Why the Olecranon tension band osteosynthesis can not fulfil the principles of „absolute Stability“.

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The clinical Problem: The olecranon fracture (as like patella fractures) is a tension fracture due to high forces of the triceps muscle. The leaver arm of the triceps is very short compared to the longer leaver arm with the resistant force of the hand. The muscle force is about 10 times higher than the weight of the forearm and the weight elevated by the hand.

An additional problem is the fact, that the ventral aspect of the proximal ulna is an articular surface and no implant should be placed on this side.

Biomechanically a tension band is a mechanical system, in which intrinsic compression forces of the system are always higher than maximal tension forces applied to the system. If the tension forces would be higher alternating deformation with the consequence of fatigue break would be the consequences. The tension band osteosynthesis of the olecranon, recommended by the AO relays on the fact of dorsal compression, because the implant can be fixed only dorsally, and only flexion of the elbow should compensate the ventral distraction and induce pressure on the articular surface. If this system with alternating bending forces would work, fatigue K-wires breakage would occur. To avoid this complication, Libitzke proposed a tension cable system; witch is placed medially and laterally in the central level of the bone. So fractures show a more even compression distribution. However dislocation of the wires, direct bone contact and the fixation in fractures with additional fragments is not solved by this technique. The second problem is, that in fracture under tension, the bone surface is covered by the muscle insertion and even without soft tissue in sow bone models, the placement of the tension band wire on the shortest way on the bone surface is possible. In patients with tendon insertion this problem is greater.

Therefore we developed an angle stable locked nail System with a 4,5mm /3,5mm (XS and XXS Nail) witch allows by his central position a symmetric compression of the fracture site and is independent from the soft tissue around. The compression is done by a compression screw in the nail and possible because the 2 proximal locking holes are longitudinal

Experimental results: Since 1987 we know from the static traction tests by Brill and Hopf that already after 1 second is no compression on the fracture site. Also experimental data from Bühren have been showed, that after 500N loading a gap of 5mm occur..
However static traction does represent the clinical situation. That’s why we conducted a comparative experimental study with 1000 cycles of alternating load of 250 and 500N in a sow bone patella model before osteotomy, after tension band osteosynthesis and after XS nail stabilisation with one or two nails. In 4 types of osteotomies these situations were tested.

**Results:** In all specimens of the tension band group visible gaps occurred. After the XS Nail osteosynthesis in all groups the deformation was lower than in the specimens before osteotomy.

In a clinical study, in 76 patients (95% altogether and 100% in 2 part fractures showed good and very god results according to the Murphy Score.

**Conclusions:** In olecranon fractures the XS nail osteosynthesis allows a more stable compression in comparison to the tension band stabilization.