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PROSPECTIVE STUDY OF THE TRUNK MUSCULATURE UNDER THE INFLUENCE OF COMPRESSIVE LUMBAR SUPPORTS

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SUMMARY

Non-specific lumbar back pain is a common clinically-diagnosed condition involving a high level of suffering for affected patients and of high socio-economic significance. One possible cause of pain syndromes can be found in the interaction between the ligaments and muscles, as well as the connective tissue/fascia. Lumbar supports are an inherent part of treatment.
There are frequent discussions amongst experts about whether it is possible that lumbar supports relieve the trunk musculature to such an extent that they ultimately lead to a weakening of the muscles. An effect of this kind on the muscles would not be beneficial in the treatment of patients with back pain based on therapeutic requirements.
Should the use of lumbar supports be rated as critical or as beneficial? The study examined the question of what effect the use of lumbar supports has on the trunk musculature when walking and under static loading.
In order to answer this question, surface electrodes were used to detect the electrical activity of important muscles in the trunk, thereby allowing conclusions to be drawn about the strain on the muscles studied, as well as the coordination of these muscles.
The myograms recorded provide information about the extent to which the muscles of the trunk are active under loading, both with and without a lumbar support.

STUDY DESIGN

Controlled, prospective cross-sectional study

METHODOLOGY

Sample:	n = 42 healthy subjects, age: 18 – 30 years
Test support:	Lumbar support (LumboTrain, Bauerfeind)
Test method:	Gait analysis, treadmill Static analysis in the CTT Centaur, BfMC; Fig. 1


Fig. 1


Fig. 2

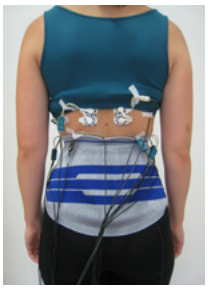
Fig. 3

Surface electromyography
(SEMG); SEMG electrodes (Ag-AgCl electrodes: H93SG, Covidien) in accordance with international standards (SENIAM, www.seniam.org) (amplifier: Biovision, measurement system used: ToM, DeMeTec, software; GJB)
The study was conducted on the following trunk and abdominal muscles:
1. M. rectus abdominis (RA)
2. M. obliquus internus abdominis (OI)
3. M. obliquus externus abdominis (OE)
4. M. multifidus lumbalis (MF) 5. M. erector spinae (iliocostalis) (ICO)
6. M. erector spinae (longissimus) (LO); Fig. 2, 3

Inclusion criteria:	· Healthy test subjects with no back pain · Adequate constitution and coordination for the measurements
Exclusion criteria:	· Restricted joint mobility, patients with chronic or acute pain, pathological joint positions, fractures, ligament injuries, muscle injuries, soft tissue damage, or somatoform disorders

Source: Hübner A., Niemeyer F., Schilling K., Anders C.. (2017). Effects of an abdominal belt on trunk muscle activity during treadmill walking, Biomech Open Lib, 1(1): 7-15

RESULTS (SELECTION)

Activation of the back muscles

There is evidence of notable and sometimes significant changes which must be associated with the lumbar support:

Two of the three back muscles studied [MF, ICO] show an increase in their EMG activity of up to 46% with LumboTrain. The third muscle studied [LO] shows no significant change in its activity under the influence of LumboTrain.

Repression of the back muscle activity by LumboTrain can therefore be refuted.

The activity of the lateral trunk muscles [OI, OE], however, reduces by up to 50% depending on the situation. This decrease in activity does not, however, constitute an inactivation of the muscle; instead it is suggested that this relates to relief effected by LumboTrain.

With LumboTrain, the abdominal muscle [RA] shows an average activation of 25%. Overall we can assume a positive influence of LumboTrain on muscular activity.

The phasicity of the musculature is increased

As a result of changes in the phasicity of the musculature, the person wearing the support consistently experiences more phases of relaxation in the muscles, in which improved circulation is possible. This general effect was observed in many exercise situations and suggests that the support can protect the muscles from fatigue.

Positive influence on muscle coordination

Everyone regularly displays differences between the two sides (natural imbalance) in the coordination of the trunk musculature, especially when running. Moreover, there are natural differences between men and women in terms of muscle coordination.

Wearing the support corrects these typical differences between the two sides in both men and women, allowing for a more even and better balanced use of the muscles.

Targeted use of the muscles

In the event of static back and side tilting, the resultant action of force of the trunk musculature was moved in the direction of the effect of the force. As a result, it was possible to relieve muscles that were not directly involved and to activate the relevant muscle groups. The muscle action of the test subjects studied was therefore in better harmony
with the current demand.

Activation profile of the trunk muscles:

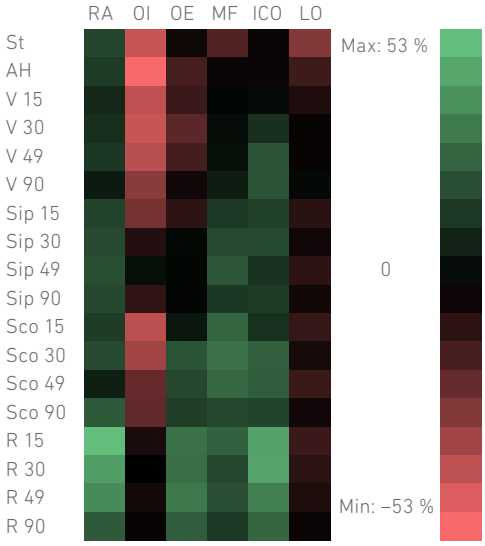

Figure:
Map representation of the relative rms differences between exercises without the support and where the bandage was worn for 3 hours for all of the test subjects as a group. Negative deviations from the situation without the support are displayed in **red** and positive deviations in **green**. The color intensity reflects the extent of the change.

V	Forward tilting
Sip	Ipsilateral sideward tilting
Sco	Contralateral sideward tilting
R	Backward tilting
St	Standing
AH	Working posture = arms crossed in front of the chest
RA	M. abdominis
OI	M. obliquus internus abdominis
OE	M. obliquus externus abdominis
MF	M. multifidus lumbalis
IOC	M. erector spinae (illiocostalis)
LO	M. erector spinae (longissimus)

DISCUSSION

For the static load applications and by applying variance analysis, it was possible to prove that the support had an effect on the activity level of almost all of the muscles studied. The post hoc tests revealed a general trend involving a reduction in the amplitude of the internal oblique muscle with simultaneously unchanged amplitudes or simultaneous increase in the amplitude level for all of the other muscles of the trunk being studied.

The internal oblique abdominal muscle is characterized by permanent activation when standing and walking.
In this respect, the temporary reduction in its amplitude caused by wearing the support results in relief of the muscle and therefore constitutes active protection against fatigue.

In general, evidence of an increase in the phasicity of all of the muscles studied can be shown when walking, and this should improve the supply to the muscles. This prevents premature fatigue of the muscles, which therefore remain fully functional for longer.

With regard to the question posed at the outset, the following is however already clear:

No relevant, repressive effect of the LumboTrain back support was found. The activity of the trunk muscles is rather increased by the support during static stress.