

EP-006

Head-Up Display 기반 3D Digital Exoscope를 이용한 유리피판술의 초기 경험

Initial Experience with Free Flap Surgery Using a Head-Up Display-Based 3D Digital Exoscope



충남대학교병원 성형외과¹
충남대학교 의과대학 성형외과학교실²

김정희^{1,2}, 권혁재¹, 김순제¹, 송승한^{1,2}, 오상하^{1,2}, 하유석^{1,2}*

Purpose

The use of 3D digital exoscopes in reconstructive microsurgery has recently increased. However, existing monitor-based systems require surgeons to gaze at external screens, potentially causing postural discomfort and visual fatigue. This study reports initial clinical experience with three cases of free flap reconstruction using a head-up display (HUD)-based 3D digital exoscope and evaluates its anastomotic efficiency and ergonomic differences compared with conventional surgical microscopes.

Methods

Three cases of free flap reconstruction were performed using a HUD-based 3D digital exoscope. The first case involved a DIEP free flap with right SIEV-left SIEV anastomosed using a coupler. The second case involved an msLD free flap for a scalp defect, anastomosing the superficial temporal artery and vein and subscapular vessels using 9-0 nylon sutures for the arteries and a 2.0 mm coupler for the veins. The third case involved a thoracodorsal artery perforator (TDAP) free flap for floor of mouth reconstruction, where the superior thyroid and subscapular vessels were anastomosed using the same technique. Anastomosis time, intraoperative stability, and surgeon discomfort were analyzed.

Results

All three flaps survived completely without vascular complications. Anastomosis time was comparable to conventional microscopy. Mild motion sickness occurred in the initial two cases but improved with adaptation and did not recur in the third case. Eliminating the need to stare at an external monitor allowed maintenance of a neutral posture, improving ergonomic stability and visual comfort compared with monitor-based exoscopes.

Conclusion

The HUD-based 3D digital exoscope can serve as a practical alternative, maintaining equivalent anastomotic performance to conventional microscopes while providing enhanced ergonomic advantages.



Fig. 1. (Left) HUD-based 3D digital exoscope system (SHIYA, MediThinQ, South Korea) (Right) Intraoperative use of the HUD-based 3D digital exoscope system during microvascular anastomosis.

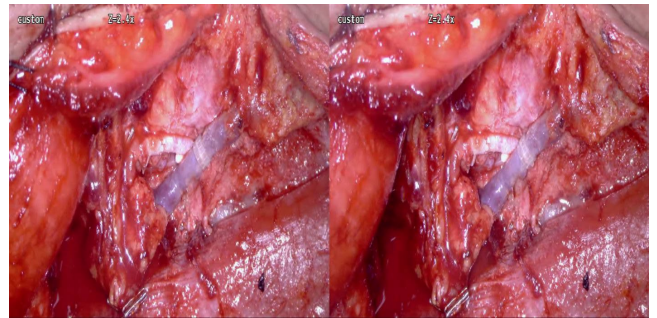


Fig. 2. Intraoperative 3D digital exoscopic view of microvascular anastomosis in the third case. The 3D digital exoscope captures two separate optical channels, which are digitally merged to generate a stereoscopic image, allowing depth perception comparable to conventional operative microscopy. During TDAP free flap reconstruction for a floor of mouth defect, the superior thyroid vessels and subscapular vessels were anastomosed using 9-0 nylon sutures for the artery and a venous coupler for the vein.

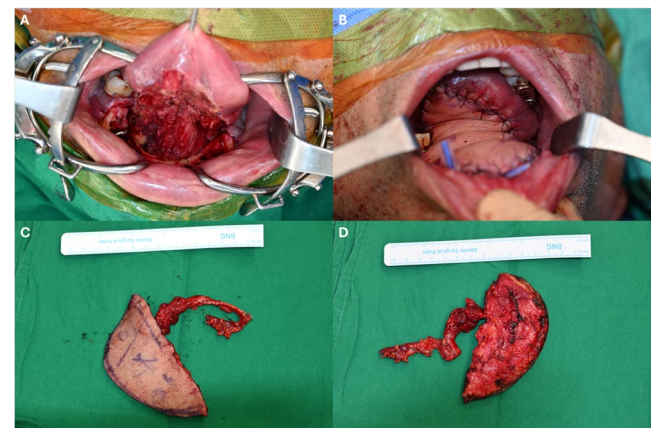


Fig. 3. The third case of TDAP free flap reconstruction for a floor of mouth defect. (A) Defect following wide excision of squamous cell carcinoma of the floor of mouth performed by the ENT team. (B) Immediate postoperative view after reconstruction with a TDAP free flap. (C, D) Harvested TDAP flap showing the skin paddle and vascular pedicle from the skin and deep surfaces.