EFFECT OF DIFFERENT LOW BACK TRAINING PROGRAMS ON LUMBAR SPINE KINESTHESIA

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Reduced kinesthetic perceptions can impair lower back sensorimotor functions and result in increased injury risk. The effect of low back training programs on lumbar spine kinesthetic sensibility is undetermined. There was a back strengthening exercise group (with low back pain; training 4.4 h/wk), a "classical" back training program group (with low back pain; training 4.9 h/wk) and a control group (training 5.4 h/wk). During an active reproduction test, subjects performed trunk positions in random order: flexion [A(0°-20°), B(20°-40°)], lateral flexion [C(0°-30°)], Using a 3D-ultrasound motion analysis system the repositioning error was calculated from the given target position to the subject perceived target position, before and after a 5 week training period. Results show decreased repositioning error after the training for both training groups.

KEY WORDS: proprioception; lower back; spine; sportive activity

INTRODUCTION: Chronic low back pain is often associated with different possible risk factors like reduced maximum force and also muscular imbalance as well as increasing deficits in the neuromuscular control (Lam et al. 1999; Gill and Callaghan 1998). Differences in lumbar spine kinaesthesia caused by sporty activity are known (Thorwesten et al. 2000). Objective of the study was to examine the influence of two different training programs for chronic low back patients on proprioceptive capabilities of the lumbar spine.

METHODS: The repositioning error of the trunk of 64 volunteers (Table 1) was tested using an ultrasonic motion analysis system (CMS 30 P3, Fa.Zebris)

Table 1 Anthropometrical Data of the Volunteers

	n=	Age [years]	Weight [kg]	Height [cm]	Sports/Week [Std.]
Total	**64**	**38.2 ±13.1**	**70.6 ±14.1**	**174.7 ±9.3**	**4.9 ±4,0**
Control group	**22**	**37.9 ±15.3**	**75.5 ±16.3**	**177.2 ±9.2**	**5.4 ±5.8**
Group 1 (Strengthening exercise group)	**22**	**38.6 ±12.6**	**67.8±112.2**	**171.5 ±7.6**	**4.4 ±2.1**
Group 2 ("classical" back training group)	**20**	**38.0 ±11.8**	**68.5 ±12.8**	**175.4 ±10.4**	**4.9 ±3.5**

Using a 3-D Ultrasound Motion Analysis System with special triple markers (fig. 1) based on miniature ultrasound transmitters, simple and rapid function tests can be carried out on the cervical and lumbar spinal column and on the entire torso. During an active reproduction test, subjects performed the following trunk positions in random order: flexion [A(0°-20°), B(20°-40°)], lateral flexion [C(0°-30°)]. The used sampling frequency was 20 Hz. Two different directions of motion of the trunk were checked during the examination. The giving of the default position followed by the repositioning was done in a randomised order under exclusion of the visual controllability in each case 10 time per position:

flexion [A (0°-20°), B (20°-40°)]

lateral flexion [C (0°-30°)]

The absolute deviation from the given target position was calculated. Student T-Test for paired samples as well as ANOVA with Scheffeès post-hoc test were calculated with SPSS 10.07

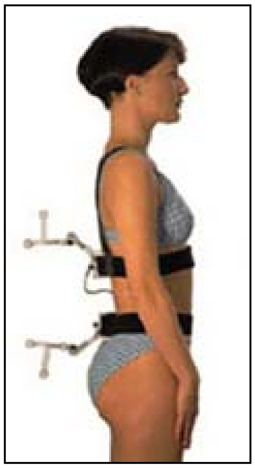

Figure 1 Used marker set of the ultrasound motion.

Both low back pain groups were trained 2 days a week over a 5 week period. For the "classical low back training" the contents focused on functional movement as well as strengthening training without weights. The contents of the strengthening exercise group focused on weight training with rehabilitation training systems.

RESULTS: The healthy control group showed a smaller absolute deviation from the given target position compared to both training groups (see tab.1). Regarding in repositioning the flexion positions between 0-20° all groups showed significantly smaller error in the retest compared to the first test (fig.2). For the flexion positions between 20° and 40° a significant increasing accuracy for repositioning lumbar spine could be demonstrated in the retest for both training groups (fig.3). The lateral bending of the trunk between 0° and 30° from upright position shows an analogous development. The repositioning error is decreasing for all groups in the second test (fig.4). Differences between both training groups could not be demonstrated.

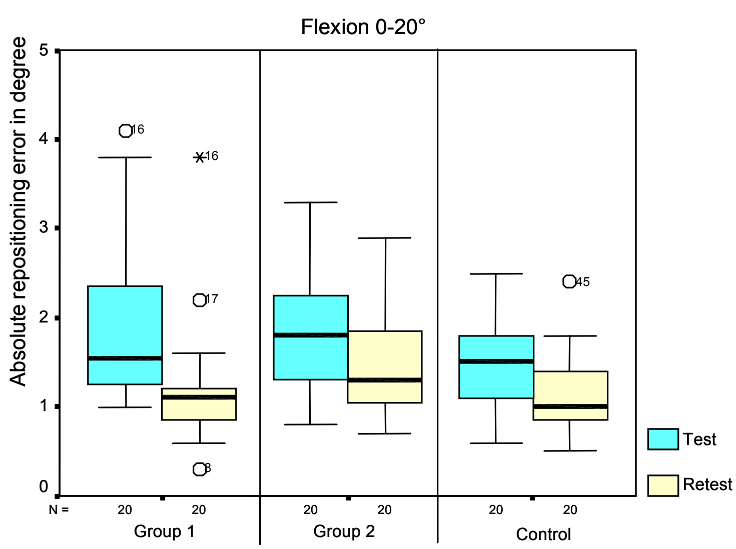

Figure 2 - Mean absolute repositioning error in flexion position between 0°-20° for test and retest.

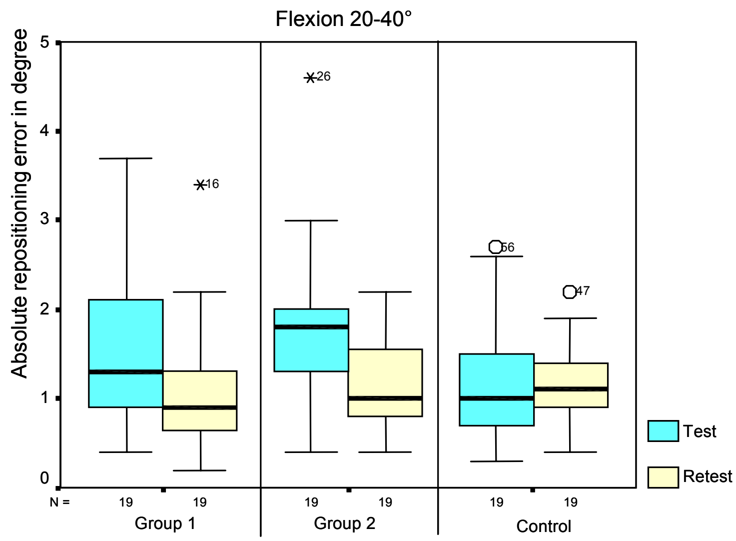

Figure 3 - Mean absolute repositioning error in flexion position between 20°-40° for test and retest.

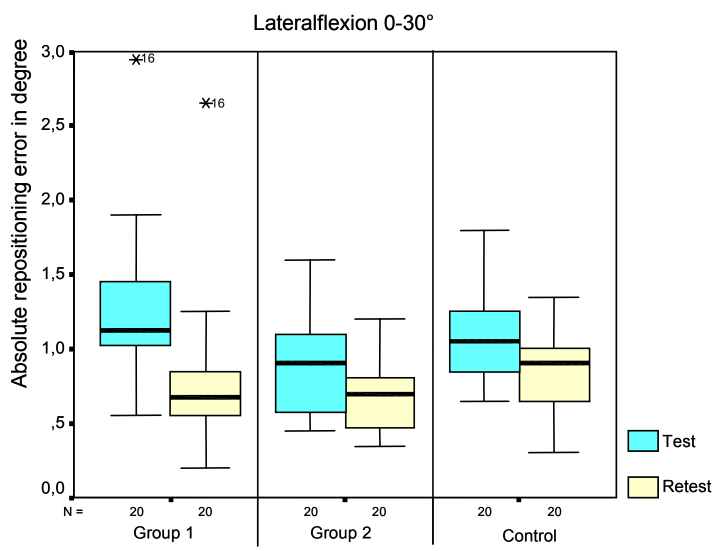

Figure 4 - Mean absolute repositioning error in lateralflexion position between 0°-30° for test and retest.

Table 1 Mean Absolute Values and Standard Deviation p-values for all Parameters

	Flexion 0-20°			Flexion 20-40°			Lateralflexion 20-40°		
	test	Re-test	p-value	test	Re-test	p-value	Test	Re-test	p-value
Control	1.46° ±0.48°	1.2° ±0.46°	0.0107 (**)	1.19° ±0.70°	1.16° ±0.43°	0.8069 (ns)	1.06° ±0.31°	0.87° ±0.28°	0.005 (**)
Group 1	1.93° ±0.93°	1.2° ±0.72°	0.0005 (***)	1.51° ±0.88°	1.08° ±0.78°	0.0191 (*)	1.26° ±0.53°	0.77° ±0.49°	0.0001 (***)
Group 2	1.87° ±0.7°	1.47° ±0.62°	0,0065 (**)	1.84° ±0.95°	1.19° ±0.49°	0.0124 (*)	0.91° ±0.34°	0.67° ±0.23°	0.003 (**)

DISCUSSION: The results showed that there is the possibility to influence lumbar spine kinaesthesia by special training programs. Strengthening exercise for low back patients as well as functional training for trunk movements can improve proprioceptive capabilities. The feedback mechanism of the lumbar spine can be trained even with strengthening exercises as well as functional training programs. Regarding the spread and the reached absolute error in the position reproduction, these findings are comparably with the work of Swinkels and Dolan (1998), and/or Maffey Ward et al. (1996) and Brumagne et al. (1999)

CONCLUSION: Low back complaints are often associated with reduction of kinaesthetic perception as described in the current work of Gill and Callaghan (1998) as well as Lam et al. (1999), Brumagne et al. (2000), Newcomer et al (2000). Further studies are necessary to evaluated combined training concepts with special proprioceptive contents as well as consideration about the question of possible preventive effects caused by special low back pain training programs is required.

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