

Original Article

Interrelation of temporal fascia, temporalis and masseter muscles

M.F. Sargon*, S. Selvi, M. Farımaz, H. Akdemir Aktaş

Department of Anatomy, Faculty of Medicine, Hacettepe University, Ankara, Turkey



ARTICLE INFO

Article history:

Received 18 November 2016

Accepted 31 October 2018

Available online 1 November 2018

Keywords:

Temporal fascia
 Temporalis muscle
 Masseter muscle
 Interrelation
 Anatomy
 Human cadaver

ABSTRACT

Introduction: In the study; interrelation in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter were examined in order to detect the possible different relationships in between them.

Methods: Interrelation in between the distal part of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter were examined in six fresh frozen and four embalmed head-neck specimens bilaterally. Three of the specimens were female and seven of them were male. Their ages varied between 76 to 83 years. In all of the 20 dissections; the zygomatic arch was removed and the interrelation in between these anatomical structures were demonstrated.

Results: In the gross anatomic examination, three different types of interrelation was found. In the first type, there was no continuity or connection in between the temporalis muscle and the muscle fibers of deep layer of masseter. In all of them; masseter formed the superficial relation of temporalis muscle. In the second type; the deep layer of masseter was connected to the temporalis muscle's distal fibers and all these fibers coursed as a single muscle. Both muscles' fibres were inserted into the coronoid process. This type was present both unilaterally and bilaterally. In the third type, the temporal fascia was inserted to the coronoid process, together with the temporalis muscle.

Discussion: Awareness of the surgeons about the high ratio of these types of interrelations will affect the success of the surgery.

© 2018 Published by Elsevier, a division of RELX India, Pvt. Ltd on behalf of Anatomical Society of India.

1. Introduction

The temporalis and masseter form two of the major masticatory muscles. Temporalis muscle attaches to the coronoid process and anterior border of mandibular ramus. The deep layer of masseter arising from the deep surface of zygomatic arch also has an insertion to the coronoid process and ramus of mandible. Above the coronoid process, is located the two laminae of deep temporal fascia. These two laminae run downwards to attach to the medial and lateral margins of the upper surface of zygomatic arch.^{1,2} The muscle segments arising from the deep masseter portion appear at the distal margin under the superficial fibers. They run almost vertically (including an angle of 10° from the vertical) from ventrocaudal to dorsocranial, and from anteroinferior, they reach the discus and fan out to the caput, collum, and capsule. The insertion of temporalis muscle is in the anterolateral area and the insertion of masseter is in the lateral area of the discus. The shape

and extent of the muscle insertions exhibit large, individual variations.³

According to the classical anatomy text-books; masseter forms the superficial relation of temporalis muscle.^{1,2} In the study; interrelation in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter were examined in order to detect the possible different relationships in between them. The detailed anatomical examination of the interrelation in between these three structures around the zygomatic arch will have an importance for the surgical approaches to the temporalis muscle tendon. Unawareness of the surgeons about the presence of these types of interrelations will affect the success of their surgery. Therefore; the study was carried out in order to prevent the injuries of these anatomical structures around the zygomatic arch during surgical procedures (Table 1).

2. Materials and methods

Interrelation in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter were examined in six fresh frozen and four embalmed head-neck specimens bilaterally. Totally, 20 specimens were studied. Three of the specimens were female and seven of

* Corresponding author at: Department of Anatomy, Faculty of Medicine, Hacettepe University, Ankara, 06100, Turkey.

E-mail address: mfsargon@hacettepe.edu.tr (M.F. Sargon).

Table 1

Types of interrelations observed in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter.

Interrelation type	Type I	Type II	Type III
Number of head and neck specimens observed	16 sides	3 sides	1 side

them were male. Their ages varied between 76 to 83 years. All of the head and neck specimens were normal in gross anatomic appearance and none of them had any surgical incisions or deformities. All procedures were approved by the Ethical Committee of Hacettepe University, Faculty of Medicine and the study was conducted in the gross anatomy dissection laboratory of Department of Anatomy, Faculty of Medicine, Hacettepe University.

2.1. Dissection

The dissection was performed in between the inferior temporal line and corner of mouth. Following the incision, the skin, soft tissues and superficial fasciae were removed. After observing the temporal fascia, its course and relations were examined. Then; in all of the 20 dissections; the zygomatic arch was removed and the interrelation in between the temporalis, muscle fibers of the deep layer of masseter and deep layer of temporal fascia were studied in order to detect the possible different relationships in between them.

3. Results

In the gross anatomic examination of the interrelation in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter; three different types of interrelation were found. In the first type of interrelation, it was observed that there was no continuity or connection in between the temporalis muscle and the muscle fibers of deep layer of masseter arising from the deep surface of zygomatic arch. In this type; the temporal fascia was also normal

anatomically. First type was present in 16 sides of the head and neck specimens and in all of them; masseter muscle formed the superficial relation of temporalis muscle (Fig. 1). In the second type; the deep layer of masseter arising from the deep surface of zygomatic arch was connected to the temporalis muscle's distal fibers which were located below the zygomatic arch. It was impossible to differentiate them from each other and all these fibers coursed as a single muscle. Both muscles' fibres were inserted into the coronoid process (Figs. 2 and 3). In the second type; the temporal fascia was normal anatomically. The second type was observed in three of the head and neck specimens. In one of these specimens; it was bilaterally observed and in two of them, it was seen unilateral, on one side of the specimen. The third type of interrelation was related with the temporal fascia. It was observed unilaterally on the right side of a male fresh frozen head and neck specimen. In this specimen, the temporal fascia was inserted to the coronoid process, together with the temporalis muscle. The course of temporalis and the muscle fibers of deep layer of masseter were similar with type one in this specimen (Fig. 4).

4. Discussion

Around the zygomatic arch are found many anatomical structures and the interrelation in between them are very important clinically. O'Brien and Ashton studied the relationship of the temporofrontal rami of the facial nerve to the fascial layers in the temporal region. The authors concluded that the dissection of the fascia above the zygomatic arch might form a risk for the nerve.⁴ Lee et al. searched the gross anatomy of the temporalis muscle and distinguished the superficial layer of temporalis muscle from the deep layer clearly. This was an important finding

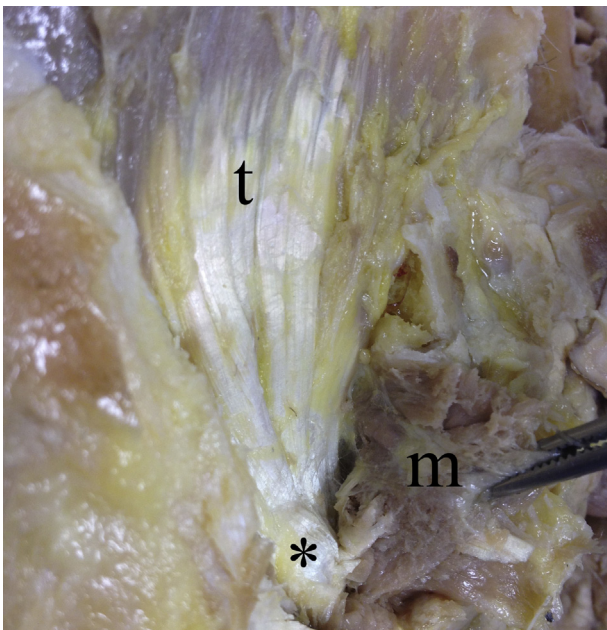
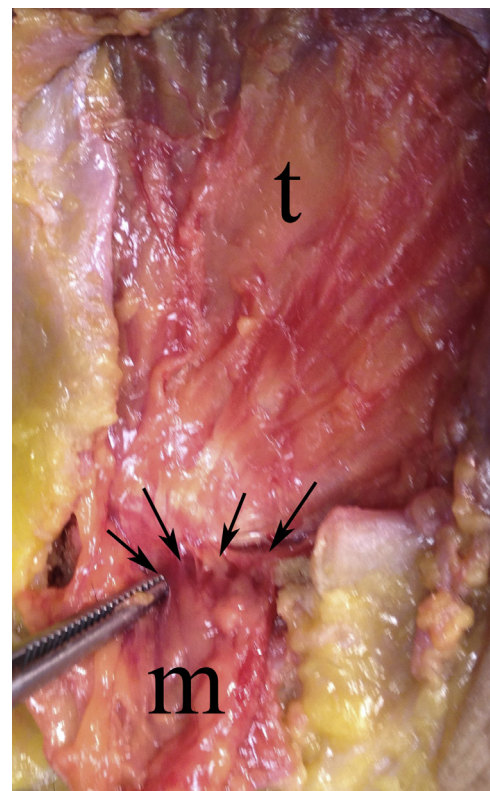
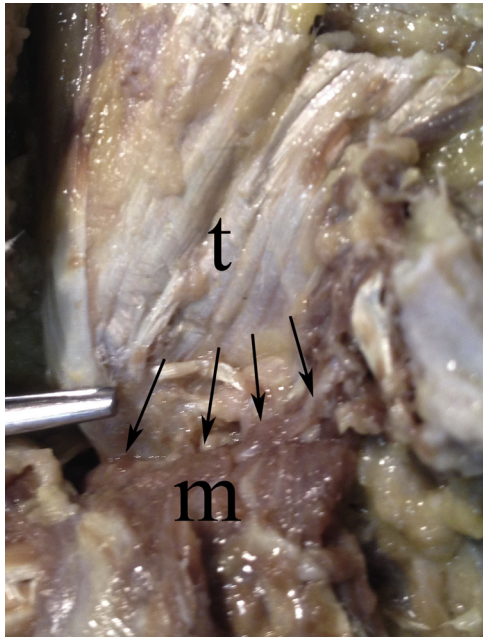


Fig. 1. Photograph showing type 1 interrelation.
t: Temporalis muscle
m: Masseter muscle coursing superficial to temporalis (deviated)
*: Coronoid process



Figs. 2 and 3. Photographs showing type 2 interrelations.
t: Temporalis muscle
m: Masseter muscle
arrows: Fibers of masseter connected to temporalis



Figs. 2 and 3. (Continued)

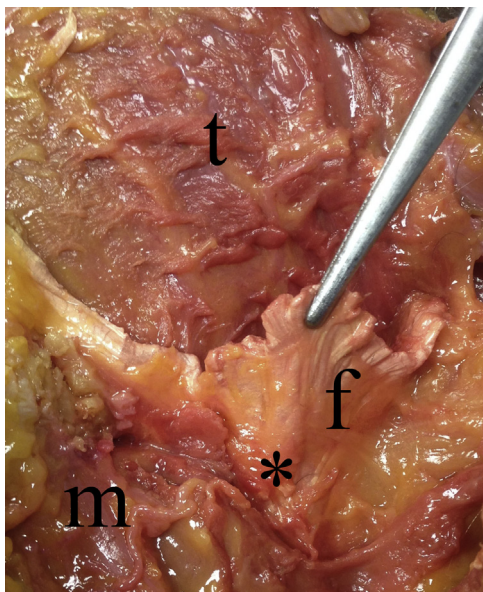


Fig. 4. Photograph showing the temporal fascia (f) inserting to the coronoid process (*) (type 3 interrelation).

t: Temporalis muscle
m: Masseter muscle

for preventing temporal hollowing during related surgical procedures.⁵ Beheiry and Abdel-Hamid examined the detailed anatomy of temporal fascia and related vessels which had a clinical importance in the temporalis myofascial flap surgery.⁶ In the study of Hwang and Kim, the precise anatomic relations between the temporal fascia and the zygomatic arch were studied in 16 cadavers. The study demonstrated that the superficial and deep layers of temporal fascia fused and inserted onto the superior margin of the arch in 56% and onto the superolateral surface in 44% of the cases.⁷ Wormald and Alun-Jones studied the superficial and deep layers of temporal fascia by light microscopy and found no histological difference in between them.⁸ Ullah and Khan described an anomalous muscle within the infratemporal fossa,

adjacent to temporalis and discussed its functional importance.⁹ Weijs reported the strong correlation in between the loading pattern of temporomandibular joint and relative sizes of masseter, temporalis and medial pterygoid muscles.¹⁰ Guerrecchi et al. searched the termination of masseter muscle over the deep surface of the temporal fascia and looked out the wrong path. In the study; muscle fibers of masseter which passed up to the zygomatic arch and terminated on the deep surface of the temporal fascia were observed in three cadavers.¹¹ Labbé and Huault reported a surgical technique of myoplasty of the temporalis muscle applied to the treatment of peripheral facial paralysis. The technique consisted of a muscle lengthening, using the totality of temporalis muscle and the transfer of its tendon attached to the coronoid process directly to the lips.¹²

The studies found in the literature clearly demonstrate the surgical clinical importance of the region around the zygomatic arch. The goal of the present study was to prevent the injuries of distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter around the zygomatic arch during surgical procedures. In the present study, the interrelation in between these three anatomical structures was examined and three different types of anatomical relations were reported. The type two interrelation described in this study is especially important for the surgical approaches related to temporalis muscle. Awareness of the surgeons about the high ratio of type two relationship will help to the surgeons during surgical approaches. Additionally; the type two relationship will also increase the temporal strength. The type three interrelation which is observed in one case also has an importance for the surgical procedures related to distal part of temporal fascia.

5. Conclusion

In conclusion; interrelation in between the distal part of deep layer of temporal fascia, temporalis muscle and the muscle fibers of deep layer of masseter must be well known for the surgical approaches around the zygomatic arch. In the literature; we could not be able to find a study describing the close interrelation in between these three anatomical structures. Therefore; the three different types of anatomical relations described in the study will take the attention of the clinicians. Awareness of these types of interrelations will affect the success of the surgery.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

We would like to send our special thanks to the cadaver bodies that were used in our research study.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- Moore KL, Dalley AF. 4th ed. *Clinically oriented anatomy*, 917 Philadelphia: Lippincott Williams and Wilkins; 1999:921.
- Standring S. Editor in Chief. 39th ed. *Gray's anatomy*, 499 Edinburgh: Elsevier Churchill Livingstone; 2005:519–520.
- Bade H. The function of the disco-muscular apparatus in the human temporomandibular joint. *Ann Anat.* 1999;181:65–67.10.1016/S0940-9602(99)80092-2.
- O'Brien JX, Ashton MW. Relationship of the temporofrontal rami of the facial nerve to the fascial layers of the temporal region. *Ann Plast Surg.* 2012;68:547–548.10.1097/SAP.0b013e318221b563.
- Lee JY, Kim JN, Kim SH, et al. Anatomical verification and designation of the superficial layer of the temporalis muscle. *Clin Anat.* 2012;25:176–181.10.1002/ca.21212.

6. Beheiry EE, Abdel-Hamid FA. An anatomical study of the temporal fascia and related temporal pads of fat. *Plast Reconstr Surg.* 2007;119:136–144.
7. Hwang K, Kim DJ. Attachment of the deep temporal fascia to the zygomatic arch: an anatomic study. *J Craniofac Surg.* 1999;10:342–345.
8. Wormald PJ, Alun-Jones T. Anatomy of the temporalis fascia. *J Laryngol Otol.* 1991;105:522–524.
9. Ullah M, Khan T. Anomalous muscle adjacent to temporalis. *Clin Anat.* 2006;19:648–650.
10. Weijs WA. The functional significance of morphological variation of the human mandible and masticatory muscles. *Acta Morphol Neerl Scand.* 1989;27:149–162.
11. Guerreschi P, Gahagnon T, Vacher C, et al. Masseter muscle termination over the deep surface of the temporal fascia: look out the wrong path. *Surg Radiol Anat.* 2011;33:863–868. [10.1007/s00276-011-0882-y](https://doi.org/10.1007/s00276-011-0882-y).
12. Labbe D, Huault M. Lengthening temporalis myoplasty and lip reanimation. *Plast Reconstr Surg.* 2000;105:1289–1297.