytec are enormous. The summaries of the selected studies listed below reveal the effectiveness of whole-body electrostimulation.

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Contents:

Page 3	Whole-body electrostimulation (EMS) to relieve back pain
Page 4	Whole-body electromyostimulation (EMS) - an innovative method for the alleviation of urinary incontinence
Page 5	Training effects of a combined training, conventional strength training and EMS training
Page 6	A multicenter study for the capability of whole-body training in the gym
Page 7	Short- and long-term training effects of mechanical and electrical stimulation on strength diagnostic parameters.
Page 8	Effects of whole-body electromyostimulation on resting metabolic rate, anthropometric and muscular parameters in the elderly
Page 9	The Influence of an adjuvant EMS training on body composition and cardiac risk factors in elderly men with metabolic syndrome
Page 10	Electromyostimulation (EMS) with cardiologic patients. Does EMS training become important for secondary prevention?

Whole-body electrostimulation (EMS) to relieve back pain

(BOECKH-BEHRENS, W.-U. / GRÜTZMACHER, N. / SEBELEFSKY, J., unpublished diploma thesis, University of Bayreuth, 2002).

Objective

The aim of this study was to identify the effects of a complex EMS training on back pain.

Methods

49 staff members (31 women, 18 men, average age 47 years) of the University of Bayreuth suffering from back pain voluntarily took part in this study. With the help of pre- and post-questionnaires the frequency and intensity of back pain and also the general extent of discomfort, mood, vitality, body stability and body shape were determined.

The subjects performed two EMS training sessions per week for 45 minutes (a total of 10 sessions) with following training parameters: Impulse duration 4 s, impulse interval 2 s, frequency 80 Hz, rise time 0 s, impulse amplitude 350 μ s. Every training session started with a warm-up period of 10-15 minutes in order to adapt to electrical stimuli and to set the individual impulse intensity for training. Within the following training program (about 25 minutes) the subjects performed different static exercise positions. To cool down the subjects performed a 5 minute relaxation program with following parameters: Impulse duration 1 s, impulse interval 1 s, frequency 100 Hz, rise time 0 s, impulse amplitude 150 μ s.

Results

A decrease in back pain was observed in 88.7 % of the subjects. 38.8 % of these subjects reported a strong decrease in back pain and 41.9 % experienced a light improvement of the extent of discomfort. Also, the frequency and the intensity of back pain significantly decreased within the training period.

Furthermore, the EMS training showed following effects: 61.4 % of the subjects reported an improvement of their general extent of discomfort, 75.5 % showed improvements in mood, 69.4 % noticed an increased vitality, 57.1 % of the men and 85.7 % of the women reported increased body stability, 50 % of the subjects noticed positive body shaping effects and 75.5 % felt more relaxed after training.

Conclusion

The whole-body EMS training counters back pain in a very effective way. The electrical stimulus obviously also activates the deeper muscle groups which are difficult to activate through conventional treatment methods. EMS training achieves therapeutic as well as preventive goals. Thus, the specific whole-body EMS training offers a very effective and time-saving all-round training to improve health.

Whole-body electromyostimulation (EMS) - an innovative method for the alleviation of urinary incontinence

(BOECKH-BEHRENS W.-U./SCHÄFFER, G., unpublished diploma thesis, University of Bayreuth, 2002).

Objective

The aim of this study was to identify the effects of EMS training on urinary incontinence.

Methods

49 subjects who suffered from back pain were examined in this study. With the help of pre- and post-questionnaires (GAUDENZ 1979) the existence, the type and the intensity of incontinence disorders was identified. 17 subjects (15 women, 2 men) with an average age of 47 years had a mostly light to medium type of urinary incontinence.

The subjects performed two EMS training sessions per week for 45 minutes (a total of 10 sessions) with following training parameters: Impulse duration 4 s, impulse interval 2 s, frequency 80 Hz, rise time 0 s, impulse amplitude 350 μ s. Every training session started with a warm-up period of 10-15 minutes in order to adapt to electrical stimuli and set the individual impulse intensity for training. Within the following guided training program (about 25 minutes) the subjects performed different static exercise positions. To cool down the subjects performed a 5 minute relaxation program with following parameters: Impulse duration 1 s, impulse interval 1 s, frequency 100 Hz, rise time 0 s, impulse amplitude 150 μ s.

Results

64.7 % of the subjects showed an alleviation of urinary incontinence. 23.5 % were free of urinary incontinence afterwards, 24.4 % reported a reduction and 35.9 % showed no changes. These results are equal to the improvements reported after treatments of incontinence with specific local electromyostimulation devices (Eriksen 1987, Sebastio 2000, Salinas Casado 1990, Meyer, 2001).

Conclusion

The whole-body EMS training offers an effective training method. EMS training achieves therapeutic goals like the alleviation of incontinence and back pain disorders as well as preventive goals such as muscle gain, body shaping, improvements in mood, vitality, body stability and increase of the general performance.

Training effects of a combined training, conventional strength training and electromyostimulation training

(BOECKH-BEHRENS, W.-U. / NIEWÖHNER, F./ WALZ, T., unpublished diploma thesis, University of Bayreuth 2003).

Objective

The aim of this study was to identify the sex-related training effects of a 6 week EMS training combined with a fitness-orientated strength training program with weight machines. The results of this study were compared to the results of previous comparable investigations that exclusively performed EMS training or conventional strength training.

Methods

28 women and 28 men with an average age of 46.2 years voluntarily participated in this experiment. The 56 untrained subjects performed one EMS training session and one fitness-orientated strength training session per week over 6 weeks. The data out of a parallel study investigating the effects of different strength training methods in strength trained subjects were taken for comparison. The EMS training used the following parameters: Impulse duration 8 s, impulse interval 4 s, frequency 80 Hz, rise time 0.3 s, impulse amplitude 350 μ s, training duration 25 minutes. As a control procedure maximal strength and strength endurance measurements were used and body weight, body fat and body circumferences were measured. Furthermore, the subjective perceived health factors, performance, body perception and mood were documented with the help of questionnaires.

Results

The subjects showed increases in strength endurance of 41-51 % in leg-press and 25-38 % in lat-pull. In contrary, only a slight increase was shown in maximal strength. The changes in body weight and body fat were significant. The body circumferences significantly decreased in waist, hip and thigh. 86 % of the men and 70 % of the women reported an improved performance through training. 61 % felt more flexible and 79 % of the subjects reported an increased vitality. Over half of the subjects reported that they were in a better mood and more active after training. 90 % of the men and 70 % of the women reported that they felt tighter, stronger and more protected. 64 % of the subjects noticed positive body shaping effects such as muscle gain and tighter tissue. In the beginning of this study half of the subjects suffered from back pain. 75 % of them felt a reduction of back pain or were pain free after training.

Conclusion

The results show that a combined training (1x whole-body EMS training session and 1x conventional strength training session with weight machines per week) is as effective as conventional strength training twice a week. As shown in previous EMS investigations, the positive effects of EMS such as the reduction of back pain and the strong sensed improvement in body stability were also documented in a similar way after a combined training.

Electrical muscle stimulation as whole-body training – A multicenter study for the capability of whole-body training in the gym

(VATTER, J., University of Bayreuth, 2003; Publication AVM-Verlag Munich 2010).

Objective

The aim of this work was to identify in a field test if whole-body training with electrical stimulation shows positive changes in strength, anthropometry, body perception, mood, general factors of health, back pain and urinary incontinence.

Methods

134 subjects (102 women and 32 men, average age 42.5 years) voluntarily participated in this study. 6 weeks before and after training the subjects were interviewed and tested in 4 different gyms, then were compared with a control group (n = 10). Also age- or gender-related differences were documented. The tests determined maximal strength, strength endurance, body weight, body fat and body circumferences, frequency and intensity of back pain and urinary incontinence disorders as well as the general extent of disorder, mood, vitality, body stability and body shape.

A total of 12 training sessions (2 times per week) were performed with following training parameters: Impulse duration/impulse interval 4 s/4 s, 85 Hz, rectangular impulse, impulse amplitude 350 μ s. After a 10-15 minute warm-up for acclimatization the subjects performed a 25 minute training program with static exercise positions. The training ended with a 5 minute relaxation program (impulse duration 1 s, impulse interval 1 s, 100 Hz, rectangular impulses, impulse amplitude 150 μ s).

Results

82.3 % of the subjects had less back pain after the study and 29.9 % were free of pain. The percentage of subjects with chronic pain reduced from 40.3 % before training to 9.3 % afterwards. 75.8 % reported an improvement in incontinence and 33.3 % were free of incontinence afterwards. The number of disorder cases significantly declined (about 50 %). The maximal strength increased by 12.2 % and the strength endurance increased by 69.3 %. Women benefited more than men (13.6 % vs. 7.3 %). 18 subjects did not complete the training. The control group showed no changes.

The subjects showed only light changes in body weight and BMI. The body fat decreased by 1.4 % in the training group and increased about 6.7 % in the control group. Younger subjects lost more weight than older; there were no gender- or weight-related changes. The body circumferences of female subjects significantly decreased in chest (-0.7 cm), thigh (-0.4 cm), waist (-1.4 cm) and hip (-1.1 cm). Male subjects showed significant reductions in waist (-1.1 cm) with a gain in upper arms (+1.5 cm), chest (+1.2 cm) and thigh (+0.3 cm) in the same time. The control group showed no reductions and gained in waist and hip.

The body perception in general improved. 83.0 % reported less hardening, 89.1 % noticed a higher stability and 83.8 % increased their performance. 86.8 % noticed positive body shaping effects. 90.0 % of the participants enjoyed the training. Training with higher intensities showed stronger improvements especially in patients with disorders but also increased muscle soreness.

Conclusion

Whole-body EMS training offers a convincing training method for the reduction of back pain and urinary incontinence. The achieved strength gains are similar to those achieved with conventional strength training and in some cases they are even above. Body shaping and mood aspects are very attractive for women and men of all age groups. Consequently, whole-body EMS training is an effective training method that appeals to a wide spectrum of age groups.

Short- and long-term training effects of mechanical and electrical stimulation on strength diagnostic parameters

(SPEICHER, U. / NOWAK, S. / SCHMITHÜSEN J. / KLEINÖDER, H. / MESTER, J., German Sport University Cologne 2008; published in medical sports network 04/2007)

Objective

The aim of the present study was to compare traditional strength training methods with dynamic whole-body EMS (WB-EMS) in regard to their effects on strength and speed.

Methods

80 students of sport science were randomized (n = 10 each) into eight different training groups (hypertrophy, maximal strength, speed strength and strength endurance, WB-EMS, vibration, WB-EMS/hypertrophy mixed and vibration/hypertrophy mixed). The traditional training groups did leg curl and leg extension exercises with machines (gym80). Depending on the different training groups the subjects performed 3 series with various additional loads (30-90 %, 3-15 repetitions). The EMS group performed lunges and squats without additional load (impulse duration/impulse interval 6 s/4 s, impulse frequency 85 Hz, impulse amplitude 350 µs, biphasic rectangular impulses, 60 % intensity). The movements were standardized via visual biofeedback. The subjects performed 2 training sessions per week over 4 weeks. Pre- and post-tests were conducted before and after training period with strength diagnostic machines. An additional retest was conducted after a two week regeneration period. The dynamics were determined in terms of power measurements (strength x velocity) with additional load (40 % and 60 %) in various angles.

Results

All training methods significantly increased maximal power. The highest increase in maximal strength was achieved by the hypertrophy group (+16 %) followed by the EMS group (+9-10 %). Only the EMS groups showed significant results in enhancing velocity. Accordingly, the measured increase in power can be related to an increase in velocity (about 30 %) – significantly higher than achieved with traditional methods (16-18 %). Apparently, the direct activation of the fast twitch muscle fibres shows positive effects for enhancing velocity. The mixed training designs such as EMS and traditional hypertrophy training show typical adaptations to both training stimuli (7 % increase in maximal strength and 12 % increase in power). Accordingly, combinations of traditional and modern training methods could offer new and promising stimuli constellations. Especially the long-term effects of whole-body EMS are very interesting. The highest increases in power were measured after a two week regeneration period.

Conclusion

The present study revealed that dynamic whole-body EMS training with miha bodytec, compared to various training methods, offers a highly effective training method for enhancing strength and velocity. Only EMS training increased the sport relevant maximal power due to an increase of movement velocity. Furthermore, the great long-term effects of EMS training offer new possibilities in training periodization. A well calculated application of whole-body EMS in combination with dynamic exercise movements offers a promising combination for strength and speed training.

Effects of whole-body electromyostimulation on resting metabolic rate, anthropometric and muscular parameters in the elderly. The training and electromyostimulation trial (test)

(KEMMLER, W. / BIRLAUF, A. / VON STENGEL, S., University of Erlangen-Nuremberg 2009).

Objective

Especially women after menopause show serious changes of body composition with increasing abdominal body fat and a corresponding reduction of muscle mass. To counteract this development the whole-body electromyostimulation training (EMS) currently offers an alternative to conventional muscle training with a lower orthopedic and cardiac load and a comparing lower training volume. The aim of this pilot study was to identify the application and practicability of EMS training in the elderly plus to determine the efficacy of this training method on anthropometric, physical and muscular values.

Methods

30 postmenopausal women with long time training experience were randomized into a control group (CG: n = 15) and an EMS group (n = 15). While the control group continued with their usual training the EMS group performed a 20 minute whole-body EMS training every 4th day in addition to two strength and endurance training sessions per week. Alongside with the resting metabolic rate and VO₂ the most important anthropometric data (body weight, body length, body fat, waist girth etc.) were determined.

Results

The resting metabolic rate showed significant reductions in the control group (-5.3 %, p = 0.038) and no changes in the EMS group (-0.2 %, p = 0.991). Despite medium effect size (ES: 0.62) these parameters showed only slight differences between EMS and control group (p = 0.065). The sum of skin fold thickness significantly decreased (p = 0.001) by 8.6 % in EMS group compared to a light and insignificant increase in control group (1.4 %). These differences were statistically significant (p = 0.001, ES: 1.37). Waist girth as a criterion for abdominal obesity significantly decreased (p > 0.001) by -2.3 % in the EMS group (vs. CG: +1.0 %, p = 0.106). The corresponding difference between the groups was significant (p = 0.001, ES: 1.64).

Conclusion

In summary, besides health relevant effects on body composition the present study also revealed enhancements of functional parameters such as maximal strength and speed strength. Furthermore, the analysis identified a high acceptance of EMS training in the well trained postmenopausal women. Accordingly, this training form, besides efficacy, seems to also ensure practicability.

The influence of an adjuvant EMS training on body composition and cardiac risk factors in elderly men with metabolic syndrome

(KEMMLER, W. / BIRLAUF, A. / VON STENGEL, S., University of Erlangen-Nuremberg 2009).

Objective

Sarcopenia and (abdominal) obesity in the elderly are in close relation to mortality, multimorbidity and frailty. The aim of this investigation was to determine how far whole-body electromyostimulation (WB-EMS) training influences the body composition and cardiac risk factors in the elderly with metabolic syndrome.

Methods

Overall 28 men with metabolic syndrome according to IDF (69.4±2.8 years) around the area of Erlangen were either randomized into a control group (CG: n = 14) or WB-EMS group (n = 14). The subjects of the WB-EMS group performed a 30 minute endurance and strength training program with EMS every 5th day over 14 weeks. In parallel the control group performed a whole-body vibration training concentrating on the enhancement of flexibility and wellbeing. As primary focus parameters the abdominal and overall body fat plus the appendicular skeletal muscle mass (ASMM) were chosen. The parameters identifying metabolic syndrome according to IDF (waist girth, glucose, triglyceride, HDL-cholesterol, systolic and diastolic blood pressure) were chosen as secondary focus parameters.

Conclusion

The changes in abdominal fat mass with a high effect size (ES: $d=1.33$) showed significant differences ($p=0.004$) between the WB-EMS group and the control group (-252 ± 196 g, $p = 0.001$ vs. -34 ± 103 g, $p = 0.330$). In parallel to this the overall body fat decreased by -1350 ± 876 g ($p = 0.001$) in the WB-EMS group and by -291 ± 850 g ($p = 0.307$) in the control group (difference: $p = 0.008$, ES: $d=1.23$). The ASMM also showed significant differences ($p = 0.024$, ES: $d=0.97$) between the EMS and vibration control group (249 ± 444 g, $p = 0.066$ vs. -298 ± 638 g, $p = 0.173$). Except for significant differences of the waist girth (EMS: -5.2 ± 1.8 cm, $p = 0.001$ vs. CG: -3.3 ± 2.9 cm, $p = 0.006$) in group comparison ($p = 0.023$, ES: $d=1.10$) no further effects on the parameters of metabolic syndrome (see above) could be identified.

Conclusion

A whole-body EMS training with a lower training volume (about 24 minutes/week) and a short training period (14 weeks) shows significant effects on the body composition of elderly persons. Accordingly, WB-EMS might be able to offer a promising alternative to conventional training programs for training persons with lower cardiac and orthopedic capacity.

Electromyostimulation (EMS) with cardiologic patients. Does EMS training become important for secondary prevention?

(Fritzsche, D. / Freund, A. / Schenk, S. / Mellwig, K.-P. / Kleinöder, H. / Gummert, J. / Horstkotte, D., cardiology clinic Bad Oeynhausen, Herz 2010; 35 (1): 34–40)

Objective

By now, it is sufficiently validated that moderate endurance training in terms of secondary prevention improves the prognosis of chronic cardiac insufficiency (CHI). Experience in clinical routine shows that only few, expertly guided, highly motivated and predominantly younger patients are willing to undergo a permanent sport support-therapy. Own experience with whole-body electrostimulation (EMS) with patients suffering of cardiac insufficiency reveals the still unknown potential of EMS in regeneration of neuro-humoral, inflammatory and skeletal muscular symptoms of diseases in general. On this basis the impact and acceptance of whole-body EMS on patients with cardiac insufficiency was investigated in a prospective pilot study.

Methods

15 patients diagnosed with chronic cardiac insufficiency performed a 6 month training program (whole-body EMS) with a miha bodytec training device. The following stimulation parameters were defined for the EMS training program: 80 Hz and 300 μ s with 4 s impulse duration and 4 s impulse interval for a 20 min training duration. A cool-down program in the 100 Hz range succeeded the training program. The patients themselves were responsible for regulating the stimulation intensity (mA) so that the subjective perception of “muscle contraction/current perception” reached level 8 according to a 10 level scale. Within the main training program the target was to perform 40-70 repetitions of exercises in isometric holding positions and dynamic movements. The cardiac performance was measured in pre-test and after 3 and 6 months of training applying spiroergometry, electrocardiography (ECG) and ECHO. Furthermore, the tests determined the metabolic status including creatine kinase (CK) and lactate dehydrogenase (LDH) plus body weight and distribution of body fat (impedance scale).

Results

The analysis showed an increase of up to 96 % in oxygen uptake at the anaerobic threshold (VO_{2at} 19.39 [\pm 5.3] ml/kg body weight [KG] before training; VO_{2at} 24.25 [\pm 6.34] ml/kg KG after training; $p < 0.05$). The diastolic blood pressure significantly decreased ($psyst < 0.05$; $pdiast < 0.001$) and the muscle mass increased up to 14 % with no changes in body weight. The training method was accepted by 100 % (no drop-outs) and the patients reported a clearly enhanced subjective performance.

Conclusion

The present investigation shows the effects of EMS training in patients with cardiac insufficiency for the first time. The improvements, such as an increased objective performance and optimized muscle-physiological and metabolic parameters, by far exceed the results of conventional aerobic training forms in terms of primary and secondary cardiologic rehabilitation in patients with cardiac insufficiency. The training form at hand offers high potential in therapy of patients with cardiac insufficiency.