Cyanoacrylate: A Handy Tissue Glue in Maxillofacial Surgery: Our Experience in Alexandria, Egypt

Ahmed Habib · Ahmed Mehanna · Ahmed Medra

Received: 11 April 2012 / Accepted: 10 August 2012 / Published online: 15 September 2012
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Abstract Cyanoacrylate tissue glue has been widely used in different surgical applications. It is easy to apply and can save considerable time and effort. Reports including series of oral and maxillofacial cases are yet to be well documented. We report our experience using cyanoacrylate tissue glue in the head and neck region in 165 patients. We have used it for indications including orbital floor graft fixation, cleft lip and palate repair, oral dressing, skin graft fixation, nasal splinting, immobilisation of traumatised teeth, management of chyle leak during neck dissection and wound closure. We have not had any complications from using cyanoacrylate. It is found to be safe and effective in different indications it is used for without undue hazards. The role of cyanoacrylate in oral and maxillofacial surgery needs further research.

Keywords Cyanoacrylate · Maxillofacial · Glue · Applications

Introduction

Cyanoacrylate preparations have been used for more than 50 years in surgery. They were initially used as surgical glue [1–3]. They polymerise rapidly within seconds

following contact with proteinaceous surfaces to form strong and flexible bonds. This chemical property makes them extensively used in different surgical applications [1–10]. They have been used for wound closure [4], haemostasis of gastrointestinal bleeding [5], obliteration of tracheo-oesophageal [6], bronchobiliary [7], and cerebrospinal fistulae [8], skin graft fixation [9] and other surgical applications [10].

While the use of these compounds in other branches of surgery is becoming more established, there is very little information published on their applications in oral and maxillofacial surgery. In addition to its obvious usage for closing facial incisions and lacerations [11], there are several papers documenting its use in the management of head and neck arterio-venous malformations (AVM) where it is usually used to embolise these tumours [12–14].

We are presenting our experience of cyanoacrylate tissue glue in maxillofacial surgery and highlighting its benefits in different applications.

Materials and Methods

Between 2006 and 2010, we used Histoacryl® Tissue Adhesive (B. Braun, Aesculap, Germany) in different maxillofacial situations (Table 1) in 165 patients. Prior to application of cyanoacrylate, the tissue surfaces should be cleaned and dried as much as possible.

Protection of the surrounding tissues from accidental contact with cyanoacrylate can be done by covering them by gauze, or chloramphenicol 1 % ointment. Careful application drop by drop is better than rapid massive application. After its application, tissues were immobilized for 30 s to have the polymerisation reaction completed.

A. Habib (✉) · A. Medra
Department of Maxillofacial and Plastic Surgery, Faculty of Dentistry, Alexandria University, Alexandria, Egypt
e-mail: seragito2000@yahoo.com

A. Mehanna
Department of Otolaryngology, Faculty of Medicine, Alexandria University, Alexandria, Egypt

Table 1 Use of cyanoacrylate in our series

Characteristics	Number
Orbital floor reconstruction (<i>n</i> = 24)	
Conchal cartilage	5
Bone grafts	12
Porous polyethylene	7
Cleft lip/palate (<i>n</i> = 41)	
Cleft palate closure	17
Cleft palate wound pack	11
Oroantral fistula	6
Alveolar bone graft dressing	7
Nasal splinting (<i>n</i> = 11)	
Internal	3
External	8
Dural repair (<i>n</i> = 3)	
Craniocynstosis	2
Frontal bone fractures	1
External eye lid weight (<i>n</i> = 3)	3
Skin graft fixation (<i>n</i> = 12)	
Split thickness graft	7
Full thickness graft	5
Temporary fixation of traumatised teeth (<i>n</i> = 14)	
Wound closure (<i>n</i> = 52)	
Paediatric facial laceration	19
Cleft lip	15
Subcuticular closure	18
Management of intra-operative chyle leak (<i>n</i> = 5)	5
Total	165

The different methods and applications are described in the following paragraphs.

Fixation of Orbital Floor Grafts

Conchal cartilage graft, bone graft, and porous polyethylene when used for orbital floor reconstruction, in management of orbital blowout fractures, can be held in place by cyanoacrylate. The glue was applied at the under surface of the grafts and the edge of the bone plates surrounding the bone loss defect. (Figs. 1–4).

Cleft Palate Closure and Packing

Cyanoacrylate can be applied to the nasal and/or the oral layer of cleft palate repair after taking sutures in cases with friable mucosal edges where occurrence of fistulae is anticipated. The glue can also be used to retain the haemostatic packs at the lateral releasing incisions of the palatal repair.

Fig. 1 Right orbital blowout fracture **Fig. 2** Insertion of porous polyethylene implant (Medpor®) with poor adaptation to the perimeter of the orbital floor

Oral Dressing

In oroantral fistula repair and alveolar grafting, after stitching of the gingivoperiosteal flaps, cotton gauze was applied to the suture line and surrounding gingiva. The cotton gauze was held in place by few drops of cyanoacrylate. Removal of the gauze was done on the 7th post-operative day by gentle traction.

Dural Repair

Surgical closure of dural tears during management of craniocynstosis, and frontal bone fractures using dural patch fixed by cyanoacrylate or applying it directly on the dural suture line was attempted.

Fig. 3 Cyanoacrylate glue application at the under surface of the porous polyethylene implant and the edge of the bony defect

Fig. 4 The porous polyethylene implant was well adapted and held in place by cyanoacrylate

Nasal Splint

Internal and external nasal splints can be kept securely in place by few drops of cyanoacrylate. (Figs. 5, 6).

Skin Graft Fixation

Skin grafts, partial and full thickness, were fixed in place by dripping of cyanoacrylate at few strategic contact points at the perimeter of the skin graft on the surrounding skin. No glue was applied to the graft bed to avoid inflammatory body reaction [10]. Split skin grafts were used to cover the donor site of free fibula and anterolateral thigh flaps when needed. Full thickness skin grafts were used for coverage of radial forearm donor site and in repair of upper eyelid ectropion.

External Eyelid Weight

After applying two drops of cyanoacrylate to the external eyelid weight, it was placed directly on the upper eyelid between the tarsus and eyelashes with the eye closed for 1 min. The external weights were removed on the day of gold weight implantation.

Chyle Leak

Cyanoacrylate was reported previously by us for achieving rapid repair iatrogenic chyle leak during neck dissection by applying few drops of cyanoacrylate to the area of chyle leak [15].

Traumatized Teeth

Cyanoacrylate was used for temporary fixation of mobilised teeth and dentoalveolar fracture in the emergency department. Mobilised structures were reduced as much as possible and then held in place through arch bar which was fixed to teeth by cyanoacrylate. The arch bar was fixed to both the mobile teeth and the neighbouring immobile teeth to gain stability. During definitive surgical treatment, the arch bar was kept in place by wiring.

Wound Closure

Cyanoacrylate can be used for skin closure after suturing the subcutaneous layer. We used it for paediatric facial lacerations, cleft lip repair, and subcuticular closure.

Fig. 5 Application of cyanoacrylate glue to the undersurface of the external nasal splint

Fig. 6 The external nasal splint kept in place by cyanoacrylate glue only

Results

The patients involved in this study did not have any evidence of adverse inflammatory reactions.

All orbital floor grafts succeeded to achieve good results including improvement in appearance and eye movements. Application of cyanoacrylate glue was very helpful to provide better graft adaptation to the orbital floor concavity.

Intraoral dressings were removed 1 week post-operatively with uneventful healing of the underlying mucosa. One of the patients with oroantral fistula had recurrence on the 12th postoperative day which needed another surgery.

We did not have premature falling of the nasal stents.

Patients with external eyelid weights had improvement of the ocular symptoms due to facial nerve paralysis. The frequency of use of artificial tears was decreased.

Cyanoacrylate was able to keep the external eyelid weight in place for a mean of 11 days.

Skin grafts fixed by surgical glue had good retention and accepted survival. The operative time required for graft fixation was significantly reduced to less than 5 min. The pain of staples or sutures removal was also avoided.

Chyle leak was stopped dramatically within few minutes after application of cyanoacrylate.

Traumatized mobile teeth were securely kept in place by surgical glue. The patients were safer during endotracheal intubation from risk of teeth loss or aspiration.

Discussion

Coover and Shearer [16] in 1957 presented cyanoacrylate for industrial purposes. This surgical glue has the characteristic of being rapidly transferred from a liquid to a solid state that occurs at room temperature without the need of catalysts, solvents or application of pressure. Also the *N*-butyl-cyanoacrylates, which are now used, have greater molecular weight and are less toxic than the methyl-2-cyanoacrylate used in the past. Nevertheless the associated direct tissue toxicity and necrosis may compromise the host's immune barriers and enhance the propensity for the development of infection [17].

The histotoxicity of cyanoacrylates is well documented and appears to be inherent in the chemical make up of the material or in its byproducts [18]. A comprehensive review of cyanoacrylates provided interesting data on the toxicity. According to the authors the toxic effect of synthetic polymers on tissues is related in part to their breakdown products and to the rate at which they are released [19].

The use of cyanoacrylates as surgical glue has been tried in many surgical fields [1–10]. The most common surgical application is probably closure of facial wounds and lacerations [4]. The trauma of suturing of the tip of Z-plasty flaps was avoided [20]. It is used also with high success in fixation of skin grafts even in burn patients [9].

Vishwanathan et al. [21] recommended the use of cyanoacrylate over traditional closure using skin suture or clips in otological surgery.

It has extensive use also in repair of tympanic membrane perforations [2], cerebrospinal fluid leaks [3, 8], esophageal varices leaks [2, 3], and surgical procedures involving gastrointestinal and cardiothoracic systems, all with varying degree of success [5, 6, 10].

In ophthalmic surgery, cyanoacrylates play a significant role in management of perforations of the cornea [22]. As regarding socket reconstruction, cyanoacrylate can stabilise the orbital implants [23].

The use of cyanoacrylate has been extended recently to include maxillofacial procedures like stabilisation of

external eyelid weights [24], cleft lip repair [25], neonatal transient otoplasty [10], experimental repair of sinus membrane perforation [26], dressing for alveolopalatal wounds after alveolar bone grafting [27], splinting of traumatised teeth [28], all with high success rate.

Similarly, we used cyanoacrylate as surgical glue in many different maxillofacial surgeries (see the table) with satisfactory results. It proved to be a reliable tissue adhesive in every indication it was used for without any clinical irritation to the tissues.

The main potential problem of cyanoacrylate is the heat production during polymerisation. We tried to avoid this by careful drop by drop application with protection of the surrounding tissues with gauze and ointment. Also capacious normal saline solution was always ready in case of accidental exposure. Low cytotoxic effect is another potential problem. However, in the ever increasing number of clinical publications that are being published on its use in surgery, these potential complications do not seem to be problematic [11].

Conclusion

The use of cyanoacrylate tissue adhesive is simple, safe, inexpensive, rapid, and effective in maxillofacial surgical applications. It avoids the complications of staples and sutures. To the best of our knowledge, there have been no contraindications to its use in maxillofacial surgery; we suggest even more widespread applications.

Conflict of interest None.

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