CHANGES IN POSTURAL CONTROL AND PROPRIOCEPTIVE CAPABILITIES AFTER KUNG FU TRAINING PROGRAM IN LOW BACK PAIN PATIENTS

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Low Back pain is often associated with reduced kinesthetic perception of the lower back and may result in early annuity or incapacitation for work. Special low back training programs can improve kinesthetic capabilities of low back pain patients. The effect of Kung Fu training has not been previously shown to be of benefit to sensorimotor control. Thirty-five volunteers (31.2 ± 6.3 years) were divided into two groups: Kung Fu exercise group (test group; with low back pain; n=23; training 2.9 ±2.3 h/week), control group (with low back pain; n=12; 34.1 ±4.2 years; training 0.25 ±0.8 h/week). During an active reproduction test, subjects performed the following trunk positions in random order: flexion [A (0°-20°), lateral flexion [B (0°-20°)]. Using a 3D-ultrasound motion analysis system the repositioning error was calculated from the given target position to the subject perceived target position. Furthermore postural balance on a force plate and isometric force of back muscles were measured before and after an 8 week training period including 16 training sessions. The results showed a decreasing repositioning error after the training period for the Kung Fu training group, in addition to an improvement in postural balance, whereas no significant changes in isometric strength could be demonstrated.

KEY WORDS: proprioception, postural balance, low back pain, spine; kung fu.

INTRODUCTION: Reduced maximum force and also muscular imbalance as well as increasing deficits in the neuromuscular control have been proposed as risk factors leading to chronic low back pain (LAM et al. 1999; GILL and CALLAGHAN 1998). Both differences in lumbar spine kinaesthesia depending on sporty activity and their improvement induced by training are known (THORWESTEN et al. 2000, 2001). The objective of the present study was to examine the influence of a Kung Fu training program with chronic low back patients, on selected proprioceptive capabilities, postural balance and isometric muscular strength of the back muscles.

METHODS: The repositioning error of the trunk was tested using an ultrasonic motion analysis system (CMS-HS, Zebris). Furthermore postural balance on a force plate and isometric force of back muscles of 35 volunteers were measured.

Table 1. Anthropometrical data of the volunteers.

	n=	Age [years]	Weight [kg]	Height [cm]	Sports/Week [Std.]
Total	35	31.2 ±6.2	72.5 ±11.5	176.9 ±9.1	2.0 ±2.3
Control group	12	34.2 ±4.2	74.0 ±10.7	179.3 ±9.3	0.3 ±0.9
test group	23	29.7 ±6.7	71.7±12.2	175.6 ±8.9	2.9 ±2.3

3-D Ultrasound Motion Analysis System with special triple markers (fig. 1) based on miniature ultrasound transmitters, was used to perform an active position reproduction test. Subjects achieved the following trunk positions in random order: flexion [A (0°-20°)], lateral flexion [B (0°-20°)]. Sampling frequency for all data collection was 20 Hz. Adoption of the default position, followed by the repositioning, was done in a randomised order. Ten repeats of each trial were recorded without visual feedback. The absolute deviation from the given target position was calculated. One-legged standing performance was measured one a force plate (PROVEC PT, Orthodata) over 20 s to calculate postural balance with and without visual control 3 times in each condition (fig. 2a). Isometric strength was measured using a force sensor (digiMax, Mechatronic) in an upright position, following the neutral-zero method with 3 repetitions over 5 s. intermitted with one minute break between trials. Mean isometric strength was calculated (fig 2b). Frequency and intensity of pain was evaluated by a standardised questionnaire.

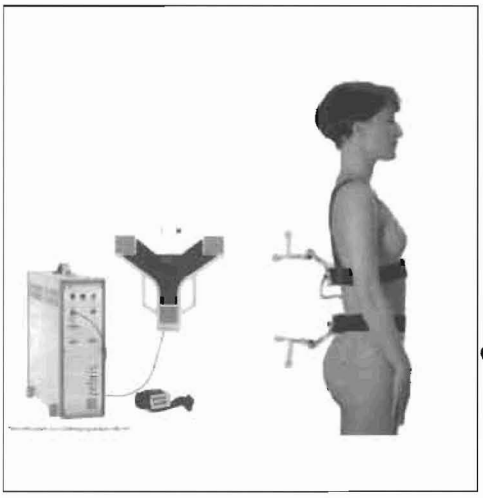

Figure 1. Used marker set of the ultrasound motion **Figure 2. a)** postural balance **b)** isometric strength

The test group was trained twice a week over a 2 month period, whereas the control group did nothing at all. Overall the volunteers completed successfully 16 training sessions. The contents of the training program focused on basic techniques of the Kung Fu "Seven Star Mantis-Style". Student T-Test for paired samples were calculated and box plots were generated using statistical software package SPSS 10.07.

RESULTS: Total repositioning error is significantly reduced for the training group. This shows a significant increase in accuracy for repositioning the lumbar spine, while the controls showed no differences compared to the first test (fig 3). Regarding the postural balance similar changes could be evaluated. The Kung Fu training group showed a significant reduction of body sway (fig.4). The isometric strength testing showed slightly increasing but not significant values for both training and control group (fig.5). In addition to this the evaluation of the questionnaire showed reduction of frequency and intensity of pain.

Table 2. Mean absolute values incl. standard deviation and p-values for all measured parameters.

	repositioning error			**postural balance (Sxy)**			**isometric strength (N)**		
	test	re-test	p-value	test	re-test	p-value	Test	re-test	p-value
Training group	1.47° ±0.45°	1.03° ±0.31°	(***)	1.02m ±0.33m	0.91m ±0.24m	(**)	621.8 N ±147.8 N	649.4 N ±185.7 N	**(ns)**
Control group	1.29° ±0.45°	1.23° ±0.31°	**(ns)**	0.92m ±0.15m	0.91m ±0.14m	**(ns)**	553.8 N ±217.9 N	623.9 N ±188.6 N	**(ns)**

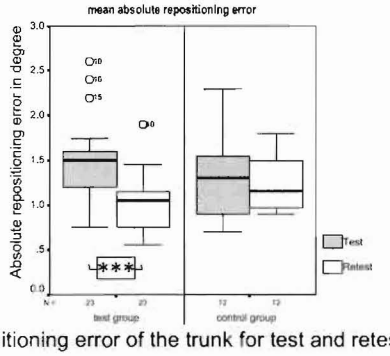

Figure 3. Mean absolute repositioning error of the trunk for test and retest.

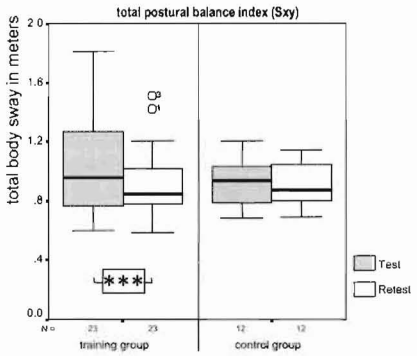

Figure 4. Postural balance index for test and retest.

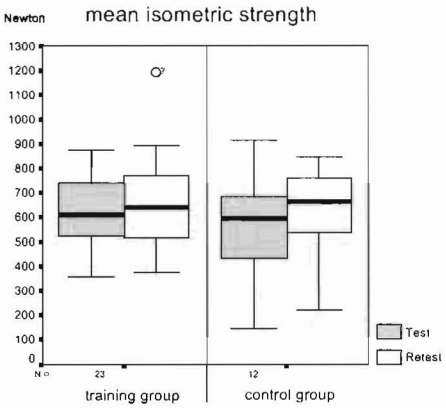

Figure 5. Mean isometric strength of the back muscles for test end retest.

DISCUSSION AND CONCLUSION: Low Back pain is often associated with reduced kinesthetic perception of the lower back and may result in early annuity or incapacitation for work (GILL and CALLAGHAN, 1998; LAM et al.,1999; BRUMAGNE et al., 2000 ; NEWCOMER et al., 2000). Special low back training programs can improve kinesthetic capabilities of low back pain patients. The feedback mechanism of the lumbar spine can be trained even with strengthening exercises as well as functional training programs (THORWESTEN et al. 2001). Even though different studies dealed with Tai Chi Chuan and its influence on selected proprioceptive parameters, like postural stability or kinesthetic sense in elderly (HAIN et al., 1999; HONG et al., 2000; JACOBSON et al., 1997; LIN et al., 2000; WOLF et al., 1997; WONG et al., 2001), the effect of Kung Fu or other "martial arts" has not been satisfactorily determined previously. The results showed that lumbar spine kinaesthesia as well as static postural stability can be positively influenced following a Kung Fu training program. Therefore possible preventive effects regarding low back pain caused by more gentle martial arts like Kung Fu and Tai Chi Chuan should be considered.

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