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ORIGINAL ARTICLE
Cosmetic

Needle versus Cannula to Treat Tear Trough: A Prospective Study Comparing both Methods

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Background: We aimed to clinically compare needle and cannula techniques in vivo with ultrasound and magnetic resonance imaging, to better understand the best technique and adverse events.

Methods: Ten adults without previous fillers in the area were injected with hyaluronic acid (CPM 22.5 HA mg/mL) with a 25G cannula on one side and a Becton Dickinson syringe needle (31G 0.3 mL) on the other. The product was fractionated among two visits. Assessment was made at time 0d, 14d, 30d, 60d, 90d, 180d, and 365d with standard camera, Vectra H2, ultrasound, and magnetic resonance imaging. Level of satisfaction was also evaluated.

Results: All the patients showed natural results with both techniques and a high satisfaction index. Cannulas were minimally less traumatic in terms of bruises. However, the product was applied in a more superficial layer and in a less precise manner, despite the fact that a deep technique was used with cannulas, depositing the product on the orbital bone. Patients reported a more noticeable change immediately after the procedure on the side treated with cannulas but less edema and a more comfortable procedure on the Becton Dickinson syringe treated side. None of the patients required hyaluronidase to dissolve overcorrection of the area, and no severe complications were observed. The product remained in most of them at day 365.

Conclusions: Cannulas seem to be less traumatic regarding bruises, but less precise in vivo. Thin needles seem to be more precise with minimal trauma. However, this difference disappears during patient's evolution. *(Plast Reconstr Surg Glob Open 2023; 11:e5327; doi: 10.1097/GOX.0000000000005327; Published online 6 November 2023.)*

INTRODUCTION

The use of minimally invasive cosmetic interventions is constantly growing around the world. In this regard, the use of new treatments to enhance patient satisfaction with a natural appearance has been increased in up to 78%.[1] Tear trough deformity is of important concern in many subjects seeking periorbital rejuvenation.[2] A prominent tear trough deformity is mainly associated with a sunken appearance of the globe resulting in the casting of a dark shadow over the lower eyelid, leading to a subject's fatigued appearance despite adequate rest and is often refractory to cosmetic concealment treatments.[3] The tear trough deformity is a natural consequence of the anatomic attachments of the periorbital tissues aging.[1–3] Although a variety of techniques have evolved to approach this cosmetic problem, volume replacement is the most frequently used technique by experienced injectors in recent years.[4] In this line, hyaluronic acid (HA) is the filler of choice to treat the tear trough area nonsurgically.[1] Although injectable soft tissue and fat fillers have been reported, outcomes are still inconsistent.[5–9] Additionally, injectors are commonly facing the underlying anatomy of this region, which is a challenge even for experienced physicians. Thus, a better understanding of the underlying fascial, muscle, and vascular anatomy is fundamental to perform safe and effective tear trough injectable interventions.[1,6–9]

Although well-documented risks have been described with these treatments, there is no standardized, evidence-based approach to inject filler in the tear trough, whether using a hypodermic needle or a microcannula.[10–12] In

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addition to this, needles and cannulas have been used to treat tear trough deformity with different approaches and results.[10–12] Many studies have reported that the cannula is more precise and less traumatic (ie, bruises) than needles to perform the procedure.[12] From the clinical point of view and based on our experience in daily clinical practice, we have observed variations in results after long-term periods, as some of the patients developed persistent edema probably due to tissue debridement with the use of cannula treatments.

Considering this frequent issue, we aimed to evaluate both techniques (use of cannula versus thin needle) in vivo in an Argentinian cohort to (1) better understand in which layer the product is deposited; (2) identify if one method results in more spreading than another and if they differ in the depth of the product deposited; (3) evidence differences in terms of results and aesthetic features; (4) evaluate patient satisfaction; (5) show a safer technique to fill the area; and lastly, (6) explain the importance of using a high cohesivity product.

Takeaways

Question: Which is the most accurate technique to treat tear trough: needle or cannula?

Findings: This study was conducted in 10 patients who were injected with HA with cannula on one side and needle on the other side at random. Our findings were that cannulas seem to be less traumatic regarding bruises, but less precise. Thin needles from BD syringes seem to be more accurate, with minimal adverse events.

Meaning: Treating tear trough with a thin needle (BD) shows a greater control of the amount of material deposited compared with cannula, with homogeneous integration and minimal trauma.

METHODS

This prospective cohort study was conducted in 10 adult patients from Argentina who were injected with a CPM 22.5 HA mg (Belotero Balance) with a 25G cannula on one side and a Becton Dickinson (BD) syringe needle (31G 0.3 mL) on the other side at random. To define on which side the product would be applied with needle or cannula, the patient was asked to choose one side (right or left), and that chosen side was treated with cannula. The patient was not aware of on which side the treatment was made whether with cannula or needle. This study was conducted in adherence to the Declaration of Helsinki (1996), and in accordance with regional laws and good clinical practice for studies in human subjects.[13]

Inclusion and Exclusion Criteria

The inclusion criteria were no previous filler injections in the area, any gender, at least 20 years of age, and with noticeable tear trough. Exclusion criteria were having previous treatment with HA fillers or fat in the area, excess of skin or edema in the area, and pregnancy.

Technique and the Used Products

We used an HA Belotero Balance (CPM 22.5 HA mg/mL) with a BD syringe needle (31G) on one side and a 25G cannula on the other (with an administration of one syringe) fractionated into two visits for both sides. The used dose was from 0.2 to 0.25 mL per side, per visit, depending on the depth with an established frequency at the time of the first application (T0) and 30 days after. The number of treatment cycles was two. Assessment schedule: T0 and days 14, 30, 60, 90, 180, and 365.

Regarding cannula injections, the entrance point 2 cm inferolateral to the lateral canthus was marked as the insertion point for the cannula. Some patients required a second stitch to the side 0.5 cm laterally and superiorly to finish the area of the palpebromalar groove above the sub–orbicularis oculi fat, on the orbital rim. The technique was retro-injection, leaving minimal drops of product slowly. Notably, it was performed in a deep plane in contact with the bone. Regarding needle injections, supraperiosteal micropunctures were made along the orbital rim.

Measure of Outcomes

Assessment was made with a standard camera (Sony A73), a Vectra H2 (Canfield), ultrasound, and magnetic resonance imaging (MRI). Immediately after the procedure, each patient received a self-questionnaire to evaluate their level of satisfaction.

Standard photography was performed before the procedures and at days T0, 14, 30, 60, 90, and 180. Vectra H2 photograph was performed before and at days T0, 14, 30, 60, 90, and 180. Ultrasound imaging was performed before and at days T0 (immediately after treatment) and 30; MRI was performed at day 14.

Ultrasound Imaging

All ultrasound assessments were carried out by the same observer with the same ultrasound device to ensure consistency throughout the assessment, using a 14 MHz broadband compact linear array transducer (Samsung Healthcare Global, Gangwon, South Korea). Assessments were conducted with patients in a 30-degree reclined seated position; each region of interest was evaluated across transversal, longitudinal, and oblique sections. The linear transducer was positioned with only minimal skin contact to avoid compression of tear trough soft tissues. In all cases, the purge of the air from both needles and cannulas was ensured by both injectors and radiologist before injecting the HA, to avoid injecting microbubbles of gas normally present inside said devices, thus preventing interference in the ultrasound analysis of soft tissues in the immediate posttreatment.

Identification of HA deposits was evaluated immediately posttreatment; HA deposits were visualized as anechoic or hypoechoic foci of tissue filling in an oblong shape or with a more rounded appearance, both morphologies had moderately defined borders because it is a gel injected into the soft tissue. The deposits were measured in transverse and longitudinal facial anatomical sections, with frozen ultrasound images in their three diameters (transverse, anteroposterior, and longitudinal). These measurements were made with identification purposes of

the injected substance (average diameters of the deposits: 7 x 10 x 12 mm in diameter).

Face MRI

All the patients' faces were examined with a General Electric Signa Explorer 1.5 Tesla MRI, using highly specific face-oriented sequences with high resolution and a small field of view (voxel size: 0.3*0.3*3.0 mm). Thin slices (1.6 mm) across axial, sagittal, and coronal planes were acquired using the following sequences: 3D Bravo fast spin echo (FSE) sequence noncontrast (TR 7283 ms, TE 102 ms, Flip angle 160 degrees), with and without FS, STIR fast spin echo noncontrast (TR 3748 ms, TE 45 ms, Flip angle 160 degrees), with and without FS, T2 Cube (TR 2500 ms, TE 99 ms), with and without FS. Axial, coronal and sagittal acquisitions were used, with a total scan time of approximately 40 minutes.

Imaging evaluation and clinical correlation were evaluated by one independent radiologist (with at least 25 years of experience in the field) volunteered to be evaluator and blinded to the identity of the used substance, clinical history and information related to the plastic surgeon and dermatologist. The radiologist described information regarding the identity of the substance and dermal filler distribution pattern on each side, based solely on ultrasound and MRI scanner findings.

Level of Satisfaction

Level of satisfaction was measured according to an ad hoc self-questionnaire designed by the coauthors based on our clinical experience. Critical questions of the survey were developed with a focused group of patients. The preliminary version was piloted two times, using two testers each time to ensure that the questions were well-defined, clearly understood, and presented in a consistent manner. Thus, patients were evaluated as follows: (1) Did you feel any difference between one side and the other during the treatment? (2) Did you find one treatment modality more comfortable than the other? (3) Were the results more noticeable on one side than on the other? Were there any changes during the follow-up period? (4) Did you notice any differences in the evolution between one side and another? (5) Would you repeat the treatment? Which modality would you choose?

RESULTS

Overall Findings

All the patients (100%) were women, with a mean age of 33.1 ± 7.8 (range: 22–50) years. All patients showed natural results with both techniques and a high satisfaction index, as illustrated in Figures 1 and 2. (**See table, Supplemental Digital Content 1,** which displays level of satisfaction according to an ad hoc self-questionnaire. **http://links.lww.com/PRSGO/C807**.) Compared with BD syringes, cannulas were minimally less traumatic in terms of bruises. Of note, we used a correct and deep technique underneath the orbicularis oculi muscle, as described and reported previously.[2,14] However, the product was applied in a more superficial layer and in a less precise manner compared with cannulas, which might result in the presence of a greater amount of filler at the same place (Fig. 3). Patients reported a more noticeable change immediately after the procedure on the side

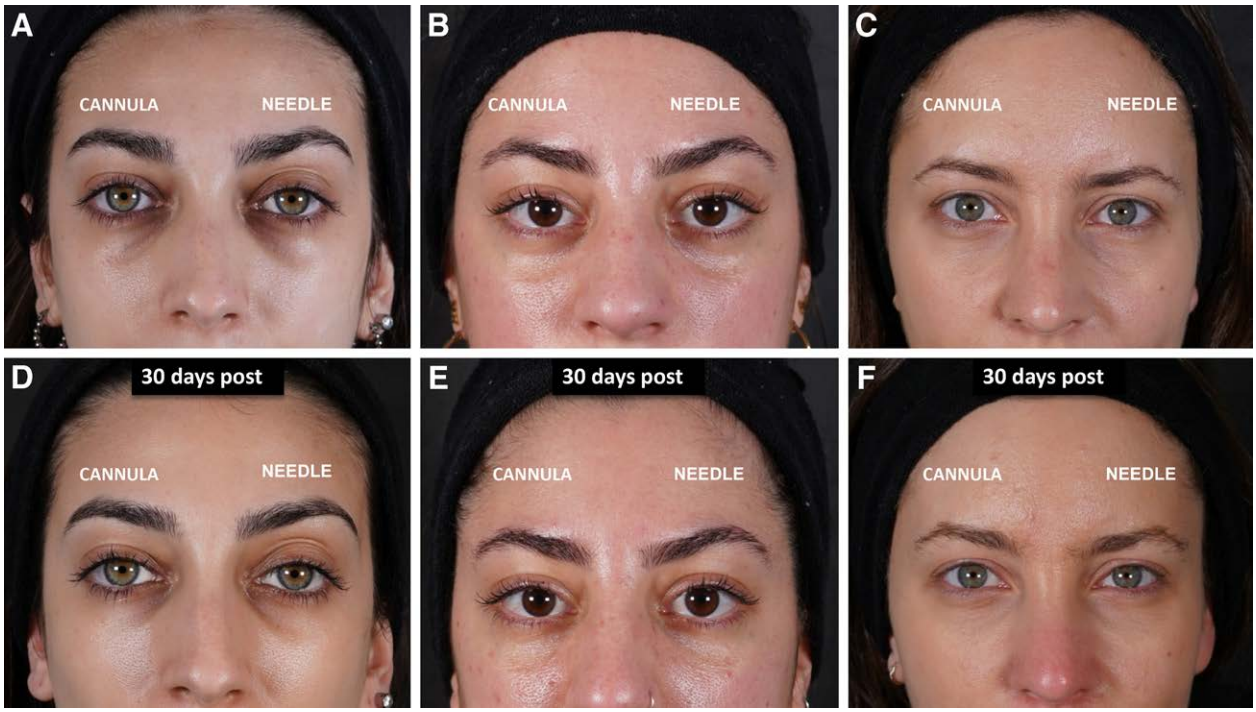

Fig. 1. Preoparative and postoperative photgraphs. A-C, Before treatment, comparing the cannula side and the BD syringe needle side on each patient. D-F, 30 days post treatment, showing both sides.

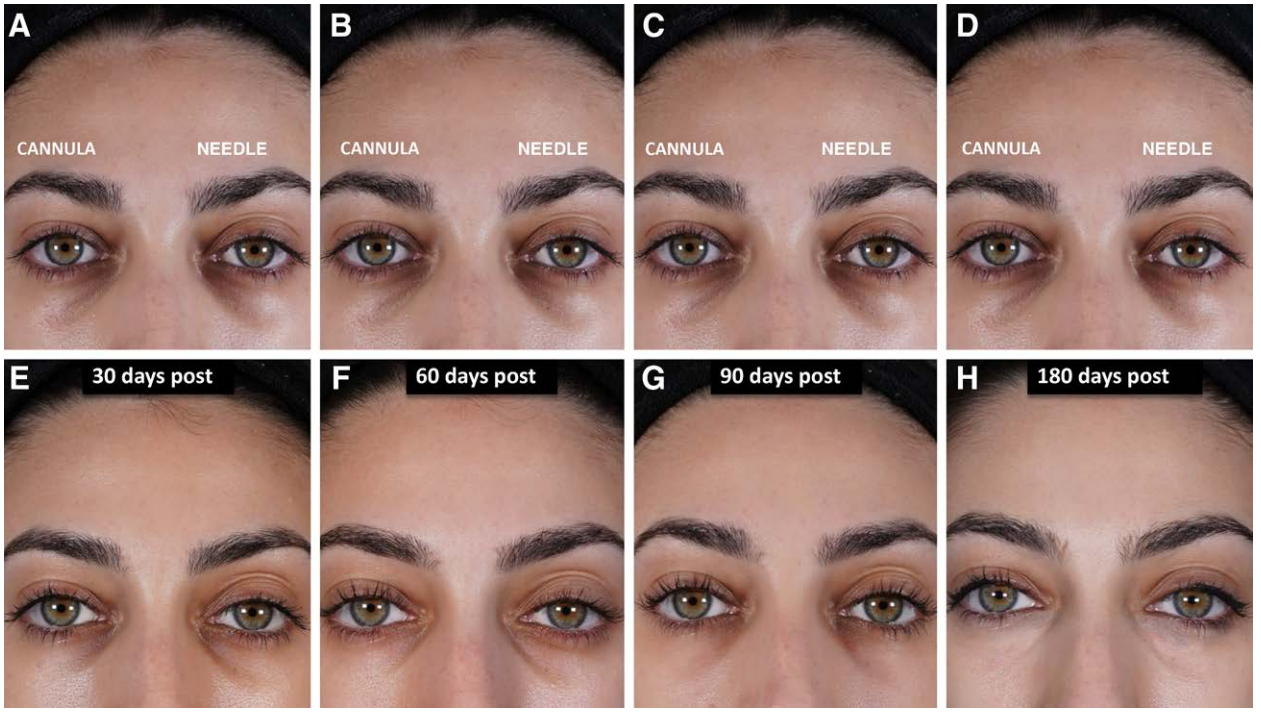

Fig. 2. Preoperative and postoperative photographs. A-D, Before treatment highlighting the cannula side on the right and the needle side on the left. E, Evolution at 30 days; F, at 60 days; G, at 90 days; H, at 180 days. A slightly different appearance with a more protruded side on the cannula side was observed at the beginning, but then it was similar on both sides.

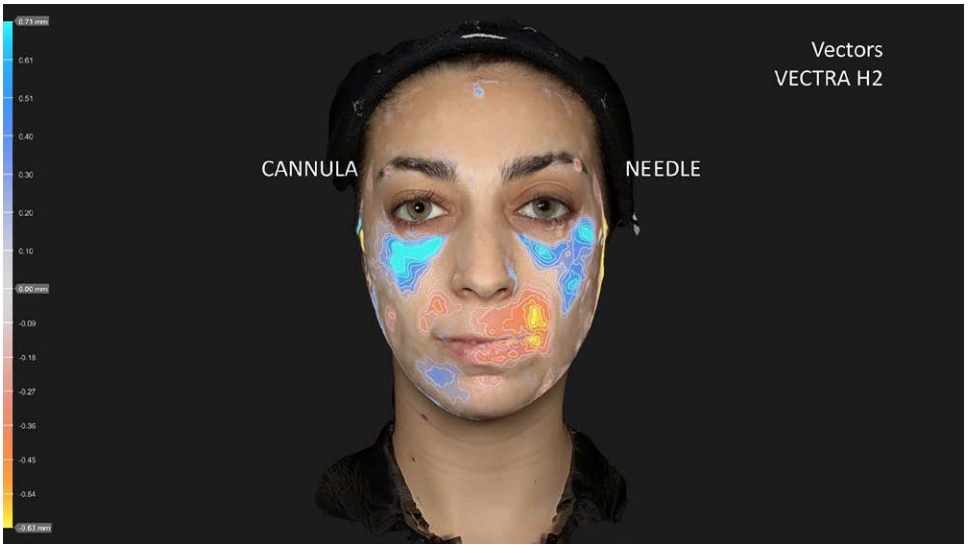

Fig. 3. In the VECTRA H2 image immediately after the procedure, a greater volume was observed on the cannula side, but the volume was the same on both sides. Therefore, we assumed that the product was more protruded.

treated with a cannula and less edema on the BD syringe treated side. During the procedure, they reported that the side treated with a BD syringe was more comfortable than the one treated with a cannula.

None of the patients required hyaluronidase to dissolve over correction of the area after 365 days of follow-up, but the cannula side protruded more than the BD side at the beginning. However, with the integration of the filler this difference disappeared. None of the patients had severe complications. The product remained in most of them at day 365.

Ultrasound Findings

Supplemental Digital Content 2 displays high resolution ultrasound images that were taken from both tear troughs (left and right) immediately after HA injection

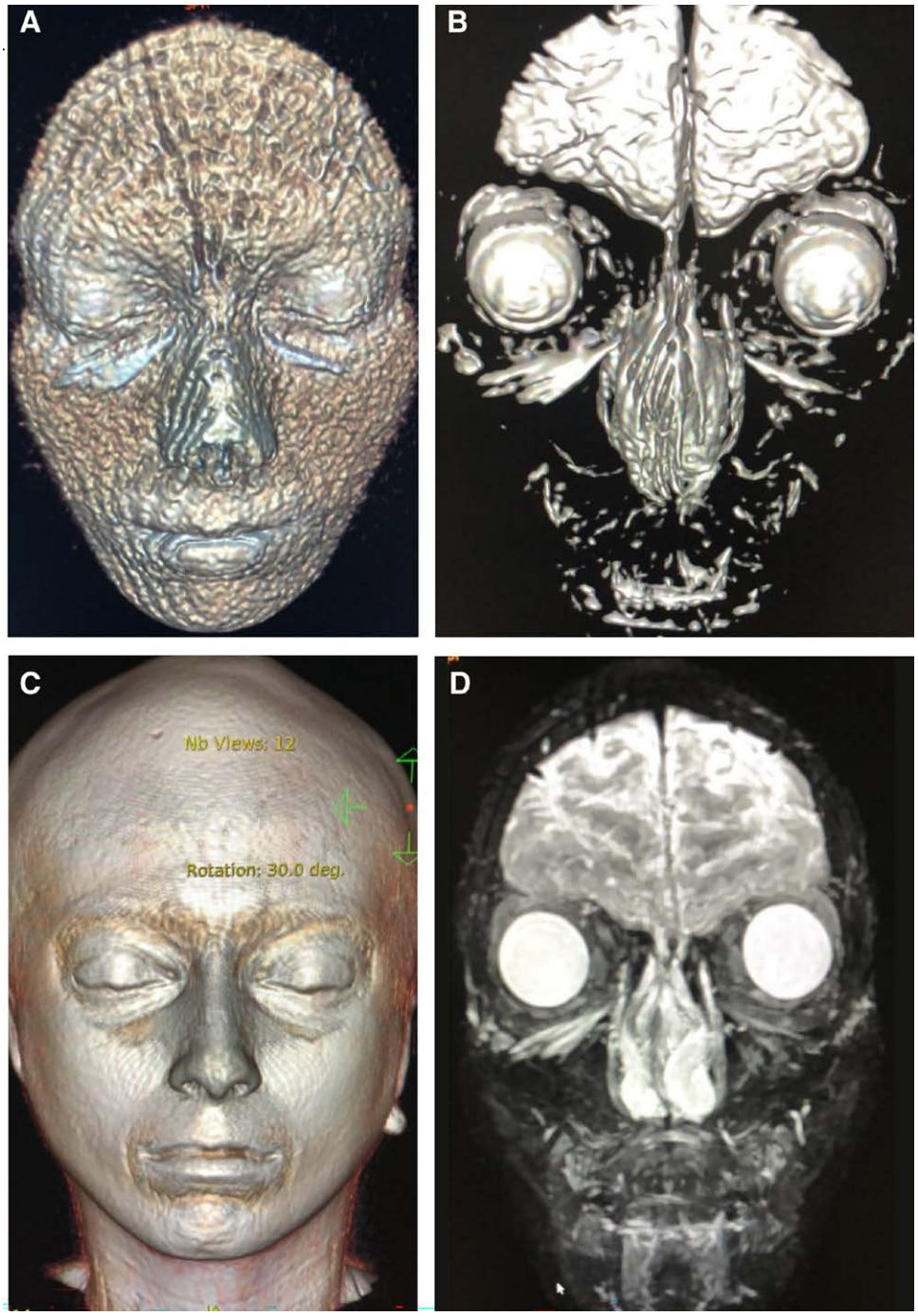

Fig. 4. Face magnetic resonance imaging. A, MRI of the face: 3D reconstruction of the tissues located immediately under the muscular plane (orbicularis oculi muscle). On the left side we can see a more diffuse or disaggregated arrangement of the HA depot ("ill defined"). On the right side the image shows a more "compact" arrangement with an agglomerate appearance of the HA depot. B, MRI of the face: 3D reconstruction. Only the HA depots can be seen; they seem practically suspended in the tear trough regions since the signal from the other tissues has been suppressed. This suppression was specifically carried out to visualize the 3D disposition of the HA depots that were implanted with the two techniques. The "ill defined and agglomerate" patterns, left and right, respectively, can be observed with a high degree of fidelity. C, 3D reconstruction MRI of the face showing the skin surface: the image shows no differences at the skin level between either technique. D, Face MRI 3D reconstruction MIP image (maximum intensity projection). This is a volume-rendering technique in which the 3D volume was confined to a region of interest, in this case the HA depots. On the left side we can see a more disaggregated arrangement of the HA depot. On the right side the image shows a more "compact" arrangement of the HA depot.

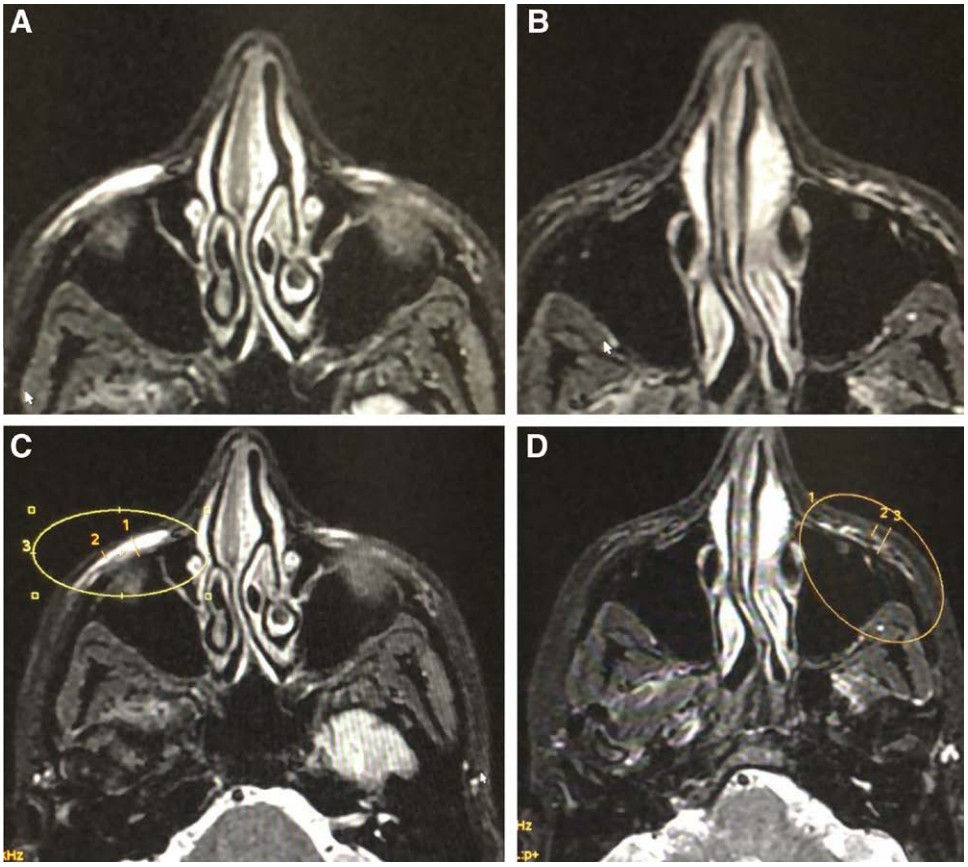

Fig. 5. Magnetic resonance imaging of the face. Axial STIR sequences. A, On the left side or tear trough the HA depot is observed in a more disintegrated or diffuse disposition; on the contrary, the HA depot on the right side tends to aggregate. B, On the left side (needle) the HA displays a clear disaggregated distribution and is further away from the cutaneous plane. C, On the right side (cannula) the HA depot is observed in an accumulated form. It is hyperintense and crescent- shaped or banana-shaped, and its disposition tends to be more superficial or closer to the cutaneous plane. D, On the left side (needle) the HA displays a clear disaggregated distribution and is further away from the cutaneous plane.

with needle on one side and cannula on the other side. [**See figure, Supplemental Digital Content 2;** Longitudinal views show HA deposits located below the muscle (orbicularis occuli) and close to the orbital periosteum. A, Well-defined hypoechoic, spherical or globular image can be observed. This image corresponds to an HA deposit that is located below the muscular plane in close proximity to the orbital periosteum. In this case, HA was injected with a needle. Note that there is a remarkable proximity to the orbital periosteum and a greater distance from the HA to the skin. This image corresponds to the images of RNM A B C D, left tear trough. B, Well-defined anechoic image with an elliptical or oblong shape. This image corresponds to the HA deposit which is located below the muscular plane and close to the orbital periosteum. In this case, the HA was injected with a cannula. Note the proximity to the orbital periosteum and a shorter previous image. This image corresponds to the images of RNM A B C D, right tear trough. C, The HA deposit was injected with needle. D, The HA was injected with a cannula. http://links.lww.com/PRSGO/C808.] We have also observed this homogeneous deposit of product in a deeper plane on the needle side over the periosteum, suggesting that the product was injected deeper and in a more integrated manner.

At 30 days, HA deposits were viewed in the form of microdroplets with an average diameter of 1.5–2 mm distributed diffusely and homogeneously in the thickness of the soft tissue located between the orbicularis oculi and the orbital periosteum. At that moment, all the HA deposits presented the same morphology of anechoic or hypoechoic droplets distributed diffusely and homogeneously in the previously mentioned correct plane.

No patient showed migration of the filler to adjacent anatomical areas or superficialization of the filler; that is, above the orbicularis oculi muscle.

Face MRI Findings

We have noticed differences with both methods: we observed deeper deposits of product with needle than with cannula at day 14. On the needle side, we observed deeper deposits of product in a more homogenous distribution and, on the cannula side, a "banana shape" in a more superficial plane, as can be observed in Figures 4 and 5.

DISCUSSION

In this study, we described the experience of two aesthetic medical doctors in the treatment of tear trough deformity, evaluating complications, side effects, overall satisfaction, and improvement. After comparing the use of needle versus cannula, we found that all our patients showed natural results with both techniques with a high satisfaction index, especially in favor of the use of needle. In this context, thin needles from BD syringes seem to be more precise with minimal trauma when compared with cannulas (less traumatic regarding bruises, but less precise in vivo). This difference disappears during patients' evolution. Likewise, our findings were confirmed by ultrasound and MRI.

Given the development of relatively new field of aesthetic medicine, doctors are using filler products and techniques with established safety profiles to reduce complications and to increase patient satisfaction. Although both needles and cannulas have been used with similar efficacy,[2] the facial arterial system is a dangerous zone for filler injections; thus, minimizing the risk of intraarterial filler injection is relevant.[2–4] There is an extensive debate among expert doctors on using cannula over needles to deliver soft-tissue fillers, as cannula generates insignificantly fewer bruises, ecchymosis, and pain scores with faster recovery; therefore, this technique is gaining popularity.[15,16] However, there is relevant evidence that the use of needles is more precise than the use of cannula, as it is assumed that positioning the tip at the periosteum is relatively simple.[17] Although some adverse events are injector-dependent, others may be inherent to the risks of using sharp needles.[17] However, a study performed in cadaver specimens reported that injecting with a sharp needle may potentially result in intravascular embolization, even when the needle is in constant contact with the periosteum. Likewise, injecting on the periosteum with nontraumatic cannula has improved safety, although not guaranteed.[18] In that study including 58 expert injectors (77% of aesthetic physicians, 15% of dermatologists, and 2% of plastic surgeons), it was reported that 79% of the total physicians thought needles were more precise for placing a filler at the periosteum, whereas 21% believed cannulas were more precise. Additionally, 71% of injector experts agreed that cannulas are safer than needles for injecting fillers at the periosteum.[18] Another study reported that using a combination of needle and cannula for treating the tear trough deformity gave a smooth contour in the lid cheek junction, with no volume deficit in the tear trough region.[12] Additionally, longer lasting results and excellent patient satisfaction was also reported, and risk of bruising and occurrence of Tyndall effect was rarely observed.[12]

In the present study, we found deeper deposits of product with a thin needle from a BD syringe than with cannula at day 14, as demonstrated by MRI. In addition, no patient showed migration of the filler to adjacent anatomical areas or superficializing of the filler toward more superficial planes (ie, above the orbicularis oculi muscle) at day 30, in line with the recommendations reported in a study on real-time ultrasound of the tear trough anatomy.[19] Recently, a review recommended that to properly correct this deformity with HA injection and avoid undesirable effects, doctors must (1) have good anatomical knowledge of the area and involvement of the structures in the tear trough; (2) perform proper clinical assessment of the patient; (3) choose the correct product; and (4) use an appropriate injection technique. In this regard, they reported that good results can be obtained with both needle and cannula, consistent with our findings.[2]

Another important point to highlight is that we obtained good satisfaction index for both techniques. Measuring satisfaction based on self-reported questionaries is important, as it can predict future aesthetic pleasure, as previously reported.[20] Self-reported satisfaction questionaries should be evaluated systematically in clinical practice to evaluate treatment holistically.

This study has some limitations that should be mentioned. This was a study with a small population, and we only included women. Additionally, we used a self-reported survey that has not been validated in Argentina. Likewise, self-reported surveys may tend to overestimate some results. It is important to highlight that the two aesthetic medical doctors are experts in advanced injection procedures. Given the exploratory nature of the study and the low number of patients included, our findings may have a restricted transferability to the general population and therefore should be interpreted with caution. Thus, considering these limitations, we could not perform specific statistical analyses, and only descriptive information was included. Despite these limitations, this study has several strengths such as (1) the prospective design, (2) the randomization, (3) the 1-year longitudinal follow-up, (4) the imaging evaluation (ie, ultrasound and MRI) and (5) the use of satisfaction measures.

In conclusion, a correction of the tear trough deformity is still a challenge in terms of natural results, avoiding both edema and persistent inflammatory intermittent edema in a long-term follow-up. Although cannulas seem to be less traumatic regarding bruises, they are less precise, with less control of the amount of material deposited by the cannula gauge (25G). In turn, with 0.3 BD syringe needles, there is greater control of the amount of material that is deposited, deeper, on bone; it integrates more homogeneously with minimal trauma. These differences disappear during the follow-up period. More follow-up time is needed to determine if tissue debridement is present with the use of cannulas.[21] This procedure requires an experienced injector who should also know both skills. The rheological properties of the product can play an important role in terms of results and integration. Desired and predictable outcomes can be achieved when all these variables are considered. Further studies evaluating the use of thin needles from BD syringes versus cannulas with a larger number of patients are needed in the near future to optimize and standardize the best treatment and prevention of adverse events in clinical practice.

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DISCLOSURE

Dr. Spada has received personal compensation for consulting, serving on a scientific advisory board, speaking, professional travel/accommodation stipends, or other activities with Merz Pharma. Dr. Schneider has received personal compensation for consulting, serving on a scientific advisory board, speaking, professional travel/accommodation stipends, or other activities with Merz Pharma. Dr. Ravera has no financial interest to declare in relation to the content of this article. Medical writing support for this article was provided by Merz Argentina S.A.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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ETHICS STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to, and the appropriate ethical review committee approval has been received. The US National Research Council's guidelines for the Care and Use of Laboratory Animals were followed.

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