Journal of Dermatological Treatment

ISSN: 0954-6634 (Print) 1471-1753 (Online) Journal homepage: www.tandfonline.com/journals/ijdt20

Anatomical-based diagnosis and filler injection techniques: marionette line (static labiomandibular fold)

Gi-Woong Hong, Sky Wong, Song-Eun Yoon, Jovian Wan & Kyu-Ho Yi

To cite this article: Gi-Woong Hong, Sky Wong, Song-Eun Yoon, Jovian Wan & Kyu-Ho Yi (2025) Anatomical-based diagnosis and filler injection techniques: marionette line (static labiomandibular fold), Journal of Dermatological Treatment, 36:1, 2452954, DOI: 10.1080/09546634.2025.2452954

To link to this article: https://doi.org/10.1080/09546634.2025.2452954

JOURNAL OF DERMATOLOGICAL TREATMENT
2025, VOL. 36, NO. 1, 2452954
https://doi.org/10.1080/09546634.2025.2452954

Taylor & Francis
Taylor & Francis Group

REVIEW ARTICLE

OPEN ACCESS Check for updates

Anatomical-based diagnosis and filler injection techniques: marionette line (static labiomandibular fold)

Gi-Woong Hong[a], Sky Wong[b], Song-Eun Yoon[c], Jovian Wan[d] and Kyu-Ho Yi[e,f]

[a]Samskin Plastic Surgery Clinic, Seoul, Korea; [b]Leciel Medical Centre, Central, Hong Kong; [c]Brandnew Aesthetic Surgery Clinic, Seoul, Korea; [d]Medical Research Inc, Wonju, Korea; [e]Division in Anatomy and Developmental Biology, Department of Oral Biology, Human Identification Research Institute, Seoul, Korea; [f]Maylin Clinic (Apgujeong), Seoul, Korea

ABSTRACT

Purpose: Marionette lines, also known as static labiomandibular folds, are common age-related perioral wrinkles that impact facial aesthetics, particularly in Asian populations. This article aims to examine the anatomical basis, etiology, and filler injection techniques used for treating marionette lines.

Materials and Methods: The study reviews anatomical studies and clinical practices related to marionette lines. Anatomical observations focus on the position of the modiolus and its relationship to age-related changes. Treatment approaches are examined through a review of filler injection techniques, including supramuscular and submuscular fat layer targeting, as well as neurotoxin use for enhancing treatment outcomes.

Results: The review finds that the anatomical positioning of the modiolus in Asian populations predisposes them to increased susceptibility to commissural ptosis and wrinkle formation. Filler injections, particularly using a cannula for deeper layers, are effective for addressing volumetric loss in the supramuscular and submuscular layers. Neurotoxin injections into the depressor anguli oris muscle can enhance results by reducing downward force on the oral commissure.

Conclusions: Marionette lines are complex, multifactorial wrinkles that benefit from a multimodal treatment approach, combining dermal fillers and neurotoxins. Awareness of anatomical variations and proper injection techniques is crucial for achieving optimal aesthetic outcomes and minimizing risks.

ARTICLE HISTORY
Received 22 October 2024
Accepted 7 January 2025

KEYWORDS
Aging; dermal fillers; Botulinum toxins; facial muscles; anatomic landmarks

Introduction

Marionette lines, also known as static labiomandibular folds, are age-related perioral wrinkles that significantly impact facial esthetics. These lines extend from the oral commissures to the mandibular border, often accompanied by the formation of a prejowl sulcus. The etiology of marionette lines is multifactorial, involving anatomical, age-related, and lifestyle factors that contribute to their development and progression (1–5).

The anatomical basis for marionette lines varies among different ethnic groups, with Asian populations showing a distinct predisposition due to the positioning of the modiolus (6–8). This muscular nodule, formed by the convergence of perioral muscles, is typically located more laterally and inferiorly in Asian faces compared to Caucasian and African populations. This anatomical difference contributes to the increased susceptibility of Asian individuals to commissural ptosis and wrinkle formation, even in neutral expressions.

Types and definitions of oral commissure wrinkles

The wrinkles that form around the oral commissures are referred to by various names in literature. This section aims to summarize the most commonly used terms for these perioral lines.

In Caucasian and African populations, the modiolus, a small, thick muscular nodule formed by the convergence of perioral muscles, is typically located at or above the level of the oral commissure. Conversely, in Asian populations, including Koreans, the modiolus is generally positioned approximately 11 mm laterally and 9 mm inferiorly to the oral commissure. Consequently, even in a neutral expression, Asian individuals often present with a downturned appearance of the oral commissures compared to their Western counterparts. This anatomical positioning predisposes Asian individuals to increased susceptibility to commissural ptosis and wrinkle formation with advancing age (9,10).

The muscular layers forming the modiolus, including the superficial depressor anguli oris (DAO) muscle and the superficial and deep fiber layers of the orbicularis oris muscle, create distinct planes due to their varying depths. This layered structure can result in the formation of a commissural line, a vertically oblique depression particularly prevalent in Asian populations due to the anatomical position of the modiolus (11–13).

Volumetric deficiency in the lateral lower lip fat compartment, one of the three superficial fat compartments below the lip, can exacerbate the thickness discrepancy between the jowl fat and the lower lip tissues. This disparity accentuates the commissural line and contributes to mouth corner drooping (Figure 1).

CONTACT Kyu-Ho Yi kyuho90@daum.net Division in Anatomy and Developmental Biology, Department of Oral Biology, Human Identification Research Institute, 50-1 Yonsei-ro, Seodaemun-gu, Seoul, 03722, Korea

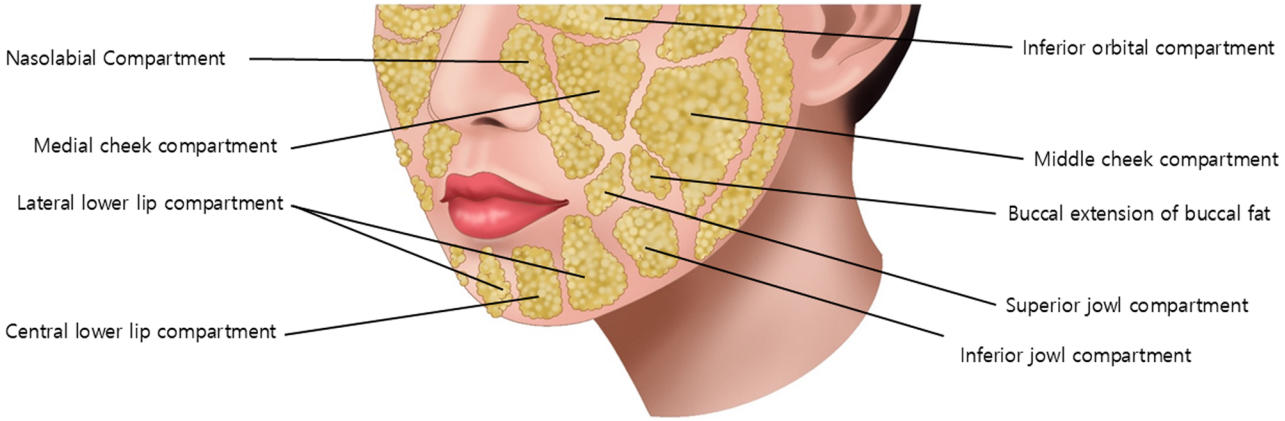

Figure 1. Superficial fatty compartments.

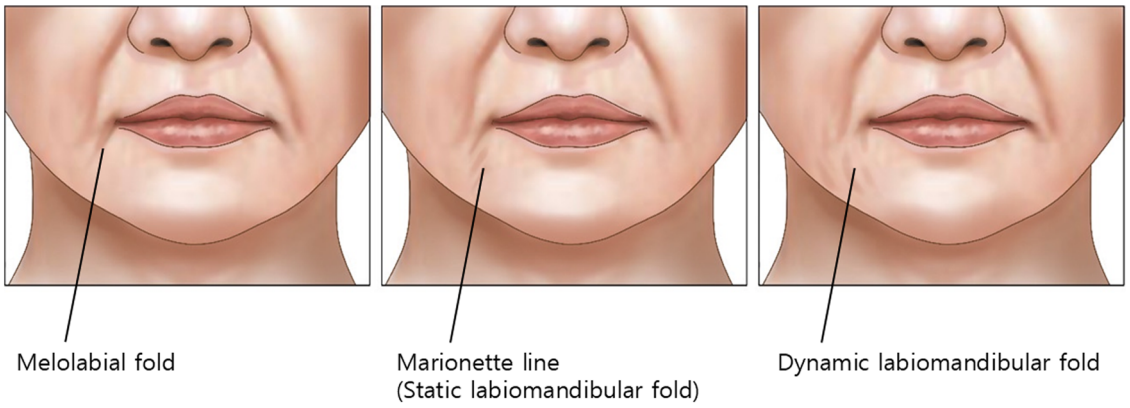

Figure 2. Types of the mouth corner line.

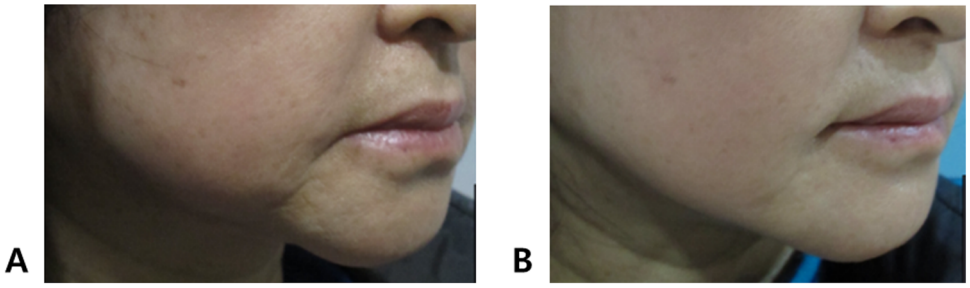

Figure 3. Before (a) and after (b) treatment of the melolabial fold with loss of deep fat volume.

The line demarcating the superficial anatomical boundary between the cheek and lower lip region is often referred to as the cheek-chin crease or melolabial fold when it becomes more pronounced due to increased tissue thickness discrepancy (Figure 2).

In cases of severe melolabial folds extending to the jawline, restoration of the lower lateral lip compartment volume is crucial for improvement. Case studies demonstrate that addressing this volumetric deficiency can result in both fold improvement and ancillary mouth corner lifting effects (Figure 3) (14).

Age-related exacerbation of the melolabial fold can lead to its extension to the mandibular border, coupled with the formation of a prejowl sulcus. This wrinkle pattern is commonly referred to as the marionette line (Figure 4) (15).

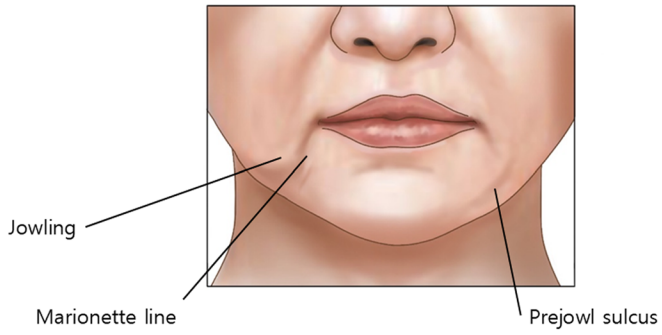

Figure 4. Marionette line with the prejowl sulcus and jowling.

The term 'marionette line' is believed to originate from the resemblance to puppet mouth corners in European marionette theater, although its precise etymological origin remains unclear. It is also termed the static labiomandibular fold due to its presence even in the absence of facial expression.

Etiological factors for marionette lines include maxillary and mandibular bone resorption, gravitational descent, deep fat compartment atrophy beneath the depressor anguli oris muscle, muscle compression, mandibular ligament tethering effects, skin and connective tissue laxity, and jowl and buccal fat ptosis (16). Treatment approaches may necessitate combination therapies addressing these multifactorial causes (Table 1).

The dynamic labiomandibular fold, distinct from the static marionette line, is characterized by its formation along the anterior border of the depressor anguli oris muscle during facial expression. With aging, this dynamic fold may become persistent even at rest, potentially extending from the nasolabial fold to the jawline (13,17–21).

The dynamic labiomandibular fold is particularly exacerbated by the lateral pulling action of the platysma and zygomaticus major muscles. This is due to the anatomical arrangement where the upper portion of the depressor anguli oris muscle inserts into the skin, while the inferior boundary is anchored by the mandibular ligament. This configuration results in a bowing effect during lateral muscle contraction (Figure 5) (22–25).

Given these distinct etiologies, the treatment approaches for dynamic labiomandibular folds differ from those for static marionette lines. The principles of management align with those for age-related dynamic perioral wrinkles, which will be elaborated upon in subsequent sections.

Table 1. Considerations for the treatment of marionette line.

1. Causes of the deepening melolabial fold (marionette line)
Resorption of the maxillary & mandibular bone
Gravitational downward displacement
Depressed labiomandibular fat with the sagging of jowl & buccal fat
Tethering effect of the mandibular ligament
Compression of the depressor anguli oris muscle
Tight lower lip compartment with redundant skin and connective tissue above the marionette line
2. Combination procedures
Botulinum toxin injection to improve the mouth corner depression caused by the depressor anguli oris muscle action
Removal of the jowl fat
Thread lifting (fat tissue repositioning)
Filler injection for the mandible border line & mouth corner

Commissural line or melolabial fold treatment

In this study, Lorient fillers were selected based on the severity of the marionette lines. For patients with more severe marionette lines, Lorient No. 4 was used due to its higher elasticity (G' 338 Pa) and better structural support. For patients with less severe lines, Lorient No. 2 was chosen because of its softer profile (G' 203 Pa), allowing for subtle volume enhancement and natural movement. After determining the appropriate filler based on severity, 0.5 ml of filler was injected per side for each patient, ensuring precise and consistent correction tailored to individual needs. This approach allowed for effective treatment of marionette lines while maintaining a natural esthetic outcome.

Filler injection is performed along and slightly medial to the wrinkle line, concurrently addressing any adjacent volume deficits. The typical approach involves needle injection into the supramuscular fat layer using linear threading and retrograde fanning techniques (Figure 6).

The volumization effect of filler injection can elevate depressed tissues, thereby attenuating the wrinkle boundary and creating an apparent lifting effect at the oral commissure. Caution must be exercised to avoid injury to branches of the facial and inferior labial arteries during the procedure.

Marionette line (static labiomandibular fold) treatment

For mild to moderate depressions, filler injection primarily targets the subcutaneous fat layer above the muscle using a needle. The injection is performed slightly medial to the marionette line using a linear threading technique, while the depressed area anterior to

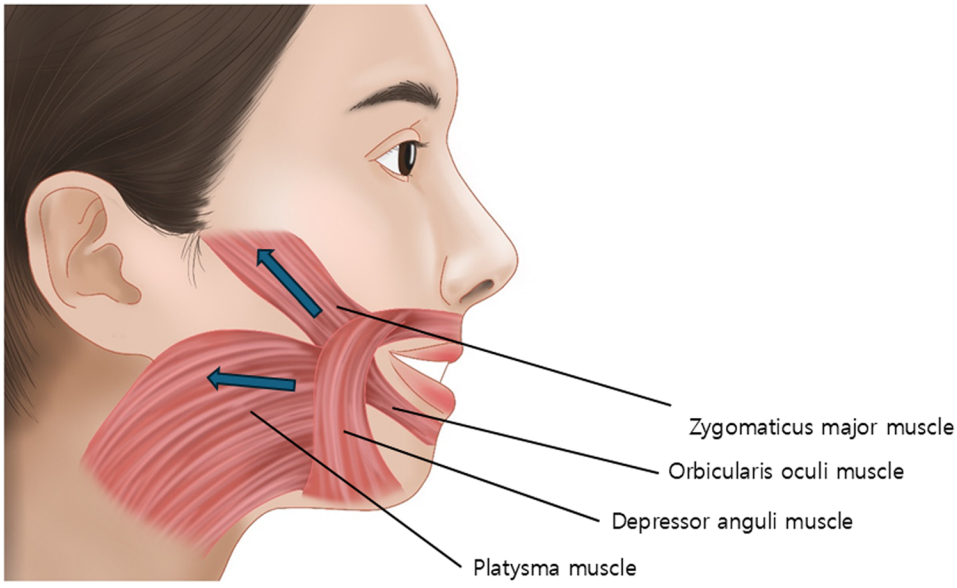

Figure 5. Bowing effect of the depressor anguli oris muscle by the lateral pulling.

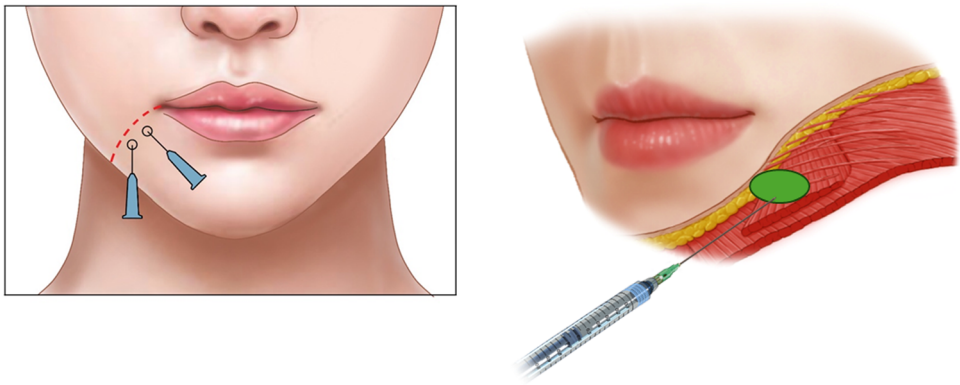

Figure 6. Injection techniques for the commissural line and melolabial fold. Injection entry point: Slightly medial to the commissural line or melolabial fold along the line or with right angles along the line for subdermal injection of soft filler to smooth out the margin of the line. Injection techniques: 1. Retrograde fanning & linear threading technique 2. Superficial multiple fern leaf or duck walk technique.

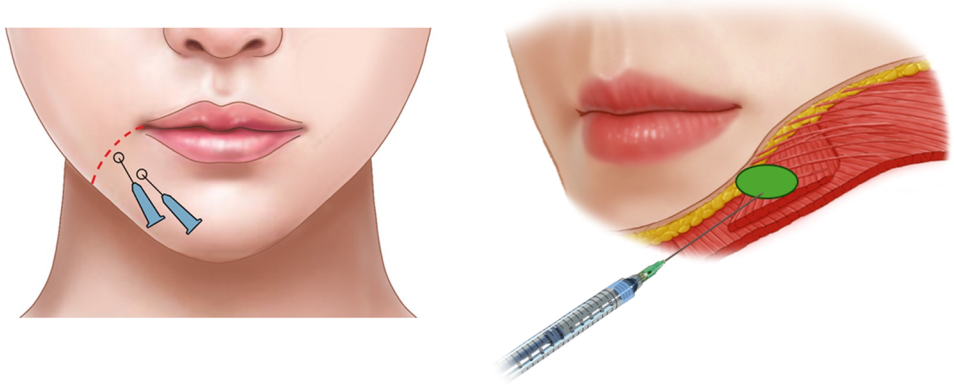

Figure 7. Injection techniques for the marionette line. Injection entry points: 1. Slightly medial to the marionette line along the line when using the needle for the subcutaneous injection of soft filler to smooth out the surface including margin of the line 2. Medial to depressed area on lower 2/3 position from the oral commissure to the mandible border when using the cannula for the volume replacement. Injection techniques: 1. Linear threading, retrograde fanning & cross hatching technique for the needle 2. Retrograde fanning, cross hatching & layering technique for the cannula.

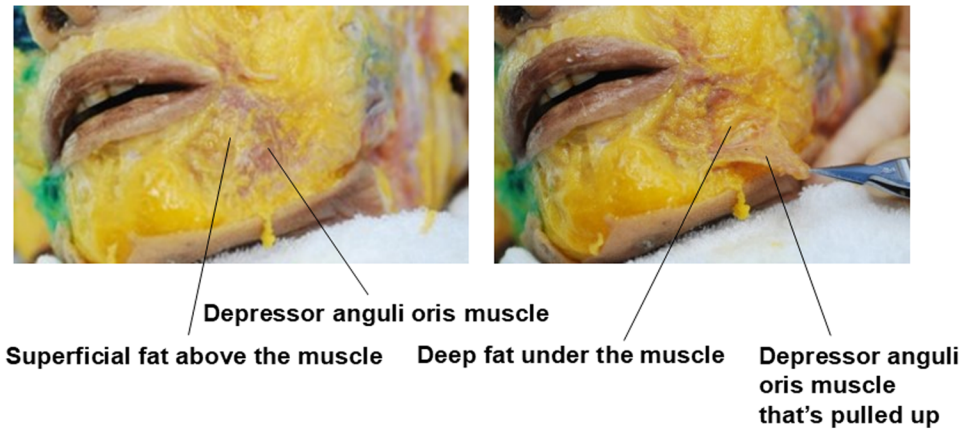

Figure 8. Superficial and deep fat medial to the marionette line.

the line is treated using retrograde fanning or cross-hatching techniques for broader volumization (Figure 7).

During marionette line and jowl treatments, it is crucial to be aware of the perioral vascular anatomy. As previously discussed in the labial section, branches of the facial artery traverse the mandibular border toward the nasolabial fold, coursing superior and inferior to the oral commissure. Gentle manipulation of needles or cannulas is essential to minimize vascular trauma. The practitioner must consider the trajectories of branches from the facial, inferior labial, labiomental, and submental arteries to avoid vascular compromise (Figure 8).

For deep wrinkles and significant volume loss, treatment of the submuscular fat layer is often necessary. In such cases, cannula

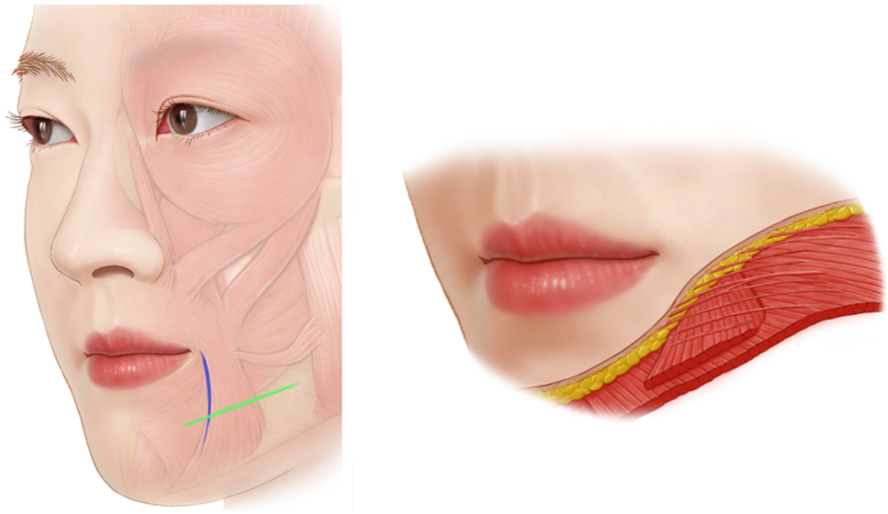

Figure 9. Overlays of cutaneous folds on anatomical images, highlighting the relationships between muscles, fat, and superficial structures.

use is preferred to mitigate risks of vascular and neural injury. To avoid vascular compromise, it is essential to inject slowly, use a cannula in high-risk areas, and remain superficial in regions near the facial, inferior, and superior labial arteries. Key anatomical landmarks should be observed, such as staying lateral to the nasolabial fold when injecting.

The entry point for cannula insertion is typically located at the medial border of the depressed area, approximately two-thirds of the distance from the oral commissure to the mandibular border. From this point, retrograde fanning and layering techniques are employed to restore volume in both the submuscular and supramuscular fat layers, simultaneously addressing the prejowl sulcus to smooth the jawline contour.

During this procedure, care must be taken to avoid injury not only to the facial artery and its perioral branches but also to the mental artery and nerve emerging from the mental foramen. The mental foramen is often located slightly medial to the midpoint of a vertical line drawn from the oral commissure to the mandibular border, or approximately 2 cm inferior to the oral commissure.

It is advisable to use the non-injecting hand to compress the superior aspect of the treatment area, preventing superior migration of filler. Following volumization, if necessary, a soft filler may be injected into the subdermal plane, including the dermis, for final surface refinement.

Hyperactivity of the depressor anguli oris muscle, which originates broadly from the mandibular border and narrows to insert into the modiolus near the oral commissure, can result in downward displacement of the oral commissure. In such cases, neurotoxin injection to weaken this muscle can be beneficial (7,26–28).

Neurotoxin treatment, by reducing the downward force on the oral commissure, can enhance the efficacy of filler treatments for commissural wrinkles. Moreover, this approach aligns with contemporary facial balancing techniques, creating an appearance of elevation at the oral commissure and imparting a more positive expression.

Discussion

In younger patients, structural causes like protrusion of buccal fat often exacerbate melolabial folds. In such cases, hyaluronic acid fillers and lipolytic agents can be used to even out the area below the fold to achieve a smoother appearance (29). Additionally, early intervention techniques, such as the use of thread lifting, skin-tightening treatments like ultrasound or radiofrequency can be used.

The treatment of marionette lines requires a comprehensive understanding of facial anatomy and a multifaceted approach to address the various contributing factors (Figure 9). Filler injections remain a cornerstone of treatment, targeting both supramuscular and submuscular fat layers to restore volume and improve contour. The choice between needle and cannula injection techniques depends on the depth of the wrinkles and the specific anatomical area being treated. For deeper injections, particularly in the submuscular layer, cannula use is often preferred to minimize the risk of vascular and neural injury.

Awareness of the perioral vascular anatomy is crucial for safe and effective treatment. The practitioner must be cognizant of the course of the facial artery and its branches, including the inferior labial and mental arteries. Careful consideration of injection techniques and entry points is essential to avoid vascular compromise. The mental foramen's location, typically found slightly medial to the midpoint between the oral commissure and mandibular border, serves as an important anatomical landmark for avoiding injury to the mental nerve and artery. Common complications associated with the treatment of marionette lines include bruising due to inferior labial artery running below the depressor anguli oris, swelling, asymmetry, and rare vascular events, such as arterial occlusion. To minimize these risks, practitioners should adopt preventive strategies, including thorough anatomical assessment, slow and controlled injections, and the use of blunt-tip cannulas in high-risk areas. Staying within the superficial plane, particularly near key arteries such as the facial artery, is critical to avoiding vascular compromise. Early recognition of complications, such as signs of vascular compromise (e.g., blanching, pain), is essential, allowing for prompt intervention with measures like hyaluronidase administration, massage, or warm compresses. By integrating these strategies into their practice, clinicians can enhance patient safety and optimize treatment outcomes for marionette lines.

Complementary to filler injections, neurotoxin treatments can play a significant role in managing marionette lines, particularly in cases where muscle hyperactivity contributes to the problem. Targeting the depressor anguli oris muscle with neurotoxin injections can reduce the downward force on the oral commissure,

enhancing the overall esthetic outcome. Botulinum neurotoxin dosage (e.g., 2–4 units per side), injection techniques (e.g., targeting the depressor anguli oris muscle), and patient selection criteria, such as avoiding over-treatment in patients with preexisting asymmetry. Contraindications and precautions for combining fillers and neurotoxins, such as avoiding treatments in areas of active infection or in patients with neuromuscular disorders (12).

This combination approach aligns with contemporary facial balancing techniques, aiming not only to restore volume but also to create a more harmonious and positive facial expression. The synergistic use of fillers and neurotoxins exemplifies the evolving nature of esthetic treatments, moving toward more holistic and personalized approaches to facial rejuvenation.

Acknowledgments

This study was conducted in compliance with the principles set forth in the Declaration of Helsinki.

Authors' contributions

All authors have reviewed and approved the article for submission. Conceptualization, Gi-Woong Hong, Kyu-Ho Yi, Jovian Wan; Song-Eun Yoon, Sky Wong. Writing—original draft preparation, Gi-Woong Hong, Jovian Wan, Sky Wong. Writing—review & editing, Gi-Woong Hong and Kyu-Ho Yi, Song-Eun Yoon. Visualization, Gi-Woong Hong, Kyu-Ho Yi. Supervision, Gi-Woong Hong and Kyu-Ho Yi.

Disclosure statement

I acknowledge that I have considered the conflict of interest statement included in the 'Author Guidelines.' I hereby certify that, to the best of my knowledge, that no aspect of my current personal or professional situation might reasonably be expected to significantly affect my views on the subject I am presenting.

Funding

There is no financial disclosure to report.

References

1. Moon HJ, Chang D, Lee W. Short-term treatment outcomes of facial rejuvenation using the mint lift fine. Plast Reconstr Surg Glob Open. 2020;8(4):e2775. doi: 10.1097/GOX.0000000000002775.
2. Hong GW, Kim SB, Park SY, et al. Why do marionette lines appear? Exploring the anatomical perspectives and role of thread-based interventions. Skin Res Technol. 2024;30(4):e13676. doi: 10.1111/srt.13676.
3. Graivier MH, Bass LS, Busso M, et al. Calcium hydroxylapatite (Radiesse) for correction of the mid- and lower face: consensus recommendations. Plast Reconstr Surg. 2007;120(6 Suppl):55s–66s. doi: 10.1097/01.prs.0000285109.34527.b9.
4. Diaspro A, Luni M, Rossini G. Thread lifting of the jawline: a pilot study for quantitative evaluation. J Cutan Aesthet Surg. 2021;14(1):47–54. doi: 10.4103/JCAS.JCAS_41_20.
5. Baspeyras M, Dallara JM, Cartier H, et al. Restoring jawline contour with calcium hydroxylapatite: a prospective, observational study. J Cosmet Dermatol. 2017;16(3):342–347. doi: 10.1111/jocd.12335.
6. Krag AE, Glick S, Hembd A, et al. The effect of depressor anguli oris muscle block on facial symmetry in synkinetic facial paralysis patients and its role in preoperative assessment. Plast Reconstr Surg. 2021;147(3):455–465. doi: 10.1097/PRS.0000000000007674.
7. Hembd AS, Sanchez CV, Halani SH, et al. Do preoperative depressor anguli oris muscle blocks predict myectomy outcomes? A single-cohort comparison in postparetic facial synkinesis. Plast Reconstr Surg. 2022;150(1):163–167. doi: 10.1097/PRS.0000000000009283.
8. Demiryurek D, Bayramoglu A, Erbil KM, et al. Three-dimensional structure of the modiolus. A computerized reconstruction study. Saudi Med J. 2003;24(8):846–849.
9. Kim H-S, Pae C, Bae J-H, et al. An anatomical study of the risorius in Asians and its insertion at the modiolus. Surg Radiol Anat. 2015;37(2):147–151. doi: 10.1007/s00276-014-1330-6.
10. Yu SK, Lee MH, Kim HS, et al. Histomorphologic approach for the modiolus with reference to reconstructive and aesthetic surgery. J Craniofac Surg. 2013;24(4):1414–1417. doi: 10.1097/SCS.0b013e318292c939.
11. Krag AE, Dumestre D, Hembd A, et al. Topographic and neural anatomy of the depressor anguli oris muscle and implications for treatment of synkinetic facial paralysis. Plast Reconstr Surg. 2021;147(2):268e–278e. doi: 10.1097/PRS.0000000000007593.
12. Yi K-H, Lee J-H, Hu H-W, et al. Novel anatomical proposal for botulinum neurotoxin injection targeting depressor anguli oris for treating drooping mouth corner. Anat Cell Biol. 2023;56(2):161–165. doi: 10.5115/acb.22.258.
13. Pessa JE, Garza PA, Love VM, et al. The anatomy of the labiomandibular fold. Plast Reconstr Surg. 1998;101(2):482–486. doi: 10.1097/00006534-199802000-00037.
14. Andrade P, Serra D, Cardoso JC, et al. Melolabial fold interpolated flap for reconstruction of complex nasal defects. An Bras Dermatol. 2012;87(5):762–765. doi: 10.1590/s0365-05962012000500016.
15. Fattahi T. The prejowl sulcus: an important consideration in lower face rejuvenation. J Oral Maxillofac Surg. 2008;66(2):355–358. doi: 10.1016/j.joms.2006.11.032.
16. Cuartero-Castro G, Márquez EA, Robledo P, et al. Buccal fat pad herniation, repositioning versus excision: a new algorithm of treatment. Eplasty. 2023;23:e60.
17. Yi KH, Lee JJ, Hur HW, et al. Hyaluronic acid filler injection for deep nasolabial folds: a novel intraoral approach. Clinical Anatomy. 2022;35(6):820–823. doi: 10.1002/ca.23919.
18. Wollina U, Goldman A. Facial vascular danger zones for filler injections. Dermatol Ther. 2020;33(6):e14285. doi: 10.1111/dth.14285.
19. Wang C, Luan S, Panayi AC, et al. Effectiveness and safety of hyaluronic acid gel with lidocaine for the treatment of nasolabial folds: a systematic review and meta-analysis. Aesthetic Plast Surg. 2018;42(4):1104–1110. doi: 10.1007/s00266-018-1149-3.
20. Qiao J, Jia Q-N, Jin H-Z, et al. Long-term follow-up of longevity and diffusion pattern of hyaluronic acid in nasolabial fold correction through high-frequency ultrasound. Plast Reconstr Surg. 2019;144(2):189e–196e. doi: 10.1097/PRS.0000000000005848.
21. Pogrel MA, Shariati S, Schmidt B, et al. The surgical anatomy of the nasolabial fold. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;86(4):410–415. doi: 10.1016/s1079-2104(98)90365-1.
22. Spiegel JH, DeRosa J. The anatomical relationship between the orbicularis oculi muscle and the levator labii superioris and zygomaticus muscle complexes. Plast Reconstr Surg. 2005;116(7):1937–1942. doi: 10.1097/01.prs.0000189194.86005.4b.
23. Shim K-S, Hu K-S, Kwak H-H, et al. An anatomical study of the insertion of the zygomaticus major muscle in humans fo-

cused on the muscle arrangement at the corner of the mouth. Plast Reconstr Surg. 2008;121(2):466–473. doi: 10.1097/01.prs.0000297652.29671.1a.
24. Sarilita E, Rynn C, Mossey PA, et al. Zygomaticus major muscle bony attachment site: a Thiel-embalmed cadaver study. Morphologie. 2021;105(348):24–28. doi: 10.1016/j.morpho.2020.06.009.
25. Pessa JE, Zadoo VP, Garza PA, et al. Double or bifid zygomaticus major muscle: anatomy, incidence, and clinical correlation. Clin Anat. 1998;11(5):310–313. doi: 10.1002/(SICI)1098-2353(1998)11:5<310::AID-CA3>3.0.CO;2-T.
26. Derakhshan A, Miller MQ, Malka R, et al. Releasing the smile: depressor anguli oris excision in the context of managing nonflaccid facial palsy. Plast Reconstr Surg. 2022;149(2):261e–269e. doi: 10.1097/PRS.0000000000008807.
27. Choi Y-J, We Y-J, Lee H-J, et al. Three-dimensional evaluation of the depressor anguli oris and depressor labii inferioris for botulinum toxin injections. Aesthet Surg J. 2021;41(6):NP456–NP461. doi: 10.1093/asj/sjaa083.
28. Choi Y-J, Kim J-S, Gil Y-C, et al. Anatomical considerations regarding the location and boundary of the depressor anguli oris muscle with reference to botulinum toxin injection. Plast Reconstr Surg. 2014;134(5):917–921. doi: 10.1097/PRS.0000000000000589.
29. Hong G-W, Song S, Park SY, et al. Why do nasolabial folds appear? Exploring the anatomical perspectives and the role of thread-based interventions. Diagnostics. 2024;14(7):716. doi: 10.3390/diagnostics14070716.