

## **Treatment of Corneal Abrasion in Children with Topical Nonsteroidal Anti-Inflammatory Drops without Pressure Patching**

**Ali M. El-Ghatit, MD and Adnan H. Marzouki<sup>1</sup>, MD, FRCS**

*Department of Ophthalmology, Faculty of Medicine,  
Alexandria University, Alexandria, Egypt, and*

*<sup>1</sup>Department of Ophthalmology, Faculty of Medicine,  
King Abdulaziz University, Jeddah, Saudi Arabia  
alielghatiti@hotmail.com*

*Abstract.* A non-comparative interventional case series to evaluate the effectiveness of non-steroidal anti-inflammatory (NSAID) drops in the management of non-infected, traumatic corneal abrasion with no pressure patch in children. One hundred patients with non-infected traumatic corneal abrasion less than 10 mm<sup>2</sup> in size and less than 12 hours in duration were studied. All patients received a cycloplegic eye drops at the time of presentation and were instructed to instill Diclofamic sodium 1.0 mg. Eye drops (Voltaren, Ciba Vision Ltd.) four times daily and Fucidic acid 10 mg (Fucithalamic Eye Ointment, LEO Pharmaceutical). The children that presented with closed eyes had more lid edema, photophobia, lacrimation and pain score than patient presented with open eyes ( $p < 0.001$ ). This dissimilarity disappeared in the second day with no statistical differences. Five children (5%) preferred to close their eye on the first day for the pain. By the second day, all the patients had a lower pain score with no discomfort. Traumatic corneal abrasion can be managed safely in children with no pressure patch and with topical NSAID to relieve the pain and the discomfort that follow the incidence with no side effect.

*Keywords:* Corneal abrasion, Nonsteroidal eye drops, Pressure eye patch, Children.

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Correspondence & reprint request to: <sup>2</sup> Dr. Ali M. El-Ghatit  
438 Horeya St, Roushdi, Alexandria, Egypt

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## Introduction

Corneal abrasion is a common occurrence present in eye injuries at an Ophthalmology Department<sup>[1-3]</sup>. The concept of management has changed during the past years for traumatic, non-contact lens related, non-infected abrasion towards no pressure patch with application of topical non-steroidal anti-inflammatory drugs (NSAIDS). Most of these studies were done mainly in the adult age group and showed a good clinical response<sup>[4-11]</sup>.

Diclofenac is a non-steroidal anti-inflammatory that affects the cyclooxygenase and lipooxygenase pathways. By inhibiting these pathways, there is a reduction in the production of prostaglandins, prostacyclins and thromboxanes which are mediators secreted in a cascade form following cell inflammation. The exact mechanisms by which NSAID's induces their analgesic effect remain obscure. One possible mechanism is the direct reduction in corneal sensitivity<sup>[12]</sup>. The other is to block the cyclooxygenase pathway of arachidonic acid metabolism and hence, decrease the level of prostaglandin E2 which is the main pain mediator. Another theory suggests that NSAID's increases the level of beta endorphins which has an analgesic effect on the cornea<sup>[11,12]</sup>. The effect of topical NSAID's on corneal sensitivity is reversible<sup>[13]</sup>.

However, no specific study has addressed the question of application of this modality of treatment in children ages from 5 to 12 years, as they represent the common age group vulnerable to corneal abrasion.

## Subjects and Methods

The study included all the patients examined at the emergency unit and the Ophthalmology outpatient department with a diagnosis of traumatic corneal abrasion less than 12 hours in duration. They were enrolled after fulfilling the following criteria; aged 5-12 years, no history of eye disease in the affected eye, no other signs of ocular trauma, no infiltrate or signs of stromal disease, no previous treatment given to the patient and the size of the abrasion was less than 10 mm<sup>2</sup> in area measured by the slit lamp. The parents were given an institutionally informed consent to participate in the study.

After complete ophthalmic history, the level of pain was first assessed by the Poker Chip Tool method<sup>[12]</sup>. The child was given four

chips of the same color and was told that one chip was for a little bit of hurt, and the fourth one was for the most hurt they could have. They were then instructed to pick the number of pieces of hurt that they had at present. Topical anesthesia was applied, if needed, in some cases to open their eye comfortably. The size of abrasion was measured in the horizontal and vertical dimension using the slit beam of the Haag-Streit 900 slit-lamp (Bern, Switzerland), to the nearest 0.2 mm. Examination of the other eye was done to exclude any epithelial dystrophies or corneal pathology. The subjective symptoms of tearing, photophobia, lacrimation and the way the child presented were recorded. All patients were given cycloplegic eye drops (cyclopentolate hydrochloride 0.5%, Minims, Chauvin Pharmaceuticals Ltd., Essex, UK) at the time of presentation till the patient achieved a full cycloplegic effect and fundus examination was done. All patients were instructed to instill Voltaren eye drops (Diclofanic sodium 1.0 mg. Ciba Vision Ltd.) four times daily and Fucithalamic eye ointment (Fucidic acid 10 mg, LEO Pharmaceutical, Malmoe, Sweden) twice daily for four days or until the abrasion healed. Parents were instructed to give oral analgesics (ibuprofen syrup) when needed and to keep a record. Voltaren Optha contains diclofanic sodium, a non-steroidal substance with anti-inflammatory and analgesic effect. Each ml contains Diclofanic sodium 1.0 mg and Thiomerosal 0.04 mg. No eye pad was given to the patient.

The patients were reviewed daily to monitor the subjective symptoms including tearing, lid edema, blepharospasm and their level of pain. The cornea was examined daily for epithelial healing. In addition, the parents were asked about the child's behavior at home, regarding his activity and the way he was dealing with the pain. Any patient who did not fulfill this criterion was excluded from the study. The corneal abrasion was considered healed when the patients and the parents reported no pain; the child could open his eye with no discomfort and with only minor superficial punctuate staining of the corneal epithelium. All patients were followed for four days and checked for any long term complications after 4 months.

### **Statistical Analysis**

The statistics software SPSS was used for the analysis of the results. Fisher's p value was based on the Analysis of Variance (ANOVA) test used for the differences between two means. Fisher's p value based on

the Chi-square test for the differences between two proportions where no mean could be obtained and the “student’s” *t* test was used for the differences between two means. P value less than 0.05 was considered statistically significant.

## Results

One hundred patients were enrolled in the study. All patients were followed for 3 days post abrasion and any patient that did not follow was excluded from the study. The study included 57 boys (57%) and 43 girls (43%). The age range of the patients was from 5 to 12 years with a mean of  $7.7 \pm 1.7$  years. The size of the corneal abrasion varied from 2 mm<sup>2</sup> to 10 mm<sup>2</sup> with a mean of  $5.5 \pm 2.2$  mm<sup>2</sup>. The common cause of abrasion (Table 1) was caused by blunt trauma (30%), followed by accidental finger nail injury (24%). Other traumatic causes of corneal abrasion included injury caused by toy while playing (13%), paper (11%) and hair comb or brush (9%). The remaining causes were caused by injuries from pencil, tree branch, cat scratch or unknown (18%). It was found that 35 (35%) patients had a previous history of corneal abrasion.

**Table 1. Causes of corneal abrasion.**

Causes	Number (n=100)	(% of total) 100%
Blunt trauma	30	30%
Accidental fingernail Injury	24	24%
Toy	13	13%
Paper	11	11%
Hairbrush, comb	9	9%
Others *	13	13%

\* Abrasion due to ball, book, cat scratch, pencil, tree branch, flying insect or unknown trauma

It was noticed that children presented at the clinic, either had their eyes opened or closed. By analyzing this type of presentation with the pain score, the clinical picture, the size of abrasion and duration till healing, the study showed the following: The children that were presented with closed eyes had more lid edema, photophobia, lacrimation and pain score, than the patient presented with open eyes ( $p < 0.001$ , Table 2). This difference disappeared in the second day with no statistical difference. The pain score was higher with larger size abrasion ( $p < 0.01$ , Table 3).

**Table 2. Children's characteristics on admission by type of eye presentation.**

	Opened-eye (n = 77)		Closed-eye (n = 23)		Total (n = 100)
	No.	%	No.	%	No.
Sex					
Boys	44	57.1	13	56.5	57
Girls	33	42.9	10	43.5	43
Lid edema	14	18.2	21	91.3	35

**Table 3. Size of corneal abrasion by pain score on presentation and type of eye presentation.**

Pain Score on Presentation	Size of Corneal Abrasion (mm <sup>2</sup> )								
	Opened-eye (n = 77)			Closed-eye (n = 23)			Total (n = 100)		
	N	Mean*	SD	N	Mean	SD	N	Mean*	SD
1	8	4.4	1.5	0	-		8	4.4	1.5
2	38	4.5	1.9	0	-		38	4.5	1.9
3	23	5.2	2.1	2	8.5	0.7	25	5.4	2.2
4	8	7.1	1.6	21	6.5	2.1	29	6.7	2.0

\* $p < 0.01$  (Fisher's  $p$  value using "student's"  $t$  test)

The pain score decreased by treatment on the second day in all cases. However, it was observed that the pain score was higher in the patient presented with closed eyes (91.3% had a score from 2-3) than the patient presented with open eyes (57.3% had a score from 2-3) in the first day (Table 4).

**Table 4. Pain score on first and second days by type of eye presentation.**

Pain Score	Opened-eye (n = 77)		Closed-eye (n = 23)		Total (n = 100)
	No.	%	No.	%	No.
First day*					
0	24	31.2	0	0.0	24
1	32	41.6	2	8.7	34
2	19	24.7	10	43.5	29
3	2	2.6	11	47.8	13
Second day*					
0	70	90.9	5	21.7	75
1	6	7.8	17	73.9	23
2	1	1.3	1	4.3	2

\* $p < 0.01$  (Fisher's  $p$  value using "student's"  $t$  test)

All the patients had healed and returned to their activities by the third day. However, it was observed that the patients that were presented with open eyes healed faster than patients with closed eyes. 94.8% of the patients presented with open eye healed and returned to normal within 2 days while 43.5% of patients presented with closed eye healed within 2 days (Table 5). This difference was statistically significant ( $p < 0.001$ ).

By reviewing the mothers of patients with closed eyes, it was found that twenty (82.6 %) of these children preferred to close their eyes on the first day; they prefer to sit quietly and keep their eyes closed most of the time. Some of the mothers have even patched the injured eye to make the child more comfortable. These children used more frequent oral analgesia than the others. On the contrary, children that presented with open eyes had a normal daily activity.

**Table 5. Duration in days till healing and return to normal by type of eye presentation.**

Days	Opened-eye (n = 77)		Closed-eye (n = 23)		Total (n = 100)
	No.	%	No.	%	No.
Healing*					
1	29	37.7	2	8.7	31
2	44	57.1	8	34.8	52
3	4	5.2	13	56.5	17
Return to normal*					
1	24	31.2	1	4.3	25
2	47	61.0	7	30.4	54
3	6	7.8	15	65.2	21

\*  $p < 0.001$  (Fisher's  $p$  using Chi-square test)

During the study, there were no adverse complications from the treatment protocol. To date, the patients have been followed for at least 3 months.

## Discussion

Traumatic corneal abrasion is a common present complaint in any eye department. It has been reported to account for more than 10% of new patients attending as emergency visits<sup>[1,2]</sup>. Although it is considered a minor injury, patients seek immediate medical care for the immediate pain, tearing, photophobia, decreased vision and foreign body sensation produced by the abrasion. Recently, the concept of management of corneal abrasion has shown that a patch does not improve healing rates nor reduce pain, and the management has changed towards no eye pad

with the use of topical non-steroidal anti-inflammatory drops<sup>[4-15]</sup>. None of these studies has addressed the pediatrics age group, which is more vulnerable to traumatic corneal abrasion. The most annoying symptom for this age group is the pain. Children do not have as high tolerance to pain as adults<sup>[12]</sup>. Both the child and his parent will seek the best approach to alleviate the pain. In this study, it was found that the child presented clinically, either had his eyes opened or closed the injured eye, and sometimes both eyes. As all patients received the same medical regimen in order to relieve the pain and discomfort by the cycloplegics and the NSAID drops, the study was able to compare the response in the two presented ways.

Children with closed eyes have more lid edema, photophobia and lacrimation than children with open eyes at the time of presentation ( $p < 0.001$ ) with higher pain score. The larger the size of the abrasion, the earlier is his presentation to the hospital ( $p < 0.01$ ). It was found that the more the size of abrasion, the more is the pain score in the closed eyes patients ( $p < 0.01$ ). The same relation was observed by Rao *et al.* but for higher age group<sup>[13]</sup>. It was found that the response of pain to the medications was good in all cases by the second day. 90.9% of all cases that presented with open eyes had a pain score of 0. However, in patients presented with closed eyes, 21.7% (5 of 23 patients) had a pain score of 0, and by the second day all children had no pain. Healing was faster in the patients that presented with open eyes ( $p < 0.001$ ) and all cases healed by the third day. It mirrored the results of previous studies confirming the effect of no patch with topical NSAIDs in relieving pain and increased patient comfort post corneal abrasion<sup>[4-19]</sup>. In a meta-analysis of randomized trials done on older age group with corneal abrasion, Calder review the pooling of data from three randomized controlled trails shared similar populations, study designs and intervention characteristics. He demonstrated a positive analgesic effect of topical NSAIDs with no patch<sup>[11]</sup>.

However, in this study, a small number of patient 5% (5 patients) did not experience good relieve of symptoms and according to the parents they had to patch the eyes in a simple way to make their child feel better, and by the second day these children were able to open their eyes.

The pain assessment in children differs from the adults as children have a limited cognitive ability to qualify or quantify pain. Pain is a

subjective experience that has sensory and emotional components. Children do not have as high a tolerance to pain as adults. Poker Chip Tool was found to be simple tool for pain assessment in children; simple to use and reliable<sup>[12]</sup>. This study addresses the issue of pain and discomfort following a traumatic corneal abrasion in children, and any medications that alleviate these symptoms with no adverse effect will be of great help. NSAID's produce potent analgesic and anti-inflammatory effect. They can reduce corneal sensitivity in normal human cornea and the effect can last up to 1 hour after the installation of a single drop<sup>[14]</sup>.

The topical adverse reaction from the use of NSAID's is mostly transient mainly burning, stinging and hyperemia of the conjunctiva at the time of application. NSAID's may be toxic to vulnerable corneal epithelium such as after cataract or photorefractive keratectomy and may retard epithelial wound healing<sup>[18-23]</sup>. In this study, no complications were observed in the healing period, or in the follow-up period, as the drug was used for a short period of time, and the small surface area of epithelial defect.

In the pediatric age group the analgesic effect of NSAID's was observed in patients undergoing strabismus surgery and was found equal to betamethasone in one study<sup>[24]</sup>, plus with a higher comfort score compared to dexamethasone in another study<sup>[25]</sup>.

In this study the response to pain was good in all cases. The rate of healing of the epithelium was completed after three days in all cases and no difference was found in healing between the children that presented opened or closed eye. In conclusion, this study demonstrated that traumatic corneal abrasion can be managed safely in children with no pressure patch with topical NSAID's to relieve the pain and the discomfort that follow the incident. The short use of the medications has no side effect and there is no delay in epithelial healing. However, the tolerance to pain can be different for some children where pressure eye pad can help for the first day.

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## علاج الخدوش السطحية للقرنية بواسطة قطرة اللاكورتزون المضادة للالتهابات بدون غطاء للعين

علي متولي الغتيت، و عدنان حامد المرزوقي<sup>1</sup>

قسم العيون، كلية الطب، جامعة الإسكندرية

الإسكندرية - مصر

<sup>1</sup> قسم العيون، كلية الطب، جامعة الملك عبد العزيز

جدة - المملكة العربية السعودية

المستخلص. الغرض من الدراسة تقييم فاعلية قطرة اللاكورتزون في علاج خدوش القرنية في الأطفال بدون غطاء للعين. أجريت الدراسة على ١٠٠ عين حدث بها خدش أقل من ١٠ مم<sup>٢</sup>، وتم علاجهم بقطرة اللاكورتزون بدون غطاء للعين. الأطفال الذين كانوا يشكون من غلق العين مع الخدش كانوا يعانون من تورم في الجفن وحساسية للضوء وألم أكثر من الذين كانت أعينهم مفتوحة عند الفحص. جميع الأطفال تحسن لديهم الألم والأعراض في اليوم الثاني بواسطة العلاج بدون غطاء للعين. خدوش القرنية ممكن علاجها بأمان بواسطة قطرة اللاكورتزون المضادة للالتهاب بدون غطاء للعين لدى الأطفال بدون أعراض جانبية.