



ORIGINAL RESEARCH PAPER

Surgery

IDENTIFICATION OF THE MARGINAL MANDIBULAR BRANCH OF FACIAL NERVE DURING OPERATION

**KEY WORDS:** Marginal mandibular nerve (MMN), Angle of the mandible, Inferior border of the mandible, neck dissection, Oral cancer

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ABSTRACT

**Background:** Identification and preservation of the marginal mandibular nerve (MMN) remains an important step in various surgical operations of the neck and parotid regions . Most of the anatomical texts show the MMN to be placed at least 1 cm below the mandible. Our study will observe the course of the MMN and evaluate its relation to the inferior border of mandible and facial vessels in vivo.

**Methods:** 66 marginal mandibular nerves were examined in 46 consecutive patients admitted under Plastic Surgery department and General Surgery department of two Medical College hospitals in Kolkata for mainly clinically cervical node positive Oral Cancers and thyroid cancers. Using a standardized method, distances were measured from the inferior edge of the mandible and the lowest point of the nerve and the results recorded

**Results:** Sixty six nerves were examined . The mean position of the nerve was 2.2mm above the right angle of the mandible and 3.2mm above the left angle of the mandible . The mean nerve position was again 0.4mm & 1mm above the lowest point of the mandible respectively on the right & left sides respectively

**Conclusion:** The marginal mandibular nerve (MMN) is significantly higher than is the standard in many anatomic texts . The location of the nerve on the right does not correlate with the left.

INTRODUCTION

Facial nerve ,the seventh cranial nerve supplies all muscles of facial expression.The terminal branches of facial nerve radiate from the anterior border of the parotid gland.The marginal mandibular branch travels towards the angle of the mandible under the platysma.It crosses the lower border of mandible at the antero inferior angle of masseter and reaches the face superficial to the facial artery and vein.It supplies risorius ,muscles of lower lip and chin and passes under depressor anguli oris. Because of its superficial course it is vulnerable to injury during surgery. Injury to the MMN , causes a very conspicuous deformity on opening the mouth , smiling or grimacing & is due to paralysis of muscles of the lower lip of that side (10). The most frequent cause of affection of this nerve is iatrogenic injury during operations in the mandibular or parotid regions. It may be injured during operations like parotidectomy, modified radical neck dissections ,submandibular gland excision, carotid endarterectomy, and rhytidectomy. Weakness in the territory of the lower lip results from injury to the nerve as anastomotic arcades between marginal mandibular and other branches of facial nerve is relatively rare.Identification of marginal mandibular branch ,and knowledge of its course,anatomical variations and relations of the marginal mandibular nerve is therefore essential to avoid surgical complications.

MATERIALS AND METHODS

The study was conducted over a period of two years in two Medical College Hospitals of Kolkata in Departments of Plastic Surgery and Department of General Surgery . After obtaining informed consent from each patient for use of data for prospective in vivo study, 46 patients were enlisted between January 2016 and January 2018. Patients with tumour involvement of the submandibular region and patients receiving prior irradiation were excluded from the study.

Out of 46 cases, bilateral MRND was done in 20 cases making the total number of MMN examined to be 66. The operations performed along with MRND were CA buccal mucosa with/without retromolar trigone involvement, Squamous cell

cancer of tongue, floor of mouth, papillary carcinoma thyroid. Routine operative steps like general anaesthesia with endotracheal intubation was done in all cases along with placement of sand bag/roll between two scapular blades to make the neck extended. For unilateral MRND, modified Schobinger incision was made with the horizontal limb of the incision being placed two fingers below mandibular ramus(Fig 1).



Figure 1 – Modified Schobinger incision

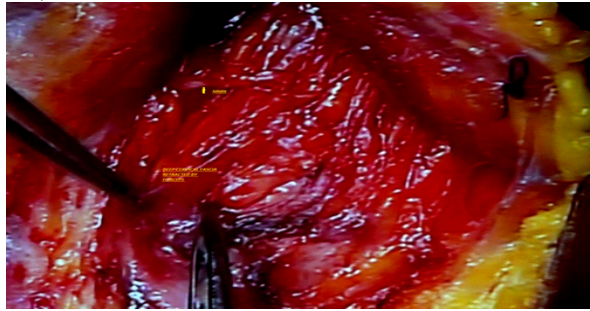
For bilateral MRND Mac Fee incision was given and skin flaps were elevated in sub-platysmal plane (Figure 2). In each case, when level Ib was being dissected an attempt was made to identify the MMN.The nerve was found ; usually traversing a course superficial to anterior facial vein.

Both the MMN and the cervical nerves were carefully dissected in a sub platysmal plane.



Figure 2 Skin flaps elevated in subplatysmal plane.

The nerve was traced from tail of parotid posteriorly to its course above mandible in front after carefully incising and retracting the deep cervical fascia



**Figure 3** MMN seen after retracting the Deep Cervical fascia with forceps



**Figure 4--** Scissors placed parallel to MMN

The MMN's relation with the constant reference lines were examined. These reference lines were the inferior border of mandible and a line 1cm below mandible. Two measurements were then made, the first one being the vertical distance of MMN from the angle of the mandible and the second being the vertical distance between lowest point of nerve with respect to inferior edge of mandible. These measurements were done by a compass which was reflected on a sterilized scale and measurements taken. Nerve stimulation was used to identify MMN which was evident by Mentalis muscle contraction and twitching of the lower lip.

**RESULTS & ANALYSIS**

46 patients were enrolled in the study, of which 29 were males and 17 were females. Age range in our study was between 29 – 74 years with the mean age being 50.7 years. In totality 66 nerves were tested – 36 right and 30 left with bilateral MMN tests done for 20 cases where bilateral modified radical neck dissection was done.

In each case, MMN was located and its position with respect to the angle of mandible and lowest border of the mandible was measured on both sides.

On the right side - the mean nerve position was 2.2mm above the angle of the mandible and 0.4mm above the lowest border of the mandible. However the lowest point on the right side was 13mm below the angle of mandible and 14mm below the lowest point of mandible and the highest point was 23mm above angle of mandible and 16mm above right lowest point.

On the left side - - the mean nerve position was 3.2mm above the angle of the mandible and 1mm above the lowest border of the mandible. However on the left side the lowest position in which the nerve was found was 6mm below the angle of mandible and 9mm below the lowest point of the border of the mandible and the highest point on which the nerve lied was 15mm above the angle of mandible and 12mm above the lowest point. (Table 1)

**Table 1** –Mean nerve position , lowest & highest points of Right &left MMN with respect to angle of mandible and lowest point of mandible on right and left side.

	MEAN NERVE POSITION	LOWEST POINT	HIGHEST POINT
Distance of MMN from <b>Right</b> angle of mandible	2.2mm above	13mm below	23mm above
Distance of MMN from <b>Right</b> lowest point of mandible	0.4mm above	14mm below	16mm above
Distance of MMN from <b>Left</b> angle of mandible	3.2mm above	6mm below	15mm above
Distance of MMN from <b>Left</b> lowest point of mandible	1mm above	9mm below	12mm above

Among the 46 cases, in 20 cases – bilateral MRND was done making the total number of MMN examined to be 66. In these 20 cases – right and left MMN comparison was done. We measured the mean right and left MMN related to the angle of mandible and the lowest point of mandible. Also the difference and p-value and correlation and regression were measured.

For these 20 cases the mean position of the right MMN was 1.9mm above the right angle of mandible and the left MMN was 3.2mm above the left angle of mandible.

The measurements for the position of MMN on right and left side with respect to right and left lowest point of mandible was 0.9mm below (mean value) for right side and 1mm above for left side (mean value). (Table 2)

**Table 2**—Mean positions of Right & left MMN with respect to angle of mandible and lowest point on mandible

	With respect to Angle of mandible	With respect to lowest point on mandible
Mean <b>right</b> MMN	1.9mm above	0.9mm below
Mean <b>left</b> MMN	3.2mm above	1mm above
Difference	1.3mm	1.9mm
P value	p=0.008296 STATISTICALLY SIGNIFICANT	p=0.097193 STATISTICALLY NOT SIGNIFICANT

**DISCUSSION**The relation of marginal mandibular branch of facial nerve with inferior border of mandible is extremely important surgically. However it can be difficult to locate in the process of performing a neck dissection or any procedure which requires complete clearance of nodal tissue in the upper neck. To find this nerve ,a sound anatomical knowledge is required. In most publications the position of Marginal Mandibular nerve (MMN) is described to be 1cm in front of and below the angle of mandible (1) and then curves downward below and in front of the mandible across the facial vessels about one finger breadth below the mandible (2).

Stern (3) however indicates that if the nerve does not course above the inferior border of mandible within 2 cm of facial vessels it is never the MMN.

There has been several controversies while identifying and distinguishing between MMN and cervical branch of facial nerve in several anatomical dissections ( 3,4,5 ). They showed that there are often multiple contributions to MMN and that it can be difficult to distinguish between MMN & cervical branch to platysma . According to Dingman and Grab (4) ,few branches of nerve could be seen running along lower border of mandible and even 2 cm below it and these branches terminated and innervated the platysma in all specimens. However Nelson and Gingrass(5) argued that these same branches when followed anteriorly; (in fresh cadaver specimens and in clinical dissections ) ascended over lower border of mandible to innervate specific depressor muscles

of the lip and thus they concluded that these branches should be identified as MMN and not cervical branches. Skandalakis et al. (6) describes an anterior ramus of cervical division of facial nerve that joins MMN ramus & contribute to lower lip innervation & according to Tulley P et al (7); platysma muscle (which is supplied by the cervical division of facial nerve) also contributes to lower lip depression.

The relation of MMN with inferior border of mandible and facial artery has been previously studied by many authors in both cadavers and in live patients.

Both Nelson and Gingrass (5) & Nason et al. (8) noted that the MMN was well below the inferior border of mandible in every instance in fresh cadaver and clinical dissections and Nelson et al.(5) recommended placing cervical incisions several centimeters below the inferior border of mandible.

Baker and Conley (9) however made an interesting observation that the nerve is drawn downward with extension of neck.

Dingman and Grab (4) who dissected 200 facial halves to find out the relation between MMN and lower edge of mandible. In their study MMN running posterior to facial artery mostly remained superior to inferior border of mandible. However in 19% cases, one or more ramus of MMN formed a downward arc whose lowest point exceeded 1cm below inferior border of mandible.

Baker and Conley (9) in their study on relationship of MMN with inferior border of mandible while performing parotidectomy; found the MMN to be located within 1- 2 cm below inferior border of mandible in every instance.

This difference in this study by Baker et.al (9), (who observed MMN in living subjects) with the finding of Dingman and Grab(4) (who did a cadaveric dissection only); could be explained by the fact that their patients were surgical cases with head rotated and extended, while the study by Dingman & Grab (4) was on preserved cadavers. In our study the mean nerve position in the right side was 2.2mm above the right angle of mandible and 0.4mm above the right lowest point of inferior border of mandible while on left side the mean nerve position was 3.2mm above left angle of mandible and 1mm above the left lowest point of inferior border of mandible – a finding that corroborates with finding of Al Qahtani et al. (1) who in their study on 52 patients with a study on 85 MMN found the mean position of the nerve to be 2.7mm above right mandibular angle and 0.2mm above right lowest point and 3.4mm above left mandibular angle and 1.1mm above left lowest point.

In our study again we found that the highest position of right MMN was 23mm above right angle of mandible and 16mm above right lowest point of mandible which again more or less correlates with the study by Al Qahtani et al.(1) who found the values to be 20mm and 13mm respectively. In our study the highest position of left MMN was 15mm and 12mm above left mandibular angle and left lowest point of mandible which again correlates with Al Qahtani et al.(1) whose corresponding values were 13mm and 10mm respectively.

In our study the lowest position of right MMN with respect to right angle of mandible and right lowest point was 13mm and 14mm below respectively, while on left side the corresponding values were 6mm and 9mm below respectively.

In our study we compared the position of MMN on both right and left sides in the same 20 patients on whom we did bilateral MRND and found the mean position of right MMN was 1.9mm above the right angle of mandible and 3.2mm above left mandibular angle with a difference of 1.3mm between right and left side with left MMN being higher than right MMN which is statistically significant ( $p=0.008296$ ). Again in these patients the mean position of right MMN was 0.9mm below right lowest point of mandible and left MMN was 1mm above the left lowest border with the difference in two positions between right and left side being 1.9mm which is not statistically significant ( $p=0.097193$ ).

Thus we propose the following steps which could help in protecting the MMN. Incision should be placed 4cm below inferior border of mandible and the flaps elevated in an exact sub platysmal plane and immediately above investing layer of deep cervical fascia and MMN keeping superficial fascia and lymph nodes intact. It is not the level of skin incision but the level of transection of investing layer of deep cervical fascia that is important. Tumescence may be used to keep the field bloodless and to make the dissections with scissors avoiding diathermy to a large extent as may be possible. The flaps should be elevated 1cm above mandible.

The dissection to find out the nerve needs to be individualized (1). One needs to see the nerve in order to protect it. To find out the MMN a meticulous dissection of superficial fascia has to be performed parallel to the inferior border of the mandible to locate the MMN keeping in mind the dynamic and variable relation of MMN with the inferior border of mandible. Following the identification of MMN and protecting it, the lymph node dissection can be pursued aggressively & safely.

## CONCLUSION

Based on dissection of 66 MMN we can conclude that in vivo the position of the nerve is significantly higher than in previously published articles and that location of the nerve in the right and left side do not match each other.

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