3D Exoscope for cerebral revascularization

A study aimed to evaluate the feasibility and effectivity of microvascular anastomosis using a 4 K 3D exoscope in an in vivo animal study.

Methods: The abdominal aortas of mice were selected as the target vessels for comparing the outcomes of microvascular anastomosis for both the conventional microscope and 3D exoscope. We recorded the vessel separation, temporary occlusion, and total procedure durations. Local conditions at the sutures were also recorded. Typical histopathological images were presented, and the patency of anastomotic vessels within 5 and 30 min were evaluated. All procedures included both superficial and deep anastomosis.

Results: Sixty mice were included in the analysis; the weight and vascular diameter were 38.5 ± 5.8 g and 0.77 ± 0.06 mm, respectively, and around 8 stiches were required. Regarding feasibility, vessel separation duration, temporary occlusion duration, total procedure duration, blood leak, and number of vascular folds between stiches, the results were comparable between the two types of microscopes. The feasibility of anastomosis was also confirmed by pathology. Regarding effectiveness, anastomotic vascular patency at 5 and 30 min were similar for both microscopes. Even in the more difficult scenario of deep anastomosis, the results were comparable.

Conclusions: In a challenging experimental setting, comparable outcomes of microvascular anastomosis were observed for the conventional microscope and 3D exoscope in these animal experiments. Therefore, in vivo microvascular anastomosis is feasible and effective using a 3D exoscope [1)].

A retrospective review over 6 mo was performed of all patients who have undergone cerebral bypass surgery at a single institution using the 4K-HD 3D EX. Advantages and disadvantages of the EX and clinical outcome of the patients were assessed.

A total of 5 patients underwent cerebral EC-IC bypass surgery with no EX-related complications and successful revascularization. The lightweight design of the EX allowed for easy instrument maneuverability as well as uncomplicated surgical set up in the operating room. The assistance of the cosurgeon was significantly more efficient compared to that of the operating microscope. The large monitor allowed for an immersive, collaborative, and valuable educational surgical experience.

Using the EX for cerebral bypass surgery, with 3D ultra-high-definition optics, enhancements of ergonomics, and improved training, we believe that the 3D 4K-HD EX may represent the next generation of operative scopes in microneurosurgery [2)].

1)
Zhang Z, Feng Y, Lu X, Yang B, Zhang H, Ma Y. Microvascular anastomosis in a challenging setting using a 4 K three-dimensional exoscope compared with a conventional microscope: An in vivo animal study. Front Surg. 2022 Oct 20;9:1021098. doi: 10.3389/fsurg.2022.1021098. PMID: 36338649; PMCID: PMC9630566.
2)
Nossek E, Schneider JR, Kwan K, Kulason KO, Du V, Chakraborty S, Rahme R, Faltings L, Ellis J, Ortiz R, Boockvar JA, Langer DJ. Technical Aspects and Operative Nuances Using a High-Definition 3-Dimensional Exoscope for Cerebral Bypass Surgery. Oper Neurosurg (Hagerstown). 2019 Aug

1;17(2):157-163. doi: 10.1093/ons/opy342. PMID: 30508137.