



SAFE MARGIN FROM MENTAL FORAMEN FOR SURGICAL PROCEDURES IN INTER-FORAMINAL REGION IN EAST-INDIAN POPULATION: A CBCT ANALYSIS

Maxillofacial Surgery

Dr. Pallabi Das	BDS, 3rd year MDS Postgraduate Trainee, Dept. of Oral and Maxillofacial Surgery, Guru Nanak Institute of Dental Sciences & Research, Panihati, Kolkata.
Dr. Kaushik Dutta	BDS, MDS, Professor and Head of the Department, Dept. of Oral Medicine and Radiology, Guru Nanak Institute of Dental Sciences & Research, Panihati, Kolkata.
Dr. Samiran Ghosh	BDS, MDS, Professor, Dept. of Oral and Maxillofacial Surgery, Guru Nanak Institute of Dental Sciences & Research, Panihati, Kolkata.

ABSTRACT

Mental foramen is an important and easily identifiable anatomical landmark for any surgical procedure in the inter-foraminal region. If a safe margin from the mental foramen is not maintained, it leads to inadvertent damage to the mental nerve leading to neuro-sensory deficit. **Aims and objective-** The length of anterior loop of mental foramen varies with genders, different races and population. This study aims to assess the length of anterior loop of mental foramen and thus the safe margin from mental foramen in East-Indian population. **Material and method-** 100 CBCT images (of East-Indian population) were collected from Institutional archive. It consisted of 200 sites of mental foramen. Length of anterior loop of mental foramen was measured. In the present study, the safe margin from mental foramen was calculated as 2 mm excess of the length of the anterior loop. **Result-** The mean length of anterior loop of mental foramen was found to be 3.06 ± 1.62 mm and the mean safe margin from mental foramen was 5.06 ± 1.62 mm. No statistically significant difference was found among the genders, sides and different age groups. **Conclusion-** We recommend a safe margin of 5mm from mental foramen. Individual pre-operative radiographic evaluation of mental foramen and its loop is of utmost importance.

KEYWORDS

Mental foramen, Anterior loop of mental foramen, mental nerve injury

INTRODUCTION

Mental foramen is a significant landmark for any surgical procedures in the inter-foraminal region such as, harvesting symphyseal bone graft, endosseous implant placement or genioplasty. The position of mental foramen varies considerably. The fact that there is a high possibility of presence of an anterior loop of the mental nerve mesial to the mental foramen needs to be considered before surgical procedures in this region, to avoid damage to the mental nerve leading to neurosensory deficit.^[1]

There are several studies which aims to detect and measure the anterior loop length using different diagnostic methods such as panoramic radiographs; cone beam computed tomography (CBCT) and CT scans of patients and cadaver. Studies have shown panoramic radiographs are not reliable due to its high rates of false positive or false negative interpretations. So, CT scans and CBCT are recommended before the surgeries in inter-foraminal region. Among them, CBCT is preferred because of lower radiation doses.

The importance of this safe margin lies in the fact that, clinically one cannot visualise the anterior loop of mental foramen. Whereas, one can easily identify the mental foramen during surgical procedure. So, this safe distance from the mental foramen obtained from the present study will help surgeons to determine lateral limit of any surgical procedure in the inter-foraminal area clinically.

MATERIAL AND METHOD

CBCT images were collected from Institutional archive. The images were of East-Indian population. CBCT images were acquired with MyRay Skyview 3D CBCT (Cefla Dental Group, North America) using the exposure parameters recommended by the manufacturer: (acquisition protocol of 90 kVp, current of 10 mA, scan time of 10.15 sec, focal spot of 0.5 mm, 0.33-0.36 mm voxels).

The images included in the study were of patients above 18 years and had complete dentition. CBCT images with any impacted tooth or pathologies in the inter-foraminal region were excluded from the study.

There are much variations regarding safety margin from mental foramen for surgical procedures among different authors. In our study we considered that the safety margin from the mental foramen should be at least 2 mm more the length of the anterior loop of mental foramen. So, any surgical procedure should be limited at least 2 mm mesial to the extent of the anterior loop of mental foramen to avoid injury to the mental nerve and sensory disorders in the lower lip (figure 1).

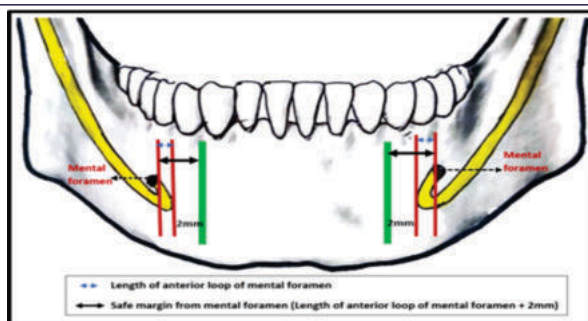


Figure 1 – Schematic diagram showing safe margin from mental foramen

At first the length of the anterior loop of mental foramen was measured. Then the safe margin of mental foramen was calculated by adding 2 mm to the obtained length of anterior loop.

Safe margin from mental foramen (in mm) = length of anterior loop of mental foramen (in mm) + 2 mm

Length of anterior loop of mental foramen-

This is measured in the coronal slices. First the coronal slices are divided in the thinnest section (0.34mm). The length of the loop was measured by counting the number of consecutive contiguous vertical cross sections between the anterior border of the mental foramen and the anterior border of the loop. This number was multiplied by the thickness of the slices. The thickness used in CBCT was 0.34 mm. The thickness of CBCT could be adjusted freely to better visualize the structures. The initial slice for measurement was considered to be the first slice just after the anterior margin of the mental foramen disappeared.^[2]

For example, in a case where the number of cross sections between the anterior border of the mental foramen and the edges of the anterior loop were 8, the length of the loop would be $8 \times 0.34 = 2.72$ mm. Here, the safe margin from mental foramen will be $2.72 + 2$ mm i.e., 4.72 mm

RESULTS

100 CBCT images were studied, that includes 200 sites of mental foramen (100 right and 100 left side). Among them, 52% (n= 104) of sites were of female candidates and 48% (n= 96) were of male. The sites were divided into 3 age groups- 18- 29 years (36%, n= 72), 30-44

years (40%, n= 80), ≥ 45 years (24%, n= 48). The software SPSS version 22 has been used for statistical analysis. Categorical variables (number and percentage of samples) were compared using Pearson's Chi Square test. Continuous variables (Mean, Median and Standard Deviation) were compared using Mann-Whitney U test or Kruskal Wallis Test as appropriate.

Length of anterior loop of mental foramen-

In present study, the mean length of anterior loop of mental foramen was found to be 3.06 ± 1.62 mm. The mean length in different subgroups is depicted in Table 1.

Table 1- Length of anterior loop of mental foramen obtained in the present study

	Mean	Median	Standard deviation	p Value	Significance
Gender					
Female	2.94	2.72	1.64	0.343	Not Significant
Male	3.17	3.06	1.61		
Side					
Right	2.96	2.72	1.57	0.743	Not Significant
Left	3.15	2.72	1.67		
Age group (in years)					
18- 29	3.03	2.72	1.50	0.849	Not Significant
30-44	3.19	2.89	1.79		
>=45	2.87	2.89	1.53		

Safe margin from mental foramen-

The mean safe margin from mental foramen was found to be 5.06 ± 1.62 mm. The mean safe margin obtained from the study in different subgroups are depicted in Table 2.

Table 2- Safe margin from mental foramen obtained in the present study

	Mean	Median	Standard deviation	p Value	Significance
Gender					
Female	4.94	4.72	1.64	0.343	Not Significant
Male	5.17	5.06	1.61		
Side					
Right	4.96	4.72	1.57	0.743	Not Significant
Left	5.15	4.72	1.67		
Age group (in years)					
18- 29	5.03	4.72	1.50	0.849	Not Significant
30-44	5.19	4.89	1.79		
>=45	4.87	4.89	1.53		

DISCUSSION

The anterior loop, which can be described as the extension of mandibular canal anterior to the mental foramen, is formed just before the ramification of the mandibular canal into the incisive canal. Anterior loop of mental foramen in an intra-bony structure. Thus, one cannot visualise the anterior loop clinically. This often leads to injury to mental nerve followed by neuro-sensory deficit while performing any surgical procedure in the inter-foraminal area. On the other hand, mental foramen is an easily identifiable anatomical landmark. Taking this into account, this study was performed to measure the safe margin from mental foramen, that would help surgeons to perform surgery without post-operative sensory deficit.

Bavitz et al.^[3] in their cadaveric study in mental nerve regions stated, the most anterior position in which the mental nerve was encountered was 1 mm forward or mesial to the most anterior aspect of the mental foramen. Based upon this finding, it is likely that damage to the mental nerve can be avoided if any surgical procedure is carried out 1 mm anterior to the anterior border of the mental foramen.

Mardinger et al.^[4] in their cadaveric study with 46 hemimandibles stated, the length of the anterior loop ranged from 0.4 to 2.19 mm and recommended a safety margin of at least 3 mm from mental foramen. Whereas, **Moghddam et al.**^[5] in their study with 234 CBCT images in Iranian population stated, the mean safe anterior distance from the anterior loop is about 3 mm and, in their study, the length of the anterior loop ranged from 2.5 to 3.1 mm.

But in the present study it was seen that the length of anterior loop ranged from 0.34 mm to 8.84 mm. So, a mere margin of 1- 3 mm will not suffice to protect the mental nerve.

Yates et al.^[6] and **Misch et al.**^[1] recommended any surgical procedure in inter-foraminal region should be performed 5 mm mesial to mental foramen. Our study is in accordance with their views as the mean safe margin was calculated to be 5.06 mm.

The length of anterior loop of mental foramen is not constant and varies among different races, genders and even among sides in same individual. So, pre-operative radiographic evaluation of the mental foramen and its loop of utmost importance in every individual.

The major limitation of this study was that the measurements were based on radiological findings as viewed on NNT Viewer software. The measurements were not correlated clinically.

CONCLUSION

To conclude, we recommend a safe margin of 5 mm from the mental foramen. But as the length of anterior loop of mental foramen varies in every individual, pre-operative radiographic evaluation is highly recommended to prevent any damage to the mental nerve.

Consent

Not applicable.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or nonfinancial in this article.

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