

## Short Report

# Anatomical considerations on the discomalleolar ligament

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### ABSTRACT

A study was carried out on the discomalleolar ligament by dissection of adult human cadavers. The ligament corresponds to the most internal portion of the superior lamina of the temporomandibular joint capsule. It extends from the posterointernal portion of the temporomandibular joint disc, penetrates the petrotympanic fissure and reaches the malleus of the middle ear. Because of its morphology and anatomical arrangement the discomalleolar ligament should be considered as an intrinsic ligament of the temporomandibular joint and distinguished from the tympanic portion of the sphenomandibular ligament (anterior ligament of the malleus).

*Key words:* Temporomandibular joint; middle ear.

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### INTRODUCTION

Since the structures of the middle ear and the temporomandibular joint are derived from the first branchial arch or mandibular arch, they can be considered as being both anatomically and ontogenetically associated (Richany et al. 1956; Rodríguez-Vázquez et al. 1993).

Their relationships have been studied during development. Some authors (Harpman & Woollard, 1938; Symons, 1952; Moffett, 1957) observed fibrous connections between the tendon of the lateral pterygoid muscle and the malleus of the middle ear. However, according to Furtsman (1963) and Yuodelis (1966) there is no evidence that the tendon of the lateral pterygoid muscle inserts into the malleus of the middle ear at any stage of development. Coleman (1970), Smeele (1988) and Mérida-Velasco et al. (1990) observed that the temporomandibular joint and the malleus are connected by fibrous tracts (discomalleolar ligament). Rodríguez-Vázquez et al. (1993) systematised the fibrous relationships between the temporomandibular joint and the middle ear and

studied the origin and development of the discomalleolar ligament.

Rees (1954) showed, in adults, how the upper layer of the bilaminar zone of the temporomandibular joint disc appears to represent the discomalleolar band in the fetus which connects the lateral pterygoid muscle with the malleus across the tympanosquamosal fissure. Pinto (1962) described a 'tiny ligament' which connects the malleus with the middle and postero-superior portion of the capsule and meniscus of the temporomandibular joint. Coleman (1970) studied the discomalleolar ligament in human adults and fetuses and described a triangular shaped band of connective tissue, the base of which is continuous with the posteromedial portion of the disc and articular capsule which enters the middle ear through the petrotympanic fissure; some fibres are connected to the walls and others are continuous with the lateral margin of the anterior ligament of the malleus. According to Toledo Filho et al. (1985), fibres of the middle and lower fascicle of the anterior ligament of the malleus pass through the petrotympanic fissure to insert into the capsule and disc of the tempo-

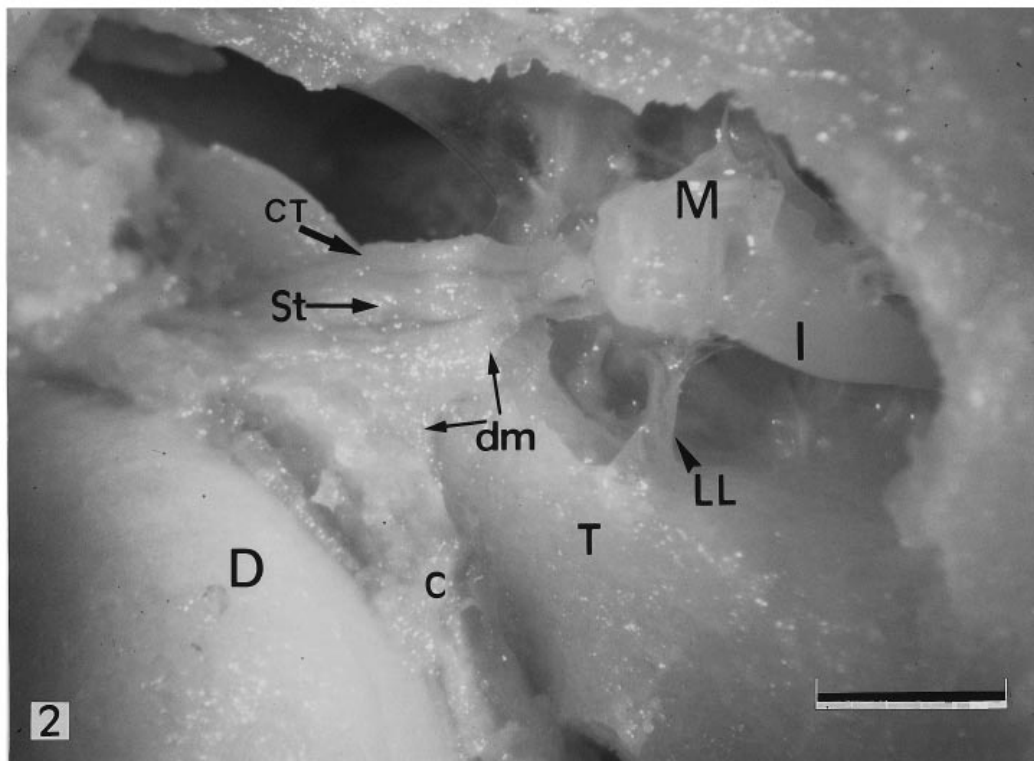
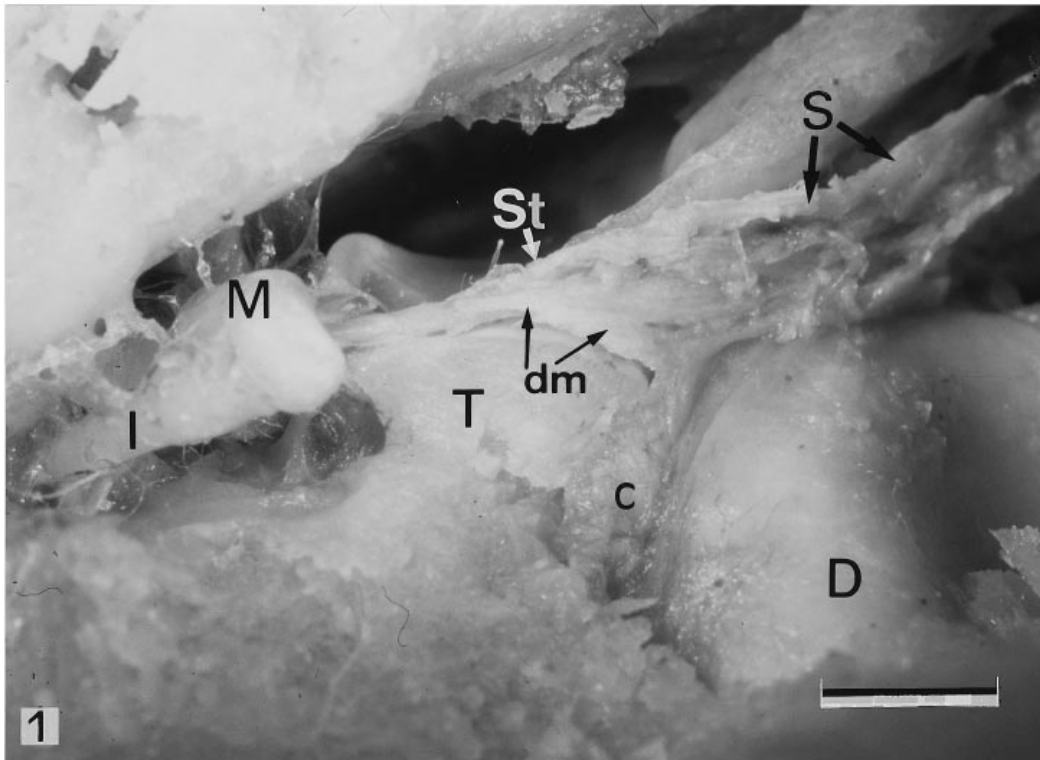


Fig. 1. Superior view of the middle ear and the temporomandibular joint disc through the middle cranial fossa. Right side. The discomalleolar ligament (dm) and the juxtaarticular portion of the sphenomandibular ligament (S) enter the middle ear along the upper edge of the tympanic bone (T) (the edge of the petrotympanic fissure), clearly visible after removing the petrous and squamous portions of the temporal bone. M, malleus; I, incus; c, capsule, D, disc of the temporomandibular joint; St, tympanic portion of the sphenomandibular ligament. Bar, 6 mm.

Fig. 2. Superior view of the middle ear and disc of the temporomandibular joint. Left side. The discomalleolar ligament (dm) is triangular in shape and corresponds to the internal part of the superior lamina of the temporomandibular joint capsule which extends dorsally towards the middle ear. Its relation to other elements passing through the petrotympanic fissure can be observed: the tympanic portion of the sphenomandibular ligament (St) which corresponds to the anterior ligament of the malleus, and the chorda tympani nerve (CT). M, malleus; I, incus; LL, lateral ligament of the malleus; c, capsule and D, disc of the temporomandibular joint; T, tympanic bone. Bar, 6 mm.

mandibular joint. Cesarani et al. (1991) observed a thin fibrous connection between the capsule of the temporomandibular joint and the neck of the malleus which they considered corresponded to a portion of the anterior ligament of the malleus. However, Komori (1986) described the discomalleolar ligament as an independent structure which is individually attached near the neck of the malleus.

The discomalleolar ligament is seldom described and often in contradictory ways, although it has been demonstrated to be a structure of clinical importance (Ioannides & Hoogland, 1983; Rholin et al. 1985; Loughner et al. 1989; Ögütçen-Toller & Juniper, 1993).

The aim of this study is to help obtain a clear picture of the discomalleolar ligament morphology and its relation with other fibrous structures such as the anterior ligament of the malleus and the sphenomandibular ligament.

#### MATERIALS AND METHODS

A total of 20 adult cadavers (10 men and 10 women) aged between 47 and 83 y preserved in 15% formalin were studied. The temporomandibular joint and the middle ear were dissected bilaterally. To this end, the calvaria were sectioned transversely, thereby approaching the middle cranial fossa, and the middle ear was opened through a section of the tegmen tympani. The horizontal portion of the squamous part of the temporal bone was dissected to expose the temporomandibular joint disc. Microdissection of the structures and their study was carried out with the aid of a magnifying lens.

#### RESULTS

We observed in all the dissected cadavers that the malleus bone of the middle ear and the temporomandibular joint disc were connected by a ligamentous structure (Figs 1, 2). This fibrous structure formed a thin, fragile and sometimes transparent lamina which extended from the posterosuperior end of the temporomandibular joint disc to the malleus of the middle ear and was attached to the neck and base of the anterior process. It was triangular in shape with a very thin, dehiscent external edge that often fractures; the internal edge was attached to the tympanic portion of the sphenomandibular ligament (anterior ligament of the malleus) (Figs 1, 2). Its vertex corresponded to the neck and base of the anterior process of the malleus. The base is in the same location as, and corresponded to, the internal

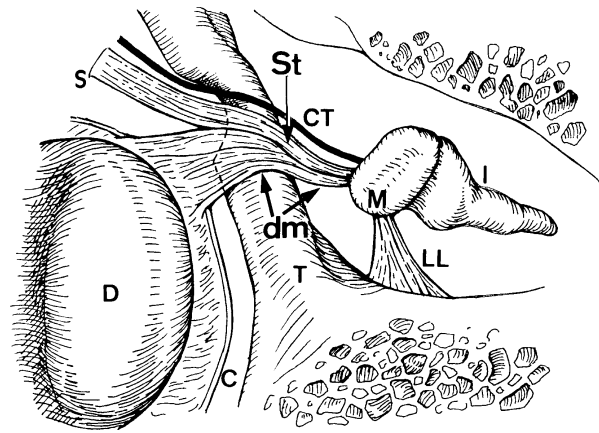


Fig. 3. Superior view diagram of the middle cranial fossa showing the anatomical arrangement of the discomalleolar ligament (dm) and its relation with the juxtaarticular portion (S) and tympanic portion (St) of the sphenomandibular ligament and the chorda tympani nerve (CT). C, capsule and D, disc of the temporomandibular joint; M, malleus; I, incus; LL, lateral ligament of the malleus; T, tympanic bone.

and upper end of the temporomandibular joint disc (Figs 1–3).

This fibrous tissue belonged to the internal portion of the upper lamina of the joint capsule and like this structure was also attached to the posterointernal portion of the disc (Fig. 2). The upper posterior lamina of the capsule (meniscotemporal fibres) was attached to the tympanosquamosal fissure, except for the most internal ones which reached the lateral portion of the petrotympanic fissure which was contingent with capsular fibres that penetrated the middle ear and form the discomalleolar ligament (Figs 1–3).

The discomalleolar ligament had a different consistency and arrangement than the sphenomandibular ligament (Fig. 1). The latter had a rounded morphology and was medial to the discomalleolar ligament.

The sphenomandibular ligament also penetrated the middle ear through the petrotympanic fissure running upwards towards the posterior external region (craniodorsal and lateral) and presented 2 portions: one juxtaarticular, medial to the temporomandibular joint and another tympanic one, inside the middle ear which inserted in the neck and anterior process of the malleus (Figs 1, 3).

The discomalleolar ligament was lateral to the sphenomandibular ligament. It extended upwards and inwards from the disc to run alongside the sphenomandibular ligament towards the neck and base of the anterior process of the malleus (Figs 1, 2). The discomalleolar ligament adhered slightly to the sphenomandibular ligament outside the middle ear (juxta-

articular portion) and also inside (tympanic portion) and to the edges of the petrotympanic fissure. The discomalleolar ligament entered the tympanic cavity through the lateral portion of the petrotympanic fissure. The sphenomandibular ligament, accompanied medially by the chorda tympani nerve, entered this region following the malleolar sulcus, carved in the anterosuperior edge of the tympanic bone (Figs 2, 3).

#### DISCUSSION

In our study we consistently observed the existence of a very thin fibrous fascicle connecting the temporomandibular joint disc with the malleus of the middle ear. This structure is not described in anatomy textbooks (Sappey, 1867; Paturet, 1951; Crépy, 1967; Pelletier, 1969; Testut & Latarjet, 1975; Romanes, 1987; Rouvière & Delmas, 1987; Dubrul, 1990; Williams, 1995). It has been given a variety of names including discomalleolar band (Rees, 1954), 'tiny ligament' (Pinto, 1962), discomalleolar ligament (Coleman, 1970), middle and inferior fascicle of the anterior ligament of the malleus (Toledo Filho et al. 1985) and articular portion of the anterior ligament of the malleus (Cesarani et al. 1991).

Another structure that passes through the petrotympanic fissure to the middle ear is the sphenomandibular ligament. Recently, Rodríguez-Vázquez et al. (1992) showed that the sphenomandibular ligament and the anterior ligament of the malleus are continuous structures originating from Meckel's cartilage and referred to the anterior ligament of the malleus as the tympanic portion of the sphenomandibular ligament.

There appears to be considerable confusion over the interpretation of the discomalleolar ligament due both to the different denominations it has been given and the difficulty of dissecting it. We do not agree with those authors who consider the discomalleolar ligament to be part of the anterior ligament of the malleus (Burch, 1966; Toledo-Filho et al. 1985; Cesarani et al. 1991), a superior extension of the sphenomandibular ligament in the tympanic cavity (Burch, 1966) or the 'tiny ligament' described by Pinto (1962). However, we do agree with the difference established by Coleman (1970), Komori (1986) and Ögütçen-Toller (1995) between the discomalleolar ligament and the anterior ligament of the malleus. In our opinion there are 2 clearly differentiated fibrous structures which connect the temporomandibular joint and the middle ear, one is the extension of the sphenomandibular ligament into the middle ear or tympanic portion

which corresponds to the classical anterior ligament of the malleus (Rodríguez-Vázquez et al. 1992). The other structure is the discomalleolar ligament which, according to our observations, corresponds to fibres of the posterosuperior part of the capsule of the temporomandibular joint which penetrate the middle ear.

The discomalleolar ligament and the sphenomandibular ligament enter the middle ear through the most lateral portion of the petrotympanic fissure and the malleolar sulcus, respectively. Recently, Mérida-Velasco et al. (1997) described the relationships existing between the lateral aspect of the discomalleolar ligament and the most medial branches of the posterior group of the anterior tympanic artery. The medial edge of the discomalleolar ligament presents adherences to the tympanic portion of the sphenomandibular ligament and both terminate in the neck of the malleus above the anterior process. This arrangement of the discomalleolar ligament confirms the observations in human fetuses by Rodríguez-Vázquez et al. (1993).

Abe et al. (1997) observed that the sphenomandibular ligament has an insertion into the temporomandibular joint disc. In our opinion, this insertion corresponds to adherences between the sphenomandibular and the discomalleolar ligaments.

According to our results, the discomalleolar ligament is a capsular structure similar to an intrinsic ligament, formed by the association of capsular fibres coming from the posterosuperior and medial end of the articular disc. Therefore these fibres belong to the upper lamina of the bilaminar zone of Rees (1954) or the upper lamina described by Zenker (1956). In fact, these fibres have previously been described by Sappey (1867) and Paturet (1951) who referred to them as posterosuperior frenomeniscal, indicating that they were situated in Glaser's fissure; according to Couly & Hureau (1976), some of these fibres extend through the petrotympanic fissure with the anterior ligament of the malleus. The remaining fibres of this upper lamina of the capsule, extending from the hind region of the disc, insert in the tympanosquamosal fissure.

Some studies have focused on determining the possible clinical implications of this structure and its relation to the craniomandibular dysfunction syndrome (Ioannides & Hoogland, 1983; Rholin et al. 1985; Loughner et al. 1989; Ögütçen-Toller & Juniper, 1993). According to Coleman (1970), Komori (1986) and Eckerdal (1991), there is no evidence that traction of the discomalleolar ligament can trigger off movement in the chain of small bones of the middle ear. We believe that possible movement of this sequence of

bones in the middle ear by traction of the discomalleolar ligament depends on the degree of closure of the petrotympanic fissure during development and, hence, the points of adhesion between the ligament and the edges of the petrotympanic fissure.

In summary, the discomalleolar ligament should be considered as an intrinsic ligament of the temporomandibular joint and, because of its origin as demonstrated by Rodríguez-Vázquez et al. (1992, 1993) and also because of its morphology and anatomical arrangement, should be distinguished from the tympanic portion of the sphenomandibular ligament or anterior ligament of the malleus.

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