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Title: Syndesmotic InternalBrace™ for anatomic distal tibiofibular ligament augmentation

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Answering reviewers

Dear reviewers,

first of all, thank you very much for your comprehensive and constructive comments and suggestions to improve our manuscript.

As I will have an **additional affiliation** starting at 1st January 2017, I have added this new affiliation named *SportOrtho Rosenheim, Praxis für Orthopädie und Unfallchirurgie, 83022 Rosenheim, Germany* indicated by **red** colour.

As suggested in the edited version of our manuscript, we have added an **audio core tip**.

As suggested in the peer-review report, our native-English speaker Gordon Mackay from Scotland has carefully revised the text for **grammar errors** and language style. We have indicated all changes regarding grammar and language style by **blue** colour.

Furthermore, concerning the surgical technique we have added some information how the **tibial footprints** are identified prior to drilling and that there is no concern

for the FiberTape impinging on the anterolateral aspect of the talus as the FiberTape runs completely outside the joint (see pages 7-8).

Describing the **double stabilization technique** we have placed emphasis on the recommended sequence of stabilization: first the anterior stabilization has to be performed (under direct visualization in case of open surgery), and when the anterior stabilization has been performed in anatomic position, a posteriorly directed second stabilization using the TightRope will not lead to malreduction. In contrast, not directing the TightRope posteriorly can lead to **malreduction** in kind of anterior displacement or malrotation (see page 8).

And of course the **neurovascular bundle** has to be protected when aiming the TightRope in a posterior direction. Therefore the surgeon has to check under fluoroscopy if the aiming k-wire enters the tibia on the lateral side and comes out of the tibia at the medial side, and before overdrilling the k-wire the surgeon has to ensure that the k-wire comes out of the tibia at the medial side anterior to the tendon of the posterior tibial muscle (see pages 8-9).

Potential **disadvantages** of the procedure may be higher costs of implants and an increased surgical time compared to using classical syndesmotic screws (see page 10). We do not think that this new procedure puts more implants into the distal fibula than using syndesmotic screws, and due to the knotless fixation using the TightRope and the aperture fixation using the InternalBrace, all the implants are quite flat with the bone surface compared to syndesmotic screws.

The **Teramoto article** clearly states that “neither single nor double fixation for syndesmosis injuries provided multidirectionally stabilizing syndesmosis” when the TightRopes were inserted in a standard lateral to medial direction, even when the posterior syndesmosis was completely intact like in the model used by Teramoto. Moreover, the article indicates that there may be a need for optimizing stabilization by use of different directions of the TightRopes instead of inserting the TightRopes into the centers of fibula and tibia according to the standard technique. This fact correlates very good with our clinical and unpublished experimental findings that

sufficient rotational stability of the distal fibula cannot be achieved by standard use of one or even two TightRopes. This is due to the technical principle of the TightRope which has to be inserted through the bones in any case regardless of the used direction, whereas the native anterior and posterior tibiofibular ligaments limiting rotation of the distal fibula are located at the surface of the bones. This important anatomic fact can be imitated by use of an *InternalBrace* but not by use of TightRopes. We amended the text to clarify that our citation of the Teramoto article concerned the standard use of TightRopes directed from lateral to medial (see page 5).

We did not experience sawing in the distal fibula using our new technique, but we know from former cruciate ligament surgery or acromioclavicular joint stabilization techniques without aperture fixation, that motion of native or artificial structures inside or on the surface of bone can severely damage bone and lead to tunnel enlargement or iatrogenic fractures by a repetitive and continuing sawing effect. And having in mind such a **risk of sawing** in the distal fibula of course we intended to avoid this problem using our new technique by ensuring tight fixation of the FiberTape inside the bone tunnel.

In fact, one severe complication that potential adopters of this technique should bear in mind not mentioned so far is **over-constraining** of the anterior syndesmosis when using the *InternalBrace* technique. Therefore a hemostat clamp can be put under the FiberTape® during tensioning (see page 8).

As recommended, to avoid **replication** of the same sentence in the abstract and the introduction, we changed the introduction using the following text: Syndesmotic instability is a strong predictor for less favorable clinical outcomes of ankle fractures, even after surgical syndesmotic stabilization (see page 5).