



# Double-stapled Colorectal Anastomosis with Bean-Shaped Rectal Doughnut Eliminating Dog Ears

## Çift Stapler Kolorektal Anostomozda Rektal Halkanın Fasülye Formunda Çıkarılması ile Kulak Oluşumunun Engellenmesi

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### ABSTRACT

The double-stapling technique defined by Knight and Griffen in 1980 has found widespread use in colorectal surgery. However, theoretically, the remaining dog ears on each side of the intersecting line between linear and circular stapler lines may have decreased blood supply and may contain tumor cells. Various modifications have been published in the literature to overcome these disadvantages of the double stapling technique. In this article, a modified technique that provides to excise the whole linear stapling line and to not leave the dog ears behind was introduced.

### ÖZ

Knight ve Griffen tarafından 1980 yılında tanımlanan çift stapler tekniği kolorektal cerrahide yaygın kullanım alanı bulmuştur. Bununla birlikte, teorik olarak, linear ve sirküler stapler hatlarının kesiştiği hattın her iki tarafında kalan kulakların (dog ears), kanlanmasının bozulabileceği gibi tümör hücreleri de içerebileceği hakkında tereddütler belirtilmektedir. Çift stapler tekniğinin bu dezavantajlarının üstesinden gelmek için tanımlanan çeşitli modifikasyonların yayınlandığı çalışmalara literatürde rastlanmaktadır. Bu makalede, dog ears oluşmasını engellemek üzere rektal linear stapler hattının tamamının çıkarılmasını sağlayan modifiye bir teknik tanıtıldı.

### Introduction

After Ravitch and Steichen performed end-to-end low rectal anastomosis with the end-to-end anastomosis instrument (EEA), and Nance defined to use the EEA together with linear stapler on upper gastrointestinal system in 1979, Knight and Griffen reported a modified stapler technique using linear and circular staplers together for colorectal anastomosis in 1980 [1,2,3]. In this double-stapling technique (DST), a horizontal closure of the lower rectal segment with a linear stapler was made. Then, an anastomosis with a circular stapler across the horizontal line was performed. The DST technique provided some advantages according to the traditional hand-sewn or single-stapled anastomosis techniques (SST) such as causing

significantly less contamination, performed easily, and, providing to anastomose the bowel segments with different diameters.

On the other hand, DST technique has at least two crossing staple lines and causes two corners called “dog ears” on each side. There were some concerns in literature that this technique may be complicated with anastomotic leakage from those “ears” because of weak blood circulation in these regions. This concern seems logical. However, some experimental studies opposing this concern reported. Julian and Ravitch reported in a dog model that there were no leakages even though the linear staples were usually removed with the doughnuts deformed, crushed or cut [4].

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Zilling showed in a pig model that the intersecting staple lines in the colonic and small bowel anastomoses did not cause to reduce the anastomotic blood flow to a dangerous ischemic level [5]. By contrary, Roumen reported in another experimental study in pigs that double stapled intersecting anastomoses were able to resist a lower pressure than well-organized staple lines performed by single circular stapler [6]. Nevertheless, Kawada suggested that the resection of the dog ears is not required because of the technical difficulties and similar clinical results, especially if the intersecting line is placed close to the edge of the rectal stump [7]. In conclusion of these contradictory results, although there is not an exact evidence of higher rate of anastomotic leakage by DST technique, the dog ears on each side of intersecting line between linear and circular staple lines may have decreased blood flow theoretically, and therefore they may be the soft belly of this technique.

Because of these contradictory results, some authors defined some new techniques that had advantages of DST technique but not cause crossing line and dog ears. Their aims were to reduce the rate of anastomotic leakage and to provide a well-organized complete linear staple line of the rectal stump that does not leave behind the dog ears to be able providing an exact oncological diagnosis without suspicion, because the dog ears may contain tumor cells.

## Gereç ve Yöntem

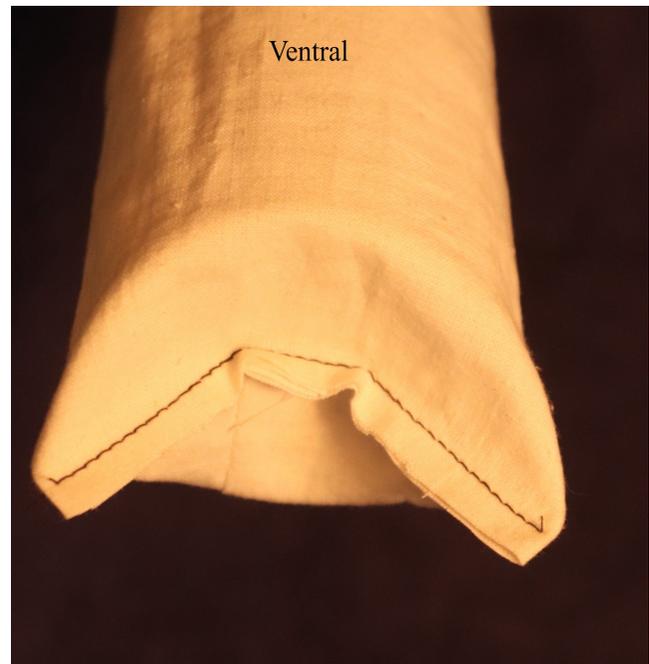
The colon is prepared according to the planned resection. The proximal segment is transected and closed in such a manner that a bulky cylinder that does not cause eversion around the anvil shaft is left behind by over-and-over pursestring suture technique. If it is required, an "O" suture may be applied over the pursestring suture.

Approximately 1.5 cm segment of the rectum is cleaned surrounding fat tissue and cut in a transverse, oblique or vertical manner by the linear stapler (GIA8048S, Covidien) in the border of the planned resection site.

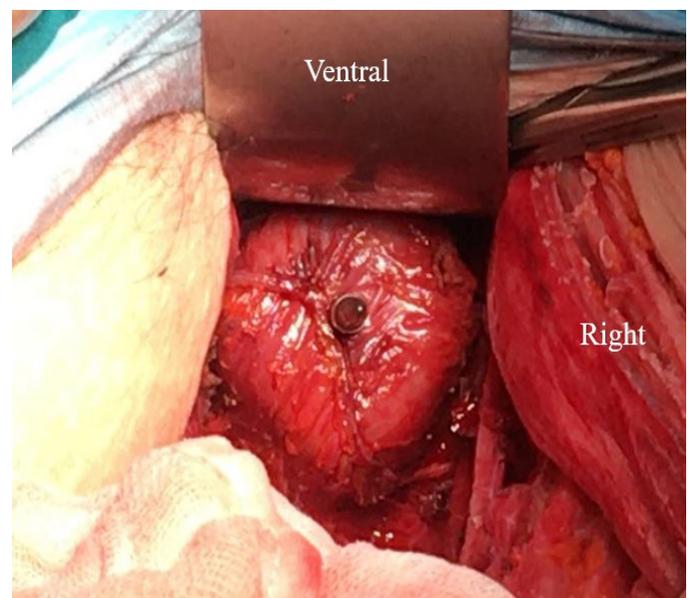
After digital dilatation, the circular stapler (CDH33, Ethicon Endo-Surgery Inc.) is gently introduced into the anal canal and driven on the staple line. The bowel is perforated by the spike of the stapler in just above the central part of the linear staple line if it is transverse, or just its right side if it is vertical or oblique (Fig. 1,2).

Tightness of the rectal stump is lessened by to be drawn back the stapler in the rectum slightly. Then, the linear staple line is shaped in a tennis racket form by using two 2-0 monofilament sutures around the spike. It is cared to leave enough space around the spike (Fig. 3,4). During this procedure, the spike does not cause to tissue disruption or laceration because it leans on the staple line.

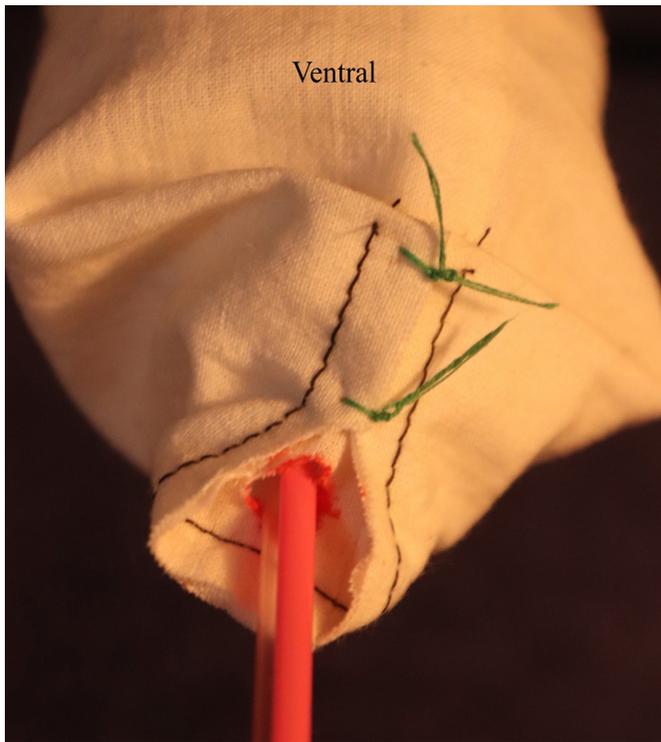
The anvil shaft is attached to the stapler. During the stapler is closed, it is drawn back slightly and thanks to that the tightness of rectal stump is lessened and the tennis racket formed linear line can be pushed into the retainer. The handle of the racket moves on to the deepest part of the retainer (Fig. 5). By firing the stapler, the procedure is terminated and slightly oblique inverting end-to-end colorectal anastomosis is performed.



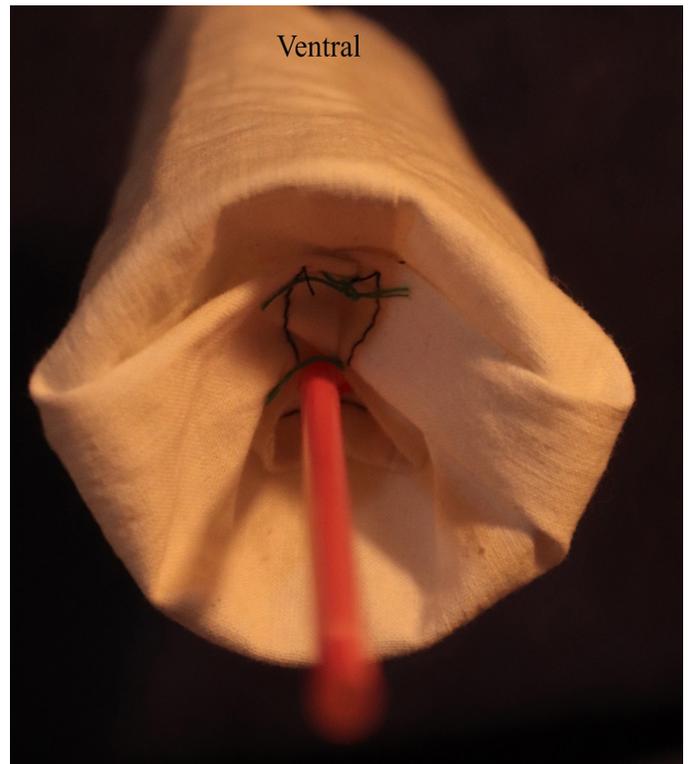
**Figure 1)** The linear staple line and the dog ears on each side of it in the model. Longer staple line causes more prominent dog ears



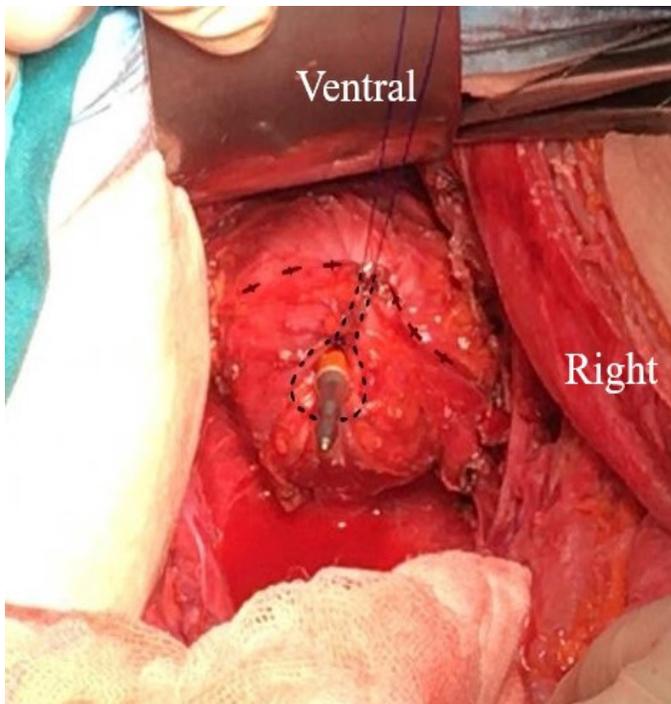
**Figure 2)** An operation view showing perforation of the rectal stump by the spike of the staple. Note that the perforation site is just ventral to the center of the linear staple line



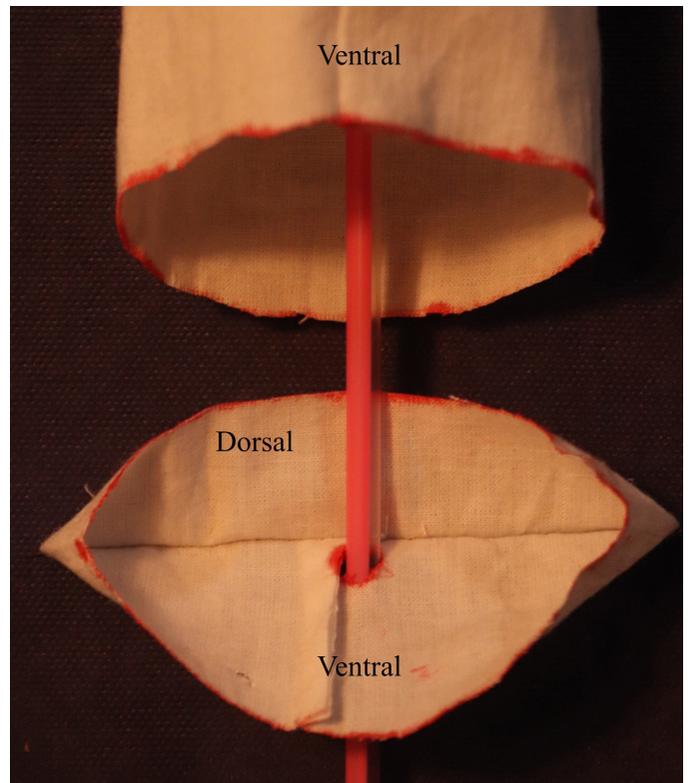
**Figure 3)** To form a tennis racket shape by two sutures in the model. Note that enough space is left around the spike



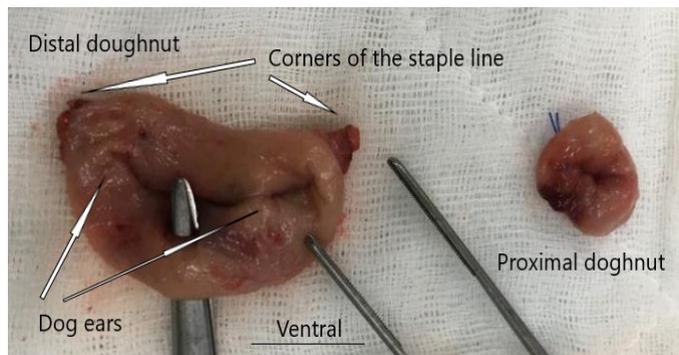
**Figure 5)** Pulling the tennis racket into the retainer of the stapler in the model. Note that the handle of the racket contains three folds of the wall and it moves into the deepest part of the retainer



**Figure 4)** Forming a tennis racket shape is shown in an operation view. The dotted line marked the staple line, and the dashed line marked the rectal wall folding in the handle of the racket



**Figure 6)** Forming of the bean-shaped doughnut and the truncated cylinder in the model



**Figure 7)** The proximal and distal doughnuts in an operation. Note the differences in diameters and shapes. The proximal doughnut is circular and small, and the distal one is bigger and in bean-shaped, and it contains all the linear staple line including the dog ears

## Discussion

The authors suggesting the dog ears are a problem in DST tried new techniques combining the advantages provided by DST and the anastomosis ability with inversion characteristics provided by SST, but not causing dog ears, such as suturing in the linear staple line, modified DST techniques eliminating one dog ear, and transanal invagination or eversion methods by KOL™ circular stapler. In this study, the author introduced a technique he used in his clinical practice. This technique had small differences from the suture techniques described previously. Hazama sutured the staple line between two corners over the trocar by one suture [8]. Roumen performed a similar technique by two sutures [6]. Asao used a mattress suture creating an omega form and suggested usage of a second suture if it is required [9]. Kang used a simple running suture, and Chen banded together with two corners by a suture around the trocar laparoscopically [10,11]. Contrary to those authors, Foppa did not use a suture in the technique of “reverse smile” [12].

In the technique reported in this study, the author suggested to form a bulky cylinder around the anvil shaft, to be taken out the spike of the stapler from just ventral of the center of the staple line on the rectal stump, and to form a tennis racket shape from the staple line.

In the completed anastomosis, the size of the site of the distal doughnut perforated by the spike is larger and the remaining rectum is in a truncated cylinder shape instead of a whole cylinder (Fig. 6). The oblique surface of this truncated cylinder faced to anterior or to the right. The dorsal side of the rectal stump is slightly longer than ventral side, and thanks to this, the tightness of the dorsal staple line may be

lesser. It is seen that the doughnuts are in different sizes and the rectal doughnut including the all the linear staple line is in a bean shape instead of in a circle (Fig. 7).

This technique was performed in various clinics and various periods by only one trainer surgeon, and therefore a comparative series providing to be evaluated the clinical results of this technique could not be composed and the specific rate of the anastomotic leakage of this technique was not identified yet.

This technique may be used in both open and laparoscopic operations in all segments, and it may provide an anastomosis eliminating the dog ears even in the wide rectal stumps with long staple lines after anterior resections or sigmoidectomies. The factor determining the resectable length of the staple line is the volume of the stapler's retainer.

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