Robotic-Assisted Upper Face Rejuvenation

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Summary: Robotic-assisted technology has not been used in aesthetic surgery so far. The authors examined the feasibility and potential advantages of robotic-assisted technology in upper face rejuvenation surgery, as well as utility of the tools available in the market. Forehead lift was performed along with blepharoplasty in 4 patients. Robotic da Vinci Surgical System (Intuitive Surgical, Inc.) was used at the stage of dissection. The stereo endoscope 30 degrees, 12 mm and later 8.5 mm in diameter, and the set of tools, 8 mm and later 5 mm in diameter, were used. Overall results appeared to be essentially the same as after usual endoscope-assisted brow lift. The advantages of the robotic-assisted surgery were as follows: the best possible display, scalability of the picture; lack of tremor, scalability of the movements’ amplitude; high degree of freedom of movements exceeding human capabilities; quick and easy switch between the endoscope and any of the 3 manipulating arms; and enhanced comfort for a surgeon. The drawbacks noted were as follows: cost, steep learning curve, lack of tactile feedback, and absence of instruments specially adjusted for aesthetic surgery. The authors conclude that robots will enter the field of aesthetic plastic surgery in the same way as endoscopy, the proviso being to adjust tools to the specific needs. (Plast Reconstr Surg Glob Open 2016;4:e747; doi: 10.1097/GOX.0000000000000725; Published online 14 June 2016.)

Our aim was to examine the feasibility and potential advantages of robotic-assisted technology in aesthetic surgery, as well as utility of the tools available in the market. We have chosen the upper face rejuvenation surgery as the model because endoscopy has been an established routine in this field.

Patients and Techniques
From March 2014 through April 2015, we performed the robotic-assisted upper face rejuvenation surgeries on 4 patients with moderate aging changes, all women of 37 to 45 years of age. Forehead lift was performed along with upper blepharoplasty in each case under endotracheal anesthesia; the lower blepharoplasty was performed additionally in 2 patients. All patients provided the informed consent for the robotic-assisted upper face rejuvenation surgery.

The dissection plane was under temporoparietal fascia in the temple and under periosteum in the forehead with periosteum division at the upper orbital rim via 5 ports as described by Ramirez.1 There were 3 forehead 2-cm incisions parallel to the hair growth line and 2 temporal incisions of 3.5 cm each. The Vicryl sutures (Ethicon, Inc., Somerville, N.J.) 3/0 were applied to shorten the frontoparietal scalp by plication, to pull and fasten fascia temporoparietal fascia in the temple and under periosteum in the forehead with periosteum division at the upper orbital rim via 5 ports as described by Ramirez.1 There were 3 forehead 2-cm incisions parallel to the hair growth line and 2 temporal incisions of 3.5 cm each. The Vicryl sutures (Ethicon, Inc., Somerville, N.J.) 3/0 were applied to shorten the frontoparietal scalp by plication, to pull and fasten fascia temporo-

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parietalis to fascia temporalis. Wounds were closed with Monocryl sutures (Ethicon, Inc.) 4-0 and 5-0. No drains were used.

The da Vinci Surgical System (Intuitive Surgical, Inc., Sunnyvale, Calif.) was used at the stage of dissection. (See Video 1, Supplemental Digital Content 1, which demonstrates surgical set up, the robotic patient-side cart with the 3 robotic arms and the command console in which the surgeon sits. This video is available in the “Related Videos” section of the Full-Text article on PRSGlobalOpen.com or at http://links.lww.com/PRSGO/A202; see Video 2, Supplemental Digital Content 2, the real-time robotic dissection around the sentinel vein. This video is available in the “Related Videos” section of the Full-Text article on PRSGlobalOpen.com or at http://links.lww.com/PRSGO/A203.)

Lid surgery was done by conventional means. In 2 initial cases, the stereo endoscope 30 degrees (12 mm in diameter) and the set of tools (8 mm in diameter) were used (Fig. 1). In the third case, the stereo endoscope 30 degrees, 8.5 mm in diameter, and instruments, 5 mm (curved scissors, DeBakey forceps) in diameter, were used.

In the fourth case, the stereo endoscope 30 degrees, 8.5 mm in diameter, and instruments, 5 mm (curved scissors) and 8 mm (monopolar curved scissors, fenestrated bipolar forceps) in diameter, were used. Light intensity was decreased by half to avoid thermal injury. The special plastic nozzle to endoscope made of a syringe was used to avoid the contact of lenses with tissues. The scrubbed assistant was necessary for creating the entry wounds, initial optical cavity, insertion of the instruments (Fig. 2), and some final manipulations.

RESULTS
We managed to complete surgical upper face rejuvenation with the standard da Vinci tools, because there were no specialized instruments at our disposal. Overall results appeared to be essentially the same as those we obtain after usual endoscope-assisted brow lift (see Supplemental
Digital Content 3, http://links.lww.com/PRSGO/A211). Somewhat lesser swelling could be noted in those operated on with 8.5-mm endoscope compared with the 12.0 mm in diameter.

We evidence the following advantages of the robotic-assisted surgery:

• The best possible display: high-definition, 3-dimensional, scalability of the picture;
• Lack of tremor, scalability of the movement amplitude. High degree of freedom of movements exceeding human capabilities—7 levels of freedom with range of motions 90 degrees.
• Quick switch between the endoscope and any of the 3 manipulating arms, by either a surgeon or an assistant.
• Possibility of substantial distance between the entry port and the surgical target allowing manipulation “behind the horizon” of the convexities.
• Limitless distance between a patient and a surgeon.
• Enhanced comfort for a surgeon: cozy posture, effortless handling, no scrubbing with aggressive antiseptics. All this may speed up the procedure.

At the same time we confirm the known drawbacks:

• Cost
• Steep learning curve
• Lack of tactile feedback, ie, feel of tissue resistance
• Nonexistence of instruments specially adjusted for aesthetic surgery at the time.

**DISCUSSION**

After emergence of endoscopy-assisted surgery, its blend with aesthetic surgery was just a matter of time and has led to a number of new approaches and techniques. Many debates ensued as to effectiveness and overall worth of them. Nowadays plastic surgeons eagerly embrace the advantages of endoscopic technologies in augmentation mammoplasty, septorhinoplasty, and abdominoplasty, etc. Moreover, these technologies are used even in open and “semi-open” approaches.

Robotic-assisted technology is the advance of endoscopy, which brings about unparalleled achievements. As any novelty, it is hard to adopt and has many pros and cons. We are assured of great prospects of this innovation in aesthetic plastic surgery. Procedures will become more speedy and effective and less traumatic. Promotion of the robotic-assisted techniques to mid-face and neck rejuvenation surgery will surely bring about further significant advantages, ie, performing minimally invasive dissection in broader areas and with more confidence and precision as far as improved visualization and instrumentation allow. This will facilitate homeostasis and placing sutures in a confined space in any desirable site. The whole area of aesthetic surgery will greatly benefit from miniaturization of instruments and endoscopes, which may cause a real breakthrough in rhinoplasty, for example, especially with advancement of the “single-site” technology, where only 1 opening is needed. Robots will enter the field of aesthetic plastic surgery in the same way as endoscopy, the proviso being to adjust hardware to our specific needs.

The question, “What is the reason for exploiting super-expensive technology when the cosmetic goal could be achieved in a traditional low-cost way?” is very pertinent. The answer paradoxically may be found in overall mismanagement pertinent to Russia. The very expensive tools like da Vinci robots are never used to their full capacity and one can easily find a way “to play” with new machines (provided sufficient training has been obtained) with no additional costs for a patient. It is all about the surgeon’s curiosity and ambitions to advance.

**REFERENCES**

1. Ramirez OM. Why I prefer the endoscopic forehead lift. Plast Reconstr Surg. 1997;100:1039–1039; discussion 1043.
2. Simler AG. Endoscopic augmentation mammoplasty: the umbilical approach. Plast Surg Nurs. 1994;14:149–153.
3. Hwang PH, McLaughlin RB, Lanza DC, et al. Endoscopic septoplasty: indications, technique, and results. Otolaryngol Head Neck Surg. 1999;120:678–682.
4. Eaves FF III, Nahai F, Bostwick J III. Endoscopic abdominoplasty and endoscopically assisted miniabdominoplasty. Clin Plast Surg. 1996;23:599–616; discussion 617.
5. Pietrabissa A, Shrama F, Morelli L, et al. Overcoming the challenges of single-incision cholecystectomy with robotic single-site technology. Arch Surg. 2012;147:709–714.