

## **THE EFFICACY OF SPINE-SPECIFIC EXERCISES AIMING AT THE IMPROVEMENT OF MOTOR CONTROL AND ENDURANCE OF BACK MUSCLES**

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Simo Taimela, MD, PhD

University of Kuopio, Department of Physiology, Finland and DBC International Ltd. Oy,  
Finland

There is strong evidence for the efficacy of exercise and behavioral modification for recurrent/chronic low back pain (LBP) (1-3). Exercises applied and related technology, however, vary largely from training the control of isolated muscle groups such as multifidus or transversus abdominis with the aid of highly advanced feedback systems, to general aerobic fitness exercises. Superiority of one type of exercises over the others is partly questionable, since high-quality randomized studies directly comparing different types of exercises are scarce. Therefore, in selecting the preferred exercise method, we need to rely on existing evidence from intervention studies, preferably with a control group, and case series. Methods that have not been proven efficacious in controlled treatment studies should be used with caution.

The aim of this article is to review the efficacy of spine-specific exercises aiming at the improvement of motor control and endurance of back muscles under the guidance of therapist who is applying behavioral modification as an adjunct to the physical training. The data is based on two previously published articles on the method (4, 5).

### **METHODS**

#### ***Intervention***

The active intervention (later ACTIVE) combines progressive exercises and behavioral modification. The intervention is based on extensive research and is in a widespread use in different countries.

The exercises aim at improving lumbar stability and co-ordination with specific equipment applying loading against resistance in lumbar extension, flexion, lateral bending and rotation (DBC International Ltd., Vantaa, Finland) as described before (4, 5). Physiotherapists guide the 12-week active program. Correct loading and range limiters ensure that exercises are performed in a painless range of motion and that they find their right target in the lumbar spine. Relaxation is applied after each specific lumbar exercise, and functional muscle and coordination exercises (lower limb exercises, sit-ups, balance training etc.) are included in the program during the last six weeks. Treatment is planned on the basis of initial endurance (7) and mobility measurements and interviews, and records are kept of the progress. The treatment begins on low loads for the first four weeks with the object of restoring mobility and especially teaching proper coordination of the lumbar spine. The load is gradually increased so that by the sixth to eighth week subjectively strenuous loading is for the first time applied. The load is further increased in

a gradual and controlled manner until, at the end of the 12 weeks, the patients are instructed to continue individual secondary prevention program(s).

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**The exercises aim at:**

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- Improving multifidus activity and endurance (8, 9)
  - Restoring the control of deep abdominal muscles (10, 11)
  - Restoring trunk co-ordination and position sense (12)
  - Restoring mobility, especially in rotational and lateral flexion directions (6)
  - Restoring normal gluteal muscle activity and lumbo-pelvic rhythm (13)
  - Training motor and postural control and balance (14-16)
  - Transferring the learned basic skills to everyday function
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The therapists provide **behavioral modification** and support during each treatment session through discussions concerning the "benign nature and good prognosis" of low back pain. The behavioral support emphasizes a positive approach to low back trouble by a reduction of negative beliefs and attitudes. More specifically, patients are encouraged to be active after the treatment and to use their spines in a controlled manner without fear. Individual results achieved during the treatment program in pain reduction and increases in loading capacity and range of movement are used in the motivation of the patient. In addition, individualized ergonomics guidance is given by the physical therapists. Advice on correct sitting, standing, lifting and other daily life activities is transmitted without encouraging the fear of back pain.

### ***SUBJECTS AND DATA-ANALYSIS***

Previously published results (4, 5) are presented in this review and details of the subjects, methods and data collection are presented in the original reports.

In the first study [Study 1., (4)], 59 patients with non-specific chronic LBP were randomized either to the ACTIVE treatment or passive control treatment. Analysis of variance with contrasts at different time points was performed; pain, disability and trunk muscle endurance were the outcome variables observed over the one-year follow-up.

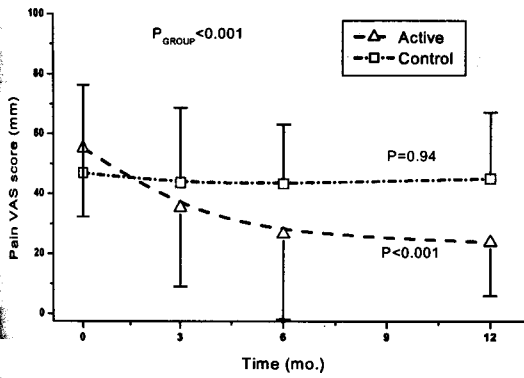
In the second study [Study 2., (5)], 125 patients (76 women, 49 men) who had gone through the ACTIVE treatment were followed-up on an average 14 months after the treatment, up to two years. The outcomes were defined as a recurrence of persistent pain and work absenteeism and a survival/failure analysis was performed between those who had continued exercising and who had been physically inactive.

### ***RESULTS***

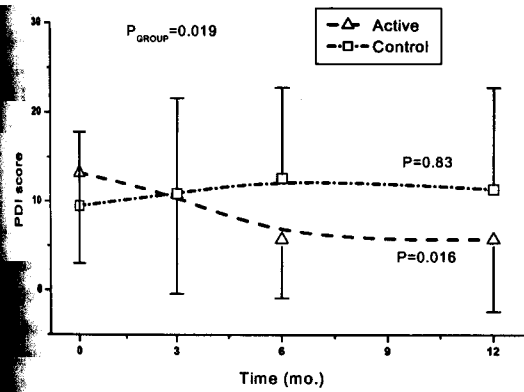
#### ***Study 1.***

In the randomized controlled trial, significant differences were found between the ACTIVE treatment and control groups in pain, disability and paraspinal muscle endurance over the one-year follow-up.

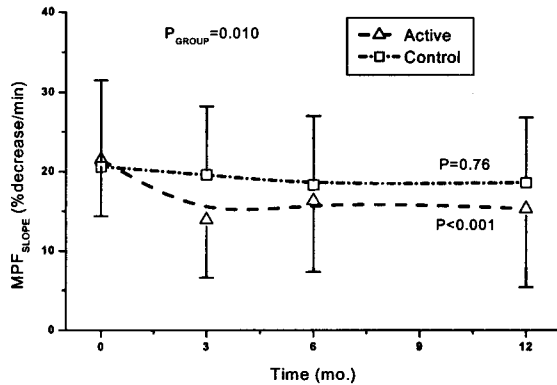
Graph 1 below presents the outcome differences in pain (average intensity VAS, mm) over the 12-month follow-up. The intervention was given during the first three months.



Graph 2 below presents the group differences in disability index (PDI (17, 18)) over the 12-month follow up. The intervention was given during the first three months.



Graph 3 below presents the group differences in paraspinal muscle endurance (7) over the 12-month follow up. The intervention was given during the first three months.



The effect size [ES = (mean post-intervention value – mean pre-intervention value)/pre-intervention standard deviation] was 0.9 for pain reduction and 1.1 for paraspinal endurance.

### Study 2.

In the follow-up study, overall response rate concerning the prevention of chronic LBP at the two-year follow-up was 73%. Recurrences of persistent pain during the follow-up period were fewer ( $p=0.03$ ) among those who had maintained regular exercise habits after the treatment than among those who had been physically inactive. Similarly, absenteeism from work was fewer ( $p<0.01$ ) among physically active than among physically inactive. However, patients with favorable outcome regarding pain reduction in the LBP rehabilitation were more likely to participate in physical exercise.

### CONCLUSIONS

The ACTIVE intervention combining progressive exercises and behavioral modification is efficacious in reducing pain, improving self-experienced function and trunk muscle endurance. The ES is high compared to other published methods. Also, the effectiveness of the ACTIVE treatment in preventing recurrence of chronic back pain and absenteeism in long-term is good, especially if the patient remains active after the guided treatment period.

There are different explanations for the outcomes. Improvement in physical function, especially regarding activation of paraspinal muscles (19), improvement in endurance (20) and restoration of range of motion rotation and lateral flexion (6), is highly concordant with pain reduction. However, the association between functional gain and reduction in pain and disability is not linear (6, 19). This indicates that although the improvement in physical function is important for pain reduction, the relationship is not related to the magnitude of how much functional, e.g., strength or mobility gain will occur.

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