Use of biodegradable collagen-glycosaminoglycan copolymer matrix implant to reduce postoperative fibrosis in strabismus surgery

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Abstract:
The occurrence of restrictive strabismus after conjunctival surgeries is widely described in the literature. Fibrosis causes adherence of the conjunctiva to the Tenon's capsule, intermuscular membrane, adipose orbital tissue, sclera, and extraocular muscle tissue. Fibrosis causes adherence of the conjunctiva to the Tenon's capsule, intermuscular membrane, adipose orbital tissue, sclera, and extraocular muscle tissue. We report a case of the use of a biodegradable collagen-glycosaminoglycan copolymer matrix implant (Ologen®) as an alternative adjuvant, used as a spacer to mechanically separate the subconjunctival and episcleral tissues to prevent fibrosis in a patient undergoing a surgical correction for a strabismus with a restrictive component due to previous surgeries of pterygium excision.

Keywords:
Biodegradable collagen-glycosaminoglycan copolymer matrix implant, strabismus, surgery

Introduction
The occurrence of restrictive strabismus after conjunctival surgeries is widely described in the literature. Fibrosis and formation of subconjunctival scars are also among the main postoperative complications of strabismus surgeries; they occur in 10% of primary surgeries and 50% of reoperations, making the results more unpredictable.[2] Fibrosis causes adherence of the conjunctiva, the Tenon’s capsule, intermuscular membrane, adipose orbital tissue, sclera, and extraocular muscle tissue. Inappropriate surgical approach, severe bleeding, excessive cauterization, suture reaction, infection, muscle capsule injury, and multiple procedures performed in the same region may lead to adhesions. Adequate surgical technique may prevent most cases of postoperative fibrosis; however, there are factors dependent on the patient’s inflammatory response.[3]

This is a case report in which we used a biodegradable collagen-glycosaminoglycan copolymer matrix implant (Ologen®) as an adjuvant to prevent fibrosis in a patient undergoing a surgical correction for a strabismus with a restrictive component due to previous surgeries of pterygium excision.

Case Report
A 68-year-old Caucasian female patient went to the ophthalmology service with a history of two procedures for pterygium excision in the left eye 12 years ago and convergent strabismus for approximately 11 years. She complained of intermittent diplopia in the primary position of gaze and denied previous strabismus surgery.

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There were no other known comorbidities and medication use. No family history of ophthalmic disorders. At the examination, she had visual acuity of 1.0 OU, normal intraocular pressure, and fundoscopy. Biomicroscopy showed intense fibrosis in the perilimbar nasal conjunctival region. In the motility, she had left esotropia of 25PD with −5 left lateral rectus restriction. Right eye ductions were normal. Passive forced duction test demonstrated a marked limitation of abduction in the left eye without further alterations. In the force generation test, we noticed moderate stride. We planned to correct the strabismus surgically. During surgery, we confirmed fibrosis in the region of the medial rectus with the presence of adipose tissue adhered to the muscle. After cleansing the region without deinsert of the medial rectus, there was a great improvement in the abduction limitation, which went from intense to mild. With this improvement and considering what we found around the muscle, we chose not to move the muscle at that first moment, and we injected triamcinolone at the surgical site. The patient had partial improvement of the ocular alignment in the 1st days, returning to an even greater esotropia angle than before the surgery a few weeks.

We then programmed the second procedure, when we cleaned the fibrosis and recessed the medial rectus 5 mm. At the end of the surgery, we placed the implant between the muscle and the Tenon’s capsule and sutured it to the episclera [Figure 1]. We also performed a 7-mm lateral rectus resection and sutured the conjunctiva in the usual way. In the postoperative period, we observed constant ocular alignment up to 1½ years of follow-up, improvement of the diplopia, and improvement of the forced duction test, maintaining abduction and mild abduction limitation of the left eye on passive forced duction test. On examination in the slit-lamp, we also noticed greater conjunctival mobility, demonstrating less fibrotic process in the region [Figure 2].

**Discussion**

The formation of fibrosis, that occurs in different degrees after conjunctival surgeries, can compromise the postoperative result of strabismus surgeries and also cause restrictive strabismus if the adhesion between the muscle and the conjunctiva is intense enough to limit the muscle action.

Migration, proliferation of fibroblasts, synthesis, and remodeling of collagen form the scar. Fibroblasts transform into myofibroblasts, which transmit contraction force by altering the organization of collagen fibers. The deposition and organization of the new collagen forms the scar, which may limitate extraocular muscle motility. The amount and intensity of cicatricial formation increases according to the number of surgeries in the same surgical site. The need for new surgical interventions generates additional tissue damage.\[2\]

Efforts to reduce adhesion and fibrosis after strabismus surgery began in the late 1960s. In 1967, Dunlap\[3\] proposed the use of plastic implants in surgeries involving extraocular muscles, an idea that was developed in subsequent years with different materials. The material initially used was silicone sheath. However, nonabsorbable materials showed unsatisfactory results and their use were discontinued due to the intense inflammatory reaction and frequent extrusion.

Subsequently, some studies were done with mechanical barriers using polydioxanone, polytetrafluoroethylene, Seprafilm, polyglactin 910 sheath, SurgiWrap, sodium hyaluronate, and hydroxypropyl methylcellulose.\[4\] Foreign body reaction and infection were uncommon with the use of these materials, but their efficacy in preventing postoperative fibrosis did not yield good results. de Carvalho et al. demonstrated that

![Figure 1](image1.png)

*Figure 1: (a) Ologen implant, which we cut by half to use, (b and c) The implant being placed on the surgical site, over the nasal conjunctiva*

![Figure 2](image2.png)

*Figure 2: Pre- and post-operative pictures in the primary position*
Further case series and comparative studies would help to confirm its benefit in the treatment of restrictive strabismus.

**Declaration of patient consent**
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**
The authors declare that there are no conflicts of interests of this paper.

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