Surgical Consideration of the Anatomic Origin of the Risorius in Relation to Facial Planes

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Abstract

Background: Confusion exists as to the plane of the risorius with respect to the superficial musculoaponeurotic system (SMAS), the parotid fascia, and the masseteric fascia, which generally are considered origins of the risorius.

Objectives: The authors attempted to clarify the origin of the risorius by topographic examination and dissection, which would provide valuable anatomic information for flap dissection in facelift surgery.

Methods: Detailed dissection was performed in the perioral region of 46 cadaveric specimens to discern the origin of the risorius in relation to the fascial layer. The anatomic aspects of the muscular arrangement and origin of the risorius were classified according to the location of attachment.

Results: The risorius originated solely from the fascial layer superficial to the SMAS in 27 specimens (58.7%; type A). It originated solely from the masseter tendon in 3 specimens (6.5%; type B) and from the fascial layers, both superficial and deep to the SMAS, in 16 specimens (34.8%; type C).

Conclusions: The patterns of risorius origination identified in this study represent important anatomic reference information for flap dissection in facelift surgery.

Keywords
facelift, flap dissection, SMAS, facial plane, risorius, anatomic origin

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According to most anatomy textbooks, the risorius arises from the parotid fascia, masseteric fascia, and skin over the masseter, and it enters the skin or the depressor anguli oris at the corner of the mouth.1-4 The risorius is one of the superficial perioral muscles involved in facial animations such as grinning and laughing; when activated, it pulls superolaterally on the corner of the mouth, resulting in dilation of the mouth.1-3 In previous studies, the risorius has been subclassified in relation to its role in a particular vector; for example, the zygomaticus risorius elevates the lips, whereas the triangularis risorius depresses the corners of the lips.5,6

Perioral muscles that animate the face are generally grouped into layers according to whether their origin is superficial (first, second, and third layers) or deep (fourth layer). The superficial layers include the depressor anguli oris, orbicularis oris, platysma, risorius, zygomaticus
major and minor, and levator labii superioris muscles.\textsuperscript{2,8} It is widely accepted that these mimetic muscles of the superficial layer are invested by the superficial musculoaponeurotic system (SMAS)\textsuperscript{8,9} and that surgically, the risorius is considered part of the SMAS.

During facelift procedures, the SMAS is surgically facilitated by tightening and suspending the facial muscles through various flap dissections and surgical approaches.\textsuperscript{10-13} Flap elevation at the anterior border of the masseter requires careful attention to avoid injuring the branches of the facial nerve, masseteric ligament, and muscle fibers of the risorius.\textsuperscript{14-16} These structures are not always easily distinguishable, and detailed knowledge of their locations and the anatomy of the fascial layer is essential to attain satisfactory outcomes.

Although some anatomic considerations have been described for effective application in facelift surgery, such as the course of the facial nerve\textsuperscript{17-19} and the arterial blood supply of the lateral face,\textsuperscript{20,21} we are unaware of any studies of the anatomic origin of the risorius in relation to the fascial layer. Some confusion exists about the plane of origin of this muscle with respect to the SMAS, parotid fascia, and masseteric fascia, which generally are considered origins of the risorius. With respect to flap dissection and elevation, this confusion translates to a risk of damage to the risorius and certain branches of the facial nerve.

The goal of this study was to clarify the origin of the risorius in the perioral region by topographic examination, followed by detailed dissection, to better inform flap dissection and elevation in facelift surgery.

**METHODS**

Forty-six hemifacial cadaveric specimens were dissected (30 male, 16 female; mean age, 71.1 years [range, 43-95 years]). Twenty-eight were from Korean cadavers (Yonsei University College of Dentistry, Seoul, Korea), and 18 were from Thai cadavers (Chulalongkorn University, Faculty of Medicine, Bangkok, Thailand). All specimens in this study were legally donated to Yonsei Medical Center and Chulalongkorn University. The study protocol was approved by the Ethics Committee of Yonsei Medical Center, Korea, and Chula Soft Cadaver Surgical Training Center, Thailand.

After removing the skin and subcutaneous tissues of the middle and lower face, a detailed dissection was performed on each specimen, focusing on the cheek region. Care was taken to ensure that fibers of the risorius were not damaged. Special attention was paid to the precise site of origin of the risorius.

When the dissection was complete, the fibers of the risorius originating from the SMAS layer were observed. The SMAS layer was reflected to separate the superficial fascial layer (SMAS) and the deep facial layer (parotid masseteric fascial layer) in order to identify the origin of the risorius muscle. The fascia was then removed to discern the topographic relationships between the risorius and the buccal branch of the facial nerve.

Histologic samples were obtained by harvesting the tendinous origin of the risorius muscle from the masseteric tendon. Sections for histologic examination were obtained after harvesting the junction of the masseter and risorius. The samples were fixed for 72 hours in 4\% paraformaldehyde, embedded in paraffin wax, cut into sections of 6 to 7 µm thick, and then stained with hematoxylin and eosin. Histologic observations were performed, and photomicrographs were obtained with the aid of a light microscope equipped with a Leica Microsystem CTR 6000 device (Leica, Wetzlar, Germany). No distinction was made between right and left specimens. All photographs and diagrams in this article are of structures viewed from the left side of the specimen. The origin of the risorius was classified according to the layer of attachment.

**RESULTS**

The origin of the risorius could be classified into 3 patterns (designated as types A-C) based on the layer of attachment. In type A specimens (58.7\%, 27/46), the risorius originated solely from the fascial layer superficial to the SMAS, in the same layer as the platysma (Figure 1A,B). The type A risorius fibers originating from the parotid-masseteric fascia were not visible when the SMAS was elevated. In type B specimens (6.5\%, 3/46), the risorius fibers originated only from the masseter tendon (Figure 1C,D). The tendinous origin of the risorius pierced the deep fascial layer (the parotid-masseteric fascia), then pierced superficial fascial layer (SMAS) as Figure 1D depicts, and was continuous with the risorius fibers in the perioral region. In type C specimens (34.8\%, 16/46), the risorius originated from the fascial layers, both superficial and deep to the SMAS (Figure 1E,F). In 10 of the type C cases (21.7\% of all cases), the risorius arose from both the SMAS and the parotid-masseteric fascia; in the remaining 6 cases (13.0\% overall), it originated from the SMAS, parotid-masseteric fascia, and masseter tendon.

In all cases where the risorius originated from the masseter tendon (types B and C), a small buccal branch of the facial nerve was observed running parallel and adjacent to the upper fibers of the tendinous origin of the risorius (Figure 2).

Histologic analysis of longitudinal sections of the tendinous risorius showed fibroblasts with elongated nuclei sandwiched between collagen fibers (Figure 3A), observations that are common at the musculotendinous junction. Also evident were tendon-to-tendon connections (Figure 3B). These findings confirmed the results of our dissections.
Figure 1. Anatomic origins of the risorius. **Type A pattern:** (A) photograph and (B) illustration show the risorius originating solely from the superficial musculoaponeurotic system (SMAS; arrowheads). **Type B pattern:** (C) photograph and (D) illustration show the risorius originating solely from the masseter tendon (arrowhead). **Type C pattern:** (E) photograph and (F) illustration show the risorius originating from both the SMAS (white arrowheads) and the parotid-masseteric fascia (black arrowheads). BFP, buccal fat pad; DAO, depressor anguli oris; M, masseter; P, platysma.
The patterns of origin and arrangement of the risorius have not been described in detail in the medical literature. The anatomic structure of the risorius is highly variable, ranging from 1 or more slender fascicles to a single, wide band of muscle. In general anatomy textbooks, the risorius has been described as originating from the parotid fascia, the fascia over the masseter, or the fascia enclosing the platysma.\textsuperscript{2,3,22} The present study was prompted by the need to establish the precise anatomic origin patterns of the risorius, which can be accomplished effectively by meticulous dissection.

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**DISCUSSION**

The patterns of origin and arrangement of the risorius have not been described in detail in the medical literature. The anatomic structure of the risorius is highly variable, ranging from 1 or more slender fascicles to a single, wide band of muscle. In general anatomy textbooks, the risorius has been described as originating from the parotid fascia, the fascia over the masseter, or the fascia enclosing the platysma.\textsuperscript{2,3,22} The present study was prompted by the need to establish the precise anatomic origin patterns of the risorius, which can be accomplished effectively by meticulous dissection.

Our findings demonstrate that the risorius can originate from the SMAS layer, the parotid-masseteric fascia, or the
masseter tendon. The SMAS is a strictly superficial anatomic structure of the face; it is located superficial to the parotid capsule and is continuous with the platysma inferiorly in the neck and the risorius in the cheek.\textsuperscript{23,24} Contrary to previous reports,\textsuperscript{23,24} the most common origin pattern of the risorius in our study (58.7% of specimens) was type A: origination solely from the fascial layer superficial to the SMAS. Therefore, the risorius should first be regarded as existing in the same fascial plane as the SMAS.

Pattern type C, in which the risorius originates from both the SMAS and the parotid-masseteric fascia, was observed in 10 (21.7%) of our 46 cases, which is consistent with previous reports.\textsuperscript{23,24} The parotid-masseteric fascia is the continuous deep layer of the superficial cervical fascia. This fascial layer has been assigned various terms based on its anatomic location; when found overlying the parotid gland and the masseter, the deep fascia has been designated as the parotid fascia and the masseteric fascia, respectively.\textsuperscript{9} Accordingly, it is unreasonable to suggest that the risorius originates from the parotid fascia, because all locations of its origin are confined to the anterior region of the masseter. Therefore, the “correct” origin of the risorius is the masseteric or parotid-masseteric fascia.

Facial soft tissue is arranged in concentric layers: skin, subcutaneous fat, SMAS, mimetic muscle, deep facial fascia (parotid-masseteric fascia), and the plane containing the facial nerve, parotid duct, and buccal fat pad.\textsuperscript{9} Our findings show that some risorius fibers may be located within the deep fascial plane of the face, along with the facial nerve and parotid duct, and that the remaining majority of these fibers lie within the SMAS plane along with the platysma (Figures 4 and 5).

**Clinical Relevance of the Findings**

Our findings highlight the potential risk of iatrogenic injury to the risorius as a result of flap dissection during facelift surgery. Structures such as the facial nerve branches, masseteric ligament, and small vessels at the anterior border of the masseter are likely to be encountered when tissues of the SMAS or sub-SMAS are elevated (Figure 5).\textsuperscript{14} If the origin of the risorius is type B or C, its muscle fibers could be accidentally cut and the buccal branch of the facial nerve damaged during sub-SMAS dissection. Surgeons should be aware of the possible existence of risorius fibers of tendinous origin at the anterior border of the masseter and be mindful that the buccal branch of the facial nerve may be intertwined with these fibers, as was true in 9 (19.6%) of our cases (Figure 2).

Dissection for the extended SMAS facelift should not extend under the risorius to the mouth, which would sever small fascial attachments between the dermis and SMAS and result in a lateral sweep deformity over time. However, a type B or C risorius origin would obviate the lateral
sweep because the fascial attachment between the dermis and SMAS (superficial to the risorius) would not be subject to damage during an extended lift.

In only 3 (6.5%) of our cases did the risorius originate solely from the masseter tendon (type B; Figure 1). To our knowledge, this presentation has not been described previously. If this origin is not detected during flap dissection, the risorius may be damaged, resulting in impaired muscle action and sequelae such as unnatural facial expressions and/or asymmetries during animation. Thorough understanding of the origin of the risorius as it relates to the fascial layer will optimize surgical results in various planes of dissection (Figure 4).

The masseter and risorius have different embryologic origins. The masseter originates from the first pharyngeal arch and the risorius from the second pharyngeal arch. Each arch has its own cranial nerve with both afferent and efferent branches innervating the arch itself. It is well documented that the facial and trigeminal nerves innervate the risorius and masseter, respectively.25,26 A noteworthy finding of the present study is that the risorius and masseter were connected by a tendon-like structure (Figure 3A). Further studies are required to elucidate the functional aspects of the connection between these muscles and its bearing on anatomic evidence-based clinical performance in facelift surgery.

**CONCLUSIONS**

Examination of the anatomic origin of the risorius has yielded new information: the risorius can arise from the SMAS layer, the parotid-masseteric fascia, or the masseter tendon. Our findings represent valuable reference material for facelift surgery.

**Disclosures**

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**REFERENCES**

