04/2024 | 54TH YEAR

LEISTUNGS SPORT

DOSB

Sports science
In theory
And practice

HOME STRAIGHT

VALIDATION OF HIGH-TONE THERAPY TO INCREASE MAXIMUM STRENGTH AND ENDURANCE

Regeneration is essential for continuous performance improvement in sport in order to avoid damage caused by overload. Measures such as sleep, active recovery and electrotherapy promote regeneration and thus enable intensive training stimuli. The extent to which the targeted use of electrical High Tone Power therapy can influence regeneration after intensive muscular training and the associated potential increase in strength performance is examined in this study.

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Introduction

Performance improvements in sport are based on an optimal ratio of stress and recovery. Regeneration is a crucial component of this. It is crucial for achieving continuous performance progress and avoiding subsequent problems such as prolonged tiredness, lack of strength or susceptibility to infection. Any excessive stress stimulus in the organism triggers a biological response that is processed as part of endogenously induced and temporally structured processes and leads to regeneration. These conversion processes do not take place during sporting exertion, but in the early or late post-exercise phase. For this reason, it is crucial to plan sufficient rest periods and to support regeneration through various measures such as sufficient sleep, active recovery, post-rolling, cold and heat treatments and prompt energy intake after intensive exertion. The effectiveness of the individual regeneration measures on the organism varies and is not always scientifically proven.[1] Why should the regeneration process be influenced at all? A key argument is that with accelerated regeneration, training stimuli can be applied in closer succession, thus increasing the total weekly training stimulus, which can ultimately have a positive impact on improving performance. The extent to which the targeted use of electrical high-frequency therapy can influence regeneration after intensive muscular training and the associated potential increase in strength performance is examined in this study. High Tone Power therapy, also known as HiToP muscle stimulation, is a newer and unique form of electrotherapy treatment that does not use a single frequency, but rather varies frequency and amplitude to supply the tissue with more energy. This could help a tired muscle to regenerate more quickly.

Theoretical background and state of research

High Tone Power therapy is a special form of electrotherapy treatment that was developed in 1998 by the German psychiatrist and neurologist Hans-Ulrich May. In contrast to conventional electrotherapy methods, which use a single frequency, High Tone Power therapy modulates the frequency between 4096 Hertz and 32768 Hertz as well as the amplitude. The current strength and frequencies can be adjusted simultaneously and individually and are inaudible to the human ear. The aim of the various frequencies is to optimally activate the cells and vitalize the body. Furthermore, resonances are generated that cause the cells and tissue structures to vibrate in order to stimulate the metabolism and accelerate the body's own processes. These mechanisms are intended to distribute minerals, nutrients, vitamins, waste products and pain and inflammation mediators more efficiently, which in turn helps the cells to be supplied more quickly, their functions to be activated and certain functions in the body to be activated.

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per can be normalized. Furthermore, it can be assumed that the cooperation and communication between the cells improves in order to maintain and reproduce the necessary structures and functions of the tissue.[2] High Tone Power therapy therefore helps to accelerate and improve regeneration and cell metabolism processes. Even though the basic mechanisms of the effects of High Tone Power external nerve and muscle stimulation are not yet fully understood, it is used very successfully to treat degenerative diseases such as polyneuropathy.[3] Polyneuropathy is a nerve disease that often occurs in diabetics and alcoholics and can cause severe pain. The findings of the first primary studies on this topic have been confirmed by a recent meta-analysis. High Tone Power therapy can achieve neurophysiological effects that focus on changing the pathogenesis of neuropathy patients. All six randomized controlled trials (RCTs) included in the analysis have shown that High Tone Power therapy is very effective in the treatment of peripheral neuropathy, including diabetic neuropathy, tarsal tunnel syndrome, median neuropathy, radial neuropathy and paraneoplastic polyneuropathy.[4]

Positive effects have also been demonstrated when using High Tone Power therapy in patients with circulatory encephalopathy.[5] It has been proven that High Tone Power therapy leads to a significant regression of the symptoms and neurological manifestations of the disease, as well as to the restoration of intellectual and amnestic functions and to a significant improvement in cerebral circulation. The effectiveness of High Tone Power therapy has also been tested in other fields of application. For example, a randomized controlled study with 35 men aged 21 to 50 who had undergone anterior cruciate ligament reconstruction also showed positive effects. The tests were carried out before and six months after the surgical reconstruction. The patients were randomly divided into an experimental group (17 patients), who received High Tone Power therapy in rehabilitation, and a control group (18 patients). The analysis after the application of High Tone Power therapy showed a statistically significant improvement in muscle torque, knee circumference, thigh circumference and knee extension in the experimental group compared to the control group.[6] Another research study examined the effectiveness of High Tone Power therapy in treating soldiers with post-traumatic stress disorder and traumatic brain injuries. This study also produced significant effects in terms of treatment outcomes.[7]

In summary, it can be said that High Tone Power therapy has been established as an effective treatment method in the clinical field for many years. The potential benefit of this form of therapy for therapeutic applications is well documented. But what benefit might High Tone Power therapy have for sport? Does targeted use influence muscular regeneration after intensive training sessions and, as a result, improve muscular performance? To date, the use of High Tone Power therapy in sport has not been scientifically tested, although there are initial indications and experiences from athletes who report faster regeneration after long, intensive endurance exercises when using it.

Objective and question

This scientific pilot study aims to test the effectiveness of High Tone Power therapy as part of bilateral strength training over an intervention period of six weeks.

To test the question, the following hypotheses are formulated:

H1: Bilateral strength training of the M. biceps brachii leads to an increase in maximum strength of the treated arm when High Tone Power therapy is applied unilaterally.

H2: Bilateral strength training of the M. biceps brachii leads to an increase in strength endurance of the treated arm when High Tone Power therapy is applied unilaterally.

Methodical approach

Subjects and study design

For the six-week controlled bilateral strength study using the M. biceps brachii as an example, five men and three women

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Figure 1 and 2: Unilateral testing of the strength of the M. biceps brachii

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Picture 3 and 4: Preacher Curls with the barbell: three sets, 4–6 reps repetitions, 80–90 percent of the1RM

aged 29 ± 15 years were recruited. All of them have been doing strength training in the gym under supervision at least twice a week for more than a year. At the beginning of the study period, the subjects underwent an initial measurement to determine their maximum strength and strength endurance. The one-repetition maximum (1RM) and the repetition maximum at 70 percent of the 1RM for the bicep curl exercise were determined for each subject and each arm. Post-testing took place after a six-week intervention phase. An interim measurement was carried out after three weeks to show initial developments. During the intervention phase, the subjects carried out High Tone Power therapy five times a week for 60 minutes each on the non-dominant arm. In addition, bilateral, targeted biceps training took place three times a week under controlled conditions.

Force measurement

At the beginning of the study period, the participants received detailed instructions on the study being conducted. The determination of maximum strength and strength endurance met the scientific quality criteria. To determine the 1RM, the biceps curl exercise was performed both on the cable pull and with dumbbells in the preacher curl variant while sitting (see pictures 1-2). It was crucial that the buttocks remained firmly on the seat and the armpit of the arm being tested was pressed tightly against the pad. This was intended to reduce the influence of the whole body on the power development of the performing arm. The range of motion ranged from the stretched arm position to an elbow angle of 90 degrees.

After a complete recovery break of several minutes, the test for the maximum number of repetitions with identical movement execution was determined at 70 percent of the 1RM. The strength measurements for both extremities (dominant and non-dominant arm) were carried out on two consecutive days to ensure reproducibility and to exclude possible influencing factors such as fatigue.

Training methodology

The subjects performed the additional bilateral strength training three times a week. The training plan followed three different training goals. On the one hand, an increase in maximum strength should be achieved, on the other hand, an increase in muscle mass through hypertrophy training and strength endurance should be improved in order to increase fatigue resistance to long-term stress. The specified stress norms for the individual training goals were based on Reader et al. (2020).[8] The training plan included the three exercises shown (see pictures 3–8).

The training intensity was calculated individually for each subject at the beginning of the intervention period based on the 1RM. The progressive adjustment of the training weights took place over the course of the training process based on the personal perception of exertion. The aim was to adjust the weight so that the number of repetitions was in the specified range and no further repetitions were possible in the respective set.

Our Expert

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Intervention with High Tone Power therapy

Treatment of subjects with the HiToP 1touch therapy device (gbo Medizintechnik, Rimbach, Germany) was used three times a week immediately after strength training and additionally on two days without prior training for 60 minutes each. The High Tone Power therapy took place in a frequency range between 4096 and 32768 Hertz and was controlled by the SimulFAMi program.

Two electrodes were placed, one above the other on the M. biceps brachii of the corresponding arm and fixed with bandages (see Figure 9). The intensity was set individually for the test subject between the lower corner frequency of 4096 Hertz and the middle frequency of 16384 Hertz. The subjective sensation in the form of a slightly noticeable tingling sensation was the setting criteria. The tingling sensation should be perceived as pleasant and should not trigger any muscular contractions. After setting the stimulus intensity, the therapy began, in which the HiToP®1touch device automatically oscillates between the frequency ranges of 4096 and 32 768 Hertz.

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Picture 5 and 6: Pull-ups with supinated grip (chin-up): 3–4 sets, 8–12 repetitions, 70–80 percent of 1RM

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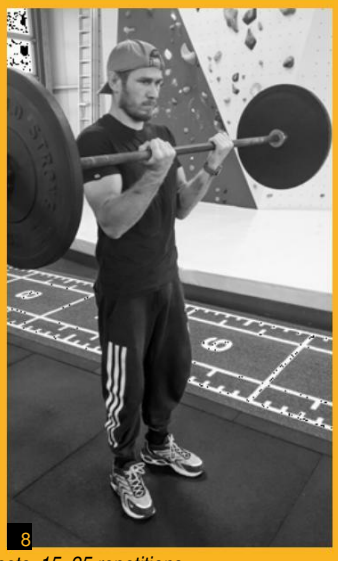

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Picture 7 and 8: Barbell curls, standing: 3–4 sets, 15–25 repetitions, 50–60 percent of 1RM

Photos: Felix Adler

Figure 9: Fixation of the electrical bandages on the upper arm

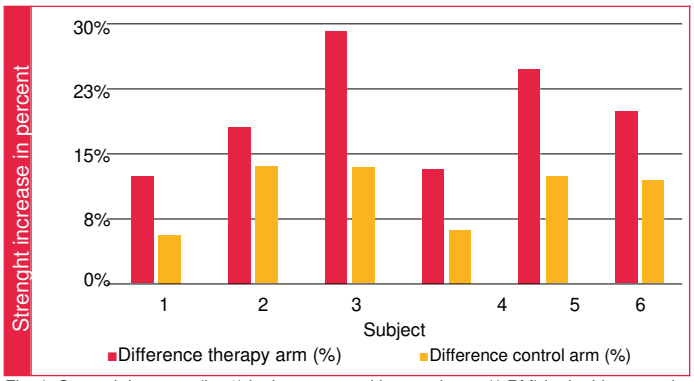

Fig. 1: Strength increase (in %) in the one-repetition maximum (1 RM) in the biceps curl exercise between the treatment arm and the control arm

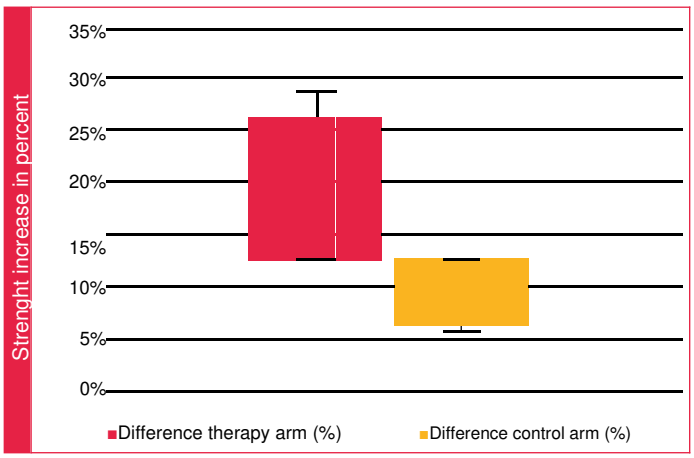

Fig. 2 (box plot diagram): Strength increase (in %) in the one-repetition maximum (1RM) in the bicep curl exercise between the treatment arm and the control arm

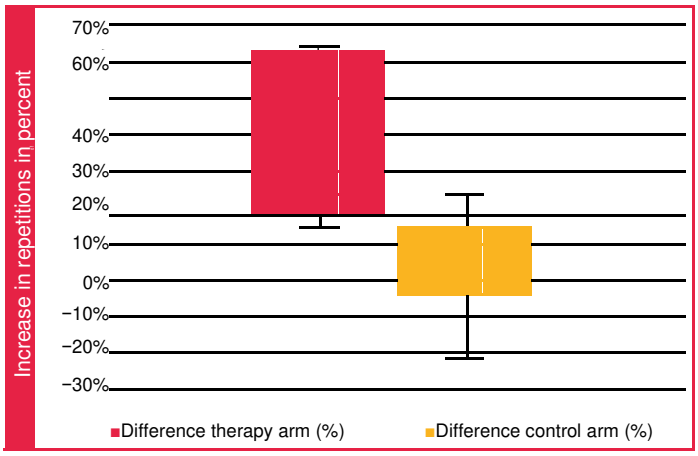

Fig. 3 (Box plot diagram): Increase in number of repetitions (in %) at 70% of the one-repetition maximum (1RM) in the bicep curl exercise between the treatment arm and the control arm

Results

In the following presentation of results, the raw data were statistically analyzed both descriptively and graphically using mean and standard deviations as well as two-factor analyses of variance for the different test conditions and measurement times. Two of the subjects stopped participating before the interim test due to injury. Six participants completed the study over the entire intervention period of six weeks.

Maximum strength

The subjects were able to significantly increase the maximum strength of the biceps brachii muscle through the six-week training. The greatest differences in the pre-post comparison occurred in the arm treated with High Tone Power therapy. Fig. 1 shows that the 1RM of the arm treated with High Tone Power therapy improved significantly more in all six subjects than that of the control arm. On average, the increase in the therapy arm was 19.7 ± 6.4 percent and in the control arm 10.8 ± 3.8 percent. Fig. 2 shows the distribution of the respective strength increases in the 1RM using a box plot for both the therapy and control arms. This also shows that the median, mean and maximum strength increases (1RM) are higher in the therapy arm compared to the control arm.

The statistical evaluation of the strength increases in the 1RM using a two-factor analysis of variance with repeated measurements showed that there was a highly significant difference ($p = 0.001$) between the groups of the factor time (pre-, intermediate and post-test) in relation to the dependent variable (maximum strength) (see Table 1). However, no statistical difference could be found between the groups of the test condition (therapy) in relation to the dependent variable. An interaction between the two variables therapy and time in relation to the dependent variable could also not be determined ($p = 0.107$).

Number of repetitions

Table 2 shows the change in the maximum repetitions between the pre-, intermediate and post-test. For all six subjects, the number of maximum repetitions increased more in the arm treated with High Tone Power therapy than in the control arm. On average, the repetitions increased by 44 ± 21 percent in the treatment arm and by 5 ± 15 percent in the control arm. It can also be seen that the subjects in the treatment arm predominantly started with lower repetitions in the pre-test and in the final post-test almost exclusively achieved higher repetition values than the control arm. In Fig. 3, the development of the maximum repetition numbers for the study period between the treatment and control arms is illustrated using a box plot.

The two-factor analysis of variance with repeated measures showed that there was a significant difference ($p = 0.004$) between the groups of the time factor (pre-, intermediate and post-test) in relation to the dependent variable (number of repetitions) in the bicep curl exercise (see Table 3). With regard to the interaction between the two variables therapy and time, a significant difference was also found with regard to the dependent variable ($p < 0.001$). However, there was no difference between the groups of the test condition factor (therapy) with regard to the dependent variable ($p = 0.381$).

Discussion

The results show that bilateral strength training led to a significant improvement in the treatment and control arms in both 1RM and repetition maximum, with the treatment arm showing a greater change than the control arm in terms of maximum strength and strength endurance, although this could not be statistically proven. Although no group effect could be found between the arm treated with High Tone Power therapy and the arm not treated, the better strength development in the treatment arm indicates a benefit of High Tone Power therapy.

In particular, the arm that was regularly treated with High Tone Power therapy showed a more significant improvement in direct comparison than the untreated arm. These improvements were noticed by the participants and were even noticeable for some subjects several weeks after the study was completed. Both arms were trained bilaterally with the same exercises, so the different development of maximum strength and strength endurance must be related to the High Tone Power therapy. The number of participants in this study is very small, but since each of the subjects represents both the intervention group and the control group for themselves, the findings are of practical relevance.

The increased strength performance of the treatment arm could be related to improved regeneration and more efficient protein biosynthesis, which in turn led to faster recovery and readiness of the muscles for use. Training stimuli with severe muscular fatigue require an increased biological effort in the recovery phase to counteract the catabolic metabolic state and the restriction of protein synthesis.[9] A targeted application of High Tone Power therapy to increase regeneration could thus promote muscle growth and open up new applications in competitive sports.

This therapy could also help to balance out muscular imbalances caused by sport and everyday life, shorten the healing process of muscle injuries and support rehabilitation measures. Athletes could resume training sooner after an injury. Competitive athletes could potentially benefit from a shortened recovery time, which would enable them to train more frequently and more intensively, build muscle mass more quickly and thus improve their performance.

Outlook

The promising results of this first pilot study on the use of High Tone Power therapy for muscle regeneration and increased strength performance should be verified in further studies with a larger number of cases, other muscle groups and over a longer intervention period. Furthermore, it would be useful to examine whether a shorter treatment period leads to similar effects.

Bibliography:
The literature list for this article is available at leistungssport.net/aktuelle-ausgabe or scan the QR code

	Square-sum	df	Medium-value of Squares	F	p
Pre-test, Intermediate test, Post-test	23.26	2	11.63	31.48	<0.001
therapy	0.01	1	0.01	0	0.992
A × B	1.85	2	0.92	2.5	0.107
Between	673.41	11	61.22		
Within the sample	673.4	10	67.34		
residuum	7.39	20	0.37		
Within	32.5	24	1.35		
Total	705.91	35	20.17		

Tab. 1: Statistical analysis of the 1RM using two-factor analysis of variance with repeated measures

Subject	arm	Pre-test	Intermediate test	Post-test
1	TA	14	17	17
	KA	18	19	14
2	TA	14	15	16
	KA	14	14	14
3	TA	14	20	23
	KA	18	20	20
4	TA	11	16	18
	KA	17	19	21
5	TA	14	20	21
	KA	19	19	20
6	TA	16	20	24
	KA	18	19	20
MV±SD	TA	13.8±1.6	18.0±2.3	19.8±3.3
MV±SD	KA	17.3±1.7	18.3±2.1	18.2±3.3

Tab. 2: Number of maximum repetitions at 70 percent of the 1RM of the therapy arm (TA) and control arm (KA) for the bicep curl exercise at the different measurement times

	Square-sum	df	Medium-value of Squares	F	p
Pre-test, Intermediate test, Post-test	76.17	2	38.08	10.16	0.004
Therapy	4.69	1	4.69	0.921	0.381
A × B	40.72	2	20.36	21,185	<0.001
Between	142.75	11	12.98		
Within the sample	138.06	10	13.81		
Residuum	47.11	20	2.36		
Within	164	24	6.83		
Total	306.75	35	8.76		

Tab. 3: Statistical analysis of maximum repetitions using two-factor analysis of variance with repeated measures

Photo: Felix Adler