

11-0 Mersilene alone as a single running suture in corneal grafts

T.S. KALYANSUNDARAM
M.A. BEARN

Abstract

Purpose To study the safety and long-term stability of 11-0 Mersilene when used alone as a single running suture in corneal grafts.

Methods Seventeen eyes on which corneal transplants were performed with 11-0 Mersilene alone as a single running suture between October 1992 and April 1998 were entered into this study. Post-operative data were collected retrospectively on a standardised form. Mean age of patients at the time of surgery was 49.7 years. Pre-operative diagnoses were keratoconus (8 eyes), Fuchs' corneal dystrophy (6 eyes), megalocornea (1 eye), bullous keratopathy (1 eye) and irregular astigmatism following penetrating corneal injury (1 eye). Mean follow-up was 54.1 months, and ranged between 24 and 91 months.

Results Fourteen eyes (82%) achieved visual acuities of 6/18 or better. Post-keratoplasty astigmatism was $\leq 5D$ in 14 eyes (82%).

Sutures were left intact in 9 eyes for a mean period of 51.1 months (24–91 months). Complications included wound leak (3 cases), elevated edge (1 case), high intraocular pressure (1 case), sterile infiltrates (1 case) and early rejection (1 case).

Conclusion 11-0 Mersilene alone can be effectively used as a single running suture in corneal grafts. These sutures can safely be left intact for a long period due to Mersilene's non-biodegradable nature.

Key words Corneal grafts, Mersilene, Stability, Suture

In penetrating keratoplasty much attention has been focused on factors that can be manipulated by the surgeon, such as suturing technique and suture type. Different suturing techniques include double running sutures,¹⁻³ running and interrupted sutures⁴⁻⁶ either combined or alone.^{7,8} In the post-operative course several approaches are possible. The first is to remove all the sutures at a given time post-operatively.^{2,3} The second is to influence astigmatism by selectively removing interrupted sutures with or without the presence of a running suture.^{4-6,9,10} A third

approach is to adjust a running suture on its own in the post-operative period. The major disadvantage of the first method is that dramatic and unpredictable changes in astigmatism frequently occur after removal of all the sutures, even years post-operatively.¹¹ Conversely not removing the sutures in the corneal transplant carries the risk of complications associated with exposed sutures¹²⁻¹⁵ as well as astigmatic change after spontaneous dissolution.¹⁰

As long as nylon remains the main suturing material for the procedure, early and stable rehabilitation of vision with long-term control of astigmatism is impossible due to the degradable nature of nylon and risk of breakage¹⁰ necessitating its removal. Mersilene, a non-biodegradable material (polyester), is strong, shows no degradation by ultraviolet light, and is insoluble; it can thus be left *in situ* and the regulation of post-operative astigmatism by suture adjustment seems possible. In the previous studies^{16,17} evaluating the visual rehabilitation and complications, a running Mersilene suture was used in combination with an interrupted 10-0 nylon suture. In the present study, we evaluated the visual results and complications arising from the use of 11-0 Mersilene alone as a single running suture.

Materials and methods

Seventeen eyes of 14 patients on whom corneal transplants were performed with 11-0 Mersilene alone as a single running suture between October 1992 and April 1998 were entered into this study. Three patients had corneal transplants in both their eyes during the same period. The surgical technique was similar in all 17 eyes. The donor cornea was cut with a 7.5–8.5 mm mounted trephine and placed into a 7–8.25 mm recipient bed. Four interrupted 10-0 nylon sutures were placed as stay sutures, followed by 14 to 16 bites of running 11-0 Mersilene suture (Fig. 1). The stay sutures were removed at the end. The Mersilene suture was tightened sufficiently to approximate the tissue, but without extra tension in the wound.

Post-operative data were collected retrospectively on a standardised form. Data were analysed with regard to age, gender,

T.S. Kalyansundaram
M.A. Bearn
Ophthalmology Department
Cumberland Infirmary
Carlisle, UK

Mr T.S. Kalyansundaram ✉
Ophthalmology Department
Royal Victoria Hospital
Belfast BT12 6BA
Northern Ireland, UK

Received: 15 August 2000
Accepted in revised form:
19 January 2001

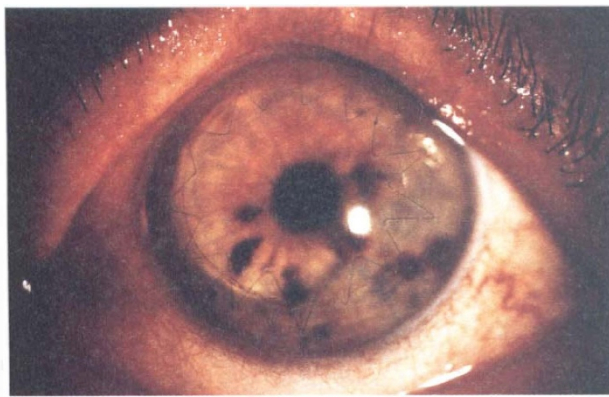


Fig. 1. 11-0 Mersilene as a single running suture in corneal graft.

pre-operative diagnosis, best corrected visual acuity, post-keratoplasty astigmatism and complications.

Results

During the study period 2 patients who did not meet the criteria of a minimum 24 months of follow-up because of their death were fully excluded from the study. Three cases of high-risk corneal grafts complicated by high intraocular pressures and further interventions were also excluded from the study.

The mean age of patients at the time of surgery was 49.7 years (range 23–85 years). Nine patients were women and 5 were men. Three eyes underwent extracapsular cataract extraction with intraocular lens implantation and in 1 eye anterior vitrectomy and secondary anterior chamber lens implantation were carried out as additional procedures. Pre-operative diagnoses, pre- and post-operative best corrected visual acuity and complications are shown in Tables 1–3. The mean follow-up was 54.1 months (range 24–91 months).

Fourteen of the 17 eyes (82%) achieved final best corrected visual acuities of 6/18 or better. Two eyes had a best corrected visual acuity of 6/24 and one patient with megalocornea achieved 6/60. Mean refractive astigmatism was 3.54 D (range 0.50–6.50 D). In 14 eyes (82%) post-keratoplasty astigmatism was ≤ 5 D (Fig. 2).

Sutures were left intact in 9 eyes for a mean period of 51.1 months (range 24–91 months). Suture adjustment was carried out in 1 eye after 6 months with a remarkable reduction in astigmatism (11 D astigmatism was reduced to 4.25 D). Sutures were removed in 8 eyes and the mean time to suture removal was 21.3 months (range 9–49 months). In 2 eyes sutures were removed due to foreign body sensation. One patient developed non-infectious

Table 2. Pre- and post-operative best corrected visual acuity in corneal graft patients

Visual acuity	Pre-operative		Post-operative best corrected	
	n	%	n	%
$\geq 6/9$	1	6	10	59
6/18–6/12	2	12	4	23
6/36–6/24	8	47	2	12
$\leq 6/60$	6	35	1	6

superficial ulceration at one segment of the graft after 26 months and the lesion healed with treatment after suture removal. In the initial period of the study sutures were removed in 5 eyes without any specific reason, but according to the perceived wisdom from the literature. There was no significant change in astigmatism after suture removal in these patients.

Post-operatively 3 cases of wound leak and 1 case of elevated edge of the graft were identified and were treated by additional interrupted 11-0 sutures. One of these patients developed signs of early rejection after 3 months and was treated. High intraocular pressure was noted 4 months after surgery in 1 patient and was surgically controlled with trabeculectomy. All the patients who had post-operative complications had their sutures removed at some stage.

Discussion

We analysed the visual results, complications, post-graft astigmatism and the long-term stability of 11-0 Mersilene when used as a single running suture in penetrating keratoplasty. The widely used nylon suture is biodegradable and breaks if allowed to remain long enough in the operated eye. 11-0 Nylon is not an ideal material for the running suture because its high ratio of spontaneous disruption leads to an undesired, statistically significant increase in post-keratoplasty astigmatism. The spontaneous disruption of sutures often results in exposure of the suture, which may cause infectious keratitis, vascularisation and graft rejection.¹⁰ The non-biodegradable nature of 11-0 Mersilene suture means it can be used in the long-term control of post-keratoplasty astigmatism. Intraoperatively Mersilene is less flexible and misjudgement of the tension may result in too tight or too loose a suture.¹⁶

Several suture techniques have been described using 10-0/11-0 nylon sutures.^{18–20} The complications and astigmatic results of using 11-0 Mersilene as a running suture along with 10-0 nylon interrupted sutures have been reported in previous studies.^{16,17} The efficacy of using a running Mersilene suture may be limited when

Table 1. Pre-operative diagnoses

Diagnosis	No. of eyes
Keratoconus	8
Fuchs' corneal dystrophy	6
Megalocornea	1
Bullous keratopathy	1
Irregular astigmatism – following penetrating corneal injury	1

Table 3. Post-keratoplasty complications

Complications	No. of patients
Wound leak	3
Elevated edge	1
High intraocular pressure	1
Sterile infiltrates	1
Early rejection	1

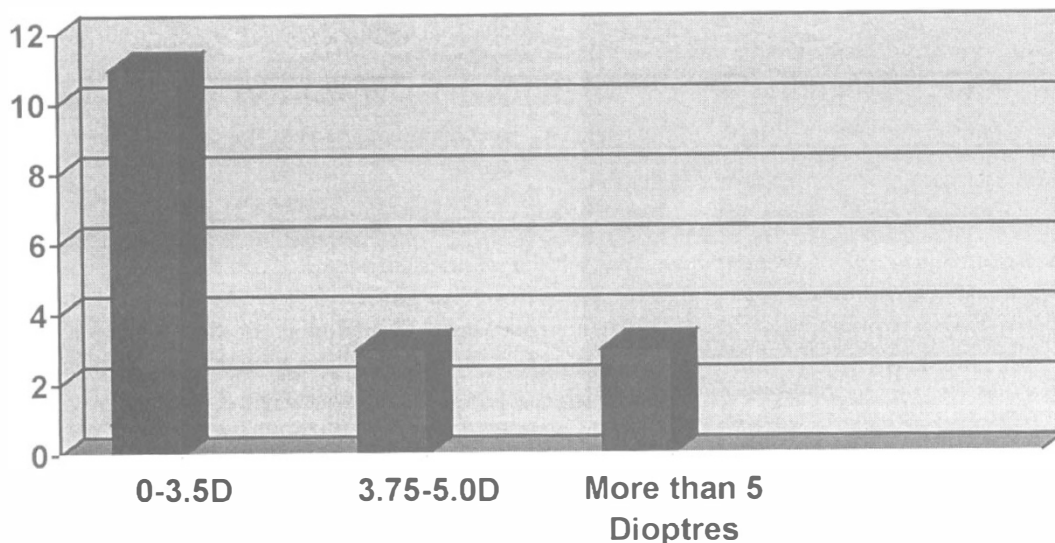


Fig. 2. Refractive astigmatism in eyes after long-term follow-up of 11-0 Mersilene as a single running suture in corneal grafts.

combined with interrupted nylon sutures which break spontaneously.¹⁷ In this study we used 11-0 Mersilene alone as a single running suture.

In one study running 11-0 Mersilene sutures remained functioning through the 48 months of follow-up.¹⁷ In another study 100% of Mersilene sutures remained intact at 4 years of follow-up.¹⁶ In our study the 11-0 Mersilene sutures remained intact, the longest period of follow-up being 91 months.

Complications such as micro-abscess formation,¹⁶ sterile infiltrates, marked scarring, ulcers, herpetic keratitis, removal of running sutures and astigmatism¹⁷ have been described. In our series sterile infiltrates occurred at one segment of the graft after 26 months in 1 patient. These infiltrates healed with treatment after suture removal. These sterile infiltrates are most probably related to individual factors of wound healing and not necessarily to the type of suture materials used.¹⁷

Three cases of wound leak and 1 case of elevated edge of the graft were noted post-operatively which needed surgical intervention by re-suturing. These complications underline the importance of ensuring accurate wound approximation preoperatively and a close watch during the post-operative period. One patient underwent trabeculectomy for high intraocular pressure noted 4 months after penetrating keratoplasty. Early rejection signs were noted in 1 eye 3 months after surgery and were treated successfully with steroids. These common post-keratoplasty complications and can not be related to the suture material. Excessive scarring mentioned in a previous study¹⁷ was not noted in our study.

Bertram and associates²¹ observed that Mersilene, whether used for interrupted sutures or as a single running suture, is unsuitable in the adjustment technique because of its inelasticity. Post-operative manipulation of Mersilene caused more cutting through the cornea than nylon. In our study, suture adjustment was done uneventfully in 1 case with a significant reduction of astigmatism.

Freuch *et al.*¹⁶ reported that the use of combined 10-0 nylon with running 11-0 Mersilene suture resulted in low astigmatism. In another study²² 8 interrupted 11-0 Mersilene sutures were used in combination with 10-0 nylon running sutures. Astigmatism was low and stable after removing the nylon sutures and partially retaining the 11-0 Mersilene suture. In our series sutures were removed in 8 cases because of foreign body sensation (2 cases), sterile infiltrates (1 case) and as a routine (5 cases). We noted no significant change in astigmatism after suture removal in these cases.

Conclusion

We report a long duration of follow-up (91 months) of 11-0 Mersilene sutures in corneal grafts. Our study suggests that 11-0 Mersilene alone can be used as a single running suture in corneal transplants and, due to its non-biodegradable nature, it remains stable without dissolution in the eye over a long period of time.

References

- McNeill JJ, Kaufman HE. A double running suture technique for keratoplasty: earlier visual rehabilitation. *Ophthalmic Surg* 1977;8:58.
- Musch DC, Meyer RF, Sugar A. The effect of removing running sutures on astigmatism after penetrating keratoplasty. *Arch Ophthalmol* 1988;106:488.
- Musch DC, Meyer RF, Sugar A, Soong HK. Corneal astigmatism after penetrating keratoplasty: the role of suture technique. *Ophthalmology* 1989;96:698.
- Binder PS. Selective suture removal can reduce postkeratoplasty astigmatism. *Ophthalmology* 1985;92:1412.
- Stainer GA, Perl T, Binder PS. Controlled reduction of postkeratoplasty astigmatism. *Ophthalmology* 1982;89:668.
- Feldman ST, Brown SI. Reduction of astigmatism after keratoplasty. *Am J Ophthalmol* 1987;103:477.
- Lin DTC, Wilson SE, Reidy JJ, Klyce SD, McDonald MB, Kaufman HE, McNeill JJ. An adjustable single running suture technique to reduce postkeratoplasty astigmatism: a preliminary report. *Ophthalmology* 1990;97:934.

8. McNeill JJ, Wessels IF. Adjustment of a single continuous suture to control astigmatism after penetrating keratoplasty. *Refract Corneal Surg* 1989;5:216.
9. Binder PS. The effect of suture removal on postkeratoplasty astigmatism. *Am J Ophthalmol* 1988;105:637.
10. Frueh BE, Feldman ST, Feldman RM, Sossi NP, Frucht-Pery J, Brown SI. Running nylon suture dissolution after penetrating keratoplasty. *Am J Ophthalmol* 1992;113:406.
11. Lin DTC, Wilson SE, Reidy JJ. Topographic changes that occur with 10-0 nylon suture removal following keratoplasty. *Refract Corneal Surg* 1990;6:21.
12. Confino J, Brown SI. Bacterial endophthalmitis associated with exposed monofilament sutures following corneal transplantation. *Am J Ophthalmol* 1985;99:111.
13. Nirankari VS, Karesh JW, Richards RD. Complications of exposed monofilament sutures. *Am J Ophthalmol* 1983;95:515.
14. Shahinian L, Brown SI. Postoperative complications with protruding monofilament nylon sutures. *Am J Ophthalmol* 1977;83:546.
15. Sugar A, Meyer RF. Giant papillary conjunctivitis after keratoplasty. *Am J Ophthalmol* 1981;91:239.
16. Frueh BE, Brown SI, Feldman ST. 11-0 Mersilene as running suture for penetrating keratoplasty. *Am J Ophthalmol* 1992;114:675-9.
17. Frucht-Pery J. Mersilene sutures for corneal surgery. *Ophthalmic Surg* 1995;26:117-20.
18. Van Meter WS, Gussler JR, Solomon KD, *et al.* Postkeratoplasty astigmatism control: single continuous suture adjustment versus selective interrupted suture removal. *Ophthalmology* 1991;98:177-81.
19. Hope-Ross MW, McDonnell PJ, Naylor CG, *et al.* The management of postkeratoplasty astigmatism by postoperative adjustment of a single continuous suture. *Eye* 1993;7:625-8.
20. Clinch TE, Thompson HW, Gardner BP, *et al.* An adjustable double running suture technique for keratoplasty. *Am J Ophthalmol* 1993;116:201-6.
21. Bertram BA, Drews-Botsch C, Gemmill M, *et al.* Complications of Mersilene sutures in penetrating keratoplasty. *Refract Corneal Surg* 1992;8:296-305.
22. Bigar F, Uffer S. The unsolved problem of transplant astigmatism. *Klin Monatsbl Augenheilkd* 1992;200:401-3.