

ENHANCING THE TEAR TROUGH WITH HYALURONIC ACID

Lakhdar Belhaouari, Paul Teisseire and Pierre Quinodoz
discuss the anatomy and physiology when treating this area,
and propose a new five-point classification scale



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KEYWORDS

tear trough, hyaluronic acid, aesthetic, ageing

ABSTRACT

The article describes how to fill the tear trough with hyaluronic acid, and proposes an original five-point scale with regard to its depth and the age of the patient. It is evident that any aesthetic treatment requires a perfect understanding of anatomy, physiology and the ageing process. This article suggests the appropriate treatment, explains the technology, its safety, and potential adverse events. Patient assessment requires consideration of the best cosmetic investment for the patient.

THE PALPEBROMALAR GROOVE forms the transitional zone between the lower eyelid and the upper part of the mid-face. This article is only concerned with addressing the volume of the under-eye groove, and the shadows caused by the hollowing of the area, but not the pigmented dark circles.

In general, hollowing of this area is less apparent in the young (*Figure 1*), although certain young people can have circles caused by hypoplasia of the fatty tissue in this area. Usually, the hollowing of the palpebromalar groove is evident in the ageing process, during which the tissue sags and there is an age-related fat atrophy (*Figure 2*). With age, the groove under the lower eyelid can become deeper, and the lower eyelid elongated. The tear trough is

one of the prominent signs of ageing owing to a loss of volume in this region, coupled with the descent of the superficial malar fat pad¹².

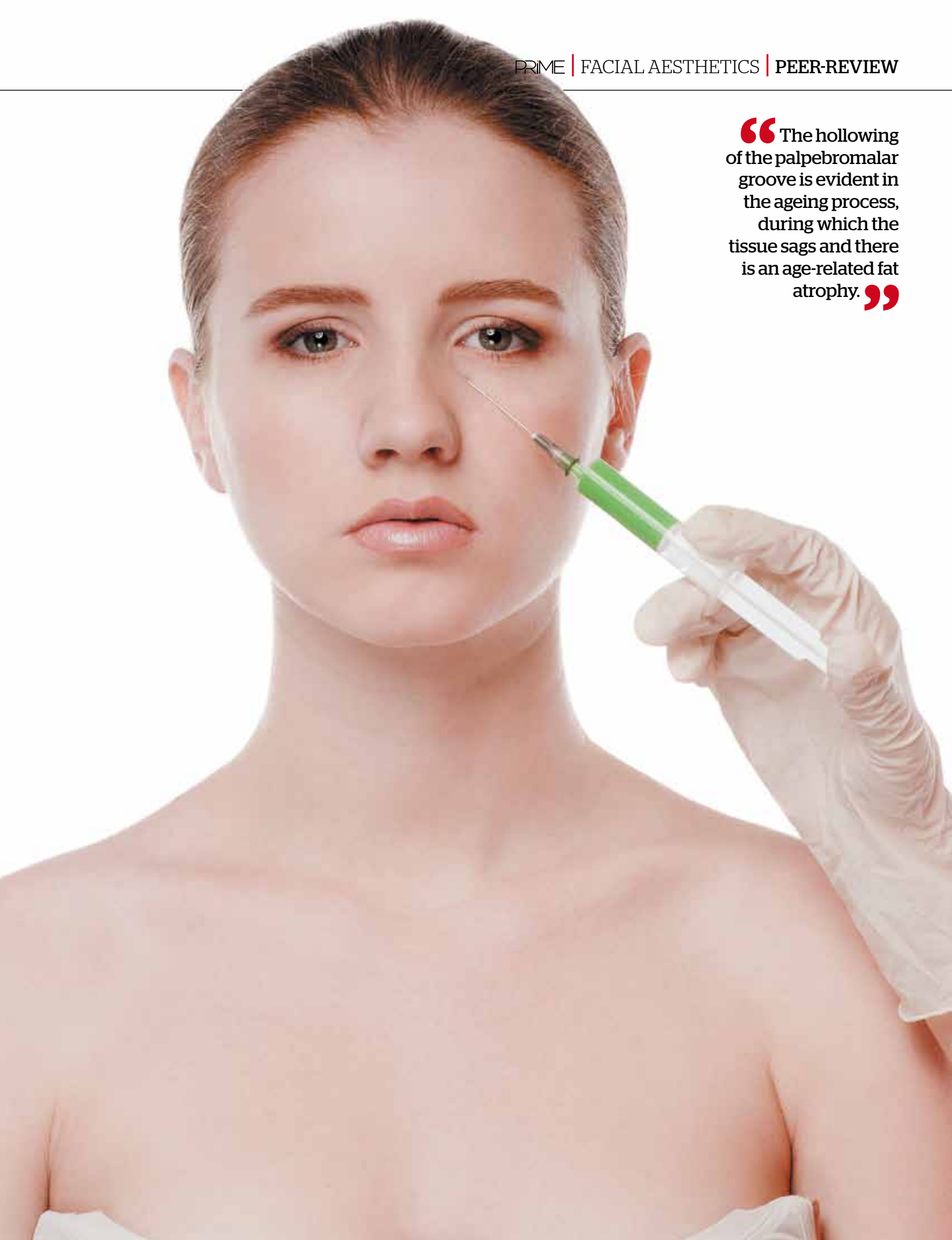
Plastic and aesthetic surgeons, aesthetic dermatologists, and aesthetic physicians aim to embellish and/or rejuvenate the faces of their patients, harmonising the volumes and so erasing any hollows and shadows.

A perfect understanding of the anatomy of the face, its physiology, and dynamic and age-induced reshaping is paramount. Mastering the techniques and products used to achieve the aesthetic goal is essential.

Understanding the anatomy and physiology

With regard to facial anatomy, the area of interest for this article is the upper portion of the mid-face until the rim of the orbit (*Figure 3*). Structurally, it shares elements with the mid-face, as described below³⁴. The rim of the inferior of the orbit forms the skeletal bony base. The deep malar fat (suborbicularis oculi fat; SOOF) is a fine strip at this level, attached at the rim of the orbit. Dense and somewhat fibrous, it forms the shield of ▷

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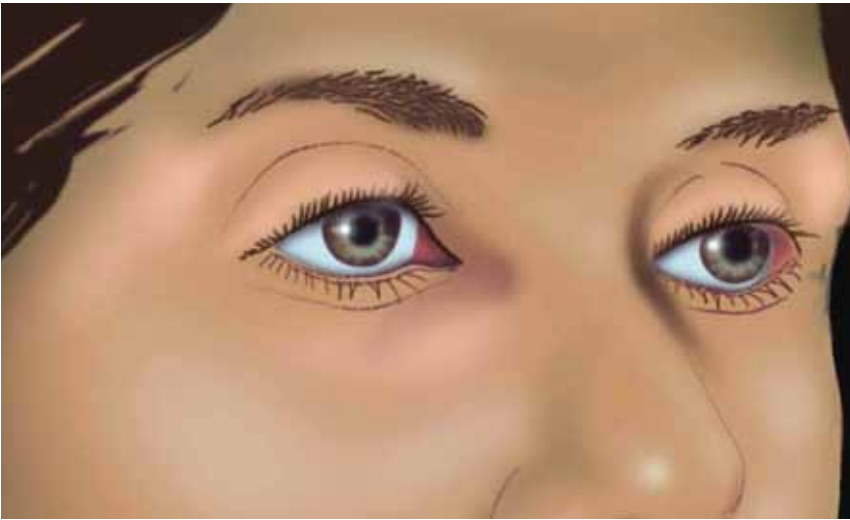


Figure 1 Appearance of the periorbital in younger patients



Figure 2 With ageing, the periorbital area undergoes changes

▷ protection for the inferior orbital rim just as the Charpy's fat pad protects the superior orbital rim. As a result of its deep bony adherence, this fat is fixed. Immobile in the facial dynamic of facial expressions, this deep fat does not sag with the tissue relaxation caused during ageing. However, similar to the superficial malar fat, it is subject to partial atrophy during the ageing process.

The orbicularis oculi muscle is a sphincter muscle responsible for voluntary movements; the constriction of the eyelids and elevation of the cheek, and of the superficial malar fat, which overlies it. The muscle contracts with laughter, elevating the lower eyelid and cheek. With age, it becomes less homogenous and less compact, losing its tonicity and spreading downward (*Figures 4 and 5*). Its fibres can become dissociated, resulting in gaps between them^{14,5}.

The superficial orbital malar fat lies under the skin and covering the orbicularis muscle; the superficial

orbital and malar fat gives both protection and shape by means of forming a fatty pad. A structure less dense than the deep malar fat, the superficial malar fat adheres to the skin.

The face is not static, but is dynamic. The orbicularis muscle is the principal motor in the mid-face for its movement in facial expression, and the superficial orbital malar fat is also involved in the mobility of this zone.

The face is not static, but ages. The resulting sagging together with the skin defines the palpebromalar groove, which with the mid-cheek groove and nasolabial fold forms the three principal grooves, and mark the changes of the ageing face. In addition, the orbital rim becomes more exposed owing to the fat loss and the descent of the superficial malar fat.

The internal part of the palpebromalar groove and the superior-internal part of the mid-cheek groove join together as a Y-shape to create the tear trough. Poets often refer to the hollow formed between the tear trough and the mid-cheek groove as the 'valley of tears'.

The skin covers all these elements. There is a transition between the very fine palpebral skin and the thicker jugal skin.

To summarise, there is the deep fixed and static fat, and a superficial mobile fat, the latter being dynamic in the creation of expression and age-induced sagging. The skin, superficial malar fat, and orbicularis muscle are all mobile and dynamic. All move as though through a sliding space situated between the deep malar fat and the orbicularis muscle, and between the orbicularis muscle and the superficial malar fat.

Is the palpebromalar junction stable?

In his observations of the periorbital area and the mid-face, Lambros⁶ wrote, 'the lid-cheek junction is very stable because it sits on tissues which are fixed'. A number of authors concur with Lambros in this regard; however, the authors of the present article are not of the same opinion. As already described, the bony rim of the orbital rim, which tends to recede with age, is fixed, as is the deep malar fat, which is fixed to the bony rim for protection. The skin, superficial malar fat and orbicularis muscle are not fixed: they are mobile.

It is obvious that the inferior eyelid lengthens during the age-related sagging and the palpebromalar junction becomes lower. This is evidenced by rejuvenation and embellishment with volumising products (such as hyaluronic acid or autologous fat, in the authors' experience), which raise the level of the palpebromalar junction and shortens the lower eyelid.

“Using a needle is certainly easier; however, a fine blunt cannula easily penetrates due to the fineness of the skin at the level of the lid-cheek junction.”

Where and how to inject

There are two major considerations: the hydrophilic nature of hyaluronic acid and the thinness of the palpebral skin. A placement of hyaluronic acid that is too superficial and injected just under this fine skin can give an unaesthetic blue appearance (Tyndall effect), ▷

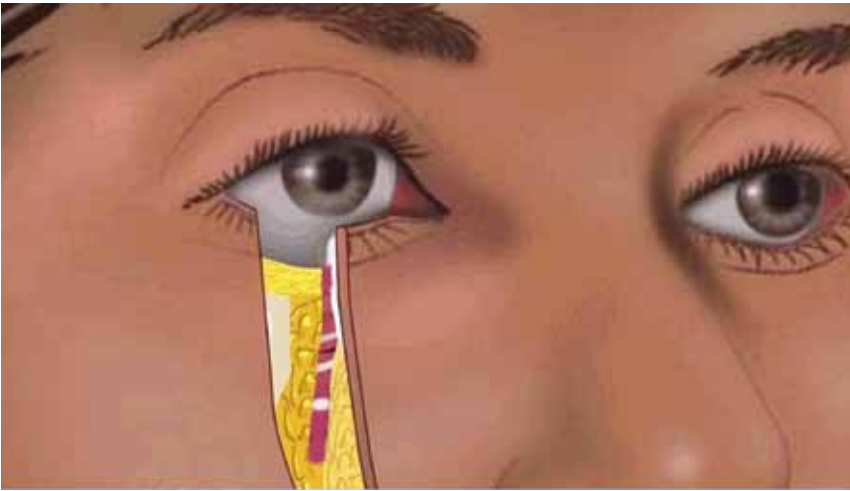


Figure 3 Anatomy of the palpebromalar junction



Figure 4 Orbicularis oculi muscle

▷ caused by light diffraction. Therefore, the injection must be deep.

The following technique is proposed:

- The injection must be deep at the level of the palpebromalar groove, in front of the bony orbital rim, and just behind the orbicularis muscle (Figure 6)
- Inject slowly with a very gentle pressure on the plunger of the syringe to avoid uncontrolled superficial spreading of the product. Do not crack under pressure
- Inject small quantities to avoid over-correction, which is unaesthetic and difficult to rectify correctly, even with hyaluronidase.

Cannula or needle?

This is generally based on the personal preference of the physician, depending on the technique he/she is most comfortable using. Using a needle is certainly easier; however, a fine blunt cannula easily penetrates

owing to the fineness of the skin at the level of the lid-cheek junction.

Although the cannula is considered to be less traumatic, the needle causes no extra bruising if the physician understands how to avoid the trunk of the facial artery and vein (i.e. medially). In the authors' opinion, the relative risk of trauma on the small vessels and capillaries, both small branches of the facial artery and facial vein, is the same when using either device. However, the impact on larger vessels, such as the trunks of the facial artery and the facial vein, is riskier with a needle, which can pierce these large vessels, whereas a cannula will avoid them.

Despite this, using a cannula requires a greater amount of force, giving less control, especially in the denser and more fibrous deep malar fat. Physicians should be wary of using a flexible cannula because of its ability to bend, making it more difficult to control its route and end cannula position. Care must be taken to ensure the flexible cannula does not slide into the orbit and the ocular globe.

Bolus or fanning techniques

Again, it is advised that physicians use the technique most comfortable for them, either fan or bolus. Product deposition can be placed using a fanning technique to create a fine and narrow sheet, or using a few small bolus, which can be gently moulded to remove any irregularity.

A very gentle pressure can reduce the risk of bruising, but caution needs to be observed as excessive pressure or massage can provoke a superficial spreading of the product, despite an initially correct placement.

What to inject?

Even if the 'ideal filler' does not exist, it is clear that hyaluronic acid is the gold standard product⁷, especially when considering the recent advances in the quality of volumising products. The authors also have experience with fat injections, with remarkable results. However, it is easier and more flexible to use hyaluronic acid as greater technical, surgical and anaesthetic requirements are necessary for fat injections. Smaller particle hyaluronic acid is even more forgiving owing to the fine anatomical structure of the treated area.

The future will be shaped by further research. Developing less hydrophilic hyaluronic acid products, resulting in less water absorption, can have an impact on this area, and so minimise the risk of the Tyndall effect. The use of short chains of hyaluronic acid can achieve this goal.

Low-molecular-weight hyaluronic acid creates a more effective cross-linking with 4-butanediol diglycidal ether (BDDE) as attachment is easier on short strings compared with high-molecular-weight hyaluronic acid, with their long chains. With short strings, attachment is easier on the two sides of BDDE; less free chains or chains attached on ▷

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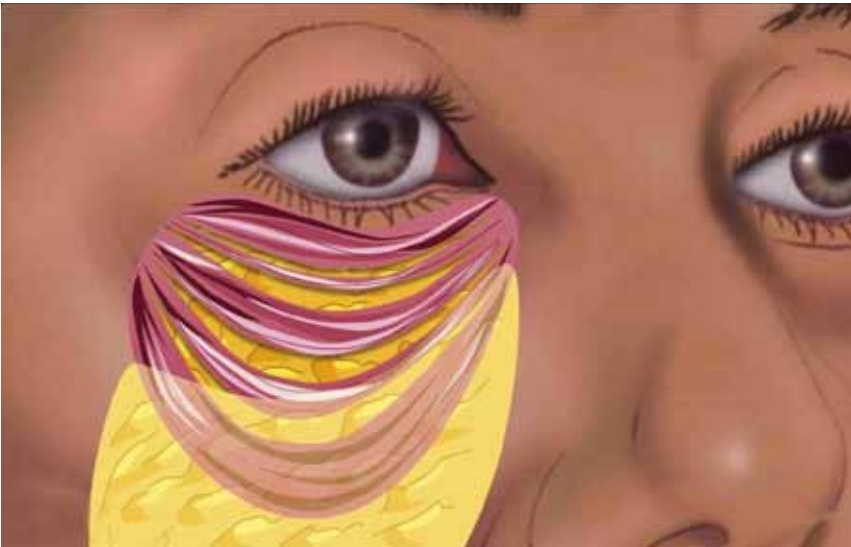


Figure 5 The orbicularis oculi muscle ages, resulting in gaps between fibres

▷ one side are obtained, so avoiding the capture of water facilitated by the free chains.

The product is less hydrophilic with less water absorption, and causes less oedema, exactly as required in this area. Juvéderm® Volbella™ has such a profile. In addition, viscosity becomes superior with the more effective cross-linking. These new products will be able

to be dispersed in a thin layer in areas such as the palpebromalar groove and tear trough, resulting in a natural appearance, with the additional benefit of a sufficiently long duration.

What to avoid

The two major considerations when treating this area of the face are the avoidance of over-correction and the Tyndall effect. The expert physician will obviously aim for a perfect correction (*Figures 7*); however, under-correction is preferable to over-correction. The Tyndall effect causes an aesthetically unacceptable swelling and blue appearance. The hydrophilic nature of the hyaluronic acid, when placed too superficially under this fine skin, gives a blue appearance caused by light diffraction.

The injection of the product can be too excessive or too superficial to the orbicularis muscle. The injection must be controlled and very gentle. In effect, excessive pressure on the syringe or uncontrolled massage can spread the hyaluronic acid superficially, even if it has been injected at the correct depth. An important anatomical fact to remember is that muscles also age; the fibres are less compact, less homogenous and more dissociated, resulting in gaps between them. An undesired superficial migration of the product through these gaps can occur, even with a correct injection. The utmost care to avoid excessive product must be taken in

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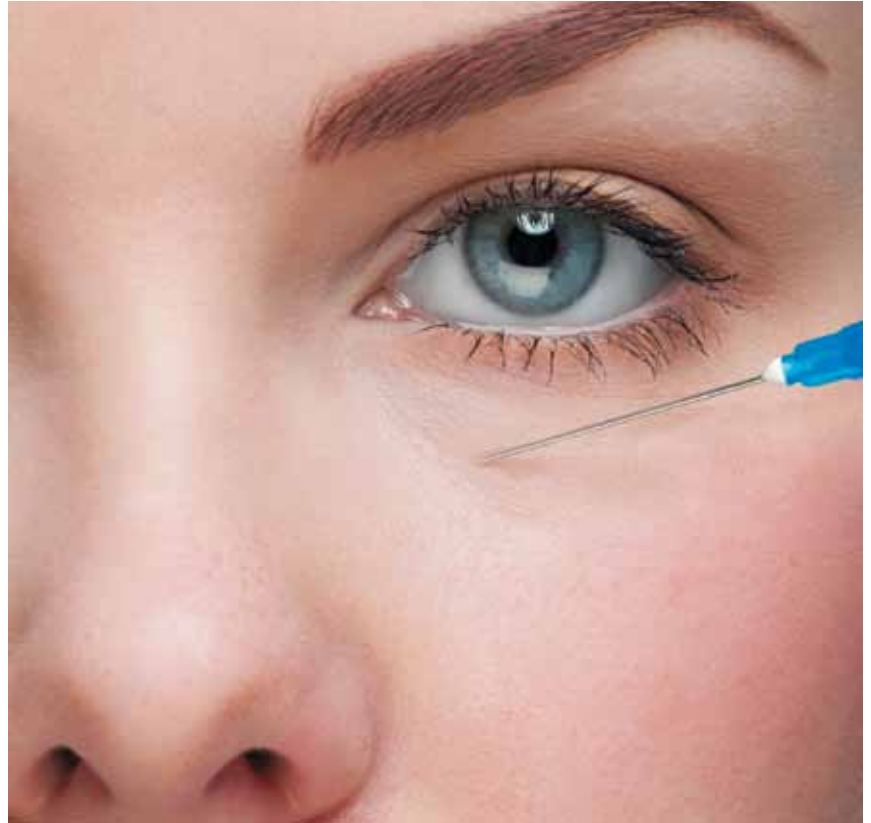
“The injection of the product can be too excessive or too superficial to the orbicularis muscle. The injection must be controlled and very gentle.”

older patients, when less compact and dissociated muscle with gaps is suspected. Under-treatment is most certainly preferable in patients with signs of laxity in this area, and especially when treating the older patient.

Palpebral malar grooves are more visible when there is a concurrent existence of inferior palpebral pockets/bags. Surgical treatment of these pockets can diminish the visibility of the palpebral-malar grooves. Similarly, treatment of the palpebral-malar grooves can diminish the visibility of the inferior palpebral pockets. It is the physician's responsibility to advise which treatment is indicated to achieve the best aesthetic result.

Classification of the tear trough groove on a five-point scale

Classification using a scale is a useful tool for both understanding and teaching. A classical scale can be based on the severity of the groove: no groove, mild, moderate, marked, very marked. For example a three-point scale is proposed as follows: ▶



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“ A beautiful glance lights up the face. Enhancement and filling of the tear trough will embellish the luminosity of the glance and overall appearance. ”

muscle and whether the muscle is compact and dissociated).

Scales 2 and 3 can be divided into two sub-points, which take into consideration the loss of tonicity with ageing:

- Young patients with compact and homogenous muscle without gaps
- Older patients with a loss of tonicity of the orbicularis oculi muscle, with less compact, less homogenous, dissociated fibres possibly producing gaps between them.

Therefore, the classic three-point scale becomes an original five-point scale, which takes into consideration the tonicity and homogeneity of the orbicularis muscle with ageing:

- Scale 1: no groove
- Scale 2A: moderate tear trough in young people
- Scale 2B: moderate tear trough in older people
- Scale 3A: marked tear trough in young people
- Scale 3B: marked tear trough in older people.

This classification will help the physician to precisely decide on treatment protocols and precautions to be taken.

In scales 2A and 3A, an injection performed with expertise—adequate amount of product deeply and gently placed under the muscle, with a gentle pressure on the plunger of the syringe—presents a minimal risk of the Tyndall effect as the orbicularis oculi is tonic and homogenous, acting as a compact barrier.

In scales 2B and 3B, a less compact orbicularis oculi muscle with dissociation of its fibres can have gaps, allowing superficial migration of the product—even with

Key points

- The hollowing of the palpebral groove, forming a tear trough, is a prominent sign of ageing but can also be seen in young people owing to hypoplasia
- Successful treatment of the tear trough requires an understanding of the anatomy, physiology and morphological changes induced by ageing
- The correct technique for filling with hyaluronic acid is paramount to avoid adverse effects
- A five-point scale can be used to ascertain the optimal treatment protocol
- Continued research and development will provide dedicated products to attain even better results with a lessened risk of adverse events

- ▷ ■ Scale 1: no groove
- Scale 2: moderate groove
- Scale 3: marked.

Physicians should understand the changes that occur with ageing: the muscle extends downward, following the sagging of the superficial malar fat and the skin. It becomes less compact, less homogenous, and with gaps between the dissociated fibres.

An original and more scientific classification is therefore proposed, incorporating these anatomical and dynamic points (i.e. the tonicity of the orbicularis

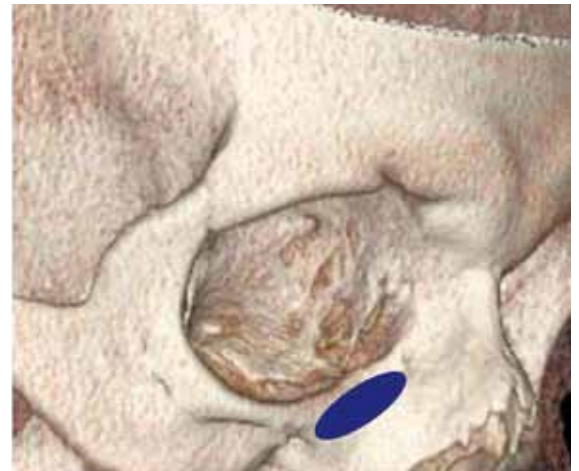


Figure 6 Where to inject in the tear trough: deep at the level of the palpebromalar groove, in front of the bony orbital rim, and just behind the orbicularis muscle

a perfectly performed injection. In these cases, under-treating is preferable to avoid the risk of the Tyndall effect.

Conclusions

A beautiful glance lights up the face. Enhancement and filling of the tear trough will embellish the luminosity of the glance and overall appearance. The use of hyaluronic acid products, the quality of which is constantly evolving, achieves this result. Certainly, the future of aesthetic medicine will be shaped by further research—the development of less hydrophilic hyaluronic acids resulting in less water absorption, and the minimisation of adverse events such as the Tyndall effect.

These new products will be able to be dispersed in a thin layer in areas such as the palpebromalar groove and tear trough, resulting in a natural appearance, and will have the additional benefit of a sufficiently long duration.

► **Declaration of interest** None for this publication. Dr Lakhdar Belhaouari is a consultant for Allergan Inc., and has received grants for conferences, masterclasses and video presentations

► **Figures 1-7** © Dr Belhaouari



Figure 7 (A) before treatment and (B) after treatment of hyaluronic acid to the tear trough

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