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The EEA™ Circular Stapler With Tri-Staple™ Technology: A New Standard in Colorectal Surgical Stapling

Jorge Marcet, MD

Professor of Surgery
Director of Colon and Rectal Surgery
University of South Florida Morsani College of Medicine
Tampa, Florida

Advanced Surgical Stapling

Advanced surgical staplers have undergone incremental improvement to address the major challenges to durable anastomoses in colorectal resections.¹ The technology must be adaptable over a range of patient-specific anatomy, including tissue thickness.¹ In more than 3,000 procedures ranging from excising malignancy to repair of damaged intestine due to diverticulitis or inflammatory bowel disease, Jorge Marcet, MD, a professor of surgery and the director of colon and rectal surgery at the University of South Florida Morsani College of Medicine, in Tampa, Florida, has used staplers to create anastomoses and restore bowel function for more than 30 years. Dr. Marcet has used the EEA™ circular stapler with Tri-Staple™ technology, a circular device with 3 staple rows, since it became available in 2018. In that time, he has noted several distinguishing features and technical advances that ensure reliable performance across colorectal procedures (Figure 1). “It has revolutionized our ability to create low rectal anastomoses,” he said.

Controlling Leaks While Facilitating Perfusion

Anastomotic leaks along the closure line can lead to infection and the potential failure of the anastomosis.^{2,3} Good apposition of the tissue with a secure closure during healing is therefore fundamental to the prevention of leaks.^{1,2}

Since blood supply is critical to healing, effective closure must be achieved without excessive tension.^{1,3} In addition, according to Dr. Marcet, some patients are at increased risk in wound healing, so it becomes particularly important to seek an optimal result in creating an anastomosis. “A substantial proportion of patients undergoing resection for

rectal cancer have received radiation, which can damage tissue. Patients on corticosteroids or other immunosuppressants, such as those for the treatment of inflammatory bowel disease, can be at an increased risk for infection that can be exacerbated by an inadequate blood supply,” he said. Tri-Staple™ technology is designed to address these challenges and produce a more secure anastomosis while allowing for increased perfusion.^{4,5,a-c}

The Technology*Three Rows of Staples*

The predecessor to Tri-Staple™ technology is DST Series™ technology, which deploys 2 rows of uniform height staples. Tri-Staple™ technology, on the other hand, provides 3 rows of staples that vary in height (Figure 2).^{6,d} It is available with a purple cartridge for medium/thick tissue; the black cartridge is available for thicker tissue.⁷

The staples closest to the lumen, the innermost row, have the shortest height, providing the greatest occlusion



Figure 1. The EEA™ circular stapler with Tri-Staple™ technology.



Figure 2. The EEA™ circular stapler with Tri-Staple™ technology has 3 rows of varied height staples.

and barrier to leaks and bleeding.^{4,7,b,c} The second and third rows, each incrementally higher, contribute strength to the closure line but reduce pressure on tissue to facilitate blood supply through the microvasculature.^{5,7,a,b} That balance between occlusion and hemostasis is “the underlying principle of the EEA™ circular stapler with Tri-Staple™ technology,” Dr Marcet said. Internal manufacturer studies show that 3 rows of staples (vs 2) provide 50% more security to the staple line without sacrificing healing.^{4,b} Dr Marcet has seen an improvement in outcomes in his procedures. “My leak and bleeding rates with the EEA™ circular stapler with Tri-Staple™ technology are substantially lower than what has been reported historically,” he said.

Tactile and Audible Feedback

The EEA™ stapler with Tri-Staple™ technology provides cues that can be seen, heard, and felt. Surgeons like Dr Marcet rely on that feedback to make informed choices in the midst of any number of operating room distractions. For example, the stapler’s handle delivers an audible and tactile click that tells Dr Marcet when the stapler has been completely fired.^{8,a,b} Similar audible and tactile signals indicate when the stapler can be safely removed from the rectal anatomy.^{9,b,d}

Other cues provided by the EEA™ stapler also inspire clinical confidence. The sloped cartridge face is designed to direct tissue fluid away from the staple line when applying gradual compression. This feature reduces pressure on tissue when clamping.^{10,b,d-f} “In addition, as the stapler is squeezed, there is tactile feedback which guides the surgeon in applying proper compression for pushing out the tissue fluid lateral from the suture line,” Dr Marcet said. “By tightening slowly, the gentle compression avoids placing too much stress when the stapler is fired. This improves perfusion during the healing process.”^{5,a,b}

Despite extensive stapling experience in the creation of anastomoses in colorectal surgery, Dr Marcet finds the feedback helpful for navigating key steps in the process. “These cues are helpful for indicating proper use of the stapler; they increase confidence and make the device easier to use,” he said.

Firing Force

Manufacturer testing indicates the firing force when using the EEA™ circular stapler with Tri-Staple™ technology is up to 62% lower than competing circular stapler devices.^{9,c,d} Also, Dr Marcet notes the smaller grip that accommodates small as well as larger hands, a feature he thinks is important for the broader group of surgeons working with these devices. “In surgery today, an increasing number of women are performing the full range of procedures, including colorectal resections. The reduced firing force makes this device easier to use, which is relevant not just to women but as a general improvement over other devices,” he said.

Donut Quality

Upon removal of the stapler, examination of the proximal and distal sides of the excised tissue “donut” can serve as a useful gauge of procedural success.³ “The first thing a surgeon does after an anastomosis is open the stapler and evaluate the quality of that donut,” Dr Marcet said. “It can indicate the integrity of the staple line.”

The EEA™ circular stapler with Tri-Staple™ technology was designed with a purse-string notch that is longer than DST Series™ technology, which allows the surgeon to reduce compression on the tissue when securing the purse-string suture so they can achieve desirable donuts that are larger and thicker. The anvil design accommodates

more tissue and is integral to forming the desired purse-string closure at the suture line (Figure 3). “It allows the tissue to be squeezed around the anvil better than other stapler devices, which is important for creating a thicker, more uniform donut,” he said.

Reliance and Versatility

Dr Marcet relies on the EEA™ circular stapler with Tri-Staple™ technology because of the technically advanced features, which he believes are the most currently available for use in colorectal surgery. He reports extensive experience with a variety of staplers from a range of device companies, and although reluctant to draw conclusions about the relative performance of staplers that he does not routinely use, Dr Marcet said competing staplers do not share many of the key features of the EEA™ circular stapler with Tri-Staple™ technology that he believes contribute to his good results and are transferable to the creation of anastomoses in other anatomic sites. “I encourage colleagues to adopt the Tri-Staple™ technology,” he said.

Conclusion

The goals of stapler design in the creation of anastomoses to restore bowel function following a colorectal resection are clear. The challenge has been to provide security at the staple line with minimal stress on the tissue, thereby preserving perfusion required for healing.^{1,3} For Dr Marcet, the cumulative effect of the design features of the EEA™ circular stapler with Tri-Staple™ technology is having the consistency with which early complications are avoided and healing is achieved across a broad range of indications. “The Tri-Staple™ technology represents a significant advance over 2-row staplers,” Dr Marcet said.

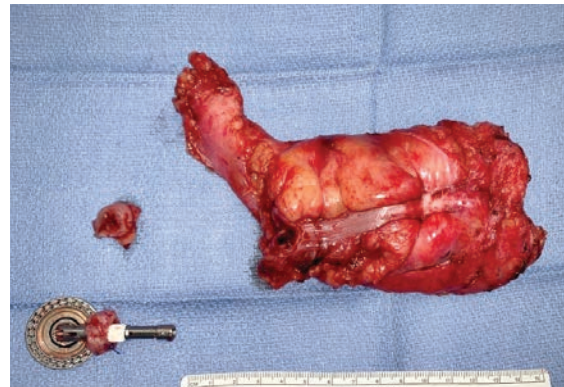


Figure 3. Cancer of mid-rectum with EEA™ circular stapler with Tri-Staple™ technology anvil and 2 intact anastomotic donuts.

Photo courtesy of Jorge Marcet, MD.

^a Preclinical results may not correlate with clinical performance in humans.

^b Compared with EEA™ circular staplers with DST Series™ technology.

^c Compared with Ethicon™ CDH circular staplers.

^d Bench test results may not necessarily be indicative of clinical performance.

^e Finite element analysis (FEA) was used to determine the strain profiles of three circular staplers during clamp-up. The EEA™ circular stapler with Tri-Staple™ technology demonstrated a graduated compression profile upon clamping.

^f Compared with Ethicon™ ILS circular staplers.

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