

RESEARCH LETTER

## Keith Needle Technique for Intraoperative Guidance in Rhinoplasty

Garrett D. Locketz, MD,<sup>1,\*</sup> Kirkland N. Lozada, MD,<sup>1,2</sup> and Jason D. Bloom, MD, FACS<sup>1,2</sup>

### Introduction

Technological advancements continue to evolve the methods by which surgeons prepare for rhinoplasty. Three-dimensional (3D) imaging technology has recently enabled surgeons to precisely measure a patient's baseline anatomy and digitally simulate their surgical goals during the preoperative consultation. Reduction of an excessive dorsal convexity, or dorsal hump, is frequently requested by rhinoplasty patients. To aid in achieving a result that approximates the patient's desires, surgeons routinely bring simulated images into the operating room to be referenced during the operation. These simulated images can be further leveraged by creating patient-specific 3D-printed marking templates that transfer of patients' desired dorsal height and contour onto the patient in the form of preoperative skin marking. Nevertheless, the ability to translate preoperative skin markings into an accurate dorsal reduction remains challenging, particularly in endonasal rhinoplasty where visualization is restricted. Thus, a technique to address this limitation is needed.

### Methods

Three sequential patients presenting for primary rhinoplasty with dorsal reduction were recruited as subjects. 3D imaging was captured of each patient preoperatively using Vectra H2 (Canfield Scientific, Inc.), and goals of surgery simulations were created during the preoperative consultation based on patient preference. Patient-specific 3D-printed marking templates were created by a third-party company and were used in the operating room before the injection of local anesthetic to mark the patient's

desired dorsal profile (Fig. 1A, B). Endonasal rhinoplasty approach was then performed in a standard manner. After the skin envelope was elevated from the dorsum and upper lateral cartilages were separated from the dorsal septum, two 50.8 millimeter Keith needles were introduced perpendicularly along the dorsal skin markings, spanning from one side of the dorsum to the other, piercing the cartilaginous dorsum at the level of the desired dorsal height (Fig. 1C, D). Keith needles remained in place during dorsal reduction, guiding the reduction toward the desired preoperative surgical goals.

### Results

Keith needles were easily visualized spanning the cartilaginous dorsum through an endonasal approach and correlated precisely with the external skin markings (Fig. 1E, F). The needles acted to guide dorsal reduction toward the desired dorsal height and contour while helping to prevent over-resection during reduction (Fig. 2). No complications were realized in any patient, and Keith needle entrance/exit locations on the skin were not identifiable postoperatively. Added cost to the procedure was <\$10. Patient-specific 3D-printed marking templates, when used, required 5 days to produce and ship, and cost ~\$100 per patient.

### Conclusion

The Keith Needle Technique is an effective method to transfer the surgically desired dorsal height and contour from preoperative skin markings onto the actual cartilaginous dorsum during rhinoplasty. In the authors' experience, this also aids in more accurate and

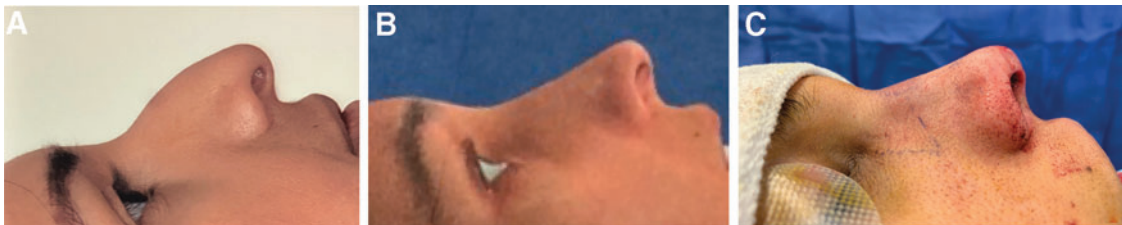
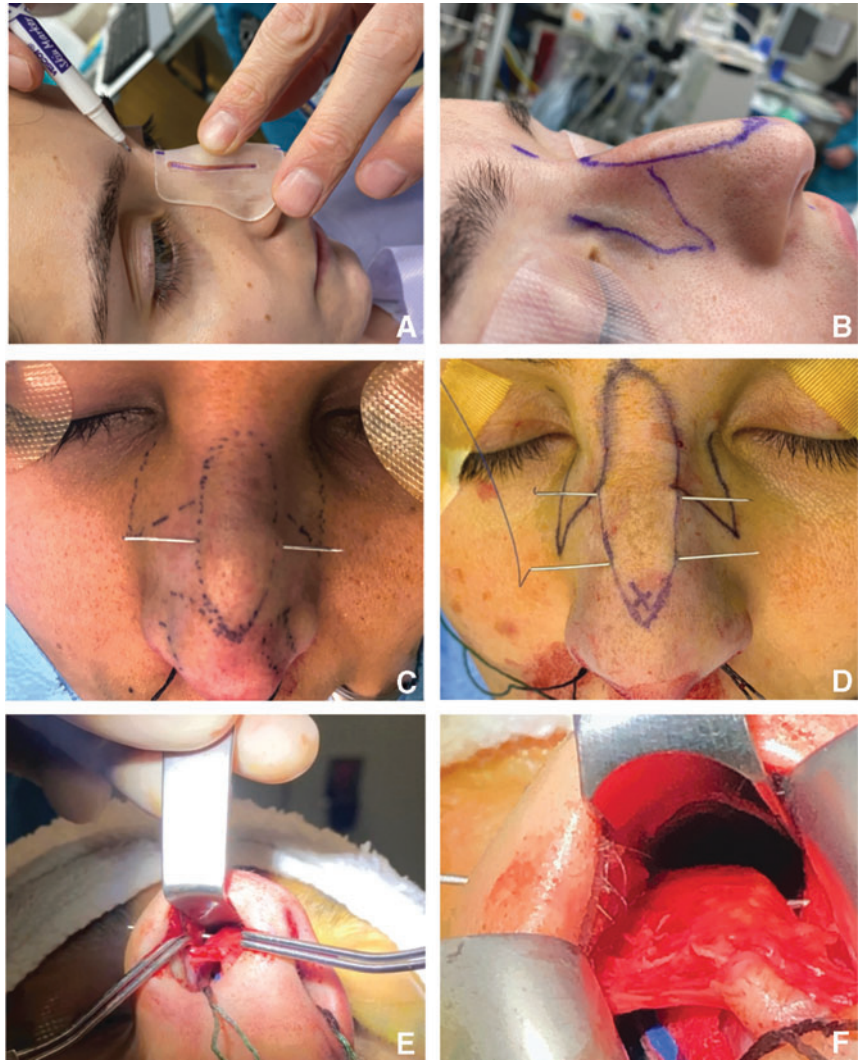
<sup>1</sup>Division of Facial Plastic and Reconstructive Surgery, Department of Otorhinolaryngology-Head and Neck Surgery, University of Pennsylvania Health System, Philadelphia, Pennsylvania, USA.

<sup>2</sup>Bloom Facial Plastic Surgery, Bryn Mawr, Pennsylvania, USA.

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\*Address correspondence to: Garrett D. Locketz, MD, Division of Facial Plastic and Reconstructive Surgery, Department of Otorhinolaryngology-Head and Neck Surgery, University of Pennsylvania Health System, 3400 Spruce Street, 5th Floor, Silverstein Building, Philadelphia, PA 19104, USA, E-mail: garrett.locketz@pennteam.upenn.edu

**Fig. 1.** (A) Patient-specific 3D-printed marking template fitted over the patient's nose preoperatively. (B) Dorsal profile skin marking as drawn through cutouts in the patient-specific marking template. Note that markings for nasal bones and osteotomy path were drawn free-handed by the surgeon. (C) Keith needles transecting the skin/soft tissue envelope and dorsal cartilaginous septum at the point of maximal convexity. (D) Keith needles placed at keystone area and at the attachment of the caudal edge of the upper lateral cartilages to the cartilaginous septum. (E, F) Keith needles visualized endonasally when soft tissue/skin envelope is elevated with an Aufricht retractor, guiding the dorsal reduction toward the desired dorsal height and contour. 3D, three-dimensional.



**Fig. 2.** (A) Preoperative profile view. (B) Digital simulation of desired dorsal height and contour from 3D images. (C) Immediate postoperative result.

efficient dorsal reduction. The technique fits into the existing workflow for standard dorsal reduction rhinoplasty, uses standard operating room equipment and supplies, and can be utilized whether performing an endonasal or open approach. Notably, the Keith Needle Technique can be easily implemented based on traditional free-handed skin markings, although the authors agree that utilizing patient-specific dorsal marking templates improves skin marking accuracy. We also highlight the importance of gentle retraction on the skin/soft tissue envelope while the Keith needles are in place, as excessive traction could theoretically result in inadvertent

damage to the skin. We also encourage judicious use of local injectable anesthetic and favor sub-superficial muscular aponeurotic system/subperiosteal dissection of the dorsum, as excessive soft tissue edema in this area may alter the position of skin markings and affect the accuracy of Keith needle placement.

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