Rapid intraoperative tissue relaxation of a scalp wound using a novel suture retention device

Allison Stoecker, DO (PGY-3), Stephanie Howarter, DO (PGY-5), and William Lear, MD
Silver Falls Dermatology, Salem, OR

Introduction
Scalp defects present unique reconstructive challenges. When wound edges are difficult to appose, surgeons often employ flaps or grafts. Scalp flaps can be large and result in loss of sensation.1 Grafts from non-hair-bearing areas can result in poor cosmetic outcomes and may heal poorly if placed over exposed bone.2 Intraoperative tissue expansion may circumvent large flaps and grafts. Retention sutures may be used for stress-relaxation, but high-tension suture damages underlying skin.3 We describe the use of a novel suture retention device (SRD) to protect wound edges and provide stress relaxation of wounds, which can then be closed linearly.

Case Report
A 61 year-old female presented with basal cell carcinoma of the right frontoparietal scalp. (Fig 1) The first defect after Mohs micrographic surgery was 4.1-cm by 7.7-cm. (Fig 2) The patient declined repair with a flap or graft. A SRD was used for intraoperative tissue relaxation. First, a USP 1 Nylon retention suture was placed centrally. The suture ends were fed through the SRD and secured with a surgical clamp. (Fig 3) Initial force to approximate the wound edges measured 25.0 N. The suture was incrementally tightened and re-clamped. After 30 minutes, the force reduced 66% to 8.5N. The increased laxity of the scalp skin was also illustrated by a 44% decrease in wound width to 2.1-cm. The wound edges flanking the midline SRD were still difficult to appose. Two more devices were placed on either side of the first SRD. (Fig 4) All retention sutures were incrementally tightened over the next 60 minutes until the wound edges could be easily approximated. (Fig 5) A 4-mm standing cone was removed from the forehead and the defect was closed in a linear fashion using buried 2.0 polydioxanone sutures followed by staples. (Fig 6) There was no dehiscence, necrosis, or infection over the following 14 days of healing.

Discussion
Skin is a viscoelastic organ which exhibits load dependent behavior. With repeated cycles of stress and relaxation, collagen fibers reorient and elastic fibers lose their elasticity. This allows for skin elongation over time, known as mechanical creep.4 Stress-relaxation may allow for direct linear closure of high-tension scalp wounds to decrease large flaps or grafts. This can be accomplished with retention sutures, but excess pressure from suture filaments can cause erosion or ulceration.5 Using a SRD may protect the skin from these forces. This device is composed of a semi-rigid insert covered with a softer shell. The core bridge-like structure allows it to withstand the forces of wound closure while protecting wound edges and dissipating pressure on the skin. Using a clamp, surgeons can incrementally place stress on the closure with up to 25N of force without apparent pressure injury to the skin. In this case, the SRD allowed for 66% reduction in force over the first 30 minutes, and subsequent linear closure of the large defect without undermining, galeotomy, flap, or graft. Further research is necessary to quantify the rate of tissue expansion and limits of force reduction.

References

Disclosures
There were no funding sources for this poster. Dr. Lear is co-founder and shareholder in SUTUREGARD™ Medical. The remaining authors have no conflicts of interest to disclose.