Surgically concerned anatomy of roots of lower third molar

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Background and Objectives: Root anatomy of lower third molar (LTM) may have variable patterns. Root number, shape and curvature all affecting the process of surgery. To determine frequency of different root patterns of LTM.

Patients and methods: Retrospectively, a total of 196 orthopantomograms of department of radiology were evaluated for LTM root number and curvature of roots.

Results: two roots 173 (88.26%) one root 22 (11.74%). All single rooted teeth showed no curvature. Among two rooted teeth the study figured out that majority of roots not fused but converge 134 (77.45%), fused together 20 (11.5%), not fused but diverge 11 (≈ 6%), not fused with root curvature.

Conclusion: Majority of LTM have two or more roots, they are convergent or divergent. Root anatomy evaluation before surgery is mandatory.

Keywords: lower third molar, impaction, molar root anatomy, teeth anatomy.

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Introduction

Surgery for removal of impacted LTM is on the first place among most common surgeries done by oral surgeon on daily basis.[1,2] Pathologies like pericoronitis, pain, resorption and caries of adjacent second molar, possible cystic and neoplastic changes, that may arise with LTM impaction, serves as some indications for surgical removal of such tooth.[3,4]

Surgical procedure for impacted tooth removal is one of the most unpredictable surgeries in oral cavity. Difficulties are arising because of improper access, bone coverage, orientation and root configuration. In majority of cases bone removal is just mandatory, but as much limited amount as it is possible. Sectioning of the impacted tooth may help surgeon to do easy removal and minimize the amount of bone removal. Factors that determine amount of bone removal and type of sectioning are depth, orientation and root configuration.[5,6]

Determination of degree of difficulty during surgery was the reason behind formulation of many classifications. The Winter and Pell/ Gregory are among the most common ones.[7]
Winter`s classification depends on the orientation of impacted tooth which may be vertical, mesioangular, distoangular, horizontal and transvers. By this classification the easiest and most difficult to be extracted are mesioangular and distoangular orientation respectively.[5,8]
Pell and Gregory`s classification has two main classes. Class A depends on the availability of sufficient space for the crown of impacted tooth and class B depends on the level of eruption compared to occlusal plan of 2nd molar.

Class A classifies LTM impaction in to subclass I, space between anterior border of ramus

and distal surface of 2nd molar is equal to or more than mesiodistal diameter of impacted tooth; subclass II, the crown of impacted tooth is partially covered by bone of ramus; subclass III, the crown is completely covered by the ramus.[5]

While class B depends on the level of eruption comparing to occlusal plan of 2nd molar. Sub class a, occlusal level of the impacted tooth is equal or near to the level of occlusal plane of adjacent 2nd molar; subclass b, the occlusal level of impacted tooth is in midway between cervical line and occlusal plan of 2nd molar; subclass c- the occlusal level of impacted tooth is below the cervical line of the 2nd molar (Table 1).[5]

Table 1: Winter's and Pell and Gregory's criteria (Balaji 2009).[5]

Classification	Type	Description
Winter	Vertical	Long axis of the 3rd moler parallel to the 2nd molar
	Horizontal	Long axis of the 3rd molar perpendicular to the 2nd molar
	Mesioangular	Long axis of the 3rd molar inclined in mesial direction to 2nd molar
	Distoangular	Long axis of the 3rd molar inclined in distal direction to 2nd molar
	Inverted	Crown of 3rd molar directed to basilar of the mandible
Pell and Gregory	Class I	There is sufficient space between the ramus and the distal part of the 2nd molar for the accommodation of the mesiodistal diameter of the 3rd molar
	Class II	The space between the 2nd molar and the ramus of the mandible is less than the mesiodistal diameter of the 3rd molar
	Class III	All or most of the 3rd molar is in the ramus of the mandible
	Position A	The occlusal plane of the impacted tooth is the same level as the occlusal plane of the 2nd molar
	Position B	The occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the 2nd molar
	Position C	The impacted tooth is below the cervical line of the 2nd molar

The above mentioned classifications are used up to date for determination of difficulty of surgical removal. As it can be noticed, all above categories depend on the crown of the impacted tooth for fabrication of classification. Searching the literature makes as to notice that there is no specific classification for root configuration which can be used for additional evaluation of surgical difficulties of impacted tooth.

Donald D. Derrick and his coauthors (1987)6 stating that basic tooth extraction

movements are determined by orientation, but modified by tooth depth, root formation and bone density. While Gustav O.Kruger (1984)[8] put the determination of root numbers, shape and inclination in the main preoperative evaluation.

The most favorable root pattern is a conical straight one. Three and more roots usually are thin with surrounding dense bone. This makes them prone to fracture. Bulbous roots are hard to withdraw through the socket and need more bone removal, but they have a very thin bone in surrounding especially on lingual side which can be easily split away.[8]

Curvature of the roots is the other point of consideration. Two or more roots may have either converge or diverge pattern, both of which locks the tooth to the bone and makes the pattern unfavorable. Curvature of single rooted tooth or one root of multiple rooted tooth mesially increases difficulty of extraction by opposing the distal tilting movement.[6]

So formulation of clear idea about the number of roots, curvature, fusion, convergence or divergence of roots of impacted LTM is the aim of our study.

The aim of this study is to determine the frequency of most popular surgically concerned root configurations among lower third molars by radiological evaluation

Patients and methods

This is a retrospective study. The data base of the radiological department in college of Dentistry/Hawler medical university for one year included. All patients aged below 18 years old and cases with absent LTM were excluded.

Evaluation were about the presence or absence of impaction, root configuration: number of roots, curvature, fusion, convergence and divergence (Figures 1-5).

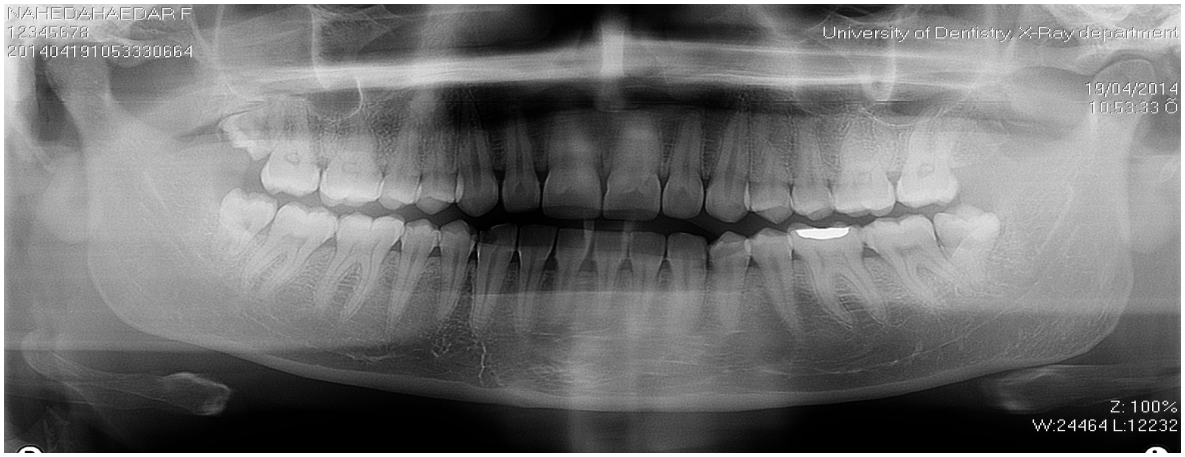

Figure 1: Vertical impacted LTM with fused roots on left side.

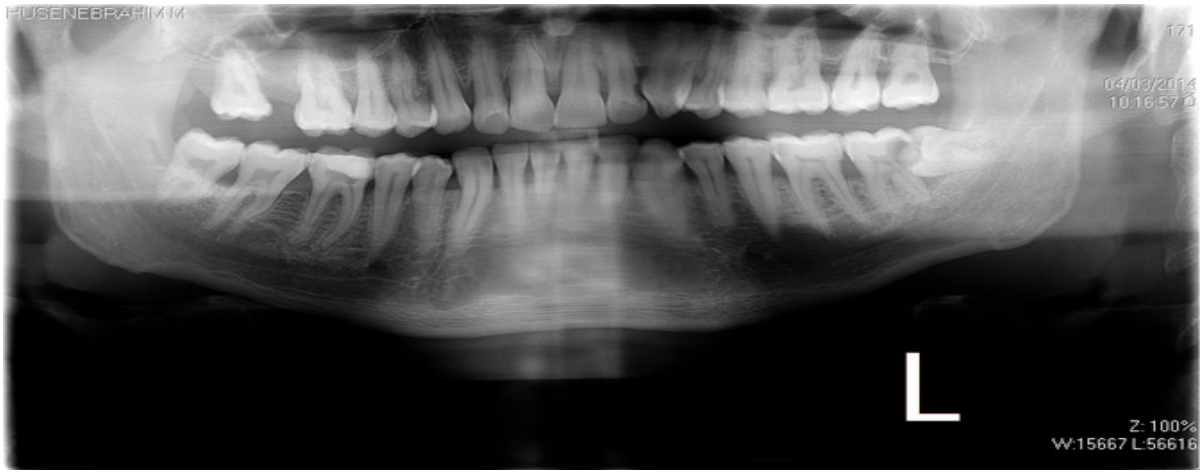

Figure 2: OPG, Root configuration of LTM, two rooted divergent on left and two rooted converge on right sides.

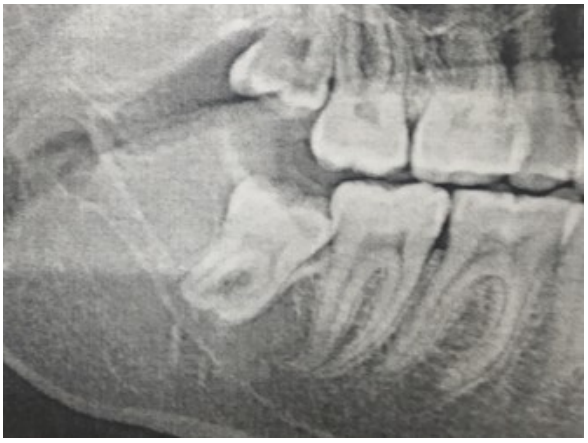

Figure 3: OPG, Two rooted LTM with single mesially curved root.

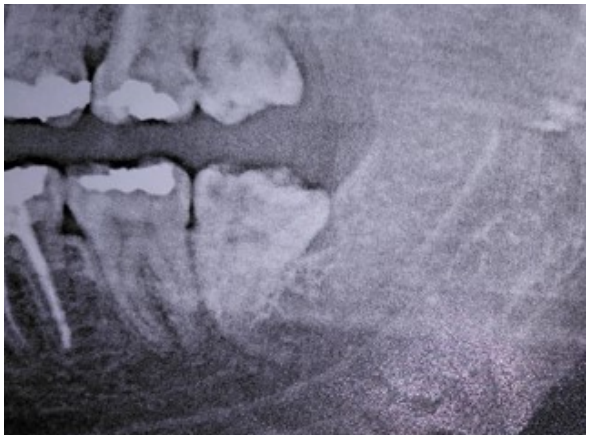

Figure 4: OPG, two fused rooted LTM with distal curvature.

Figure 5: OPG, Two rooted LTM both distally curved.

A case sheet formulated for this reason in Excel office format. The sheet contains two parts; biographic information like name, age, sex, and impaction related information as it was mentioned above.

At the end general outline for the condition be statistically analyzed to get answers for questions mentioned in objectives by which we can answer the main two questions of the aim.

Tests of frequency and chi square were be used. Data analysis carried out using SPSS program.

Results

A total of 196 OPGs of impacted LTM involved in this study. Out of which, 89 (45.41%) were female and 107 were male (54.59%). The age range that contained all cases was 23-49 years old.

The majority of impacted teeth were lower right 3rd molar 100 (51.02 %), lower left 3rd molar 96 (48.98%).

All impacted teeth in our study (Figure 1) were of two types regarding the number of roots: two roots 173 (88.26%) one root 22 (11.74%). All single rooted teeth showed no curvature. Among two rooted teeth the study figured out that majority of roots not fused but converge 134 (77.45%), fused together 20 (11.5%), not fused but diverge 11 (≈ 6%), not fused with root curvature distally at the apical third 5 (≈ 2.8%), not fused with root curvature mesially at the apical third 4(≈ 2.2%) (Figure 1).

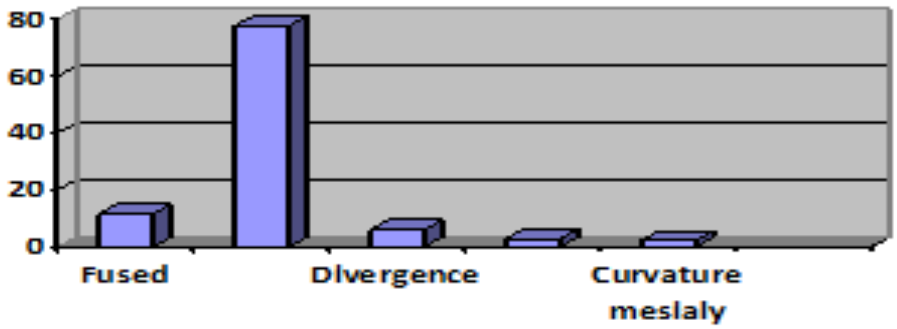

Figure 1: General prevalence of roots types.

Regarding configuration tendency among female group the study showed that out of 89 cases, just 15 cases had con-shaped, one-rooted lower eight. The rest were with two roots. Among two roots 9 (12.16%) of cases showed fusion of roots, 56 (75.67%) with convergence, with divergence 5 (6.75%), curvature distally 3 (4.05%), curvature mesially 1 (1.35%). (Table 1 and Figure 2).

In the male group the tendency was as follow: Out of 107 cases, one rooted teeth were just 7 (6.54%), two rooted teeth 100 (93.46%). Among two rooted teeth 11 (11%) the roots were fused, 78 (78%) were convergence, 6 (6%) were divergence, 2 (2%) curved distally, 3 (3%). (Table 2 and Chart 3) The two groups of male and female were not significantly different at P< 0.05 (Table 3).

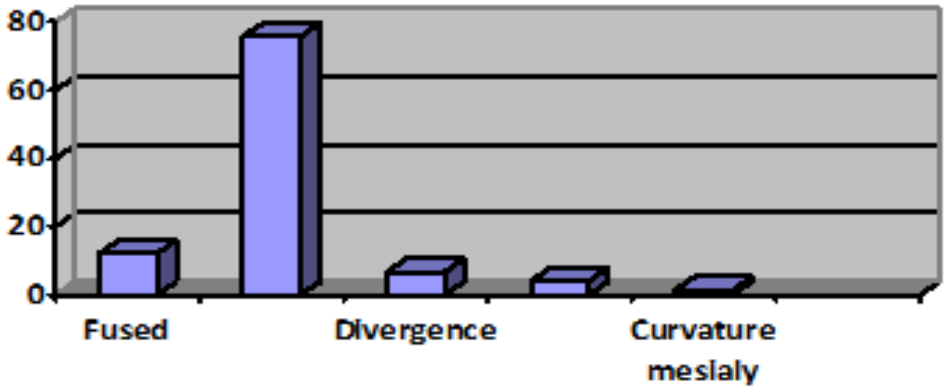

Figure 2: Female root configuration.

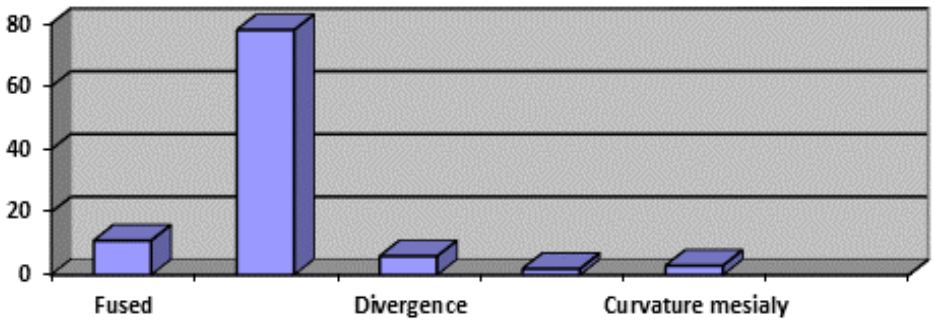

Figure 3: Male root configuration.

Table 2: Male to female comparing.

		Male		Female	
		No. of cases	Percentage	No. of cases	Percentage
One rooted impacted 3rd molar		7	6.54	15	16.85
Two rooted impacted 3rd molar	Fusion of roots	11	11	9	12.16
	Convergence of roots	78	78	56	75.67
	Divergence of roots	6	6	5	6.75
	Curvature distally	2	2	3	4.05
	Curvature Mesially	3	3	1	1.35
	All	100	93.46	74	83.15

Discussion

Anatomy of roots of LTM has a huge role on its extraction. Simple and straight forward extraction is possible in those cases, in which there is single straight and conical root (Figure 1), or, two rooted but they fused with no curvature. The results of our study showed that such extraction is possible just in 42 cases 21.42% (one rooted teeth which comprises 22 cases 11.22%, and 20 cases 10.2% of two fused rooted teeth).

The finding of single rooted LTM in our study matches that of Gulabivala et al.[9] (11%). But it is much less than that of Sidow et al.[10] (17%), Kuzekanani et al.[11] (21%), and, Cosic et al.[12] (56%). and disagree with Gulabivala et al.[9] regarding two fused roots (20%).

Difficulty starts when LTM become two and more roots. In our study they comprise 78.58% of cases. Our results are close to that of Gulabivala et al.[9] (68%); Sidow et al.[10] (83%) and Kuzekanani et al.[11] (79%). But it is much higher that of Cosic et al.[12] (44%).

The two rooted LTM, as the majority, seems to be close to the normal anatomy of other lower molars (first and second). But the picture is not identical. Even when there are two roots, the majority have curved one, which is not a common picture in other molars.

In surgical point of view, convergence of roots (Figures 1 and 2), that comprises 134 (77.45%), prone to fracture of apical third. This can be explained by two main factors: the hooking effect and apposing direction of the force of extraction. The first one is a problem when the patient has dens and massive inter-radicular bone that will hold apical third of roots in place. The second factor leads to fracture of at least one of the roots, the one which has curvature concavity of which facing the direction of extraction force. The same is true for divergent (Figure 2 left side) that comprises 11 cases 6% in our study, and, single curved root out of two or three (not fused with root curvature distally at the apical third 5 (≈ 2.8%), not fused with root curvature mesially at the apical third 4 (≈ 2.2%) (Figures 3, 4 and 5).

Despite the fact that the picture was different, both sex groups were not significantly different at $P<0.05$.

Another point of concern is the diameter of roots which decreases by increasing in number of roots. Thin roots are more prone to fracture than thick one. This matters when we have dens alveolar bone. This fact was discussed in textbook of surgery by Kruger,8 but we didn't calculate it in our study.

The anatomy of roots may have a great impact on the process of surgery. It may be the reason behind bone removal, bone expansion and endangering inferior alveolar nerve. They are the reason for spending more time in surgery and more pain and swelling for patient. Knowing the anatomy of roots may help surgeons to do extraction faster, to make less trauma, to have less complications and less patients suffering.

Conclusion

The majority of LTM have two or more roots, they are convergent or divergent. Root anatomy evaluation before surgery is mandatory.

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Conflict of interest

The authors reported no conflict of interests.

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