A NEW THORACOSCOPIC IMPLANTABLE STABILIZATION SYSTEM FOR THORACOLUMBAR FRACTURE TREATMENT - BIOMECHANICAL TESTING, SURGICAL TECHNIQUE AND CLINICAL OUTCOME –

1.Klinisch Markus Schultheiss[1], Erich Hartwig[1], Hans-Joachim Wilke[2], Lothar Kinzl[1], Lutz Claes[2]
[1]Department of Trauma-, Hand- and Reconstructive Surgery, University of Ulm, Steinhövelstrasse 9 , 89075 Ulm Germany, www.unfallchirurgie.uni-ulm.de *Institute of Orthopedic Research and Biomechanics, University of Ulm, Helmholtzstr.14, 89081 Ulm Germany, www.biomechanics.de

INTRODUCTION

Accommodated to the circumstances of a thoracoscopic minimally invasive spine surgery a new ventral instrumentation system was developed for the treatment of thoracolumbar fractures. The aim of this study was the comparative biomechanical, static and fatigue testing of a new ventral stabilization system, furthermore to demonstrate the feasibility of the new operative technique in a prospective clinical study.

METHODS

The new stabilization system for the anterior column consisting of a plate and four monocortical screws was developed together with an instrumentation system for endoscopic or minimally invasive operation technique (MACS TL™ Aesculap). Biomechanical tests were performed on 12 human cadaveric T10-L2 spine specimens (mean BMD 145±40 mg/ccm, mean age 77±18 years) in a spine tester, which provides controlled moment loading with pure moments with 3.75 Nm in one plane and constrained motion in free space. The Range of Motion and Neutral Zone were measured initially and after corpectomy; strut grafting and stabilization was performed with the new system in comparison to currently available systems (USS™ dorsal, Ventrofix™ ventral). Furthermore static and fatigue tests were performed according to the ASTM recommendations and a synthetic model of Kotani (1999).

In a prospective clinical study, 45 patients underwent this technique. Procedure was performed in a lateral position with one lung ventilation facilitating intrathoracic preparation through 4-5 intercostal working channels or minimally invasive open approach. At the thoracolumbar junction the diaphragm is splitted endoscopically. Stabilization was performed video assisted mono - and bisegmental after partial corpectomy, decompression and strut grafting with the new system meanly at the thoracolumbar junction after initial posterior instrumentation in most cases. Lesions varied from fresh/ old fractures to metastasis.

Pre- and postoperative follow up included clinical examination, neurological status and radiological visualization via X-ray and CT scan.

RESULTS AND DISCUSSION

The new system provided excellent static and fatigue values according to the ASTM and the model of Kotani in comparison to existing systems. In the biomechanical in vitro testing significant decrease ($p<0.05$) of the Range of Motion and the Neutral Zone was achieved in all directions compared with the intact spine. The primary stability parameters were comparable (flexion/ extension, axial rotation) or improved (lateral bending) ($p<0.05$) with the Ventrofix™ system. In all patients the operation was successfully performed in a complete thoracoscopic or minimally invasive procedure. One superficial infection, but no approach or implant related complication occurred in this initial series within 37 month follow up.

Together with the advantages of endoscopic instrumentation technique, the MACS TL system provides excellent static, fatigue and biomechanical parameters in comparison. Our clinical experience with this minimally invasive procedure demonstrated the feasibility of the method. In a multi-centrestudy more than 300 patients underwent this technique. Further studies will verify the major advantages compared to the open procedure of reduced morbidity of the approach, postoperative pain reduction, early recovery of function and shortened hospital stay.

SUMMARY

The new thoracoscopic minimally invasive technique provides a high biomechanical stabilization within smaller dimensions and minimized surgical approach.

REFERENCES

Kotani, Y., et al. (1999).. *Spine* , **14,** 1406-1413.