· Review ·

# Review on superglue eye injuries

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## 超强力胶眼部损伤的研究进展

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**摘要**
该研究旨在对超强力胶可能对眼部造成的损伤问题进行回顾。本文对以往有关强力胶有害影响的文献进行了系统的研究。在过去的 30 年中,超强力胶对眼部的损伤问题是很常见的,其中大多数是意外事件,虽然它对眼部组织具有毒性,但通过安全教育可以进行预防。本文阐述了眼部超强力胶损伤的处理方法,指出了预防眼部超强力胶损伤的重要性。
**关键词**:眼外伤;胶水;超强力胶水;眼部;损伤

## Abstract
• The purpose of this study is to run a review on possible superglue injuries to the eye. In this review, previous papers regarding the harmful impacts of superglue were systematically studied. Superglue eye injuries have been common during the three last decades and most of them were accidental and preventable by introducing safety issues and although it may be toxic for the tissues, it is not associated with long term morbidity. This paper addresses the management of superglue injuries and shows the importance of the prevention of ocular superglue injuries.
• KEYWORDS: ocular trauma; glue; superglue; eye; injury
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## INTRODUCTION

Chemical injury is one of the most prevalent complaints of the patients referring to ophthalmology care providers, which requires immediate care[1]. It most commonly occurs among men between 20 to 40 years old in the workplace[2]. Chemical eye injury may cause devastating ocular complications including glaucoma and ocular surface disintegration leading to long term disability and poor life quality as well[3-5]. Superglue (cyanoacrylate) has become popular as a powerful adhesive one for strong bounding of broken materials like wood, glasses, metals, plastics and even cosmetic applications to stick on nails or to repair them[6]. Superglue has also some medical applications and it is utilized as a biologic adhesive and sealant to close the tissue together[7], but those used domestically are more toxic than those used as a tissue sealant[8]. Due to a similar bottle design of superglue to eye drop bottles and its ease of access in the markets, several cases of inadvertent instillation to the eye which has already been reported[9-11]. We aimed to review the studies relating to a superglue eye injury, its complications, and the management.

We reviewed previous papers in PubMed database, Google scholar, EMBASE and Cochrane library to find original English studies on superglue eye injuries. The related articles (42 articles) for a comprehensive review and update were included with a particular focus on published articles. The present research complies with the tenets of Declaration of Helsinki.

**Epidemiology and Risk Factors** Superglue eye injury may occur in several conditions like the workplace, school, home, *etc*. It may occur when inadvertently instilled in the eye instead of topical medications; due to similarity of the bottle or tube design to the medical drops or ointment containers respectively[12-13], splash to the eye during playing especially with children (1-10 year), direct insertion by hand or maybe as a result of assault[6,14-15]. The exact prevalence and demographic characteristics of superglue eye injury are not clear, because it is limited to several case reports so further comprehensive studies are required.

In a retrospective study by Tabatabaei *et al*[15] 105 patients referring to the emergency department with superglue eye injury were investigated: the mean age of the patients was 24.7 years, 53% of them belong to the male group and the rest of them were female. The most injury occurred at home (72.4%) then workplace (24.8%) and the highest three major risk factors were patients' carelessness (78.1%), childhood curiosity (11.4%), similarity of the glue bottle to

ophthalmic eye drops (2.9%) and one person had been assaulted. McLean[14] reported 14 cases of superglue eye injury and the mean age of the victims was 22.6 years, and most of them occurred during the opening of the cap of the glue containers and the second common condition was children playing with the bottle. Another report by Mandal *et al*[16] described a 6-year-old girl suffered from the application of superglue in her left eye by her mother mistaking it for chloramphenicol ointment. Reddy[6] reported a 6-year-old girl with accidental putting superglue in both her eyes by her grandfather mistaking it for an ophthalmic ointment.

Needham *et al*[13] reported a mother inadvertently instilled superglue into her baby's eye confusing it with chloramphenicol eye drop and a 3-year-old child who instilled nail drop to her eye imitating her mother action, using antibiotic eye drop. Bruder *et al*[17] reported three cases of superglue eye injury: case 1 was an 82-year-old woman with insulin-dependent diabetes mellitus and case 2 was a 55-year-old man with none insulin-dependent diabetic Mellitus, both had background diabetic retinopathy and due to poor visual acuity at least in one eye, they had instilled superglue into their eyes instead of artificial tear.

Good *et al*[18] reported two cases of superglue eye injuries: a 27-year-old man had dropped nail fastening glue to his right eye instead of chloramphenicol eye drop leading to a chemical tarsorrhaphy and a 17-year-old had instilled superglue to the right eye as a topical eye drop due to poor vision in darkness leading to complete eye closure.

**Toxicity** Superglue is a monomer that can be condensed in a few seconds and works better on dry surfaces. Because of the wetness of the ocular surface and blinking reflex due to the painful irritation of the eye, most of the glue will pour out of the eye and attach to dry surfaces of lids or may even accumulate in the lower fornix[14].

It may attach to eyelid margin and lashes leading to eye closure (chemical tarsorrhaphy) and limits ocularmovement[10-11,18-21]. Conjunctival epithelium injury, corneal abrasion, and punctate epithelial keratopathy frequently have been reported in superglue injuries[9,11,14,22-23] but most of the cases will heal completely by receiving appropriate ophthalmic care.

**Management** Copious irrigation may reduce condensation of the glue and decrease the rate or size of the ankyloblepharon, so it would be beneficial to be performed by the victims or their relatives[22]. All the victims are recommended to seek emergent medical care. They should be evaluated by an ophthalmologist and complete ophthalmic examination should be performed. Several management processes have been proposed by authors to remove condensed glue and revers tarsorrhaphy.

Raynor[24] reported a tight tarsorrhaphy due to superglue injury, necessitating general anesthesia and surgical repair of the eyelid; they applied wet patches to the eye according to manufacturers' safety director and the next morning the lids were separated without any significant discomfort. They suggested the complete eyelid adhesion can be reversed by overnight wet patching without any sequels. Bruder *et al*[17] reported three cases of superglue eye injury that occurred accidentally.

The first and second cases were treated by mechanical glue removal and reversing tarsorrhaphy at the emergency department, conversely, the third case was a 5-year-old boy who had accidentally splashed superglue to his eye leading to tarsorrhaphy and it was not possible to open the eye mechanically for an ocular exam. So, they decided to take the patient to the operating room and dissolved the superglue with acetone-soaked cotton swap[17].

Rohrbach *et al*[36] reported a female who inadvertently dropped the superglue in her eye, she was treated with intensive rinsing and mechanical removal of the hard glue particle and remaining of the glue was also rejected spontaneously and subtotal corneal erosion healed without any sequel; he stated that vigorous manipulation may have been more harmful than useful[24]. In this setting, corneal abrasion could easily be healed without any sequel[21].

Reddy[6] reported 3 cases of eyelid adhesion by superglue, one of them was separated by pulling eyelid with fingers and the other two by trimming the eyelashes. Terman *et al*[25] reported an 11-year-old girl that superglue squirted into her eye and the lids were closed completely. They preferred to utilize sodium bicarbonate 0.3% solution and daily observation instead of eyelashes trimming and any mechanical removal of the glue because of the child's fear, and in less than 24h the lids were separated spontaneously, but there is also a report demonstrated the tarsorrhaphy may persist for even 4d, necessitating general anesthesia to reverse it[18] and it is important to consider the risk of amblyopia in children.

Wong *et al*[26] separated the eyelids of a five-year-old girl using tetracaine gel and trimming the eyelashes by scissors while the child was awake. Jijelava *et al*[21] proposed the hook-assisted technique as a useful method to revers tarsorrhaphy. He introduced the muscle hook behind the attached lids from the opening site in the lid fissure, while pulling the hook parallel to lid margin, counter pressure was applied with the other hand. Corneal and conjunctival erosion can be treated with topical antibiotics and cycloplegics[11,22] and bandage contact lenses can be used optionally. Almost all victims have been treated successfully without long term morbidities.

## DISCUSSION

Cyanoacrylate, super glue, was available from 1958. Over the last decades, superglue had become more popular because of its ability to bind to many surfaces and materials powerfully even artificial cosmetic nails[11]. Furthermore superglue can strongly bind to variety of human tissues[27]. However, cyanoacrylates used commercially have higher tissue toxicity than those used medically[8].

In ophthalmology, medical tissue adhesives can be divided into synthetic adhesives (*e.g.* cyanoacrylate derivatives) and biologic adhesives (*e.g.* fibrin-based adhesives)[28]. Cyanoacrylate:

**Table 1 Previous studies regarding superglue eye injuries**

| Authors | Year | No. | Clinical manifestation | Managements |
|---|---|---|---|---|
| Margo *et al*[10] | 1982 | 3 | Eyelid sticking, kerato-conjunctivitis, corneal abrasion, corneal edema, lid margin erosion | Topical antibiotic, lash trimming, reveres tarsorrhaphy by irrigation |
| Morgan *et al*[33] | 1984 | 1 | Sticking eyelid | Cutting eyelashes, topical antibiotic, eye patch |
| Silverman[22] | 1988 | 1 | Corneal abrasion | Topical antibiotics & cycloplegics, eye patch |
| Raynor[24] | 1988 | 1 | Sticking eyelids | Separation with warm patch |
| Lyons[34] | 1990 | 6 | Eyelid sticking, corneal and conjunctival epithelialabrasion and punctate epithelial keratopathy | Glue removal and treatment with topical mydriatics and antibiotics. |
| Good *et al*[18] | 1994 | 2 | Sticking eyelids, corneal abrasion | Antibiotic ointment general anesthesia & lid separation |
| Bruder *et al*[17] | 1995 | 3 | Sticking eyelids, corneal erosion | Overnight patch with ointment then lid separation with mechanical force, reverse tarsorrhaphy with acetone soaked cotton swap under general anesthesia. Glue removal with forceps, topical antibiotic drop |
| Landers *et al*[35] | 1996 | 1 | Sticking eyelids, extensive corneal erosion | Wet patch, surgical lid separation |
| McLean[14] | 1997 | 14 | Sticking eyelids, corneal erosion, conjunctival erosion, conjunctivitis, punctate epithelial keratopathy | Irrigation, lash trimming, topical antibiotic |
| Rohrbach *et al*[36] | 2000 | 1 | Conjunctivitis and corneal abrasion | Intensive rinsing, mechanical removal, topical anti-inflammatory |
| Leibowitz *et al*[37] | 2000 | 1 | Corneal and conjunctival erosion | Topical antibiotics |
| Knight[12] | 2001 | 1 | Sticking eyelids, upper lid adhesion to cornea | Follow up and conservative management |
| Needham *et al*[13] | 2001 | 2 | Sticking eyelids, corneal erosion | Mechanical lash removal, topical antibiotic |
| Terman[25] | 2002 | 1 | Sticking eyelids | Admission for observation, pain management, and 3% sodium bicarbonate solution compresses, moist compresses and antibiotic ointment |
| Mandal *et al*[16] | 2003 | 2 | Eyelid sticking | Topical antibiotic and conservative management |
| Desai *et al*[31] | 2005 | 3 | Sticking eyelids, corneal abrasion | Conservative treatment |
| Wali *et al*[20] | 2009 | 1 | Sticking eyelids, corneal abrasion | Conservative treatment, topical antibiotic |
| Øgard *et al*[38] | 2010 | 1 | Eyelid closure | Surgical separation of the eyelid |
| Yusuf *et al*[11] | 2010 | 1 | Corneal abrasion | Topical antibiotic |
| Reddy[6] | 2012 | 3 | Sticking eyelids | Separation of lids by finger, trimming of eyelashes |
| Wong *et al*[26] | 2012 | 1 | Sticking the eyelid | Tetracaine gel, cutting of lashes, dexamethasone/neomycin/polymyxin B |
| Tabatabaei *et al*[15] | 2016 | 105 | Corneal and conjunctival abrasion, sticking eyelid, hyepersensitivty to glue | NA |
| Jijelava *et al*[21] | 2017 | 1 | Sticking the eyelid | Hook-assisted separation of eyelids, trimming the residual glue |
| Zegers[23] | 2017 | 1 | Corneal abrasion, sticking of eyelids | Mechanical removal of the glue, and eyelashes |
| Pujari *et al*[39] | 2018 | 2 | Eyelid closure and erythema | Eyelash trimming |
| Cookey *et al*[40] | 2018 | 1 | Matting of the upper and lower lid margin and eyelashes, corneal ulcer | Glue-matted eye lashes were trimmed and the glue on the cornea and conjunctival surface was gently removed, corneal ulcer was managed with topical antibiotics, systemic analgesics, and vitamins |
| Steinemann *et al*[41] | 2018 | 1 | Corneal endothelial insufficiency | Corneal endothelial keratoplasty |
| Akelma *et al*[42] | 2019 | NA | Causing thermal second degree burn (in epidermis and dermis) | Irrigated under cold water |

it has very high tensile strength that rapidly polymerize on contact with basic substances such as water or blood to form a strong bond. Because they are synthetic and nonbiodegradable, they are usually used on an external surface and may induce an inflammatory foreign body reaction, including neovascularization and tissue necrosis[28]. The main indication for cyanoacrylate is the management of perforated corneal ulcers, both sterile and infectious types. Also it is used for ulcers where the cornea is very thin and might perforate in the next couple of days or weeks[29]. Cyanoacrylate glue blepharorrhaphy is used in immobilized patients with recalcitrant exposure keratopathy[28]. In some reports, this glue was used in posterior retinal breaks associated with retinal detachments in pediatric patients who

underwent vitreoretinal surgery for retinal detachment[30].

In early 1980 they were repacked to bottle designs identical to ophthalmic drops and the first case of the ocular superglue toxicity was reported in 1982 mistaken for eye drop[10]. After that, several cases of superglue injury due to victim carelessness, the similarity of the glue container to ophthalmic drops and ointments, children's curiosity with lack of parent's careful supervision and poor vision of the user have been reported[9,14-15,31]. Yusuf *et al*[11] divided the victims into 3 distinct groups: 1) persons with poor vision that mistake their eye drops for superglue; 2) careless people with normal vision; 3) children that splashed the glue to their eyes while playing. In a cross-sectional study by McLean (14 cases), the injury occurred most commonly during uncapping the container that may be due to air bubble inside of the tube (7 cases) and the second common condition were children under 6 years old (4 cases) that played with superglue without parent's supervision[14].

In our previous study, the most common risk factor was related to the patient's carelessness and the second was due to child curiosity without parents' supervision[15]. To prevent accidental superglue injury, it is necessary to keep the glue away from the children and the use of child-proof caps may prevent eventual damage. For those that use medical eye drop, it is better to store super glue in a place physically distinct from the medical eye drop to avoid confusion. The risk of accidental injury may be diminished by applying changes to the superglue containers like the different shapes of the dropper, warning flag and vertical ribs on the superglue bottles[8,12,14,16,18]. Although previous attempts have been made to change the non-medical dropper designs, it seems that the companies did not change their commercial packages, despite several reports of injuries. Some author proposes to substitute the multi-dose eye drops with sterile single-dose ones, with labeling on the flange with clear text or in braille style[9,11]. Several ocular injuries induced by superglue include: severe pain, conjunctival and corneal abrasion, punctate epithelial keratopathy, loss of eyelashes and chemical tarsorrhaphy[32]. Although all the victims have been treated completely without long term complications, it may induce short term morbidities like severe pain, ocular sensitivity and considerable psychologic stress of functional blindness[11], leading to seeking emergent medical care.

Copious irrigation and physical removal of the superglue by the patients and their relatives may decrease condensation to cyanoacrylate monomer and reduce consequent tarsorrhaphy and other serious complications[11,27]. Once the accident occurs, it is highly recommended to refer to the emergency department[14]. Yusuf *et al*[11] classify the management into the following stages: the first was the management of sticky lids and releasing the chemical tarsorrhaphy which is a very common consequence to permit ocular examination and removing residual debris from the ocular surface, and the second was to identify and manage the sustained ocular damage according to the standard protocols.

The sticky eyelids especially those with partial adhesion can be separated using the slit lamp by eyelash trimming optionally, overnight wet patching and sodium chloride 0.3%[6,24-25]. Also, it is advised to palpate the globe movement over the closed lids to ensure that the eye is not glued to the posterior surface of the eyelids. After releasing the eyelids, it is crucial to perform an ophthalmic examination, and removing retained glue particles from the ocular surface (it can be carried out by fine forceps)[14]. Fluorescein staining may be useful to identify the corneal and conjunctival abrasions as the major sequel of these injuries and successful treatment have been achieved by topical antibiotic drops and ointments, analgesics and cycloplegics[11]. However, superglue eye injury seems not to be severe as other chemical eye injuries like alkali and acid burn and do not appear to accompany by long term morbidities[14].

## CONCLUSION

Overall, superglue eye injuries have been common during the three last decades and most of them were accidental and preventable by introducing safety issues and although it may be toxic for the tissues, it is not associated with long term morbidity.

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