



# Botulinum neurotoxin injection for treating plunged nose and post-rhinoplasty: anatomical perspectives of depressor septi nasi, nasalis, levator labii superioris alaeque nasi muscle

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**Abstract:** Botulinum neurotoxin (BoNT) injection for the treating plunged nose, post-rhinopasty and hyaluronic filler migration is common procedures in clinical settings. However, the lack of thorough anatomical understanding makes it difficult to locate the nose region muscles. The anatomical considerations concerned with BoNT injection into the nasalis, levator labii superioris alaeque, and depressor septi nasi muscles were reviewed in this study. The injection spots have been presented for the nasalis, levator labii superioris alaeque, and depressor septi nasi muscles, with the recommended injection technique for each muscle. We have suggested the ideal injection sites in association with outer anatomical landmarks of the nose region. Moreover, these proposals would support a more accurate procedure of BoNT injection in relieving plunged nose, preventing post-rhinoplasty deviation, and migration of the hyaluronic acid filler.

**Key words:** Nasalis, Levator labii superioris alaeque nasi, Depressor septi nasi, Botulinum neurotoxin, Plunged nose

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## Introduction

Botulinum neurotoxin (BoNT) prevents neural communication by blocking the release of acetylcholine at the neuronal muscular junction, thereby obstructing muscle contraction [1-9]. Practitioners frequently use BoNT for aesthetic

purposes, mainly to eliminate facial wrinkles by weakening the facial muscles [10-20]. Persons with well-developed nasalis and depressor septi nasi muscles (DSN) have a plunged nose tip; a plunged nose exaggerates when one smiles. This nose tip can be elevated by paralyzing the associated muscles with BoNT (Fig. 1).

Another indication of using BoNT injection in the nose is after hyaluronic acid filler injection into the nose; hyaluronic acid dermal fillers, restores the volume while BoNT inactivates the muscle [21, 22]. Thus, the combination of BoNT with soft tissue augmentation is a highly effective multi-step treatment for contouring and reshaping the nose [21, 22].

The DSN and nasalis muscles are known to affect the outcome of rhinoplasty. The relapse of a deviated nose after rhinoplasty could be due to implant or graft migration [23, 24]. To

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avoid a deviated nose and asymmetry, the roles of the post-operative patient are not to use excessive facial expressions and avoid chewing solid food [25, 26].

When treating the nose region with BoNT, side effects such as diplopia and upper lip ptosis may be caused by unintended blocking of the rectus inferioris or rectus medialis and levator labii superioris alaeque nasi, respectively. Other critical complications may include chewing and speaking struggles due to diffusion of BoNT into nearby muscles such as the orbicularis oris. For a better treatment outcome, the procedure should be initiated at a less significant dosage. If the preferred effects are not achieved, an additional dose of BoNT can be used. Moreover, an increase in the dose and multiple injections of BoNT creates antibodies that can lead to inadequate treatment outcomes [27-30]. Numerous previous studies on BoNT injection have elaborated on the anatomy of the muscles [14-16, 18, 31-38].

The purpose of this study was to suggest safe and effective BoNT injection points and injection techniques for treating plunged nose tip, post-rhinoplasty and migration of hyaluronic acid filler injection in the nose.

### Anatomy of the nasalis muscle

The nasalis muscle can be divided into alar and transverse parts. The transverse part of the nasalis muscle is a triangular-shaped muscle that starts from the maxillary ca-

nine fossa and inserts into the lateral nasal cartilage. On the other hand, the alar part of nasalis muscle is a square-shaped muscle that originates from the maxillary lateral incisor and inserts into the minor alar cartilage. The transverse part of the nasalis muscle narrows the nostrils by contraction of the nasal aperture, while the alar part of the nasalis muscle widens the nostrils.

### Anatomy of the levator labii superioris alaeque muscles

The levator labii superioris alaeque nasi muscle (LLSAN) originates from the maxillary frontal process and inserts into the nasal ala and upper lip. The LLSAN can be divided into superficial and deep layers. The superficial layer continues inferiorly to the superficial layer of the levator labii superioris muscle and the deep layer runs deep to the levator labii superioris muscle.

### Anatomy of the DSN

The DSN is located deep within the lip. It originates from the incisive fossa of the maxilla, inserts into the mobile portion of the nasal septum, and intermingles with the deep muscle fibers of the orbicularis oris muscle. This muscle pulls down the tip of the nose to enlarge the nostrils (Fig. 2). This muscle also shortens the upper lip during smiling.

### Injection techniques

Treating plunged nose, post-rhinoplasty, and hyaluronic

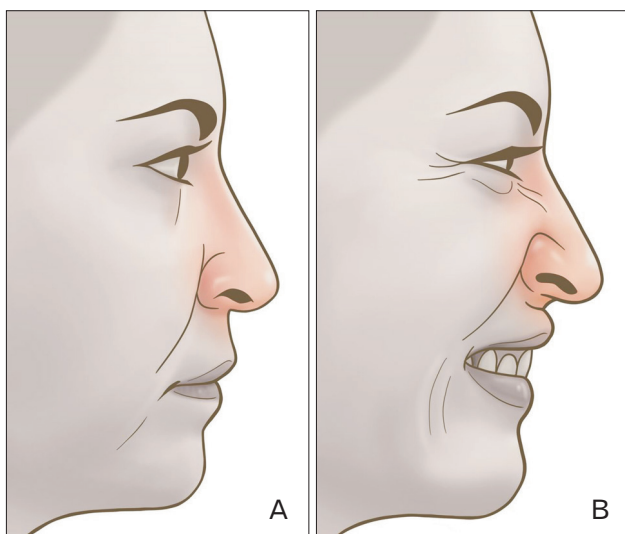


Fig. 1. The primary aesthetic worries plunged nose tip for many individuals. The appearance in absence of facial expression (A). The plunged nose appears when smiling (B).

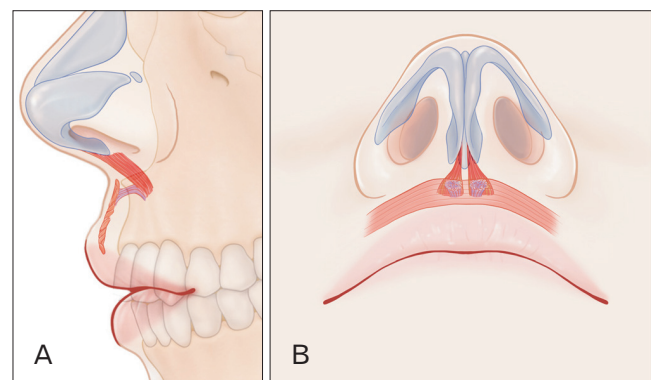


Fig. 2. The schematic representation of the lateral (A) and inferior (B) views of the depressor septi nasi muscle. The purple shaded muscle is part of depressor septi nasi muscle that connects the orbicularis oris muscle.

acid filler injections can be improved through BoNT injections into the DSN, LLSAN, and nasalis muscles. The DSN originates from the nasal spine and inserts into the tip of the nose, pulling down and plunging the nose tip during smiling. LLSAN inserts into the ala nasi, pulling it superolaterally. The nasalis is involved in nose movement because it is responsible for pressing, widening, or narrowing the nares. Therefore, injections into the DSN, LLSAN, and nasalis are required for satisfactory treatment outcomes.

Four units (4 U) of BoNT are injected deeply after the needle tip touches the bone, into the subnasale inferior towards the columella (targeting the DSN). This is followed by superficially injecting 2 U of BoNT 1 cm above the medial end of the supra-alar crease (targeting the transverse part of nasalis muscle). Additionally, a deep injection of 2 U is administered into the lower part of the LLSAN on each side. The location for targeting the lower part of LLSAN is 1 cm lateral to the middle of the nasal alar crest (Fig. 2).

## Discussion

The contouring of the nose is an important correction technique of plastic reconstructive surgery and aesthetic settings. To treat and alter the shape of the nose, BoNT treatment alone, or combined therapy with rhinoplasty and/or hyaluronic acid filler injection in the nose is often conducted.

A plunged nose is also an aging sign that causes drooping of the nasal tip and increasing prominence of the dorsal hump. There is a comparative shortening of the lower third of the face and comparative lengthening. This is due to the loss of support of the lateral cartilage, leading to drooping of the nose tip, and highlighting the nose dorsum convexity [39]. To alleviate this problem, BoNT injection is commonly administered in the nose to correct the aging plunged nose. In contrast, in persons with well-developed nasalis and depressor septi nasi muscles, the nose tip can be elevated by paralyzing these muscles with BoNT. In 2013, Cigna et al. [40] performed a double-blinded prospective study on the effect of BoNT on the plunged nose tip and found that the nose tip was elevated and the philtrum lengthened after BoNT was injected into the depressor septi nasi muscle.

In addition, combination therapy with BoNT and hyaluronic acid dermal filler injections is often performed. The consecutive treatment with BoNTs following filler injection has been shown to increase the durability of tissue retention of the filling agent and prevent the migration of fillers

[21, 22, 31, 32, 34, 41-46]. The BoNT and dermal fillers may contour the nose appearance through double inactivation of the involved muscles and reflation. With dermal fillers, the volume of nose is restored and BoNT inactivates muscle movements. Although dermal filler should be principally regarded for elevation of the nose tip, BoNT helps stabilize and maintain the structure of the dermal filler by reducing absorption and preventing migration through nasal muscle contraction [25, 26].

In plastic and reconstructive surgery of the nose, the nasalis and DSN are well known to influence the outcome of rhinoplasty. The reappearance of a deviated nose can occur after corrective rhinoplasty is performed due to implant and graft migration [23, 24]. BoNT efficiently inactivates the nose muscles after corrective rhinoplasty to prevent the recurrence of deviation due to the movements of the nose and facial muscles [39, 47, 48]. Particularly, the DSN links the motion of the nose and lips by intermingling two separate muscular structures. Therefore, several articles have been published on cutting the connecting part of the orbicularis oris muscle and depressor septi nasi after nose plastic and reconstructive surgery [39]. Rohrich et al. [39] proved the importance of this muscle in an anatomic study with dissected cadavers to classify DSN. They classified DSN into three types and reported that the DSN showed a distal insertion of the orbicular oris muscle in 62% of cases (Fig. 3) [49-51].

A broad and precise anatomical knowledge of the nose region muscles is essential for a satisfactory treatment with the lowest possible doses of BoNT. We have reviewed the

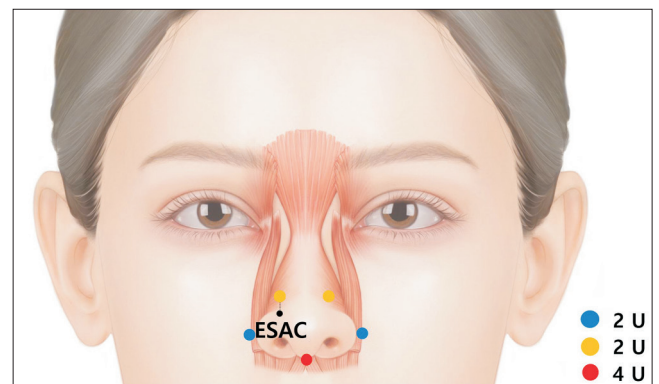


Fig. 3. Injection point for the plunged nose, post-rhinoplasty, hyaluronic acid filler injection. The injection amount for each point for targeting transverse part of nasalis muscle (yellow dot), alar part of nasalis muscle (blue dot), and depressor septi nasi (red dot). Each points can be injected in botulinum neurotoxin units of 2, 2, and 4. ESAC, end of the supra-alar crease.

anatomical structures and proposed injection techniques for the nose region muscles for treating plunged nose tip, post-rhinoplasty and migration of hyaluronic acid dermal filler injection. As BoNT injection procedure is frequently performed in the nose region, side effects such as paralysis of adjacent muscles and lip ptosis have been reported [39].

In summary, 4 U of BoNT is injected deeply after the needle tip touches the bone into the subnasale inferior to the columella (targeting the DSN). This is followed by superficially injecting 2 U to 1 cm above the medial end of the supra-alar crease (targeting the transverse part of the nasalis muscle). Additionally, deep injection of 2 U was administered into the lower part of the LLSAN on each side. The lower part of the LLSAN was targeted 1 cm lateral to the middle of the nasal alar crest. This study proposes BoNT injection points in the nose region to provide an anatomical guide for practitioners.

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Conceptualization: KHY, HJK. Data acquisition: JHL. Data analysis or interpretation: SOK, HH. Drafting of the manuscript: HJL, YJC. Critical revision of the manuscript: THA. Approval of the final version of the manuscript: all authors.

## Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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