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Severe corneal burn due to accidental application of salicylic acid packed in a plastic dropper bottle

Quemadura corneal severa debida a la aplicación accidental de ácido salicílico envasado en un frasco gotero plástico

Corneal burn by accidental application of acid

Virgilio Galvis [1-3], Alejandro Tello [1-3], Néstor I. Carreño [1-3], Camilo A. Niño [1-3], Natalia A. García [2,4], Valeria Otoya [1], Rodrigo Arana [1,3]

[1] incluir sección institucional, Universidad Autónoma de Bucaramanga, Floridablanca, Colombia

[2] incluir sección institucional, Centro Oftalmológico Virgilio Galvis, Floridablanca, Colombia

[3] incluir sección institucional, Fundación Oftalmológica de Santander FOSCAL, Floridablanca, Colombia

[4] incluir sección institucional, Universidad del Rosario, Bogotá, D.C., Colombia

Corresponding author:

Alejandro Tello, Centro Médico Carlos Ardila Lulle, torre a, piso 3, módulo 7, Urbanización El Bosque, Floridablanca, Santander.

Phone: +57 7 6392929; fax: +57 7 6392626

alejandrotello@gmail.com

Contribución de los autores:

Virgilio Galvis y Rodrigo Arana: concepción de la idea.

Camilo A. Niño y Valeria Otoya: revisión bibliográfica

Valeria Otoya y Rodrigo Arana: recolección de información.

Valeria Otoya y Néstor I. Carreño: redacción del manuscrito.

Alejandro Tello, Natalia A. García participó en todas las etapas del trabajo.

Todos los autores revisaron el manuscrito.

Las quemaduras oculares por aplicación accidental de sustancias, farmacológicas o no farmacológicas, envasadas en frascos goteros plásticos, han sido descritas desde hace mas de tres décadas, y siguen ocurriendo. Estas quemaduras pueden causar lesiones potencialmente graves de la córnea.

Presentamos el caso de un paciente que por error, al confundirlo con un lubricante ocular, se aplicó acido salicílico en el ojo derecho, causándole una severa quemadura corneal. Afortunadamente luego de un manejo médico y quirurgico agresivo (incluyendo oxigenoterapia e injerto de membrana amniótica) los resultados visuales fueron buenos. Sugerimos realizar campañas educativas y además tomar medidas legislativas en nuestro país para evitar el envase de sustancias corrosivas en este tipo de frascos goteros, con el fin de disminuir el riesgo de quemaduras accidentales.

Palabras clave: córnea; opacidad de la córnea; quemaduras químicas; limbo de la córnea; epitelio anterior; lámina limitante anterior.

Eye burns by accidental application of substances, pharmacological or non-pharmacological, packaged in plastic dropper bottles, have been described for more than three decades, and continue to occur. These burns can cause potentially serious corneal injuries.

We present the case of a patient who mistakenly applied salicylic acid to the right eye, when confusing it with an eye lubricant, causing a severe corneal burn. Fortunately, after aggressive medical and surgical management (including oxygen therapy and amniotic membrane grafting) the visual results were good. We suggest conducting educational campaigns and also taking legislative measures in our country to avoid the packaging of corrosive substances in this type of dropper bottles, in order to reduce the risk of accidental burns.

Key words: Cornea; corneal opacity; burns, chemical; limbus corneae; epithelium, corneal; bowman membrane.

Chemical eye burns constitute a true ophthalmological emergency and are responsible for 1.3% to 6.4% of emergency consultations for ocular causes (1). They must be treated immediately and can have a devastating impact on the patient's vision and quality of life. Therefore, the establishment of preventive measures and strategies that help reduce the frequency of these accidents in the future is vital. About two thirds of eye burns occur with chemicals at work, however another cause of eye burns that has been described since the 1970s, and which unfortunately continues to occur, is that a corrosive element is accidentally applied in the eyes, confusing it with an ophthalmic eye drops, because of the similarity of the bottles that contain them. This error can be made by the same patient or by health personal (2-13). Next, we describe the case of an adult patient who presented an eye burn in this type of circumstances.

Clinical case

This is a 59-year-old male patient who consulted to the emergency department of the Fundación Oftalmológica de Santander Foscal in 2017 after having accidentally applied some drops he used as an antifungal on his right eye. These drops, manufactured by a laboratory not approved by the regulatory agency of medicines in Colombia (National Institute of Food and Drug Surveillance - INVIMA) apparently contained salicylic acid, and were packaged in a plastic dropper bottle. The accident occurred while he confused the bottle with the one of an eye lubricant. Upon admission, 3 hours after the event, bipalpebral soft edema, lower chemosis, and staining in some areas of the bulbar conjunctiva were found in that eye. A central abrasion area of approximately 4 x 4 mm was visible in the cornea and the rest of the cornea was covered by a white-gray membrane of necrotic epithelial tissue. The tarsal conjunctiva was also covered by a similar membrane. Cellularity was found in the anterior chamber (+) and medium mydriasis. Profuse washing and subtotal removal of the corneal and conjunctival necrotic material were performed (on the corneal periphery this necrotic tissue was firmly attached). Chemical burn of the ocular surface that involved cornea, limbus, bulbar and tarsal conjunctiva in the right eye was diagnosed. Topical medications were initiated: Gatifloxacin 0.3% + Prednisolone 1% (Zypred®, Allergan) every 3 hours, sodium hyaluronate 0.4% (Lagricel®, Sophia) every hour, and Oxytetracycline 0.5% + Polymyxin b 10,000 IU (Terramycin) ® ophthalmic ointment, Pfizer) every 8 hours. In addition, vitamin C 1000 mg orally every 8 hours and doxycycline (Etidoxina®, Euroetika) 100 mg orally every 12 hours. A new assessment was made six hours later and almost total de-epithelization of the cornea and in 360 degrees in the peripheral cornea and the adjacent limbus a membrane of necrotic tissue, were found. The de-epithelized area showed very little fluorescein uptake (figure 1). The absence of epithelium was confirmed by attempting a debridement of the central area of the cornea with a forceps, evidencing the presence of a hardened membrane, which seemed to correspond to the Bowman membrane with changes in protein coagulation (figure 2). Given the severity of the condition, an emergency surgical procedure was performed the next day with an amniotic membrane graft covering the entire ocular surface, supported by a retention ring made of an intravenous tubing (14). On the first postoperative day the retention ring presented displacement and extrusion, with loss of the membrane. A new graft was performed with double amniotic membrane, fixed with tissue glue (fibrin sealant), and anchoring the membrane using 6-0 polypropylene mattress sutures and bolsters. 0.4 cc of autologous plasma enriched with platelet growth factors, and a subconjunctival injection of antiangiogenic (bevacizumab 12.5 mg) and steroid deposit (triamcinolone 20 mg) were also applied (figure 3).

Additionally, one week after the burn, daily sessions of 100% oxygen application were started per mask at 10L / min of 1-hour duration, of which the patient had 16 sessions. In addition, 6 sessions of oxygen application were made at 5 L / min on the right eye with a camera made for that purpose (15,16). 20 days after the burn, the amniotic membrane had been almost completely reabsorbed (only a remnant was observed on temporal conjunctiva) and 95% of the cornea was epithelialized (with only two remaining areas with fluorescein staining) (figure 4).

After one month, the biconjugate of gatifloxacin and dexamethasone was changed to loteprednol 0.5% (Lotesoft®, Poen), which was used in a two-months taper scheme. On examination, there was a central cornea with haze, inferior dotted keratitis, mild conjunctivalization between the 9 and 10 o'clock meridians. The corneal haze decreased progressively in the following months, reaching good central corneal transparency, but the conjunctivalization increased and by the third month reached to compromise three quadrants with invasion of approximately 1 mm of the peripheral cornea (figure 5).

In March 2018 (seven months after the burn) a stable clinical picture was seen, with good central corneal transparency (without fluorescein staining) and slight decrease in conjunctivalization compromise. Chronic treatment was left with preservative-free lubricants.

In the last control, two years after the burn, conjunctivalization was evident compromising only two quadrants (figure 6). The cornea was of good transparency and showed no fluorescein staining. Visual acuity was found in 20/40 without correction, and reached 20/20 with + 0.50-0.50 x 90.

Discussion

Corneal burns can be caused by chemical substances (solid, liquid, dust or vapor) when they come into contact with the ocular surface. These chemicals can be alkalis or acids contained in various products such as detergents, disinfectants or solvents. Generally, the lesions caused by alkalis (ammonia, magnesium hydroxide, lime, bleach) are more serious than by acids (sulfuric, hydrochloric, nitrous), because they have a greater capacity to penetrate the tissues (17,18).

Immediate copious irrigation, even using regular tap water, is universally recommended in acute eye burns (preferably at the moment of the accident, at the workplace or at home). Eye washing should be continued when the patient arrives at the emergency department (18,19). Medical therapy involves the use of agents that promote epithelialization, minimize inflammation and prevent scar complications. Biological fluids such as umbilical cord blood serum, amniotic membrane suspension, autologous serum and autologous plasma rich in growth factors promote healing when used as supplements to conventional therapy (18,19). Surgical treatment of acute eye burns includes debridement of necrotic tissue, application of tissue adhesives (fibrin glue), tenoplasty and tectonic keratoplasty. Amniotic membrane transplantation is a surgical treatment frequently used as a complement to conventional treatment to promote epithelial healing, minimize pain and restore visual acuity, although many cases with positive results have been published, clear evidence of its positive effect is scarce (18-20). Another alternative rarely used is systemic or local oxygen therapy, as proposed by Sharifipour et al (15,16).

In our case we obtained good results by adding to the medical management both the use of the amniotic membrane and oxygen therapy (both by mask and by camera over the eye).

A finding that caught our attention was that initially the examination did not show a clear uptake of fluorescein on the corneal surface, which was almost completely devoid of epithelium (this was confirmed because when scraping with a forceps in the central area, it was not possible to lift any cell layer that could correspond to the epithelium) (figures 2 and 3). A possible explanation for this finding is that due to coagulation necrosis immediately caused by the acid, the epithelium became like a white-gray membrane that was lost in 90% of the corneal area and was left only as a peripheral remnant, not viable, over 2 mm of peripheral cornea (figure 1) (17). What was exposed then was very possibly Bowman's membrane, which due to the severe changes in coagulation of its proteins, stained very little with fluorescein. We have seen this in a couple of cases of severe acid burn. According to our knowledge this finding has not been published, although without a doubt those who frequently receive patients with corneal acid burns have seen it. However, for an examiner with little experience, it can become a confounding factor, since it may consider that there is no corneal epithelial compromise, because it does not visualize a clear uptake of fluorescein, when in reality there might be a total compromise of the corneal epithelium and therefore we consider it important to highlight it.

Our patient, despite having a favorable evolution, for the severity of the incident secondarily developed a partial limbal insufficiency, which fortunately remained stable.

The patient herein presented, as well as the other similar published cases, demonstrate the serious danger of packaging caustic substances in squeezable dropper bottles that can be mistakenly confused with those containing ophthalmic medications (figure 7). The American Academy of Ophthalmology has a policy statement that recommends uniform color coding of caps and labels for topical eye medications (21), but surprisingly, to our knowledge, there is currently no standardized policy to avoid packaging of dangerous substance for the eyes, whether pharmacological or non-pharmacological, in squeezable plastic dropper bottles similar to those used for eye medications. We plan to initiate an awareness campaign in this regard both in the media for the general public, and in scientific publications, aimed at health professionals, such as this report, so that they can be engaged in the prevention of these accidents, advising patients to store medications completely separate from non-pharmacological substances, which may come in similar containers. Additionally, we will resume a work that we started a few years ago, of trying to ensure that the regulations in our country prohibit the packaging of dangerous substances in squeezable plastic dropper bottles that can be confused with ophthalmic eye drops.

Surprisingly, in addition to many unauthorized presentations of salicylic acid in this type of soft plastic containers, there are also several commercial presentations of drugs for dermatological topical use that contain this caustic substance that are authorized to be dispensed by the regulatory body in Colombia (National Surveillance Institute of Medicines and Foods - INVIMA) in this sort of packaging (plastic dropper bottles). Other manufacturers have modified their presentation and do so in glass bottles that contain lids with a brush or with a spatula attached, which avoids this type of risk of accidental application to the eyes. If a manufacturer argues that it is essential to pack a hazardous substance in a dropper bottle, then it should be mandatory to use glass bottles with glass droppers, or if plastic should be used, change the shape of the lid (including for instance a truncated cylinder-shaped end) so that it is easy to differentiate them from an eye drops container. In addition, in these plastic bottles, a safety cap with child safety locking, which gives the patient, not being able to easily open the container, the possibility to recognize that it is not an eye medication.

Suggestions similar to these have been made in scientific articles for more than 30 years, but unfortunately the measures have not been taken in many cases, and therefore we continue to receive such cases of accidents that are completely preventable (21-23).

Conflict of interest

All authors certify that they have no financial interest or non-financial interest in the subject matter or materials discussed in this case report.

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Figures

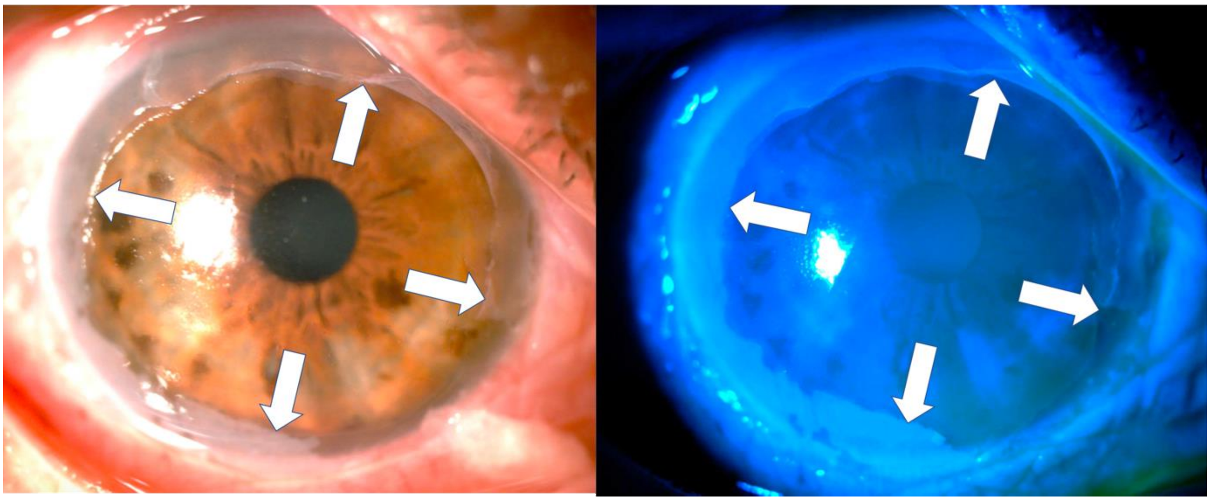

Figure 1. Six hours after the acid burn, and having performed a debridement of the necrotic tissue membrane that covered the cornea, a remnant of this membrane could be seen in the entire corneal periphery (white arrows). The de-epithelized area of the cornea stained very slightly with fluorescein. In the remnant of the peripheral necrotic membrane, obvious fluorescence was observed when using the cobalt blue filter (right).

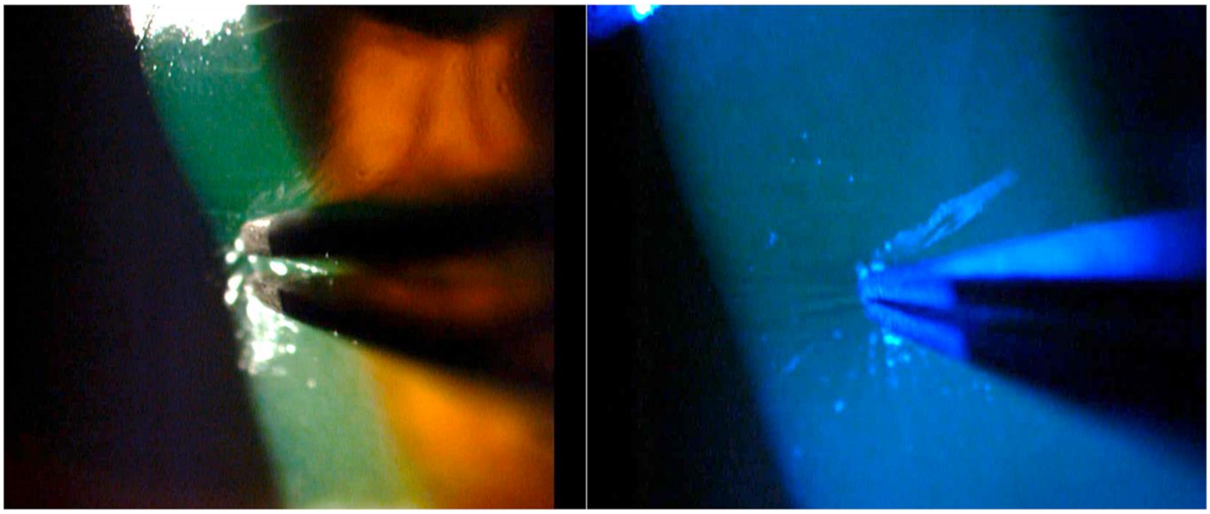

Figure 2. Attempting debridement over the central area of the cornea confirmed the absence of epithelium.

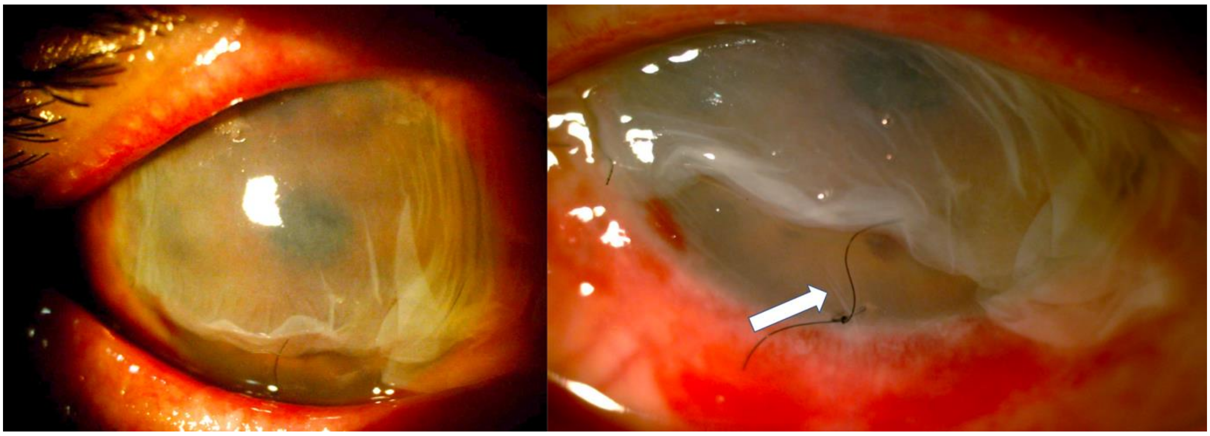

Figure 3. A graft with double amniotic membrane was performed, covering the entire cornea and conjunctiva, fixed with sutures and tissue glue, and with a retaining ring placed in the conjunctival *culs- de-sac*. Ten days later the outermost membrane was in partial resorption, but the amniotic membrane adjacent to the cornea still remained *in situ*, as confirmed by the presence of fine folds adjacent to the suture (white arrow) in the figure on the right.

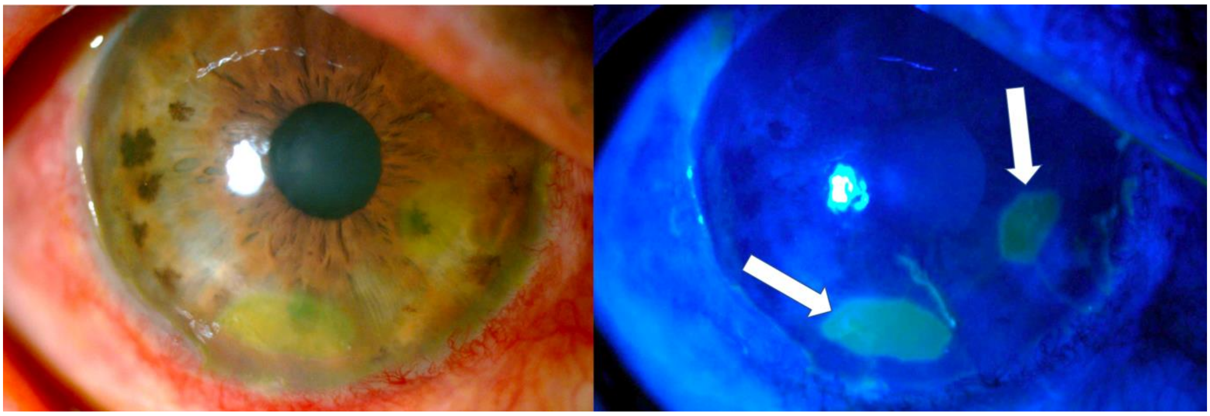

Figure 4. Three weeks after the burn, the amniotic membrane on the surface of the cornea had been reabsorbed, and a healthy-looking epithelium was observed, with only two oval de-epithelialization areas that stained with fluorescein (arrows).

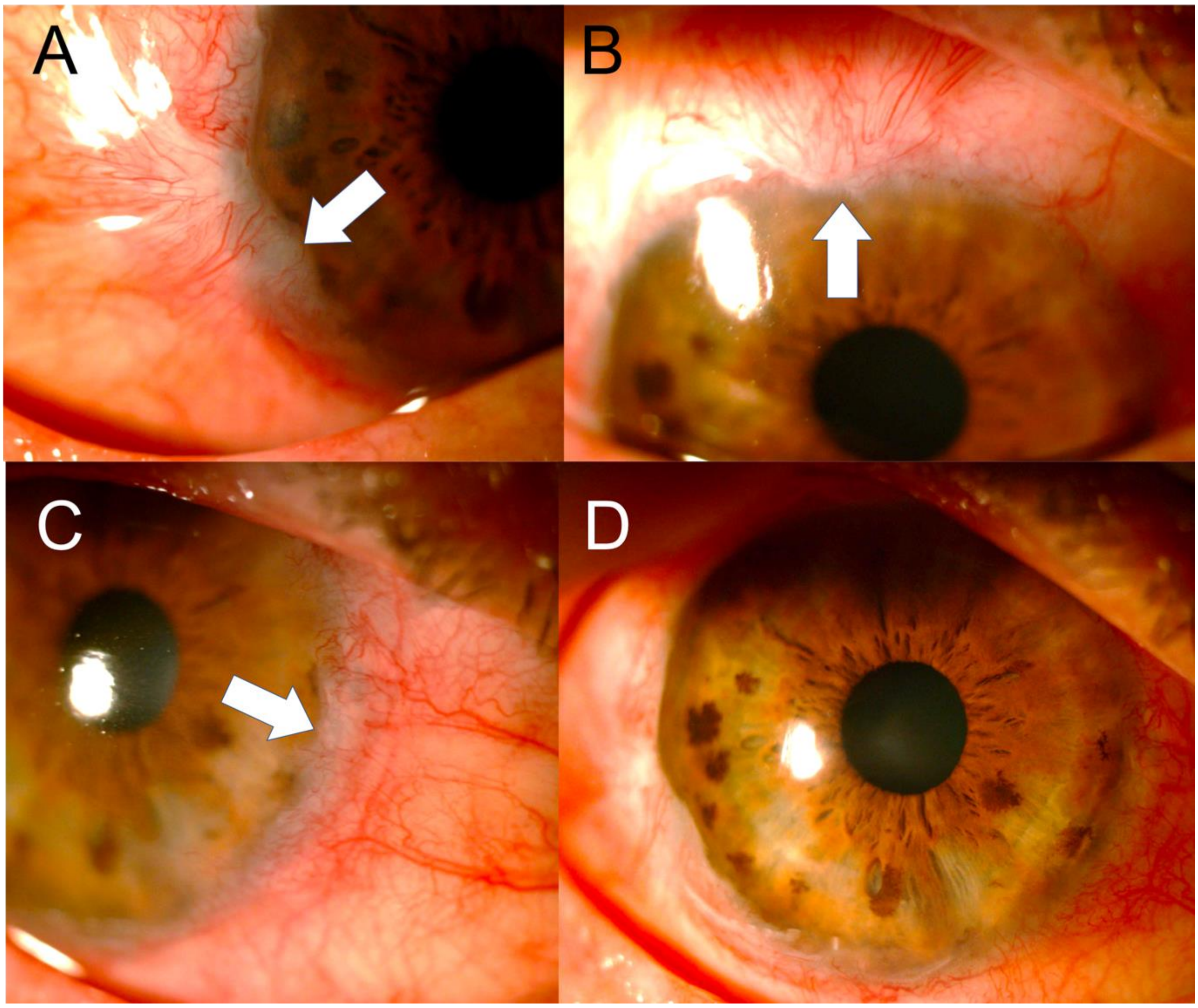

Figure 5. Three months after the accident, conjunctivalization was observed that compromised three quadrants of the cornea, but with invasion of less than 2 mm (A-C, white arrows). The central cornea showed good transparency (D).

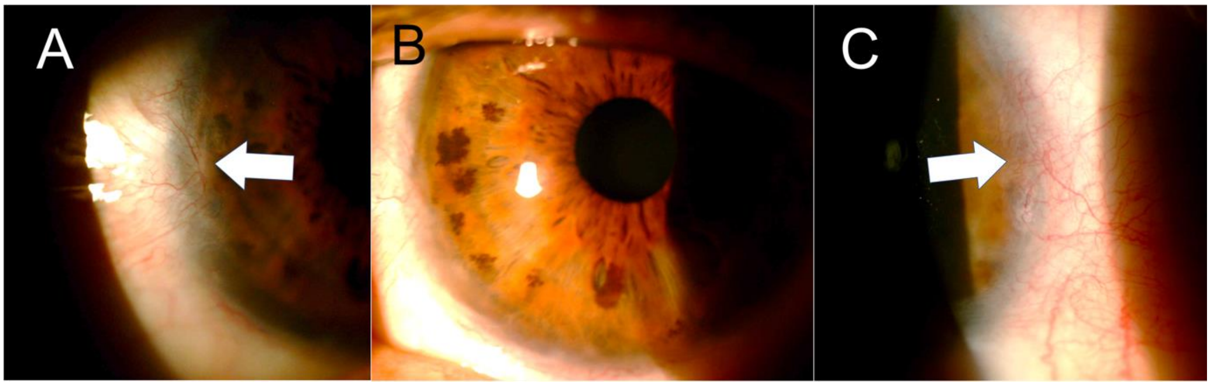

Figure 6. Two years after the burn, the cornea presented good transparency (B) and the conjunctival areas only involved two quadrants and showed significant regression (A and C).

Figure 7. Squeezable plastic dropper bottles containing salicylic acid produced by informal laboratories, to be used as keratolytic or antifungal substances for dermatological conditions, which can easily be confused with the dropper bottle of an ophthalmic eye medication.