ANATOMIC STUDY OF THE DISCOMALLEOLAR LIGAMENT: A TOPOGRAPHIC DESCRIPTIVE CONTRIBUTION FOR IMAGE CAPTURING

ESTUDO ANATÔMICO DO LIGAMENTO DISCOMALEOLAR: CONTRIBUIÇÃO DESCRITIVA TOPOGRÁFICA PARA CAPTURA DE IMAGENS

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ABSTRACT

Introduction: The obtaining of reliable structures that form the temporomandibular joint (TMJ) images has always been a challenge for professionals who work in the study and treatment of the problems that affect this joint. **Objective:** Since the discomalleolus ligament can promote a union between a temporomandibular joint and the middle ear, and that auditory disorders are usually related to the temporomandibular disorders, which makes it diffcult to diagnose it, this study proposes anatomically an orientation for identification of the ligament for the guidance control to capture images of the discomalleolus ligament in the petrotympanic fissure. **Methods:** Subsidized by cadaveric dissection a measurement of planes through sections in dry skull through the formation of a three-dimensional prototype was performed. The study had the release from the anatomy department from the Federal Univesity of Pernambuco. **Conclusion:** The guidelines generated from the topographic-anatomical study are effective in determining the discomalleolus ligament in radiological images.

Keywords: Temporomandibular Joint; Dysfunction Syndrome Temporomandibular; Middle Ear; Radiology

RESUMO

Introdução: A obtenção de imagens confiáveis das estruturas que formam a articulação temporomandibular sempre foi um desafio para os profissionais que trabalham no estudo e tratamento dos problemas que acometem essa articulação. **Objetivo:** Tendo em vista que o ligamento discomaleolar pode promover a união entre a articulação temporomandibular e a orelha média, e que distúrbios auditivos geralmente estão relacionados aos quadros de disfunções temporomandibulares promovendo dificuldade em diagnosticá-la, este estudo concerne em propor anatomicamente, uma orientação para identificação do ligamento que servirá de orientação para captura de imagens do ligamento discomaleolar na fissura petrotimpânica. **Métodos:** Subsidiada por dissecação cadavérica, a mensuração de planos através de secções em crânio seco através da formação de um protótipo tridimensional foi obtida. O estudo teve liberação do Departamento de Anatomia da Universidade Federal de Pernambuco. **Conclusão:** As linhas de orientação geradas a partir do estudo anatômico-topográfico são eficazes na determinação do ligamento discomaleolar em imagens radiológicas.

Palavras-chaves: Articulação Temporomandibular; Síndrome da disfunção temporomandibular; Orelha média; Radiologia

INTRODUCTION

In dental radiology, image interpretation is based on anatomical knowledge of the bones and adjacent soft tissues of the maxilla and mandible. Anatomical dissections of human cadavers verified a specific relationship between the temporomandibular joint (TMJ) capsule, articular disc, sphenomandibular ligament, and middle ear, a connection formed by the discomalleolar (DML) and anterior malleolar ligaments that join the malleus1,2.

A temporomandibular disorder may change the position of the ossicles and the tympanic membrane through joint movements, causing hearing loss and related non-otological aural symptoms1-3.

The development of the TMJ and middle ear in humans is complex and still controversial4-7,9-13.

The DML is an embryonic remnant of the lateral pterygoid muscle11. Although its existence has been demonstrated, it is not mentioned in anatomy textbooks. Several authors have described it as a fibroelastic structure, inserted into the anterior process of the malleus and lateral to the chorda tympani nerve, which establishes an anatomical relationship between the TMJ, the middle ear, and Huguier's canal2,12,13.

The most frequent signs and symptoms presented by patients with TMD are pain in the masticatory muscles and TMJ, cervical pain, noises during mandibular movements, limitations or asymmetries in these movements, otological symptoms, fracture of restorations, and dental sensitivity. Auditory symptoms can be related to TMD or other auditory diseases, which confirms the possible coexistence of auditory impairments and highlights the need to define audiological conditions in TMD8,9. A study described that the movement of the capsular ligament and disc oscillated the tympanic membrane and the middle ear ossicular chain, which can generate otological symptoms related to TMD2.

Obtaining reliable images of the structures that form the TMJ has always been a challenge for specialists. Anatomical characteristics and the overlapping of adjacent structures are the primary causes of difficulties in clear visualization, which hinder diagnosis14.

Radiological examinations of the TMJ are intended to identify or confirm morphological or functional anomalies, provide diagnostic information for disc structures, and prevent inadequate treatments14,15.

Since the DML links the TMJ to the middle ear, and auditory disorders are often related to difficult-to-diagnose TMD, this study proposed a three-dimensional boundary to identify the location of the DML via imaging examinations.

METHODS

The study was conducted at the Department of Anatomy of the Federal University of Pernambuco (UFPE) and was divided into two stages. The first stage involved cadaveric dissection to identify the DML.

A suitable cadaveric specimen containing the superficial and deep tissue layers arranged by anatomical planes was selected from the anatomy department collection. To visualize the DML in the tympanic cavity, an osteotomy was performed on the anterior wall of the petrous part of the temporal bone, and the superior wall of the tympanic cavity was removed to expose the malleus and the DML (Figure 1).

In the TMJ cavity, a retroauricular dissection of the superficial and deep layers of the TMJ was performed to visualize the neck of the mandibular condyle. Then, the condyle was sectioned for lateral rotation to expose the posterior part of the articular capsule, and the DML was visualized (Figure 2).

In the second stage, a cadaveric bone specimen was selected, and lines were traced to delimit the DML region, creating a three-dimensional plane as a reference for image acquisition, followed by the resection of the three-dimensional block.

RESULTS

A topographical study was conducted on a dry skull to identify measurement planes and delimit the region containing the DML. In the anteroposterior position, a line was drawn from the inferior border of the maxillary process of the zygomatic bone to the mastoid process (L1), and another from the superomedial border of the infraorbital foramen to the base of the sphenoidal spine (L2) (Figure 3). In the lateromedial position, a line was drawn from the center of the articular eminence of the zygomatic bone to L2 (L3), and another connecting the anterior border of the mastoid process of the temporal bone to the extension of L2 (L4) (Figure 4). To measure height, a line from the zygomatic crest of the maxillary bone to the inferior border of the external acoustic meatus served as the inferior limit (L5), while an imaginary line passing transversely through the frontozygomatic suture, parallel to Camper's plane, served as the superior limit (L6) (Figure 5). This process created a three-dimensional plane used as a reference to delimit an area containing the petrotympanic fissure and the potential location of the DML (Figure 6).

Figure 1. View of the MDL and the malleus bone.

Figure 2. View of the DML.

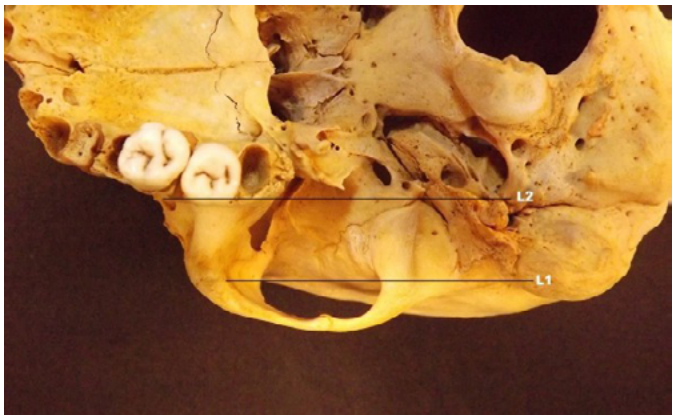

Figure 3. Line from the inferior border of the maxillary process of the zygomatic bone to the mastoid process (L1) and a line from the superomedial border of the infraorbital foramen to the base of the sphenoidal spine (L2).

Figure 4. Line (L3) from the center of the articular eminence of the zygomatic bone to L2, and another line (L4) that connects the anterior border of the mastoid process of the temporal bone to the extension of L2.

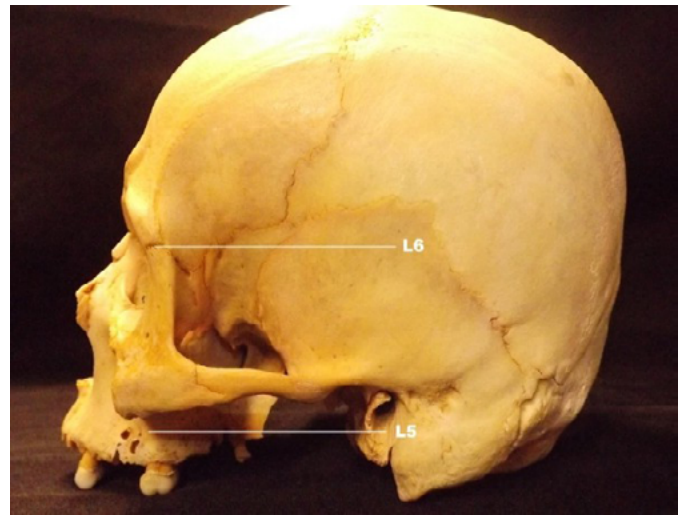

Figure 5. Line from the zygomatic crest of the maxillary bone to the inferior border of the external acoustic meatus (L5), and an imaginary line (L6) passing transversely through the frontozygomatic suture, parallel to Camper's plane.

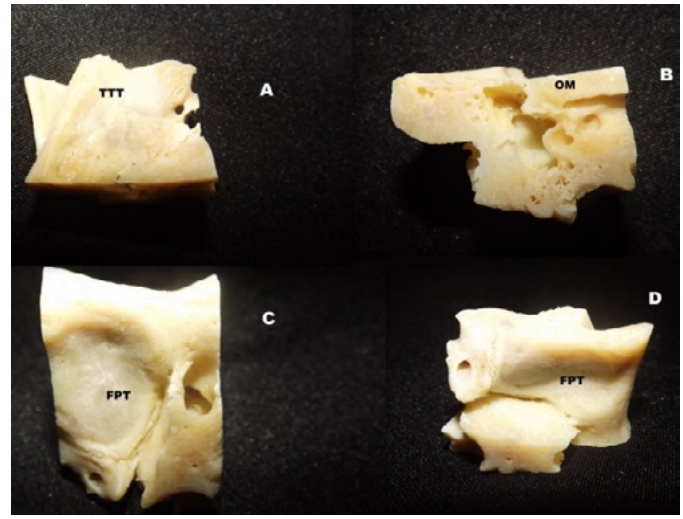

Figure 6. A: *tegmen tympani* (TTT) - superior view; B: Middle ear (ME) - posterior view; C: petrotympanic fissure (PTF) - lateral view; D: petrotympanic fissure (PTF) - inferior view.

COMMENTARY

Several authors describe the DML extending posteriorly from the TMJ disc and capsule, passing through the petrotympanic fissure, and joining the malleus. The findings showed that the DML inserts into the posterior portion of the disc and articular capsule, originating from the anterior region of the malleus and passing through the petrotympanic fissure, corroborating the literature[2,7].

Dissections have shown that the anterior malleolar ligament is present in the petrotympanic fissure[12]. Another study describes the DML as originating in the tympanic cavity and extending toward the lateral portion of the tympanic fissure[13]. Through the study of a dry skull and the measurement of the planes bordering this fissure, an image for the visualization of the DML may be created.

Detailed dissections of postmortem specimens using a superior approach through the middle cranial fossa, rather than the classic lateral approach, have been described[2]. In these dissections, the tissue was limited posteriorly by an imaginary line between the internal and external auditory meati, medially by a line between the internal auditory canal and the foramen ovale, anteriorly by a straight line passing mediolaterally through the foramen ovale perpendicular to the anterior line, and laterally by another straight line from the external acoustic meatus joining the anterior line. This imaginary rectangle formed within the middle cranial fossa contains part of the middle ear, the TMJ, and related structures. The floor of the middle cranial fossa and the roof of the tympanic cavity were carefully removed to expose the TMD meniscus, the chorda tympani nerve, middle ear ossicles, the external pterygoid muscle, tympanic membrane, auditory tube, and other structures in the region[2]. In the cadaveric dissection, a petrous approach was chosen to observe the structures of the middle ear and TMJ, enabling visualization of the DML, the capsule and meniscus of the TMJ, and the malleus bone.

In the topographical study using a dry skull and cadaveric dissection, a three-dimensional bone structure containing the petrotympanic fissure, the passage site of the ligament, was delimited. The tracings resulted in a region defined by an anterior coronal section at the geometric center of the articular eminence of the mandibular condyle and a posterior coronal section tangent to the lateromedial depth of the auditory canal. The region was also delimited by two transverse sections: one tangent to the superior border of the petrous temporal bone, and the other tangent to the neck of the mandibular condyle. This bone block was created to guide the sections used for image acquisition and to capture the DML path from the middle ear to the posterosuperomedial border of the TMJ articular capsule.

CONCLUSION

This study proposed that the DML may be identified in imaging examinations by a three-dimensional plane, containing the petrotympanic fissure, formed by tracing lines L1, L2, L3, L4, L5, and L6.

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