

## **A NEW APPROXIMATOR USED IN MICROVASCULAR ANASTOMOSIS**

Dear Editor,

**M**icrosurgery is a valuable discipline performed in many surgical practices. In literature, hundreds of studies dealing with different aspects of microsurgical practice including studies about new agents for anastomosis, different suturing materials and methods plus new models for surgical training, etc.,<sup>1-3</sup> have been published. However, not much attention has been given to the newly developed microsurgical equipments. For decades, traditional clamps, micropoorteqes, forceps, dilators, and approximators have been slightly modified.<sup>4-8</sup>

To bring a new dimension to this field, an interesting and a useful microvascular approximator which will be hopefully attractive for the microsurgeons, particularly for the beginners has been designed.

The device is a simple, regular 1.8 cm double-micro-clamp based on a rectangular light green plate, which provides a complementary underground. There are three L-shaped flexible rods hinged on the base at 0°, 90°, and 180°. These rod ends have curved ends which help to hold sutures inside (Fig. 1). In addition, the main trunk of the double clamp is fixed to the base with two independent joints which enables the vessel in the clamps to move back and forth, up and down without distortion. This two way action of the approximator maintained by the simple double-joint system also prevents the vessel from getting out of the operative field when the vessel is rotated around itself (Fig. 2).

Initially, distal and proximal ends of the vessel are identified. Routine steps like irrigation, dilatation, and adventitia removal are done as usual. After that, to place the vessel ends on the plate, third mobile rod, which is on the top is displaced from its original position (Fig. 2a). First suture is placed at 0° and the suture is left long to be attached to the rod 1. Next suture is placed 180° away from the first, and is attached to rod 2 in the same manner. Third suture is placed in the middle of previous sutures (90°). After this step, the mobile rod (rod 3) is approximated to the top of the field and is connected to the 90° suture. This gives the vessel a tent-like shape where the back wall can be easily seen (Fig. 2b). Successive sutures are placed in between these stay sutures according to the vessel size and thus the front wall suturing is over now.

Afterwards, first and second sutures which were attached to rods 1 and 2, respectively, are de-attached without cutting. However, the third suture connected to rod 3 is cut short and removed from the operative field (Fig. 3). Later, the double microclamp system is turned upside down with the help of the two-joint mobile system which prevents vessel distortion. Hence, the back wall can be clearly visualized (Fig. 2c). Zero and 180° long suture ends are again attached to rods 1 and 2, respectively. Two hundred seventy degree suture is placed and as before, the third mobile rod is brought to the field for attachment. Other sutures are placed as described above. After carrying out these steps successfully, all the sutures are cut short, rods displaced, and clamps removed (Fig. 2d). Gross prototype of the device is demonstrated in Figure 4.

In summary, this newly designed approximator introduces many advantages. It is simple and has a relatively low cost. As the surgeon gets used to the device anastomosis,

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\*Correspondence to: Karaca Basaran, M.D., Plastik Cerrahi Departmani, Istanbul University, Tip Fak, Hastanesi, Monoblok Binasi, Capa Millet Cad, Fatih-Istanbul. E-mail: basarankaraca@gmail.com

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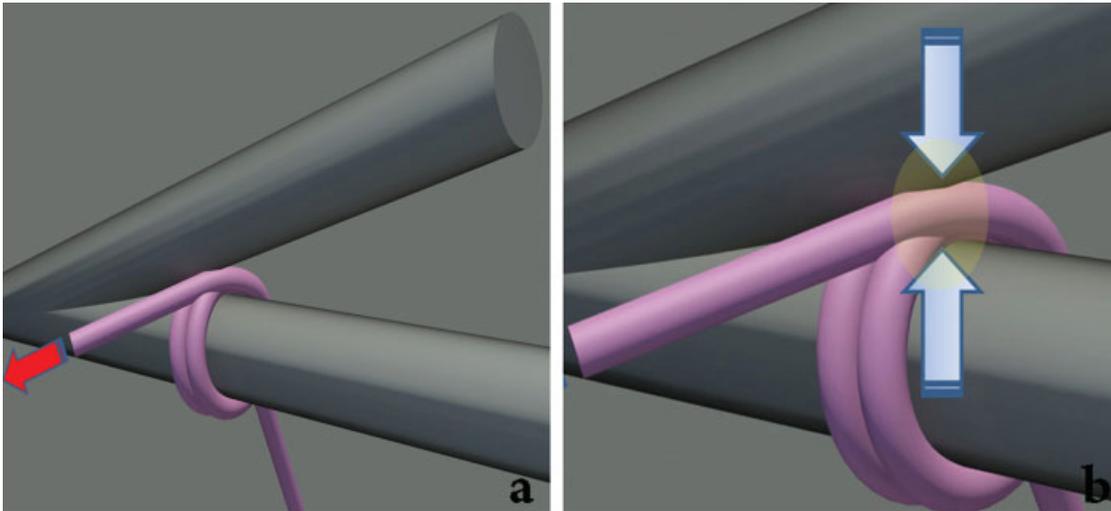


Figure 1. Demonstration of the method of holding the suture between rod ends. Note the sharply curved rod ends which keep the suture held tightly in place. [Color figure can be viewed in the online issue, which is available at [www.interscience.wiley.com](http://www.interscience.wiley.com).]

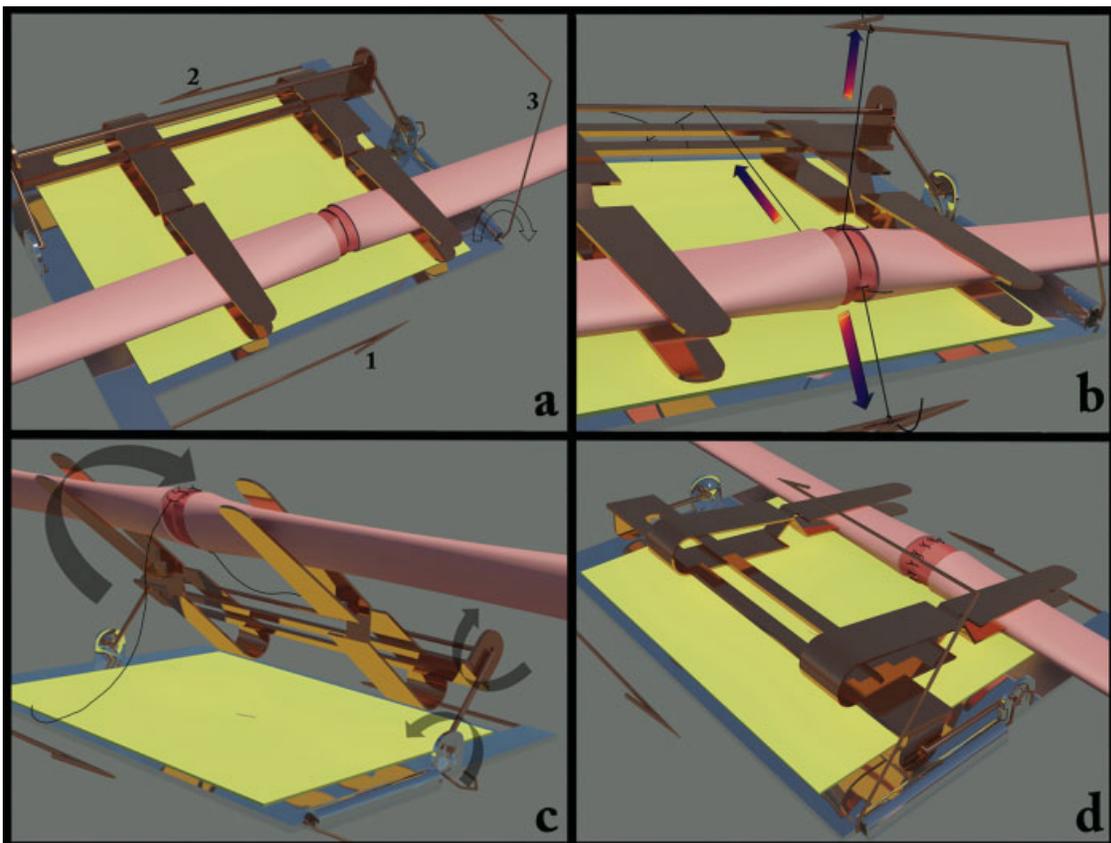


Figure 2. Schematic model of the approximator. A simple, regular double-microclamp is fixed on a plate with three L-shaped flexible rods hinged at  $0^\circ$ ,  $90^\circ$ , and  $180^\circ$ . **(a)** First rod (1) stands on the surgeon side, whereas the second one (2) is placed behind the plate. Third rod (3) is constructed above the plate in the middle, which is mobile unlike the others. **(b)** Tent-like shape of the vessel after placement of first three sutures. **(c)** Double-microclamp system is turned upside down with the help of the two-joint mobile system fixed to the base. Back wall is now ready to be sutured after this manoeuvre. **(d)** Suture ends are cut short and rods displaced. Anastomosis is finished now. [Color figure can be viewed in the online issue, which is available at [www.interscience.wiley.com](http://www.interscience.wiley.com).]

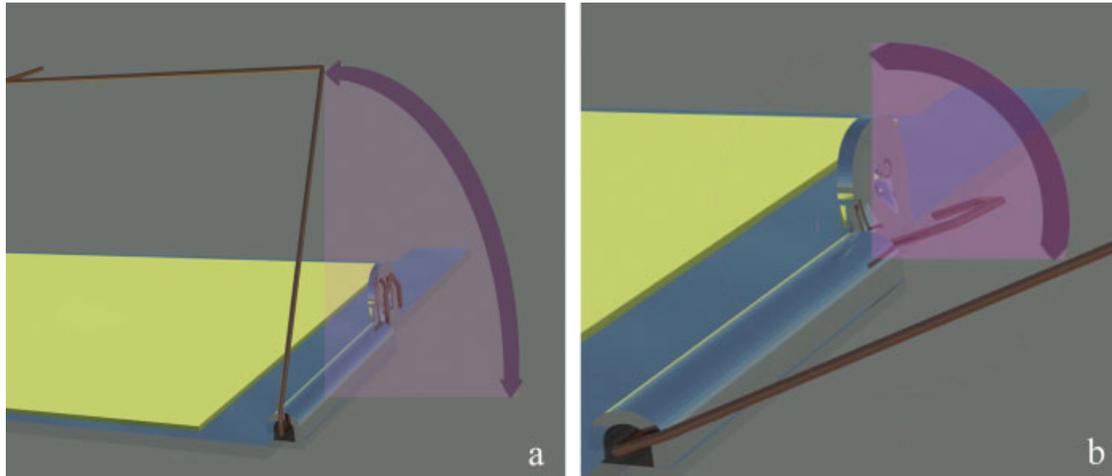


Figure 3. Schematic drawing of the mobile rod 3. It can move easily on the axis of the arrow demonstrated (a). Note that it has a maximum 90° of motion. Its further movement inside the operating field is restricted by the mechanism demonstrated in (b). Surgeon brings this rod just before the placement of the 90° and 270° knots. [Color figure can be viewed in the online issue, which is available at [www.interscience.wiley.com](http://www.interscience.wiley.com).]

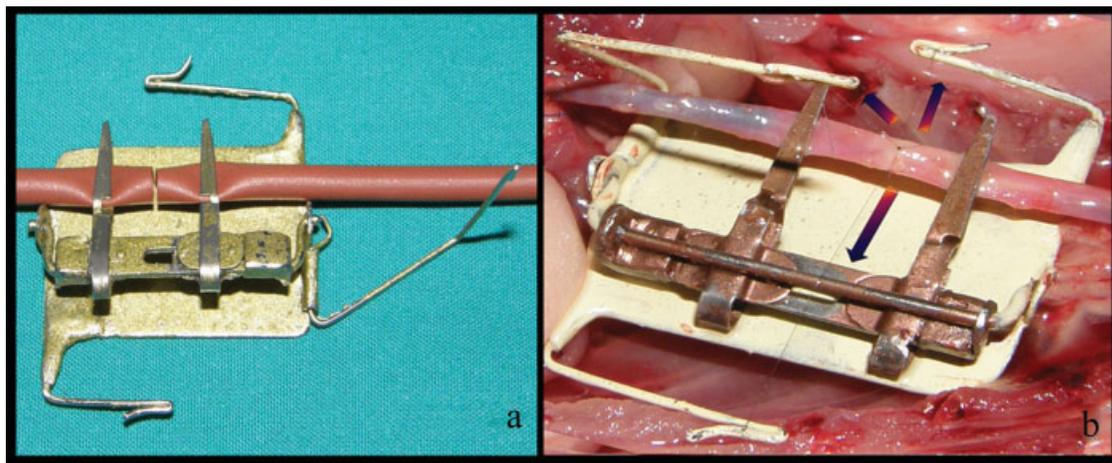


Figure 4. (a) Gross prototype of the approximator. (b) Anastomosis being performed on cadaveric rat aorta. Double clamp is 1.8 cm in length and vessel is about 2.2 mm in diameter. For the purpose of demonstration, all surrounding tissues were removed. [Color figure can be viewed in the online issue, which is available at [www.interscience.wiley.com](http://www.interscience.wiley.com).]

time gets shorter which then minimizes the ischemia induced tissue damage. With the help of three stay sutures, surgeons can easily perform anastomosis without assistance and most importantly vessels tent-like shapes reduces the possibility of back wall suturing due to the good exposure of all walls. In addition, it can also be used in different tasks especially for holding retracting stitches during end-to-side anastomosis or nerve coaptations, etc.

However, disadvantages, too, are present. From the financial perspective, more suture material is used compared to the traditional method. Second, operative placement of the apparatus may be time consuming for

surgeons. The use of this method may be difficult especially in narrow operative fields like fingers and deep body cavities, etc. To overcome this problem, different sized clamps can be designed according to the vessel size. Third, device requires an adaptation period. This can be burdensome for the experienced surgeons who are used to perform anastomosis with conventional clamps.

Finally, this firstly designed approximator with its axial rotational movement makes anastomosis easier compared to the previously reported models<sup>9,10</sup> as well as the traditional clamps. It enables the surgeon to visualize the details of the vessel walls and understand the general

structure of microvascular anastomosis. This is particularly important for the beginners.

It should also be stated that this device is manufactured without any financial support. Main target of this study is to enable safer and faster anastomotic techniques with newly developed devices. The device is not commercially available as it is mainly designed for presenting new ideas and innovations to the field of microsurgery without any financial interest. Though our plan is to use this instrument in experimental practice, with minor modifications and revisions by the readers, we hope it will deserve a place in clinical practice, as well.

**MEMET YAZAR, M.D.**  
**KARACA BASARAN, M.D.\***  
**ERDEM GUVEN, M.D.**  
**ALPER METE UGURLU, M.D.**  
**MURAT TOPALAN, M.D.**

*Faculty of Medicine, Department of Plastic  
 Reconstructive and Aesthetic Surgery  
 Istanbul University  
 Istanbul, Turkey*

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