Ocular Cosmetics in Ancient Times

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Although cosmetics, from Greek κόσμησις (adorn), now refers to external products used to beautify the skin, hair, eye, or other parts of the body, cosmetics was not the first objective of primitive eye painting. The first aim of body painting in primitive cultures may have been to protect people from evil spirits, which could enter their body through vulnerable openings, such as the eyes. The second aim was for medical purposes, to treat visible or nonvisible pathologies in the eye (such as conjunctivitis, hordeolum, corneal ulcer, white cataracts, loss of vision) or elsewhere in the body. Lastly, cosmetics were used to enhance the association of the eyes with youth, beauty, and social power. In some cases, two or three objectives were combined. Rupestrian paintings and stone engravings provide evidence that eyelids were painted to give them an appearance of youth or power in prehistoric paleolytic and neolytic times. Historic times began with the gradual development of script.

About 8 millennia ago, the Sumerians of Mesopotamia introduced agriculture and cattle farming, followed about 2 millennia later by pictographic and syllabic writings. Sumerians and Babylonians left little information about ocular pastes and cosmetics. The Assyrian cuneiform tablet of the physician Nabu-le’u cites antimony, copper, zinc oxide, iron oxide, arsenic, and sea salt for the treatment of the eyes, but there are no graphic written quotations with regard to cosmetics. (The old terms do not correspond to present terminology. For instance, antimonium was introduced by alchemists about four centuries ago, referring to the Latin stibium, hence, the symbol Sb for antimony.)

A few centuries later, hieroglyphic and phonetic script were developed in ancient Egypt, and from then on, abundant information about eye medicines and cosmetics were recorded.

The pharmacopoeia of Pharaonic Egypt was rich in liquid and pasty ocular applications obtained from botanical sources (eg, henna, myrrh, incense, cedar or sycamore sawdust, gum arabic, burnt almonds, olive oil); from animals (eg, fat, honey, mammalian, lizard or bat blood, women’s or animal milk, liver pastes, turtle brain); or from minerals (eg, hematites [iron oxide], galena [lead ore, plumbic sulfate], cerussite [plumbic carbonate and lead hydrate], stibnite [antimony sulphide], lapis lazuli [silicate of aluminium mixed with sulfate of calcium and soda, and frequently with iron pyrites], chrysocolla [copper ore or copper hydrosilicate, with silica], malachite [copper carbonate], copper sulfate, copper oxide, mercury oxide, zinc oxide, and potassium nitrate.

The most frequently used substance was the “black paste” for the eyes, called mesdemet and mainly composed of plumbic sulfate or antimony sulfide. Other cosmetics for the eye and other parts of the body were green collyrium or ouadjou that contained copper carbonate or hydrosilicate. Also used were ground green malachite, gray galena, white cerussite, reddish copper, blue-green chrysocolla, and ochre ash. Usually they were mixed with oil or fat. When combined, depending on the proportions, the mixture had various color tones and consistencies. The black paste or mesdemet was used to give shadow color to the upper and lower lids, and to extend the outline of the inner and outer lid rims and the eyebrows (Figure 1). After the fourth dynasty, it was common to extend the eyebrows and the outer corner of the lids to the temple. The black paste was probably different for rich and poor people, as the antimony-based pastes were more expensive than the lead-based ones.

Most of these products came from the Nile valley, Sinai peninsula and Mediterranean-Jordan strip, but some were imported from Arabia and other parts of south Asia, including mesdemet of antimony sulfide, which did not exist in Egypt. In ancient Egypt, the principal markets for cosmetics and other merchandise were Babylon and Athens. The liquid and pasty collyria were used for religious, medical, or cosmetic purposes.

USES OF COSMETIC SUBSTANCES

Religious Use

During life, mystic protection of the gods against diseases and accidents was always present. It was believed that some body paintings had magical and protective power. They were used in everyday life or in religious rituals and were applied to males and females of all ages. Even after a person’s death, different parts of the body were painted, such as the eyes, in order to present a look of respect and submission in the world of the gods and spirits, and perhaps also to enhance the corpse’s appearance for the mourners attending the burial ritual.

The British Museum preserves a box for cosmetic cleaning that belonged to the spouse of the scribe Ani, in the 18th century.

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dynasty (1550-1295 BCE). It contains some wooden tubes with paste “for smearing the eyes during the periods of the Nile river swelling” (in those times the real causes of the Nile swelling were a mystery and were considered to be divine). Other tubes contained paste for the dry periods and for protection against wind-borne sand.

**Medical Use**

Conjunctivitis, including trachoma and other forms, and blepharitis were very common in ancient cultures, such as Pharaonic Egypt. The Ebers papyrus, circa 1550 BCE, states that many people “can not produce eyelashes in their lids,” which suggests that blepharitis was common. Already in the Ancient Empire (≈ 2.650-2.150 BCE), the most commonly used pastes for medical treatments or for facial cosmesis were the “black pastes for the eye.” The Ebers papyrus cites more than 50 times the use of mesdemet on the eyebrows, lid surface, and eyelashes, not only to make them more visible and apparently bigger, but also to maintain their health – to treat and eliminate the "blood around the eye," to treat “sudden eye pain," and to kill lice and nits. It could be used alone or mixed with other substances, such as wood powder, onion, or, in severe ocular external edemas, with “the milk of a woman who has just borne a boy.”

Some modern pharmacologic studies do not verify a clinical improvement of the eyes with conjunctivitis, blepharitis or dermatitis that were treated with mesdemet.

**Cosmetic Use**

Cosmetics were very common in ancient Egypt and were used by men and women, whether rich or poor. Cosmetic painting of the lids and eyelashes is considered to have been first practiced by adult women, and later on by pubescent girls (until recently, most females married when pubescent). These young girls perhaps used eye painting to copy the ways of adult ladies, as a subconscious or conscious manifestation of their maturity, elegance, and/or social state. The verb “to make up the eyes” was sedjemir, which also meant “to speak with the eyes” or “to express with the eyes.”

The use of cosmetics by men was less frequent, maybe because their manifestation of masculinity was mainly based in their physical strength, authority, and power. Moreover, lid cosmetics had perhaps become a symbol of femininity, and thus their use would not have made men attractive to women or respected by society. However, men did use lid makeup (Figure 2), although infrequently, and sometimes they dyed the beard, mustache, hair, eyebrows and eyelashes.

In the Ancient Empire the most frequent color used was the green udyu, a powder and paste made with crushed malachite stone. However, after the IVth dynasty, black mesdemet became the most commonly used. Other commonly used body and eye cosmetics were white cerussite powder and the blue of lapis lazuli.

Tattooing of skin on the forehead, eyelids, or hands was also frequent. It was usually done with henna. Henna is a vegetable dye obtained from *Lawsonia inermis* or *Lawsonia alba*, whose leaves, when crushed and dried, produce a reddish powder. When the powder was mixed with water, it formed a paste used to paint hands, nails, grey hair, and eyelids. Its dark-red color on the applied cutaneous surfaces was nonpermanent. Frequently, aromatic components, such as fir resin, myrtha, calamus, and many others, were added to the cosmetic.

Aside from its cosmetic purpose, the painting of the eyes played a preventive and protective role in eye pathologies, sometimes contributing to improvement of vision and preservation of eye health. In the Old Hebrew civilization, the Bible several times uses the term...
phukh for a black paste for medical use, frequently in the eyes.9 In the Babylonian Talmud10 (IV-VI century CE), the terms *kolron* and *kechol* are cited several times to refer to face pastes or eye creams, whose use was curative or for embellishment of the lids.9,11 Rabbi Johanan and Rabbi Jose stated that antimony, “the powder of stibium stops the tears andpromotes growth of eyelashes.”10,12,13

In the Indus valley, the first information about the historic use of ocular cosmetics is based on pictures and writings.

Over millennia BCE, there was Indian, Persian, and Assyrian trade with Southwest Asia and the East Mediterranean (involving Sumerians of Mesopotamia, Ancient Egypt, Indus valley, classic Greece, classic Rome, and Chinese, Japanese, and Arab cultures). This commerce between India and the Mediterranean countries increased with discovery by the Phoenicians of *cañilla* purple dye, a red and blue dye extracted from the molluscan *Murex brandaris*, and with the “silk routes.” The fabric of silkworms was invented by the Chinese. The export of silk to Middle Asia, East Asia, and Mediterranean countries was so important, that this route took the name of “silk route(s).” This trade began to diminish about five centuries ago when the Portuguese discovered a marine route around the Cape of Good Hope in South Africa.

Ayurvedic cosmetics were made with various substances, such as stibnite, lead, mustard oil, almond oil, or lamp soot. Eyes painted with these substances were healthier and looked bigger, brighter, and more beautiful. Surma was the name given to the black paste for the eyes (*kohl* in Arabic culture). Henna, locally known as *mehndi*, was introduced in the Indus valley between the IV and VI centuries CE.14 Uptan, made from triturated nuts and flowers, was used to beautify lids and other skin surfaces. Other cosmetics used for this purpose were butter and oil pastes made from saffron.

The glabella, ie, the space between eyebrows, receives its name from Latin *glabella*, diminutive of *glaber*, meaning *without hairs*. The glabella is an important area, because in humans, its appearance expresses attention, fury, peace, and other states of mind. The Vedic religion said that this area is “the third eye,” which “sees and understands” intuitive concepts, gives clairvoyance, and maintains youthfulness and mental health.15,16 Even now, many women of the Hindu cultures paint a red circle on it to beautify the face. This pigment is ground turmeric (*kurkum*) of intense yellow color, which, when mixed with water, becomes bright red.

In classic Greece, the term *kollyrion* referred to pastes and solutions with various components and combinations to be used as medications. Dioscorides cited ocular unguents for medical use, such as stibnite, vitriol (salts of sulfuric acid), and lapis lazuli.17 Some of them were also used to embellish the eyes. So, Dioscorides wrote that “a good paste of stibnite is a cosmetic,” and it had the popular names of “enlarger of the eyes” and “embellisher of the women.”18

The classic Roman culture took the Greek term *kollyrion* and modified it to the Latin *collyrium*. The term applied to various balsams and pastes for medical uses in various parts of the body. *Collyris* was an ornament in the form of a round flat tortilla that women used on the head, first as a medical plaster and later as a cosmetic on the forehead.19 The chemical composition of the substance was very different for each use. Plinius the Elder wrote that many women used *stibium*, a paste collyrium of antimony that also contained silver and other components, to blacken their eyelashes, lids, and eyebrows.20

Romans frequently added perfumes or other physical embellishers to cosmetic collyria, eg, the collyrium of *Atropa belladonna*. This collyrium had been used in Ancient Egypt as a narcotic, and in Syria to relieve melancholy. Romans used it to provoke a moderate pupillary mydriasis, which lasted for some days and was considered beautiful.20,21

In East Asia, the Chinese culture had an important interaction with the Afro-Eurasian countries through the silk routes. The silk routes influenced not only trade, but also cosmetics, technology, religion, philosophy, and military expansion, not only with China but also among the countries on the routes.24,25

In ancient China, the model of cosmesis was white face, dark eyebrows, and floral glitter gold. The white cosmetic was made with rice powder, and trade and pilgrimage extended its use to Western countries. The model...
of beauty for Japanese women was a face and lids whitened with rice powder, and the lid edges and eyebrows colored orange-yellow with crushed safflower petals. This is the model copied by the modern geishas.

In the Buddhist religion, which began in the V Century BCE in Nepal and spread mainly to East Asia, the face of Gautama Buddha is sometimes represented with the eyebrows joined in the glabella (Figure 3).

In the VII and VIII centuries CE, the Arabs conquered to the west the Mediterranean North-African lands and the European Iberian peninsula, and to the east, the Syrian, Mesopotamian, and Persian countries. They respected the use of the cosmetic pastes used by the Coptic and other conquered countries, and maintained and increased their use in Egypt and other societies with Mohammedan culture. The eyelid and eyebrow cosmetics, which already existed in many cultures, became more widespread with the Arab expansion and the Mohammedan influence. Islam introduced new codes of behavior for men and women, such as public segregation of the sexes and female veiling. The use of the veil increased the importance of cosmetics for the eyes, glabella and hands, as these were the most visible areas (Figure 4).

The Arab culture maintained many of the cosmetics of ancient Egypt and of other Semitic and Aryan countries in their domain, using compounds of antimony, lead, or henna. The use of kohl spread in the new Arabic cultures. Al-Qoati of Toledo (XII century CE) explained how to prepare the mineral stibium by washing, burning and moistening it for ocular application.27 He cited other pastes for the eyelashes: “Collyrium of a wise man for the growing of the eyelashes” (quotation 144); “Collyrium of Ibn Tlaws to make the eyelashes grow” (quotation 145); and “Description of a medicament to maintain the eyelashes and eyebrows” (quotation 147). Al-Gafiqi of Cordoba discussed hygiene and medicines for the eye, applying the name Akal to the dry collyria.28,29

The use of eye cosmetics increased even in Egypt. For instance, the Venetian Prospero Alpinus, who lived in Egypt between 1580 and 1584, wrote that all the Egyptian women had small boxes with cosmetics, such as incense and oil, or with kohl to blacken the lid rims.30

The great influence of the Arab culture in medieval Europe did not popularize the use of kohl in the Christian countries; the Christian church leaders considered it sinful to use makeup, and this discouraged its use among the elegant ladies. However, its use increased later, especially in Renaissance Italy and in the European “Illustration” (the period of cultural change introduced with the French Revolution and death of Louis XVI [1793]).

**TOXICITY OF COSMETIC SUBSTANCES**

Kohl intoxication through the use of ocular cosmetics with antimony is practically nonexistent. Intoxication due to oral ingestion of antimony is rare, and when it occurs, it is manifested by vomiting, diarrhea, migraine, cardiac arrhythmia, and hemorrhage. However, intoxication by lead (intoxication saturnine) is the most frequent mineral intoxication in humans, and when the amount of lead exceeds the normal values of 11 µg/dL (5.31 µmol/L), polyneuropathy, headache, psychological inhibition, myalgia, and renal insufficiency can occur. Lead intoxication affects children more than adults, and cases of death produced by the abusive use of lead-containing kohl have been described. Some surfocular cosmetics contain up to 60-80% lead.31 Cases of lead intoxication in patients abusing the lid application of pastes with an excess of lead have been reported.32,33 Lead intoxication can also be produced by causes not related to lead kohl, such as the use of old lead pipe lines, lead mining, industrial use, and use of lead in gasoline, wall paints, etc. Most developed countries now have strict laws governing the use and control of these products.
The Semitic term of recently sold in Egypt with the name kohl.

CHEMICAL COMPOSITION OF KOHL

With respect to etymology, the term kohl is thought to derive from the Semitic term ākhal, meaning black. Later, this term evolved to many dialectal variants, such as kohol, khol, kohl, kajal, kēhela, which refer to the color of the powder or paste. For instance, a dark-colored powder recently sold in Egypt with the name kohl was made of crushed stibnite, burnt almonds, lead, oxidized copper, ochre, ash, malachite, and chrysocolla.

With respect to chemical composition, the first verified meaning of the Semitic Arabic term kohl was applied to a cosmetic black paste, usually of stibnite (antimony sulfur), to paint the eyelids. The Prophet Muhammad advised the use of ethmid, a mountain mineral stone, today known as a variety of stibnite, which consists mainly of antimony trisulfide, is rather inert, and does not irritate the conjunctiva.

The composition of kohl has varied. The main component of kohl seems to have been antimony salts and/or lead salts, as deduced from the chemical studies of cosmetic residues found in a millenary Egyptian flask of mesdemet. Recently, there have been more and more products that maintain the name kohl, but have different composition, usually with more lead components. At the beginning of the XX century, Hirschberg analyzed 10 different products used to clarify vision, sold with the name kohl. Only one was pure antimony sulfide, and the others added lead, lead sulfide, zinc oxide, copper, and vegetable matter in different proportions. In more recent studies, Al-Hazzaa et al analyzed samples of kohl. They found antimony in only one of them, and in a small proportion of 7.8%, the rest being mainly lead. In a study about the composition of kohl, lead content was 53% in a Saudi Arabian sample and 79.5% in an Israeli sample.

However, kohl may have other fundamental components. In the second half of the XX century, when the occidental Sahara was a Spanish province, most of the native Saharais painted their lids with kēhela (Saharan dialectal term derived from kohl). This kēhela, analyzed in the University of the Canary Islands was identified as powder of manganese bioxide (pyrolusite, MnO2), mixed with powder of iron oxide and quartz crystals. It was mixed with ostrich grease, forming a paste. This paste was applied to the conjunctiva in cases of trachoma or other types of conjunctivitis or lid irritation. It was also used by women as a cosmetic to paint the rims and anterior surface of the lids, eyebrows, lips and hands, which remained black for some days.

Currently, confusion still exists if the term kohl is applied to a cosmetic or medical black substance to be applied to the lids, even when this product is not made of stibnite (antimony sulfur), but galena (native lead sulfide), manganese, or other ingredients. Consequently, any kohl paste must detail its composition as a guarantee of safety.

TERMINOLOGY RELATED TO KOHL

Another word derived from the term kohl, whose meaning has evolved to use with other chemical products, is alcohol. Alcohol perhaps has the same etymology as kohl. According to the Oxford and Webster dictionaries, alcohol comes from the finely pulverized antimony used to darken the eyelids, from Arabic kohl, kuhl, or kuhul, with the addition of the Arabic definite article al-. The Andalusian Arabic al-kuhl or al-kuhul term passed to the Old Spanish alcohol, and then to the Middle Latin of books, and finally to the verbal European languages. The Swiss alchemist and physician Paracelsus (1493-1541) had mentioned in the first half of the XVI century the term alcohol in the Low Latin of the European scientific books to mean the spirit of the wine. Currently, the term alcohol means not only the ethyl alcohol obtained by distillation of wine, but also other organic compounds with the oxhydril group (HO-).

Nevertheless, some Arab scholars say that “the famous Webster dictionary is wrong, because, how could such a highly irritant and corrosive substance have anything to do with a commonly used cosmetic? Alcohol will burn the eye,” and it was suggested that alcohol comes from the Arabic al-ghol (the genius or spirit that can alter the mind).

There may be two different reasons for the differences between the substantive name kohl and the chemical substances that actually compound it. First, the term kohl always signified the cosmetic pastes that give a dark or black color to the eyelids or other skin, independently of their chemical

Figure 4. Lady using an Andalusian veiling. Eyelids, temple, glabella and lower forehead have been painted with henna. Upper lid of the right eye is painted with kohl.
composition. Second, kohl was initially the antimony paste, but for commercial reasons, the quantity of the original antimony was reduced, or even eliminated. The new substances with other more economical mineral salts substituted for the antimony were not specified.

In any case, kohl as an ocular cosmetic is found abundantly in many countries, including the U.S.A., European Union, Russia, and others. Most of the nonregulated kohl cosmetics come from Pakistan, India, and Indonesia. There it is called surma, and it is sold freely in small flasks that contain a high proportion of powder of galena (native lead sulfide). It is then introduced in other countries by tourists or by immigrants.

AUTHOR'S NOTE

Ocular cosmetics have a longstanding tradition in all cultures. This essay has described their use in ancient times. In the next issue of The Ocular Surface, the evolution of the surfocural cosmetics in modern times will be discussed.

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Because all vertebrate species, including humans, obtain information from looking into each other’s eyes, the eyes are often the first object of attention of people upon meeting each other. In humans, the physical characteristics of youth are strongly associated with the conceptual standards of beauty. With age, the position of the lids changes, the exposed surface of the eye decreases, the lid’s skin loses surface uniformity and develops wrinkles, and its hue darkens. Eyelashes decrease in number, length, thickness, and darkness, and their form and position change. In youth, eye makeup enhances natural beauty; later, it can serve to simulate the attractive characteristics of youth.

In 1834, the French perfumer and businessman Eugène Rimmel (1820-1887) emigrated to London, where his father founded a cosmetic center. It is still there today, and has many subsidiary branches in other countries devoted to inventing, manufacturing, and marketing eye shadows, mascaras, eyeliners, lipsticks, and other cosmetics. Although the etymological meaning of cosmetic (κοσμητικός = designed to beautify and adorn) would encompass cosmetic surgical procedures, that area is beyond the scope of this paper, which will focus on preparations designed to beautify skin, hair or complexion.

I. EYELASHES

A. Natural Characteristics of Eyelashes

In humans, eyelashes are present at birth. They emerge from the pilosebaceous glands (which contain the pilous follicles and glands of Zeis and Moll) and are situated not in a continuous line on the lid rims, but dispersed in the anterior part of the four lid rims in a band of about 0.4 mm wide between the lacrimal puncta and the lateral angle of the lid junction. There are about 100-150 eyelashes in the upper lid and 50-75 in the lower. Their mature length is 8-12 mm in the upper lid and 6-8 mm in the lower, a little longer in the center of the lids. In Mongolian races, the lashes are a little shorter and sparser.1,2

In young people, the normal eyelash has a lifetime of 4-6 months. When the eyelash physiologically drops out, the pilous follicle of the pilosebaceous gland produces a new eyelash that emerges in about 1 month. When an eyelash is artificially pulled out, it takes about 50-60 days to grow back.

Eyelashes are not cylindrical in shape, because their distal or terminal ends are thinner than the follicular root and their axes are curved. Lashes are concave turning upward in the upper lids and concave turning downward in the lower lids. They are more or less parallel to each other, with many variations due to the curvature of the lid rims, to differences in the position of the pilosebaceous follicles, and to differences in size related to the stage of the growing cilia. With aging, lash length and thickness diminishes, and their position and direction is more irregular.

Eyelash color is a little darker than hair and eyebrow color and has less tendency to gray with aging. The Middle-European Celtic race tends to have reddish hair, and the Nordic-European Germanic races tend to have yellowish hair, with similarly less intense color of the eyelashes. Exceptionally, white eyelashes are due to poliosis, or melanin deficiency, in some cutaneous areas.3-11

B. Cosmetic Substances and Techniques

In recent years, many cosmetics have been developed to conceal aging and/or disease-related conditions of the eyelashes and lid skin, simulating normal young eyelashes, enhancing the color, length, and thickness of lashes with mascara, and coloring the tarsal lid skin with pastes and liners (Figures 1 and 2).

Almost two centuries ago, Rimmel made a paste to be applied to the eyelashes with the newly invented vase-line petroleum jelly combined with coal. Later, new cosmetic pastes and creams were developed for the eyelashes, but despite differences in composition and color, any type of cosmetic to coat the eyelashes and change their appearance was given the generic name of rimmel. (A similar generalization had occurred with eau de cologne, which was originally a water perfumed with lemon. The Italian Giovanni Farina took it to the German city of Köln (in French, Cologne) and then to France in 1709 with some additions and changes. Even though the current “eaux de Cologne” are very different from Farina’s original, the term “eau de Cologne” persists and is applied to very different liquid perfumes.)

Although many new variants of eyelash cosmetics from other manufacturers received the generic name of rimmel, the popular term rimmel gradually became limited to the product of the Rimmel trademark. Other similar products to coat the eyelashes began many decades ago to be termed mascara.

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are unique to each brand. More gaudy colored pigments, such as red, green, and ultramarine blue, are used to attract attention rather than to enhance a natural appearance of beauty. Substances applied to the lids are usually removed daily. Therefore, the pH of their cleaning and removal products must have an acidity similar to that of the basal tear (ie, 7.4) and lack ethyl alcohol and any other cutaneous and surfocicular irritants. Guillen identified possible minor inconveniences of eye cosmetics: mascara can facilitate the breakup of the lipid layer of the tear film; eye shadow can distribute its particles on the tear film surface and increase debris formation; eyeliners applied directly to the lid rim may block the orifices of the meibomian glands, and their removal requires contact with the lid edge and further disturbance of the tear film.13

In youth, the eyelashes are naturally curled. Later, eyelash curlers (electric or non-electric14) can produce this effect temporarily. Curlers are also used in rare cases in which hair from the head has been surgically transplanted to replace missing eyelashes or eyebrows. The transplantation technique is similar to that used for hair transplants on the head. As the hair transplanted to the lashes maintain their original characteristics, they must be curled and curved to simulate normal eyelashes, and they will also need to be trimmed regularly.

Knapp15 and Wheeler16 took a band of the skin from the eyebrows and implanted it in the anterior edge of the lid rim. The direction of these hairs is different than the eyelashes, and this type of transplantation did not gain popularity.

False, or artificial, eyelashes are attached with eyelash glue to the lid rims in about half a minute. When natural eyelashes are short or sparse, the false lashes are applied as single clumps to complement the natural ones. If natural lashes are completely absent, the false lashes are applied as a full-set, extending from the front of the lacrimal punctum to the outer corner of the lids. False eyelashes have been popular since the mid-XX century. In many cases, their application is combined with lid shadow.

C. Pharmacological Treatments

Heating and expression of the pilosebaceous and meibomian glands are an attempt to maintain fluid secretion of the Zeis and Moll glands, and to counteract age-related meibomian gland dysfunction with lid thermomassage once or twice a day to facilitate ciliary growth.17-19 The number and size of the eyelashes may partially or totally recover normality after several months of treatment. Recently, more complex instruments have appeared. For instance, "hot spectacles" maintain a temperature of about 40-42°C between the goggles and the lid rims, and the LipiFlow Thermal Pulsation System heats the meibomian and pilosebaceous glands and compresses the lids between a scleral contact lens and a spherical sector placed on the anterior surface of the lid.20 Age-related meibomian gland dysfunction and associated blepharitis may improve with treatment and rejuvenate the eyelashes.

Parasitosis of the eyelash roots by acarus Demodex folliculorum or Demodex brevis is very common, leading gradually to blepharitis, oligotrophy, and malalignment of the eyelashes. Rarely, the blepharitis causes trichiasis or madarosis. The most common early treatment against the infestation by Demodices was the topical application to the lid rims of yellow mercury oxide ointment. Today it is tea tree oil 50% drops or foam, azithromycin 1%, and the cyclosporin A 0.05%.21,22

Pharmacological stimulators of eyelash growth and darkness are the collyria of prostaglandin analogs. It was discovered by chance that many patients being treated with topical prostaglandin analogs for chronic glaucoma experienced increases in the number, length, and darkness of eyelashes,23-25 as well as changes in iris color.25 One of these analogs, bimatoprost, has been approved to treat eyelash deficiency.26,27 In contrast, some antiglaucomatous topical medications of the beta-blocker type (eg, Timogel, Timoftol, Betagan, etc.) have occasionally been associated with alopecia.28
Interferon, cyclosporine, and drugs that target epidermal growth factor may also stimulate the growth of eyelashes.

II. LID SKIN

A. Skin Smoothness

The skin of the lids has a thickness of 0.3 to 0.8 mm, much thinner than on the rest of the face. Open lids of a young Caucasian expose about 10 mm of the vertical diameter of the cornea, but as the upper lid descends with age, less of the cornea is seen; exposure of corneal diameter is about 8 mm in a 60-year-old person and about 7 mm in an 80-year-old person.

In an awake person, the eyes and the lids are in continuous motion (with normal blinking about 10 times/minute), with the upper lid moving much more than the lower one. During sleep (about 8 hours/day), the closed and relaxed lid covers the entire ocular surface.

The frequent movement of the upper lid, coupled with the natural progressive laxity of the cutaneous tissues with age, causes the skin of the lids to lose the relative smoothness of youth more than in other parts of the body. Linear macroscopic wrinkles are produced by a progressive excess of skin.

In a young person, the skin of the upper lid, when the eye is open in primary position of gaze, has a concave depression between the superior orbital rim and the prominence produced by the eyeball, termed the *superior orbito-palpebral horizontal concavity*. Under this concavity begins a convex prominence of the lid due to the protrusion produced by the eyeball, termed the bulbo-palpebral lid convexity. After birth, the skin of the superior orbito-palpebral concavity and of the bulbo-palpebral lid convexity is smooth when the lid is closed, but when the eye is open, a more or less horizontal furrow appears in the horizontal band of the skin covering the area of union between the preseptal and the pretarsal skin surface of the bulbar convexity of the upper lid. Age-related degeneration of the tissues (laxity, dermochalasis, fat bags, etc.) and the continuous traction of the upper lid produced by blinking gradually produce increased elongation and laxity of the skin, diminishing the fold of the superior orbito-palpebral concavity, and creating one or more horizontal creases in the band covering the tarsus of the preocular convexity of the upper lid.

In most Negroids and Caucasians, when the eye is open in primary position of gaze, the upper part of the furrow of the upper lid hangs down and its vertex approaches 2 or 3 mm of the lid rim, making it very evident, sometimes even forming two skin folds. In Mongoloid races, this skin upper fold hangs to the eyelashes, and this hanging fold, known as Mongolian, or epicanthic, fold, hides the bottom of the wrinkle and makes it appear that there is not a fold in the preocular convexity of the upper lid.

The skin of the lower lid has very small vertical and horizontal displacements and changes of position, which are different when contracted with blinking vs when relaxed in sleep. Sulci or wrinkles are not present in young people, but they can appear with aging, mainly in the lateral part of the lid.

In both upper and lower lids, orbital and subcutaneous palpebral fat can also modify the form of the lid skin surface. When it is excessive, it produces fat bags, a protrusion or droopy convex surface, which may need be masked with eye make-up or removed with cosmetic surgery. When orbital and subcutaneous fat is deficient, the lid surface may be deep-set, producing a dark circle under the eye. The darkness can be lessened with a concealing cream. In more extreme cases, it can be treated with subcutaneous introduction of autologous fat from another part of the body or hyaluronic acid.

B. Skin Color

Various factors produce changes in skin color with age. The age-related loss of tension of the skin causes a minute and diffuse irregularity of its surface, almost imperceptible to the naked eye. However, the irregularity alters the brightness and color of the skin, because the reflexion of the light is not uniform.

Sun exposure also causes darkening of the skin over time. Historically, people who worked as farmers or ranchers in the country developed brown skin, especially on the face and backs of hands, which were more exposed to sun. Such darkening was seen as a manifestation of middle or lower social class, so people tried to avoid sun exposure by covering their faces and hands with hats, veils, or gloves. During the 1800’s, both fashionable and working class women kept their skin as pale as possible. This began to change in the 1900’s, when bathing in swimming pools and at beaches during the hot season became a sign of economic success, elegance, and high social standing. By the later 1900’s, in developed countries, vacationing in the sun was common in all social classes, and the medical problems produced by excess of sun on the skin were evident. Protecting the skin with sunscreens and use of dark cosmetics and tanning lotions to replace natural sun-darkened skin became common practice. In some Asian countries, skin whitening continues to represent the ideal of beauty. In western countries, this is less frequent (Figure 3).

Eye shadow to color the lid skin existed in pharaonic Egypt with use of the vegetable dye henna. Its use was spread by the Arabic Mohammedan cultures. It was also used in medieval Europe, and it is still used in some countries, sometimes with the addition of paraphenylenediamine and p-toluidine diamine, which are toxic in high concentrations.

Eye shadows in natural hues are used to maintain or simulate a youthful...
appearance; other colors are used to present a more dramatic, attention-attracting look. Natural-colored shadows are applied between the eyelashes and the eyebrows. As the distance between the upper lid rim and the eyebrow is greater in women than in men, a pale eye shadow makes this area appear larger, having a feminizing effect.\(^{34}\) Frequently, the upper part of the upper lid is painted a little darker to simulate a deeper superior orbito-palpebral concavity, which would, naturally, have diminished light.

Eye shadows in unnatural hues are often applied in excessive and exaggerated fashion, with no attempt to simulate a natural look (Figure 4).

Common ingredients of eye shadow are mica, talc, sericite, magnesium, and other colorants that are not normally rejected.\(^{34}\) The most common pigments used for non-natural colors are black iron oxide for giving a tonality without brilliance, manganese oxide for giving a yellowish or maroon tone, chromium oxide for a greenish hue, and ultramarine blue for a bluish color.

Some cosmetics are designed to preserve the normal physiology and anatomy of the lid skin. These contain ultraviolet filters (titanium dioxide, zinc oxide), hydrating substances (hyaluronic acid, sodium lactate, alantoin), antioxidants (vitamin A, vitamin C, vitamin E), astringents (camomile, hamamelis, calendula), collagen stimulators (extract of Asiatic centella), unsaturated fatty acids (arachidonic acid, omega-3), and nutrients (vitamins, urea derivatives, tocopherols, elastin).

Other cosmetics, termed filmogens, cover with a very thin film the micro-wrinkles formed by excess of skin, but do not impede the lid movements. These filmogen substances are synthetic polymers (eg, celluloses, proteoglycans, sodium alginate, gamma-poly-glutamic acid) that extend over the lid skin. They are also contained in many types of mascara and eyelid shadow, and function as surfactant stabilizers and humectants.\(^{35}\)

Eye putty is a type of eyelid glue used in East Asia in persons with epicanthic fold. It is a water soluble adhesive flap, to be put behind the wrinkle fold of the upper lid, fastening it to the pretarsal lid skin, elevating the fold slightly. This makes it appear smaller and younger, and increases the opening of the lid and the exhibition of the eyelashes. It takes only about a minute for the anterior and posterior surfaces to adhere to each other. The effect lasts for a few hours, and the putty can be easily removed.\(^{36}\)

Application of radiofrequency to the lid skin is a noninvasive procedure to improve dermal laxity and fine wrinkles. It causes shrinkage of old dermal collagen and new collagenesis in the most superficial skin layers. Most commonly, the procedure uses heat generated by monopolar radiofrequency.\(^{37-40}\)

Other wrinkles near the eyes, such as crow’s feet on the outer lid corner and glabellar rhytids in the space between the eyebrows, may be formed or increased by muscular contraction. They may disappear with subcutaneous or intramuscular local injection of botulinum toxin, whose inhibitor effect lasts about 3 months.\(^{41,42}\)

### III. SUPPLEMENTARY ADORNMENT

Intentional wounds and adornments, eg, eyebrow and lid piercings, and subcutaneous application of vegetable dyes or minerals, were common in prehistoric cultures on five continents. They have now returned, with various changes, to the universal common culture.

Piercing of the eyebrows is quite common. Piercing of the eyelids is less common but is increasing. Lid piercings are usually done in the lateral part of the upper or lower lid (Figure 5). This is because, during blinking, the lateral third of the lid and the lateral palpebral ligament become tight and tense, and the eyeball is pushed backward about 1 mm by the pressure of the precorneal part of the upper lid.\(^{32}\) Thus, the piercing does not create pressure on or scrape the eyeball with the bulbar conjunctiva.

Although juxtaocular piercings outside the lids are mainly done in the eyebrows, more rarely they may be done in the skin of the upper region of the zygoma or in the glabella and upper part of the nose.

In ancient times, henna was the most commonly used material to tattoo the body, mainly the hands and face, including the lids.\(^{43}\) Its cosmetic use disappeared in many countries, and its use became limited to correction of scars, irregular eyebrows, and anomalous pigmentations. The popularity of tattooing has now re-emerged among young people as a sign of individuality and self-affirmation.\(^{44}\) Currently, the most commonly used micropigment is iron oxide. The emo culture, developed in the last two decades among some teenagers, is expressed in their lifestyle, clothing, hairstyles, tattoos, etc. Tatooing of the lids with polychromatic figures is not uncommon.

Colored contact lenses are sometimes used to conceal corneal nubeculae or scars, or to improve the vision in cases of aniridia and albinism. They are also used in normal eyes, simulating various color tones of the iris (brown, light blue, green, yellowish, etc.), creating different designs in one, two, or three concentric rings of the iris, or changing the size or shape of the pupil.\(^{45}\)

### IV. LEGISLATION GOVERNING COSMETICS

Current cosmetic laws in the USA date back to 1938. The European Union
(founded in 1993, but with its roots four decades earlier) regulated the use of cosmetics in the law n° 76/768/CE, which was enacted in July 1976. Many other countries have also established laws to regulate the uses of cosmetics. Legislation is continuously modified to address technical progress, with many successive amendments, corrections, and addenda. Ocular cosmetics sold commercially must include written information with the laboratory name, chemical components and the quantity of each one, function of the product, repeated-dose toxicity, indications and contraindications, durability and expiration date, and many other characteristics. In a revision of the European Union Cosmetics Directive in 2003, 1328 chemicals were banned from cosmetics, and new addenda and modifications will be applied on 11 March 2013.

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