

Bachelor-Abschlussarbeit

Thema: Evaluation of an Osmotic Pump to Drive a Lengthening Implant
for Distraction Osteogenesis

Zusammenfassung:

Distraction osteogenesis is a well-established treatment for patients suffering from limb length discrepancies. By now, all common distraction devices are driven manually or by an external power source to incrementally extend the bone. Children's varying limb size, correlating to their age, is limiting the selection of treatment devices. Compact dimensions, avoiding of skin penetration and a continuous lengthening rate are assumed to potentially improve bone and soft tissue healing and to reduce postoperative complications such as pain, infections or psychological stress and immobilization. This thesis is a feasibility study, determining the potential of an osmotic engine as an actuator for an implantable lengthening device in pediatrics.

Initially a mathematical model has been established to determine key values affecting the osmotic engine and to compute theoretical results, on the aspects of each specimen. Afterwards, test methods and equipment were designed and evaluated to assure a moderate test setup during the entire study. Evaluation of the experimental and theoretical results led to a complementation of the mathematical model for further use in future studies in this project.

Priorly defined design inputs and acceptance criteria were considered for experimental investigations. Thermal changes turned out to be a non-critical value, due to its temporary appearance. Whereas, the concentration gradient is highly impacting the system and needs to be constant to assure a consistent lengthening rate. Also, static, axial forces, applied to the engine reduce the lengthening process significantly and requires extensive research. New provided membranes failed during the studies, due to unexpected material defects. This study reveals the potential of this unique project, which must be continued, and which needs further development to lead to clinically applicable devices.

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