

# Indirect Tightening of Lower Eyelid Skin Following Poly-L-lactic Acid Treatment of the Cheeks

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## INTRODUCTION

**A**ging of the periorbital skin and midface is a complex, dynamic, and three-dimensional process. Studies have demonstrated that the eyes are among the first visual cues to infer age, which is why many patients seek lower eyelid rejuvenation to correct the “tired” look. A youthful periorbital region is characterized by minimal wrinkles, no excess skin, fullness, minimal pigmentation, and a smooth lid-cheek transition.<sup>1</sup> The peri-ocular skin has the thinnest epidermis and dermis, making it susceptible to cutaneous changes that come with age, highlighted by the fact that this skin is juxtaposed to thicker cheek skin. These changes, such as dermal atrophy and rhytides, are intimately associated with the activity of the orbicularis oculi muscle, making it more susceptible to fine lines and static wrinkles. Periorbital aging is multifactorial and is influenced by alterations in the skin, muscle resting tone, fat, ligaments, and bones.

Young skin is made of 80% type I and 15% type III collagen.<sup>2</sup> With age, fibroblasts reduce their type I and type III collagen production, leading to a shift in the collagen ratio and a higher proportion of type III collagen.<sup>3</sup> In addition to decreased collagen production, aging skin has more elastin fragments, decreased vascular supply, and flattening of the dermal-epidermal junction.<sup>1</sup> Resting muscle tone is another essential component in periorbital aging. It increases with time, leading to dynamic and static rhytids as the orbicularis oculi muscle attempts to find a resting tone on an orbit that is gradually resorbing.

With time, midfacial fat pads descend with downward traction on the arcus marginalis, which leads to volume loss at the inferior orbital rim.<sup>1</sup> Facial retaining ligaments are stretched with age, leading to alteration of the periorbital appearance. These facial retaining ligaments serve as anchoring points for the superficial musculoaponeurotic system (SMAS) and overlying dermis to the deep fascia and periosteum.<sup>4</sup> These ligaments stabilize the facial fat pads, but continuous muscular activity leads to soft tissue displacement with ligament stretching.

The infraorbital hollow is anatomically divided into 4 main areas: 1) tear trough groove (TT), 2) nasojugal groove (NJG), 3) palpebromalar groove (PMG), and 4) mid-cheek groove (MCG).<sup>5</sup>

The tear trough-orbicularis retaining ligament complex is crucial in the undereye aging process. TT ligament is osteocutaneous, and its main function is to tether the orbicularis oculi muscle and malar fat pad to the maxilla. TT continues medially and transitions to becoming the orbital-retaining ligament (ORL) at the mid-pupillary line.<sup>5</sup> It can atrophy with time, resulting in infraorbital hollows. The ORL attaches the orbicularis oculi muscle to the orbital rim and forms the superior border of the suborbicularis orbital fat pad (SOOF).<sup>5</sup>

Lastly, the midface’s vertical and horizontal bony projections are lost with aging. An increase in the vertical height of the orbit and loss of maxillary bony projection lead to decreased surface area available to support the overlying soft tissue. This anatomic change is called the Concertina effect.<sup>1</sup> To correct the aging lower eyelid, it is essential to address the skin quality and reinforcement of the attenuated orbicularis oculi muscle and orbital septum.

Filler injections are gaining more popularity for the rejuvenation of the lower eyelid and remain the most challenging area for filler injections. Since the skin is the thinnest under the eyes and it is intimately associated with the orbicularis oculi muscle, adding volume with fillers comes with the inherent risk of product aggregation and the Tyndall effect. Hyaluronic acid (HA) fillers are currently the most commonly used product for infraorbital volume loss correction.<sup>6</sup> Other products used for the treatment of the infraorbital area include calcium hydroxyapatite and Poly-L-lactic acid (PLLA).

Poly-L-lactic acid (PLLA) (Sculptra<sup>®</sup>, Galderma Laboratories, Fort Worth, TX) is a biostimulatory agent, currently FDA cleared for HIV lipoatrophy and correction of fine lines and wrinkles in the cheek area. Multiple studies have shown that it increases type I collagen production 3 to 6 months after injection. PLLA particles are mixed with sterile water, which is absorbed within a few hours of injection, leaving behind the PLLA molecules. The body recognizes PLLA as a foreign body and induces a subclinical macrophage-driven inflammatory reaction, which leads to fibroblast activation and increased collagen synthesis.<sup>7</sup> PLLA has numerous off-label indications and is commonly used to address both volume loss and skin

texture disruptions caused by age.<sup>2</sup> PLLA injection has also been shown to positively affect skin physiology parameters such as skin hydration, transepidermal water loss (TEWL), elasticity, and skin quality (redness, pore size, pigmentation, radiance, and smoothness). These changes are hypothesized to be due to PLLA-dependent stimulation of adipose-derived stem cells, triggering tissue regeneration and stimulation of collagen, elastin, and fat.<sup>8</sup> Historically, PLLA has not been recommended for use immediately under the eye because of the risk of subcutaneous nodule formation, which can happen from product aggregation in the orbicularis oculi muscle. There are only a few published case reports of infraorbital nodule formation following PLLA injection. Based on a retrospective review of 130 patients, the overall risk of nodule formation after injection into the cheek has an incidence of about 7.2%.<sup>9,10</sup>

This study aims to present a series of cases demonstrating indirect thickening of the infraorbital skin leading to periorbital rejuvenation following PLLA treatment of the cheeks, while also proposing a unique injection technique to achieve these results.

#### Patients and Injection Technique

In this paper, we present patients who underwent 2 to 5 rounds of PLLA injection for the purpose of pan-facial skin rejuvenation. PLLA was reconstituted with 8 milliliters (mL) of sterile water and 1 mL of 2% lidocaine without epinephrine. After cleansing the treatment area, the anticipated cannula entry points located in the inferomedial cheek at the intersection of the lateral canthus and nasal ala were anesthetized using a small dermal injection of 1% lidocaine with epinephrine using a 30-gauge (G) needle. A 21-gauge pilot needle was used to create a cannula entry point. A 22-gauge cannula was then advanced beneath the zygomaticus major and SMAS into the medial and lateral suborbicularis oculi fat pads, and subsequently redirected superior to the SMAS into the medial and lateral superficial subcutaneous fat pads, without extending past the ORL superiorly. Approximately 2 mL PLLA was injected per side. The product was massaged for 5 minutes immediately after the procedure, and patients were instructed to massage the treated areas for 5 minutes, 5 times daily, for 5 days beginning on the day of treatment. Patients returned to the clinic for follow-up photographs (Figures 1–3, pre- and posttreatment).

### RESULTS AND DISCUSSION

This case review evaluates the indirect effect of PLLA injection for periorbital skin rejuvenation via injections in two planes of the cheek. These cases demonstrate that the dual-depth injections of PLLA result in biostimulatory effects extending 1 to 2 cm beyond the injection site, which can lead to indirect skin thickening via fibroblast activation on multiple planes. Injection in the subcutaneous plane can increase collagen type I production, leading to increased skin thickness and quality, while also activating the fibroblasts of the facial ligaments. Through

**FIGURE 1A AND 1B.** Frontal view: 35-year-old female prior (Figure 1A) and following 2 treatments of poly-L-lactic acid injection (Figure 1B).



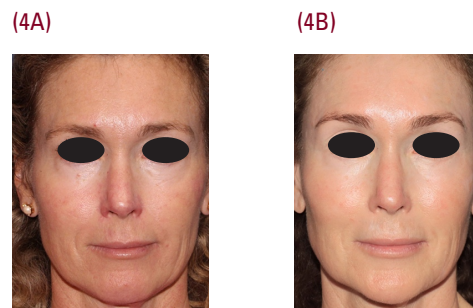
**FIGURE 2A AND 2B.** Frontal view: 44-year-old female prior (Figure 2A) and following 8 treatments of poly-L-lactic acid injection (Figure 2B) over the past 8 years.



**FIGURE 3A AND 3B.** Frontal view: 52-year-old female prior (Figure 3A) and following 4 treatments of poly-L-lactic acid injection (Figure 3B).



**FIGURE 4A AND 4B.** Oblique view: 52-year-old female prior (Figure 4A) and following 4 treatments of poly-L-lactic acid injection (Figure 4B).



deeper injections in the supraperiosteum prezygomatic space, volume can be added to stimulate adipose tissue stem cells as well as compensate for bony resorption. Similar results have been observed with dual-depth treatments in the infraorbital region using microfocused ultrasound with visualization, with improvements in orbital septum thickening and tightening confirmed by CT imaging.<sup>11</sup> By targeting these dual planes of the cheek, PLLA may promote collagen production in multiple layers of the cheeks, indirectly enhancing the infraorbital region. Although hyaluronic acid (HA) fillers can also be used for infraorbital rejuvenation for restoring volume, HA products do not stimulate as much collagen and elastin to thicken and tighten the skin, may cause a Tyndall effect when the skin in the area is thin, as well as draw too much water in the area that can cause prolonged edema over time.<sup>12</sup> Studies have shown that calcium hydroxyapatite, which induces a foreign body reaction in the skin similar to PLLA, leads to more collagen I and elastin production when compared head-to-head to HA fillers.<sup>13</sup>

## CONCLUSION

Our study demonstrates that PLLA offers benefits for infraorbital rejuvenation despite not being injected directly into the tear trough. The technique used is unique because it provides rejuvenation of the cheeks, strengthening of the ocular retaining ligament, and biostimulatory effects of PLLA extending beyond the injection point, leading to infraorbital rejuvenation. This approach highlights the significance of seeing the whole picture when it comes to treating the infraorbital region, as treatment in one area can produce positive effects in adjacent regions.

## DISCLOSURES

NY and PK have no conflicts of interest to disclose. SF reports consultancy for Abbvie, Galderma, Merz, and Revance; research grants from Abbvie, Caliway, Galderma, Merz, Teoxane Tigermed, and Symatase; payments for lectures and speaking from Abbvie, Galderma, Merz, and Revance; and stock ownership in Abbvie and Revance.

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