

Macroscopic Analysis of the Insertion Points of the Lateral Pterygoid Muscle in Adult Individuals

Análisis Macroscópico de los Lugares de Inserción del Músculo Pterigoideo Lateral en Individuos Adultos

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SUMMARY: The lateral pterygoid muscle (LPM) is intimately related with the temporomandibular joint (TMJ), playing an important role in its physiology. This makes it of interest to researchers who investigate temporomandibular disorders. The literature indicates that anatomical variations exist in the insertion of the superior fascicle of the LPM. Imaging and cadaver studies have revealed that the LPM may present an accessory fascicle. The study object was to carry out macroscopic analysis of the LPM, examining the origin and insertion of its superior and inferior fascicles. The study used 38 half-heads of adult individuals fixed in formaldehyde 10 %. To carry out macroscopic analysis of the LPM, an initial incision was made along the lower margin of the zygomatic arch; the origin of the masseter muscle was then dissected, separating its insertion on the lateral face of the mandibular ramus and retracting the muscle to posteroinferior. Two incisions were made on the zygomatic arch and the insertion of the temporal muscle on the coronoid process was identified with dissection pincers; it was dissected to gain access to the infratemporal fossa and the two fascicles of the LPM. The superior fascicle (SF) originated on the infratemporal face of the greater wing of the sphenoid, and on the superior third of the lateral face of the lateral lamina of the pterygoid process of the sphenoid in 26 samples. In 12 samples, it originated on the greater wing of the sphenoid and the infratemporal crest of the sphenoid. Type I insertion was found in 20 samples, Type II in 6 samples and Type III in 12 samples. In all the samples analysed, the inferior fascicle (IF) originated on the inferior two thirds of the lateral face of the lateral lamina of the pterygoid process and on the lateral face of the pyramidal process of the palatine, with insertion on the pterygoid fovea. The accessory fascicle (AF) of the LPM was present in 6 samples. The AF originated on the greater wing of the sphenoid in 2 cases and inferior to the superior fascicle in 4 cases; its insertion was on the capsular disc complex in all cases. The results obtained in our study contribute anatomical data on the LPM in Brazilian adult individuals, with evaluation of its insertion points.

KEY WORDS: Lateral pterygoid muscle; Anatomical variations; Cadaver.

INTRODUCTION

The lateral pterygoid muscle (LPM) is intimately related with the temporomandibular joint (TMJ), and consequently plays an important role in the physiology of this joint. This makes it of interest to researchers who investigate temporomandibular disorders (Alves & Cândido, 2016). In the literature it has been described as a muscle with two insertions of origin (fixed points) or two heads, one superior and one inferior (Pompei Filho *et al.*, 2010); a third head may be present (Pompei Filho *et al.*, 2010; Torres-Villar *et al.*, 2021). It has also been described as a muscle

with two fascicles, one superior and one inferior. The superior fascicle has been described as having its origin (insertion) on the lateral face of the greater wing of the sphenoid and the infratemporal crest (Langton & Eggleton, 1992; Rouvière & Delmas, 2002; Kendall *et al.*, 2005). Its terminal insertion (mobile point) has been widely discussed and studied in recent years, with three possible types: Type I insertion occurs on the pterygoid fovea and on the capsule of the TMJ; Type II occurs only on the pterygoid fovea and Type III occurs only on the capsule of the

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TMJ (Naidoo & Juniper, 1997; Antonopoulou *et al.*, 2013). The inferior fascicle originates on the lateral face of the lateral lamina of the pterygoid process and on the lateral face of the pyramidal process of the palatine, and is inserted on the pterygoid fovea (Norton, 2007; Alves & Cândido, 2016). The study object was to carry out macroscopic analysis of the LPM, examining the origin (fixed point) and insertion (mobile point) of its superior and inferior fascicles.

MATERIAL AND METHOD

Thirty-eight half-skulls of adult individuals were examined, 19 right side and 19 left side, fixed in formaldehyde 10 %, belonging to the Laboratory of Human Anatomy of the Institute of Biological Sciences and Health of Universidade Federal de Alagoas, Maceió, Brazil. To carry out macroscopic analysis of the LPM, an initial incision was made along the lower margin of the zygomatic arch; the origin of the masseter muscle was then dissected, separating its insertion on the lateral face of the mandibular ramus and retracting the muscle to posteroinferior. Two incisions were made with a rongueur along the zygomatic arch: the anterior incision was at the limit between the body and the temporal process of the zygomatic bone; the posterior incision was made on an imaginary vertical line at the level of the axis of the neck of the mandible. The insertion of the temporal muscle on the coronoid process was identified with dissection pincers and dissected to gain access to the infratemporal fossa. Vasculo-nervous elements in of the region were eliminated, and the two fascicles of the LPM were identified using the buccal nerve as a reference.

RESULTS

Thirty-eight samples (half-skulls) were analysed, of which 19 were right side (50 %) and 19 left side (50 %). A total of 32 samples (84 %) presented 2 fascicles of the LPM (superior and inferior), while in 6 samples (16 %) 3 fascicles were observed (superior, inferior and accessory).

Superior fascicle (SF) of the LPM. The SF of the LPM originated on the infratemporal face of the greater wing of the sphenoid, and on the superior third of the lateral face of the lateral lamina of the pterygoid process of the sphenoid in 26 samples (68 %). In 12 samples (32 %), it originated on the greater wing of the sphenoid and the infratemporal crest of the sphenoid. For the terminal insertion (mobile point), Type I was found in 20 samples (52 %), viz. 10 on the right side and 10 on the left; Type II was found in 6 samples (16

%), 5 on the right side and 1 on the left; and Type III in 12 samples (32 %), 4 on the right side and 8 on the left.

Inferior fascicle (IF) of the LPM. In all the samples analysed, the IF of the LPM originated on the inferior two thirds of the lateral face of the lateral lamina of the pterygoid process and on the lateral face of the pyramidal process of the palatine, with insertion on the pterygoid fovea.

Accessory fascicle (AF) of the LPM. The AF of the LPM was present in 6 samples (16 %), 3 on the right side and 3 on the left side. The origin of the AF was on the greater wing of the sphenoid in 2 cases (33 %) and inferior to the superior fascicle in 4 cases (67 %). The insertion of the AF was on the capsular disc complex in all cases.

DISCUSSION

The lateral pterygoid muscle (LPM) is very important in mandibular movements; it has classically been considered to consist of a superior and an inferior head (Pompei Filho *et al.*, 2010; Alves & Cândido, 2016), with the possible presence of a third head (Pompei Filho *et al.*, 2010; Torres-Villar *et al.*, 2021). It has also been described as a muscle with two fascicles, one superior and one inferior (Rouvière & Delmas, 2002; Alves & Cândido, 2016).

The SF of the LPM, according to some authors, originates on the infratemporal face of the greater wing of the sphenoid, while the IF of the LPM originates on the lateral face of the lateral lamina of the pterygoid process (Madeira, 2001; Usui *et al.*, 2008; Matsunaga *et al.*, 2009). In our study, the SF of the LPM originated on the infratemporal face of the greater wing of the sphenoid, and on the superior third of the lateral face of the lateral lamina of the pterygoid process of the sphenoid in 26 samples (68 %). In 12 samples (32 %), it originated on the greater wing of the sphenoid and the infratemporal crest of the sphenoid. In all the samples analysed, the IF of the LPM was observed to originate on the inferior two thirds of the lateral face of the lateral lamina of the pterygoid process and on the lateral face of the pyramidal process of the palatine.

Turning to the insertion of the SF of the LPM, there are authors in the literature who state that in most cases it is inserted on the pterygoid fovea (Type II) and in a smaller number of cases on the anteromedial portion of the disc and on the articular capsule of the TMJ (Type III) (Usui. *et al.*, 2008; Matsunaga *et al.*, 2009; Coskun *et al.*, 2009). Other authors state that it is inserted on the pterygoid fovea and on the capsule of the TMJ (Type I) (Madeira, 2013; Alves &

Cândido, 2016). In the present study, the terminal insertion of the SF (mobile point) was found to be distributed as follows: Type I in 20 samples (52 %), viz. 10 on the right side and 10 on the left; Type II in 6 samples (16 %), 5 on the right side and 1 on the left; and Type III in 12 samples (32 %), 4 on the right side and 8 on the left. In the case of the IF, some authors assert that it is inserted on the pterygoid fovea and on the anteromedial portion of the condylar process of the mandible (Usui. *et al.*, 2008; Coskun *et al.*, 2009). In all the samples examined in the present study, the IF of the LPM was inserted on the pterygoid fovea.

Comparing our results with the data available in the literature, we may conclude that some discrepancies exist, mainly in the insertion of the SF of the LPM. This may be explained by the different dissection techniques used in works in which the LPM was studied in cadavers. Another aspect that must be borne in mind is that the studies in cadavers were carried out in different populations, each with its own ethnic characteristics. Finally, we can say that the results obtained in our study contribute anatomical data on the LPM in Brazilian adult individuals, with evaluation of its insertion points.

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RESUMEN: El músculo pterigoideo lateral (MPL) presenta íntima relación con la articulación temporomandibular (ATM) y desempeña un rol importante en la fisiología de esta articulación, despertando el interés de investigadores que se dedican al estudio de los trastornos temporomandibulares. La literatura señala que existen variaciones anatómicas del MPL, con respecto a la inserción del fascículo superior. Los estudios cadavéricos e imagenológicos han revelado que el MPL puede presentar un fascículo accesorio. El objetivo del estudio fue realizar un análisis macroscópico del MPL, examinando el origen e inserción de sus fascículos superior e inferior. Se utilizaron 38 hemicabezas de individuos adultos fijadas en formaldehído al 10 %. Para realizar el análisis macroscópico del MPL se realizó inicialmente una incisión a lo largo del margen inferior del arco cigomático, luego se seccionó el origen del músculo masétero separando su inserción en la cara lateral de la rama de la mandíbula, retrayendo al músculo en sentido posteroinferior. Se hicieron dos cortes en el arco cigomático y con pinzas de disección se identificó la inserción del músculo temporal en el proceso coronoides, el cual se seccionó para ingresar a la fosa infratemporal y acceder a ambos fascículos del MPL. El fascículo superior (FS) del MPL se originó en la cara infratemporal del ala mayor del esfenoides y en el tercio superior de la cara lateral de la lámina lateral del proceso pterigoideo del esfenoides en 26 muestras. En 12 muestras se originó en el ala mayor del esfenoides y cresta infratemporal del esfenoides. Con

relación a su inserción, se encontró el Tipo I en 20 muestras; el Tipo II en 6 muestras y el Tipo III en 12 muestras. En todas las muestras analizadas el origen del fascículo inferior (FI) del MPL fue en los dos tercios inferiores de la cara lateral de la lámina lateral del proceso pterigoideo y en la cara lateral del proceso piramidal del palatino insertándose en la fovea pterigoidea. El fascículo accesorio (FA) del MPL estuvo presente en 6 muestras. El FA se originó en el ala mayor del esfenoides en 2 casos e inferior al fascículo superior en 4 casos y su inserción, en el complejo disco capsular en todos los casos. Mediante los resultados obtenidos en nuestro estudio estamos aportando datos anatómicos en relación al MPL en individuos brasileños adultos, evaluándolo con respecto a sus lugares de inserción.

PALABRAS CLAVE: Músculo pterigoideo lateral; Variaciones anatómicas; Cadáver

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