STUDY PUBLICATION OF SELECTED RESULTS

EFFECTS OF THE "SPORTS ANKLE SUPPORT" COMPRESSION SLEEVE ON BALANCE AND FINE COORDINATION IN PATIENTS WITH ACUTE ANKLE SPRAINS

BACKGROUND

Roughly half of all supination traumas occur during exercise, with men between 15 and 24 years of age more frequently affected than women, and women over 30 years more commonly affected than men. [1]
After a supination trauma, rapid pain reduction is observed over the course of the first 2 weeks.
Yet 5 to 33 percent of patients still experience pain after 1 year, with 36 to 85 percent of patients reporting full recovery after 3 years.
During the first 2 weeks to 3 years, the recurrence rate for supination trauma is 3 to 34 percent. [2]

With the exception of triple ligament or syndesmosis injuries, most ankle ligament injuries can be managed using conservative, early functional treatment. Independent of the severity of the injury, the treatment regimen should be strictly adhered to for at least 6 weeks, and the individual phases of ligament healing should be respected. In these cases, it is useful to provide the patient with a modular orthosis, coupled with sensorimotor measures/physiotherapy. [3]

The objective of this study led by L. Niklaus[1], Dr. A. Kilper[2], Dr. L. Schütz[2] and Prof. T. Milani[1], which was conducted at Chemnitz Technical University; Human Locomotion Department[1], and Chemnitz Hospital; Department of Orthopedics & Trauma Surgery[2], is to investigate the effects of an elastic compression support, the Sports Ankle Support, on ankle stability in patients with acute unilateral supination trauma during late post-traumatic recovery. The study explored the support's acute impact on joint stabilization and fine coordination in the injured ankle 6 weeks after the trauma was sustained.
The support was examined on 20 patients and 20 healthy volunteers 6 weeks after the injury.

STUDY DESIGN

Randomized, controlled laboratory study (Evidence Level 1b)

METHODOLOGY

Sample:	**n = 40 subjects;** n = 20 with support = IG = intervention group, n = 20 without support = CG = control group **n = 20 patients** Age: 33.8 ± 9.5 years, Height: 173.2 ± 10.1 cm, Weight: 76.8 ± 14 kg Gender: m : f = 9 : 11; Injured side: right : left = 10 : 10 (A grade 1 ankle sprain was identified in 40 percent of patients and a grade 2 ankle sprain in 45 percent of patients. One case had a grade 3 sprain. Grade 0 was found in 10 percent of subjects.) **n = 20 healthy volunteers** Age: 33.0 ± 10.8 years, Height: 173.4 ± 9.2 cm, Weight: 71.8 ± 11.6 kg, Gender: m : f = 8 : 12
Test supports:	Sports Ankle Support (Bauerfeind AG)
Measurement systems and test procedures:	Active angle reproduction test Center of Pressure (COP) single-leg stance, measurement of the joint displacement distance for 20 sec. Gait analysis: hindfoot angle, step length, stance pain scale and instability scale (10-point VAS, visual analog scale)
Investigation period:	Measurement: acute effect, CW 6 after injury, The measurements were taken for the CG and IG WITH and WITHOUT a support being worn in randomly assigned order.

METHODOLOGY

Inclusion criteria:

First-time diagnosis of a recent unilateral supination trauma (upper ankle sprain, lateral collateral ligament lesion), clinical consultation no later than 3 days after the injury,
still presenting with symptoms
2 to 3 weeks after the injury

Exclusion criteria:

Bony avulsion, fractures, any other injuries and/or conditions that impair gait or balance
Age: <18 or >65 years
Previous ankle trauma within less than 1 year
General chronic ankle instability

RESULTS

When patients were examined in CW 6 after the injury, 50 percent reported minor feelings of instability in the ankle and 15 percent reported moderate feelings of instability right before the measurements were performed. 35 percent of patients showed mild swelling, 15 percent had moderate swelling. Only one patient reported impaired walking ability. Three patients also received concomitant physiotherapy. Two patients were still unable to work, while eleven patients (55 percent) felt unable to exercise.

Table 1: Self-reported assessment of the support after movement tests; in %

		Perfect	Good	Notice-able	Still OK	No effect
Ankle stability provided by the support	Patients	20%	65%	15%	0%	0%
	Control group	40%	40%	20%	0%	0%
Wearing comfort of the support	Patients	30%	60%	10%	0%	0%
	Control group	35%	50%	15%	0%	0%

ACTIVE ANGLE REPRODUCTION / FINE COORDINATION IN THE ANKLE

Ankle joint proprioception is significantly improved both in the patient group and the CG when wearing the support. The ankle support noticeably enhances fine coordination in subjects with injured as well as healthy ankle joints.

Table 2: Mean deviation from the target line [in degrees per frame] for both groups with and without the support; including statistical comparison of the conditions with and without the support

	Patients n = 20	CG n = 20
Without support (mean ± SD)	1.24 ± 0.5°	1.30 ± 0.4°
With support (mean ± SD)	1.11 ± 0.4°	1.16 ± 0.4°
Mean difference (w/o – w/)	0.14 ± 0.2°	0.15 ± 0.3°
Statistics (p value)	p = 0.002*	p = 0.025*

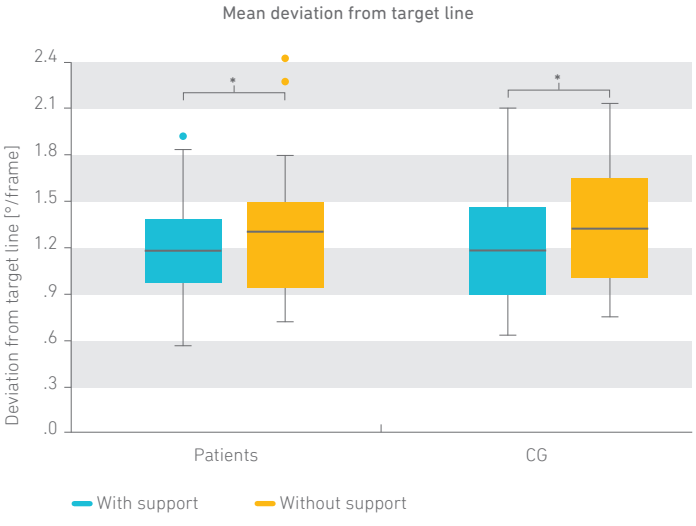

Fig. 1: Location and distribution of the data in Table 2

CENTER OF PRESSURE [COP]: A BIOMECHANICAL MEASURE FOR BALANCE

When patients wore the support, both CoP length and CoP area were significantly reduced when standing on one leg, indicating an improvement in balance.
In the CG, CoP values were slightly lower when the support was worn, but this observation was not significant. Repeat measurements on the healthy side did not yield any different outcomes in both groups (not shown).
The support predominantly contributes to an improvement in CoP when balance is impaired.

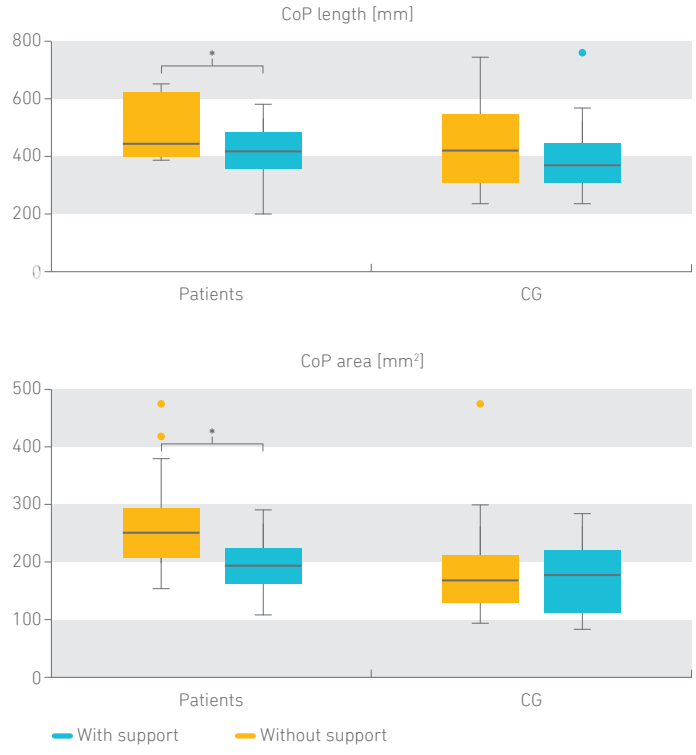

Fig. 2,3: Left: CoP length; right: CoP area when standing on one leg for 20 seconds (for all measurement conditions)

GAIT ANALYSIS: STEP LENGTH AND STANCE

The support did not influence step length in the CG.
When no support was worn, patients showed a significant difference in step length between the healthy and injured sides. This difference is no longer present when wearing a support, with the injured side approximating the healthy side.

Stance duration in the CG was also not impacted by the support, as already observed for the step length. In the patient group, a significant difference can again be seen between the healthy and injured sides when no support is worn. This difference disappears when a support is worn.
In patients showing an impaired gait, wearing a support improves symmetry between the injured and healthy sides.

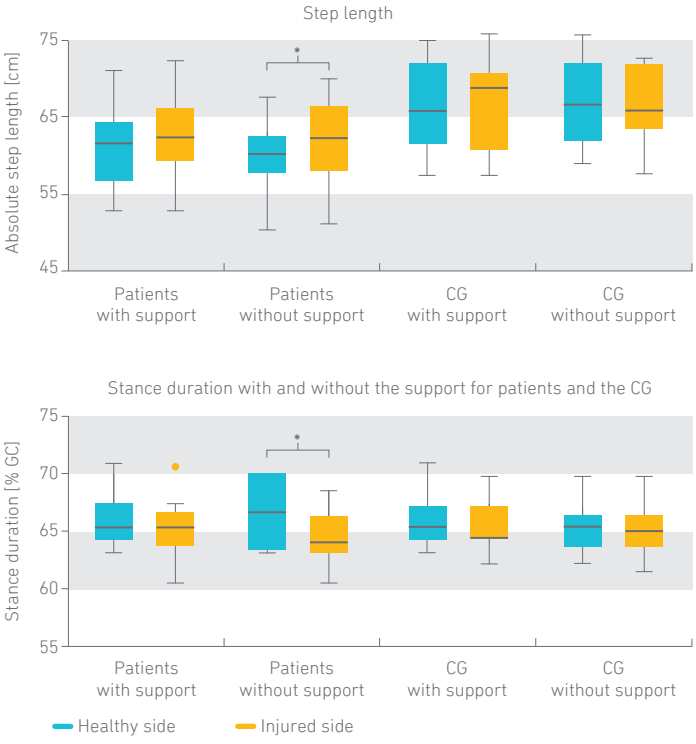

Fig. 4,5: Gait, right; step length and left; stance duration in percent of the entire step cycle (stance, swing phases)

GROUND REACTION FORCES

Wearing a support significantly improves loading of the injured side in patients, both for loading response during heel strike as well as foot push-off during walking, when compared to not wearing a support. The support also improves gait symmetry regarding this outcome (not shown).

GAIT ANALYSIS: HINDFOOT MOVEMENT

Initial ground contact shows mild inversion, both in the CG as well as in patients, when wearing the support and without the support. The positions do not differ. In the CG, an eversion movement of 3° can be observed after the inverted initial ground contact with and without the support.

When no support is worn, patients still tilt toward inversion for the loading response. This constitutes non-physiological movement, suggesting ankle instability. This tilting movement during walking can be prevented by wearing a support. Instead, starting from a slightly inverted position of the heel at initial ground contact, mild eversion can be observed until neutral alignment is reached. The increased inversion seen in patients is prevented when wearing the support. It significantly stabilizes the ankle during loading response, preventing lateral tilting.

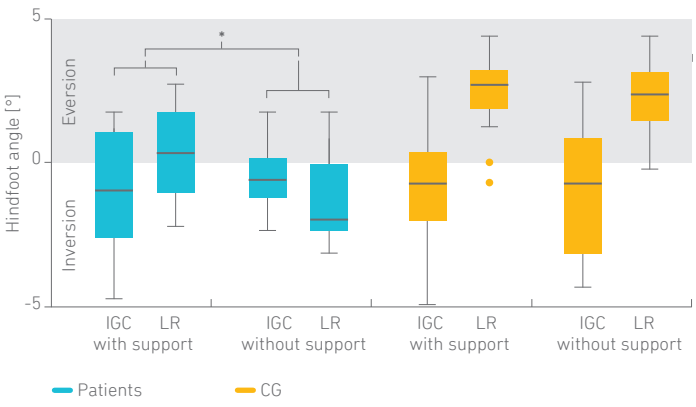

Fig. 6: Gait, box plots of hindfoot angles for the time-points: initial ground contact (IGC) and loading response (LR) for patients and the control group, with and without the support

DISCUSSION

According to statistical evidence, functional intervention options are better than immobilization in cases of mild to moderate ankle sprains. Functional intervention includes elastic supports, soft bandages, taping and also orthoses combined with coordination training. [4] The results obtained in this study using the Sports Ankle Support point in the same direction. When the support was worn, patients were able to clearly improve or even "normalize" their asymmetrical gait, as assessed in multiple measures that describe steadiness and ankle stability.

Ankle supports or orthoses do not affect even complex movement patterns, as shown in runners and soccer players as well as volleyball players during landing as an example. [5,6] Also when worn for prevention, e.g. during exercise, supports and orthoses do not disrupt or impair dynamic balance or range of motion. [7]

In fact, these medical devices are also useful for the secondary prevention of self-reported repeat injuries. They achieve this goal to the same extent as neuromuscular training and sometimes even prove superior. [8]

CONCLUSIONS

Patients who suffered supination trauma showed marked symptoms such as ankle swelling, "abnormal" gait and perceived mild to moderate ankle instability even after 6 weeks of treatment.

When patients wore a Sports Ankle Support at this point in the recovery phase, the following results were observed:

- **The Sports Ankle Support increases perceived ankle stability in patients.**
- **The Sports Ankle Support significantly improves gait outcomes – step length, stance, ground reaction force and hindfoot angle.**
- **The Sports Ankle Support enhances the feeling of balance, thus also contributing to a more stable and secure gait.**

SOURCES

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