The comparison of pain perception between polypropylene and chromic catgut suture in Müller muscle's conjunctival resection with externalization of suture knots; a randomized controlled trial

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Objective: Muller's muscle conjunctival resection (MMCR) is a posterior approach surgical technique to correct blepharoptosis. The purpose of this study was to compare the patient-reported pain scores and surgical outcomes between polypropylene sutures and chromic catgut sutures.

Methods: A prospective randomized comparative clinical trial enrolled subjects from one tertiary eye center. Patients undergoing unilateral MMCR were randomized to receive either a polypropylene suture or a chromic catgut suture. Upper eyelid margin-to-reflex distance was measured and recorded before and after surgery. Then, pain scores were quantified using the pain visual analog scale: measured during surgery, one day after surgery, and when the sutures were removed. The results were analyzed using an unpaired t-test.

Results: The study enrolled twenty-two unilateral cases. Seventeen (77%) of the subjects were female. The mean patient age was 45 years (45.18). The mean margin-to-reflex distance was 1.84 mm preoperatively, which increased to 2.96 and 3.09 mm one month postoperatively in the polypropylene and the catgut suture groups, respectively (P value <0.0001). Results demonstrated significant pain scores difference between the two sutures during sutures removal. There were no suture-related complications.

Conclusion: Patients receiving polypropylene sutures reported significantly more pain during suture removal than those receiving catgut sutures. However, the surgical outcomes were not different.

Conflicts of interest: No conflict of interest is reported.

Keywords: MMCR, MRD-1, chromic catgut, polypropylene

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Introduction

Catgut and polypropylene are the two well-known suture materials. Both types of catgut, such as chromic and plain, are monofilament sutures manufactured from sheep or goats' intestines. Catgut usually lasts one to two weeks for retention time with rapid healing but less knot preservation as it is an absorbable suture. On the other hand, polypropylene is a synthetic suture made of monofilament, non-absorbable material. Thus, polypropylene, with a structurally lower density, provides more stiffness.[1]

The Muller muscle conjunctival resection (MMCR) procedure involves removing a small portion of the conjunctiva and the muller muscle to elevate the drooping eyelid. MMCR was first described by Putterman and Urist in 1975 for patients with a positive phenylephrine test.[2] Phenylephrine test is used to determine the

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desirable candidate for MMCR. The advantages of MMCR include the absence of external scars, time efficiency, predictable eyelid configuration, reliability, and symmetry.[3-4] MMCR can be done in several techniques: no suture, single suture, running suture tied off with the knot buried under the wound, or externalized suture with a closed conjunctiva tissue.[5-8] Advantages of externalization are that there is no knot inside the conjunctivae and it is easy to remove the stitch. The only significant disadvantage of an externalization suture is the pain perceived while removing the suture. This study aimed to compare pain and surgical outcomes between using polypropylene sutures and chromic catgut sutures.

Patients and Methods

After the approval of the institutional review board, subjects were recruited from the Department of Ophthalmology, Thammasat University Hospital, from January 1, 2022, to December 31, 2022. The subjects were 27 and 79 years of age with a diagnosis of involutional blepharoptosis, which is defined as margin-to-reflex-distance-1 (MRD-1) (the distance between the upper eyelid margin and the corneal light reflex) of <2.5 mm. All subjects had a positive phenylephrine test (after phenylephrine, marginal reflex distance 1 increased >2 mm).

Exclusion criteria of this study were subjects with previous eyelid trauma or surgery, combined eyelid procedures such as brow lift and upper blepharoplasty, or a history of the cicatrizing conjunctival disease.

After informed consent was obtained, eyelid examinations were performed and digital photographs were taken. Subject characteristic data collected included age, gender, visual acuity, marginal reflex distance 1, marginal reflex distance 2, eyelid crease height, and levator function. All 22 subjects were then randomized with the allocation ratio 1:1. A computer was used to generate random numbers by permuted block randomization with varying block sizes using blocks of 2 and 4 for suture with 5-0 polypropylene C-1 suture (Ethicon Inc., Johnson and Johnson) or 5-0 chromic catgut absorbable C-1 suture (Covidien). Procedure types were concealed in opaque, sealed envelopes, and sequentially numbered by the coordinator such that the surgeon was blinded to the type of suture until the day of surgery.

The primary outcome measure was the postoperative pain score. The secondary outcome measure was the change in MRD-1. The ratio of resection length to desired eyelid elevation was used. Informed consent was obtained from all patients before the surgery.

All surgeries were performed under local anesthesia by a single surgeon. After the eyelid was manually everted by a Desmarres retractor, Caliper measurements were used to mark out the conjunctiva. The marked position on the conjunctiva is 4 mm from the superior tarsal edge and in a central position. Subsequently, the conjunctival was marked medially and nasally from the central marked position. Silk 6-0 sutures were sutured through the conjunctivae at the marked point to elevate the conjunctiva and underlying Müller's muscle. A Putterman ptosis clamp was placed at the superior tarsal border to secure the grasped posterior lamellar tissues. While elevating the ptosis clamp a 5-0 polypropylene C-1 suture or 5-0 chromic catgut absorbable C-1 suture was used to suture in a horizontal mattress technique running from lateral to the medial side. Upon completion, the suture ends were externalized in the skin to minimize the risk of keratopathy. Next, the clamped tissue was excised using a no.15 Bard-Parker blade. To prevent cutting the suture, the blade edge was kept 30 degrees along the base of the ptosis clamp. Finally, the upper eyelid was reverted and topical antibiotic ointment was applied on the lower fornix and suture, as seen in Figure 2. The patients were provided with postoperative advice on refraining from vigorous exercise, eye rubbing, and water from entering the eyes. All patients were scheduled for two follow-up appointments one day and one-week post-operation. At the follow-up visits, patients were asked to state the pain during the suture's removal and the surgical outcome between the two groups (polypropylene or chromic catgut) was evaluated. The pain was assessed using a visual analog scale (VAS) on a scale of 0-10 during the removal of sutures in both groups. While pre- and post-operative mean MDR1 measurement was applied to evaluate the surgical outcome in the two groups.

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Figure 1: Externalization suture (Picture is permitted for use in this research by the patient)

Results

A total of 22 patients were included in the study. The patients were divided into two groups by the type of suture used. Characteristics of patients are presented in Table 1. 11 (50.0%) patients received chromic catgut suture. 9 (81.8%) were female and 2 (18.2%) were male. On the other hand, 11 (50.0%) patients received polypropylene suture, with 8 (72.0%) and 3 (27.3%) being female and male, respectively.

The mean age of patients who received chromic catgut sutures and polypropylene sutures was 48.0 (95% confidence interval 39.0-53.0) and 47.0 (95% confidence interval 42.0-53.0), respectively (P value = 0.95).

The difference between preoperative and postoperative MRD-1 in catgut group was 1.2 (95% confidence interval 1.2-1.4). Whereas in the polypropylene group, the difference between pre- and postoperative MRD-1 was 1.2 (95% confidence interval 0.9-1.3). The P value for the MRD-1 difference was 0.95 which was considered statistically insignificant.

According to Table 1, intraoperative and postoperative day one pain scores for catgut and polypropylene groups were 1.0 (1.0-2.0) and 1.0 (0.0-1.0), respectively.

The pain scores during the removal of sutures among the patients using a visual analog scale were assessed and compared using box and whisker plots, as shown in Figure 1.

The median pain score during suture off for patients who used catgut was 2. 75% of the patients in the catgut group had a pain score of 1-3, while the remaining 25% had a pain score of 0-1.

The median pain score during suture-off for patients who used polypropylene was 8.5. Of all the patients in the polypropylene group, 50% had a pain score of 8-9, 25% had a pain score of 7-8, and the remaining 25% had a pain score of 9-10.

Pain scores reported by patients between utilizing catgut and polypropylene during suture removal were significantly different (P value < 0.001).

Table 1: Characteristics of patients

Characteristics[a]		Catgut (N = 11)	Polypropylene (N = 11)	P value[b]
Gender, n (%)	Male	2 (18.2)	3 (27.3)	1.00
	Female	9 (81.8)	8 (72.7)	
Age (year)		48.0 [39.0, 53.0]	47.0 [42.0, 53.0]	0.95
MRD-1 difference (mm)		1.2 [1.2, 1.4]	1.2 [0.9, 1.3]	0.16

Table 2: Pain scores intraoperative and postoperative day 1

Pain score	Catgut (N = 11)	Polypropylene (N = 11)	P value[b]
Intraoperative	1.0 [1.0, 2.0]	1.0 [1.0, 2.0]	0.78
Postoperative day 1	1.0 [0.0, 1.0]	1.0 [0.0, 1.0]	0.97

[a] Data are presented as median [interquartile range] continuous variables and number (percent) for categorical variables. Percentages may not total 100 due to rounding.

[b] To compare between groups, Fisher's exact test or Mann-Whitney U test is used as appropriate.

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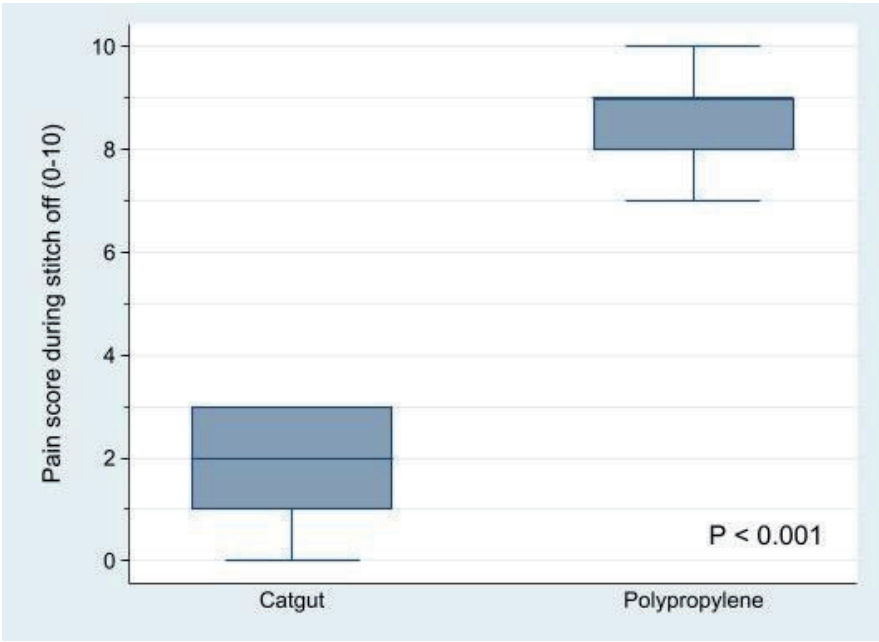

Figure 2: Pain scores (visual analogue scale 0-10) during stitch off between groups

Discussion

The history of Muller's muscle conjunctival resection (MMCR) as a surgical treatment for ptosis dates back to the early 20th century. Since then, there have been many studies that report on the application of different suture types (plain gut, chromic catgut, polypropylene, etc.). However, neither effects nor outcomes of each specific suture material were compared in the following studies. In this paper, the author compared the efficacy and outcomes between catgut and polypropylene sutures. The results found that there is no difference in the surgical outcome between using different types of suture for MMCR procedure. This is likely due to the identical positions where the muller muscle and conjunctiva were resected regardless of which suture was selected.

In common practice, suturing of muller muscle and conjunctival tissue are done with plain gut sutures. In Thailand, other absorbable sutures such as Polyglactin (Vicryl) are not used as they are known to induce more inflammatory cytokine production as well as foreign body reactions.[9] But, this paper does not mention the tissue reaction or infection rate among each type of monofilament suture or between monofilament and multifilament sutures.[10] In this research, the author compared the absorbable chromic catgut with non-absorbable polypropylene sutures. Consequently, the author found that the pain perception during the removal of suture postoperatively between the two suture groups is significantly different. During removal of the sutures, the chromic catgut was found to have a lower pain score than the polypropylene group. This is likely due to the discrepancies in coefficient of friction between chromic catgut and polypropylene sutures. Coefficient of friction is a function of multiple variables including applied tension, suture material and configuration which determines the amount of resistance upon suture penetration through the skin.[10] Therefore, the author hypothesizes that the lower pain scores in the chromic catgut group were due to the lower friction coefficient of chromic catgut compared to polypropylene suture. The lesser coefficient of friction of chromic catgut, the easier for the suture removed from the subcuticular layers, thus, results in less pain sensation.

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Conclusion

MMCR is suitable for ptosis correction with good clinical outcomes. Patients sutured with polypropylene reported significantly more pain than those with catgut during sutures removal. While the pain perception was dissimilar between the two groups, the surgical outcome was not different.

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