# Real Function of Superior Head of Lateral Pterygoid Muscle by Magnetic Resonance Imaging¶

## *MUSCULUS PTERYGOIDEUS LATERALIS'İN ÜST KARNININ ESAS FONKSİYONUNUN MANYETİK RESONANS METODU İLE BELİRLENMESİ*

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**Summary**

**Purpose:** This study aims to clarify the real function of superior lateral pterygoid muscle.

**Material and Method:** In this study, Magnetic Resonance Imaging Technique (MRI) was used and the real function of superior lateral pterygoid muscle of thirty volunteers (13 males and 17 females) ranging in age from 20 to 57 were investigated.

**Results and Conclusions:** Our results indicated that the superior lateral pterygoid muscle is active while the mouth is open.

**Key Words:** Superior lateral pterygoid muscle, Magnetic resonance imaging

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**Özet**

**Amaç:** Bu çalışmanın amacı, m. pterygoideus lateralis'in üst karnının esas fonksiyonunu ortaya koymaktır

**Materyal ve Metod:** Çalışmamızda manyetik resonans tekniği kullanılmış ve yaşları 20-57 arasında değişen otuz gönüllünün (13 erkek, 17 kadın) m. pterygoideus lateralis'inin üst karnının esas fonksiyonu araştırılmıştır.

**Bulgular ve Sonuç:** M. pterygoideus lateralis'in üst karnının ağız açık olduğu zaman aktif olduğu tesbit edilmiştir.

**Anahtar Kelimeler:** M. pterygoideus lateralis'in üst karnı, Manyetik resonans tekniği

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M. pterygoideus lateralis, particularly in man, is a triangular muscle with a history of controversy. It has been described as a single unit (1-5), but it has also been widely accepted as a double - headed muscle (5-14).

The upper head or superior lateral pterygoid muscle is considerably smaller than the lower head or inferior lateral pterygoid muscle. It originates at infratemporal surface of the greater sphenoid wing, extending almost horizontally, backward and outward to insert on pterygoid fovea of the mandibular condyle, the articular disc and capsule (3,4,9,10,12,14,15). The inferior lateral pterygoid muscle originates at outer surface of the lateral pterygoid plate and extends backward, upward and outward to its insertion primarily on the neck of the condyle (3,9,10,12,14). Two heads of the lateral pterygoid muscle make a unique contribution to jaw movement control by virtue of their attachments to temporomandibular joint disc and condyle (16). However, there are some confliction for the function of two heads of this muscle. Some authors

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stated that the mandible are protruded by the two heads which are opening muscle of the chin (14,17). The others revealed that the inferior lateral pterygoid muscle is only active during opening, the superior lateral pterygoid muscle remains inactive, becoming active only is conjunction with the elevator muscles (3,11).

A number of studies, including electromyography (EMG), have investigated the function of the lateral pterygoid muscle. However the real function of the superior head has not been resolved yet due to its deep placement (18-23). Birou (24) has investigated the lateral pterygoid muscle by Tomodensitometry (TDM) and Magnetic Resonance Imaging (MRI). The author stated that MRI is better than TDM because of its three dimensional aspect.

This study aims to clarify the real function of the superior head of the lateral pterygoid muscle using MRI.

## Materials and Methods

The study was performed on 30 musculoarticular areas of healthy subjects (13 males and 17 females) aged from 20 to 57 years. Data were collected by the same person throughout the study. Clinical examination did not reveal any craniomandibular disorders or any muscular spasms.

For each exploration, two mandibular positions were defined:

1. The position of the chin with lips closed and the condyle placed in the mandibular fossa.

2. The position of the chin with lips opened and the condyle on the articular eminence.

Volunteers were examined with a 1.5 T Siemens Magnetom Vision MRI system. All images were focused into the infratemporal fossa. First axial images of infratemporal fossa with 4 mm slice thickness are obtained with a T1W sequence (TR: 352 ms, TE: 12 ms). After localizing the superior head of lateral pterygoid muscle on transvers images, sagittal oblique images with 3 mm slice thickness (TR: 352 ms, TE: 12 ms) parallel to this muscle were obtained with mouth closed position. Afterwards the volunteer was required to open his/her mouth with an apparatus of 3 cm thickness (if it was possible for the volunteer to open his/her mouth more than this, then the images were obtained with the mouth wide open position instead of using the apparatus) and the same sagittal oblique images were obtained. The MRI system used, which gives to run like the same sequence as many times as, it makes possible to examine the same coordinates with the mouth closed and open positions. And on these sagittal oblique images, the length of superior head of the lateral pterygoid muscle of each volunteer was measured from crista infratemporalis to temporomandibular joint disc with the mouth open and closed positions. The vertical lengths of these muscles were also measured on its largest portion on both positions (this time we did not measured the same coordinates since when the muscle contracts, the position of its largest portion changes due to contraction).

The sagittal and vertical lengths of the superior lateral pterygoid muscle were measured for each position (Figure 1). Morphometric values were obtained and statistically evaluated by the " paired -samples t test" (25).

## Results

The inferior and superior heads have a strong opening action as expected. Sagittal and vertical

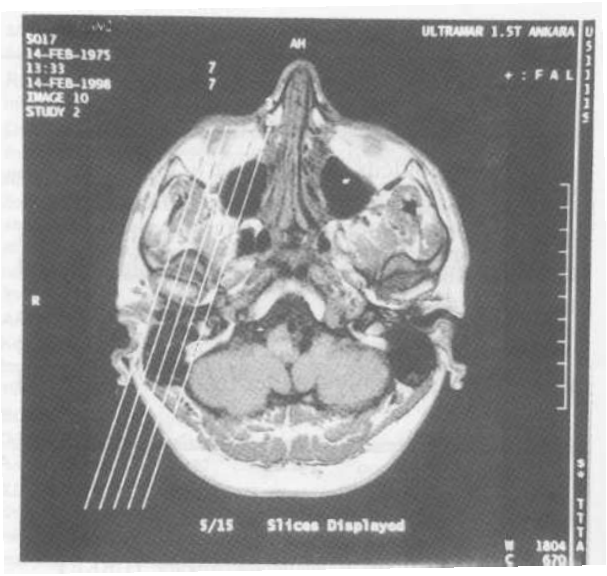


**Figure 1a.** On transvers T1W images, shows a superior head of lateral pterygoid muscle, and used these images as a localizer to our sagittal oblique images.

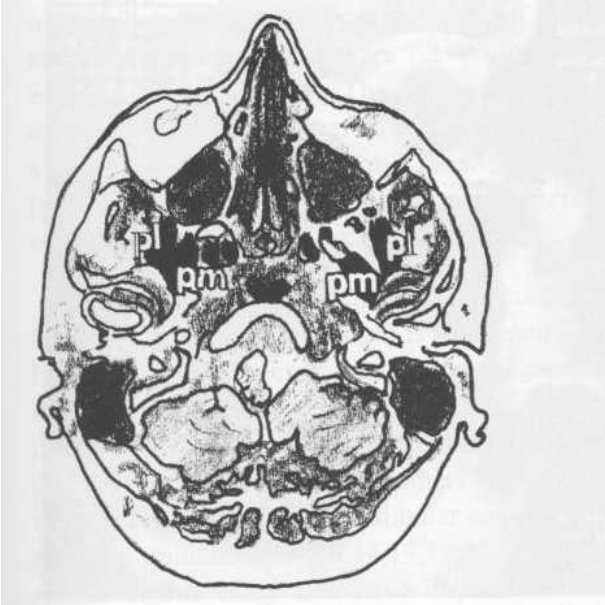


**Figure 1b.** Scheme of figure 1a.

lengths of the muscle are presented in Table 1 for the open and closed positions of the mouth. The mean sagittal length of the superior lateral pterygoid muscle is 23. 6 ± 0.45 mm., 27. 3 ± 0.34 mm. in the open and closed mouth, respectively. The mean vertical length of the superior lateral pterygoid muscle of the open and closed mouth position are 7.2 ± 0.36 mm., 5.4 ± 0.33 mm. respectively.

Difference between open and closed mouth was statistically found to be significant for sagittal and vertical lenghts ($p<0.01$). Indicating that muscle length is decreased, when the mouth is open.

## Discussion

The lateral pterygoid muscle in man is triangular shaped and has two distinct anatomical heads (4,9,10,14). Birou et al. (26) have studied the relationship between anatomic and CT sections of the lateral pterygoid muscle in anatomic specimens. Anatomic and CT sections show that three parts can be distinguished. The head classically called pterygoid being itself divided into two parts by a septum.

The superior lateral pterygoid muscle is of particular interest because it inserts in pterygoid fovea of the mandibular condyle, the articular disc and capsule (4,9,10,14,15).

Activity of superior lateral pterygoid muscle in relation to the function of other jaw muscles seems to be important in mandibular condyle- disc coordination of temporomandibular joint and muscle pain (9,10).

Although researchers generally agree on the function of inferior lateral pterygoid muscle, there is conflicting reports in the literature with respect to function of the superior lateral pterygoid muscle (3,11,16,20,27).

The lack of certainty about the structural organization of this muscle makes it difficult to understand how it functions and what the electro-myographic recording actually represents. Electromyo-graphic evidence indicates that the superior head is active during closing movements (3,6,11,28). However, Auf der Maur (29) revealed that the electrode was positioned wrongly in the temporal muscle. In addition, Carpentier et al. (2) stated that the location of electrodes recording muscle activity remains questionable, at least in human research.

In this study, we determined the real function of the superior lateral pterygoid muscle by MRI.

**Table 1.** The sagittal and vertical lengths of the superior lateral pterygoid muscle are shown (mm). (Minimum and maximum values are given in paranthesis)

| | SAGITTAL | | VERTICAL | |
|---|---|---|---|---|
| | Open | Closed | Open | Closed |
| Means and SEM | 23.6 ± 0.45<br>(20.0-28.0) | 27.3 ± 0.34<br>(24.0-30.0) | 7.2 ± 0.36<br>(3.0-11.0) | 5.4 ± 0.33<br>(3.0-9.0) |

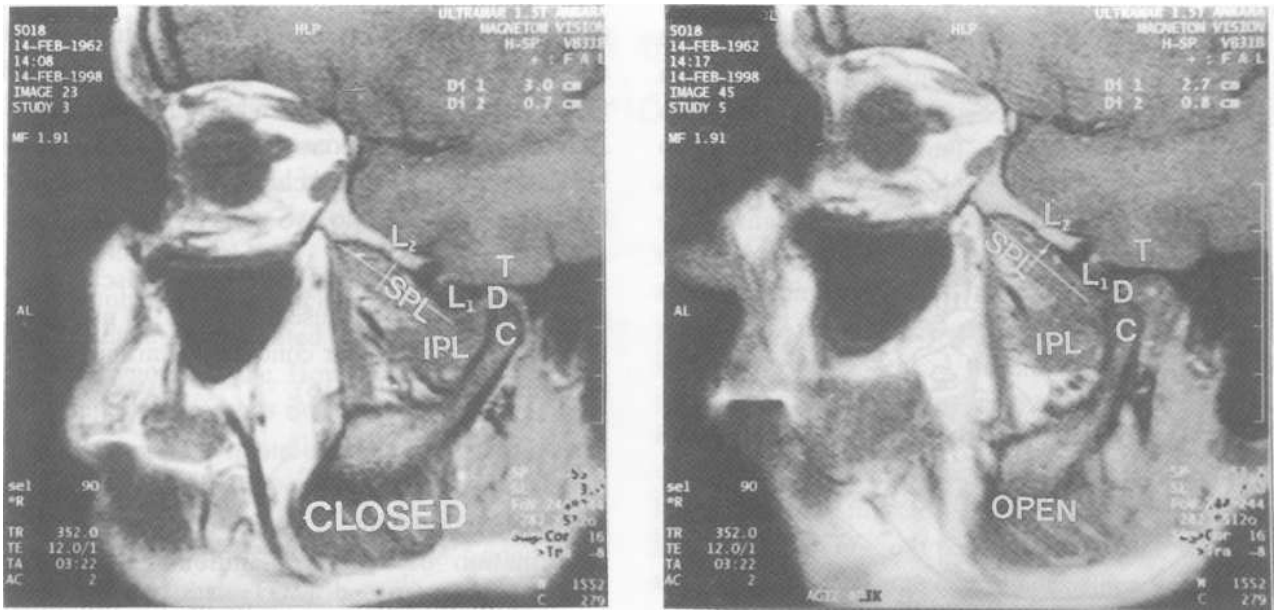


**Figure 2a-b.** On sagittal oblique image, shows the measurements of the length of the muscle from crista infratemporalis to temporomandibular joint disc with the mouth closed (a) and open (b) positions. The figure also shows the vertical length of the muscle on both positions.

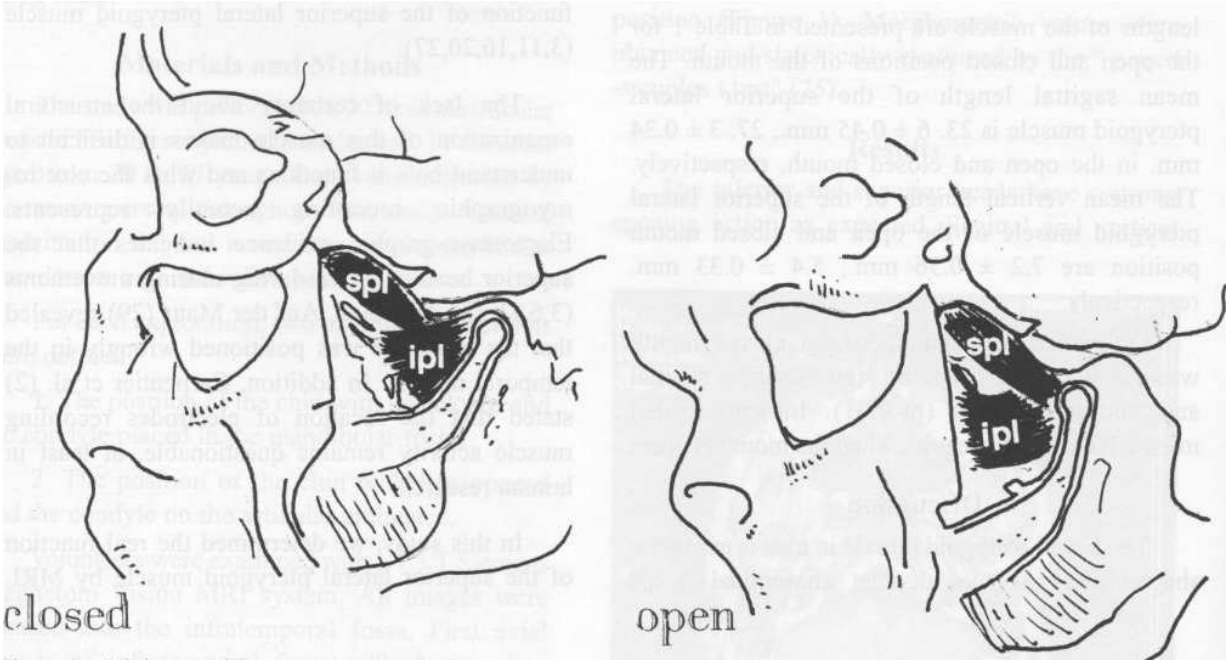


**Figure 2c-d.** Schemes of figures 2a-b, respectively.

L1 = Sagittal length
L2 = Vertical length
SPL = Superior Lateral Pterygoid muscle
IPL = Inferior Lateral Pterygoid muscle
D = Disc
C = Caput mandibulae
T = Tuberculum articulare
PM= Medial Pterygoid muscle

For this purpose, the sagittal and vertical lengths of the muscle were measured in the open and closed mouth (Figure 1). The mean sagittal lengths of the superior lateral pterygoid muscle of the open and closed mouth position are 23. 6 ± 0.45 mm., 27. 3 ± 0.34 mm, respectively. The mean vertical lengths

of the superior lateral pterygoid muscle of the open and closed mouth poosition are 7.2 ± 0.36 mm., 5.4 ± 0.33 mm., respectively. The differences between open and closed mouth wer statistically found to be significant for sagittal and vertical lenghts ($p<0.01$). Indicating that muscle length is decreased when the mouth is open.

When a triangular - shaped muscle contracts to initiate a movement, its length is shortened (4,14). For this reason, superior head of lateral pterygoid muscle is an opening muscle of the mouth by protracting the mandibular condyle rotates on the disc. This is inagreement with others who state that this muscle protracts the mandibular condyle on the articular eminence (2,4,10,14,17,19,27,30-35). The results of this study also have important clinical implications for interpretation of MRI.

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