# Retaining ligaments

**Dr Sotirios Foutsizoglou** on understanding the anatomy and function of the retaining ligaments and septa in the face

The retaining ligaments of the face are important in understanding concepts of facial ageing and rejuvenation. They are located in constant anatomical locations where they separate facial spaces and compartments. Furthermore, they have a sentinel role in relationship to facial nerve branches.

Descriptions of the retaining ligaments are variable in the literature due to different interpretations of anatomy, several classifications, locations, and nomenclature systems.[1] This article will review and clarify the anatomy of the most relevant retaining ligaments of the face, including the cheek, mandible, and periorbital areas.

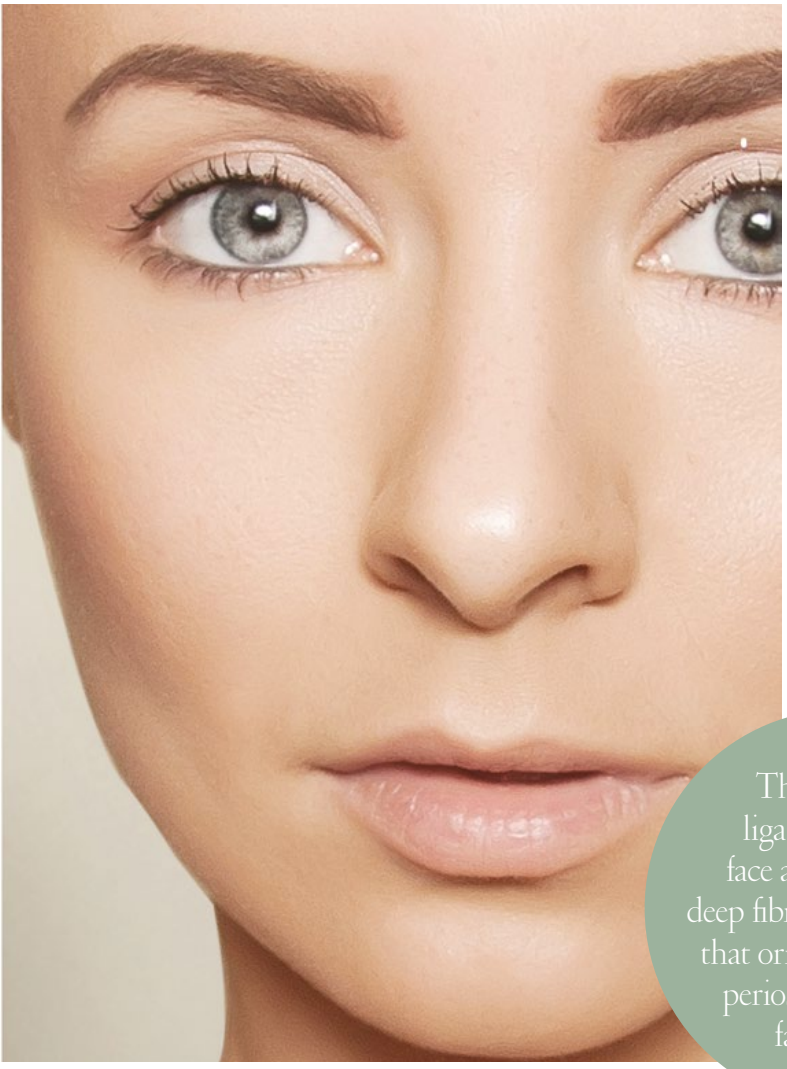
## THE RETAINING LIGAMENTS OF THE FACE

The soft tissue of the face is arranged into five distinct layers. These layers, from superficial to deep, are (1) skin, (2) subcutaneous fat tissue or superficial areolar area, (3) the superficial musculoaponeurotic system (SMAS), (4) deep areolar containing ligaments, deep fat compartments and soft tissue spaces and (5) deep fascia.[2]

The deep fascia consists of the periosteum of the facial skeleton and the deep muscle fasciae (deep temporal and paratidomasseteric), where the skeleton is overlain by the masticatory structures.

Above the zygomatic arch the deep fascia is continuous with the deep temporal fascia. In the neck, the corresponding layer is the investing layer of the deep cervical fascia, the most superficial part of the deep cervical fascia, which completely encloses the neck, including the sternocleidomastoid and trapezius muscles, and forms a roof over the anterior and posterior triangles of the neck.

The retaining ligaments of the face are strong and deep



fibrous attachments that originate from the periosteum or deep facial fascia and travel perpendicularly through facial layers to insert onto the dermis, interconnecting and stabilising all five layers of the facial soft tissue in specific anatomical locations.[3,4] These fibrous condensations of connective tissue limit shearing forces on the face, thereby creating a "retaining system", and provide stability for the vascular supply to the face.[5]

Microscopically, each ligament is rooted in a tree-like distribution as a periosteal or deep fascial thickening that divides as it approaches the SMAS into numerous branches, which insert onto the dermis as described by Mendelson.[6] This branching network of fibres is called the retinacular cutis, which is part of a larger complex system of fibrous septa in the subcutaneous layer. It is likely that the superficial extensions of the retaining ligaments into the subcutaneous layer contribute to the formation of septa that divide the subcutaneous fat tissue (layer two) into the fat compartments of the face.[7,8]

This theory is supported by the fact that some of these subcutaneous septal boundaries overlap with the location of the deeply seated retaining ligaments. In areas with thick subcutaneous tissue, the retinacular cutis lengthens significantly, predisposing its fibres to weakening and distension with ageing.[7]

> The retaining ligaments of the face are strong and deep fibrous attachments that originate from the periosteum or deep facial fascia

Furthermore, the retinacular cutis fibres are not uniform across the face, but vary in orientation and density according to the anatomy of the underlying deeper structures.

At the location of the retaining ligaments, the vertically orientated retinacular cutis fibres are the most dense and most effective in supporting the overlying soft tissues.

In between these retaining ligaments in layer four are located the soft tissue spaces of the face, that facilitate the mobility of the superficial fascia over the deep fascia. The retinacular fibres are less dense and orientated more horizontally where the subcutaneous fat overlies a space. This variation in the density and orientation of the retinacular cutis fibres in the subcutaneous fat is the anatomical basis for the compartmentalisation of the subcutaneous fat tissue.[6,8]

Stuzin et al classified the retaining ligaments as (1) osteocutaneous ligaments originating from the periosteum, such as the zygomatic and mandibular cutaneous ligaments, and (2) fasciocutaneous ligaments, which coalesce between the superficial and deep fasciae of the face, such as the masseteric and parotid cutaneous ligaments.[7,9]

In addition, Knize and Moss et al defined as true those retaining ligaments that insert directly into the dermis.[10,11] Examples of true retaining ligaments, per this definition, are the zygomatic and masseteric retaining ligaments.

Moss et al also described other forms of ligamentous attachments, mainly in the temporal and periorbital area, in the form of septa and adhesions. According to Knize and Moss, septa and adhesions are not considered true retaining ligaments since they do not insert directly onto the dermis; instead, the septa exert a >

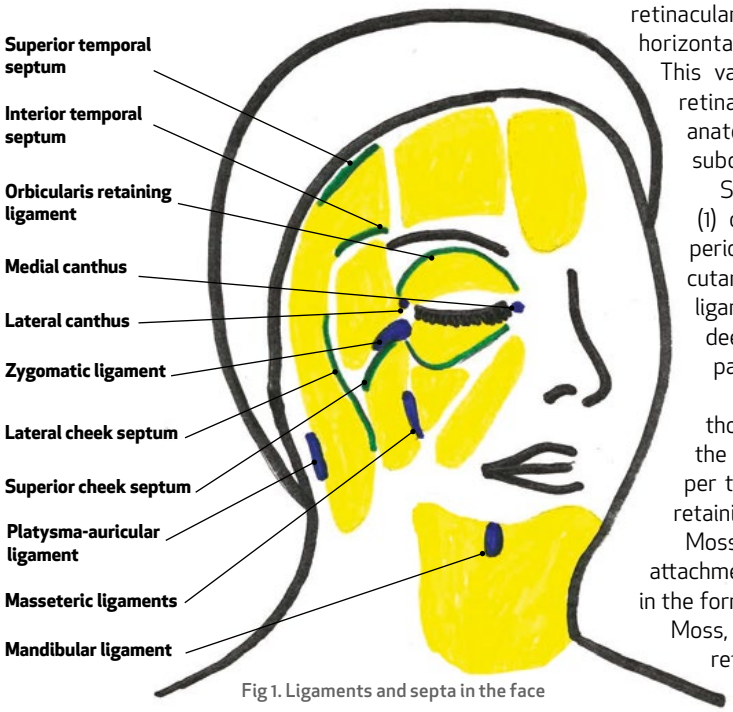



Fig 1. Ligaments and septa in the face

direct effect on the SMAS and an indirect effect on the dermis through the retinacular cutis.[1]

## PERIORBITAL LIGAMENTS

The orbicularis retaining ligament, a part of the circumferential periorbital septum, is the main periorbital retaining ligament (Fig. 1). It is an osteocutaneous ligament that originates from the periosteum of the orbital rim, traversing the orbicularis oculi muscle and inserting into the skin of the lid-cheek junction.

The orbicularis retaining ligament spans from the periosteum just outside the orbital rim to the fascia on the under-surface of the orbicularis.[1,2] The location of the attachment to the orbicularis muscle correlates with the position of the palpebromalar groove, which becomes more evident with ageing as the overlying soft tissue deflates (Fig. 2).

Medially, between the medial corneoscleral limbus and the insertion of the medial canthal tendon, just inferior to the lacrimal crest, the bilayered orbicularis retaining ligament is continuous with the tear trough ligament. This is a true osseo-cutaneous ligament, which tethers both the medial eyelid skin and orbicularis muscle to the orbital rim. The tear trough ligament is found on the maxilla between the palpebral and orbital parts of the orbicularis oculi.[13]

In the lateral canthal region, the orbicularis retaining ligament expands and merges with a dense fibrous condensation between the superficial and deep fascia known as the lateral orbital thickening. This is a firm triangular fibrous adhesion connecting the orbicularis fascia on the under-surface of the muscle to the underlying deep fascia, which in this region is made up of thickened lateral orbital rim periosteum and adjacent deep temporal fascia.[14]

> The most important retaining ligaments of the cheek are the zygomatic and masseteric ligaments

### Midface retaining ligaments

The most important retaining ligaments of the cheek are the zygomatic and masseteric ligaments. The zygomatic ligaments are strong true retaining ligaments occupying a predictable anatomical location. They originate at the inferior border of the zygomatic arch and extend anteriorly to the junction of the arch and body of the zygoma.[5,9] The masseteric ligaments, on the other hand, vary in location given the fact that they are condensations of the deep fascia.[15]

### Lower face retaining ligaments

The mandibular ligament is a major ligament supporting the facial soft tissues in the lower face. The mandibular ligament is an osteocutaneous ligament that arises from the anterior third of the mandible, posteriorly to the mandibular origin of the DAO muscle, and inserts directly into the dermis[9,16] (Fig 1).

The mandibular ligament develops minimal, if any, laxity between its origin and its connection with the SMAS, with only some mild weakening occurring superficially to the SMAS.[1,2] The mandibular ligament contributes to the pre-jowl sulcus as it provides fixed cutaneous tethering along its attachment to the mandibular border whereas lateral to the ligament there is an age-related premasseteric SMAS ptosis and a descent of soft tissues below the body of the mandible (Fig 2).

## RELATIONSHIP OF THE RETAINING LIGAMENTS TO THE FACIAL NERVE

There is an intimate relationship between the retaining ligaments of the face and the facial nerve and its branches.

The facial nerve branches exit the parotid gland and remain deep to layer five in the lateral face. As they approach the anterior face, the branches traverse layer four to reach the underside of mimetic muscles of the face. The transitions occur at predictable locations, in close association with retaining ligaments that provide stability and protection for the nerves.[3]

The inferior temporal septum is a landmark for the temporal branches of the facial nerve that pass just medial and parallel.[11] The orbicularis retaining ligament has an intimate relationship to the zygomaticofacial nerve branches located just inferior to the lateral aspect of the ligament. However, these branches can be compromised without any consequence.[15]

The zygomatic retaining ligaments are landmarks for the zygomatic facial nerve branches. The zygomatic branch passes in a deep plane just inferior to the zygomatic ligament.[4]


A recent study showed that the main zygomatic and upper masseteric retaining ligaments, located at a mean of 1cm from each other, create a pathway where an upper zygomatic nerve passes in a deep plane, 4mm deep to the deep fascia.

A lower zygomatic nerve passes just inferior to or penetrates the upper masseteric ligament at a more superficial level, 1mm deep to the deep fascia, and pierces the deep fascia just distal to the ligament.[17]

Another important observation is that facial nerve branches often penetrate the ligaments. This incidence was reported to be 27% for the zygomatic ligaments and 66% for the masseteric ligaments.[17,1]

The masseteric ligaments are important landmarks for the buccal facial nerve branches. These ligaments guard the nerves, which penetrate the deep fascia and become superficial on top of the buccal fat pad, just distal to the masseteric ligaments.[6]

The marginal mandibular nerve runs posteriorly to the mandibular ligament.[19]

Finally, the great auricular nerve is anatomically related to the subcutaneous extension of the platysma-auricular ligament. This septal extension separates the lateral temporal cheek fat compartment from the post-auricular compartment and the great auricular nerve travels through this septum.[19]

## AGEING CHANGES IN THE FACIAL LIGAMENTOUS FIXATION

Facial ageing is a complex process. It is the cumulative effect of simultaneous changes of the many components of the face as well as the interaction of these components with each other. Ageing is seen in all layers of the soft tissue, as well as in the skeleton.[2]

Advancing age is associated with soft tissue descent, skeletal thinning and recession, and volumetric deflation. The combination of volume loss and the effect of underlying retaining ligaments contribute to the macroscopic hallmarks of facial ageing.

The major facial ligaments in their passage from their fascial origin to SMAS are robust and do not undergo significant primary ageing changes.[20] Most of the ligament change is in the multiple finer retinacular ligament branches from the SMAS through the subcutaneous layer to the dermis, which are prone to being weakened over time by repetitive movement.

The combination of volume loss and the effect of underlying retaining ligaments contribute to the macroscopic hallmarks of facial ageing

In a youthful midface, there is a convex arc from the lower eyelid to the lip with evenly distributed volume and a smooth transition from one aesthetic unit to another.

With the development of age-related laxity of the superficial layer, the ligamentous insertion through the superficial fascia becomes apparent as a cutaneous groove or line of concavity, indicating a line of resistance, to further sag of the soft tissues, e.g. the mid-cheek furrow.[14]

In contrast, the larger and more mobile, non-attached areas in between these supporting structures undergo greater laxity and displacement to form folds or J-shaped bulges, e.g. the nasolabial fold, malar mound bulge and pre-jowl sulcus (Fig. 2).

In addition, the retrusion and resorption of the facial skeleton, in particular those bones of dental origin (i.e. the maxillae and mandible) cause the origin of the multi-linked fibrous retaining ligaments to be displaced posteriorly. This pulls the skin inwards, exaggerating the concavity between the areas of relative convexity that develop with ageing.

More specifically, the inferior orbital rim is covered by soft tissue, minimising the delineation between the lower eyelid and upper cheek. Volume loss at the inferior orbital rim in conjunction with the underlying fixed and unyielding orbital retaining ligament creates a prominent concavity (palpebromalar groove).

The tear trough deformity is an age-related unmasking of the tear trough ligament which tethers both the eyelid skin and the orbicularis muscle to the medial infra-orbital rim.

Volume loss and tethering of the malar septum (superior cheek septum or zygomatico-cutaneous ligament) create the mid-cheek furrow that runs parallel to the nasolabial fold and is a hallmark of midface ageing.

Marionette lines and facial jowling appear secondary to differential volume loss within the superficial and deep fat compartments, soft tissue laxity and descent, and progressive pre-masseteric SMAS ptosis along the inferior border of the mandible.

The formation of the prejowl sulcus is due to fixation of the skin to the underlying resorbing bone via the mandibular ligament as discussed earlier in this article (Fig. 2). >

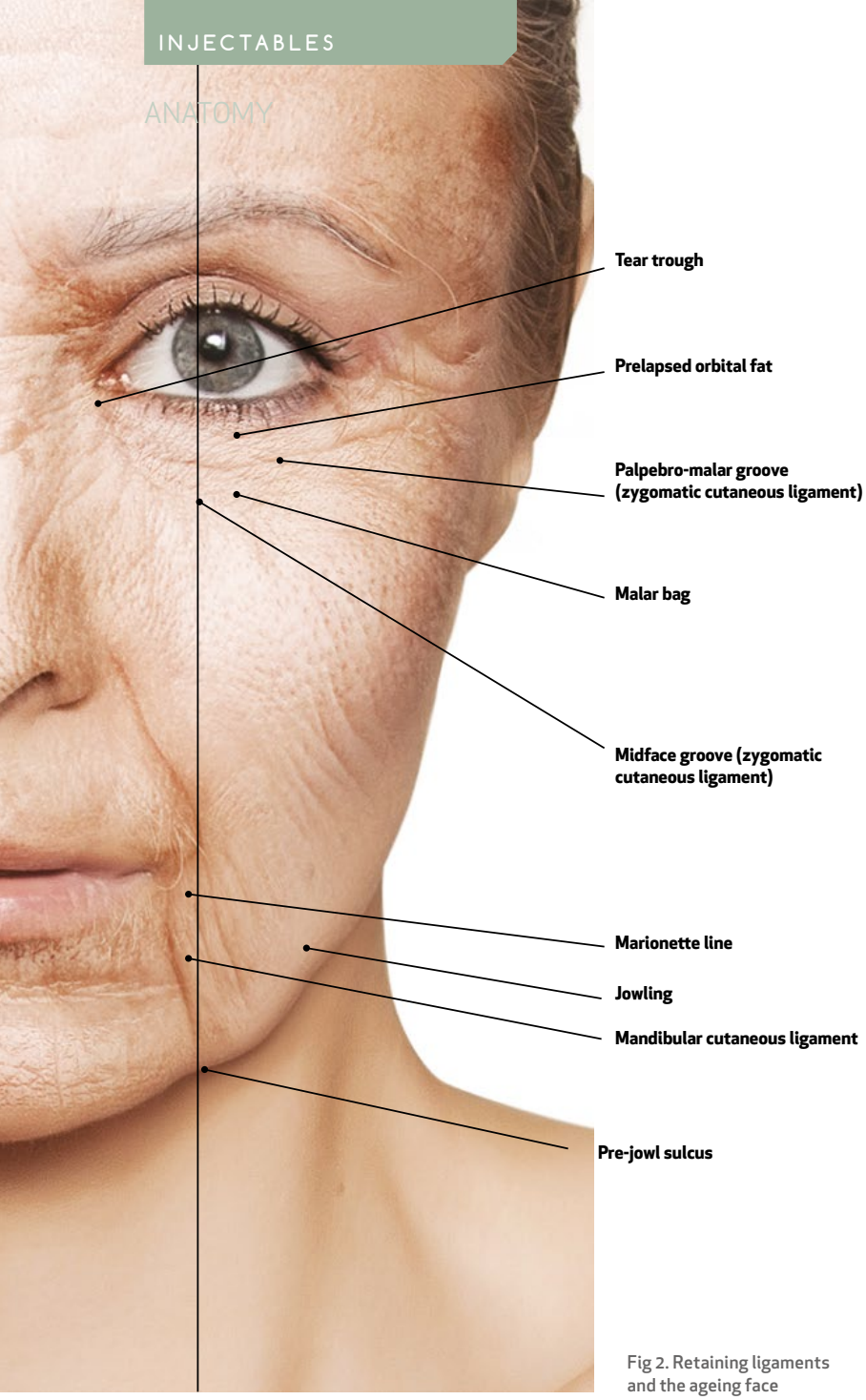



Fig 2. Retaining ligaments and the ageing face

## CONCLUSION

The retaining ligaments of the face are important landmarks that occupy predictable anatomical locations. Any facial rejuvenation procedure that undermines a superficial fascial flap (SMAS, superficial temporal fascia, or platysma) requires release of the retaining ligaments to allow unrestricted mobilisation and redraping of the flap. In aesthetic medicine, doctors encounter their superficial extensions (between SMAS and dermis) when, for example, doing a thread lift using suspension threads. Therefore, understanding the contribution of the facial retaining ligaments to the aging changes in the face and knowledge of their location, function, and proximity to the SMAS and facial nerves can add to the safety and efficacy of facial aesthetic surgical and non-surgical procedures. **AM**

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