Summary

✓ Pathologic myopia is the seventh leading cause of blindness in the US and two percent of Americans have the disease; Canadian statistics are not available.

✓ Pathologic myopia involves elongation of the eyeball and scleral support surgery aims to control the progression of this elongation. The most commonly used technique involves placing a strip of sclera from a donor eye around the eyeball to prevent further stretching.

✓ Due to variable trial designs and variable patient characteristics, this review determined there is insufficient evidence to establish the clinical efficacy of this procedure.

✓ More robust evidence is required, using standardized techniques and standardized outcome measures, before a meaningful evaluation of scleral support surgery can be conducted.

The Technology

Pathologic myopia involves elongation of the eyeball. Scleral support surgery aims to reinforce progressively thinning sclera (the white outer coat of the eyeball) and prevent further stretching of the eyeball. Borley and Snyder first reported use of this procedure using human donor sclera in nine patients in the US in 1958. A follow-up report by Miller and Borley in 1964 summarized 63 cases. The procedure used in these reports was complex and increased complications in several operated eyes. In the 1970s, Snyder and Thompson described a simplified technique for scleral support in a total of 62 cases (the Snyder-Thompson technique). Among the revisions to the surgical protocol were the omission of scleral resection and the use of cryosurgery (extreme cold) instead of diathermy (heat) to treat peripheral retinal degeneration. The Snyder-Thompson technique involves scleral grafts from donor eyes. The graft is placed under the four muscles that surround the eye and is positioned over the back curvature of the patient’s eyeball.

Regulatory Status

Surgical techniques are not subject to standard regulation. No surgeon in Canada is known to perform scleral support surgery. The literature suggests at least seven centres around the world perform this procedure.

Patient Group

Pathologic myopia can occur in one or both eyes and has a strong genetic predisposition. It typically develops by adolescence and is characterized by an elongated eyeball that continues to stretch with age, resulting in progressive myopia, or nearsightedness. In many cases, this anatomical change leads to serious complications and loss of central vision. Typically the macula (a small area of the retina responsible for central vision) is damaged by new blood vessels (neovascularization) which grow abnormally from beneath the retina and lead to retinal haemorrhage, edema, scarring or detachment. The Snyder-Thompson technique has been used in patients with (1) myopia of greater...
than 7 to 8 diopters (D), (2) decreasing vision, (3) increasing axial length, and (4) increasing macular degeneration.4

The prevalence of pathologic myopia is highly variable across countries.5 Pathologic myopia is the seventh leading cause of blindness in the US and two percent of Americans have the disease.5 Canadian statistics are not available.

Current Practice

No effective therapy is known that halts disease progression in pathologic myopia. Currently-used options only treat complications of the disease and include vision correction,6 drug therapy for neovascularization7 and laser treatment or surgery for retinal detachment.5,8

The Evidence

Eight studies were identified for this assessment of scleral support surgery: two studies, reported in six publications, from Russia;9-14 two studies from two US centres;15,16 and one study each from Australia,17 China,18 Hungary19 and Slovakia.20 Six studies were based on the Snyder-Thompson technique9,15,17-20 and two studies12,16 were based on a surgical protocol developed by Curtin in the US using fascia lata from the leg as graft material.

The eight studies describe a total of 2,537 operations. Surgery was undertaken in both eyes in 17-87% of patients in five studies.9,12,17,18,20 Patient age ranged from 2 years to 62 years across six studies. Four studies were case series15,17,19,20 and three studies compared findings of the operated eyes, with unoperated eyes acting as controls.9,12,16 The study in China by Wang (1996),18 compared three groups: cases, controls and those having undergone radial keratotomy (a surgical procedure involving incision of the cornea). Over 40% of the total operations were performed in children and adolescents. Donor sclera was used alone or in combination in five studies9,15-17,20 and fascia lata in four studies.12,16,19,20 Porcine skin was the primary graft material in one study.20 Baseline myopia ranged from 6 D to 39 D across seven studies, with a yearly progression of 0.5 D or more.

Follow-up was reported in seven studies and ranged from 3 months to 16 years. The number of cases at follow-up was 1,932 (76%). Across four studies, stabilization or improvement of visual acuity was observed in at least 85% of cases, at up to 14 years of follow-up.12,15,17,20 Four studies reported on changes in refraction at follow-up.9,12,16,20 A study by Avetisov (1997),9 in patients aged 8 to 15 years, reported stabilization (a change of 2 D or less over follow-up) in 867/906 cases (96%) at one year, and 651 cases (72%) at seven years post-surgery. The respective figures in 318 controls were 219 (69%) and 106 (33%). The relative benefit of scleral support surgery was 1.4 (1.3 to 1.5) at one year, and 2 (1.8 to 2.5) at seven years. A second procedure was performed in 18 cases (2%), displaying a yearly visual change progression of greater than 1 D following the initial procedure. In an additional 31 cases (3%) with a yearly progression of less than 1 D, a non-surgical method (see below under the heading “concurrent developments”) was performed following the initial surgery.9 An earlier analysis of 256 cases in 219 patients (age range 7 to 48 years), at the same Russian centre, identified a number of patient baseline characteristics that adversely affected surgical results.10,11 These included early-onset myopia, childhood age, a high progression rate (1.5 to 2 D/year), recessive-type heredity and presence of comorbid disease.11

Curtin (1987)16 reported a mean change in refraction from baseline to end of follow-up of 0.77 D in 23 cases (compared to 0.71 D in 20 controls) over a period of eight years. In this study, 74% of cases were aged 8 to 18 years.
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A study by Gerinec (2001), with a patient age range of 8 to 18 years, reported a change of 1.28 D with a mean follow-up of four years (-10.96 D pre-surgery vs. -12.24 D post-surgery). Four studies, including two with controls, reported on changes in axial length; no overall significant differences were observed between cases and controls up to eight years post-surgery.

### Adverse Effects

Post-operative complications were reported in six studies: 111 of 1,565 cases (7%), with close to half the cases having acute inflammation involving ocular muscles. Significant complications across studies included retinal haemorrhage or detachment (9 cases) and problems with ocular mobility (strabismus) (4 cases).

### Administration and Cost

Pre-operative and post-operative examinations for scleral support surgery include indirect ophthalmoscopy, ultrasound measurements, fluorescein angiography, refraction and acuity measurement. The procedure involves the use of scleral grafts, is performed under general anaesthesia, and requires that the patient remain in the hospital overnight for observation. No cost estimates are presently available for scleral support surgery.

### Rate of Technology Diffusion

A few surgeons and centres throughout the world perform this procedure. The criteria for patient selection are variable, as are indications for surgery. Type and size of graft material, surgical technique and operator experience may affect surgical outcome.

### Concurrent Developments

A variety of materials have been used as scleral grafts including donor sclera, fascia lata, collagen, mersilene, polytetrafluoroethylene (Gore-Tex™) and silicone. Non-surgical methods have also been investigated. One such method consists of injecting a dose of liquid polymer at the back of the scleral surface; after polymerization the composition forms an elastic foamed gel layer over the scleral surface. This technique has been reported to have limited therapeutic effect for higher degrees of myopia (refraction exceeding 10 D).

### Implementation Issues

Scleral support surgery has been reported to slow progressive myopia in over two-thirds of cases within 14 years of follow-up. Current findings, however, are not robust due to weak trial design and loss to follow-up of about one-fourth of operated-eye cases. Moreover, there is high variability in patient baseline characteristics across these trials. Taken together, there is insufficient evidence to establish the clinical efficacy of this procedure. These studies uncover a number of factors that may contribute to procedural outcome including the extent of myopic degeneration, patient age and rate of progression of the myopia. More robust evidence is required, using standardized techniques and standardized outcome measures, before a meaningful evaluation of scleral support surgery can be conducted.

### References


