

AN EXPERIMENTAL STUDY ON THE USE OF FIBRIN SEALANTS IN STRABISMUS SURGERY*

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SUMMARY: Erbil H, H, Sınay S, Süllü Y, Kandemir B. (Departments of Ophthalmology and Pathology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey). An experimental study on the usage of fibrin sealants in strabismus surgery. Turk J Pediatr 33: 110-116, 1991.

Fibrin sealants were used in place of the classical suture materials in strabismus surgery. Classical recession operations were performed on the right eyes of ten albino rabbits, while the recessed anterior rectus muscles of the left eyes were fixed to the sclera with the tissue sealant. Better histopathological results were obtained with the fibrin sealant than with the classical sutures, but the functional results were worse.

Key words: fibrin sealant, strabismus surgery, extraocular muscles.

Strabismus is a major ophthalmic problem, particularly in children, because it often results in amblyopia, but can also lead to psychological and asthenopical problems. Suturing attempts and suture materials used in surgical techniques to either reduce or induce the strength of extraocular muscles can cause some well known complications. Nurözler et al¹ reported the following postoperative complications, all due to suturing, that they had observed after performing strabismus surgery on 191 horizontal muscles: scleral perforation (1.57 %), acute allergic suture reaction (2.09 %), and chronic suture granuloma (1.04 %). Although these rates are not high, to prevent such complications, disappointing both for the surgeon and the patient, we suggest that tissue adhesives be used instead of sutures in certain surgical procedures.

Tissue adhesives are either synthetic (acrylates, gelatin-formaldehyde-resorcin) or natural (fibrin sealant)². Synthetic tissue adhesives have been found to be too toxic for clinical treatment purposes³. Fibrin sealants are highly concentrated homologous cryoprecipitates accelerating natural wound repair⁴.

The present study was carried out on experimental animals to ascertain if fibrin sealants could be used in place of sutures when attaching sclera to muscles in strabismus surgery.

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Material and Methods

Recession operations were performed on the anterior rectus muscles of both eyes of ten albino rats under general anesthesia, in which the animals had inhaled ether and had been administered ketamine intramuscularly.

The recessed muscles of the right eyes were fixed to the sclera with 6-0 vicryl sutures and the muscles of the left eyes were attached by using a fibrin sealant. The sealant kit we used (Tisseel) contained fibrinogen, factor XIII, fibronectin, thrombin, aprotinin and CaCl_2 , and two solutions prepared at 37 °C which were mixed in a special double lumened injection system (duploject system) just before application. In order that the sealant take effect, the muscle end of the eyes was brought next to the scleral tissue and was held there steady for five minutes. All conjunctivas were closed by suturing. Postoperatively, the eyes were left open and antibiotic eyedrops and ointments were applied daily. On the seventh day postoperatively, all the eyes were enucleated and examined anatomically and histopathologically. The histologic sections were stained with hematoxylin and eosin (H + E).

Results

None of the ten eyes in which the muscles were fixed to the sclera by suturing showed anatomical problems. In two of the ten eyes, in which the fibrin sealant was used, the recessed muscles retracted to the orbital space, dislodging from their new insertions upon the release of the muscle forceps. These eyes were not included in the histopathologic examinations. The H + E stained histologic sections prepared from the muscle sclera junctions showed the following microscopic findings: in both suture and sealant groups, tissue integrity was obtained between muscle and sclera (Figs. 1 and 2). Microscopic examination at higher magnifications of the suture group revealed that some of the muscle fibers had atrophied, while others had been replaced with connective tissue, and that there was a decrease in the striations of the muscle fibers (Fig. 3). In the sealant group, the striations were fully preserved, but some muscle fibers had lost their polygonal structures and had formed round shapes (Fig. 4).

Discussion

In all the histologic sections, the muscle tissues of both the adhered and the sutured segments were alive and integral. Microhematomas were observed at the operated sites of the suture group, but were not present in the newly formed insertion areas of the sealant group. Fibrinogen, factor XIII and thrombin included in the sealant were effective in inducing hemostasis.



Fig. 1: Complete tissue integrity between muscle and sclera can be seen in the suture group (H + E $\times$ 100).



Fig. 2: Complete tissue integrity between muscle and sclera is maintained in the sealant group (H + E $\times$ 100).

Tissue destruction and muscle fiber atrophy may occur, to some extent, due to surgical trauma. But the histopathologic sections showed trauma resulting from suturing, which perhaps is caused by the suture material used. This complication was observed much less in the sections of the eyes in which fibrin sealant had been used.



Fig. 3: Higher magnification of Fig. 1 shows lack of some muscle fiber striation and displacement of some fibers with connective tissue (H + E $\times$ 200).

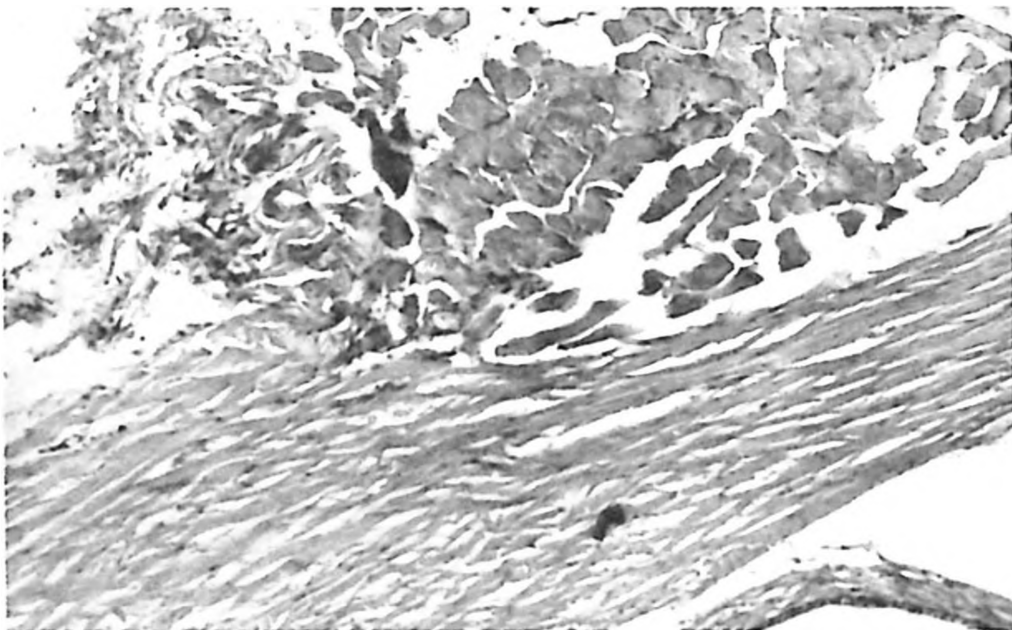


Fig. 4: Higher magnification of Fig. 2 shows, generally, that normal histologic structure of muscle fibers is preserved but some formed round shapes (H + E $\times$ 200).

We found that the greatest drawback in using the sealant was its insufficient adhesive properties which resulted in the retraction of the muscle from its original insertion to the retroocular orbital tissue. Although tissue adhesives provide a better microscopic impairment base, it seems that they must be used in

combination with sutures, at least in strabismus surgery. It may be possible to use sutures and sealants together, since the sealant aids in maintaining hemostasis and in accelerating wound healing, but we did not attempt this technique. Aichmair, et al⁵ reported successful experimental results with this combined surgical procedure, but they did not include a control group in their study in which only suturing was used.

The second major drawback that we discovered in using the sealant is that there is broader adhesion of the muscle to sclera than required because the sealant spread on the new insertion line seeps down into the muscle pathway. The resulting amount of recession (or resection) will over or under correct the deviation which the surgeon plans and in spite of excellent surgical planning, unsuccessful results are not a surprise. In addition, sliding of the insertion back from the equator will produce restrictions of eye movements. Flick⁶ who was rather sceptical about this method, pointed out in his report that sealing was sometimes so rapid that a correction could not be made during the operation.

In ophthalmology, fibrin tissue sealants have been used experimentally in the reconstruction of corneal and conjunctival wounds^{7,8}, and lens capsule perforations⁹, but reports of gluing extraocular muscles with fibrin in strabismus surgery are extremely rare.

Although our results showed positive effects with fibrin sealants, we believe that it is still too early to use these adhesives in strabismus surgery. Careful microsurgery and advanced suture materials will further reduce the complications of classical surgical attempts.

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