ASSESSMENT OF MANDIBULAR 3RD MOLAR APICES TO THE INFERIOR DENTAL CANAL USING CONVENTIONAL RADIOGRAPHY AND CBCT

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Abstract:

Conventional radiographs provide only a 2 dimensional view of complicated three dimensional structures. The proximity, angulations, location of impacted teeth, related to the IAN can be adequately determined using conventional 2-D periodical and panoramic radiographs. Computed tomography necessitates the administration of a high dose radiation, especially when the slice width is shortened to increased cost are the negative aspects of computed tomography compared with conventional imaging. Cone beam computed tomographies are becoming more readily available for use in maxilla facial applications. CBCT provides better image quality of teeth and their surrounding structures, compared with conventional CT and offers high spatial resolution. CBCT seems to be more accurate data about inferior alveolar canal. Hence the present study was undertaken to assess and select roots of third molar with close proximity to inferior dental canal in panoramic radiograph having radiographic signs of darkening of root, disruption of canal cortex and canal deviation and to evaluate the same roots with CBCT using trans axial and coronal sections which is angulated parallel to long axis to tooth, axial and coronal sections for proximity of inferior dental canal with the apices of third molar root.

Keywords: CBCT, IAN

Introduction:

Extraction of impacted mandibular third molar is a routine procedure in oral surgery due to recurrent pericoronitis, caries and pulpitis, orthodontic reasons, cysts and tumours. The most common complications being pain, root tip fracture, paresthesia, alveolar osteitis, temporomandibular joint disorder.

When there is a closer relationship between the tooth and inferior alveolar nerve, the incidence of

nerve injuries high as 23- 35%. An accurate preoperative radiographic examination is therefore considered indispensable before extraction of third molars. This examination should help the surgeon to evaluate the difficulty of the operation and to choose the most appropriate surgical technique for example, where to remove bone, how to split the tooth and in which direction the roots can be lifted.

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dimensional structures. The proximity, angulations, location of impacted teeth, related to the IAN can be adequately determine using conventional 2-D periodical and panoramic radiographs. Computed tomography necessitates the administration of a high dose radiation, especially when the slice width is shortened to increased cost are the negative aspects of computed tomography compared with conventional imaging.

Cone beam computed tomographies are becoming more readily available for use in maxilla facial applications. CBCT provides better image quality of teeth and their surrounding structures, compared with conventional CT and offers high spatial resolution. CBCT seems to be more accurate data about inferior alveolar canal.

Hence the present study was undertaken to assess and select roots of third molar with close proximity to inferior dental canal in panoramic radiograph having radiographic signs of darkening of root, disruption of canal cortex and canal deviation and to evaluate the same roots with CBCT using trans axial and coronal sections which is angulated parallel to long axis to tooth, axial and coronal sections for proximity of inferior dental canal with the apices of third molar root.

Materials

1. ROTOGRAPH MODEL MR05 (VILLA SISTEMI MEDICALI - CEI BOLOGNA ITALY)

2. CBCT MACHINE KODAK9500

Tube voltage 90 kV, Tube current 10 mA, Tube focal spot 0.7 mm

3D technology: amorphous silicon flat panel, Exposure time: 13 seconds.

Field of view medium field program: 90 x 150 mm

Voxel size: 200 um x 200 um x 200 um

3. Laptop with LCD screen of 14 inch of 1366 x 768 resolution.

Methodology

The study was carried out following approval of ethical committee and scientific committee SRM University and informed patients who underwent pre-operative radiographic evaluation before extraction of impacted mandibular third molars were obtained. Radiographs with close proximity of third molar with inferior dental canal were selected based on the following radiographic signs like darkening of the root, disruption of canal cortex, deviation of the inferior dental canal.

Darkening of the root is considered when increased radiolucency of the root is evident where the canal crosses the root. Disruption of canal cortex is observed when two radiopaque lines that constitute the roof and floor of the inferior alveolar canal. The canal cortex is considered to be disrupted if it disappears on reaching the tooth structure. Either one or both lined may be involved. Deviation of the inferior dental canal is considered to be deviated if, when it crosses the mandibular third molar, it changes its direction.

Intra osseous pathologies like cyst or tumors, third molars with root resorption, third molar with developing roots were exclude from the study.

21 patients were enrolled in the study among them 16 male and 5 female patients were there. Teeth with single root involvement with 17. 47 roots which had close proximity with inferior dental canal were selected for study. Selected patients underwent cacti imaging with patient positioning and exposure according to manufacturer's instructions.

CBCT images evaluated in CS 3D imaging software version 3.2.21. brightness is adjusted to 63, contrast 90, enhancement filter to 85. The position of the trans axial section or CS view shown on the reconstructed panoramic image is used to adjust trans axial section parallel long axis of the tooth which pass through the root apex of impacted tooth.

Trans axial section along long axis tooth's limitation in CS 3D imaging software 3.2.21 of

45 to 135 degree from the X axis and horizontal impactions are assessed by selecting orthogonal slicing tab. after adjusting the coronal and sagittal

sections and image are evaluated in axial and coronal sections.

Figure 1:

Results:

In our study roots of third molar with close proximity with inferior dental canal in panoramic radiograph having radiographic signs of darkening of root, disruption of canal cortex and canal deviation were trans axial, axial and coronal

sections. CBCT images were used to determine proximity and position of inferior dental canal with third molar root apices, grooving of third molar root and canal cortication.

22 roots showed darkening of root in OPG. 23 roots had radiographic finding of disruption of

canal cortex and 2 root had radiographic finding of canal deviation. As sample size was small in the category of radiographic finding of canal deviation no statistical analysis was done.

Our study had predominant prevalence of mesioangular impactions of 59.6% followed by 17% of distoangular impactions, 12.8% of horizontal impactions and vertical impactions of

10/6%. 68.2% of mesioangular impactions were present in radiographic feature of disruption of canal cortex and distoangular, vertical and horizontal impactions in disruption of canal cortex were of 30.4%, 8.7%, 13% respectively and in canal deviation, 100% of mesioangular impactions were evident.

Table 1: Prevalence on types of impactions in radiographic features darkening of root apex, disruption of canal cortex and canal deviation.

Type of Impaction	Radiographic feature							
	Darkening of Root		Disruption of canal cortex		Canal cortex		Total	
	N	%	N	%	N	%	N	%
Distoangular	1	4.5	7	30.4	0	0	8	17
mesioangular	15	68.2	11	47.8	2	100	28	59.6
Vertical	3	13.6	2	8.7	0	0	5	10.6
Horizontal	3	13.6	3	13.0	0	0	6	12.8
Total	22	100.0	23	100.0	2	100.0	47	100.0

In position of inferior alveolar canal in relation to third molar, buccally and inferiorly positioned inferior dental canal showed predominance of 44.7% and lingually placed canal of 8.5%. Canal placed interradicularly in 2.1% of roots.

Table 2:

Position of inferior dental canal in relation to third molar	Radiographic feature							
	Darkening of Root		Disruption of canal cortex		Canal cortex		Total	
	N	%	N	%	N	%	N	%
Buccal	9	40.9	12	52.2	0	0	21	44.7
Interradicular	1	4.5	0	0	0	0	1	2.1
Inferior	9	40.9	10	43.5	2	100	21	44.7
Lingual	3	13.6	1	4.3	0	0	4	8.5
Total	22	100.0	23	100.0	2	100.0	47	100.0
P - Value	0.026		0.11					

40.9 % of buccal and inferior positioned canals in relation to third molars in teeth with radiographic signs of darkening of root were present. Lingually and interradicularly placed canal in 13.6% and 4.5% of roots respectively with p-0.026.

Table 3:

Proximity of inferior dental canal to root of mandibular third molar.	Radiographic feature							
	Darkening of Root		Disruption of canal cortex		Canal cortex		Total	
	N	%	N	%	N	%	N	%
In contact	18	81.8	20	87	2	100	40	85.1
No contact	4	18.2	3	13	0	0	7	14.9
Total	22	100.0	23	100.0	2	100.0	47	100.0
P - Value	0.003		<0.001					

52.2% of buccal and 43.5% of inferiorly positioned inferior dental canal in relation to third molar were present in teeth with radiographic sign of disruption of canal cortex, lingually and interraderically placed canals in disruption of canal cortex is 4.3% and 100% of inferior canals were present.

Table 4:

Position of inferior dental canal in relation to third molar	In contact	% of in contact	No contact	% of no contact
Buccally	15	71.43%	6	28.57
Interraderical	1	100.0%	0	0.00
Inferior	20	95.24%	1	4.76
Lingual	4	100.0%	0	0.00
Fischer's exact test P-0.200				

Lingually and interraderically positioned inferior positioned canals of 95% and buccally placed canals of 71% with P- Value of 0.200.

Discussion

21 patients, 16 males and 5 females (30 teeth) were selected for close relationship with inferior dental canal. 47 roots which had close relationship with inferior dental canal with panoramic radiographic sign of darkening of root, disruption of canal cortex and canal deviation were selected and 3d imaging with CBCT was done. CBCT images were analysed for position & proximity of inferior dental canal in relation to third molar root, grooving of the roots of third molar and canal corticalisation.

Seven radiological signs had been suggested as indicative of a close relationship between the mandibular third molar root and the inferior alveolar canal. Four signs seen on the root of the tooth are darkening of root, narrowing of roots, deflection of root, bifid apex. Changes in the appearance of the inferior alveolar canal are deviation of canal, narrowing of canal, loss of lamina dura. Previous studies^(9,10) showed three signs had increased risk of injury which are

darkening of root, disruption of canal cortex and canal deviation.

Panoramic radiograph is frequently used in preoperative evaluation of impacted tooth. But inadequacy of two dimensional images of panoramic radiograph restricts it from assessing complicated tooth to inferior dental canal relations. CT is useful with its cross sectional imaging capability to analyse different tooth relationships with the canal. Cone-beam computed tomography generates three-dimensional (3D) data at lower absorbed doses of radiation than conventional computed tomography with high resolution images, is suitable in evaluating relationships of mandibular canal with impacted tooth.

Grooving in our study is only 4.3% which is not in agreement with earlier study⁽²²⁾ which showed grooving in 23%. This difference can be due low prevalence of lingually placed canal in our study of 8.5% in which grooving occurs in preponderance. Even though grooving were

present in low prevalence they were present only in the lingual side which is in concurrence with earlier studies^(8, 11,12) who reported that grooving of the tooth root mainly occurs at the lingual side. Even though our frequency of grooving is less of 4.3%, they were present only in radiographic sign of darkening of root which is in concurrence with Previous studies^(16,18) which showed grooving of the root occurred more frequently among darkening of roots. Previous study⁽¹²⁾ stated that a dark band on panoramic radiograph was an important indicator of the grooving of the tooth by the canal which is not in concurrence with our study which has 9.1% of grooving in darkening of root.

Canal corticalisation was absent in 55.3% which was higher than earlier study⁽⁴²⁾ in which 40.3% of absence of corticalisation is evident the difference of which can be attributed to their's large sample size of 695 teeth. In the present study absence of canal corticalisation is evident in radiographic sign of darkening of root in 45.5% which was less when compared to earlier study⁽¹⁴⁾ in Darkening of roots which had 76% of absence of corticalisation. Absence of canal corticalisation in radiographic sign of disruption of canal cortex is 61% in the present study, which is in agreement with earlier study⁽¹⁴⁾ in radiographic sign of Interruption of canal cortex which showed 58.5% of absence of corticalisation.

Conclusion

Though Panoramic radiographs reveal the close proximity of mandibular third molar to inferior dental canal, CBCT images can be used for accurate assessment of proximity and to obtain in depth information about the position of inferior dental canal, grooving of third molar root and canal corticalisation, which are imperative for preoperative planning of surgical removal of impacted tooth. This outweighs the risk of increased radiation and benefits the patient. So CBCT can be used for preoperative planning to patients with impacted tooth having radiographic sign of darkening of root and disruption of canal cortex. Cross sections along long axis of tooth can

be used for easy assessment of relationships between impacted tooth root apices and inferior dental canal.

Reference

1. Yun-Hoa Jung, Kyung-Soo Nah, Bong-Hae Cho. *Imaging Science in Dentistry* 2012; 42 : 121
2. F S Neves , T C Souza, S M Almeida, F Haiter-Neto, D Q Freitas and F N Bo'scolo *Dentomaxillofacial Radiology* (2012) 41, 553–55
3. Ilkay Peker, Cigdem Sarikir, Meryem Toraman Alkurt and Zeynep Fatma Zor Peker et al. *BMC Oral Health* 2014, 14:7
4. J. Szalma, L. Vajta, E. Lempel, S. Jeges, L. Olasz *Int. J. Oral Maxillofac. Surg.* 2013; 42: 483–488
5. Shoaleh Shahidi, Barbod Zamiri, Pegah Bronoosh *Imaging Science in Dentistry* 2013; 43: 105-9
6. W Tantanapornkul, K Okochi, A Bhakdinaronk, N Ohbayashi and T Kurabayashi *Dentomaxillo facial Radiology* (2009) 38, 11–16
7. Blaeser BF, August MA, Donoff RB, Kaban LB, Dodson TBJ *Oral Maxillofac Surg.* 2003 Apr;61(4):417-21
8. Monaco G, Montevecchi M, Bonetti GA, Gatto MR, Checchi L. Reliability of panoramic radiography in evaluating the topographic relationship between the inferior dental canal and impacted third molars. *J Am Dent Assoc* 2004; 135: 312–318
9. Suomalainen A, Ventä I, Mattila M, Turtola L, Vehmas T, Peltola JS. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010 Feb;109(2):276-84
10. Jhamb A¹, Dolas RS, Pandilwar PK, Mohanty S. *J Oral Maxillofac Surg.* 2009 Jan; 67(1):58-66. doi: 10.1016/j.joms.2008.06.014.
11. J. Pawelzik, Cohnen, Willers, Becker, J *Oral Maxillofac Surg* 60:979-984, 2002
12. H. Ghaeminia et.al *International Journal of Oral and Maxillofacial Surgery* Volume 40, Issue 8, August 2011.

13. Tantanapornkul W, Okouchi K, Fujiwara Y, Yamashiro M, Maruoka Y, Ohbayashi N, Kurabayashi T. A comparative study of cone-beam computed tomography and conventional panoramic radiography in assessing the topographic relationship between the inferior dental canal and impacted third molars. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007; 103:253–259.
14. Maegawa H, Sano K, Kitagawa Y, Ogasawara T, Miyauchi K, Sekine J, Inokuchi T. Preoperative assessment of the relationship between the mandibular third molar and the inferior dental canal by axial computed tomography with coronal and sagittal reconstruction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003; 96: 639–646.
15. De Melo Albert DG, Gomes AC, do Egito Vasconcelos BC, de Oliveirae Silva ED, Holanda GZ. Comparison of orthopantomographs and conventional tomography images for assessing the relationship between impacted lower third molars and the inferior dental canal. *J OralMaxillofac Surg* 2006; 64: 1030–1037.
16. Miller CS, Nummikoski PV, Barnett DA, Langlais RP. Cross-sectional tomography. A diagnostic technique for determining the buccolingual relationship of impacted mandibular third molars and the inferior alveolar neurovascular bundle. *Oral Surg Oral Med Oral Pathol* 1990; 70: 791–797.
17. Nakagawa Y, Ishii H, Nomura Y, Watanabe NY, Hoshiba D, Kobayashi K, Ishibashi K. Third molar position: reliability of panoramic radiography. *J Oral Maxillofac Surg* 2007; 65: 1303–1308.
18. Nakamori K, Fujiwara K, Miyazaki A, Tomihara K, Tsuji M, Nakai M, et al. Clinical assessment of the relationship between the third molar and the inferior alveolar canal using panoramic images and computed tomography. *J Oral Maxillofac Surg* 2008; 66: 2308–2313.
19. Shoaleh Shahidi, Barbod Zamiri Pegah Bronoosh *Imaging Science in Dentistry* 2013; 43: 105-9.
20. Yun-Hoa jung *Imaging science in dentistry* 09/2012; 42(3):121-7.