Original Article - Analytical Study

Vermilion lower lip cross flap - An anatomic study on 22 fresh cadavers

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ABSTRACT

Context: Vermilion lower lip cross flap is indicated for reconstruction of upper lip in residual deformities following trauma or cleft lip. Flap survival depends on incorporation of inferior labial artery in pedicle. **Aims:** This article reports measurement of vertical distance between inferior labial artery and vermilion surface under light microscope in midline sagittal cross-sectional specimens harvested from 22 fresh male cadavers, to design cross lip vermilion flap more accurately and reduce morbidity of donor site. **Settings and Design:** This study is designed to measure vertical distance between uppermost parts of inferior labial artery to vermilion surface in 22 fresh male cadavers. Tissue specimens were taken from lower lip midline in sagittal plane. Histological sections stained with Hematoxylin–eosin were reviewed by Pathologist. **Materials and Methods:** Measurements were done by staged micrometer which was calibrated in 10 μm subdivisions under light microscope. Vertical distance was measured in millimeter and artery location was defined as submucosal, in superficial muscle and deep muscular layer. **Statistical Analysis Used:** Descriptive study. **Results:** Analysis of data shows that mean distance was 2.42 ± 1.67 mm. In 77.27% of cases, the artery was in submucosal layer and in 13.64% of cases this artery was located in superficial muscular layer. **Conclusions:** As a result 4-mm depth incision of lower lip vermilion that incorporate superficial layer of orbicularis oris muscle will ensure blood supply of lower lip vermilion cross flap.

Key words: Artery, orbicularis oris, surgical flaps

INTRODUCTION

Inferior labial artery arises from the facial artery that passes across intraoral side of lower lip, which is used in vermilion cross lip flap.[1] This flap is used in repair of remaining congenital cleft lip defect and minor soft tissue trauma reconstruction of lips.[2-4] Lower lip vermilion tissue transfers and reconstructs upper lip vermilion defect. It is an ideal reconstruction because defective mucosa will be replaced with the same kind of the tissue with similarity in color and texture. Upper and lower lips are held together via this flap for 3 weeks, and then the pedicle is divided in a second surgery, although one stage surgery without pedicle division is possible.[5] Flap perfusion depends on incorporation of inferior labial artery in pedicle.[6] It is the pedicled, axial pattern myomucosal flap which has the best color match with upper lip vermilion.

This article reports measurements of vertical distance between inferior labial artery and vermilion surface under light microscope in midline sagittal cross sectional specimens harvested from 22 fresh male cadavers, to design cross lip vermilion flap more accurately and reduce morbidity of donor site.

MATERIALS AND METHODS

This study was done on 22 fresh male cadavers after being ethically approved by the Iranian forensic medicine ethical committee. In designing experimental study it was initially decided to take three specimens; one in midline and two others

at one centimeter to lip commissures but this would distort remaining lip tissue and was not permitted by forensic medicine organization, hence only midline sagittal autopsy specimens were taken. Two vertical incisions, 10 mm in depth with scalpel blade, were made on lower lip midline [Figure 1]. Horizontal distance between two incisions was 3 mm. Autopsy tissues were sent to the laboratory. For hematoxylin–eosin staining, 4 μm sections cut from paraffin-embedded tissue which had been fixed in 10% buffered formalin and evaluated under light microscope. In histopathologic examination, epithelium, submucosa, muscle, minor salivary glands, and inferior labial artery were identified.

Under light microscope, the tissue between epithelium and supporting muscle was called submucosa. Equivalent thickness in muscular layer was named superficial muscular layer and the muscle below this level was called deep muscular layer. Cross sections of inferior labial artery in specimens were found, and its location was defined as submucosa (Sub), superficial muscular layer (Ms) and deep muscular layer (Md). It should be mentioned that this classification is arbitrary and does not coincide with division of this muscle by anatomists to deep and superficial parts. Vertical distance between surface epithelium and uppermost part of this artery was measured via micrometer calibrated in 10 μm subdivisions [Figures 2 and 3].

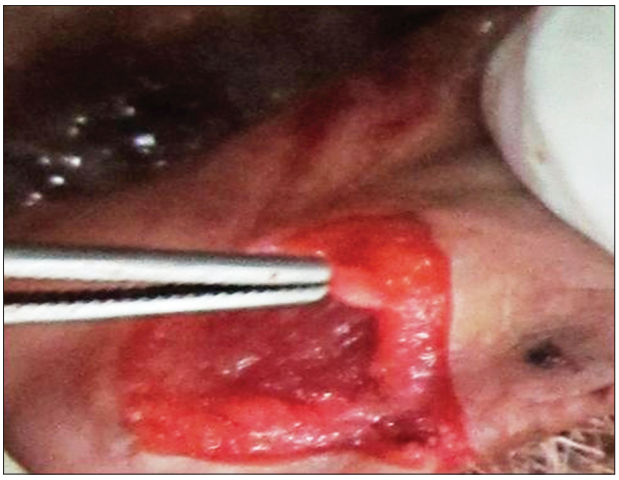

Figure 1: Inferior labial artery identified in dissection of lower lip in fresh cadaver dissection

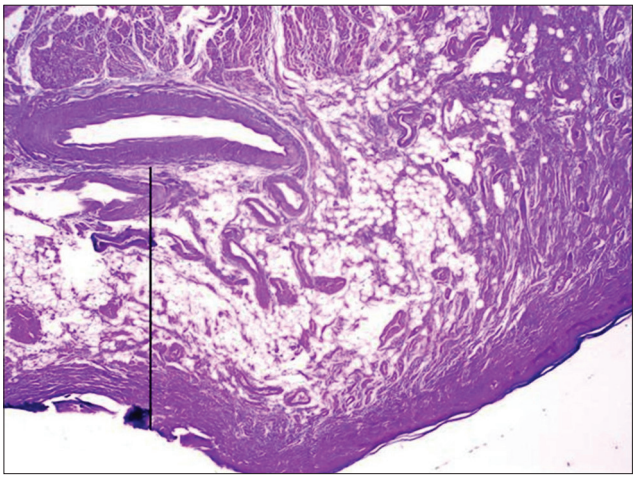

Figure 2: Histopathologic section: Vertical distance between inferior labial artery and surface epithelium. (H and E staining, original magnification ×400)

RESULTS

The 22 cases of fresh male cadavers were studied. The mean age of cases was 42 years. Inferior labial artery was present in all specimens. Data obtained from experiment are shown in Table 1.

Vertical distance between surface epithelium and uppermost part of inferior labial artery was between 1.22 and 4.59 mm. The mean distance was 2.42 ± 1.67 mm. In measurement of this distance if cross section of the artery was in oblique direction, then measurements were done in center, right, and left corners

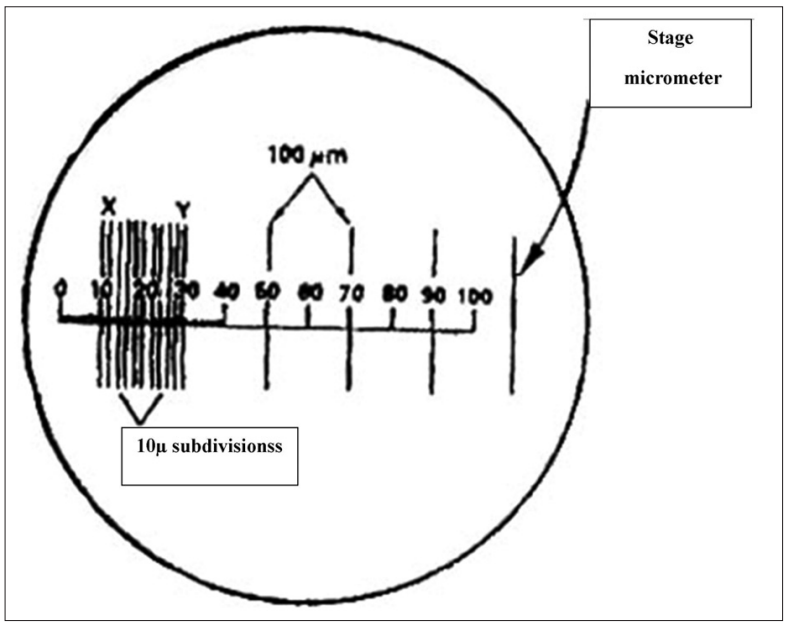

Figure 3: Micrometer calibrated in 10 μm subdivision is used to measure vertical distance (Vd)

Table 1: Vertical distance between inferior labial artery and superior vermilion surface

Case	Sub	Ms	Md	VD mm
1	*			2.67
2	*			1.8
3		*		3.6
4	*			2.85
5	*			2.37
6	*			1.5
7			*	4.59
8	*			2.55
9	*			1.44
10	*			2.61
11	*			2.04
12		*		2.94
13		*		3.66
14	*			2.07
15	*			2.1
16	*			2.04
17	*			1.51
18	*			1.49
19			*	4.02
20	*			1.37
21	*			1.22
22	*			2.84

Sub = submucosal layer, Ms = superfacial muscular layer, Md = deep muscular layer, VD = vertical distance between inferior labial artery and surface epithelium

and the mean value is given in Table 1.

DISCUSSION

Vertical distance between inferior labial artery and vermilion border is an important factor in lower lip pedicle flap design. Abbe-Estlander, vermilion advancement, and cross lip vermilion flaps all are inferior labial artery-based flaps.[7-9]

In vermilion lower lip cross flap, the pedicle should contain inferior labial artery. This flap is especially used for secondary correction of lip deformities in cleft patients where upper lip red vermilion deficiency is corrected by transfer of wet part of lower lip vermilion. Length/width ratio of this flap dictates that this flap should have axial pattern blood supply. In designing this flap it should be noted that too deep incisions in lower lip cause lip distortion during suturing, hence upper lip contour correction concurrent with lower lip deformity, that is not acceptable to the patient.

This flap is also indicated in upper lip vermilion deficiencies, resulting from trauma or pathologic processes. This myomucosal flap has small mucosal paddle so it is not useful in major upper lip vermilion defects reconstruction. It needs two separate surgeries for flap insertion and pedicle division. Speaking, eating, and oral hygiene maintenance are difficult in between these two surgeries. It needs excellent patient cooperation. For these reasons, this flap is not usable in pediatric patients. Moreover, this flap cannot correct skin deficiecy of upper lip; wherein Abbe falp is indicated. In cleft patients with van der Woude syndrome and lower lip pits, this flap is contraindicated. Simultaneous tertiary alveolar bone grafting with this flap is not recommended

Table 2: Inferior labial artery diameter in origin from facial artery

Reference	Published year	Materials	Mean external diameter in origin
7	1998	10 formalin-fixed cadavers	1.11 (0.8–1.5 mm)
15	2003	14 formalin-fixed cadavers	1.2 (1–1.8 mm)
10	2004	6 fresh cadavers	0.5–1.5 mm (mean was not reported)
16	2005	25 formalin-fixed cadavers	1.3 (0.5–1.5 mm)
17	2008	14 formalin-fixed cadavers	1.4 ± 0.31 mm

because this flap inhibits maintaining good oral hygiene which is needed in operated alveolar cleft patients. Lower lip perfusion originate from three sources: Inferior labial artery, horizontal, and vertical labiomental arteries.[10] Another anastomosis between these arteries and sublingual artery is also present.[11] The main source of blood supply, especially for red vermilion, is inferior labial artery.[12] Facial arteries terminate as inferior labial artery without upper branches in 5.5–10%.[13,14] In Table 2, diameters of inferior labial artery at origin are shown.[7,10,15-17] Earlier only one study has shown an internal diameter diameter of inferior labial artery measured; 0.8 mm (0.2–1.4 mm) in origin.[7] This study showed that inferior labial artery was located in the submucous layer in 77.27% cases and in 13.64% of the specimens this artery was in the superficial muscle layer of the orbicularis oris. Schulte *et al*.[18] in 9 cadaver's dissection reported that 87% of inferior labial arteries were located in submucous layer which agree with our finding. Vertical distance between inferior labial artery and surface epithelial in midline of lower lip was 2.42 ± 1.67 mm. Practical advices for lower cross lip vermilion flap creation are placing of incision 1 cm from corner of the mouth, sharp dissection of 4 mm depth, continue toward midline in the same plane, and terminate incision 1 cm before contralateral corner of the mouth. This plane inhibits inferior labial artery damage during flap elevation and long length of this flap causes more patient comfort during the 3 week period. In clinical practice, flap pedicle division is done under local anesthesia. Clinically, superficial muscle layer should be incorporated in thickness of flap and this muscular cuff protects vessels and porvides venous drainage.[6] Inferior labial artery can be identified easily with sonography.[19] This tool with knowledge of inferior labial artery anatomy helps to properly design lower lip vermilion cross flap.

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