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Research Article

The Yellow Ligament of the Chin, As Part of Retaining Ligaments of the Face: Bibliographic Review and Proposal for Terminology Change

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Abstract

Background: The yellow ligament of the chin or chin fat pad is poorly described in anatomic publications, is a morphological structure not very well known, but constant, its relevance in facial physiognomy is currently recognized. its anatomy, histology and function. a change of terminology is proposed according to the anatomical terminology.

Methods: The study observational of the population consisted of the 10 patients who were going to perform procedures in the chin. A bibliographic review of the yellow ligament of the chin was carried out.

Results: The yellow ligament of the chin is an constant anatomical structure described in the various anatomy texts and journal articles that were evaluated, of the 10 patients observed clinically in trans-surgical procedures on the mental region, the yellow ligament of the chin was present clinically in 8 patients.

Conclusions: Based on the anatomy, location and histology of the yellow ligament of the chin, and to the descriptions of the yellow ligaments to chin this must be recognized is part of the retaining ligaments of the face, a new terminology is proposed for said ligament, septum dermis osseum menti (osteocutaneous mentalis septum, in english).

Introduction

The yellow ligament of the chin is poorly described in anatomic publications, is a morphological structure not very well known, but constant, whose description, function and location have been studied by anatomists, and its relevance in facial physiognomy is currently recognized. The retaining ligaments of the face support facial soft tissue in normal anatomic position, resisting gravitational change. As this ligamentous system attenuates, facial fat descends into the plane between the superficial and deep facial fascia, and the stigmata of facial age develop [1]. The layers of the facial soft tissue are supported in normal anatomic position by a series of retaining ligaments that run from deep, fixed facial structures to the overlying dermis. Two types of retaining ligaments are noted as defined by their origin, either from bone or from other fixed structures within the face.

Materials and Methods

Literature search

A systematic literature search in bibliographic databases public domain books on human anatomy and journal articles indexed from the 18th to the 21st centuries were reviewed, in which they alluded to the morphological description and surgical procedures of the chin region and the yellow ligament of the chin, in order to determine what name they use to designate the anatomical element that separates the two mentalis muscles. The search was carried out in the Gallica database, portal of the digital library of the National Library of France (BnF) and its associates; also in the portals: Google Books, Google Scholar, Internet Archive, Inclusion criteria. Studies were included if they met the following criteria: Where we search the words: chin, chin fat pad, ligamento amarillo del menton, mentonnière, mentalis muscle, houppe du menton, ligament jaune du menton, chin dimple, chin fissure, kinnes, Kinngegend. The study observational of the population consisted of the 10 patients aged ≥18 years who were going to perform procedures in the chin area in ten mandibular procedure of the symphysis in a Caribbean population made up of mulattoes. The study complies with the ethical standards of the journal.

Results

Historical aspects

Joseph Lieutaud is credited with describing the mentalis muscle, which he called houppe du menton-beard tassel because of its shape-, this muscle was initially described in 1694 by William Cowper under the name levator labii inferiores [2], but it is Lieutaud who recognized the ligament on the lips, naming it in 1742 as: ligament de la lèvre inférieure [3] (Figure 1), although Jean Cruveilhier in 1843 names it as the ligament jaune de la houppe du menton [4]. The anatomical ones after Cruveilhier take him as a reference or identify the structure in an unnamed way, in such a way we find the following terms for this structure in the literature:

- Ligament of the lower lip [3],
- Yellow ligament of the chin tassel [4],
- Unnamed-Hemispheric cushion of fatty connective tissue [5],
- Unnamed-middle lamina of fibroelastic tissue [6,7],
- Unnamed-Connective tissue protuberance [8],
- Unnamed-intermediate tendinous band [9],

- g) Unnamed-Fibrous Bridge [10],
- h) Tassel ligament [11],
- i) Unnamed-Fibro-fat tissue pad [12],
- j) Unnamed-tendon intermuscular raphe [13],
- k) Adipose body of the chin [14],
- l) Corps adipeux du menton or Chin fat pad [15]

It seems that after [8,11], it was called the adipose body of the chin, only modifying the term by [13], who defined it as a tendinous intermuscular raphe, no one else has analyzed the consistencies and inconsistencies of this term.

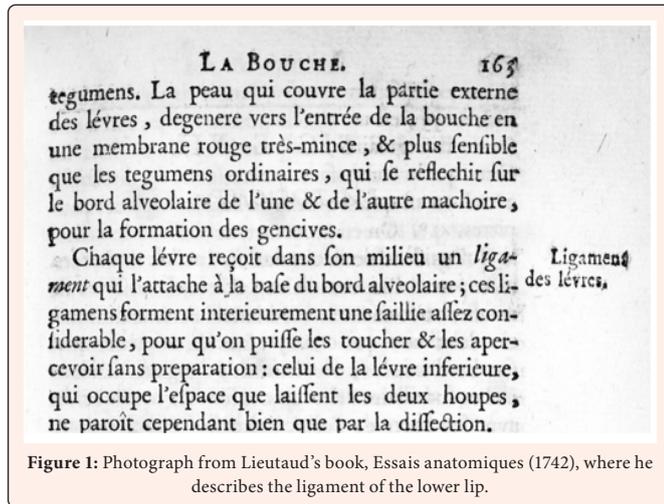


Figure 1: Photograph from Lieutaud's book, Essais anatomiques (1742), where he describes the ligament of the lower lip.

Most of the descriptions are brief, but we can see in the photograph the most detailed description found of the yellow ligament, made by [11], on the other hand [12], when conducting an exhaustive investigation of the facial muscles focuses on this structure when speaking of the mentalis muscle. The only ones who draw it are Merkel in a cross section in figure 225 of his book [8], and Testut & Latarjet in the french edition of 1928 draws it in his work [7], in Figure 775 in a frontal section, but we do not find this figure in the first editions of his treatise. Although many have studied it histologically, only Cuenca-Guerra in 1997 [16], presents a histological photograph of the ligament.

Anatomy

This yellow ligament of the chin has a cylindrical shape and is more or less developed according to the subjects, it sends to the skin, in the midline, a more or less considerable extension according to the subjects [4], it is below the lower lip, in front of the mental protuberance and together with the mentalis muscle it contributes to form the protrusion of the chin. The skin attachments of the mentalis muscle generally overlap and insert into the deep dermis of the chin. Often, a little fat according to Garfien & Zide (2008) can separate them near the bone insertions, but at the level of the skin insertion the separation can be 8 to 10 mm [17], and in edentulous jaws 12 mm with a mean width at the bone insertion of the mental muscle of approximately 5 mm. [18]. The shape of the chin is modeled in the details by the soft parts, but in general it is completely determined by the bone support, and with its extremely variable shapes it is possible to dispense with describing the physiognomic details, but we are going to describe one in particular, the fovea mentalis (cleft chin or chin dimple). This fovea mentalis is due to the fact that the skin is united and attracted inwards by the fibro-fatty tissue pad-the yellow ligament of the chin-that is located between the two muscles and is attached to the periosteum [1, 7, 8, 15], which ensures an equal distribution of force over the entire mentalis muscle [12]. This adhesion is what explains the anatomical differences in the medial fossa of the chin (cleft chin), whose shape and depth vary according to the disposition of the fibroadipose ligament and the fat pad that surrounds it [4]. This may explain why this ligament is more visible and developed in people who do not have a mental fossa according to our observation was carried out in an ethnic group mestizo-Caribbean people where had the yellow ligament of the chin.

The frequency of cleft chin varies widely among different populations. The fovea mentalis (cleft chin) is an autosomal dominant inherited feature; the ten of the mental fossa is on chromosome 5 [19]. When one of the two parents express the trait, there

is a 25% to 50% chance of passing it on to their children; however, if both parents express the trait, the probability doubles from 50% to 100% [20]. The mental fossa is common among people originating from Europe, the Middle East, and South Asia [21]. Other like McDonald [22], concluded that, the family studies do not fit the myth that cleft chin is caused by a dominant allele. He recommends should not use cleft chin to demonstrate basic genetics (Figure 2).



Figure 2: Schematic representation of the chin region: 1) Orbicularis muscle; 2) mentolabial sulcus; 3) yellow ligament-adipose bearing-, 4) mentalis muscle, 5) connective trabeculae-Fibrous cord when the fovea mentalis is present-. 6) Depressor labii inferiores muscle; 7) Depressor angulis oris; 8) Mandible. Surgical view where the yellow ligament of the chin can be seen.

Three types of mentalis muscle morphology. (A) Type A-1, two bilateral mentalis muscles merged with each other. (B) Type A-2, the two mentalis muscles were separated. (C) Type B, mentalis muscle was flat and comprised of only a few muscle fibers [23,12] explained that, in the so-called cleft chin, the superior fibers of the musculo mentalis are probably few or absent and the skin of the chin will be directly attached to the underlying fibrous pad. The fibers of this ligament, at their anterior edge, are attached to the skin, the highest fibers pass under the bottom of the vestibular sulcus of the mucosa of the lips to reach the labial sulcus: their lower fibers are more widely spaced and arranged in a chained manner, house the adipose granules [11].

Histology

Histological study of the fat body on the chin showed that it was made up of lobes of mature adipocytes, most of the time separated by numerous septofibrous cells. These

septa were more or less fibrous depending on the sector. This arrangement was more reminiscent of subcutaneous fat than of the fatty body of the cheek that we analyzed at the same time [15] (Figure 3,4).

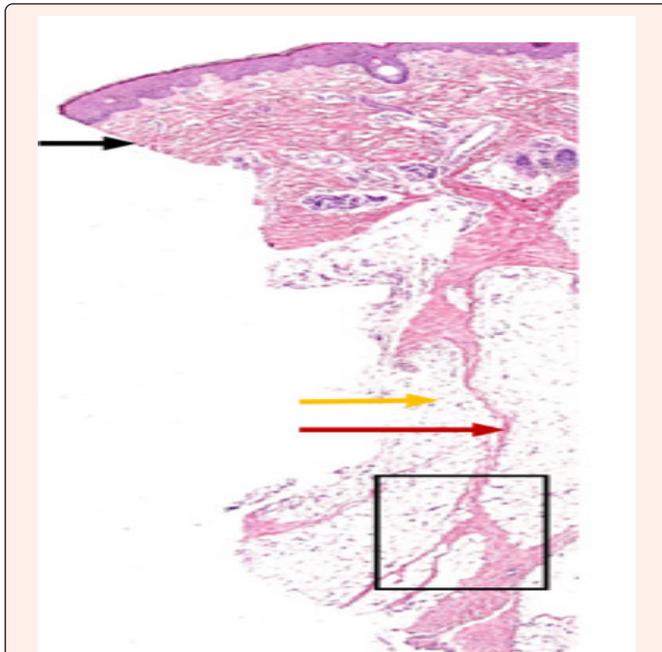


Figure 3: Histological photograph of the yellow ligament of the chin. Fibrous bands in the subcutaneous fat tissue (H&E, ×40).

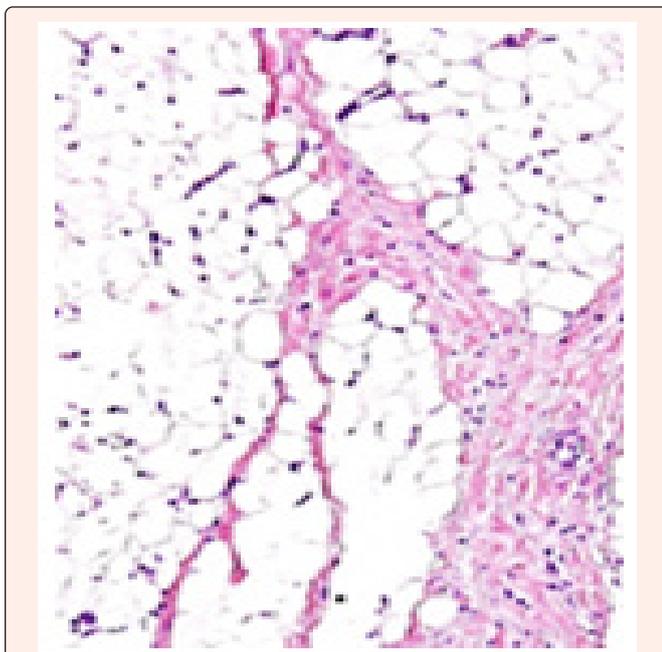


Figure 4: Widened fibrous septa of subcutaneous fat tissue (H&E, ×100). black arrow: subcutaneous tissues; yellow arrow: fat tissues; red arrow: fibrous bands.

Subcutaneous fat contains dermal white adipose tissue and is subdivided by fibrous septa into different compartments, which have previously been identified both in cadavers and in imaging studies [24]. Using transmission and scanning electron microscopy [25], subdivided adipose tissue deposits into three groups: the structural type being: the one that contains adipose tissue with large adipocytes, while each cell is obviously covered by a thin fibrous layer [24]. Type I SMAS morphology covers the

region lateral to the NLF, and its morphological description corresponds to the first description by Mitz and Peyronie and to the description in subsequent studies [26-28]. Type I SMAS consists of fibrous septa enveloping lobules of fat cells, and it covers the forehead, the parotid, the zygomatic and infraorbital regions, and the lateral part of the naso labial fold [26], and now this central part of the mental region. Together, the collagen meshwork and the fat lobules, acting like small viscoelastic fat pads, have dynamic properties [26,29].

Function

This yellow ligament of the chin separates and serves as an attachment to the mentalis muscle and fills the space between them. During the contraction of the mentalis muscles, this fat body is crushed by these muscles, thickens in the center, thins in the extremities and lengthens [15], the yellow ligament of the chin is forced upward and this in turn forces upward the orbicularis oris muscle and thus the lower lip [12]. It thus contributes to the expression of hesitation, doubt, contempt and disgust. It also participates in chewing pushing back the remains of food in the vestibule [30], citing [15], in speech helping to articulate the vowels o, u and the consonants b, f, g, m, p, v. All these fine movements would not be possible without the existence of the fatty body on the chin [14]. Incidentally, the chin acquires a cylindrical shape and the skin sinks in different parts of the chin region where the muscle fibers are inserted. When the orbicularis oris muscle contracts, the ligament is pushed down and flattened against the underlying bursa and symphysis menti.

This causes a downward shift of the lower lip and a flattening of the chin. This ligament ensures an equal distribution of force over the entire muscle mentalis [12]. This is why the yellow ligament together with the mentalis muscles are an essential component in the position of the chin and lip. Numerous surgical approaches exist for doing dimple creation, such as transcutaneous sutures or by an open technique that is performed through intraoral approach, which would show no scar formation [31]. Guerrero-Santos (1971) quotes Ivo Pitanguy (1968) who described a procedure where he thinned the skin at the site of the future dimple when a flap is separated from the median raphe while an augmentation mentoplasty is performed [32], they used it to firmly fix the implant and also creates a dimple in the midline on the chin. Pre-contoured chin implants with a midline groove or notch, although not currently available, can give a similar result.

Our study

The yellow ligament of the chin is a constant anatomical structure described in the various anatomy texts and journal articles that were evaluated, of the 10 patients observed in trans-surgical procedures on the mental region, the yellow ligament of the chin was present clinically in 8 patients, no one had cleft chin. Regarding the term and the anatomical description, when comparing the Anatomical Terminology (FICAT), no equivalent term was found referring to that structure that would allow it to be described. Based on evaluation by a Latin language expert, the proposed term would be: septum dermis osseum menti (osteocutaneous mentalis septum, in English).

Established that this element is a septum directed from the symphysis of the chin to the skin and located in the mental region. The term osteocutaneous is given by its insertions in the dermis and the symphysis of the chin; and the mentalis septum term is given by its location in the human economy and the function. The English name of this structure was proposed should be: osteocutaneous mentalis septum, so an expert in the Latin language concluded that the name in Latin should be: septum dermis osseum menti. Based on the anatomy, location and histology of the yellow ligament of the chin, and to the descriptions of the yellow ligaments to chin this must be recognized as part of the retaining ligaments of the face.

Discussion

The retaining ligaments of the face support facial soft tissue in normal anatomic position, resisting gravitational change. As this ligamentous system attenuates, facial fat descends into the plane between the superficial and deep facial fascia, and the stigmata of facial age develop (1) clinical/surgical name not recognized in anatomical terminology. Should we include it within the retaining ligaments of the face? Due to the growing interest in the anatomy of the face, surgeons and clinical anatomists have turned their attention to the gross anatomy of the face.

Descriptions of retaining ligaments vary in the literature. Due to different interpretations of the anatomy, various classifications, locations, and nomenclature

systems have been proposed [33,34]. The retaining ligaments of the face are strong and deep fibrous junctions that originate in the periosteum or deep facial fascia and travel perpendicularly through the facial layers to insert into the dermis [35]. It is Furnas in 1989 who is credited with the first use of this retaining ligament terminology, when he described the retaining ligaments of the cheek [36]. These ligaments act as anchor points, retaining and stabilizing the skin and the superficial fascia (SMAS) to the underlying deep fascia or the facial skeleton in defined anatomical locations, seen from this point of view we have the hypothesis, this definition would be the yellow ligament of the chin a facial retention ligament [35]. Classified the retaining ligaments as: a) osteocutaneous ligaments originating from the periosteum, such as the zygomatic and mandibular cutaneous ligaments, and b) fasciocutaneous ligaments, which coalesce between the superficial and deep fasciae of the face [37]. Created his own terminology categorizing the retaining ligaments of the face as adhesion, septum, and true ligaments, and did not utilize the term "cutaneous" at all. This classification system (which, again, includes ligaments, septa, and adhesions), while sound from the morphological and structural standpoints, is not without flaws [33].

Although there is no direct effect on the lower lip, indirectly the mentalis muscles and the yellow ligament of the chin provide the main vertical support for the lower lip [38]. Considering all this, we can deduce that this structure, the yellow ligament to the chin, is a retaining point of the mental region. In the clinic, the facial soft tissues descend as a result of the laxity of these ligaments due to aging and the effect of gravity, developing the stigmata of the aging face [35], also accentuated due to bone changes typical of aging [39]. In the case of the yellow ligament of the chin, which is firmly adhered to the dermis and its use in cosmetic surgery, it is the opposite of the facial retaining ligaments, which when sectioned allow the unrestricted mobilization of the flap in face lift surgeries; In the case of the yellow ligament of the chin, its surgical representation is to modify it to produce the mental fossa that some patients request or to eliminate them as others wish. The yellow ligament of the chin has been described in different books under different names. This is a not very well-known morphological structure, whose description, function and location have been studied by anatomists, and its relevance in facial physiognomy is currently being recognized. This should not be confused with another unfamiliar ligament, the mental ligament, describe by Kang et al. and located in the originated at the bony part at which the mentalis muscle and the depressor labii inferioris muscle interdigitate and their fibres penetrate the interdigitation [40]. The bibliography describing its function was reviewed, such as anchor point, retaining and stabilizing the skin and superficial fascia (SMAS) to the underlying deep fascia and the facial skeleton, composed of collagen fibers and adipose tissue and its relevance in facial physiognomy and aging.

Several living subjects were photographed to confirm the existence of this element, which appears without reference in the Anatomical Terminology and with an anatomically incorrect name. The TAI, developed by the International Federation of Anatomy Associations and written in Latin, must be translated into other vernacular languages by anatomists who make use of these terms, taking into consideration that the names of the structures should have an informative value (Federative International Committee on Anatomical Terminologies (FICAT) [41]. Recently surgeons have described fibrous condensations which they have called retaining ligaments of the face. Previously, the authors have reported on the anatomical findings of these "ligaments," in addition to discussing the specific definition of what constitutes a ligament. Several authors, including [42], have described the facial fat compartments in relation to these ligaments and inferred the role that these ligaments can play in contributing to the decrease in fat and facial aging. The name does not agree with that of ligament, since functionally it is not a ligament; Taking into account its function and anatomical location, the name yellow ligament of the chin does not provide information to infer it either. The histology of a ligament is incompatible, since it is defined as a fibrous tissue structure -without septa- and, in addition, functionally the ligaments unite the bones between them or fix an organ, although it fixes the skin to the bone chin, this ligament yellow chin due to its histological constitution does not resemble a ligament itself. Regarding the term "septo" it is evident, since there is antecedents, it is defined as a complete or incomplete division of something and that later is exclusively related to morphological sciences [38].

Septo corresponds to a word that derives directly from the Latin, Septum, evidencing a close relationship between the original Latin term and its Hispanic translation [43], this septum is then formed by fibroadipose tissue, in which its histological appearance is marked by the existence of numerous fibrous septa (fibrous bands with adipose bodies). According to [44,45], septa and adhesions are not considered true retaining ligaments since they do not insert directly onto the dermis; instead, the septa exert a direct effect on the SMAS and an indirect effect on the dermis through the reticular cutis.

Conclusion

The yellow ligament of the chin together with the mentalis muscles are an essential component in the position of the chin and lip. The fine movements would not be possible without the existence of the yellow ligament of the chin. As the International Anatomical Terminology promotes clearer and more precise communication between professionals in the medical sciences and other health professionals, in the case of the yellow ligament of the chin, such a name is not precise and manifests incompatibility with the true location on the chin, and does not refer to its function. The name yellow ligament does not refer to its structural component, hence the rational need to change its name to assimilate it to a true anatomical structure. The term dermo-osseous mental septum is proposed, a term that meets the corresponding criteria for its morphological reference and location. This is why we can name the yellow ligament of the chin with the appropriate name of the osteocutaneous mentalis septum (septum dermis osseum menti, in Latin), as part of the retentive ligaments of the face, which fix the middle part of the dermis of the chin to the mandibular bone and at the same time they serve as separated and the insertion to the mentalis muscles, also filling the space between them. With an adequate understanding of the anatomic changes that occur with aging, rhytidectomy can be approached as a reconstructive procedure, restoring facial soft tissue to its original anatomic state and location. In chin region surgeries this ligament should be taken into account and reconstructed in cases of patients with cleft chin. Future studies should be carried out perform a histological study with more specimen, to determine its involvement in cleft chin genetics at the different race, your participation in the aging process, and its application in facial rejuvenation and in cleft chin surgeries either for its removal or creation.

Conflicts of interest

The authors have no affiliations with or involvement in any organization or entity with any financial interest in the topic [46].

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