

## A Review of Some Significant Breakthroughs in Textile Sutures for Ophthalmic Surgery

N Gokarneshan<sup>1\*</sup> and U.Ratna<sup>2</sup>

<sup>1</sup>Department of Costume Design and Fashion, Dr. SNS Rajalakshmi College of Arts and Science, Coimbatore, India

<sup>2</sup>Department of Textiles and Clothing, Avinashilingam Deemed University Coimbatore, India

### ABSTRACT

The article reviews some significant trends in textile sutures intended for use in ophthalmic surgery. Comparison has been made with rate and type of suture related complications between 10-0 monofilament nylon (Aurolab Nylon Sutures, double arm, Aurolab) and 10-0 polyglactin 910 sutures (Vicryl, single arm, Aurolab) for pediatric cataract surgery. It is a prospective, comparative study performed in children who underwent surgery for congenital or developmental cataract from March 2013 to February 2016. Patients underwent suturing with either nylon or Vicryl in unilateral cases, but in most bilateral surgeries, one eye received Vicryl sutures while the other eye received nylon. The sutures were compared for their complications and the need for suture removal. Also comparison has been made with regard to the clinical results of using silk versus nylon sutures for conjunctival autograft suturing in pterygium surgery. In this prospective, randomized, controlled, clinical trial 50 eyes from 50 patients with primary nasal pterygium were randomized to undergo pterygium surgery with the use of either nylon sutures or silk sutures for conjunctival autograft suturing. Patients were followed up for 6 months. Main outcome measures included recurrence, postoperative discomfort according to a visual analog scale (VAS), graft hyperemia, and graft edema.

### \*Corresponding author

N Gokarneshan, Department of costume design and fashion. E-mail: advaitcbe@rediffmail.com

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### Introduction

Pediatric cataract surgery differs from adult cataract surgery in various ways, one important difference being that sutureless cataract surgery is inappropriate in children due to the presence of poor scleral rigidity which results in reduced wound integrity if left unsutured. In addition, children are at a higher risk of trauma to the eye and therefore have more chance of wound dehiscence, leading to complications such as shallowing of the anterior chamber, iris prolapse, anterior synechia formation, intraocular lens extrusion or displacement, vitreous prolapse, glaucoma, and even infection, including endophthalmitis [1]. There are various approaches for wound construction in pediatric cataract surgeries. Most surgeons prefer a clear corneal approach due to its ease and because it induces less astigmatism, while some prefer the pars plana or the pars plicata approach and few other have a preference for scleral tunnel incisions [2-4].

Pterygium is a wingshaped fibrovascular lesion of the ocular surface, which is associated with chronic sunlight exposure [5]. Cameron's map shows a direct relationship between pterygium prevalence and proximity to the equator (warm and dry climate) [6]. Its incidence is more in males with a male to female ratio of 2:1, it is more common in farmers than in city dwellers, and more prevalent in those who do not wear eyeglasses. Elderly patients have the highest prevalence rate, although the highest incidence

rate was among much younger age group (20-to 40-year old) [7].

### Comparison between nylon and vicryl sutures used in pediatric cataract surgery

Irrespective of the approach, the options that are widely available for suturing the surgical wounds include 10-0 nylon and 10-0 Vicryl sutures. Nylon is a nonabsorbable, monofilament composed of polyamides, which has long-standing tensile strength and induces minimal cellular reaction, while Vicryl is a synthetic absorbable polyglactin suture (copolymer of glycolide and lactide) but induces more reaction. Nevertheless, the Vicryl suture gets absorbed within 56–70 days eliminating the need for suture removal [8]. Between the two sutures, the braided nature of the Vicryl suture makes it difficult to secure a good knot to seal the incision than the nonbraided nylon suture. However, there was still a dilemma regarding which of the two sutures would be a better option in children. To answer this simple question, we decided to study and compare the absorbable suture material that has a higher tendency to develop reaction with the non absorbable suture that is easy to apply but requiring suture removal under general anesthesia or sedation.

To plan the surgery for congenital cataract appropriately, the surgeon needs to keep in mind certain differences with respect to an adult eye. Ocular dimensions continue to grow until adolescence [9]. The sclera is thinner, more vascular, and elastic in children as compared to adults. Most of the cataract surgeries in children are done under general anesthesia, unlike local or

topical anesthesia, which is frequently used for adults. Children are more vulnerable to complications of anesthesia than adults [10]. Pediatric cataracts may be associated with other systemic conditions which may complicate general anesthesia [11]. Hence, it is better to avoid another general anesthesia only to remove a suture. Among our cases as well, we had several children who had associated congenital heart disease and Toxoplasma, Rubella, Cytomegalovirus and Herpes (TORCH) infections and were operated under high-risk consent due to their systemic diseases. A clear corneal sutureless approach (e.g., temporal) as performed in adults is less applicable in children because of the high rates of wound dehiscence and iris incarceration [12]. Although this approach is easy and the induced astigmatism is low, the risk of trauma to the incision is higher and its consequences make it less attractive for children. To prevent complications as discussed above, we should prefer to close the incision.

There are few studies that compare the types of suture material for surgical wound closure [13-15]. However, not many comparing the same in children. We, therefore, compared readily available suture materials: 10-0 nylon and 10-0 Vicryl for the surgical wound closure in children undergoing cataract surgery. We ensured adequacy of wound closure, suture tension, and the absence of leakage at the end of surgery.

Bartholomew et al. have studied 8-0 Vicryl, 8-0 nylon, and silk sutures for closing surgical wounds during pediatric cataract surgery [16]. They divided their complications into early and late (2 weeks after surgery), and their results showed higher early complications in the Vicryl group, and they attributed them to difficulty in knot tying, resulting in poor wound closure. They reported bleb formations secondary to leakage from the wounds due to inadequate wound closure or early dissolution of the sutures. Our children in either group did not have any bleb formation, indicating the absence of wound leak probably due to better wound apposition.

However, sutures must never be over tightened to avoid the development of high astigmatism. Bartholomew RS et al have suggested that, in a child with more congestion, the sutures tend to hydrolyze earlier [17]. This would be of concern in complicated pediatric cataracts which tend to develop more postoperative reaction. In our study, the earliest absorption of 10-0 Vicryl was at 2 weeks after surgery. We had no case of a broken suture postoperatively that needed re-suturing. Only one suture from the Vicryl group was noted as loose at the 6th day follow-up which was removed without the need for suturing again.

10-0 nylon sutures have the advantage of having low antigenicity, high elasticity, and prolonged tensile strength [18]. However, studies show that nylon sutures can cause several complications if left *in situ* such as vascularization, astigmatism, becoming loose, accumulation of mucus, and breaking of sutures which can lead to giant papillary conjunctivitis, limbitis, conjunctivitis, and even suppurative keratitis when the knot were not buried. Both these studies recommend that nylon sutures should be removed within 6–12 months after surgery. In our cohort, two children needed 10-0 nylon suture removal as late as 36 months after surgery as the suture got vascularized. Nylon sutures, therefore, require a regular follow-up until they are removed. Such situations would require another anesthesia for suture removal, unlike Vicryl suture that's gets absorbed and is, therefore, a better option in this regard. However, we have noted that Vicryl sutures do cause an opacification of the suture tract unlike nylon sutures.

An interesting observation that we found during the course of this study was the difficulty in tying the Vicryl sutures as compared to the nylon sutures [19]. We observed that tying of the knots took more time and multiple attempts to achieve adequate wound closure with Vicryl sutures than with nylon. However, since we did not have any quantitative scale to assess it, we will address this aspect in a subsequent study.

Vicryl, being an absorbable suture material, could be preferred over a non absorbable suture material like nylon as the latter has a higher chance of suture removal and relatively more complications, needing repeated anesthesia. However, one should ensure proper tying of the Vicryl suture to further reduce the chances of complications.

### **Comparison between sutures for suturing of conjunctival autograft in pterygium Surgery**

Although various surgical procedures have been described for the treatment of pterygium, recurrence remains the main complication of the surgery. Pterygium excision followed by conjunctival autograft has been shown to be a safe and effective procedure for pterygium surgery, with recurrence rates ranging from 2% to 39% [20-24]. The suture materials commonly used for conjunctival autograft suturing include polyglactin, silk, and nylon [25]. Silk sutures are nonabsorbable, sterile, nonmutagenic surgical sutures composed of natural proteinaceous silk fibers called fibroin. Silk sutures elicit a minimal acute inflammatory reaction in tissues, which is followed by gradual encapsulation of the suture by fibrous connective tissue. *In vivo* while silk sutures are not absorbed, progressive degradation of the proteinaceous silk fiber may result in gradual loss of tensile strength over time [26]. Nylon, on the other hand, is a nonabsorbable monofilament suture composed of polyamides, with minimal induction of cellular response and prolonged tensile strength retention. Various suture materials and techniques are employed to secure the autograft including absorbable and non absorbable sutures of different diameters. Sutures are placed in interrupted or continuous fashion, with the knots left exposed or buried. Although many reports have surveyed technical modifications and recurrence rates of conjunctival autograft for pterygium surgery, few have compared the use of different suture materials in terms of postoperative patient discomfort. Suture-related complications include postoperative discomfort, infection, prolonged operating time, suture abscesses, buttonholes, pyogenic granuloma, and chronic inflammation [27]. Many studies have evaluated risk factors for recurrence. Younger age, thicker (6-0 to 8-0) sutures, and untreated postoperative inflammation are known to be risk factors for recurrence. The morphology of pterygium may also affect the recurrence [28]. The purpose of our randomized, controlled trial was to assess the clinical outcomes of using two different suture materials, silk, and nylon in suturing of conjunctival autograft in pterygium surgery. Our main outcome measures included postoperative discomfort, conjunctival reactions, graft complications as well as the rate of recurrence.

Both silk and nylon are effective suture materials for autograft suturing in pterygium surgery with similar postoperative discomfort and recurrence rate [29]. Significantly greater number of nylon sutures remains buried on the autograft and could not be removed easily. Further researches seem necessary to further clarify advantages and disadvantages of silk and nylon sutures for securing conjunctival autograft in pterygium surgery.

### **Conclusion**

A select number of children have been included in the study, of which certain number of children underwent bilateral surgery, some underwent unilateral surgery. A chosen number of nylon

sutures have been placed in selected number of, of which 34.4% have been removed due to suture-related complications, whereas 19.7% ( $P = 0.03$ ) of the select number of Vicryl sutures placed in select number of children needed suture removal at an average of 2.9 weeks with the earliest at 6 days postoperatively. The odds of Vicryl suture being removed was 0.42 times with respect to nylon. The most common reason encountered for suture removal in both the materials was sutures becoming loose (16.3%), followed by vascularization (14.1%), infiltration (1.5%), and opacification (4.4%).

Absorbable suture such as 10-0 Vicryl is preferred over nonabsorbable suture 10-0 nylon for suturing incisions in pediatric cataract surgery, to avoid subjecting the child to repeated anesthesia. According to the results, there was no significant difference between groups regarding recurrence rate of pterygium ( $P = 0.72$ ). A significant decrease in the mean VAS discomfort score from day 1 to day 14 was observed in both groups ( $P = 0.001$ ); postoperative discomfort during the first 2 weeks, was not significantly different between the two groups. At 2 weeks' postoperatively, significantly greater number of nylon sutures remained on the autograft ( $P = 0.021$ ), some of which were buried and could not be removed.

Both silk and nylon are effective suture materials for autograft suturing in pterygium surgery with similar postoperative discomfort and recurrence rate. Significantly greater number of nylon sutures remains buried on the autograft and could not be removed easily.

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