

# Maxon® – A New Synthetic Monofilament Absorbable Suture For Gastrointestinal Anastomosis

Dr Majeed Hameed Alwan\*

## ABSTRACT

In a controlled clinical trial, Maxon® sutures were assessed in twenty five patients who required various gastrointestinal anastomosis. In another twenty five cases, Vicryl® and Silk sutures were used.

In both groups of patients, there was no abnormality, and post-operative complications developed in two cases of the Maxon® and control groups respectively. None of these complications were related to sutures or anastomotic dehiscence. The handling characteristics of Vicryl® and Silk were rated excellent. 3/0 Maxon® was rated excellent and in four out of nine patients in whom 2/0 Maxon® was used, it was rated acceptable, but improved to excellent in the other five cases, as adaptation to the handling of the suture improved.

Maxon® is a new synthetic, absorbable monofilament, developed by Davis and Geck and has been designed to combine the predictable performance of a synthetic absorbable suture with the benefits of a monofilament. Maxon® has also been shown to have substantial strength during the critical wound healing period.

The aim of this trial is to assess<sup>(1)</sup> the performance of Maxon® when used in gastrointestinal anastomoses, <sup>(2)</sup> the safety of Maxon® as indicated by the incidence and nature of any complications directly attributable to the suture; and <sup>(3)</sup> the handling characteristics of Maxon® as perceived by the surgeon.

## METHODS

### Whole Series

A total of fifty patients requiring gastrointestinal and biliary surgeries were entered in the trial. They were divided into two equal groups. In the first group Maxon® was used, while in the second group Vicryl® and Silk were used. In both groups, single or two layers, continuous or interrupted sutures were carried out depending on the disease and part of the gastrointestinal tract (as it will be indicated later). The sutures used were 2/0 and/or 3/0 maxon®, 2/0 Vicryl® and 3/0 Silk.

A case record form was designed and completed for every patient in this trial. This covered details of the diagnosis, any co-existent disease or concomitant therapy, the surgery performed with the suture type, size and suture technique used. The condition of the operating site was indicated to be either clean or contaminated. Since opening the gastrointestinal tract will contaminate the field, the term contaminated was strictly used when there was soiling of the field with pus or gastrointestinal contents.

The form also included the assessment of the handling characteristics of the suture that was used in each patient. These included knot rundown, knot repositioning, knot security, tissue drag, suppleness, and overall handling. For this purpose 'Excellent' was taken to mean better than expected, 'Acceptable' as expected and 'Poor' as worse than expected.

---

\*Consultant Surgeon  
Department of Surgery  
Al-Sabah Hospital – Kuwait.



All patients received antibiotics (Cephalosporins or Aminoglycosides groups with Metronidazole) with premedication. In the majority of cases these were given for one day post-operatively, but in few patients, they were continued for five days.

Post-operatively, patients were assessed at one week, one month and two months. Clinical evidence of anastomotic dehiscence were particularly looked for as shown by a raised temperature, pulse or white blood cell count, with localised abdominal pain, guarding or rigidity or any evidence of peritonitis.

### **MAXON® GROUP (25 PATIENTS)**

There were twenty three males and two females, aged 17-70 years (40.6 years). Modified Saguira operation (2 cases) means abdominal exploration with splenectomy, devascularisation of the abdominal oesophagus and upper two thirds of stomach, ligation of the coronary vein and oesophago-gastric transection-anastomosis.

There were 11 emergency operations, 19 clean operations and 6 were contaminated. Two patients were diabetics receiving insulin, and one patient was receiving antituberculous treatment.

### **CONTROL GROUP (25 PATIENTS)**

There were nineteen males and six females, aged 24-73 years (45.2 years). Vicryl® 2/0 was used for the inner layer and Silk 3/0 for the outer layer.

There were 8 emergency operations, 21 clean operations and 4 were contaminated. One patient was diabetic receiving insulin.

## **RESULTS**

### **Maxon® Group**

There was no mortality, and post-operative complications developed in four patients, none of them due to the suture or anastomotic dehiscence. The two cases with oesophageal varices needed supportive treatment for hepatic failure followed by satisfactory recovery. One patient developed gastric stasis after truncal vagotomy and gastrojejunostomy. The condition improved gradually with continuous nasogastric suction. One patient had superficial wound infection.

In sixteen patients only 3/0 suture was used. Except for suppleness which was rated acceptable, all other characteristics were rated excellent, and the overall handling was excellent. In another five cases both 3/0 and 2/0 sutures were used, with similar rates for the 3/0 suture. In another four patients only 2/0 sutures were used. Four out of the nine patients where 2/0 sutures were used, all characteristics including the overall handling were rated acceptable. However, in the other five cases, and as we adapted more to the handling of the suture, the rating improved to excellent except for suppleness which remained acceptable.

In all patients square knots were used and two additional throws found to be necessary to improve knot security.

### **Control Group**

There was no mortality, and post-operative complications developed in five patients, none of them due to the suture or anastomotic dehiscence. Three patients developed superficial wound infection. One patient had hepatic failure, and one patient developed fever in the tenth post-operative day with no abdominal irritation or radiological evidence of leakage. All patients have had satisfactory recovery.

The suture handling characteristics assessment in all patients were rated excellent. Square knots were also used.

## **DISCUSSION**

Maxon® (MAS-1) is a synthetic copolymer made by reacting trimethylene carbonate (TMC) and glycolide. D & C Green no. 6 may be incorporated into the copolymer in order to enhance the visibility of the finished suture. The suture is sterilized by exposure to ethylene oxide.

In preclinical studies<sup>1</sup>, Maxon® sutures are found to retain an average of 81%, 59% and 30% of their strength after 2, 4 and 6 weeks respectively, of in-vivo exposure. There was essentially no absorption of MAS-1 sutures for the first 6-8 weeks after in-vivo exposure. The suture material was broken down and excreted mainly in urine and expired air. There were no findings except those which might be associated with a foreign body reaction to an



innocuous substance. MAS-1 sutures elicited a minimal tissue reaction and were completely absorbed in 6-7 months. These sutures demonstrated efficacy in gastrointestinal repair as well as general wound closure.

The physical properties of MAS-1 sutures were studied in comparison with chromic gut and the synthetic sutures Dexon® S (absorbable braided polyglycolic acid suture), Dermalon® (non-absorbable monofilament nylon suture) and Prolene® (non-absorbable monofilament polypropylene suture). Measurements for knot pull, needle holding and straight pull tensile strength, diameter and elongation to break were obtained. These studies<sup>1</sup> demonstrate that the suture is strong, safe and effective in surgical procedures where absorbable sutures are desired.

Similar results were obtained from other reports which studied the chemical and physical properties of these sutures<sup>2,3,4</sup>.

Cacciari et al<sup>4</sup> after testing these sutures experimentally in sheep fetuses with induced diaphragmatic defect and their correction in utero, used Maxon® in 50 surgical procedures in children<sup>5</sup>. These procedures dealt with different gastrointestinal, genitourinary, hepatobiliary and hernia conditions. Although they stated that it was not possible to draw an overall conclusion on the use of this suture material as they only sampled it in paediatric surgery, however, in comparison with their experience with other suture materials, the main quality of Maxon® sutures was their resistance to traction even after a length of time and by its extraordinary smoothness, even in the finer sizes. These sutures therefore represent an excellent combination of great strength and fine size, which makes it extremely easy to handle in a wide variety of procedures and age groups. Due to the great smoothness of the suture, they recommend to add one or two extra throws for knot security.

Thuroff et al<sup>6</sup> used Maxon® sutures to form the Mainz-pouch (mixed augmentation ileum and

cecum) for bladder augmentation and continent diversion. They reported no drawback effects or complications related to these sutures.

## CONCLUSION

**In our series, there were no exclusions from the trial with regard to patient's age, sex, race, co-existent disease or concomitant therapy. The sutures were also used in elective and emergency operations, and in clean and contaminated fields. Our experience with 2/0 and 3/0 Maxon® sutures supports the experience of others and confirm the characteristics mentioned, namely, their smoothness and strength when compared with other sutures. They are also safe and effective, but need extra throws for knot security. These characteristics make them quite suitable for gastrointestinal anastomosis.**

## REFERENCES

1. Katz AR, Mukherjee DP, Kaganov AL, Gordon S. A new synthetic monofilament absorbable suture made from polytrimethylene carbonate. *Surg Gyn Obst* 1985;161:213-222.
2. Thiede A, Stuewe W, Luendstedt B. Comparison of physical parameters and handling properties of rapidly and medium fast absorbable suture materials. *Chirurgie* 1985;56:804-808.
3. Trimbo JB, Van Rijssel EJC, Kloppe PJ. Performance of sliding knots in monofilament and multifilament suture material. *Obst Gyn* 1986;68:3:425-430.
4. Cacciari A, Riccioni N, Pavanello P, Pelliccia A, et al. Ernia Diaframmatica Congentia. Impiego di una nuova sutura sintetica monofilamento a lento riassorbimento. Dati preliminari. *Pediatria oggi medica e chirurgica* 1986;6:1:1-5.
5. Cacciari A, Riccioni N, Pavanello P, Pelliccia A. Impiego Clinico in chirurgia Pediatrica di una nuova sutura sintetica monofilamento a lento riassorbimento. *Pediatria oggi medica e chirurgica* 1986;6:1:6-14.
6. Thuroff JW, Alken P, Engelmann U, Riedmiller H, Jacobi GH, Hohenfellner R. Der Mainz-Pouch zur Blasenerweiterungsplastik und kontinenten Harnableitung. *Akt Urol* 1985;16:1-8.