



TOPOGRAPHICAL LANDMARKS FOR IDENTIFICATION OF MASSETERIC BRANCH OF MANDIBULAR NERVE – A CADAVERIC STUDY

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ABSTRACT Masseteric nerve block technique is used for the reduction of dislocated mandibular condyles and for the treatment of masseter muscle pain. Masseteric neurectomy is employed as a treatment modality for benign masseteric hypertrophy. Recently, masseteric nerve is used for facial reanimation procedures. However, it is not always easy to locate the nerve since the facial measurements on which some surgical approaches are based upon are variable. The aim of this study was to gain an adequate knowledge regarding the topography of the masseteric nerve. The study was carried out in the Department of Anatomy, JIPMER from October, 2014 to March, 2016 after obtaining permission from the Post-Graduate Research Monitoring Committee and Institute Ethics Committee. Sixteen formalin fixed cadavers available for the undergraduate dissection were utilised for the study. After meticulous dissection, the masseter muscle and the masseteric nerve were exposed. The required measurements were taken using the digital vernier caliper. The results were statistically analysed for mean, standard deviation and range. The masseteric nerve was 16.15 ± 2.31 mm medial to the midpoint of the temporomandibular joint capsule immediately below the lower border of the zygomatic arch. The masseteric nerve was 15.87 ± 1.64 mm superior to the lowest point of the mandibular notch. In this study, constant, predictable bony landmarks have been considered to identify the masseteric nerve, which can be used effectively in clinical practice for better manipulation of the masseteric nerve.

KEYWORDS : Masseteric nerve block, masseteric neurectomy, facial reanimation techniques, TMJ (Temporomandibular joint) dislocation

INTRODUCTION:

Masseteric nerve is a branch of the anterior division of the mandibular nerve. It emerges above the upper border of the lateral pterygoid and reaches the undersurface of the masseter muscle via the mandibular notch. Within the muscle, it divides into an upper and a lower branch. The upper branch supplies the deep part of the muscle while the lower branch supplies the superficial part of the muscle.⁽¹⁾

The masseteric nerve block technique which involves the delivery of local anaesthesia just before it innervates the masseter muscle has been a promising treatment modality for acute and chronic masseter muscle pain.^(2,3) It is also being used for the reduction of dislocated mandibular condyles.^(4,5,6)

Recently masseteric neurectomy is being employed for the treatment of benign masseteric hypertrophy. Masseteric hypertrophy is characterised by idiopathic enlargement of one or both the masseter muscle resulting in facial asymmetry, trismus, protrusion and bruxism. Selective neurectomy induces muscular atrophy and thereby reduction of hypertrophied mass of masseter muscle. However, the surgeons do encounter difficulty in identifying the nerve intraoperatively as standard surgical landmarks to localise this nerve are limited.^(7,8) A proper understanding of the location and course of the nerve is essential in manipulating it.

The masseteric nerve is now gaining popularity in the transposition operation to rectify facial palsy. The anatomical proximity of the masseteric nerve to the facial nerve and its high potential for motor neural input has made it an ideal choice for the nerve transfer for facial paralysis surgery. However, the main trunk of the nerve should not be injured to avoid denervation of the masseter muscle. Also, the distal segment of the masseteric nerve could be harvested as a part of masseter transposition flap. Clinical outcome of the muscle flap depends upon the viability of the innervation of the flap.^(9,10,11,12) A clear understanding of the topography and course of the nerve is essential to avoid injury during the masseteric nerve harvest.

MATERIALS AND METHODS:

The study was approved by the Post Graduate Research Monitoring Committee on September, 2014. Ethical clearance was obtained from the Institute Ethics Committee on October, 2014. The study was then carried out in the Department of Anatomy, JIPMER from October, 2014 to March, 2016. Sixteen formalin fixed cadavers available for the undergraduate dissection were utilised. The cadaver number, age, sex and date of dissection were recorded. Following palpable bony landmarks in the infratemporal region were first identified on each side (*Fig 1*)

- Angle of the mandible (gonion)
- Base of the mandible

- Anterior border of the ramus of the mandible
- Posterior border of the ramus of the mandible
- Temporomandibular joint
- Zygomatic arch
- Mandibular notch

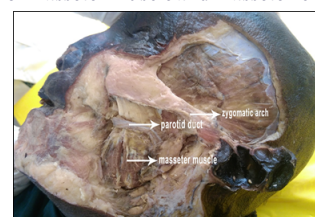
An incision was made on the skin over the zygomatic arch and along the anterior border of the ramus of the mandible. The skin and the fascia were removed. The masseter muscle was then exposed (*Fig 2*). An incision was made gently over the masseter muscle along the lower border of the zygomatic arch. Care was taken not to damage the underlying masseteric nerve. The muscle belly was then gently reflected downwards and laterally, exposing the masseteric nerve. The exit of the nerve through the mandibular notch into the muscle was observed. The distance between the masseteric nerve and the midpoint of the temporomandibular joint capsule was measured with the help of a digital vernier caliper (A). The distance between the exit of the nerve immediately below the zygomatic arch and the lowest point of the mandibular notch was also measured using the vernier caliper (B) (*Fig 3*).

Fig 1: External palpable bony landmarks related to the infratemporal fossa



A – TM joint	D – posterior border of the ramus of the mandible
B – zygomatic arch	E – anterior border of the ramus of the mandible
C – mandibular notch	F – gonion
	G – base of the mandible

Fig 2: Exposure of masseter muscle and masseteric nerve



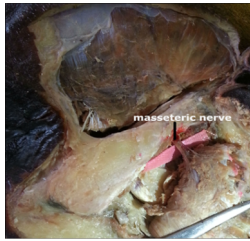
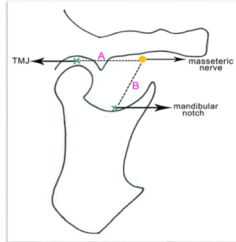


Fig 3: Masseteric nerve topography



- A- Distance from the mid point of the temporomandibular joint capsule to the masseteric nerve (immediately below the lower border of zygomatic arch)
- B- Distance from the lowest point on the mandibular notch to the masseteric nerve

RESULTS:

Table I: Masseteric nerve topography in relation to the temporomandibular joint and mandibular notch

Measurement	Mean ± SD (mm) (n=32)	Range (mm)
A	16.15 ± 2.32	12.5 - 21.5
B	15.87 ± 1.64	13 - 18

- A – Distance from the mid point of the temporomandibular joint capsule to the masseteric nerve (immediately below the lower border of zygomatic arch)
- B – Distance from the lowest point on the mandibular notch to the masseteric nerve
- The masseteric nerve was **16.15 ± 2.32** mm medial to the midpoint of the temporomandibular joint capsule immediately below the lower border of the zygomatic arch.
- The masseteric nerve was **15.87 ± 1.64** mm superior to the lowest point on the mandibular notch.

Table II: Comparison of the measurements related to the topography of masseteric nerve between the right and the left side

Measurement	Side	Mean ± SD (mm) (n=16)	Range (mm)	p value
A	Right	16.25 ± 2.29	12.5 - 21.5	0.823
	Left	16.06 ± 2.40	13 - 21	
B	Right	15.93 ± 1.61	13.5 - 17.5	0.833
	Left	15.81 ± 1.72	13 - 18	

- A – Distance from the mid point of the temporomandibular joint capsule to the masseteric nerve (immediately below the lower border of zygomatic arch)
- B – Distance from the lowest point on the mandibular notch to the masseteric Nerve

In the 16 formalin fixed cadavers dissected, no statistically significant difference was observed in the measurements related to the topography of masseteric nerve between the right and the left side (p>0.05)

DISCUSSION:

Masseteric nerve block is a novel technique used in the management of the pain and spasm of the masseter muscle caused by the dislocated mandibular condyle. Recently, the masseter muscle is being used for facial reanimation. However there is paucity of knowledge regarding the precise topography of masseteric nerve. Intraoperative identification of masseteric nerve depends on the physical measurements using available surface, soft tissue and bony landmarks. In the current study, only the constant bony landmarks –

temporomandibular joint, zygomatic arch and mandibular notch were taken into consideration to frame the topography of masseteric nerve. This is in contrast to the previous studies where the soft tissue landmarks were included to identify the nerve. Collar et al., suggested a subzygomatic triangle which included the zygomatic arch, temporomandibular joint and frontal branch of the facial nerve for the localisation of masseteric nerve.^[13]

In the present study, in all the cadavers dissected, the masseteric nerve emerged out of the mandibular notch immediately below the lower border of the zygomatic arch. This is in consistent with the findings of Cotruflu et al., who demonstrated the nerve immediately below the zygomatic arch to run within the muscle belly.^[14] However, this contradicts with the study done by Borschel et al., where the nerve emerged out of the mandibular notch 1 cm inferior to the zygomatic arch.^[15] Kaya et al. suggested that the exit of the nerve through the mandibular notch was 1.0-1.5 cm inferior to the zygomatic arch.^[16]

In our study, masseteric nerve was 16.15 ± 2.31 mm medial to the midpoint of the temporomandibular joint capsule immediately below the lower border of zygomatic arch and 15.87 ± 1.64 mm superior to the lowest point of the mandibular notch (**Table I**) In the study done by Kaya et al., the nerve was 1 cm medial to the temporomandibular joint and 1 cm superior to the mandibular notch.^[16] There was no significant statistical difference in the measurements between the right and the left side implying bilateral symmetry of the nerve (**Table II**)

APPLICATIONS:

Based on the findings of the current study, it is possible to locate the masseteric nerve precisely in a triangular area bounded by temporomandibular joint, zygomatic arch and mandibular notch. This helps to avoid injury to the trunk of the masseteric nerve during masseteric-facial nerve transfer surgeries. It also aids the surgeon in selective masseteric neurectomy and for the successful masseteric nerve block.

CONCLUSION:

Masseteric nerve has wide clinical applications. It is increasingly being used in facial reanimation surgeries, treatment of benign masseteric hypertrophy and reduction of temporomandibular joint dislocation. However, due to the lack of availability of reliable anatomical landmarks, intraoperative identification of this nerve is challenging. In this study, constant, predictable bony landmarks have been used to identify the masseteric nerve. They can be used effectively in clinical practice for better manipulation of the masseteric nerve.

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