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Do steep helix angles lead to collapse of the growing module in minimal-invasive expandable prostheses?

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Introduction: In the course of wide resection the physis of the lower extremity has often to be resected in bone sarcoma patients. To avoid limb-length inequality one possibility is the implantation of minimal-invasive expandable prostheses. According to literature mechanical failure rates vary between 5- 50 % in minimal-invasive growing prostheses.

Case presentation: Herein we present three patients (one osteosarcoma, two Ewing's sarcoma) with complete collapse of the minimal-invasive HMRS[®] (Howmedica Modular Resection System) growing prosthesis following bone sarcoma resection between 2003 and 2005. Eight growing prostheses of the same type were implanted in our center in total. Lengthening was performed under general anesthesia and one full rotation of the lengthening screw equates to 0.9 mm. Patients were nine, ten and twelve years respectively at the time of implantation. Complete collapse of the growing module occurred after six (10.3 cm of lengthening), four (5.8 cm of lengthening) and three (4.7 cm of lengthening) lengthening procedures respectively (s. Fig 1 and 2). Intraoperatively, loosening of the adjustment screw was seen in all three patients and. Despite technically correct tightening of the fixation screw the growing module re-collapsed shortly after revision surgery and severe limb-length inequality occurred which ultimately resulted in loss of prosthesis. During in-vitro testing of the explanted prostheses we were able to lengthen the growing module although the fixation screw was locked. **Discussion:** The same mechanical failure mechanism of the growing module lead to major complications in all three patients. This complication has not been described in literature before. In contrast to non-invasive prostheses the helix angle of the thread of the growing module is guite steep to increase the efficiency when lengthening manually. However, this might result in a loss of self-locking property and ultimately lead to the collapse of the growing module.



Figure 1. Patient 1



Figure 2. Patient 2