SUMMARY OF SELECTED FINDINGS

EFFECTIVENESS OF THE MalleoLoc® ORTHOSIS IN THE REDUCTION OF CHRONIC MECHANICAL ANKLE INSTABILITY

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INTRODUCTION

Ankle sprains are the most common acute musculoskeletal injuries among the physically active population. In Germany, this type of injury occurs around 8,200 times per day (1). As this kind of trauma is often brushed off as a trivial injury, many patients do not receive professional treatment. About 55 per cent of patients do not seek medical care (1). This may be one of the reasons why patients with lateral ankle sprains often suffer from recurring sprains, combined with the development of physical and subjective limitations as well as "giving way" of the affected ankle (2, 3). 20 to 40 percent of patients with ankle sprains will eventually develop chronic ankle instability (4). Persistent ankle instability contributes to sensorimotor deficits and impaired function, which results in reduced physical activity and quality of life. As a long-term consequence, it can also contribute to the development of osteoarthritis of the ankle (2).

In order to stabilize the ankle and prevent recurrence, ankle orthoses can be used as part of non-surgical treatment. The study presented here that was conducted by Wenning et al. examines the effectiveness of the MalleoLoc orthosis in the reduction of chronic mechanical ankle instability (MAI). For this, the innovative 3SAM method (3D arthrometric ankle measurement using MRI) was used to determine 3D joint congruency. This is a combination of the high-resolution MRI technique in 3D and the mechanical/functional approach of arthrometric measurement (5). Using this method, the goal was to quantify the mechanical component of chronic ankle instability, by measuring the joint congruency area or the cartilage contact area (CCA).

STUDY DESIGN

Quasi-experimental study, controlled, randomized, single-center

Fig. 1: 3SAM study design (3D arthrometric ankle measurement using MRI); Image: Udo Schönewald

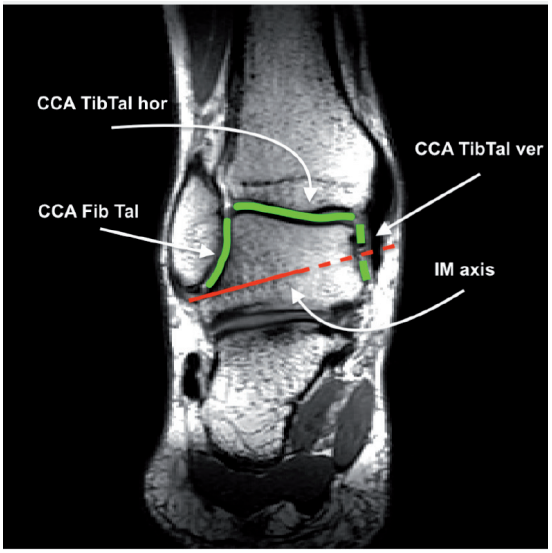

Fig. 2: MRI scan with articular surface congruency highlighted in green; ventral view of the right foot in its normal position

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METHODOLOGY

Sample:	· Control group (= healthy volunteers) n = 25 (16 women, 9 men) · MAI group (= patients with mechanical ankle instability) n = 25 (16 women, 9 men)
Examination method:	3SAM = 3D arthrometric ankle measurement using MRI
Indication:	Mechanical ankle instability (MAI)
Test orthosis:	MalleoLoc
Data analysis:	Descriptive statistics
Inclusion criteria for control group:	· No previous ankle injuries · Mechanically stable during clinical examination
Inclusion criteria for MAI group:	· Chronic ankle instability (according to Gribble et al. 2013) · CAIT <24 (Cumberland Ankle Instability Tool) · No acute injury within the 3 months prior to the MRI examination · Mechanical instability found during clinical examination
Outcome measurements:	3D joint congruency/cartilage contact area (CCA) (talofibular, talotibial horizontal, talotibial vertical)

RESULTS

The 3D joint congruency was determined both in the control group and MAI group. The measurements included the "talofibular" contact area as an indicator for lateral osseous stabilization, "talotibial horizontal" as the horizontal weight-bearing area and "talotibial vertical" as an indicator for medial osseous stabilization. The measurements were carried out in the normal position (neutral zero) and in a functional position (plantar flexion/supination). In the MAI group, the parameters were also determined in the functional position, with the test subjects wearing the MalleoLoc ankle orthosis.

Comparison of joint congruency in the normal and functional positions

The test showed a reduction of the articular surface areas (talofibular, talotibial horizontal, and talotibial vertical) in functional position (plantar flexion/supination), both in the healthy control group and in the MAI group. In the control group, the talofibular contact area was decreased by 32.8 per cent, compared with a decrease of 56.3 per cent in the MAI group (Fig. 3). This also shows that the reduction in the laterally supporting articular surface is greater in the MAI group than in the control group.

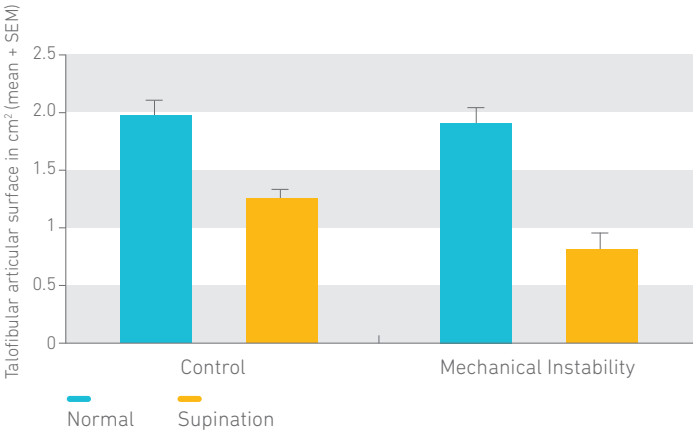

Fig. 3: Joint congruency in the normal and functional positions in healthy controls and patients with mechanical instability (MAI). Shows the mean values of the talofibular articular surface areas in cm^2.

There is a reduction in joint congruency in the functional position, both in healthy subjects and patients with mechanical ankle instability.

Patients with mechanical instability lose more of the articular surface in the functional position compared with the healthy control group.

Impact of an orthosis on joint congruency

In the functional position, patients with mechanical ankle instability show reduced joint congruency compared with healthy controls (Fig. 3 and 5). Wearing the MalleoLoc ankle orthosis, however, resulted in a significant improvement in joint congruency in the functional position for patients with mechanical ankle instability (Fig. 4 and 5). This significant effect was observed in the talofibular, talotibial horizontal and talotibial vertical areas (Fig. 5). In MAI patients, the orthosis increased the talofibular contact area by 18.8 per cent, the talotibial horizontal area by 19.5 per cent and the talotibial vertical area by 32.2 per cent.

Fig. 4: MRI scan of the articular surfaces (talofibular, talotibial vertical and talotibial horizontal) with orthosis; ventral view of the right foot in a functional position

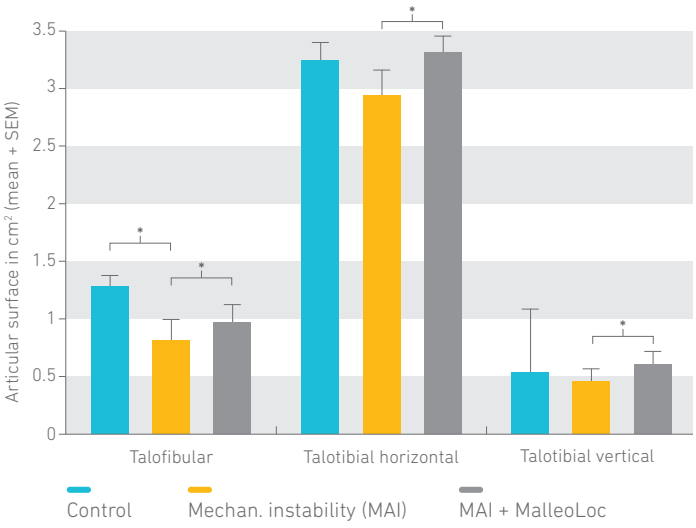

Fig. 5: Comparison of joint congruency in a functional position in healthy controls, patients with mechanical instability (MAI) and patients with mechanical instability wearing an ankle orthosis (MAI + MalleoLoc). Shows the mean values of the articular surface areas in cm^2.

In a functional position, joint congruency is reduced in patients with chronic mechanical ankle instability.

The MalleoLoc significantly improves joint congruency.

Assessment of the ankle orthosis by the subjects examined

To assess the subjective stability and wearing comfort of the orthosis, the subjects specified a value from 0 to 10, with 0 being very poor and 10 being very good. On average, the healthy controls rated the stability of the orthosis at 7.2 and its comfort at 5.2 (Fig. 6). Patients with mechanical instability assessed the stability of the orthosis at an average of 8 and comfort at 5. Thus, there is no significant difference in the rating values of the two groups.

Parameter	Control	MAI
Stability	7.2	8
Comfort	5.2	5

Very poor (0) — Very good (10)

Fig. 6: Subjective assessment of the orthosis in terms of stability and comfort on a scale of 0 (very poor) to 10 (very good)

The MalleoLoc provides significant stabilization to healthy subjects as well as patients.

DISCUSSION

A dynamic reduction in joint congruency in a functional position (plantar flexion/supination), i.e. the loss of cartilage contact area (CCA), is a crucial factor for ankle instability. The study conducted by Wenning et al. showed that the joint's contact area was significantly increased by wearing an ankle orthosis. Improved joint congruency provides a possible biomechanical explanation why an ankle orthosis prevents sprains.
Two experimental examinations proved that the MalleoLoc can limit both passive and quickly induced, active inversions in patients with chronic instability (6, 7). This confirms that the orthosis stabilizes the ankle and has a preventive effect on recurring sprains.
A systematic review also evaluated the effect of different external ankle stabilizers (including orthoses) in the prevention of inversion sprains among amateur and professional athletes (8). The use of an orthosis resulted in a reduction of recurring sprains by 69 per cent. Furthermore, the study presented here indicates that the MalleoLoc could prevent the development of osteochondral lesions on the talar shoulders caused by local pressure peaks, because the

contact areas are increased in supination, possibly resulting in lower pressure loads. This means that wearing the orthosis could lead to an increase in the weight-bearing articular surface, and thus a potential reduction in the risk of talar cartilage damage.
When interpreting the current study results, however, it must be borne in mind that the measurements were taken under static and not in highly dynamic measurement conditions. The 3SAM methodology used here seems to have the potential for identifying possible high-risk patients with mechanical instability in the future. This would allow quantification of the mechanical instability in athletes at the time of "return to play", which may facilitate a more accurate assessment of whether they would benefit from mechanical treatment, such as prolonged use of an orthosis, or surgery.

CONCLUSION

The MalleoLoc improves joint congruency in patients with chronic mechanical ankle instability. This may explain why wearing an orthosis can prevent recurring sprains and lead to a redistribution forces in the joint over a larger area, potentially protecting the joint more effectively.

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