

# Extraocular muscle surgery on goats' eye: An inexpensive technique to enhance residents' surgical skills

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Hands-on resident surgical training for various ocular procedures is essential to impart good surgical skills to the budding ophthalmologists. Here in this report, we demonstrate a simple and inexpensive technique of performing extraocular muscle surgery on goats' eye. These animal eyes possess soft tissue resemblance to that of human eyes to a greater extent in terms of scleral rigidity, muscle elasticity, its width, thickness, and its insertion onto the sclera. Therefore, rectus muscle recession, resection, and plication surgeries can be performed repeatedly to improve an individual's orientation and practical experience before performing the procedure on human eyes.

**Key words:** Extraocular muscle surgery, goat's eye, resident training

In routine clinical practice, accurate surgery on extraocular muscles to achieve precise ocular alignment is of paramount importance.<sup>[1]</sup> Hands-on experience of the young strabismologists is an important task during their residency training program to enhance surgical skills.<sup>[1-6]</sup> However, this has to be balanced with the increased risk of complications which can occur in procedures carried out by residents. In the literature, there have been numerous efforts to enhance surgical skills by teaching surgeries on simulating extraocular muscles (bacon, chicken, rabbit eyes, and noncadaveric model eyes).<sup>[1-5]</sup> However, in these observations the experiences of muscle and scleral tissue handling as compared to the human eyes are limited. Therefore, to fill this deficiency, here we demonstrate how to perform surgeries on goats' eye extraocular muscles.

## Surgical Technique

At our national ophthalmic surgical skill development lab, the residents are regularly trained for cataract and corneal suturing techniques on goats' eye under direct supervision by the senior resident. After obtaining goats eyes from a local slaughterhouse, a careful inspection was performed to identify the rectus muscles; eyes with good muscle strength and length of more than 12–15 mm were included for the observation. These eyes were then fixed on a mannequin head module, in such a way that the muscle, its insertion, and the posterior sclera till the optic nerve is clearly visible. The free end of the muscle is then tied onto a rubber band

and placed away from the globe so as to simulate the elastic strength in the muscle.

Using a 6–0 polyglactin absorbable suture bites were taken along the insertion of extraocular muscle (0.5 mm from insertion) and after taking bites for entire width, the knots are interlocked to secure the muscle tightly. With the help of a scissor, the muscle is disinserted and secured back. To recess the muscle, using gentian violet, markings were made along the scleral surface in the original direction of muscle. For convenience, a mark is placed at 6–8 mm from the insertion with the help of a Castroviejo caliper. The residual ends of 6–0 polyglactin suture needles are then passed at the marked site by taking a partial thickness scleral bite and the muscle is secured by placing two to three firm knots [Fig 1].

In the second exercise, a resection surgery was performed. The muscle is marked along its surface using a gentian violet marker at 6 mm (our convenience) from the insertion. The initial suture bites are taken along the 6 mm mark and the muscle is dissected just anterior to it, followed by the removal of residual muscle stump. The muscle is advanced and sutured onto the insertion site to achieve the desired results of muscle resection [Fig 2].

In the third exercise, a muscle plication was performed. After marking the muscle along its surface at 6 mm from the insertion,

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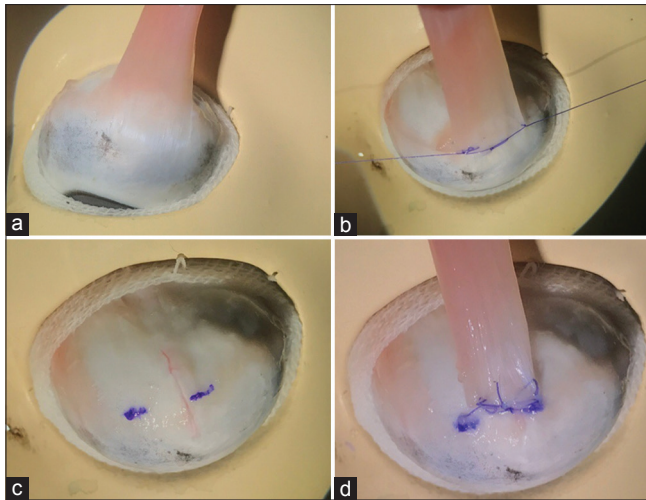
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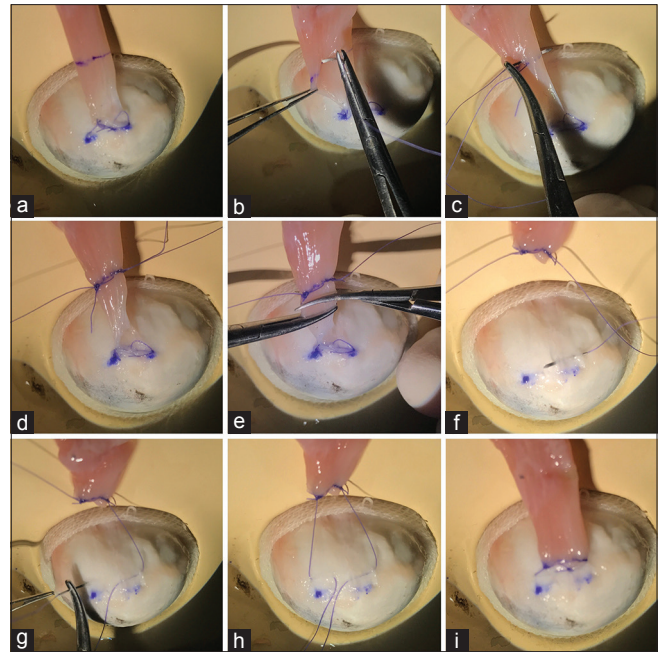
**Figure 1:** (a) Positioned globe with rectus on the mannequin head. (b) Around 0.5 mm from the rectus muscle insertion 6-0 polyglactin suture is passed. (c) The rectus muscle is disinserted and the amount of desired recession was marked using GV paint. (d) At the desired location of the recession muscle is re-sutured

6-0 polyglactin sutures are passed to secure the muscle. These suture ends are then brought anteriorly and passed through a partial thickness sclera just in front of muscle insertion, the sutures thread in between are titrated and advanced toward to anterior scleral bite so as to create a fold beneath and plicate the muscle. While performing these procedures, muscle and lens hooks were used like as in a routine manner.

## Discussion

Surgical hands-on training during various residency training programs, at various conferences and workshops, continues to evolve in the present competitive world with increasing expectations. These efforts are in continuation with the widespread technological advances in the field of simulation so as to resemble the biological tissues to a larger extent. Among the noted observations, artificial eyeballs with extraocular muscles, pig's eyes, and rabbit eyes with externally supplemented other animal extraocular muscles have been used to refine the surgical skills.<sup>[2,5]</sup> However, these externally supplemented biological tissues are likely to have a lesser resemblance to the practical scenario; therefore, a simple and inexpensive technique with a better tissue resemblance to human eyes will be of greater benefit to the young practitioners.

Through this report we would like to highlight the utility of goat's eye as an alternative module to hone surgical skills as compared to other artificial and other less realistic methods. This is due to 1) Human eye resemblance of the sclera and the muscles with respect to its anatomical and morphological features. 2) Tissue handling and suturing techniques were much more realistic in experience as compared to an externally supplemented chunk of chicken and bacon muscle tissue. 3) In Indian setups with genuine scarcity for expensive laboratory and artificial modules, cheaper and easily available goats' eyes can be used as better alternatives. However, limitations of our technique are 1) lack of real conjunctival or tenon's tissue handling experience, 2) availability of extra space around the muscle and the globe, as compared to human eyes, and 3) lack of questionnaire-based evaluation. However, our main intention



**Figure 2:** (a) The rectus muscle is marked at the desired location of resection. (b-d) The muscle is secured with 6-0 polyglactin sutures. (e) After clamping the muscle, it is cut just anterior to the sutures. (f-i) The resected muscle is secured back to its original insertion site

here is to show the possibility of this better surgical procedure on goats' eye as a technique. Therefore, this observation unveils the newer possibilities of surgical training at lesser cost and also to compare and contrast different techniques to build a better platform for resident training in future.

To conclude, goats' eyes with intact extraocular muscles can be considered as a better and cheaper alternative to traditional expensive modules, to train our residents, and refine their surgical skills in strabismus.

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## Conflicts of interest

There are no conflicts of interest.

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