A sticky sight: cyanoacrylate ‘superglue’ injuries of the eye

Summary
A 64-year-old man presented to casualty with blurred vision and pain in his left eye, 2 h after inadvertently instilling clear nail glue into his eye instead of postoperative Timolol eye drops. The glue was removed at the slit lamp revealing a corneal abrasion, which was managed with topical antibiotics. Inadvertent ocular cyanoacrylate, or ‘superglue’, instillation has been reported frequently since 1982 when superglue was repackaged into ophthalmic style dropper bottles. This case report highlights the continuing problem of cyanoacrylate eye injuries and serves as a reminder to healthcare professionals to report such incidents to manufacturers and regulatory bodies, on behalf of their patients, to promote the introduction of universal safety mechanisms on all household chemical containers. Failure of glue manufacturers to introduce safety cap mechanisms has resulted in significant ocular morbidity over the last 27 years, and such incidents are expected to occur until superglue bottles are redesigned.

Background
Cyanoacrylate ‘superglue’ was first sold as a commercial product in 1958, and its use in do-it-yourself kits and acrylic nail sets has led to its widespread availability in the home. Its repackaging into ophthalmic style dropper bottles in the early 1980s has resulted in many cases of inadvertent ocular instillation, through misidentification by the poorly sighted patients prescribed topical medications, the careless but well-sighted individual using over the counter eye drops, or accidental inoculation in children playing with the containers unsupervised. Here we describe an ophthalmic patient who sustained a cyanoacrylate eye injury through inadvertent self-instillation and the further management this required. We present a review of all such reported cases in the literature and propose a simple solution to prevent the majority of such incidents from occurring in the future: the introduction of a safety cap mechanism on superglue dispensers.

Case presentation
A 64-year-old man presented to the accident and emergency eye unit at the Oxford Eye Hospital with a 2 h history of severe pain and blurred vision in his left eye. He reported having instilled a common brand of nail glue (Boots Clear Nail Glue) into his left eye 2 h previously after mistaking the container for his postoperative Timolol eye drops,
prescribed following intraocular surgery. During the consultation he produced both bottles demonstrating the similarity in size, shape and opening mechanism of the bottles (figs 1 and 2).

Figure 1

Front and view of the Boots Clear Nail Glue bottle on the left beside Timolol 0.25% eye drops prescribed for high postoperative intraocular pressures on the right. Note the similarities in size, shape and colour of the bottles, and the absence of a protective opening mechanism.
Figure 2

Rear view of the Boots Clear Nail Glue bottle on the left beside Timolol 0.25% eye drops prescribed for high postoperative intraocular pressures on the right.

After applying the glue, the patient irrigated his left eye immediately with tap water, without any effect on the pain or blurred vision. In casualty his visual acuity was 6/6 unaided in his right eye and 6/12 in his left eye. On examination, the eyelids were tightly bound medially. The glue was removed using fine forceps at the slit lamp in the eye casualty unit, without the need for anaesthesia. Slit lamp examination showed moderate left sided conjunctival injection and a corneal abrasion (measuring 2.8 mm by 3.3 mm) evident on staining with fluorescein. The pH in both eyes was 7.0 after the procedure.

He had undergone phacoemulsification for traumatic cataract 13 months previously with secondary "piggy back" intraocular lens (IOL) insertion in his left eye 18 days earlier for postoperative anisometropia.

The patient had been prescribed Timolol 0.25% twice daily, for postoperative secondary glaucoma, and 0.1% dexamethasone four times daily and chloramphenicol 0.5% four times daily in his left eye.

**Treatment**

After clinical evaluation at the emergency eye unit, the patient was managed with chloramphenicol eye drops four times daily and cyclopentolate 1% twice daily for the corneal abrasion.
Outcome and follow-up

The patient was followed up 2 days later when his symptoms of pain and blurred vision had improved, although there was some discharge reported from his left eye. His visual acuities had improved to 6/4 bilaterally. Slit lamp examination showed that his corneal abrasion had healed although there was a small conjunctival epithelial defect medially. His medications were continued, and on final outpatient review 2 weeks later his conjunctivae and corneas appeared normal bilaterally.

This incident was formally reported on the NHS patient safety incident reporting website, and to the manufacturers of the nail glue preparation that caused the patient’s eye injury.

Discussion

Inadvertent ocular cyanoacrylate or ‘superglue’ instillation mistaken for intraocular eye drops has been reported in the literature on several occasions since it was first described in 1982. Although cyanoacrylate containing superglues were available since 1958, it was not until their widespread repackaging into dropper bottles resembling those of ophthalmic medical dispensers in the early 1980s that inadvertent ocular instillation of glues became a commercial consumer hazard. During the 1980s, the popularity of acrylic and artificial nails increased on a global scale and the use of ophthalmic style plastic dropper bottles for cyanoacrylate adhesives became a feature of the kits used to attach the acrylic material to the consumer’s native nail. Correspondingly, household do-it-yourself kits also utilised this new convenient form of superglue packaging, further contributing to its common presence in the home of the consumer over the last 30 years.

There are 12 PubMed indexed publications relating to inadvertent cyanoacrylate injuries of the eye; two retrospective observational studies, nine letters to editors of journals describing cases, and one case report. Table 1 presents demographic data from all 36 reported cases of glue eye injury in the literature including details of ocular injuries sustained and management instituted. The median age of presentation from reported cases is 27 years, with the youngest victim aged 1 and the oldest aged 61 years.

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The demographic data, clinical findings and management of all reported cases of inadvertent cyanoacrylate glue instillation into the eye between 1982 and 2009 (PubMed referenced)

Cyanoacrylate, the adhesive chemical in superglue, is a monomer formed from the condensation of formaldehyde and cyanoacetate, bonding in seconds through contact with weak bases and on contact with a variety of human tissues. Cyanoacrylate glue serves a large assortment of ophthalmic uses including temporary tarsorrhaphy for corneal exposure and ulceration, skin closure and blepharoplasty in oculoplastics, sealing impending or frank corneal perforations, aqueous leaks, securing contact lenses in severe corneal injury, and punctal closure. However, cyanoacrylates used commercially have higher tissue toxicity than those used medically.
Accidental instillation of commercial cyanoacrylate results in significant short term ocular morbidities (table 1). Those reported include corneal abrasions, punctuate keratopathy, conjunctivitis and conjunctival abrasion, eyelid skin excoriation, loss of eyelashes, tarsorrhaphy, periocular dermatitis, invariable intense stinging or burning pain upon instillation,41 significant loss of visual acuity and/or functional blindness—together with the not inconsiderable psychological distress it causes to the victim and their relatives. The management of acute glue instillation of the eye has two principal phases: primarily to reverse the very commonly induced tarsorrhaphy to permit full ocular slit lamp examination and removal of visible residual debris. The secondary aim is to identify and treat sustained ocular damage along standard protocols as for other traumatic injuries.

The initial reversal of tarsorrhaphy can be achieved at the slit lamp, particularly if the tarsal plate adhesions are partial, although eyelash trimming may be required to allow full ocular examination. It has been suggested that a complete, tightly bound tarsorrhaphy can be freed by the application of a wet patch overnight.4 However, this is not always possible and there is a report of a patient who sustained cyanoacrylate induced tarsorrhaphy for 4 days, requiring general anaesthesia to reverse it.4 Copious irrigation immediately upon instillation by the patient or their relatives/carers is often performed (table 1); in addition to removing some of the glue through physical force, it may also reduce the rate of condensation into the cyanoacrylate monomer and reduce the severity of the resulting tarsorrhaphy and consequent ocular trauma.12 Once tarsal separation is achieved, thorough slit lamp examination is required to remove residual fragments of glue using fine forceps,2 and the instillation of fluorescein drops to identify corneal epithelial trauma. Cyanoacrylate often bonds in dry conditions; the tarsal margins and the lower conjunctival fornices provide ideal environments and common sites of glue accumulation and action.2 The secondary management of cyanoacrylate instillation centres on corneal abrasions and punctuate keratopathy, the most common and important sequelae of this eye injury. Management of traumatic corneal abrasions follows existing protocols with intraocular antibiotic drops or ointments and topical or oral analgesics if required. Mydriatic drops and pressure patching were commonly used in the early case reports, before evidence against their use was published.1718 The long term ocular prognosis in patients with cyanoacrylate injuries of the eye appears favourable from published case reports. Outpatient follow-up consultations to assess corneal epithelial healing post-injury has demonstrated complete recovery in each reported case of corneal abrasion secondary to cyanoacrylate instillation.

The concern over bottle design has previously been communicated,4 but as yet there appears to be no action on behalf of the companies that design the packaging for commercial glues and/or eye medication preparations, despite the frequent reporting of these episodes. It has been suggested that in order to make medications and glues distinct, either (1) the shape and/or size of the bottles necessitate distinct design, (2) a system of colour coding of bottle tops may be needed, (3) a safety bottle top mechanism should be introduced for nail glues and any toxic substance packaged in dropper bottles, or (4) suggestions should be made to patients to keep these items physically apart to avoid confusion, as these items are often kept together in bathroom cabinets, or on dressing tables.
The reported cases of inadvertent cyanoacrylate instillation demonstrate three distinct patient groups who are victim to this injury: (1) poorly sighted individuals who honestly confuse the glues for their prescribed eye drops; (2) careless, normally sighted individuals who confuse the glue for over the counter eye drops, such as antihistamines; (3) children who play with glue bottles and accidentally splash them into their eye(s).

The majority of these accidents in each of the patient groups described are preventable by a relatively simple modification to the opening mechanism of the bottle tops on superglue preparations. Bleaches, toilet cleaners, and indeed other medicaments and chemicals have child safety mechanisms to protect children, and an equivalent mechanism on glue bottles that resemble ocular dropper bottles would be correspondingly protective. Children would be incapable of opening the bottles independently, and poorly sighted individuals may need to inspect closely the small text on the bottle, or request assistance from another individual who would read the bottle. Careless individuals would have to afford the bottle more attention, increasing the likelihood of identifying it as toxic and preventing glue instillation.

This report highlights the fact that nearly 30 years after the first reported cases of inadvertent cyanoacrylate instillation in the eye, no action has been taken by glue manufacturers to redesign the dropper bottles they are packaged in. A simple modification would prevent the majority of further cyanoacrylate injuries, which in view of the evidence presented, will continue to cause ocular morbidity until they are redesigned.

Learning points

• Cyanoacrylate superglue injuries of the eye are a common and preventable cause of ocular morbidity.

• Despite being toxic and harmful to human tissues, superglues are not required by law to have safety mechanisms incorporated into their dispensing bottles.

• The introduction of safety cap mechanisms on the ophthalmic style dropper bottles that the glues are packaged in could prevent the majority of these incidents.

• Medical professionals have a duty of care to their patients to report such incidents to national and regulatory bodies to appeal for such a modification of packaging.

• Cyanoacrylate superglue injuries of the eye will continue to occur until safety mechanisms are introduced.

Footnotes

• Competing interests: None.

• Patient consent: Patient/guardian consent was obtained for publication.

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