

Topographic Anatomy of the Superior Labial Artery for Dermal Filler Injection

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Background: The superior labial artery, which is a branch of the facial artery, supplies the upper lip area. The aim of this study was to determine the distribution pattern of the superior labial artery and provide precise topographic information of the artery for dermal filler injection.

Methods: Sixty hemifaces from 18 Korean and 18 Thai cadavers were used for this study. The various distribution patterns of the superior labial artery were classified according to its relationship with the facial artery.

Results: The course of the superior labial artery was classified into four types: type I (56.7 percent), in which the artery and the alar branch both arise directly and independently from the facial artery; type II (21.7 percent), in which the superior labial artery branches off from the facial artery and then gives off an alar branch; type III (15.0 percent), in which it is the terminal branch of the facial artery; and type IV (6.7 percent), in which the artery is absent. The origin of the superior labial artery was located 12.1 ± 3.1 mm (mean \pm SD) lateral and at a variable angle of 42.8 ± 26.9 degrees relative to the mouth corner.

Conclusions: The superior labial artery proceeded from the origin of the artery located within a 1.5-cm-side square superolateral to the mouth corner as running along the vermilion border of the upper lip to the facial sagittal midline at a depth of 3 mm. Thus, clinicians should be careful when injecting dermal filler into this area. (*Plast. Reconstr. Surg.* 135: 445, 2015.)

Plastic surgery and cosmetic procedures have been developing rapidly in response to the growing interest in physical appearance. Dermal filler injection is particularly popular among patients who are reluctant to undergo surgery, because it represents a rapid way of eliminating wrinkles, smoothing acne scars, and enhancing volume.¹ Among the many types of dermal filler (e.g., hyaluronic acid, calcium hydroxide, collagen, and poly-L-lactic acid), hyaluronic acid is currently the most highly recommended material because of its degradability and favorable safety profile.²

However, despite the safety of dermal fillers, as demonstrated by many manufacturers, complications of dermal filler injection do occasionally

arise, such as recurrent infection, nodular masses, and tissue necrosis.¹⁻⁵ Skin necrosis as a result of direct injury, compression, or obstruction of the blood vessels during dermal filler injection is considered one of the most severe complications.

Dermal filler injection around the lips is frequently performed for lip augmentation, to provide fuller and more sensual lips, and for correction of the nasolabial fold. Because this region of the face has limited collateral circulation, damage to the superior labial artery or facial artery during these procedures could lead to tissue necrosis of the upper lip and alar rim.^{6,7} It is therefore clear that a detailed understanding of superior labial artery topography is critical for successful and complication-free dermal filler injection to the upper lip area. However, there is a dearth of studies on the precise topography of the superior labial artery. The aim of this study was to describe

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DOI: 10.1097/PRS.0000000000000858

Disclosure: *The authors have no financial interest to declare in relation to the content of this article. The authors have no financial or private relationships with commercial, academic, or political organizations or people that could have improperly influenced this research.*

the various distribution patterns of the superior labial artery and thus elucidate the course of the superior labial artery to indicate the best location for dermal filler injection into the upper lip area.

MATERIALS AND METHODS

Sixty hemifaces from 18 Korean and 18 Thai cadavers (24 bilateral specimens and 12 unilateral specimens) donated legally to the Yonsei Medical Center and Chulalongkorn University were used in the present study. Twenty-four of the cadavers were male and 12 were female cadavers, with a mean age of 73 years (range, 46 to 95 years). In all specimens, latex (Neoprene, lot no. 307L146; DuPont, Wilmington, Del.) containing a red coloring agent (colorant universel; Castorama, Templemars, France) was injected into the common carotid artery before dissection to enable clear visualization of the course of the superior labial artery.

The skin and subcutaneous tissues of the hemifaces were removed and detailed dissection was performed on all specimens, with extreme care being taken not to damage the underlying muscles. Special attention was paid to the precise site of the origin of the superior labial artery

(the S point). The muscles covering the superior labial artery were then cut and retracted so that the course of the superior labial artery could be followed. The distribution pattern of the superior labial artery was classified according to its relationship with the facial artery.

The topographic course of the superior labial artery was investigated using digital calipers (CD-15CP; Mitutoyo, Kanagawa, Japan) and a protractor. First, the location of the S point was measured in polar coordinates [distance (l) and angle (θ)] relative to the plane established by two axes through the mouth corner: X axis (cheilion to cheilion) and Y axis (parallel to the sagittal midline). The distance (L) and depth (D) of the superior labial artery from the vermilion border of the upper lip were measured at the following four points: the mouth corner (d_1), the intermediate point between the peak of Cupid's bow and the mouth corner (d_2), the peak of Cupid's bow (d_3), and the sagittal midline (d_4). Finally, the greatest length of the nasal septal branch from the sagittal midline and the depth from the skin were also measured (Fig. 1). All photographs and diagrams in this article are viewed from the right side of the face.

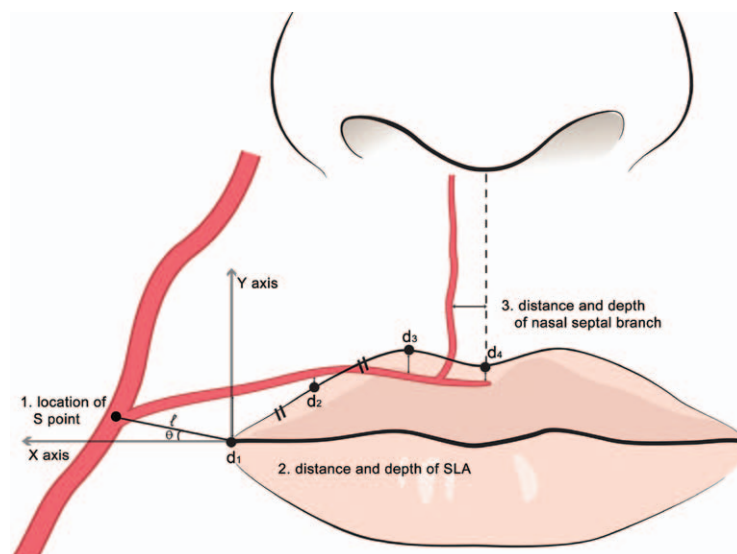


Fig. 1. Measured parameters of the course of the superior labial artery. 1, Location of the origin of the superior labial artery (the S point): the coordinates of the origin of the superior labial artery (S point; l , θ) were measured relative to a plane defined by two axes through the mouth corners: X axis (cheilion to cheilion) and Y axis (parallel to the sagittal midline). 2, The distance and depth of the superior labial artery from the upper lip vermilion border was measured at four points: the mouth corner (d_1), the intermediate point between the peak of Cupid's bow and the mouth corner (d_2), the peak of Cupid's bow (d_3), and the sagittal midline (d_4). 3, The distance and depth of the nasal septal branch were measured at the point farthest from the sagittal midline.

RESULTS

The topography of the superior labial artery did not differ between male and female cadavers. The distribution patterns of the superior labial artery could be classified into the following four types according to its relationship with the facial artery (Fig. 2):

Type I: The superior labial artery and the alar branch arise directly and separately from the facial artery.

Type II: The superior labial artery arises directly from the facial artery and then gives off the alar branch.

Type III: The superior labial artery is the terminal branch of the facial artery.

Type IV: The superior labial artery is absent.

Types I through IV were observed in 56.7 percent (34 of 60), 21.7 percent (13 of 60), 15.0 percent (nine of 60), and 6.7 percent (four of 60) of cases, respectively (Fig. 3). In type IV, the upper lip was supplied by the contralateral superior labial artery in 5.0 percent of cases (three of 60) and by the infraorbital artery in 1.7 percent (one of 60).

The superior labial artery sometimes gave off several nasal septal branches, which ran upward to the nasal septum [(51 of 60 (85.0 percent))] and were located either beneath [38 of 60 (63.3 percent)] or above [13 of 60 (21.7 percent)] the orbicularis oris muscle. In some cases [nine of 60 (15.0 percent)], the nasal septal branches supplying the nasal septum arose from the contralateral superior labial artery rather than the ipsilateral superior labial artery.

The S point was located 12.1 ± 3.1 mm (mean \pm SD) lateral and 42.8 ± 26.9 degrees relative to the mouth corner, and was located within a 1.5-cm-side square bounded by the X and Y axes in 85 percent (51 of 60) of cases (Fig. 4).

The morphometric data regarding the relationship between the superior labial artery (D and L) and the vermilion border (d_1 to d_4) are listed in Table 1. The superior labial artery ran superior to the upper lip vermilion border at the mouth corner (Ld_1) and the midpoint between the peak of Cupid's bow and the mouth corner (Ld_2), but inferior to the vermilion border at the peak of Cupid's bow (Ld_3) and the sagittal midline (Ld_4). The superior labial artery ran inferiorly to the vermilion border as it coursed medially. There was no significant difference in the depth at any of the measured points (i.e., Dd_1 , Dd_2 , Dd_3 , and Dd_4).

DISCUSSION

The superior labial artery is the main artery supplying the upper lip. The lip and oral cavity are vulnerable to defects, and because the arterial supply to those areas is crucial to the success of flap surgery, most studies on the superior labial artery have focused on successful reconstructive flap surgery. In much of the literature on flap surgery, the data reported most often pertain to the external diameter of the superior labial artery, and its length and the distance from the mouth corner.⁸⁻¹¹ However, whereas flap surgery requires the acquisition of a pedicle with blood vessels, dermal filler injection requires a delicate procedure that avoids the blood vessels, to leave them undamaged.

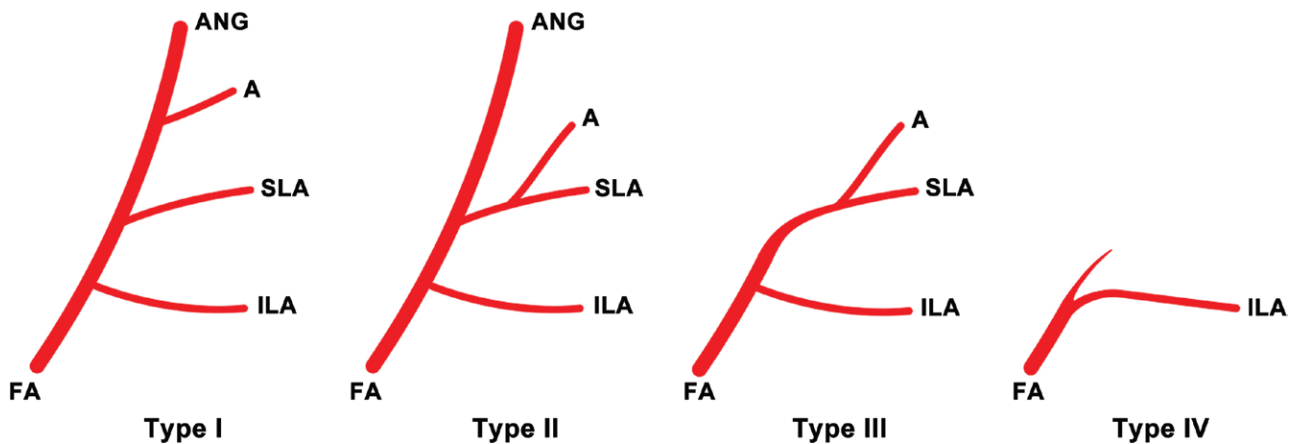


Fig. 2. Schematic diagrams of the four types of superior labial artery. Type I: the superior labial artery and alar branch both arise directly and separately from the facial artery. Type II: the superior labial artery arises from the facial artery and then gives off an alar branch. Type III: the superior labial artery is the terminal branch of the facial artery. Type IV: the superior labial artery is absent. ANG, angular artery; A, alar branch; SLA, superior labial artery; ILA, inferior labial artery; FA, facial artery.

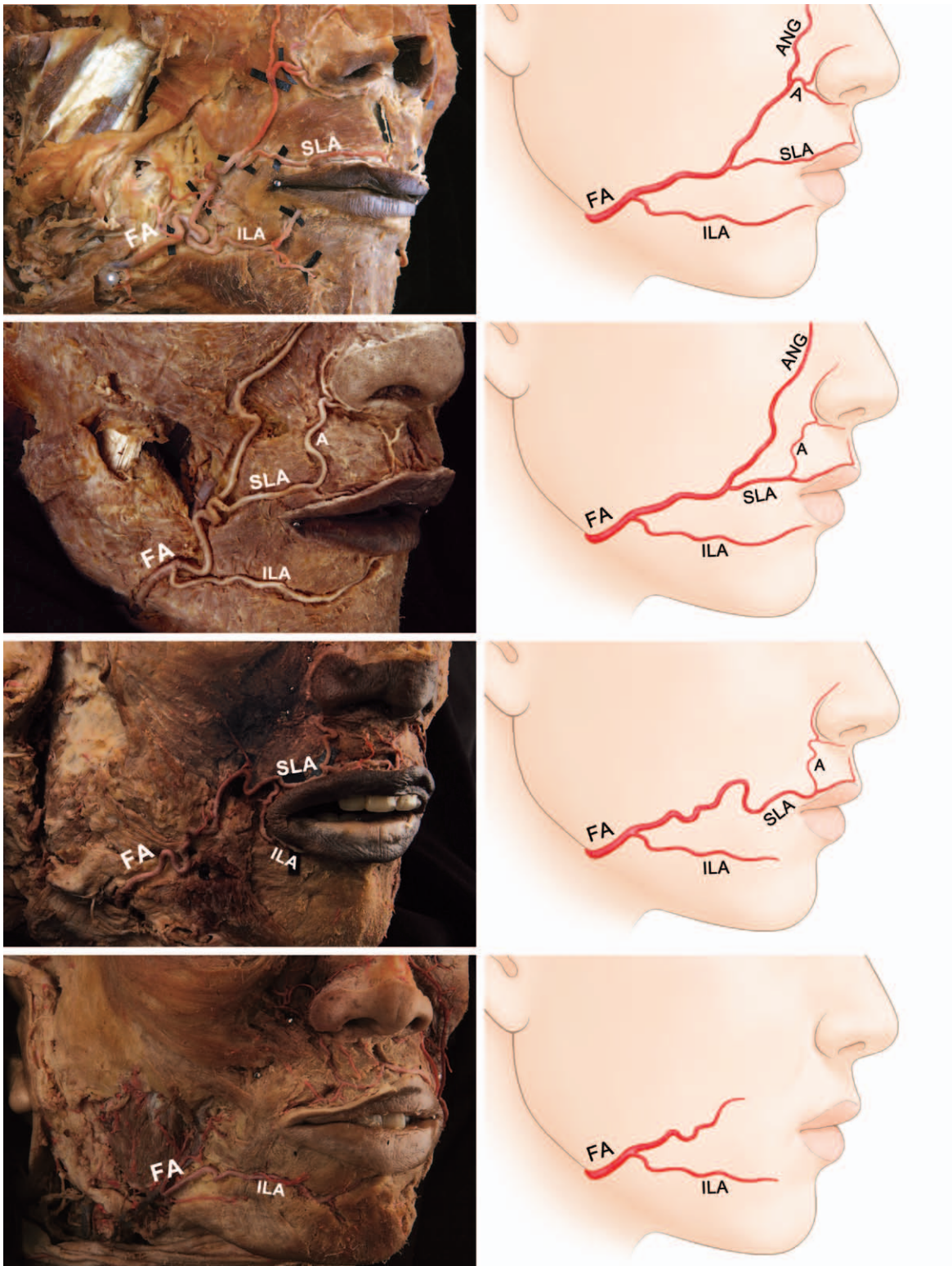


Fig. 3. Four types of superior labial artery, defined relative to its relationship with the facial artery trunk. (Above) Type I ([34 of 60 (56.7 percent)]: the superior labial artery and alar branch arise directly and separately from the facial artery. (Second row) Type II [13 of 60 (21.7 percent)]: the superior labial artery arises from the facial artery and then gives off an alar branch. (Third row) Type III [nine of 60 (15.0 percent)]: the superior labial artery is the terminal branch of the facial artery. (Below) Type IV [four of 60 (6.7 percent)]: the superior labial artery is absent. ANG, angular artery; A, alar branch; SLA, superior labial artery; ILA, inferior labial artery; FA, facial artery.

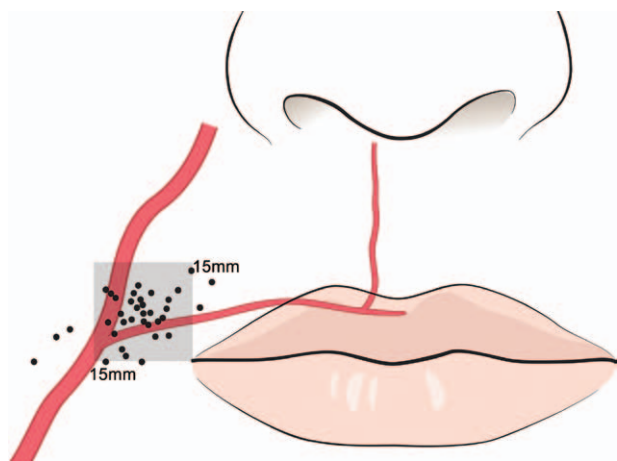


Fig. 4. Location of the S point. The S point (shown as dots in this figure) was located within a 1.5-cm-side square bounded by the X and Y axes in 85 percent of cases.

Table 1. Distance and Depth of the Superior Labial Artery from the Vermillion Border of the Upper Lip*

	L (mm)	D (mm)
Mouth corner (d_1)	$+8.0 \pm 2.1$	3.5 ± 1.0
Midpoint between Cupid's bow peak and mouth corner (d_2)	$+0.7 \pm 2.6$	3.3 ± 1.2
Cupid's bow peak (d_3)	-1.1 ± 2.9	3.8 ± 0.9
Sagittal midline (d_4)	-0.6 ± 3.0	3.9 ± 1.3

L, length; D, depth.

*The data are presented as mean \pm SD values. Positive and negative values indicate that the superior labial artery was located superior and inferior to the upper lip vermilion border, respectively.

The findings of the present study provide information regarding the possible permutations of the courses and branches of the superior labial artery that could be approximated on the facial skin. In 85 percent of cases, the S point was located within a 1.5-cm-side square superolateral to the mouth corner. After the superior labial artery branched from facial artery, in most cases, it ran superior to the vermilion border under the orbicularis oris muscle, with a minimum depth of 3 mm. It then coursed inferior to the vermilion border before approaching the peak of Cupid's bow. At the sagittal midline, the nasal septal branch ramified from the superior labial artery and ran upward to the nasal septum along the sagittal midline.

This course of the superior labial artery along the vermilion border represents important knowledge for lip augmentation using dermal filler injection. The standard procedure for upper lip augmentation involves injecting dermal filler into the submucous layer of the upper lip. Because most of the superior labial artery appears to travel under the orbicularis oris muscle, injecting dermal filler above the orbicularis oris muscle would avoid the critical complications related to the lip

augmentation procedure. However, in 25 percent of cases, the nasal septal branches ran on top of the orbicularis oris muscle and the superior labial artery ran 1 to 4 mm inferior to the vermilion border after passing the peak of Cupid's bow. Thus, lip augmentation near the midline should be performed carefully, with dermal filler being injected into the upper lip at a depth of 3 mm.

There are two arteries related to the nasolabial fold that are prone to damage during dermal filler injection: (1) the facial artery trunk in type I and (2) the alar branch in types II and III.^{12,13} The facial artery follows a common course between the S point and the alar-facial crease in type I. In contrast, the alar branch arose from the superior labial artery near the mouth corner in types II and III, and ran to the alar-facial crease instead of the facial artery in type I. Furthermore, the facial artery in type II always detoured to the medial side of the orbit along the lower margin of the orbicularis oculi muscle.

In those cases in which the nasal septal branch did not arise from the ipsilateral superior labial artery, the contralateral nasal septal branch always supplied the nasal septum. This complementary arterial distribution was found in type IV where the superior labial artery was absent. In such cases, the vascularization from the facial artery was limited in the lower lip area. Thus, the ipsilateral infraorbital artery or the contralateral superior labial artery supplying the area near the midface appeared to be more developed with regard to both diameter and length (Fig. 5).

This study examined the various distribution patterns and common courses of the superior labial artery relative to soft-tissue landmarks such as the mouth corner and the peak of Cupid's bow, with a view to enabling successful and complication-free dermal filler injections. Also, the findings of this study show that in most cases the origin of the superior labial artery appears to be located within a 1.5-cm-side square superolateral to the mouth corner. This origin of the superior labial artery may be estimated by placing a thumbnail beside the mouth corner (Fig. 6). Thus, clinicians should recognize the course of the superior labial artery during lip augmentation and injection at a depth of 3 mm. We believe that these findings will be helpful not only for dermal filler injection, but also for other injectable treatments to the upper lip area.

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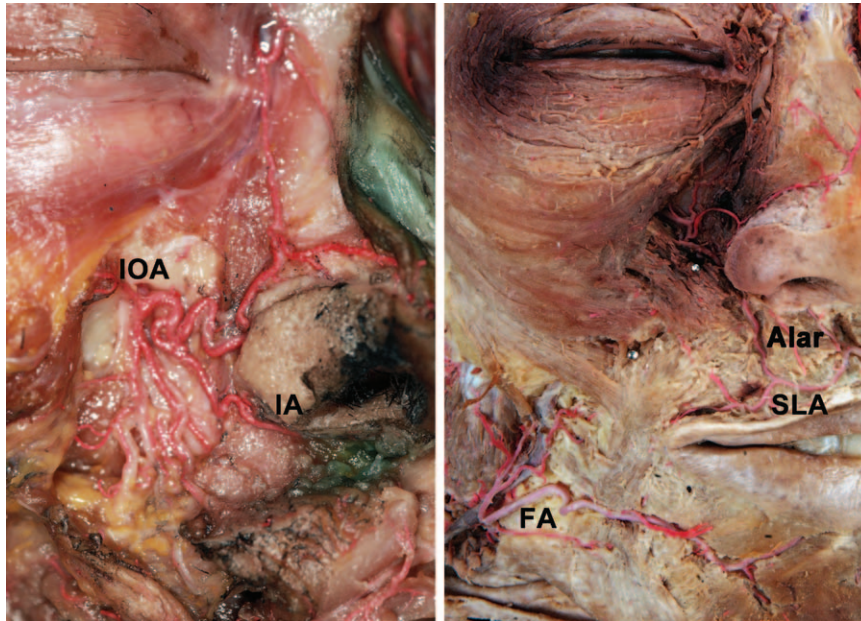


Fig. 5. Complementary arterial distribution patterns in type IV. When the superior labial artery was absent, the ipsilateral infraorbital artery (*left*) or the contralateral superior labial artery (*right*) supplied the midface. In both cases, the supplying arteries were excessively developed in terms of both diameter and length. IOA, infraorbital artery; IA, inferior alar branch; FA, facial artery; SLA, superior labial artery.

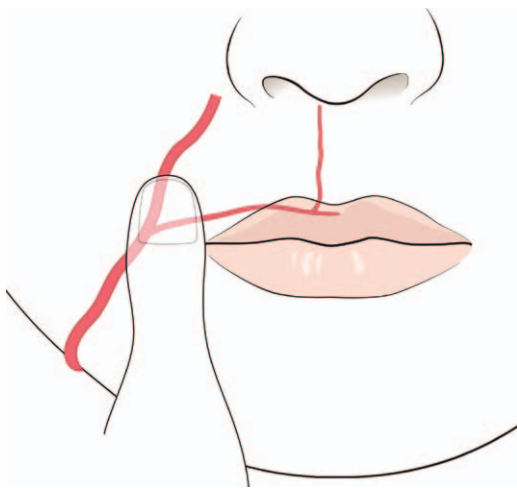


Fig. 6. The S point may be estimated by placing a thumbnail beside the mouth corner.

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