Original Article

Measurement of Lingual Cortical Plate Thickness and Lingual Position of Lower Third Molar Roots Using Cone Beam Computed Tomography

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Abstract

Objective: The objective of the study was to determine the potential risk of tooth/root displacement into the soft tissue during the third molar surgery. While performing third molar surgeries, one of the many complications is displacement of the tooth into the soft tissues. This can be due perforation of the lingual cortical bone during surgery or the position of the tooth root which may be close to the lingual bone.

Materials and Methods: Retrospective samples of 251 patients were collected who had undergone cone-beam computed tomography (CBCT) for various reasons. Measurements were performed independently and recorded twice by one surgeon and one radiologist; the average of the two measurements was calculated and evaluated using MyRay CBCT.

Results: On the right and the left side, the average distances in males for AL were 3.31 and 2.96 mm, respectively, whereas in females was found to be 3.98 and 3.56 mm which were statistically significant. On the right and left side, the average distances in males for RL were 2.03 and 1.78 mm, respectively, whereas in females, it was 2.41 and 1.99 mm, respectively, with the significant *P* value in the right side.

Conclusion: Despite the sample size being of 251 patients, a large number of root of the third molar (95.62%) were not in contact with lingual cortical bone, but still practitioner should be careful during surgery as there might be the risk for displacement of the tooth. The images used were of impacted molar used in this study and these teeth were not subjected to surgery. Hence, the results can be only correlated theoretically, i.e., there would be a risk of displacement of the tooth during extraction.

Keywords: *Cone beam computed tomography, impaction, lingual cortical plate, third molar*

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Introduction

Third molar surgeries are relatively common but have their own complications.[1] The common complication of the third molar surgeries is neurosensory deficits such as lingual nerve paraesthesia and inferior alveolar nerve injury, infection, trismus, alveolar osteitis, iatrogenic burns due to high-speed bur, and hematoma.[2-6] The angulation of the third molar tooth and the thickness of the lingual cortical bone also determine the degree of difficulty of the surgeries. In third molar surgeries, the displacement of the tooth or tooth root into in the soft tissue spaces is also seen.[7-9]

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Various imaging modalities have been done for the assessment of third molar position before surgery.[10,11] Cone-beam computed tomography (CBCT) is one of the newer imaging techniques used in dentistry; CBCT is used by general dentists and specialists to improve the diagnosis and treatment planning. It helps to visualize

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the structures in three-dimensional planes.[12] Its radiation dose is lesser than the other radiographic investigatory procedure.[13-15]

With the help of CBCT, we can assess the position of the third molar with relation to the mandibular canal and surrounding soft and hard tissue.[16] Furthermore, we would be able to know the amount of bone to be removed during the surgery.

The present study was done to measure the thickness of lingual cortical plate and lingual position of lower third molar roots using CBCT so that to determine the potential risk of tooth/root displacement during the third molar surgery.

Materials and Methods

The present study was conducted in the Department of Oral Medicine and Radiology, Kalinga Institute of Dental Sciences, KIIT University, Bhubaneswar, for a period of 3 months from November 2016 to January 2017. This study was approved by the Ethics Committee of KIIT University (KIMS/KIIT/IEC/111/2016) and informed patient consent form was obtained.

After conducting the pilot study among Bhubaneswar population of 800,000, the prevalence of mandibular third molar impaction was found to be 48%. Sample size was calculated using the formula,

$$n = \frac{Z^2 \times (P) \times (1 - P)}{C^2}$$

In the above formula, Z (constant) = 95%, P (percentage of prevalence) = 0.48, and C (confidence level) = $(0.05)^2$. After substituting the above values in the formula, we got the sample size of 251.

CBCT images of 251 impacted lower third molar teeth were selected randomly and evaluated for this study. The data were collected from images of patients who had undergone CBCT imaging for various treatment reasons such as impacted teeth and dental implants. The exclusion criteria were cysts in the third molar region, developing third molars with incomplete root formation, and ectopic third molars. The CBCT mandibular scans were acquired using a MyRay Hyperion X9 (field of view 11 cm × 8 cm) operated at 85 kV and 12 mA. The slice thickness was 0.3 mm and the thinly sliced transplanar images were assessed using the NNT viewer QR srlVia Silvestrini Verona, 20 37135 Italy.

Evaluation of images

Each measurement was performed independently and recorded twice by one surgeon and one radiologist who were very well experienced of oral and maxillofacial structures. Then, the average of the two measurements was calculated and evaluated.

The teeth were grouped according to Winter's classification, i.e., mesioangular, distoangular, vertical, and horizontal according to their position in the CBCT in the panoramic. The other categories under Winter's classification were excluded from the study.

Two distances were measured from the tooth

1. AL (the distance from the root apex of the tooth, which is in the most lingual position, to the lingual cortical plate) [Figure 1]
2. RL (the distance from the most lingual point on the apical half of the root to the lingual cortical plate) [Figure 2]. If the tooth has more than one root, then the most lingual root is considered.

Statistical analysis

Comparisons between groups were performed using the Chi-square test using IBM SPSS Statistics version 20.0. (SPSS software version 20.0, Armonk, NY: IBM Corp).

Results

The study comprised 251 patients. In this study, there were 152 males (60.6%) and 99 females (39.4%) [Table 1]. The median age for men was 34.16 and for women was 31.08 [Table 1].

The teeth were classified according to Winter's classification that is [Table 2] mesioangular (41/251 or [16.33%]), distoangular (8/251 or [3.18%]), vertical (179/251 or [71.31%]), and horizontal (23/251 or [9.16%]).

The distance was measured from the apex of the third molar to lingual cortical plate which was named as AL [Figure 1] and distance from the most lingual point on the apical half of the root to the lingual cortical plate was named as RL [Figure 2].

The average distance between root of the third molar and lingual cortical bone was found to be 3.38 mm. On the right side, the average distance in males for AL was 3.31 mm whereas in females was 3.98 mm with P = 0.03 which was statically significant. On the left side, the average distance in males for AL was 2.96 mm, whereas in females was found to be 3.56 mm with P = 0.038 which was also statically significant [Table 3a].

The average distance from the most lingual point on the apical half of the root to the lingual cortical plate was

Table 1: Gender of the study participants

Gender	Frequency	Percentage	Median age
Male	152	60.6	34.16
Female	99	39.4	31.08
Total	251	100.0	32.5

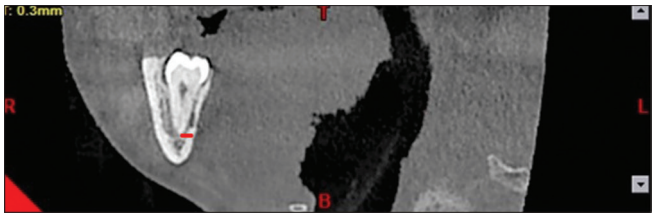

Figure 1: The distance from the apex of the third molar to the lingual cortical bone; AL

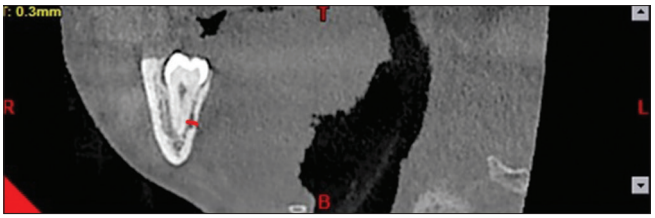

Figure 2: The distance from the most lingual point on the apical half of the root of the third molar to the lingual cortical plate; RL

Table 2: Type of impaction of the study participants

Gender	Mesioangular	Distoangular	Vertical	Horizontal	Total
Male					
Frequency (*n*)	21	4	113	14	152
Percentage of total	8.4	1.6	45.0	5.6	60.6
Female					
Frequency (*n*)	20	4	66	9	99
Percentage of total	8.0	1.6	26.3	3.6	39.4
Total					
Frequency (*n*)	41	8	179	23	251
Percentage of total	16.3	3.2	71.3	9.2	100.0

Table 3a: Comparison of distance from AL/RL for the third molar impacted - left side

	Sex	Mean	SD	*P* (significant)
Distance from AL	Male	2.96	1.78	0.038
	Female	3.56	1.06	
Distance for RL	Male	1.78	1.34	0.246
	Female	1.99	0.89	

SD=Standard deviation

Table 3b: Comparison of distance from AL/RL for the third molar impacted - right side

	Sex	Mean	SD	*P* (significant)
Distance from AL	Male	3.31	1.69	0.03
	Female	3.98	1.71	
Distance for RL	Male	2.03	1.11	0.047
	Female	2.41	0.97	

SD=Standard deviation

found to be 2.01. On the right side, the average distance in males for RL was 2.03 mm whereas in females was 2.41 mm with $P = 0.047$ which was statically significant. On the left side, the average distance in males for RL was 1.78 mm whereas in females was 1.99 mm with $P = 0.246$ which was statically insignificant [Table 3b].

The total number of the samples was further categorized according to the thickness of the lingual cortical bone present, i.e., Type A - some amount of bone present; Type B - 0 amount of bone present; and Type C - the tooth present in the soft tissue.

Out of 251 samples, 240 CBCT images showed that some amount of bone was present lingually, 11 roots showed 0 mm of bone, and there were 0 cases which showed root present in the soft tissue. The percentage of Type A was 95.62%, Type B was 4.38%, and Type C was 0%.

Discussion

Third molar surgeries have numerous complications, in which the displacement of tooth or tooth root is one of the dangerous complications. There are very few cases in the literature about them. When it occurs, the sites are floor of the mouth, submandibular,[9] and pterygomandibular spaces.[17]

The present study revealed that on the right and the left side, the average distances in males for AL were 3.31 and 2.96 mm, respectively, whereas in females was found to be 3.98 and 3.56 mm which were statistically significant. On the right and left side, the average distances in males for RL were 2.03 and 1.78 mm, respectively, whereas in females, it was 2.41 and 1.99 mm, respectively, with the significant *P* value in the right side.

The position as well as the inclination of tooth in relation with surrounding bones plays a key role in the surgery. A thin lingual cortical plate or an already fenestrated bone along with lingually tilted tooth possesses a risk for displacement of tooth or the tooth root into the facial spaces. Apart from this, excessive force by the surgeon also can cause the displacement of the tooth or the root into the facial spaces.[18]

CBCT has much more advantages over the conventional CT scan, low radiation dose, and the images can be viewed in all the three planes. Other imaging

techniques cannot provide the accurate relation between the structures. With the help of CBCT, an accurate relationship of the inferior alveolar canal and the apices of the tooth root can be obtained, which cannot be done by conventional radiographic methods.

In this study, two points were taken to measure the lingual cortical bone thickness from the mandibular third molars, one point was taken from the root apex to the lingual cortical plate, and other was taken from the most lingual position of the tooth to the lingual cortical plate as fenestration of the lingual cortical plate may not only occur from the root apex but also may occur at any point.

A Recent study done by Emes *et al*. measured the lingual position of the lower third molar roots using CBCT, in which they stated the bone thickness ranging from 0.65 to 1.03 mm lingual to the lower third molar which was evaluated on 32 CBCT images.[19]

The present study result showed 2.01–3.38 mm thickness of the lingual cortical bone which was evaluated on 251 CBCT images. The actual bone thickness might be thinner than the average measurements made on the basis of the CBCT images; considering the conclusions stated by Emes *et al*. This difference seen was probably due to random sample selection.

Many factors play a role that affect the distance between roots of the third molar and lingual cortical plate like an undercut present on the lingual which is an anatomic property.[20] The presence of undercut was not considered in the present study.

In a study done by Braut *et al*.[21] on buccal and lingual bone thickness in posterior mandible, he found that the buccal bone thickness increased in the molar region when compared to premolar region, but no significant difference was found in the lingual region.

Limitations

The images used were of impacted molar, and these teeth were not subjected to surgery. Hence, the results can be correlated only theoretically that there would be a risk of displacement of the tooth during extraction.

Strength

this is one of the rare studies and had not been reported earlier among Bhubaneswar population.

Conclusion

Despite the sample size being of 251 patients, a large number of root of the third molar (95.62%) were not in contact with lingual cortical bone, but still practitioner should be careful during surgery as there might be the risk for displacement of the tooth.

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Conflicts of interest

There are no conflicts of interest.

References

1. Osborn TP, Frederickson G Jr., Small IA, Torgerson TS. A prospective study of complications related to mandibular third molar surgery. J Oral Maxillofac Surg 1985;43:767-9.
2. Gomes AC, Vasconcelos BC, de Oliveira e Silva ED, da Silva LC. Lingual nerve damage after mandibular third molar surgery: A randomized clinical trial. J Oral Maxillofac Surg 2005;63:1443-6.
3. Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C. Lingual nerve damage after third lower molar surgical extraction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:567-73.
4. Mason DA. Lingual nerve damage following lower third molar surgery. Int J Oral Maxillofac Surg 1988;17:290-4.
5. Kipp DP, Goldstein BH, Weiss WW Jr. Dysesthesia after mandibular third molar surgery: A retrospective study and analysis of 1,377 surgical procedures. J Am Dent Assoc 1980;100:185-92.
6. Lilly GE, Osbon DB, Rael EM, Samuels HS, Jones JC. Alveolar osteitis associated with mandibular third molar extractions. J Am Dent Assoc 1974;88:802-6.
7. Aznar-Arasa L, Figueiredo R, Gay-Escoda C. Iatrogenic displacement of lower third molar roots into the sublingual space: Report of 6 cases. J Oral Maxillofac Surg 2012;70:e107-15.
8. Guruprasad Y, Chauhan DS. Displacement of mandibular third molar crown into lateral pharyngeal space. J Craniomaxillary Dis 2012;1:53-7.
9. Kose I, Koparal M, Günes N, Atalay Y, Yaman F, Atilgan S, *et al.* Displaced lower third molar tooth into the submandibular space: Two case reports. J Nat Sci Biol Med 2014;5:482-4.
10. Pawelzik J, Cohnen M, Willers R, Becker J. A comparison of conventional panoramic radiographs with volumetric computed tomography images in the preoperative assessment of impacted mandibular third molars. J Oral Maxillofac Surg 2002;60:979-84.
11. Matzen LH, Wenzel A. Efficacy of CBCT for assessment of impacted mandibular third molars: A review – Based on a hierarchical model of evidence. Dentomaxillofac Radiol 2015;44:20140189.
12. Gerlach NL, Meijer GJ, Maal TJ, Mulder J, Rangel FA, Borstlap WA, *et al.* Reproducibility of 3 different tracing methods based on cone beam computed tomography in determining the anatomical position of the mandibular canal. J Oral Maxillofac Surg 2010;68:811-7.
13. Ludlow JB, Davies-Ludlow LE, Mol A. Dosimetry of Recently Introduced CBCT Units for Oral and Maxillofacial Radiology. In Proceedings of the16th International Congress of Dentomaxillofacial Radiology Beijing, China; 26-30, 2007. p. 97.
14. Commission of European Communities. European Guidelines on Radiation Protection in Dental Radiology. The Safe Use of Radiographs in Dental Practice. Eur Com 2004;136:14.
15. Roberts JA, Drage NA, Davies J, Thomas DW. Effective dose from cone beam CT examinations in dentistry. Br J Radiol 2009;82:35-40.
16. Ghaeminia H, Meijer GJ, Soehardi A, Borstlap WA, Mulder J, Bergé SJ. Position of the impacted third molar in relation to the mandibular canal. Diagnostic accuracy of cone beam computed

tomography compared with panoramic radiography. Int J Oral Maxillofac Surg 2009;38:964-71.
17. Tumuluri V, Punnia-Moorthy A. Displacement of a mandibular third molar root fragment into the pterygomandibular space. Aust Dent J 2002;47:68-71.
18. Rodriguez Y Baena R, Beltrami R, Tagliabo A, Rizzo S, Lupi SM. Differences between panoramic and Cone Beam-CT in the surgical evaluation of lower third molars. J Clin Exp Dent 2017;9:e259-65.
19. Emes Y, Oncu B, Aybar B, Al-Badri N, Issever H, Atalay B, *et al.* Measurement of the lingual position of the lower third molar roots using cone-beam computed tomography. J Oral Maxillofac Surg 2015;73:13-7.
20. Herranz-Aparicio J, Marques J, Almendros-Marqués N, Gay-Escoda C. Retrospective study of the bone morphology in the posterior mandibular region. Evaluation of the prevalence and the degree of lingual concavity and their possible complications. Med Oral Patol Oral Cir Bucal 2016;21:e731-6.
21. Braut V, Bornstein MM, Lauber R, Buser D. Bone dimensions in the posterior mandible: A retrospective radiographic study using cone beam computed tomography. Part 1 – analysis of dentate sites. Int J Periodontics Restorative Dent 2012;32:175-84.