

The Application of 3D Printed Surgical Guides in Approaching Ideal Nasal Tip Position in Rhinoplasty

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Introduction: Virtual simulation is becoming increasingly common in rhinoplasty consultation. In addition to marketing, virtual simulation offers a useful intra-operative reference. Three-dimensional printing translates the simulated surgical plan into anatomic models and guides that can be incorporated into operative decision-making, notably for nasal tip positioning. This study aims to evaluate the application of 3D-printed surgical guides to determine dorsal height and positioning of the septal extension graft to control nasal tip position during rhinoplasty.

Methods: Patients undergoing primary open rhinoplasty with septal extension grafts using 3D printed sagittal tip position guides had pre-operative 3D photographs. Virtual simulations of the ideal rhinoplasty result were created according to the surgeon's aesthetic ideals, as well as patient preference. 3D printed sagittal contour guides were printed and sterilized to be used intra-operatively. 3D printed guides were fit onto the nose at the sagittal midline following dorsal hump reduction to establish dorsal height according to the pre-determined surgical simulation. The guide was then fit onto the nose to assess nasal tip position prior to tip modification, and following placement of the septal extension graft. The septal extension graft was adjusted according to the tip position determined by the 3D printed guide. 3D photographs were obtained at the end of the operation and at 1 month post-operatively and compared to the pre-operative simulation.

Results: 4 Patients underwent primary open rhinoplasty with septal extension grafts (cosmetic n=3, post traumatic n=1). 3D printed sagittal tip position guides were useful for assessing tip position throughout the operative sequence. 3D analysis demonstrated adherence to the simulated tip position in tip projection (z-axis) and rotation (y-axis) on the on table result and at 1 month follow up. The mean difference in tip projection and tip rotation between the simulation to the on-table result was 1.3mm +/-1.3mm p<0.05, and 0.06mm +/- 0.4mm p<0.01. The mean difference in tip projection and rotation at 1 month was 0.6mm +/- 0.5mm p<0.01, and 0.1mm +/- 0.1mm p<0.01, respectively.

Conclusion: Nasal tip position is central to rhinoplasty aesthetics. Virtual simulation is useful in defining aesthetic goals pre-operatively. Three-dimensional printing technology increases the utility of virtual simulation by translating the surgical plan

into anatomic models and guides. Sagittal nasal tip guides may offer an alternative to the projectometer as a method for positioning septal extension grafts. These guides assist to confirm aesthetic goals defined pre-operatively are met in the operative setting.