SENSORIMOTOR ASPECTS OF THE SPINE IN ATHLETES AND NON-ATHLETES

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Deficits in proprioceptive capabilities are often associated with the occurrence of low back pain as seen in tests involving exact position reproduction. The degree to which athletic activity can improve kinesthetic sensibility of the spine has not been satisfactorily determined previously. Twenty-seven volunteers (30.4 ±4.4 years) were divided into two groups: athletes (n=18; training 5.7 ±3.8 h/week) and non-athletes (n=9). During an active reproduction test, subjects performed the following trunk positions in random order: flexion [A(10°-20°), B(40°-60°), C(80°-90°)], lateral flexion [A(0°-20°), B(20°-45°)], and axial rotation [A(0°-20°), B(20°-45°)].Using a 3D-ultrasound motion analysis system the variability of the given angle was recorded for each trial. A large variation was generally demonstrated in the measured values. Regarding the accurate reproduction of a given angle, the athlete group showed less discrepancy with a smaller standard deviation than the non-athlete group. The results point to superior kinesthetic abilities in the athlete group and the possibility of improving proprioceptive functions with training.

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

INTRODUCTION: Low back pain still ranks among the most cost-intensive medical problems of western industrialised countries and causes extremely high socio-economic costs by medical supply, inability to work and early annuity. Several histological working groups (MLAIN & Pickar 1998; Vandenabeele et al. 1997; Yamashita et al. 1990 & 1993) succeeded in finding different mechanoreceptors in the facet joints of the spine. Chronical low back pain can be caused by 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 & Callaghan 1998). References to an improved sensory motor control of the spinal column by sporty activity are not well known. Objective of the study was to examine the proprioceptive capabilities in the range of the spinal column of sportsmen and non-sportsmen.

METHODS: The reproduction accuracy of given positions of the trunk of 27 volunteers (15 woman, 12 man; (Table 1) was tested using an ultrasonic motion analysis system (CMS 50, Fa.Zebris)

Table 1 Anthropometric Data of the Volunteers

	n	Age [years]	Weight [kg]	Height [cm]	Sports/Week [Std.]
Total	27	30,4 ±4,4	67,7 ±10,3	172,9 ±7,6	3,8 ±4,1
Sportsmen	18	29,3 ±4,3	67,3 ±8,9	173,2 ±6,7	5,7 ±3,8
Non-Sportsmen	9	32,6 ±4,0	68,6 ±13,3	172,2 ±9,6	0,0 ±0,0

Using a 3-D Ultrasound Motion Analysis System with special triple markers (Figure 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. The used sampling frequency was 20 Hz. Three 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 randomized order under exclusion of the visual controllability in each case 3 time per position:

flexion [A (10°-20°), B (40°-60°) and C (80°-90°)]
lateral flexion [A (0°-20°) u. B (20°-45°)]
axial rotation [A (0°-20°) u. B (20°-45°)]
The absolute deviation from the given position was calculated. Mann Whitney-U-test was performed for statistical evaluation using SPSS 8.5.

Figure 1 - Used marker set of the ultrasound motion.

RESULTS: The group of sportsmen showed a smaller absolute deviation from the given default position compared to the group of non-sportsmen (see Table 1). Regarding the flexion-movement the group of sportsmen shows a significantly smaller error for all 3 positions (Flex B [p=0,027] and Flex C [p=0,007]) (Figure 2). The lateral flexion shows a analogous development. The repositioning error of the group of sportsmen is smaller in the positions " LatA"(p=0,012) and " LatB"(p=0,059) (Figure 3). For the axial rotation no difference is provable between the groups (Figure 4). The average values of all positions for each movement underlined these results and showed smaller deviations for the flexion and lateral flexion movement for the athletes group (Flex [p=0,007]; Lat [p=0,017]; Ax [p=0,980]) (see Figure 5).

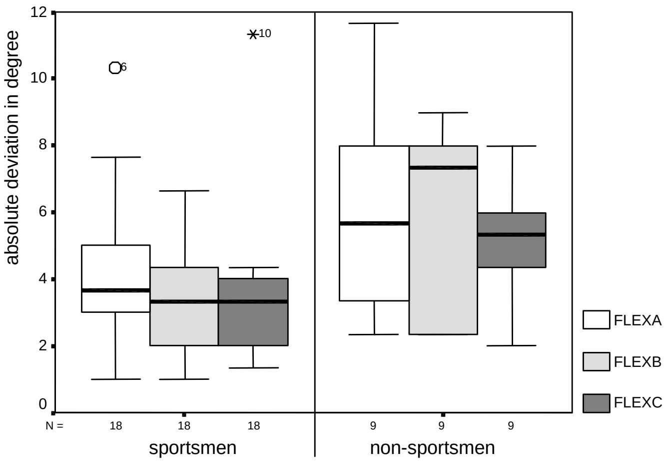

Figure 2 - Mean absolute deviation in repositioning in flexion position A, B, and C for athletes and non sportsmen.

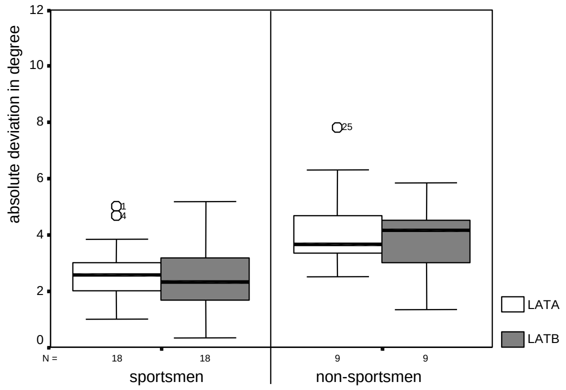

Figure 3 - Mean absolute deviation in repositioning in lateral flexion position A and B for athletes and non sportsmen.

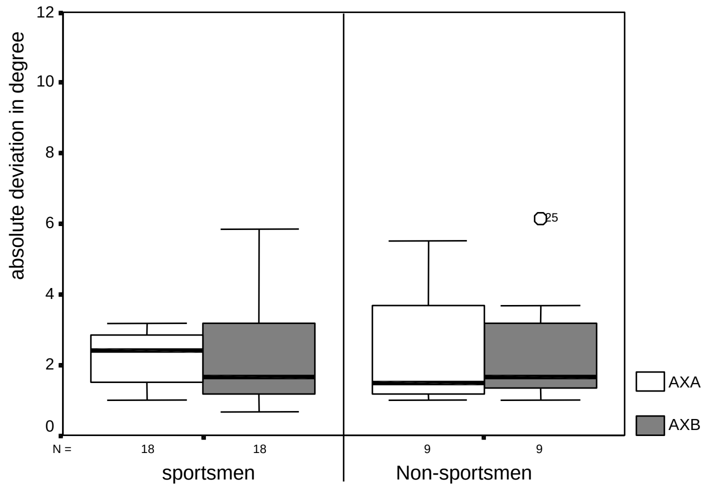

Figure 4 - Mean absolute deviation in repositioning in axial rotation position A and B for athletes and non sportsmen.

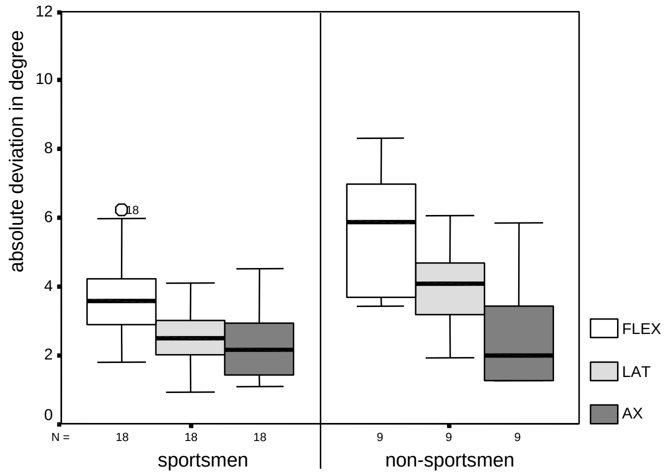

Figure 5 - Mean absolute deviation in repositioning in flexion, lateral flexion and axial rotation for athletes and non sportsmen.

Table 1 **Mean absolute values incl. standard deviation p-values for all parameters**

	flex A	flex B	flex C	lat A	lat B	ax. A	ax. B
Athletes	4.4°±2.3°	3.4°±1.5°	3.4°±2.3°	2.7°±1.0°	2.4°±1.3°	2.2°±0.8°	2.3°±1.4°
non-athletes	6.0°±3.1°	6.0°±2.8°	5.2°±1.9°	4.2°±1.8°	3.6°±1.6°	2.6°±1.7°	2.5°±1.7°
P-value	0,176	0,027**(*)**	0,007**(**)**	0,012**(*)**	0,059	0,820	0,668

DISCUSSION: The results point on a better-trained feedback mechanism of the sensorimotor system of the spinal column for the group of sportsmen. These findings are comparably with the work of Swinkels and Dolan (1998), and/or Maffey Ward et al. (1996) and Brumagne et al. (1999) regarding the spread and the reached absolute error in the position reproduction. However, no differences between athletes and non-athletes regarding the proprioceptive capabilities are described so far.

CONCLUSION: Regarding the described reduction of kinesthetic perception with low back complaints in the current work of Gill and Callaghan (1998) as well as Lam et al. (1999), consideration about the question of possible preventive effects caused by sporting activity is required.

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