

Comparative trial of Dexon (polyglycolic acid), collagen, and silk sutures in ophthalmic surgery

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The ideal suture for use in ophthalmic surgery is one that is fine yet strong, non-irritant, and non-allergenic, predictably and reliably absorbed after a suitable period of time, and with good knot-holding properties. Previous studies have shown that Dexon, a new synthetic absorbable suture manufactured from polyglycolic acid, a linear homopolymer of hydroxyacetic acid, possesses many of these features.

Eilert, Binder, McKinney, Beal, and Conn (1971) compared Dexon with silk, cotton, nylon, and catgut in rabbits. They concluded that Dexon sutures were well tolerated, causing an early tissue reaction comparable with that of silk, nylon, and cotton but less marked than that caused by plain or chromic catgut. The tensile strength of Dexon compared favourably with that of the other sutures and Dexon handled with the ease of silk while being absorbed more completely than catgut.

Numerous clinical trials involving Dexon have already been published (Haxton, Clegg, and Lord, 1974; Livingstone, Simpson, and Naismith, 1974; Miller, 1973; Mouzas and Pompa, 1974), but only a few have been carried out in ophthalmic surgery.

White and Parks (1974) compared Dexon with catgut and silk sutures in a series of 116 eye operations; they concluded that Dexon had many of the properties of both silk and catgut. Apart from a tendency to grab loose tissue, Dexon handled like silk, but was predictably absorbed, usually after about 4 weeks. Although knot tying was slightly more difficult than with chromic catgut, once the surgeon's knot was drawn tight, it did not slip and the Dexon was harder to break than chromic catgut. Green-dyed Dexon was easier to see than its plain counterpart.

Sugar, Lorfel, and Sumner (1974) used Dexon to close the wounds in 55 cataract extractions. No side-effects occurred that were attributable to the suture material. Dexon was found to be strong yet easy to handle, especially when dyed green.

There was no tendency for the knot to slip and the suture was absorbed uniformly in about 7 to 8 weeks.

In view of these promising reports from abroad, it was decided that a clinical trial should be carried out in the Ophthalmic Department of the Birmingham and Midland Eye Hospital. This trial was designed to answer three important questions:

1. How much ocular tissue reaction does Dexon produce?
2. How long does Dexon take to absorb in the eye?
3. How does Dexon handle; in particular, how suitable is it for microsurgery?

Material and methods

To answer these questions we decided to compare Dexon with sutures that are in routine use in ophthalmic surgery. In this study green-dyed polyglycolic acid sutures sizes 5/0 and 6/0 were compared with 6/0 collagen or virgin silk sutures.

Any patient requiring a routine eye operation was eligible for inclusion in the trial. Most of the patients were admitted from the hospital waiting list, their initial assessment having been carried out in the Outpatient Department.

The original aim was to use the experimental sutures alone in about half the patients, and to use silk or collagen exclusively in about the same number of controls. Because many surgeons use different suture types for different layers, it was decided to use Dexon for one layer and silk or collagen for another in certain operations. As far as possible the choice of suture material was made randomly. In the case of patients requiring a bilateral procedure, Dexon was used for one eye and the control suture for the other.

A detailed record was kept of the operation and the suture materials used. Follow-up assessments were carried out in the ward during the first few days after operation and as far as possible at 2, 4, 8 and/or 12 weeks in the Outpatient Department. At each assessment the patient was asked his subjective opinion of the amount of discomfort and lacrimation. Objective assessments were made of the degree of conjunctival oedema and congestion. These symptoms and signs were graded as nil, mild, moderate, or severe. Each assessment was made by the author himself. In addition, a

Table I Number of patients undergoing eye operations

Operations	No. of operations			Age range (yrs)	Mean age (yrs)
	Male	Female	Total		
Cataract extraction	6	10	16	50-84	67
Squint correction	12	15	27	3-39	7
Trabeculectomy	3	1	4	61-82	73
Peripheral iridectomy	—	2	2	81	81
Enucleation	1	1	2	53-54	54
All operations	22	29	51	3-84	34

record was kept of the state of wound apposition and the extent to which the sutures were still visible at the various follow-up appointments. Colour photographs were taken whenever possible to provide an accurate and permanent record of each patient's progress. Intraocular operations were examined regularly with the slit lamp.

Results

Altogether 47 patients underwent 51 eye operations, four patients needing bilateral procedures. Of these 22 patients were male (age range 3 to 84 years) and 25 were female (age range 3 to 81 years). Three patients were diabetic.

Table I shows the operations that were performed. The majority of patients had cataract extractions or squint corrections. The two sexes were fairly evenly represented in these two main diagnostic categories and, as expected, most of the cataract patients were elderly and most of the squint corrections were in children.

Table II shows the sutures used for the various operations. Dexon was used exclusively in 20 of the 51 operations and for one or other layer in nine operations. In the 22 control operations Dexon

was not used at all. In these, silk was used exclusively in eight cataract operations and collagen was used exclusively in 12 squint corrections. Silk was also used throughout in the control trabeculectomy and peripheral iridectomy operations. In practice no differences between Dexon and control groups were observed that were attributable to the various diagnoses or operations performed.

OCULAR TISSUE REACTION

The extent of tissue reaction at the various assessments is given in Table III. In these assessments only the results of the operations which used either Dexon or control sutures exclusively are given. All diagnoses are shown together. One Dexon patient failed to return for follow-up.

Each column (a) shows the results obtained during the first 2 days after operation. At this stage very few patients in either group complained of discomfort but a moderate degree of watering was experienced by four of the control patients and one of the Dexon sutured patients. Oedema was

Table II Types of sutures used

Type of operation	No. of operations using various sutures*				Total no. of operations
	(a) Dexon (b) Dexon	(a) Dexon (b) Collagen or silk	(a) Collagen or silk (b) Dexon	(a) Collagen or silk (b) Collagen or silk	
Cataract extraction	5	2 Dexon/silk	1 silk/Dexon	8 silk/silk	16
Squint correction	9	2 Dexon/collagen	4 collagen/Dexon	12 collagen/collagen	27
Trabeculectomy	3	0	0	1 silk/silk	4
Peripheral iridectomy	1	0	0	1 silk/silk	2
Enucleation	2	0	0	0	2
All operations	20	4	5	22	51

* (a) = Conjunctival suture (b) = Deep suture (sclera or muscle, etc.)

Table III Comparison of degree to which the various sutures produced symptoms and signs at 2 days (a), 2 weeks (b), and 8-12 weeks (c)

Symptoms or sign	Suture material	No. of operations of given severity score											Significance of difference	
		Nil (per cent)			Mild (per cent)			Moderate (per cent)			Severe (per cent)			
		(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)		(c)
Discomfort	Dexon*	17 (89.5)	18 (94.7)	19 (100)	1 (5.3)	0	0	1 (5.3)	1 (5.3)	0	0	0	0	N/S
	Collagen** or silk	18 (81.8)	20 (90.0)	21 (95.5)	0	0	0	4 (18.2)	2 (9.1)	1 (4.5)	0	0	0	
Watering	Dexon	14 (73.7)	16 (84.2)	19 (100)	0	0	0	5 (26.3)	4 (21.0)	0	0	0	0	N/S
	Collagen or silk	14 (63.6)	18 (81.8)	22 (100)	0	0	0	8 (36.4)	4 (18.2)	0	0	0	0	
Oedema	Dexon	11 (57.9)	14 (73.7)	17 (89.5)	0	1 (5.3)	1 (5.3)	8 (43.1)	4 (21.0)	1 (5.3)	0	0	0	N/S
	Collagen or silk	11 (50.0)	16 (72.7)	22 (100)	1 (4.6)	0	0	10 (45.4)	6 (27.3)	0	0	0	0	
Congestion	Dexon	0	0 (100)	19 (100)	2 (10.5)	9 (47.4)	0	10 (52.6)	9 (47.4)	0	7 (36.9)	1 (5.3)	0	N/S
	Collagen or silk	0	0	16 (72.7)	1 (4.6)	4 (18.2)	6 (27.3)	19 (86.4)	16 (72.7)	0	2 (9.0)	2 (9.1)	0	

*Total number of Dexon operations = 19 **Total number of collagen or silk operations = 22 N/S: Not significant

present in nearly half the eyes in both groups. The greatest difference between the groups was in the incidence and degree of congestion, which tended to be more severe in the Dexon patients.

Each column (b) showed that by 2 weeks most of the symptoms and signs were settling down. A few eyes were still moderately oedematous but there was little difference between the Dexon and control groups. Once again the main difference at this stage was in the incidence and severity of congestion, which tended to be more pronounced in the control suture group.

Each column (c) shows the results observed in the final stages of assessment. Nearly all the patients were free of symptoms and signs. None of the Dexon-sutured eyes showed congestion, but six of the control eyes were still mildly congested.

Some idea of the amount of tissue reaction can be gained from the series of photographs of an elderly patient who underwent bilateral cataract extraction. The left eye was sutured with silk (Fig. 1 a-c) and the right eye with Dexon (Fig. 2 a-c). The degree of tissue reaction was initially slight in both eyes. The Dexon was completely absorbed in 8 weeks; there was no green staining to be seen.

In nine operations Dexon was used in combination with one or other control sutures. In no case

was there any unusual tissue reaction—the Dexon appeared to behave in exactly the same way as if it had been used exclusively.

ABSORPTION OF DEXON

Dexon was used exclusively in 20 operations (see Table II), but one patient in this group failed to return for follow-up. The presence or absence of the sutures was noted at each follow-up assessment. The slit lamp was used to check absorption in intraocular operations because it was easier and more reliable to observe the changes in the sclero-corneal sutures beneath the conjunctiva than the conjunctival sutures themselves, since these usually dropped off before they had been absorbed. The average absorption time was 5 weeks (range 4 to 6 weeks).

We were able to confirm the complete and uncomplicated absorption of Dexon in a child who underwent surgery for the correction of a left convergent squint in which Dexon was used throughout. At the last follow-up the eye had developed a divergent squint and we suspected that the stitches had loosened allowing the muscle to slip. The eye was re-opened and the medial rectus was found to be firmly attached to the sclera. The suture had not slipped. There was no trace of



FIG. 1 Control, left cataract extraction, silk suture
(a) Second day, (b) Third week, (c) Eighth week

FIG. 2 Dexon suture, right cataract extraction
(a) Second day, (b) Third week, (c) Eighth week

Dexon, nor were there any adhesions or signs of irritation or pigmentation.

HANDLING PROPERTIES OF DEXON

Dexon was found to be stronger than the control sutures of equivalent size. Wound apposition was good in all cases. Dexon's 'roughness' meant that knots held well once tied, but also that the sutures tended to snag in the softer tissues. Dexon seemed

to be a little stiff for some of the more delicate microsurgical procedures, such as cataract extraction. In all other respects the handling properties of Dexon compared very well with those of the control sutures.

DIABETES

Three diabetics were included in the series and it is perhaps worth noting that in them the experi-

mental sutures behaved in exactly the same way as in normal patients, despite being a homopolymer of hydroxyacetic acid.

SIDE-EFFECTS

No serious unwanted effects were observed that were attributable to Dexon sutures. There was one case of vitreous haemorrhage and one case of Tenon's cyst in the Dexon group.

Conclusions

This comparatively short series of cases confirms previous claims (White and Parks, 1974; Sugar and others, 1974) that Dexon synthetic absorbable sutures are suitable and safe for use in ophthalmic surgery.

The tissue reaction caused by Dexon was slightly greater initially than that observed with silk and collagen, but the reverse was true at later assessments. These observed differences in tissue reaction were not statistically significant, however.

The average absorption time was 5 weeks; this compares well with the time found by White and Parks (1974) but is shorter than the 7 to 8 weeks observed by Sugar and others (1974).

Dexon handled well but had the slight disadvantage of being rather thick, rough, and stiff which tended to make its use in microsurgery a little difficult. A smaller size of suture, like virgin silk, would probably overcome this difficulty. Dexon

was strong, the knots held well, and the green sutures were easy to see.

Therefore Dexon can be considered to be as well tolerated by the ocular tissues as collagen and virgin silk, yet unlike silk it is absorbable and unlike collagen it contains no foreign protein.

Summary

The tissue reaction, absorption, and handling properties of Dexon synthetic absorbable sutures, which are made from polymerized hydroxyacetic acid, were compared with those of silk and collagen in 51 eye operations, consisting mainly of cataract extractions and squint corrections.

There was no significant difference between the sutures as regards degree of tissue reaction. The Dexon sutures were very strong and the knots held well. The sizes used in this series were found to be a little too thick and stiff for use in microsurgery; smaller sizes would be easier to use and still remain strong enough. The Dexon was reliably absorbed in 5 weeks on average. No serious adverse reactions were seen with any of the sutures. Dexon was as well tolerated as the control sutures but had the advantage over silk of being absorbed and over collagen of containing no foreign protein.

I wish to thank Mr S. J. Crews, Mr V. H. Smith, Mr P. Eustace, Mr D. Austin, and Dr Kukreja for their help in carrying out this study and Dr R. J. E. Daniel of Davis and Geck Laboratories for supplying the materials and for help in compiling this paper.

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