P43

THE "PUSH-FORWARD EFFECT" IN TRANSPEDICULAR IMPLANTS OF THE PLATE-SCREW FAMILY

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Introduction: While using plate-screw systems, the plate exerts an anteriorly directed force on the segment(s), bridged by the implant. The force breaks the bending-lever, which acts on the anchoring screws. This could explain, why not as much screws in plate-systems show fatigue-breakage, as expected by their minor shaft-diameter. Furthermore, this "pushing-forward force" could be beneficially implemented in the construction of internal fixation systems of the screw-rod type. In order to investigate this effect under varying conditions, a biomechanical study was performed.
Material and methods: 7 thoracic (T9-11) and 8 lumbar (L2-4) human specimen were tested. Bone quality was evaluated by DEXA, by qCT, and by insertion-torque. The convergence of the anchoring screws was < 25° (thoracic) and > 35° (lumbar). The specimen were tested native and weakened anteriorly and then completely T9-10 or L2-3, instrumented with fixator alone and under augmentation with a cross-link, with a push-forward device, and with both augmentations together, according to the recommendations of the "GW".
Results: With varying defects, differences in primary stability were more significant, than among the types of instrumentation/augmentation. Within the same defects, the hypothesis of improvement by augmentation was supported by 303 of 432 results, 61/432 significant ($p = < 0.005$). This tendency increased with the extent of defects and with osteoporosis. In difference to the push-forward-device, the impact of the cross-link decreased with greater convergence of the screws.
Conclusion: The augmentation of internal fixators by a cross-link or/and by a "push-forward-additive" can improve the primary stability. Recommendations for the use of these devices are depending on the convergence of the anchoring screws, on the bone quality, on the extent of a defect, and on the performance of the applied fixation-system.

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